HPE ArubaOS-Switch Management and Configuration Guide for YC.16.03

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This switch software guide is intended for network administrators and support personnel, and applies to the switch models listed on this page unless otherwise noted. This guide does not provide information about upgrading or replacing switch hardware.

Applicable Products

Aruba 2540 Switch Series (JL354A, JL356A, JL355A, JL357A)

NOTE

For successful time protocol setup and specific configuration details, you may need to contact your system administrator regarding your local configuration.

General steps for running a time protocol on the switch

Using time synchronization ensures a uniform time among interoperating devices. This helps you to manage and troubleshoot switch operation by attaching meaningful time data to event and error messages.

The switch offers TimeP, SNTP (Simple Network Time Protocol), NTP, and a `timesync` command for changing the time protocol selection (or turning off time protocol operation).

NOTE

Although you can create and save configurations for all time protocols without conflicts, the switch allows only one active time protocol at any time.

In the factory-default configuration, time synchronization is disabled by default.

NOTE

Because the Aruba 2540 Switch Series does not contain an RTC (real time clock) chip, Hewlett Packard Enterprise recommends configuring one of the time synchronization protocols supported. Failure to do so could result in the switch time being reset to the factory default of 01/01/1990 00:00:00 in the case of a switch reload, software upgrade, or power cycle.

TimeP time synchronization

You can either manually assign the switch to use a TimeP server or use DHCP to assign the TimeP server. In either case, the switch can get its time synchronization updates from only one designated TimeP server. This option enhances security by specifying which time server to use.

SNTP time synchronization

SNTP provides three operating modes:

- **Broadcast mode**

  The switch acquires time updates by accepting the time value from the first SNTP time broadcast detected. (In this case, the SNTP server must be configured to broadcast time updates to the network broadcast address; see the documentation provided with your SNTP server application.) Once the switch detects a particular server, it ignores time broadcasts from other SNTP servers unless the configurable Poll Interval expires three consecutive times without an update received from the first-detected server.

  NOTE

  To use Broadcast mode, the switch and the SNTP server must be in the same subnet.

- **DHCP mode**

  DHCP mode is enabled by default. In DHCP mode, the SNTP server address and the timezone are provided in the DHCP address reply.

- **Unicast mode**

  The switch requests a time update from the configured SNTP server. (You can configure one server using the menu interface, or up to three servers using the CLI sntp server command.) This option provides increased

security over the Broadcast mode by specifying which time server to use instead of using the first one detected through a broadcast.

Selecting a time synchronization protocol

Procedure

1. Select the time synchronization protocol: `TimeP`, `SNTP`, or `NTP`.
2. Enable the protocol; the choices are:
   a. TimeP: `DHCP` or `Manual`
   b. SNTP: `Broadcast` or `Unicast`
   c. NTP: `Broadcast` or `Unicast`
3. Configure the remaining parameters for the time protocol you selected.

   The switch retains the parameter settings for both time protocols even if you change from one protocol to the other. Thus, if you select a time protocol, the switch uses the parameters you last configured for the selected protocol.

Simply selecting a time synchronization protocol does not enable that protocol on the switch unless you also enable the protocol itself (step 2, above). For example, in the factory-default configuration, TimeP is the selected time synchronization method. However, because TimeP is disabled in the factory-default configuration, no time synchronization protocol is running.

Disabling time synchronization

You can use either of the following methods to disable time synchronization without changing the TimeP, SNTP, or NTP configuration:

- Global config level of the CLI
  - Execute `no timesync`.
- System Information screen of the Menu interface
  1. Set the `Time Synch Method` parameter to `None`.
  2. Press **[Enter]** , then **[S]** (for **Save**).

SNTP: Selecting and configuring

The following table shows the SNTP parameters and their operations.

Table 1: *SNTP parameters*

SNTP parameter	Operation
Time Sync Method	Used to select either SNTP, TIMEP, NTP, or None as the time synchronization method.
SNTP Mode	
`Disabled`	The Default. SNTP does not operate, even if specified by the Menu interface **Time Sync Method** parameter or the CLI `timesync` command.
`Unicast`	Directs the switch to poll a specific server for SNTP time synchronization. Requires at least one server address.

Table Continued

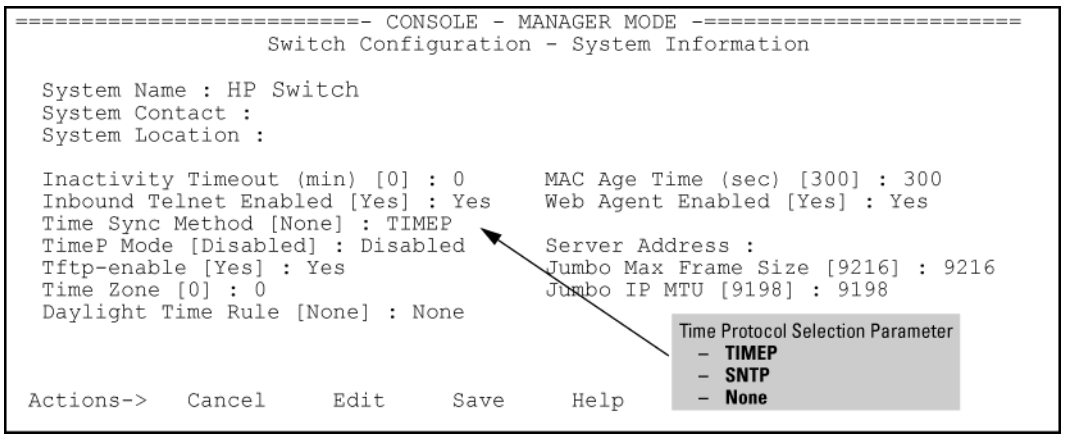
SNTP parameter	Operation
`Broadcast`	Directs the switch to acquire its time synchronization from data broadcast by any SNTP server to the network broadcast address. The switch uses the first server detected and ignores any others. However, if the Poll Interval expires three times without the switch detecting a time update from the original server, the switch accepts a broadcast time update from the next server it detects.
Poll Interval (seconds)	**In Unicast Mode:** Specifies how often the switch polls the designated SNTP server for a time update.**In Broadcast Mode:** Specifies how often the switch polls the network broadcast address for a time update.Value is between 30 to 720 seconds.
Server Address	Used only when the **SNTP Mode** is set to `Unicast`. Specifies the IP address of the SNTP server that the switch accesses for time synchronization updates. You can configure up to three servers; one using the menu or CLI, and two more using the CLI.
Server Version	Specifies the SNTP software version to use and is assigned on a per-server basis. The version setting is backwards-compatible. For example, using version 3 means that the switch accepts versions 1 through 3. Default: 3; range: 1 to 7.
Priority	Specifies the order in which the configured servers are polled for getting the time. Value is between 1 and 3.

Viewing and configuring SNTP (Menu)

Procedure

1. From the Main Menu, select:
   a. **2. Switch Configuration…**
   b. **1. System Information**

   Figure 1: *System Information screen (default values)*



2. Press **[E]** (for **Edit**).

   Move the cursor to the **System Name** field.
3. Use the **Space** bar to move the cursor to the **Time Sync Method** field.
4. Use the **Space** bar to select **SNTP**, then move to the **SNTP Mode** field.
5. Complete one of the following options.

   Option 1

a. Use the **Space** bar to select the **Broadcast** mode.
b. Move the cursor to the **Poll Interval** field.
c. Go to 6. (For Broadcast mode details, see **SNTP time synchronization**)

Figure 2: *Time configuration fields for SNTP with broadcast mode*

```
Time Sync Method [None] : SNTP
SNTP Mode [Disabled] : Broadcast
Poll Interval (sec) [720] : 720
Tftp-enable [Yes] : Yes
Time Zone [0] : 0
Daylight Time Rule [None] : None
```

Option 2

d. Use the **Space** bar to select the **Unicast** mode.
e. Move the cursor to the **Server Address** field.
f. Enter the IP address of the SNTP server you want the switch to use for time synchronization.

NOTE

This step replaces any previously configured server IP address. If you will be using backup SNTP servers (requires use of the CLI), see **SNTP unicast time polling with multiple SNTP servers**.

g. Move the cursor to the **Server Version** field. Enter the value that matches the SNTP server version running on the device you specified in the preceding step.

   If you are unsure which version to use, Hewlett Packard Enterprise recommends leaving this value at the default setting of 3 and testing SNTP operation to determine whether any change is necessary.

NOTE

Using the menu to enter the IP address for an SNTP server when the switch already has one or more SNTP servers configured, the switch deletes the primary SNTP server from the server list. The switch then selects a new primary SNTP server from the IP addresses in the updated list. For more on this topic, see **SNTP unicast time polling with multiple SNTP servers**.

h. Move the cursor to the **Poll Interval** field, then go to step 6.

Figure 3: *SNTP configuration fields for SNTP configured with unicast mode*

```
Time Sync Method [None] : SNTP
SNTP Mode [Disabled] : Unicast        Server Address : 10.28.227.15
Poll Interval (sec) [720] : 720       Server Version [3] : 3
Tftp-enable [Yes] : Yes
Time Zone [0] : 0                  <--
Daylight Time Rule [None] : None
```

Note: The Menu interface lists only the highest priority SNTP server, even if others are configured. To view all SNTP servers configured on the switch, use the CLI **show management** command. Refer to "SNTP Unicast Time Polling with Multiple SNTP Servers" on page 1-33.

6. In the **Poll Interval** field, enter the time in seconds that you want for a Poll Interval.

   (For Poll Interval operation, see **SNTP parameters**)
7. Press **Enter** to return to the Actions line, then **S** (for **Save**) to enter the new time protocol configuration in both the startup-config and running-config files.

Viewing and configuring SNTP (CLI)

Syntax:

show sntp

Lists both the time synchronization method (`TimeP`, `SNTP`, or `None`) and the SNTP configuration, even if SNTP is not the selected time protocol.

If you configure the switch with SNTP as the time synchronization method, then enable SNTP in broadcast mode with the default poll interval, `show sntp` lists the following:

SNTP configuration when SNTP is the selected time synchronization method

```
switch(config)# show sntp

 SNTP Configuration

  Time Sync Mode: Sntp
  SNTP Mode : Unicast
  Poll Interval (sec) [720] : 719


  Priority SNTP Server Address            Protocol Version
  -------- ------------------------------ ----------------
  1        2001:db8::215:60ff:fe79:8980   7
  2        10.255.5.24                    3
  3        fe80::123%vlan10               3
```

In the factory-default configuration (where TimeP is the selected time synchronization method), `show sntp` still lists the SNTP configuration, even though it is not currently in use. In **SNTP configuration when SNTP is not the selected time synchronization method** on page 29, even though TimeP is the current time synchronous method, the switch maintains the SNTP configuration.

SNTP configuration when SNTP is not the selected time synchronization method

```
switch(config)# show sntp

 SNTP Configuration

  Time Sync Mode: Timep
  SNTP Mode : Unicast
  Poll Interval (sec) [720] : 719


  Priority SNTP Server Address            Protocol Version
  -------- ------------------------------ ----------------
  1        2001:db8::215:60ff:fe79:8980   7
  2        10.255.5.24                    3
  3        fe80::123%vlan10               3
```

Syntax:

show management

This command can help you to easily examine and compare the IP addressing on the switch. It lists the IP addresses for all time servers configured on the switch, plus the IP addresses and default gateway for all VLANs configured on the switch.

Display showing IP addressing for all configured time servers and VLANs

```
switch(config)# show management

 Status and Counters - Management Address Information

  Time Server Address : fe80::215:60ff:fe7a:adc0%vlan10

  Priority  SNTP Server Address             Protocol Version
  --------- ----------------------------- ----------------
  1         2001:db8::215:60ff:fe79:8980   7
  2         10.255.5.24                    3
  3         fe80::123%vlan10               3


  Default Gateway   :10.0.9.80

  VLAN Name    MAC Address     | IP address
  ------------ --------------- + ---------------
  DEFAULT_VLAN 001279-88a100   | Disabled
  VLAN10       001279-88a100   | 10.0.10.17
```

Configuring (enabling or disabling) the SNTP mode

Enabling the SNTP mode means to configure it for either broadcast or unicast mode. Remember that to run SNTP as the switch's time synchronization protocol, you must also select SNTP as the time synchronization method by using the CLI `timesync` command (or the menu interface **Time Sync Method** parameter.)

Syntax:

timesync sntp

Selects SNTP as the time protocol.

sntp {<broadcast | unicast>}

Enables the SNTP mode.

Syntax:

sntp server <ip-addr>

Required only for unicast mode.

Syntax:

sntp server priority <1-3>

Specifies the order in which the configured servers are polled for getting the time. Value is between 1 and 3.

Syntax:

sntp <30-720>

Configures the amount of time between updates of the system clock via SNTP.

Default: 720 seconds

Enabling SNTP in Broadcast Mode

Because the switch provides an SNTP polling interval (default: 720 seconds), you need only these two commands for minimal SNTP broadcast configuration:

Syntax:

timesync sntp

Selects SNTP as the time synchronization method.

Syntax:

sntp broadcast

Configures broadcast as the SNTP mode.

Example:

Suppose that time synchronization is in the factory-default configuration (TimeP is the currently selected time synchronization method.) Complete the following:

Procedure

1. View the current time synchronization.
2. Select **SNTP** as the time synchronization mode.
3. Enable **SNTP** for Broadcast mode.
4. View the SNTP configuration again to verify the configuration.

The commands and output would appear as follows:

Figure 4: *Enabling SNTP operation in Broadcast Mode*

```
switch(config)# show sntp [1]
 SNTP Configuration
  Time Sync Mode: Timep
  SNTP Mode : disabled
  Poll Interval (sec) [720] :720

switch(config)# timesync sntp

switch(config)# sntp broadcast

switch(config)# show sntp [2]
 SNTP Configuration
  Time Sync Mode: Sntp
  SNTP Mode : Broadcast
  Poll Interval (sec) [720] :720
```

- [1]

  `show sntp` displays the SNTP configuration and also shows that TimeP is the currently active time synchronization m
- [2]

  `show sntp` again displays the SNTP configuration and shows that SNTP is now the currently active time synchronizat

Enabling SNTP in unicast mode (CLI)

Like broadcast mode, configuring SNTP for unicast mode enables SNTP. However, for unicast operation, you must also specify the IP address of at least one SNTP server. The switch allows up to three unicast servers. You can use the Menu interface or the CLI to configure one server or to replace an existing unicast server with another. To add a second or third server, you must use the CLI. For more on SNTP operation with multiple servers, see **SNTP unicast time polling with multiple SNTP servers** on page 47

Syntax:

timesync sntp

Selects SNTP as the time synchronization method.

Syntax:

sntp unicast

Configures the SNTP mode for unicast operation.

Syntax:

[no] sntp server priority < *1-3* > < *ip-address* > [version]

Use the `no` version of the command to disable SNTP.

`priority`	Specifies the order in which the configured SNTP servers are polled for the time.
`ip-address`	An IPv4 or IPv6 address of an SNTP server.
`version`	The protocol version of the SNTP server. Allowable values are 1 through 7; default is 3.

Syntax:

no sntp server *priority* <*1-3*> <*ip-addr*>

Deletes the specified SNTP server.

priority <1-3>

value must match what server is configured with. Deleting an SNTP server when only one is configured disables SNTP unicast operation.

Example:

To select SNTP and configure it with unicast mode and an SNTP server at 10.28.227.141 with the default server version (3) and default poll interval (720 seconds):

```
switch(config)# timesync sntp
```

Selects SNTP.

```
switch(config)# sntp unicast
```

Activates SNTP in unicast mode.

```
switch(config)# sntp server priority 1 10.28.227.141
```

Specifies the SNTP server and accepts the current SNTP server version (default: 3).

Configuring SNTP for unicast operation

```
switch(config)# show sntp

 SNTP Configuration

  Time Sync Mode: Sntp
  SNTP Mode : Unicast
  Poll Interval (sec) [720] : 720


  Priority SNTP Server Address                          Protocol Version
  -------- -------------------------------------------- ----------------
  1        2001:db8::215:60ff:fe79:8980 7
  2        10.255.5.24 3
  3        fe80::123%vlan10 3
```

In this Example:, the **Poll Interval** and the **Protocol Version** appear at their default settings.

Both IPv4 and IPv6 addresses are displayed.

Note: Protocol Version appears only when there is an IP address configured for an SNTP server.

If the SNTP server you specify uses SNTP v4 or later, use the `sntp server` command to specify the correct version number. For example, suppose you learned that SNTP v4 was in use on the server you specified above (IP address 10.28.227.141). You would use the following commands to delete the server IP address , re-enter it with the correct version number for that server.

Specifying the SNTP protocol version number

```
switch(config)# no sntp server 10.28.227.141 [1]
switch(config)# sntp server 10.28.227.141 4 [2]
switch(config)# show sntp

 SNTP Configuration

  Time Sync Mode: Sntp
  SNTP Mode : Broadcast
  Poll Interval (sec) [720] : 600

  IP Address     Protocol Version
  -------------  -----------------
  10.28.227.141  4 [3]
```

- [1]Deletes unicast SNTP server entry.
- [2]Re-enters the unicast server with a non-default protocol version.
- [3]`show sntp` displays the result.

Changing the SNTP poll interval (CLI)

Syntax:

sntp <30..720>

Specifies the amount of time between updates of the system clock via SNTP. The default is 720 seconds and the range is 30 to 720 seconds. (This parameter is separate from the poll interval parameter used for Timep operation.)

Example:

To change the poll interval to 300 seconds:

```
switch(config)# sntp 300
```

Changing the SNTP server priority (CLI)

You can choose the order in which configured servers are polled for getting the time by setting the server priority.

Syntax:

sntp server priority <1-3> <*ip-address*>

Specifies the order in which the configured servers are polled for getting the time Value is between 1 and 3.

You can enter both IPv4 and IPv6 addresses. For more information about IPv6 addresses, see the IPv6 configuration guide for your switch.

Example:

To set one server to priority 1 and another to priority 2:

```
switch(config)# sntp server priority 1 10.28.22.141

switch(config)# sntp server priority 2
                 2001:db8::215:60ff:fe79:8980
```

Disabling time synchronization without changing the SNTP configuration (CLI)

The recommended method for disabling time synchronization is to use the `timesync` command.

Syntax:

no timesync

Halts time synchronization without changing your SNTP configuration.

Example:

Suppose SNTP is running as the switch's time synchronization protocol, with `broadcast` as the SNTP mode and the factory-default polling interval. You would halt time synchronization with this command:

```
switch(config)# no timesync
```

If you then viewed the SNTP configuration, you would see the following:

SNTP with time synchronization disabled

```
switch(config)# show sntp
 SNTP Configuration
  Time Sync Mode: Disabled
  SNTP Mode : Broadcast
  Poll Interval (sec) [720] : 720
```

Disabling the SNTP Mode

If you want to prevent SNTP from being used even if it is selected by `timesync` (or the Menu interface's `Time Sync Method` parameter), configure the SNTP mode as disabled.

Syntax:

no sntp

Disables SNTP by changing the SNTP mode configuration to `Disabled`.

Example:

If the switch is running SNTP in unicast mode with an SNTP server at 10.28.227.141 and a server version of 3 (the default), `no sntp` changes the SNTP configuration as shown below and disables time synchronization on the switch.

Disabling time synchronization by disabling the SNTP mode

```
switch(config)# no sntp
switch(config)# show sntp

 SNTP Configuration

  Time Sync Mode: Sntp
  SNTP Mode : disabled
  Poll Interval (sec) [720] : 600

  IP Address      Protocol Version
  --------------  -----------------
  10.28.227.141   3
```

Note that even though the **Time Sync Mode** is set to **Sntp**, time synchronization is disabled because `no sntp` has disabled the **SNTP Mode** parameter.

SNTP client authentication

Enabling SNTP authentication allows network devices such as HPE switches to validate the SNTP messages received from an NTP or SNTP server before updating the network time. NTP or SNTP servers and clients must be configured with the same set of authentication keys so that the servers can authenticate the messages they send and clients (switches) can validate the received messages before updating the time.

This feature provides support for SNTP client authentication on switches, which addresses security considerations when deploying SNTP in a network.

Requirements

You must configure the following to enable SNTP client authentication on the switch.

SNTP client authentication support

- Timesync mode must be SNTP. Use the `timesync sntp` command. (SNTP is disabled by default).
- SNTP must be in unicast or broadcast mode. See **Configuring unicast and broadcast mode for authentication** on page 38.
- The MD5 authentication mode must be selected.
- An SNTP authentication key-identifier (`key-id`) must be configured on the switch and a value (`key-value`) must be provided for the authentication key. A maximum of 8 sets of `key-id` and `key-value` can be configured on the switch.
- Among the keys that have been configured, one key or a set of keys must be configured as trusted. Only trusted keys are used for SNTP authentication.
- If the SNTP server requires authentication, one of the trusted keys has to be associated with the SNTP server.
- SNTP client authentication must be enabled on the HPE Switch. If client authentication is disabled, packets are processed without authentication.

All of the above steps are necessary to enable authentication on the client.

SNTP server authentication support

SNTP server is not supported on Switch products.

You must perform the following on the SNTP server:

- The same authentication key-identifier, trusted key, authentication mode and key-value that were configured on the SNTP client must also be configured on the SNTP server.
- SNTP server authentication must be enabled on the server.

If any of the parameters on the server are changed, the parameters have to be changed on all the SNTP clients in the network as well. The authentication check fails on the clients otherwise, and the SNTP packets are dropped.

Configuring the key-identifier, authentication mode, and key-value (CLI)

This command configures the `key-id`, `authentication-mode`, and `key-value`, which are required for authentication. It is executed in the global configuration context.

Syntax:

sntp authentication key-id <*key-id*> authentication-mode <md5> key-value <*key-string*> [trusted]

no sntp authentication key-id <*key-id*>

Configures a key-id, authentication-mode (MD5 only), and key-value, which are required for authentication.

The `no` version of the command deletes the authentication key.

Default: No default keys are configured on the switch.

`key-id`	A numeric key identifier in the range of 1-4,294,967,295 (2^{32}) that identifies the unique key value. It is sent in the SNTP packet.
`key-value <key-string>`	The secret key that is used to generate the message digest. Up to 32 characters are allowed for *`key-string`* .
`encrypted-key <<key-string>>`	Set the SNTP authentication key value using a base64–encoded aes-256 encrypted string.

Setting parameters for SNTP authentication

```
switch(config)# sntp authentication key-id 55 authentication-mode md5
key-value secretkey1
```

Configuring a trusted key

Trusted keys are used in SNTP authentication. In unicast mode, you must associate a `trusted` key with a specific NTP/SNTP server. That key is used for authenticating the SNTP packet.

In unicast mode, a specific server is configured on the switch so that the SNTP client communicates with the specified server to get the date and time.

In broadcast mode, the SNTP client switch checks the size of the received packet to determine if it is authenticated. If the broadcast packet is authenticated, the key-id value is checked to see if the same key-id value

is configured on the SNTP client switch. If the switch is configured with the same key-id value, and the key-id value is configured as "trusted," the authentication succeeds. Only trusted key-id value information is used for SNTP authentication. For information about configuring these modes, see **Configuring unicast and broadcast mode for authentication** on page 38.

If the packet contains key-id value information that is not configured on the SNTP client switch, or if the received packet contains no authentication information, it is discarded. The SNTP client switch expects packets to be authenticated if SNTP authentication is enabled.

When authentication succeeds, the time in the packet is used to update the time on the switch.

Configuring a `key-id` as `trusted` (CLI)

Enter the following command to configure a key-id as trusted.

Syntax:

sntp authentication key-id <*key-id*> trusted

no sntp authentication key-id <*key-id*> trusted

Trusted keys are used during the authentication process. You can configure the switch with up to eight sets of key-id/key-value pairs. One specific set must selected for authentication; this is done by configuring the set as `trusted`.

The `key-id` itself must already be configured on the switch. To enable authentication, at least one `key-id` must be configured as `trusted`.

The `no` version of the command indicates the key is unreliable (not trusted).

Default: No key is trusted by default.

For detailed information about trusted keys, see **Configuring a trusted key** on page 36

Associating a key with an SNTP server (CLI)

Syntax:

[no] sntp server priority <1-3> {< *ip-address* | *ipv6-address* >} <*version-num*> [key-id <1-4,294,967,295>]

Configures a `key-id` to be associated with a specific server. The key itself must already be configured on the switch.

The `no` version of the command disassociates the key from the server. This does not remove the authentication key.

Default: No key is associated with any server by default.

`priority`	Specifies the order in which the configured servers are polled for getting the time.
`version-num`	Specifies the SNTP software version to use and is assigned on a per-server basis. The version setting is backwards-compatible. For example, using version 3 means that the switch accepts versions 1 through 3. Default: 3; range: 1 - 7.
`key-id`	Optional command. The key identifier sent in the SNTP packet. This `key-id` is associated with the SNTP server specified in the command.

Associating a `key-id` with a specific server

```
switch(config)# sntp server priority 1 10.10.19.5 2 key-id 55
```

Enabling SNTP client authentication

The `sntp authentication` command enables SNTP client authentication on the switch. If SNTP authentication is not enabled, SNTP packets are not authenticated.

Syntax:

[no] sntp authentication

Enables the SNTP client authentication.

The `no` version of the command disables authentication.

Default: SNTP client authentication is disabled.

Configuring unicast and broadcast mode for authentication

To enable authentication, you must configure either unicast or broadcast mode. When authentication is enabled, changing the mode from unicast to broadcast or vice versa is not allowed; you must disable authentication and then change the mode.

To set the SNTP mode or change from one mode to the other, enter the appropriate command.

Syntax:

sntp unicast

sntp broadcast

Enables SNTP for either broadcast or unicast mode.

Default: SNTP mode is disabled by default. SNTP does not operate even if specified by the CLI `timesync` command or by the menu interface `Time Sync Method` parameter.

`Unicast`	Directs the switch to poll a specific server periodically for SNTP time synchronization.The default value between each polling request is 720 seconds, but can be configured.At least one manually configured server IP address is required.

At least one `key-id` must be configured as `trusted`, and it must be associated with one of the SNTP servers. To edit or remove the associated `key-id` information or SNTP server information, SNTP authentication must be disabled.

`Broadcast`	Directs the switch to acquire its time synchronization from data broadcast by any SNTP server to the network broadcast address. The switch uses the first server detected and ignores any others. However, if the Poll Interval (configurable up to 720 seconds) expires three times without the switch detecting a time update from the original server, the switch accepts a broadcast time update from the next server it detects.

Viewing SNTP authentication configuration information (CLI)

The `show sntp` command displays SNTP configuration information, including any SNTP authentication keys that have been configured on the switch.

SNTP configuration information

```
switch(config)# show sntp

 SNTP Configuration

  SNTP Authentication : Enabled
  Time Sync Mode: Sntp
  SNTP Mode : Unicast
  Poll Interval (sec) [720] : 720

  Priority SNTP Server Address                  Protocol Version KeyId
  -------- ------------------------------------ ---------------- -----
  1        10.10.10.2                           3                55
  2        fe80::200:24ff:fec8:4ca8             3                55
```

Viewing all SNTP authentication keys that have been configured on the switch (CLI)

Enter the `show sntp authentication` command, as shown in **Show sntp authentication command output** on page 39.

`Show sntp authentication` command output

```
switch(config)# show sntp authentication

  SNTP Authentication Information

  SNTP Authentication : Enabled

  Key-ID  Auth Mode  Trusted
  ------- ---------- --------
  55      MD5        Yes
  10      MD5        No
```

Viewing statistical information for each SNTP server (CLI)

To display the statistical information for each SNTP server, enter the `show sntp statistics` command.

The number of SNTP packets that have failed authentication is displayed for each SNTP server address, as shown in **SNTP authentication statistical information** on page 39.

SNTP authentication statistical information

```
switch(config)# show sntp statistics
SNTP Statistics

  Received Packets : 0
  Sent Packets : 3
  Dropped Packets : 0

  SNTP Server Address                    Auth Failed Pkts
  -------------------------------------- ----------------
  10.10.10.1                                    0
  fe80::200:24ff:fec8:4ca8                      0
```

Saving configuration files and the include-credentials command

You can use the `include-credentials` command to store security information in the running-config file. This allows you to upload the file to a TFTP server and then later download the file to the HPE switches on which you want to use the same settings. For more information about the `include-credentials` command, see "Configuring Username and Password Security" in the access security guide for your switch.

The authentication key values are shown in the output of the `show running-config` and `show config` commands only if the `include-credentials` command was executed.

When SNTP authentication is configured and `include-credentials` has not been executed, the SNTP authentication configuration is not saved.

Configuration file with SNTP authentication information

```
switch(config) # show config
Startup configuration:
.
.
.
timesync sntp
sntp broadcast
sntp 50
sntp authentication
sntp server priority 1 10.10.10.2.3 key-id 55
sntp server priority 2 fe80::200:24ff:fec8:4ca8 4 key-id 55
```

SNTP authentication has been enabled and a key-id of 55 has been created.

In this Example:, the `include-credentials` command has not been executed and is not present in the configuration file. The configuration file is subsequently saved to a TFTP server for later use. The SNTP authentication information is not saved and is not present in the retrieved configuration files, as shown in the following Example:.

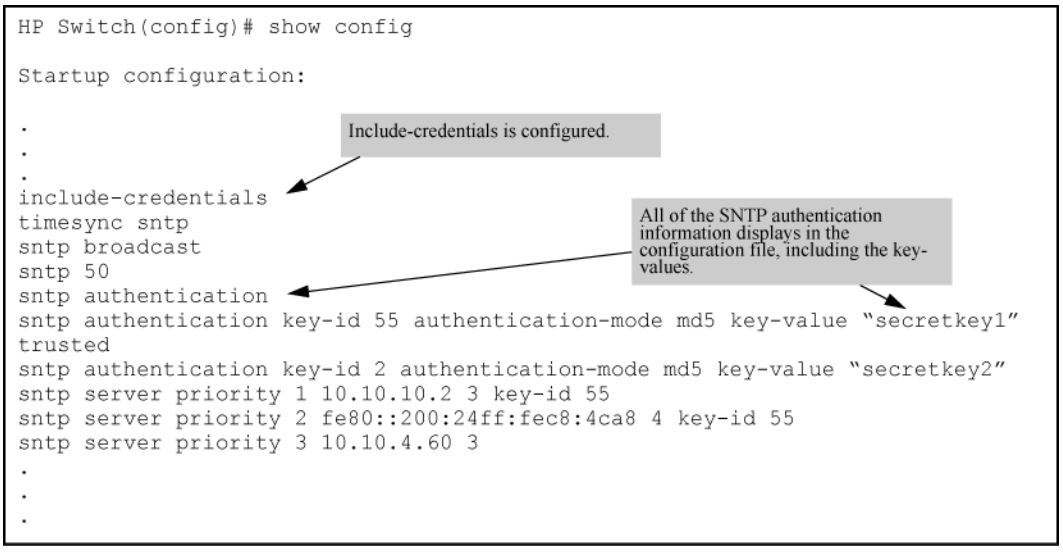
Retrieved configuration file when `include credentials` is not configured

```
switch(config) # copy tftp startup-config 10.2.3.44 config1
.
.
.
Switch reboots ...
.
Startup configuration
.
.
.
timesync sntp
sntp broadcast
sntp 50 sntp server priority 1 10.10.10.2.3
sntp server priority 2 fe80::200:24ff:fec8:4ca8 4
.
.
.
```

The SNTP authentication line and the Key-ids are not displayed. You must reconfigure SNTP authentication.

If `include-credentials` is configured, the SNTP authentication configuration is saved in the configuration file. When the `show config` command is entered, all of the information that has been configured for SNTP authentication displays, including the key-values.

Figure 5: *Saved SNTP Authentication information when `include-credentials` is configured*



TimeP: Selecting and configuring

The following table shows TimeP parameters and their operations.

Table 2: *TimeP parameters*

TimeP parameter	Operation
Time Sync Method	Used to select either TIMEP, SNTP, NTP, or None as the time synchronization method.
TimeP Mode	
Disabled	TimeP does not operate, even if specified by the Menu interface **Time Sync Method** parameter or the CLI `timesync` command.
DHCP	When TimeP is selected as the time synchronization method, the switch attempts to acquire a TimeP server IP address via DHCP. If the switch receives a server address, it polls the server for updates according to the TimeP poll interval. If the switch does not receive a TimeP server IP address, it cannot perform time synchronization updates.
Manual	When TimeP is selected as the time synchronization method, the switch attempts to poll the specified server for updates according to the TimeP poll interval. If the switch fails to receive updates from the server, time synchronization updates do not occur.
Server Address	Used only when the **TimeP Mode** is set to **Manual**. Specifies the IP address of the TimeP server that the switch accesses for time synchronization updates. You can configure one server.

Viewing, enabling, and modifying the TimeP protocol (Menu)

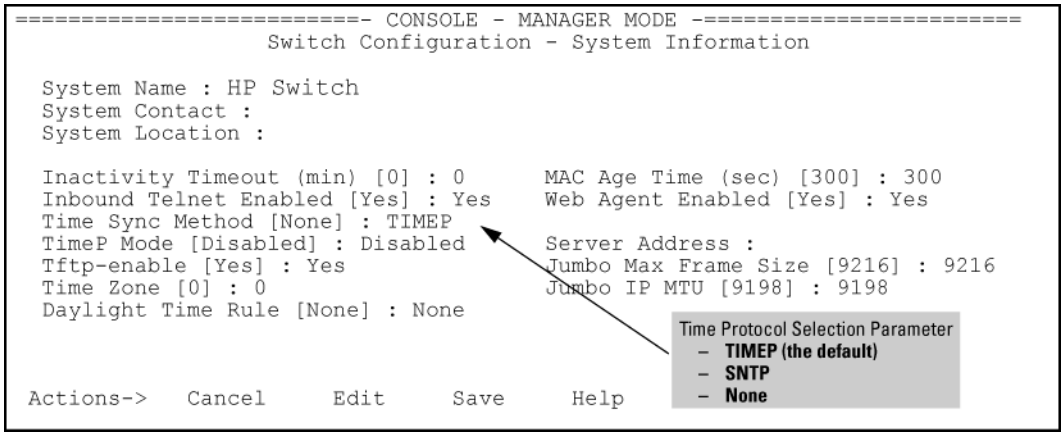
Procedure

1. From the Main Menu, select:

   2. Switch Configuration

   1. System Information

   Figure 6: *System Information screen (default values)*



2. Press **[E]** (for **Edit**).

   The cursor moves to the **System Name** field.
3. Move the cursor to the **Time Sync Method** field.
4. If **TIMEP** is not already selected, use the **Space** bar to select **TIMEP**, then move to the **TIMEP Mode** field.
5. Do one of the following:

   - Use the **Space** bar to select the **DHCP** mode.
     - Move the cursor to the **Poll Interval** field.
     - Go to step 6.

   Enabling TIMEP or DHCP

```
Time Sync Method [None] :   TIMEP
TimeP Mode [Disabled] :     DHCP
Poll Interval (min) [720] : 720
Time Zone [0] :             0
Daylight Time Rule [None] : None
```

   - Use the **Space**bar to select the **Manual** mode.
     - Move the cursor to the **Server Address** field.
     - Enter the IP address of the TimeP server you want the switch to use for time synchronization.

       NOTE: This step replaces any previously configured TimeP server IP address.
     - Move the cursor to the **Poll Interval** field, then go to step 6.
6. In the **Poll Interval** field, enter the time in minutes that you want for a TimeP Poll Interval.
7. Select **[Enter]** to return to the **Actions** line, then select **[S]** (for **Save**) to enter the new time protocol configuration in both the startup-config and running-config files.

Viewing the current TimeP configuration (CLI)

Using different `show` commands, you can display either the full TimeP configuration or a combined listing of all TimeP, SNTP, and VLAN IP addresses configured on the switch.

Syntax:

show timep

Lists both the time synchronization method (TimeP, SNTP, or None) and the TimeP configuration, even if SNTP is not the selected time protocol. (If the TimeP Mode is set to `Disabled` or `DHCP`, the Server field does not appear.)

If you configure the switch with TimeP as the time synchronization method, then enable TimeP in DHCP mode with the default poll interval, `show timep` lists the following:

TimeP configuration when TimeP is the selected Time synchronization method

```
switch(config)# show timep

 Timep Configuration

  Time Sync Mode: Timep
  TimeP Mode [Disabled] : DHCP    Server Address : 10.10.28.103
  Poll Interval (min) [720] : 720
```

If SNTP is the selected time synchronization method, `show timep` still lists the TimeP configuration even though it is not currently in use. Even though, in this Example:, SNTP is the current time synchronization method, the switch maintains the TimeP configuration:

TimeP configuration when TimeP is not the selected time synchronization method

```
switch(config)# show timep

 Timep Configuration

  Time Sync Mode: Sntp
  TimeP Mode [Disabled] : Manual   Server Address : 10.10.28.100
  Poll Interval (min) [720] : 720
```

Syntax:

show management

Helps you to easily examine and compare the IP addressing on the switch. It lists the IP addresses for all time servers configured on the switch plus the IP addresses and default gateway for all VLANs configured on the switch.

Display showing IP addressing for all configured time servers and VLANs

```
switch(config)# show management

 Status and Counters - Management Address Information

  Time Server Address : 10.10.28.100

  Priority SNTP Server Address                          Protocol Version
  -------- ------------------------------------------- ----------------
```

```
1         10.10..28.101                                    3
2         10.255.5.24                                      3
3         fe80::123%vlan10                                 3


Default Gateway : 10.0.9.80

VLAN Name    MAC Address          | IP Address
------------ -------------------- + -------------------
DEFAULT_VLAN 001279-88a100        | 10.30.248.184
VLAN10 001279-88a100              | 10.0.10.17
```

Configuring (enabling or disabling) the TimeP mode

Enabling the TimeP mode means to configure it for either broadcast or unicast mode. Remember to run TimeP as the switch's time synchronization protocol, you must also select TimeP as the time synchronization method by using the CLI `timesync` command (or the menu interface **Time Sync Method** parameter.

Syntax:

timesync timep

Selects TimeP as the time synchronization method.

Syntax:

ip timep {<dhcp | manual>}

Enables the selected TimeP mode.

Syntax:

[no] ip timep

Disables the TimeP mode.

Syntax:

[no] timesync

Disables the time protocol.

Enabling TimeP in manual mode (CLI)

Like DHCP mode, configuring TimeP for `manual` mode enables TimeP. However, for manual operation, you must also specify the IP address of the TimeP server. (The switch allows only one TimeP server.)

Syntax:

timesync timep

Selects TimeP.

Syntax:

ip timep manual <*ip-addr*>

Activates TimeP in manual mode with a specified TimeP server.

Syntax:

no ip timep

Disables TimeP.

Enabling TimeP in DHCP Mode

Because the switch provides a TimeP polling interval (default:720 minutes), you need only these two commands for a minimal TimeP DHCP configuration:

Syntax:

timesync timep

Selects TimeP as the time synchronization method.

Syntax:

ip timep dhcp

Configures DHCP as the TimeP mode.

For example, suppose:

- Time Synchronization is configured for SNTP.
- You want to:
  - View the current time synchronization.
  - Select TimeP as the synchronization mode.
  - Enable TimeP for DHCP mode.
  - View the TimeP configuration.

Enabling TimeP in Manual Mode

Like DHCP mode, configuring TimeP for Manual Mode enables TimeP. However, for manual operation, you must also specify the IP address of the TimeP server. (The switch allows only one TimeP server.) To enable the TimeP protocol:

Syntax:

timesync timep

Selects TimeP.

Syntax:

ip timep manual <*ip-addr*>

Activates TimeP in manual mode with a specified TimeP server.

Syntax:

[no] ip timep

Disables TimeP.

NOTE

To change from one TimeP server to another, you must use the `no ip timep` command to disable TimeP mode, the reconfigure TimeP in manual mode with the new server IP address.

Example:

To select TimeP and configure it for manual operation using a TimeP server address of 10.28.227.141 and the default poll interval (720 minutes, assuming the TimeP poll interval is already set to the default):

```
switch(config)# timesync time
```

Selects TimeP.

```
switch(config)# ip timep manual 10.28.227.141
```

Activates TimeP in Manual mode.

Configuring TimeP for manual operation

```
switch(config)# timesync timep
switch(config)# ip timep manual 10.28.227.141
switch(config)# show timep
 Timep Configuration
  Time Sync Mode: Timep
  TimeP Mode :  Manual              Server Address : 10.28.227.141
  Poll Interval (min) : 720
```

Changing from one TimeP server to another (CLI)

Procedure

1. Use the `no ip timep` command to disable TimeP mode.
2. Reconfigure TimeP in Manual mode with the new server IP address.

Changing the TimeP poll interval (CLI)

Syntax:

ip timep {< dhcp | manual >} interval <1-9999>

Specifies how long the switch waits between time polling intervals. The default is 720 minutes and the range is 1 to 9999 minutes. (This parameter is separate from the `poll interval` parameter used for SNTP operation.)

Example:

To change the poll interval to 60 minutes:

```
switch(config)# ip timep interval 60
```

Disabling time synchronization without changing the TimeP configuration (CLI)

Syntax:

no timesync

Disables time synchronization by changing the `Time Sync Mode` configuration to `Disabled`. This halts time synchronization without changing your TimeP configuration. The recommended method for disabling time synchronization is to use the `timesync` command.

Example:

Suppose TimeP is running as the switch's time synchronization protocol, with `DHCP` as the TimeP mode, and the factory-default polling interval. You would halt time synchronization with this command:

```
switch(config)# no timesync
```

If you then viewed the TimeP configuration, you would see the following:

TimeP with time synchronization disabled

```
switch(config)# show timep

 Timep Configuration
  Time Sync Mode: Disabled
  TimeP Mode : DHCP Poll Interval (min): 720
```

Disabling the TimeP mode

Syntax:

no ip timep

Disables TimeP by changing the TimeP mode configuration to `Disabled` and prevents the switch from using it as the time synchronization protocol, even if it is the selected `Time Sync Method` option.

Example:

If the switch is running TimeP in DHCP mode, `no ip timep` changes the TimeP configuration as shown below and disables time synchronization. Even though the TimeSync mode is set to TimeP, time synchronization is disabled because `no ip timep` has disabled the TimeP mode parameter.

Disabling time synchronization by disabling the TimeP mode parameter

```
switch(config)# no ip timep

switch(config)# show timep

 Timep Configuration
  Time Sync Mode: Timep
  TimeP Mode : Disabled
```

SNTP unicast time polling with multiple SNTP servers

When running SNTP unicast time polling as the time synchronization method, the switch requests a time update from the server you configured with either the `Server Address` parameter in the menu interface, or the primary server in a list of up to three SNTP servers configured using the CLI. If the switch does not receive a response from the primary server after three consecutive polling intervals, the switch tries the next server (if any) in the list. If the switch tries all servers in the list without success, it sends an error message to the Event Log and reschedules to try the address list again after the configured `Poll Interval` time has expired.

If there are already three SNTP server addresses configured on the switch, and you want to use the CLI to replace one of the existing addresses with a new one, you must delete the unwanted address before you configure the new one.

Displaying all SNTP server addresses configured on the switch (CLI)

The System Information screen in the menu interface displays only one SNTP server address, even if the switch is configured for two or three servers. The CLI `show management` command displays all configured SNTP servers on the switch.

How to list all SNTP servers configured on the switch

```
switch(config)# show management

 Status and Counters - Management Address Information

  Time Server Address : fe80::215:60ff:fe7a:adc0%vlan10

  Priority SNTP Server Address                          Protocol Version
  -------- ------------------------------------------- ----------------
  1 2001:db8::215:60ff:fe79:8980                        7
  2 10.255.5.24                                         3
  3 fe80::123%vlan10                                    3


  Default Gateway : 10.0.9.80

  VLAN Name    MAC Address          | IP Address
  ------------ -------------------- + -------------------
  DEFAULT_VLAN 001279-88a100        | Disabled
  VLAN10       001279-88a100        | 10.0.10.17
```

Adding and deleting SNTP server addresses

Adding addresses

As mentioned earlier, you can configure one SNTP server address using either the Menu interface or the CLI. To configure a second and third address, you must use the CLI. To configure the remaining two addresses, you would do the following:

Creating additional SNTP server addresses with the CLI

```
switch(config)# sntp server priority <1-3> 2001:db8::215:60ff:fe79:8980
switch(config)# sntp server 10.255.5.24
```

If there are already three SNTP server addresses configured on the switch, and you want to use the CLI to replace one of the existing addresses with a new one, you must delete the unwanted address before you configure the new one.

Deleting addresses

Syntax:

no sntp server <*ip-addr*>

Deletes a server address. If there are multiple addresses and you delete one of them, the switch re-orders the address priority.

Example:

To delete the primary address in the above Example: and automatically convert the secondary address to primary:

```
switch(config)# no sntp server 10.28.227.141
```

Operating with multiple SNTP server addresses configured (Menu)

When you use the Menu interface to configure an SNTP server IP address, the new address writes over the current primary address, if one is configured.

SNTP messages in the Event Log

If an SNTP time change of more than three seconds occurs, the switch's Event Log records the change. SNTP time changes of less than three seconds do not appear in the Event Log.

Network Time Protocol (NTP)

All NTP communications use Coordinated Universal Time (UTC). An NTP server usually receives its time from an authoritative time source, such as a radio clock or an atomic clock attached to a time server, and then distributes this time across the network. NTP is extremely efficient; no more than one packet per minute is necessary to synchronize two machines to within a millisecond of each other.

NTP uses a stratum to describe the distance between a network device and an authoritative time source:

- A stratum 1 time server is directly attached to an authoritative time source (such as a radio or atomic clock or a GPS time source).
- A stratum 2 NTP server receives its time through NTP from a stratum 1 time server.

Before synchronizing, NTP compares the time reported by several network devices and does not synchronize with one that is significantly different, even if it is a stratum 1.

The security features of NTP can be used to avoid the accidental or malicious setting of incorrect time. One such mechanism is available: an encrypted authentication mechanism.

Though similar, the NTP algorithm is more complex and accurate than the Simple Network Time Protocol (SNTP).

Enabling this feature results in synchronizing the system clock; therefore, it may affect all sub-systems that rely on system time.

Commands

The following commands allow the user to configure NTP or show NTP configurations.

`timesync` Command

This command is used to configure the protocol used for network time synchronization.

Syntax

[no] timesync { timep | sntp | timep-or-sntp | ntp }

Options

`no`

Deletes all timesync configurations on the device.

`timep`

Updates the system clock using TIMEP.

`sntp`

Updates the system clock using SNTP.

`timep-or-sntp`

Updates the system clock using TIMEP or SNTP (default).

`ntp`

Updates the system clock using NTP

Example

```
switch(config)# timesync
sntp              Update the system clock using SNTP.
timep             Update the system clock using TIMEP.
timep-or-sntp     Update the system clock using TIMEP or SNTP.
ntp               Update the system clock using NTP.
```

timesync ntp

This command is used to update the system clock using NTP.

Syntax

```
timesync ntp
```

Description

Update the system clock using NTP.

ntp

This command selects the operating mode of the NTP client.

Syntax

```
ntp [broadcast|unicast]
```

Options

`broadcast`

Sets ntp server to operate in broadcast mode.

`unicast`

Sets ntp server to operate in unicast mode.

Usage

The default mode is broadcast.

[no] ntp

This command disables NTP and removes all NTP configurations on the device.

Syntax

```
[no] ntp [authentication <key-id>
 | broadcast | enable | max-association
<integer> | server
<IP-ADDR> | trap
<trap-name> | unicast]
```

Description

Disable NTP and removes the entire NTP configuration.

Options

authentication	Configure NTP authentication.
broadcast	Operate in broadcast mode.
enable	Enable/disable NTP.
max-association	Maximum number of Network Time Protocol (NTP) associations.
server	Configure a NTP server to poll for time synchronization.
trap	Enable/disable NTP traps.
unicast	Operate in unicast mode.

Example

```
switch(config)# no ntp
This will delete all NTP configurations on this device. Continue [y/n]?
```

ntp enable

This command is used to enable or disable NTP on the switch.

Syntax

```
ntp enable
```

Example

```
switch(config)# ntp
enable      Enable/disable NTP.
```

Description

Enable or disable NTP. Use [no] to disable NTP.

Restrictions

Validation	Error/Warning/Prompt
If timeSync is in SNTP or Timep when NTP is enabled.	`Timesync is not configured to NTP.`
When timesync is NTP and ntp is enabled and we try to change timesync to SNTP.	`Disable NTP before changing timesync to SNTP or TIMEP`

ntp authentication

This command is used for authentication of NTP server by the NTP client.

Syntax

```
ntp authentication key-id <KEY-ID> [authentication-mode <MODE> key-value <KEY-STRING>] [trusted]
```

Parameters/Options

`key-id <id>`

Sets the key-id for the authentication key.

Subcommands

`authentication-mode`

Sets the NTP authentication mode

`key-value <KEY-STRING>`

Sets the key-value for the authentication key.

`[trusted]`

`Sets the authentication key as trusted.`

Example

```
Switch(config)# ntp
Authentication      Configure NTP authentication.
```

```
Switch(config)# ntp authentication
key-id              Set the key-id for this authentication key.
```

```
Switch(config)# ntp authentication key-id
<1-4294967295>      Set the authentication key-id.
```

```
Switch(config)# ntp authentication key-id 1
authentication-mode  Set the NTP authentication mode.
trusted              Set this authentication key as trusted.
```

```
Switch(config)# ntp authentication key-id 1
authentication-mode|trusted md5
Authenticate using MD5.
```

```
Switch(config)# ntp authentication key-id 1
authentication-mode|trusted md5key-value  Set the NTP authentication key.
```

```
Switch(config)# ntp authentication key-id 1
authentication-mode|trusted md5 key-value
KEY          Enter a string to be set as the NTP authentication key.
```

ntp authentication key-id

Syntax

```
ntp authentication key-id
<key-id> [authentication-mode [md5 | sha1]
 key-value <key-value>] [trusted]
```

Description

The NTP client authenticates the NTP server.

Options

authentication-mode	Set the NTP authentication mode. • md5: Authenticate using MD5. • sha1: Authenticate using SHA1.
trusted	Set this authentication key as trusted.

ntp max-association

This command is used to configure the maximum number of servers associated with this NTP client.

Syntax

ntp max-association
<number>

Options

`max-association <number>`

Sets the maximum number of NTP associations.

Description

Configure maximum number of servers associated with the client. Up to eight servers can be configured as the maximum.

Restrictions

The range for a maximum number of NTP associations is 1–8.

Example

```
Switch(config)# ntp
max-associations      Maximum number of NTP associations.

Switch(config)# ntp max-associations
<1-8>                 Enter the number.
```

Restrictions

Validation	Error/Warning/Prompt
When the number of configured NTP servers is more than the max-associations value.	`The maximum number of NTP servers allowed is <number>.`
When the max-associations value is less than the (n) number of configured NTP servers.	`Max-associations value cannot be less than the number of NTP servers configured.`

ntp server

This command is used to configure the NTP servers.

Syntax

[no] ntp server

ntp server <IP-ADDR|IPv6-ADDR> [key <key-id>] [oobm] [max-poll <max-poll-val>][min-poll <min-poll-val>][burst | iburst] [version <1-4>]

Parameters/Options

`[no]`

Removes the unicast NTP configurations on the device.

Subcommands

`IP-ADDR`

Sets the IPv4 address of the NTP server.

`IPV6-ADDR`

Sets the IPv6 address of the NTP server.

`key <key-id>`

Specifies the authentication key.

`max-poll <max-poll-val>`

Configures the maximum time intervals in power of 2 seconds. Range is 4–17 (e.g., 5 would translate to 2 raised to 5 or 32).

`min-poll <min-poll-val>`

Configures the minimum time intervals in seconds. Range is 4–17.

`burst`

Enables burst mode.

`iburst`

Enables initial burst mode.

`version`

Sets version 1–4.

Usage

A maximum of 8 NTP servers can be configured.

Example

```
switch(config)# ntp
server          Allow the software clock to be synchronized by an NTP
time server.
broadcast       Operate in broadcast mode.
unicast         Operate in unicast mode.
```

```
switch(config)# ntp server
IP-ADDR         IPv4 address of the NTP server.
IPV6-ADDR       IPv6 address of the NTP server.
```

```
switch(config)# ntp server <IP-ADDR>
Key             Specify the authentication key.


switch(config)# ntp server <IP-ADDR> key key-id
Max-poll        Configure the maximum time intervals in seconds.

switch(config)# ntp server <IP-ADDR> key key-id max-poll
<4-17>          Enter an integer number.


Switch(config)# ntp server <IP-ADDR> key key-id
Min-poll        Configure the minimum time intervals in seconds.


switch(config)# ntp server <IP-ADDR> key key-id min-poll
<4-17>          Enter an integer number.


switch(config)# ntp server <IP-ADDR> key key-id prefer max-poll
<max-poll-val> min-poll <min-poll-val>
iburst          Enable initial burst (iburst) mode.
burst           Enable burst mode.


Switch(config)# ntp server IP-ADDR key key-id prefer maxpoll <number>
minpoll <number> iburst
```

Restrictions

Validation	Error/Warning/Prompt
If authentication key-id not configured	`Authentication key-id has not been configured.`
If Key-id is not marked as trusted	`Key-id is not trusted.`
When min poll value is more than max poll value	`NTP max poll value should be more than min poll value.`

ntp server key-id

Syntax

ntp server <*IP-ADDR* |*IPV6-ADDR*>
key—id <*key-id*> [max-poll
<*max-poll-val>]* [min-poll
<*min-poll-val*>] [burst | iburst]

Description

Configure the NTP server. <*IP-ADDR*> indicates the IPv4 address of the NTP server. <*IPV6-ADDR*> indicates the IPv6 address of the NTP server.

Options

burst Enables burst mode.

iburst	Enables initial burst (iburst) mode.
key-id	Set the authentication key to use for this server.
max-poll <*max-poll-val*>	Configure the maximum time intervals in seconds.
min-poll <*min-poll-val*>	Configure the minimum time intervals in seconds.

ntp ipv6-multicast

This command is used to configure NTP multicast on a VLAN interface.

Syntax

```
ntp ipv6-multicast
```

Description

Configure the interface to listen to the NTP multicast packets.

Example

```
Switch(vlan-2)# ntp
ipv6-multicast      Configure the interface to listen to the NTP multicast packets.
```

Restrictions

Validation	Error/Warning/Prompt
If ipv6 is not enabled on vlan interface	`IPv6 address not configured on the VLAN.`

debug ntp

This command is used to display debug messages for NTP.

Syntax

debug ntp <*event* | *packet*>

Options

`event`

Displays event log messages related to NTP.

`packets`

Displays NTP packet messages.

Description

Enable debug logging. Use [no] to disable debug logging.

Example

```
Switch(config)# debug ntp
event               Display event log messages related to NTP.
packet              Display NTP packet messages.
```

ntp trap

This command is used to configure NTP traps.

Syntax

ntp trap *<trap-name>*

Description

Enable NTP traps. Use [no] to disable NTP traps.

Options

ntp-mode-change	Trap name resulting in `send notification when the NTP entity changes mode, including starting and stopping (if possible).`
ntp-stratum-change	Trap name resulting in `send notification when stratum level of NTP changes.`
ntp-peer-change	Trap name resulting in `send notification when a (new) syspeer has been selected.`
ntp-new-association	Trap name resulting in `send notification when a new association is mobilized.`
ntp-remove-association	Trap name resulting in `send notification when an association is demobilized.`
ntp-config-change	Trap name resulting in `send notification when the NTP configuration has changed.`
ntp-leapsec-announced	Trap name resulting in `send notification when a leap second has been announced.`
ntp-alive-heartbeat	Trap name resulting in `send notification periodically (as defined by ntpEntHeartbeatInterval) to indicate that the NTP entity is still alive.`
all	Enable all traps.

Usage

The traps defined below are generated as the result of finding an unusual condition while parsing an NTP packet or a processing a timer event. Note that if more than one type of unusual condition is encountered while parsing the packet or processing an event, only the first one will generate a trap. Possible trap names are:

`- 'ntpEntNotifModeChange' The notification to be sent when the NTP entity changes mode, including starting and stopping (if possible).`

`- 'ntpEntNotifStratumChange' The notification to be sent when stratum level of NTP changes.`

`- 'ntpEntNotifSyspeerChanged' The notification to be sent when a (new) syspeer has been selected.`

`- 'ntpEntNotifAddAssociation' The notification to be sent when a new association is mobilized.`

- 'ntpEntNotifRemoveAssociation' The notification to be sent when an association is demobilized.

- 'ntpEntNotifConfigChanged' The notification to be sent when the NTP configuration has changed.

- 'ntpEntNotifLeapSecondAnnounced' The notification to be sent when a leap second has been announced.

- 'ntpEntNotifHeartbeat' The notification to be sent periodically (as defined by ntpEntHeartbeatInterval) to indicate that the NTP entity is still alive.

- 'ntpEntNotifAll' The notification to be sent when all traps have been enabled

show ntp statistics

This command is used to show NTP statistics.

Syntax

```
show ntp statistics
```

Description

Show information about NTP packets.

Examples

Switch(config)# show ntp statistics

NTP Global statistics information

NTP In Packets : 100
NTP Out Packets : 110
NTP Bad Version Packets : 4
NTP Protocol Error Packets : 0

switch(config)# show ntp statistics

```
NTP Global statistics information

NTP In Packets              : 100
NTP Out Packets             : 110
NTP Bad Version Packets     : 4
NTP Protocol Error Packets  : 0
```

show ntp status

Syntax

Description

Show the status of NTP.

```
show ntp status
```

Example

Switch(config)# show ntp status

NTP Status information
NTP Status : Disabled NTP Mode : Broadcast

```
Synchronization Status : Synchronized        Peer Dispersion : 8.01 sec
Stratum Number         : 2                   Leap Direction  : 1
Reference Assoc Id     : 1                   Clock Offset    : 0.0000 sec
Reference              : 192.0.2.1           Root Delay      : 0.00 sec
Precision              : 2**7                Root Dispersion : 15.91 sec
NTP Uptime             : 01d 09h 15m         Time Resolution : 1
Drift                  : 0.000000000 sec/sec

System Time            : Tue Aug 25 04:59:11 2015
Reference Time         : Mon Jan  1 00:00:00 1990
```

show ntp associations

Syntax

show ntp associations [detail
<IP-ADDR>]

Description

Show the status of configured NTP associations.

Options

detail Show the detailed status of NTP associations configured for the system.

Switch(config)# show ntp associations

```
                    NTP Associations Entries

Address           St   T  When Poll  Reach   Delay    Offset   Dispersion
--------------    ---  -- ---- ----- ------ -------   -------  ----------
121.0.23.1        16   u    -  1024    0     0.000     0.000     0.000
231.45.21.4       16   u    -  1024    0     0.000     0.000     0.000
55.21.56.2        16   u    -  1024    0     0.000     0.000     0.000
23.56.13.1         3   u 209  1024  377     54.936   -6.159     12.688
91.34.255.216      4   u 132  1024  377     1.391     0.978     3.860
```

Switch(config)# show ntp associations detail <IP ADDR>

```
NTP association information

IP address       : 172.31.32.2                  Peer Mode       : Server
Status           : Configured, Insane, Invalid  Peer Poll Intvl : 64
Stratum          : 5                            Root Delay      : 137.77 sec
Ref Assoc ID     : 0                            Root Dispersion : 142.75
Association Name : NTP Association 0            Reach           : 376
Reference ID     : 16.93.49.4                   Delay           : 4.23 sec
Our Mode         : Client                       Offset          : -8.587 sec
Our Poll Intvl   : 1024                         Precision       : 2**19

Dispersion       : 1.62 sec
Association In Packets    : 60
Association Out Packets   : 60
Association Error Packets : 0
Origin Time      : Fri Jul 3 11:39:40 2015
```

```
Receive Time     : Fri Jul 3 11:39:44 2015
Transmit Time    : Fri Jul 3 11:39:44 2015

-------------------------------------------------------------------------------
Filter Delay =   4.23    4.14    2.41    5.95    2.37    2.33    4.26    4.33
Filter Offset = -8.59   -8.82   -9.91   -8.42  -10.51  -10.77  -10.13  -10.11
```

show ntp authentication

Syntax

Description

Show the authentication status and other information about the authentication key.

```
show ntp authentication
```

Switch(config)# show ntp authentication

```
NTP Authentication Information

Key-ID     Auth Mode   Trusted
--------   ----------  -------
67            md5        yes
7             md5        no
1             sha1       yes
2             sha1       no
```

Validation rules

Validation	Error/Warning/Prompt
If access-list name is not valid.	Please enter a valid access-list name.
If the authentication method is being set to two-factor authentication, various messages display.	If both the public key and username/password are not configured: Public key and username/password should be configured for a successful two-factor authentication. If public key is configured and username is not configured: Username and password should be configured for a successful two-factor authentication. If the username is configured and public key is not configured: Public key should be configured for a successful two-factor authentication. If “ssh-server” certificate is not installed at the time of enabling certificate-password authentication: The “ssh-server” certificate should be installed for a successful two-factor authentication.

Table Continued

Validation	Error/Warning/Prompt
If the authentication method is set to two-factor while installing the public key, a message displays.	The client public keys without username will not be considered for the two-factor authentication for the SSH session.
If the username and the key installation user for that privilege do not match, a message displays and installation is not allowed. This will also happen when the authentication method is set for two-factor.	The username in the key being installed does not match the username configured on the switch.
If the maximum number of <username : TA profile> associations is reached for a given TA profile, a message displays.	Maximum number of username associations with a TA profile is 10.
If secondary authentication type for two-factor authentication chosen is not "none", a message displays.	Not legal combination of authentication methods.
If the authentication method is anything other than two-factor and the two-factor authentication method options are set, a message displays.	Not legal combination of authentication methods.
If two-factor authentication is set and user tries to SSH into another system using `ssh <ip | hostname>` command, a message displays.	SSH client is not supported when the two-factor authentication is enabled.
If timeSync is in SNTP or Timep when NTP is enabled.	Timesync is not configured to NTP.
If timesync is NTP and NTP is enabled and we try to change timesync to SNTP.	Disable NTP before changing timesync to SNTP or TIMEP.
If we try to configure NTP servers more than the configured max-associations value.	The maximum number of NTP servers allowed is 2.
If we have ‘n’ NTP servers configured and we try to configure a max-associations value less than (n) number of NTP servers already configured.	Max-associations value cannot be less than the number of NTP servers configured.
If authentication key-id is not configured.	Authentication key-id %d has not been configured.
If key-id is not marked as trusted.	Key-id %d is not trusted.
If min poll value is more than max poll value.	NTP max poll value should be more than min poll value.
If ipv6 is not enabled on vlan interface.	IPv6 address not configured on the VLAN.

Cause

Event	Message
RMON_AUTH_TWO_FACTOR_AUTHEN_STATUS	W 01/01/15 18:24:03 03397: auth: %s. Examples: W 01/01/15 18:24:03 03397: auth: Public key and username/password should be configured for the successful two-factor authentication. W 01/01/15 18:24:03 03397: auth: Username and password should be configured for the successful two-factor authentication. W 01/01/15 18:24:03 03397: auth: Public key should be configured for the successful two-factor authentication. I 01/01/15 18:24:03 03397: auth: The validation of certificate of SSH user ‘user1’ is successful.
RMON_SSH_KEY_TWO_FACTOR_EN	W 01/01/15 18:24:03 03399: ssh: %s. Examples: W 01/01/15 18:24:03 03399: ssh: The client public keys without username will not be considered for the two-factor authentication for SSH session. W 01/01/15 18:24:03 03399: ssh: The privilege level for the user with the SSH key conflicts with the user configured.
RMON_SSH_TWO_FACTOR_AUTH_FAIL	W 01/01/15 18:24:03 03398: ssh: %s. Examples: W 01/01/15 18:24:03 03398: ssh: The two-factor authentication for SSH session failed due to the failure in public key authentication. W 01/01/15 18:24:03 03398: ssh: The two-factor authentication for SSH session failed due to the failure in username/password authentication. W 01/01/15 18:24:03 03398: ssh: The two-factor authentication for SSH session failed due to the failure in validating the client certificate. W 01/01/15 18:24:03 03398: ssh: The two-factor authentication for SSH session failed as “ssh-server” certificate is not installed.
When NTP client enabled.	NTP client is enabled.
When NTP client disabled.	NTP client is disabled.

Table Continued

Event	Message
When NTP found a new broadcast server.	A new broadcast server at %s.
When system clock was updated with new time.	The system clock time was changed by %ld sec %lu nsec. The new time is %s.
When NTP stratum was updated.	The NTP Stratum was changed from %d to %d.
When all NTP associations are cleared.	All the NTP server associations are reset.
When server is not reachable.	The NTP Server 10.1.1.2 is unreachable. (2 times in 60 seconds)
When MD5/SHA1 authentication failed.	The MD5 authentication on the NTP packet failed. The SHA1 authentication on the NTP packet failed.

Monitoring resources

Displaying current resource usage

To display current resource usage in the switch, enter the following command:

Syntax:

show {<qos | access-list | policy> resources}

Displays the resource usage of the policy enforcement engine on the switch by software feature. For each type of resource, the amount still available and the amount used by each software feature is shown.

`show resources`	This output allows you to view current resource usage and, if necessary, prioritize and reconfigure software features to free resources reserved for less important features.
`qosaccess-listopenflowpolicy`	Display the same command output and provide different ways to access task-specific information. See “Viewing OpenFlow Resources” in the OpenFlow administrators guide for your switch.

Displaying current resource usage shows the resource usage on a switch configured for ACLs, QoS, RADIUS-based authentication, and other features:

- The "Rules Used" columns show that ACLs, VT, mirroring, and other features (For example, Management VLAN) have been configured globally or per-VLAN, because identical resource consumption is displayed for each port range in the switch. If ACLs were configured per-port, the number of rules used in each port range would be different.

Displaying current resource usage

```
switch(config)# show access-list resources

 Resource usage in Policy Enforcement Engine
```

```
       | Rules       | Rules Used
 Ports | Available   | ACL | QoS | IDM | Other |
 ------+-------------+-----+-----+-----+-------|
 1-48  |        2006 |  10 |   5 |   0 |     6 |

       | Meters      | Meters Used
 Ports | Available   | ACL | QoS | IDM | Other |
 ------+-------------+-----+-----+-----+-------|
 1-48  |         255 |     |   5 |     |     0 |

       | Application |
       | Port Ranges |  Application Port Ranges Used
 Ports |  Available  | ACL | QoS | IDM | Other |
 ------+-------------+-----+-----+-----+-------|
 1-48  |          31 |   1 |   0 |   0 |     0 |

2 of 16 Policy Engine management resources used.

Key:
ACL = Access Control Lists
QoS = Device & Application Port Priority
IDM = Identity Driven Management
Other = Management VLAN, DHCP Snooping, ARP Protection, RA Guard.

Resource usage includes resources actually in use, or reserved for future
use by the listed feature. Internal dedicated-purpose resources, such as
port bandwidth limits or VLAN QoS priority, are not included.
```

Viewing information on resource usage

The switch allows you to view information about the current usage and availability of resources in the Policy Enforcement engine, including the following software features:

- Access control lists (ACL)
- Quality-of-service (QoS), including device and application port priority, ICMP rate-limiting, and QoS policies
- Dynamic assignment of per-port or per-user ACLs and QoS through RADIUS authentication designated as “IDM”, with or without the optional identity-driven management (IDM) application
- Virus throttling (VT) using connection-rate filtering
- Mirroring policies, including switch configuration as an endpoint for remote intelligent mirroring
- Other features, including:
  - Management VLAN
  - DHCP snooping
  - Dynamic ARP protection
  - Jumbo IP-MTU

Policy enforcement engine

The policy enforcement engine is thehardware element in the switch that manages QoS, mirroring, and ACL policies, as well as other software features, using the rules that you configure. Resource usage in the policy enforcement engine is based on how these features are configured on the switch:

- Resource usage by dynamic port ACLs is determined as follows:
  - Dynamic port ACLs configured by a RADIUS server (with or without the optional IDM application) for an authenticated client determine the current resource consumption for this feature on a specified slot. When a client session ends, the resources in use for that client become available for other uses.
- When the following features are configured globally or per-VLAN, resource usage is applied across all port groups or all slots with installed modules:

- ACLs
- QoS configurations that use the following commands:
  - QoS device priority (IP address) through the CLI using the `qos device-priority` command
  - QoS application port through the CLI using `qos tcp-port` or `qos udp-port`
  - VLAN QoS policies through the CLI using `service-policy`
- Management VLAN configuration
- DHCP snooping
- Dynamic ARP protection
- Remote mirroring endpoint configuration
- Mirror policies per VLAN through the CLI using `monitor service`
- Jumbo IP-MTU

- When the following features are configured per-port, resource usage is applied only to the slot or port group on which the feature is configured:
  - ACLs or QoS applied per-port or per-user through RADIUS authentication
  - ACLs applied per-port through the CLI using the `ip access-group` or `ipv6 traffic-filter` commands
  - QoS policies applied per port through the CLI using the `service-policy` command
  - Mirror policies applied per-port through the CLI using the `monitor all service` and `service-policy`commands
  - ICMP rate-limiting through the CLI using the `rate-limit icmp` command

Usage notes for show resources output

- A 1:1 mapping of internal rules to configured policies in the switch does not necessarily exist. As a result, displaying current resource usage is the most reliable method for keeping track of available resources. Also, because some internal resources are used by multiple features, deleting a feature configuration may not increase the amount of available resources.
- Resource usage includes resources actually in use or reserved for future use by the listed features.
- "Internal dedicated-purpose resources" include the following features:
  - Per-port ingress and egress rate limiting through the CLI using `rate-limit in/out`
  - Per-port or per-VLAN priority or DSCP through the CLI using `qos priority` or `qos dscp`
  - Per protocol priority through the CLI using `qos protocol`
- The "Available" columns display the resources available for additional feature use.
- The "IDM" column shows the resources used for RADIUS-based authentication with or without the IDM option.
- "Meters" are used when applying either ICMP rate-limiting or a QoS policy with a rate-limit class action.

When insufficient resources are available

The switch has ample resources for configuring features and supporting RADIUS-authenticated clients (with or without the optional IDMapplication).

If the resources supporting these features become fully subscribed:

- The current feature configuration, RADIUS-authenticated client sessions, and VT instances continue to operate normally.
- The switch generates anevent log notice to say that current resources are fully subscribed.
- Currently engaged resources must be released before any of the following actions are supported:
  - Modifying currently configured ACLs, IDM, VT, and other software features, such as Management VLAN, DHCP snooping, and dynamic ARP protection.You can modify currently configured classifier-base QoS and

mirroring policies if a policy has not been applied to an interface. However, sufficient resources must be available when you apply a configured policy to an interface.

- Acceptance of new RADIUS-based client authentication requests (displayed as a new resource entry for IDM).Failure to authenticate a client that presents valid credentials may indicate that insufficient resources are available for the features configured for the client in the RADIUS server. To troubleshoot, check the event log.
- Throttling or blocking of newly detected clients with high rate-of-connection requests (as defined by the current VT configuration).The switch continues to generate Event Log notifications (and SNMP trap notification, if configured) for new instances of high-connection-rate behavior detected by the VT feature.

Viewing port status and configuring port parameters

Connecting transceivers to fixed-configuration devices

If the switch either fails to show a link between an installed transceiver and another device or demonstrates errors or other unexpected behavior on the link, check the port configuration on both devices for a speed and/or duplex (mode) mismatch.

- To check the mode setting for a port on the switch, use either the Port Status screen in the menu interface or `show interfaces brief` in the CLI (see **Viewing port status and configuration (CLI)**).
- To display information about the transceivers installed on a switch, enter the `show tech receivers` command in the CLI (**The show tech transceivers command** on page 75).

Table 3: *Status and parameters for each port type*

Status or parameter	Description
Enabled	`Yes` (default): The port is ready for a network connection. `No`: The port will not operate, even if properly connected in a network. Use this setting, For example, if the port needs to be shut down for diagnostic purposes or while you are making topology changes.
Status (read-only)	`Up`: The port senses a link beat. `Down`: The port is not enabled, has no cables connected, or is experiencing a network error. For troubleshooting information, see the installation and getting started guide you received with the switch. See also to Appendix C, "Troubleshooting" (in this manual).

Table Continued

Status or parameter	Description
Mode	The port's speed and duplex (data transfer operation) setting.`10/100/1000Base-T Ports:` • `Auto-MDIX` (default): Senses speed and negotiates with the port at the other end of the link for port operation (MDI-X or MDI).To see what the switch negotiates for the auto setting, use the CLI `show interfaces brief` command or the `3. Port Status` option under `1. Status and Counters` in the menu interface. • `MDI`: Sets the port to connect with a PC using a crossover cable (manual mode—applies only to copper port switches using twisted-pair copper Ethernet cables) • `MDIX`: Sets the port to connect with a PC using a straight-through cable (manual mode—applies only to copper port switches using twisted-pair copper Ethernet cables) • `Auto-10`: Allows the port to negotiate between half-duplex (HDx) and full-duplex (FDx) while keeping speed at 10 Mbps. Also negotiates flow control (enabled or disabled). Hewlett Packard Enterprise recommends auto-10 for links between 10/100 auto-sensing ports connected with Cat 3 cabling. (Cat 5 cabling is required for 100 Mbps links.). • `10HDx`:10 Mbps, half-duplex • `10FDx`: 10 Mbps, full-duplex • `Auto-100`: Uses 100 Mbps and negotiates with the port at the other end of the link for other port operation features. • `Auto-10-100`: Allows the port to establish a link with the port at the other end at either 10 Mbps or 100 Mbps, using the highest mutual speed and duplex mode available. Only these speeds are allowed with this setting. • `Auto-1000`: Uses 1000 Mbps and negotiates with the port at the other end of the link for other port operation features. • `100Hdx`: Uses 100 Mbps, half-duplex. • `100Fdx`: Uses 100 Mbps, full-duplex **Gigabit Fiber-Optic Ports (Gigabit-SX, Gigabit-LX, and Gigabit-LH):** • `1000FDx`: 1000 Mbps (1 Gbps), full-duplex only • `Auto` (default): The port operates at 1000FDx and auto-negotiates flow control with the device connected to the port. **Gigabit Copper Ports:** • `1000FDx`: 1000 Mbps (1 Gbps), full-duplex only • `Auto` (default): The port operates at 1000FDx and auto-negotiates flow control with the device connected to the port. **10-Gigabit CX4 Copper Ports: 10-Gigabit SC Fiber-Optic Ports (10-GbE SR, 10-GbE LR, 10-GbE ER):** • Auto: The port operates at 10 gigabits FDx and negotiates flow control. Lower speed settings or half-duplex are not allowed.  NOTE Conditioning patch cord cables are not supported on 10-GbE.

Table Continued

Status or parameter	Description
Auto-MDIX	The switch supports Auto-MDIX on 10Mb, 100Mb, and 1 Gb T/TX (copper) ports. (Fiber ports and 10-gigabit ports do not use this feature.) • `Automdix`: Configures the port for automatic detection of the cable type (straight-through or crossover). • `MDI`: Configures the port to connect to a switch, hub, or other MDI-X device with a straight-through cable. • `MDIX`: Configures the port to connect to a PC or other MDI device with a straight-through cable.
Flow control	• `Disabled` (default): The port does not generate flow control packets, and drops any flow control packets it receives. • `Enabled`: The port uses 802.3x link layer flow control, generates flow-control packets, and processes received flow-control packets. With the port mode set to `Auto` (the default) and flow control enabled, the switch negotiates flow control on the indicated port. If the port mode is not set to `Auto`, or if flow control is disabled on the port, flow control is not used. Note that flow control must be enabled on both ends of a link.
Broadcast limit	Specifies the percentage of the theoretical maximum network bandwidth that can be used for broadcast traffic. Any broadcast traffic exceeding that limit will be dropped. Zero (0) means the feature is disabled. The broadcast-limit command operates at the port context level to set the broadcast limit for a port on the switch. NOTE: This feature is not appropriate for networks that require high levels of IPX or RIP broadcast traffic.

Viewing port configuration (Menu)

The menu interface displays the configuration for ports and (if configured) any trunk groups.

From the Main Menu, select:

1. Status and Counters 4. Port Status

A switch port status screen

```
=========================- CONSOLE - MANAGER MODE -==========================
                       Status and Counters - Port Status

                  Intrusion                                  MDI   Flow  Bcast
  Port     Type     Alert   Enabled Status     Mode          Mode  Ctrl  Limit
  ----- --------- --------- ------- ------ ---------- ----- ----- ------
  1     100/1000T No        Yes     Down   100FDx     Auto  off   0
  2     100/1000T No        Yes     Down   1000FDx    Auto  off   0
  3     100/1000T No        Yes     Down   1000FDx    Auto  off   0
  4     100/1000T No        Yes     Down   1000FDx    Auto  off   0
  5     100/1000T No        Yes     Down   1000FDx    Auto  off   0
  6     100/1000T No        Yes     Down   1000FDx    Auto  off   0
  7     100/1000T No        Yes     Down   1000FDx    Auto  off   0
  8     100/1000T No        Yes     Down   1000FDx    Auto  off   0
```

```
  9     100/1000T No        Yes     Down   1000FDx    Auto  off   0
  10    100/1000T No        Yes     Down   1000FDx    Auto  off   0
  11    100/1000T No        Yes     Down   1000FDx    Auto  off   0

 Actions->   Back   Intrusion log   Help

Return to previous screen.
Use up/down arrow keys to scroll to other entries, left/right arrow keys to
change action selection, and <Enter> to execute action.
```

Configuring ports (Menu)

The menu interface uses the same screen for configuring both individual ports and port trunk groups. For information on port trunk groups, see the chapter on "Port Trunking".

Procedure

1. From the Main Menu, select:

   2. Switch Configuration…

   2. Port/Trunk Settings

   Port/trunk settings with a trunk group configured

```
=====================- TELNET - MANAGER MODE -=====================
               Switch Configuration - Port/Trunk Settings

  Port     Type     Enabled      Mode      Flow Ctrl  Group  Type
  ----   -------- + --------  -----------  ---------  -----  -----
  A1     1000T    | Yes       Auto-10-100  Disable
  A2     1000T    | Yes       Auto-10-100  Disable
  A3     1000T    | Yes       Auto         Disable
  A3     1000T    | Yes       Auto         Disable
  A4     1000T    | Yes       Auto         Disable
  A5     1000T    | Yes       Auto         Disable
  A6     1000T    | Yes       Auto         Disable
  A7     1000T    | Yes       Auto         Disable    Trk1   Trunk
  A8     1000T    | Yes       Auto         Disable    Trk2   Trunk

 Actions->   Cancel    Edit    Save    Help

Cancel changes and return to previous screen.
Use arrow keys to change action selection and <Enter> to execute
action.
```

2. Press `[E]` (for **E**dit).

   The cursor moves to the `Enabled` field for the first port.

   For further information on configuration options for these features, see the online help provided with this screen.

3. When you have finished making changes to the above parameters, press `[Enter]`, then press `[S]` (for `Save`).

Viewing port status and configuration (CLI)

Use the following commands to display port status and configuration data.

Syntax:

show interfaces [brief | config | < *port-list* >]

brief	Lists the current operating status for all ports on the switch.
config	Lists a subset of configuration data for all ports on the switch; that is, for each port, the display shows whether the port is enabled, the operating mode, and whether it is configured for flow control.
<port-list>	Shows a summary of network traffic handled by the specified ports.

The `show interfaces brief` command listing

```
switch(config)# show interfaces brief
Status and Counters - Port Status

                | Intrusion                                 MDI   Flow  Bcast
Port  Type      | Alert     Enabled Status Mode             Mode  Ctrl  Limit
----- --------- + --------- ------- ------ ---------- ----- ----- ------
B1    100/1000T | No        Yes     Down   Auto-10-100 Auto  off   0
B2    100/1000T | No        Yes     Down   1000FDx     Auto  off   0
B3    100/1000T | No        Yes     Down   1000FDx     Auto  off   0
B4    100/1000T | No        Yes     Down   1000FDx     Auto  off   0
B5    100/1000T | No        Yes     Down   1000FDx     Auto  off   0
B6    100/1000T | No        Yes     Down   1000FDx     Auto  off   0
```

The `show interfaces config` command listing

```
switch(config)# show interfaces config

 Port Settings


  Port  Type      | Enabled Mode         Flow Ctrl MDI
  ----- --------- + ------- ------------ --------- ----
  B1    100/1000T | Yes     Auto-10-100  Disable   Auto
  B2    100/1000T | Yes     Auto         Disable   Auto
  B3    100/1000T | Yes     Auto         Disable   Auto
  B4    100/1000T | Yes     Auto         Disable   Auto
  B5    100/1000T | Yes     Auto         Disable   Auto
  B6    100/1000T | Yes     Auto         Disable   Auto
```

Dynamically updating the show interfaces command (CLI/Menu)

Syntax:

show interfaces display

Uses the `display` option to initiate the dynamic update of the `show interfaces` command, with the output being the same as the `show interfaces` command.

Select **Back** to exit the display.

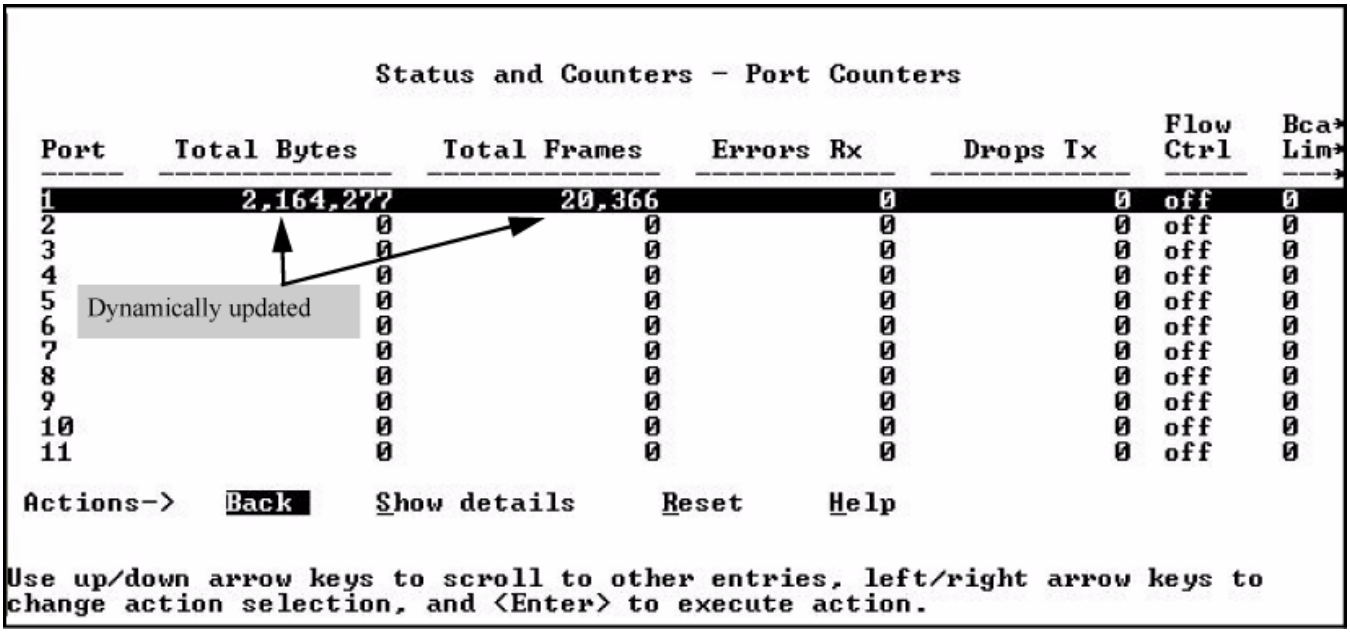
Example:

```
switch# show interfaces display
```

When using the **display** option in the CLI, the information stays on the screen and is updated every 3 seconds, as occurs with the display using the menu feature. The update is terminated with **Cntl-C**.

You can use the arrow keys to scroll through the screen when the output does not fit in one screen.

Figure 7: *`show interfaces display` command with dynamically updating output*



Customizing the show interfaces command (CLI)

You can create `show` commands displaying the information that you want to see in any order you want by using the `custom` option.

Syntax:

`show interfaces custom [port-list] column-list`

Select the information that you want to display. Supported columns are shown in the table below.

Table 4: *Supported columns, what they display, and examples:*

Parameter column	Displays	Examples
port	Port identifier	A2
type	Port type	100/1000T
status	Port status	up or down
speed	Connection speed and duplex	1000FDX
mode	Configured mode	auto, auto-100, 100FDX
mdi	MDI mode	auto, MDIX
flow	Flow control	on or off

Table Continued

Parameter column	Displays	Examples
name	Friendly port name	
vlanid	The vlan id this port belongs to, or "tagged" if it belongs to more than one vlan	4tagged
enabled	port is or is not enabled	yes or nointrusion
intrusion	Intrusion alert status	no
bcast	Broadcast limit	0

The custom show interfaces command

```
switch(config)# show int custom 1-4 port name:4 type vlan intrusion speed enabled
mdi

 Status and Counters - Custom Port Status

                                  Intrusion
  Port Name       Type       VLAN  Alert     Speed   Enabled MDI-mode
  ---- ---------- ---------- ----- --------- ------- ------- --------
  1    Acco       100/1000T  1     No        1000FDx Yes     Auto
  2    Huma       100/1000T  1     No        1000FDx Yes     Auto
  3    Deve       100/1000T  1     No        1000FDx Yes     Auto
  4    Lab1       100/1000T  1     No        1000FDx Yes     Auto
```

You can specify the column width by entering a colon after the column name, then indicating the number of characters to display. In the above example, the Name column displays only the first four characters of the name. All remaining characters are truncated.

NOTE

Each field has a fixed minimum width to be displayed. If you specify a field width smaller than the minimum width, the information is displayed at the minimum width. For example, if the minimum width for the Name field is 4 characters and you specify Name:2, the Name field displays 4 characters.

You can enter parameters in any order. There is a limit of 80 characters per line; if you exceed this limit an error displays.

Error messages associated with the show interfaces command

The following table provides information on error messages associated with the `show interfaces custom` command.

Error	Error message
Requesting too many fields (total characters exceeds 80)	Total length of selected data exceeds one line
Field name is misspelled	Invalid input: <*input*>

Table Continued

Error	Error message
Mistake in specifying the port list	Module not present for port or invalid port: <*input*>
The port list is not specified	Incomplete input: custom

Note on using pattern matching with the `show interfaces custom` command

If you have included a pattern matching command to search for a field in the output of the `show int custom` command, and the `show int custom` command produces an error, the error message may not be visible and the output is empty. For example, if you enter a command that produces an error (such as vlan is misspelled) with the pattern matching `include` option, the output may be empty:

```
HP Switch(config)# show int custom 1-3 name vlun  |  include vlan1
```

It is advisable to try the `show int custom` command first to ensure there is output, and then enter the command again with the pattern matching option.

Note that in the above command, you can substitute `int` for `interface`; that is: show `int custom`.

Viewing port utilization statistics (CLI)

Use the `show interface port-utilization` command to view a real-time rate display for all ports on the switch. The example below shows a sample output from this command.

A `show interface port-utilization` command listing

```
switch(config)# show interfaces port-utilization
 Status and Counters - Port Utilization

                              Rx                              Tx
 Port   Mode      | --------------------------- | ---------------------------
                  | Kbits/sec  Pkts/sec  Util   | Kbits/sec  Pkts/sec  Util
 ----- -------- + ---------- --------- ----- + ---------- --------- -----
 B1     1000FDx   | 0          0         0      | 0          0         0
 B2     1000FDx   | 0          0         0      | 0          0         0
 B3     1000FDx   | 0          0         0      | 0          0         0
 B4     1000FDx   | 0          0         0      | 0          0         0
 B5     1000FDx   | 0          0         0      | 0          0         0
 B6     1000FDx   | 0          0         0      | 0          0         0
 B7      100FDx   | 624        86        00.62  | 496        0         00.49
```

Operating notes for viewing port utilization statistics

- For each port on the switch, the command provides a real-time display of the rate at which data is received (Rx) and transmitted (Tx) in terms of kilobits per second (KBits/s), number of packets per second (Pkts/s), and utilization (Util) expressed as a percentage of the total bandwidth available.
- The `show interfaces <port-list>` command can be used to display the current link status and the port rate average over a 5 minute period. Port rates are shown in bits per second (bps) for ports up to 1 Gigabit; for 10 Gigabit ports, port rates are shown in kilobits per second (Kbps).

Viewing transceiver status (CLI)

The `show interfaces transceivers` command allows you to:

- Remotely identify transceiver type and revision number without having to physically remove an installed transceiver from its slot.
- Display real-timestatus information about all installed transceivers, including non-operational transceivers.

The example shows sample output from the `show tech transceivers` command.

Part # column below enables you to determine the manufacturer for a specified transceiver and revision number.

The show tech transceivers command

```
switch# show tech transceivers

Transceiver Technical Information:
 Port # |   Type     | Prod # | Serial #          | Part #
 -------+------------+--------+-------------------+----------
 21     | 1000SX     | J4858B | CN605MP23K        |
 22     | 1000LX     | J4859C | H11E7X            | 2157-2345
 23     | ??         | ??     | non operational   |
 25     | 10GbE-CX4  | J8440A | US509RU079        |
 26     | 10GbE-CX4  | J8440A | US540RU002        |
 27     | 10GbE-LR   | J8437B | PPA02-2904:0017   | 2157-2345
 28     | 10GbE-SR   | J8436B | 01591602          | 2158-1000
 29     | 10GbE-ER   | J8438A | PPA03-2905:0001   |

The following transceivers may not function correctly:
 Port #         Message
 --------       ------------------------
 Port 23        Self test failure.
```

Operating Notes

The following information is displayed for each installed transceiver:

- Port number on which transceiver is installed.
- Type of transceiver.
- Product number — Includes revision letter, such as A, B, or C. If no revision letter follows a product number, this means that no revision is available for the transceiver.
- Part number — Allows you to determine the manufacturer for a specified transceiver and revision number.
- For a non-HPE switches installed transceiver (see **line 23 of "The show tech transceivers command" example**), no transceiver type, product number, or part information is displayed. In the Serial Number field, `non-operational` is displayed instead of a serial number.
- The following error messages may be displayed for a non-operational transceiver:
  - `Unsupported Transceiver. (SelfTest Err#060)`
  - `This switch only supports revision B and above transceivers.`
  - `Self test failure.`
  - `Transceiver type not supported in this port.`
  - `Transceiver type not supported in this software version.`
  - `Not an HPE Switch Transceiver.`

Enabling or disabling ports and configuring port mode (CLI)

You can configure one or more of the following port parameters.

See **Status and parameters for each port type**.

Syntax:

[no] interface <*port-list*> [<disable|enable>]

Disables or enables the port for network traffic. Does not use the `no` form of the command. (Default: `enable`.)

speed-duplex [<auto-10|10-full|10-half|100-full|100-half|auto|auto-100|1000-full>]

Note that in the above Syntax:, you can substitute `int` for `interface` (for example, `int <port-list>`).

Specifies the port's data transfer speed and mode. Does not use the `no` form of the command. (Default: `auto`.)

The 10/100 auto-negotiation feature allows a port to establish a link with a port at the other end at either 10 Mbps or 100 Mbps, using the highest mutual speed and duplex mode available. Only these speeds are allowed with this setting.

Examples:

To configure port C5 for auto-10-100, enter this command:

switch(config)# int c5 speed-duplex auto-10-100

To configure ports C1 through C3 and port C6 for 100Mbps full-duplex, enter these commands:

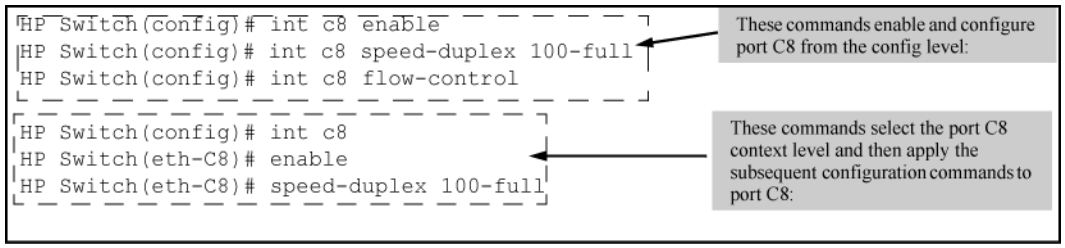
switch(config)# int c1-c3,c6 speed-duplex 100-full

Similarly, to configure a single port with the above command settings, you could either enter the same command with only the one port identified or go to the context level for that port and then enter the command. For example, to enter the context level for port C6 and then configure that port for 100FDx:

switch(config)# int e c6
switch(eth-C6)# speed-duplex 100-full

If port C8 was disabled, and you wanted to enable it and configure it for 100FDx with flow-control active, you could do so with either of the following command sets:

Figure 8: *Two methods for changing a port configuration*



For more on flow control, see **Enabling or disabling flow control (CLI)** on page 76.

Enabling or disabling flow control (CLI)

NOTE

You must enable flow control on both ports in a given link. Otherwise, flow control does not operate on the link and appears as `Off` in the `show interfaces brief` port listing, even if flow control is configured as enabled on the port in the switch. (See **The `show interfaces brief` command listing** example.) Also, the port (speed-duplex) mode must be set to `Auto` (the default).

To disable flow control on some ports, while leaving it enabled on other ports, just disable it on the individual ports you want to exclude.

(You can find more information on flow control in the **Status and parameters for each port type** table.)

Syntax:

[no] interface <*port-list*> flow-control

Enables or disables flow control packets on the port. The `no` form of the command disables flow control on the individual ports. (Default: Disabled.)

Examples:

Suppose that:

1. You want to enable flow control on ports A1-A6.
2. Later, you decide to disable flow control on ports A5 and A6.
3. As a final step, you want to disable flow control on all ports.

Assuming that flow control is currently disabled on the switch, you would use these commands:

Figure 9: *Configuring flow control for a series of ports*

```
switch(config)# int a1-a6 flow-control

switch(config)# show interfaces brief

 Status and Counters - Port Status

                 | Intrusion                    MDI  Flow Bcast
 Port   Type     | Alert    Enabled Status Mode      Mode Ctrl Limit
 ------ --------- + --------- ------- ------ ---------- ---- ---- -----
 A1     10GbE-T   | No       Yes     Up     1000FDx    NA   on   0
 A2     10GbE-T   | No       Yes     Up     10GigFD    NA   on   0
 A3     10GbE-T   | No       Yes     Up     10GigFD    NA   on   0
 A4     10GbE-T   | No       Yes     Up     10GigFD    NA   on   0
 A5     10GbE-T   | No       Yes     Up     10GigFD    NA   on   0
 A6     10GbE-T   | No       Yes     Up     10GigFD    NA   on   0
 A7     10GbE-T   | No       Yes     Down   10GigFD    NA   off  0
 A8     10GbE-T   | No       Yes     Up     10GigFD    NA   off  0

switch(config)# no int a5-a6 flow-control

switch(config)# show interfaces brief

 Status and Counters - Port Status

                 | Intrusion                    MDI  Flow Bcast
 Port   Type     | Alert    Enabled Status Mode      Mode Ctrl Limit
 ------ --------- + --------- ------- ------ ---------- ---- ---- -----
 A1     10GbE-T   | No       Yes     Up     1000FDx    NA   on   0
 A2     10GbE-T   | No       Yes     Down   10GigFD    NA   on   0
 A3     10GbE-T   | No       Yes     Down   10GigFD    NA   on   0
 A4     10GbE-T   | No       Yes     Down   10GigFD    NA   on   0
 A5     10GbE-T   | No       Yes     Down   10GigFD    NA   off  0
 A6     10GbE-T   | No       Yes     Down   10GigFD    NA   off  0
 A7     10GbE-T   | No       Yes     Down   10GigFD    NA   off  0
 A8     10GbE-T   | No       Yes     Down   10GigFD    NA   off  0

switch(config)# no int a1-a4 flow-control

switch(config)# show interfaces brief

 Status and Counters - Port Status

                 | Intrusion                    MDI  Flow Bcast
 Port   Type     | Alert    Enabled Status Mode      Mode Ctrl Limit
 ------ --------- + --------- ------- ------ ---------- ---- ---- -----
 A1     10GbE-T   | No       Yes     Down   1000FDx    NA   off  0
 A2     10GbE-T   | No       Yes     Down   10GigFD    NA   off  0
 A3     10GbE-T   | No       Yes     Down   10GigFD    NA   off  0
 A4     10GbE-T   | No       Yes     Down   10GigFD    NA   off  0
 A5     10GbE-T   | No       Yes     Down   10GigFD    NA   off  0
 A6     10GbE-T   | No       Yes     Down   10GigFD    NA   off  0
 A7     10GbE-T   | No       Yes     Down   10GigFD    NA   off  0
 A8     10GbE-T   | No       Yes     Down   10GigFD    NA   off  0
```

Port shutdown with broadcast storm

A LAN broadcast storm arises when an excessively high rate of broadcast packets flood the LAN. Occurrence of LAN broadcast storm disrupts traffic and degrades network performance. To prevent LAN traffic from being disrupted, an enhancement of fault-finder commands adds new options, and the corresponding MIBs, that trigger a port disablement when a broadcast storm is detected on that port.

Under this enhancement, the CLI commands given only supports broadcast traffic and not multicast and unicast types of traffic.

The waiting period range for re-enabling ports is 0 to 604800 seconds. The default waiting period to re-enable a port is zero which prevents the port from automatic re-enabling.

Avoid port flapping when choosing the waiting period by considering the time to re-enable carefully.

Use the following commands to configure the broadcast-storm on a port.

Syntax:

[no] fault-finder broadcast-storm [ethernet] <port-list> action [warn|warn-and-disable <seconds>] [percent <percent>|pps <rate>]

To remove the current configuration of broadcast-storm on a port, use:

Syntax:

no fault-finder broadcast-storm [ethernet] <port-list>

broadcast-storm	Configure broadcast storm control.
pps	Rising threshold level in number of broadcast packets per second.
percent	Rising threshold level as a percentage of bandwidth of the port. The percentage is calculated on 64 byte packet size.
warn	Log the event only.
warn-and-disable	Log the event and disable the port.
seconds	Re-enable the port after waiting for the specified number of seconds. Default is not to re-enable.

Configuration examples:

switch(config)# fault-finder broadcast-storm [ethernet] <A1> action [warn-and-disable <65535>]< percent 10>

switch(config)# fault-finder broadcast-storm [ethernet] <A2> action [warn-and-disable <pps 100>

switch(config)# fault-finder broadcast-storm [ethernet] <A22> action [warn] <pps 100>

Viewing broadcast storm

Use the following command to display the broadcast-storm-control configuration.

Syntax:

show fault-finder broadcast-storm [[ethernet] port-list]

Examples:

switch# show fault-finder broadcast-storm [A1]

Port	Bcast Storm	Port Status	Rising Threshold	Action	Disable Timer	Disable Timer Left
A1	Yes	Down	10%	warn-and-disable	65535	—

switch (config)# show fault-finder broadcast-storm

Port	Bcast Storm	Port Status	Rising Threshold	Action	Disable Timer	Disable Timer Left
A1	Yes	Down	200 pps	warn-and-disable	10	9

switch (config)# show fault-finder broadcast-storm A1

Port	Bcast Storm	Port Status	Rising Threshold	Action	Disable Timer	Disable Timer Left
A1	No	Up	—	none	—	—

switch (config)# show fault-finder broadcast-storm

Port	Bcast Storm	Port Status	Rising Threshold	Action	Disable Timer	Disable Timer Left
A1	Yes	Up	75%	warn	—	—

SNMP MIB

SNMP support will be provided through the following MIB objects:

hpicfFfBcastStormControlPortConfig OBJECT IDENTIFIER

:: = { hpicfFaultFinder 5 }

hpicfFfBcastStormControlPortConfigTable OBJECT-TYPE

- syntax sequence: **HpicfFfBcastStormControlPortConfigEntry**
- max-access: not-accessible
- status: current
- description: This table provides information about broadcast storm control configuration of all ports.**::= {hpicfFfBcastStormControlPortConfig 1}**

hpicfFfBcastStormControlPortConfigEntry OBJECT-TYPE

- syntax **HpicfFfBcastStormControlPortConfigEntry**
- max-access: not-accessible
- status: current
- description: This object provides information about broadcast storm control configuration of each port.
- index: {**hpicffffbcaststormcontrolportindex**}**::= {hpicfFfBcastStormControlPortConfigTable 1}**

hpicfFfBcastStormControlPortConfigEntry ::=

- Syntax sequence:**hpicfFfBcastStormControlPortIndex** InterfaceIndex,

  hpicfFfBcastStormControlMode Integer,

  hpicfFfBcastStormControlRisingpercent Integer32,

  hpicfFfBcastStormControlRisingpps Integer32,

  hpicfFfBcastStormControlAction Integer,

  hpicfFfBcastStormControlPortDisableTimer Unsigned32

hpicfFfBcastStormControlPortIndex OBJECT-TYPE

- Syntax: Interfaceindex
- max-access: not-accessible
- status: current
- description: The Index Value Which Uniquely Identifies A Row In The Interfaces Table.

  ::= {hpicfFfBcastStormControlPortConfigEntry 1}

hpicfFfBcastStormControlMode OBJECT-TYPE

- Syntax Integer: disabled(1), **Bcastrisinglevelpercent**(2), **Bcastrisinglevelpps**(3)
- max-access: read-write
- status: current
- description: The broadcast storm control mode of a port. A value of disable (1) indicates that no rising threshold value is set for broadcast storm traffic on this port. A value of **bcastrisinglevelpercent** (2) indicates that the rising threshold rate for broadcast storm traffic is configured in percentage of port bandwidth. A value of **bcastrisinglevelpps** (3) indicates that the rising threshold rate for broadcast storm traffic is configured in packets per second.
- DEFVAL: disabled

  ::= {hpicfFfBcastStormControlPortConfigEntry 2}

hpicfFfBcastStormControlRisingpercent OBJECT-TYPE

- Syntax Integer32 (1..100)
- max-access: read-write
- status: current
- description: This Is The Rising Threshold Level in percent of bandwidth of the port. **hpicfFfBcastStormControlAction** occurs when broadcast traffic reaches this level.

  ::= {hpicfFfBcastStormControlPortConfigEntry 3}

hpicfFfBcastStormControlRisingpps OBJECT-TYPE

- Syntax Integer32 (1..10000000)
- max-access: read-write
- status: current
- description: This object indicates the rising threshold for broadcast storm control. This value is in packets-per-second of received broadcast traffic. **hpicffffbcaststormcontrolaction** object takes action when broadcast traffic reaches this level.

  ::= {**hpicfFfBcastStormControlPortConfigEntry** 4}

hpicfFfBcastStormControlAction OBJECT-TYPE

- Syntax integer: none(1), warn(2), warnanddisable(3)
- max-access: read-write
- status: current
- Description: This object defines the action taken by the switch when a broadcast storm occurs on a port. A value of none (1) indicates that no action is performed. A value of warn (2) indicates that an event is logged when broadcast traffic crosses the threshold value set on that port. A value of warn-and-disable (3) indicates that the port is disabled and an event is logged as soon as the broadcast traffic reaches the threshold value set on that port.
- DEFVAL: none

  ::= {hpicfFfBcastStormControlPortConfigEntry 5}

hpicfFfBcastStormControlPortDisableTimer OBJECT-TYPE

- Syntax Unsigned32 (0..604800)
- Units: seconds
- max-access: read-write
- status: current
- Description: This object specifies the time period for which the port remains in disabled state. A port is disabled when broadcast traffic reaches the threshold value set on that port. This time period is specified in seconds. The default value is zero which means that the port remains disabled and is not enabled again.
- DEFVAL {0}

  ::= {hpicfFfBcastStormControlPortConfigEntry 6}

Configuring auto-MDIX

Copper ports on the switch can automatically detect the type of cable configuration (MDI or MDI-X) on a connected device and adjust to operate appropriately.

This means you can use a "straight-through" twisted-pair cable or a "crossover" twisted-pair cable for any of the connections—the port makes the necessary adjustments to accommodate either one for correct operation. The following port types on your switch support the IEEE 802.3ab standard, which includes the "Auto MDI/MDI-X" feature:

- 10/100-TX xl module ports
- 100/1000-T xl module ports
- 10/100/1000-T xl module ports

Using the above ports:

- If you connect a copper port using a straight-through cable on a switch to a port on another switch or hub that uses MDI-X ports, the switch port automatically operates as an MDI port.
- If you connect a copper port using a straight-through cable on a switch to a port on an end node—such as a server or PC—that uses MDI ports, the switch port automatically operates as an MDI-X port.

Auto-MDIX was developed for auto-negotiating devices, and was shared with the IEEE for the development of the IEEE 802.3ab standard. Auto-MDIX and the IEEE 802.3ab Auto MDI/MID-X feature are completely compatible. Additionally, Auto-MDIX supports operation in forced speed and duplex modes.

For more information on this subject, see the IEEE 802.3ab standard reference. For more information on MDI-X, the installation and getting started guide for your switch.

Manual override

If you require control over the MDI/MDI-X feature, you can set the switch to either of these non-default modes:

- Manual MDI
- Manual MDI-X

The table below shows the cabling requirements for the MDI/MDI-X settings.

Table 5: *Cable types for auto and manual MDI/MDI-X settings*

Setting	MDI/MDI-X device type	
	PC or other MDI device type	Switch, hub, or other MDI-X device
Manual MDI	Crossover cable	Straight-through cable
Manual MDI-X	Straight-through cable	Crossover cable
Auto-MDI-X (the default)	Either crossover or straight-through cable	

The AutoMDIX features apply only to copper port switches using twisted-pair copper Ethernet cables.

Configuring auto-MDIX (CLI)

The auto-MDIX features apply only to copper port switches using twisted-pair copper Ethernet cables. For information about auto-MDIX, see **Configuring auto-MDIX** on page 82.

Syntax:

interface <*port-list*> mdix-mode < {auto-mdix | mdi | mdix>}

`auto-mdix`	The automatic,default setting. This configures the port for automatic detection of the cable (either straight-through or crossover).
`mdi`	The manual mode setting that configures the port for connecting to either a PC or other MDI device with a crossover cable, or to a switch, hub, or other MDI-X device with a straight-through cable.
`mdix`	The manual mode setting that configures the port for connecting to either a switch, hub, or other MDI-X device with a crossover cable, or to a PC or other MDI device with a straight-through cable.

Syntax:

show interfaces config

Lists the current per-port Auto/MDI/MDI-X configuration.

Syntax:

show interfaces brief

- Where a port is linked to another device, this command lists the MDI mode the port is currently using.
- In the case of ports configured for `Auto` (`auto-mdix`), the MDI mode appears as either `MDI` or `MDIX`, depending upon which option the port has negotiated with the device on the other end of the link.
- In the case of ports configured for `MDI` or `MDIX`, the mode listed in this display matches the configured setting.

- If the link to another device was up, but has gone down, this command shows the last operating MDI mode the port was using.
- If a port on a given switch has not detected a link to another device since the last reboot, this command lists the MDI mode to which the port is currently configured.

The `show interfaces config` displays the following data when port A1 is configured for `auto-mdix`, port A2 is configured for `mdi`, and port A3 is configured for `mdix`:

Displaying the current MDI configuration

```
switch(config)# show interfaces config

 Port Settings

  Port   Type      | Enabled Mode         Flow Ctrl MDI
  ------ --------- + ------- ------------ --------- ----
  A1     10GbE-T   | Yes     Auto         Disable   Auto
  A2     10GbE-T   | Yes     Auto         Disable   MDI
  A3     10GbE-T   | Yes     Auto         Disable   MDIX
  A4     10GbE-T   | Yes     Auto         Disable   Auto
  A5     10GbE-T   | Yes     Auto         Disable   Auto
  A6     10GbE-T   | Yes     Auto         Disable   Auto
  A7     10GbE-T   | Yes     Auto         Disable   Auto
  A8     10GbE-T   | Yes     Auto         Disable   Auto
```

Displaying the current MDI operating mode

```
switch(config)# show interfaces brief

 Status and Counters - Port Status

                    | Intrusion                              MDI  Flow Bcast
  Port   Type       | Alert     Enabled Status Mode          Mode Ctrl Limit
  ------ ---------- + --------- ------- ------ ------------ ---- ---- -----
  A1     10GbE-T    | No        Yes     Up     1000FDx      MDIX off  0
  A2     10GbE-T    | No        Yes     Down   10GigFD      MDI  off  0
  A3     10GbE-T    | No        Yes     Down   10GigFD      MDIX off  0
  A4     10GbE-T    | No        Yes     Down   10GigFD      Auto off  0
  A5     10GbE-T    | No        Yes     Down   10GigFD      Auto off  0
  A6     10GbE-T    | No        Yes     Down   10GigFD      Auto off  0
  A7     10GbE-T    | No        Yes     Down   10GigFD      Auto off  0
  A8     10GbE-T    | No        Yes     Down   10GigFD      Auto off  0
```

Using friendly (optional) port names

This feature enables you to assign alphanumeric port names of your choosing to augment automatically assigned numeric port names. This means you can configure meaningful port names to make it easier to identify the source of information listed by some `show` commands. (Note that this feature **augments** port numbering, but **does not replace** it.)

Configuring and operating rules for friendly port names

- At either the global or context configuration level, you can assign a unique name to a port. You can also assign the same name to multiple ports.
- The friendly port names you configure appear in the output of the `show name` [*port-list*], `show config`, and `show interface <port-number >` commands. They do not appear in the output of other `show` commands or in Menu interface screens. (See **Displaying friendly port names with other port data (CLI)** on page 86.)

- Friendly port names are not a substitute for port numbers in CLI commands or Menu displays.
- Trunking ports together does not affect friendly naming for the individual ports. (If you want the same name for all ports in a trunk, you must individually assign the name to each port.)
- A friendly port name can have up to 64 contiguous alphanumeric characters.
- Blank spaces within friendly port names are not allowed, and if used, cause an **invalid input** error. (The switch interprets a blank space as a name terminator.)
- In a port listing, **not assigned** indicates that the port does not have a name assignment other than its fixed port number.
- To retain friendly port names across reboots, you must save the current running-configuration to the startup-config file after entering the friendly port names. (In the CLI, use the `write memory` command.)

Configuring friendly port names (CLI)

For detailed information about friendly port names, see **Using friendly (optional) port names** on page 84.

Syntax:

interface <*port-list*> name <*port-name-string*>

Assigns a port name to port-list.

Syntax:

no interface <*port-list*> name

Deletes the port name from <*port-list*>.

Configuring a single port name (CLI)

Suppose that you have connected port A3 on the switch to Bill Smith's workstation, and want to assign Bill's name and workstation IP address (10.25.101.73) as a port name for port A3:

Configuring a friendly port name

```
switch(config)# int A3 name
Bill_Smith@10.25.101.73
switch(config)# write mem
switch(config)# show name A3

 Port Names
  Port : A3
   Type : 10/100TX
```

Configuring the same name for multiple ports (CLI)

Suppose that you want to use ports A5 through A8 as a trunked link to a server used by a drafting group. In this case you might configure ports A5 through A8 with the name "Draft-Server:Trunk."

Configuring one friendly port name on multiple ports

```
switch(config)# int a5-a8 name Draft-Server:Trunk
switch(config)# write mem
switch(config)# show name a5-a8

 Port Names

  Port : A5
```

```
   Type : 10GbE-T
   Name : Draft-Server:Trunk

 Port : A6
   Type : 10GbE-T
   Name : Draft-Server:Trunk

 Port : A7
   Type : 10GbE-T
   Name : Draft-Server:Trunk

  Port : A8
   Type : 10GbE-T
   Name : Draft-Server:Trunk
```

Displaying friendly port names with other port data (CLI)

You can display friendly port name data in the following combinations:

Syntax:

show name

Displays a listing of port numbers with their corresponding friendly port names and also quickly shows you which ports do not have friendly name assignments. (`show name` data comes from the running-config file.)

Syntax:

show interface <*port-number*>

Displays the friendly port name, if any, along with the traffic statistics for that port. (The friendly port name data comes from the running-config file.)

Syntax:

show config

Includes friendly port names in the per-port data of the resulting configuration listing. (`show config` data comes from the startup-config file.)

Listing all ports or selected ports with their friendly port names (CLI)

Syntax:

show name [*port-list*]

Lists the friendly port name with its corresponding port number and port type. The `show name` command without a port list shows this data for all ports on the switch.

Friendly port name data for all ports on the switch

```
switch(config)# show name
Port Names
  Port   Type       Name
  ------ ---------- ---------------------------
  A1     10GbE-T
  A2     10GbE-T
```

```
  A3      10GbE-T   Bill_Smith@10.25.101.73
  A4      10GbE-T
  A5      10GbE-T   Draft-Server:Trunk
  A6      10GbE-T   Draft-Server:Trunk
  A7      10GbE-T   Draft-Server:Trunk
  A8      10GbE-T   Draft-Server:Trunk
```

Friendly port name data for specific ports on the switch

```
switch(config)# show name A3-A5
 Port Names
  Port : A3
  Type : 10GbE-T
  Name : Bill_Smith@10.25.101.73
 Port : A4
  Type : 10GbE-T
  Name :
 Port : A5
  Type : 10GbE-T
  Name : Draft-Server:Trunk
```

Including friendly port names in per-port statistics listings (CLI)

Syntax:

show interface <*port-number*>

Includes the friendly port name with the port's traffic statistics listing. A friendly port name configured to a port is automatically included when you display the port's statistics output.

If you configure port A1 with the name "O'Connor_10.25.101.43," the `show interface` output for this port appears similar to the following:

A friendly port name in a per-port statistics listing

```
switch(config)# show interface a1
 Status and Counters - Port Counters for port A1

  Name   : O'Connor@10.25.101.43
  MAC Address      : 001871-b995ff
  Link Status      : Up
  Totals (Since boot or last clear) :
   Bytes Rx        : 2,763,197          Bytes Tx        : 22,972
   Unicast Rx      : 2044               Unicast Tx      : 128
   Bcast/Mcast Rx  : 23,456             Bcast/Mcast Tx : 26
  Errors (Since boot or last clear) :
   FCS Rx          : 0                  Drops Tx        : 0
   Alignment Rx    : 0                  Collisions Tx   : 0
   Runts Rx        : 0                  Late Colln Tx   : 0
   Giants Rx       : 0                  Excessive Colln : 0
   Total Rx Errors : 0                  Deferred Tx     : 0
  Others (Since boot or last clear) :
   Discard Rx      : 0                  Out Queue Len   : 0
   Unknown Protos  : 0
  Rates (5 minute weighted average) :
   Total Rx (bps) : 3,028,168           Total Tx  (bps) : 1,918,384
   Unicast Rx (Pkts/sec) : 5            Unicast Tx (Pkts/sec) : 0
   B/Mcast Rx (Pkts/sec) : 71           B/Mcast Tx (Pkts/sec) : 0
   Utilization Rx  : 00.30 %            Utilization Tx : 00.19 %
```

For a given port, if a friendly port name does not exist in the running-config file, the Name line in the above command output appears as:

Name :

Searching the configuration for ports with friendly port names (CLI)

This option tells you which friendly port names have been saved to the startup-config file. (`show config` does not include ports that have only default settings in the startup-config file.)

Syntax:

show config

Includes friendly port names in a listing of all interfaces (ports) configured with non-default settings. Excludes ports that have neither a friendly port name nor any other non-default configuration settings.

See **Listing of the startup-config file with a friendly port name configured (and saved)** on page 88 to configure port A1 with a friendly port name. Notice that the command sequence saves the friendly port name for port A1 in the startup-config file. The name entered for port A2 is not saved because it was executed after `write memory`.

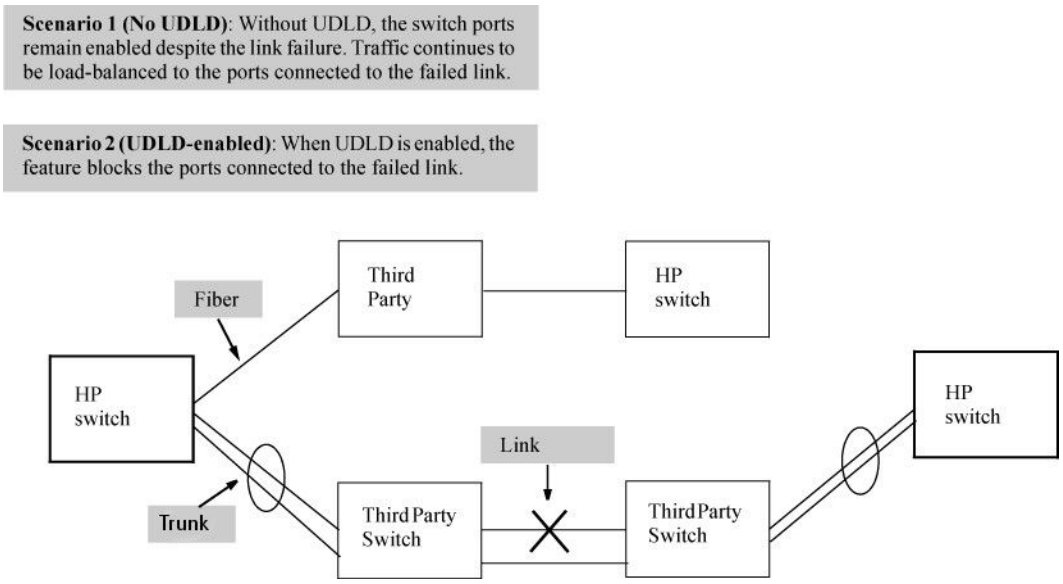
Listing of the startup-config file with a friendly port name configured (and saved)

```
switch(config)# int A1 name Print_Server@10.25.101.43
switch(config)# write mem
switch(config)# int A2 name Herbert's_PC

switch(config)# show config

 Startup configuration:
; J9091A Configuration Editor; Created on release xx.15.05.xxxx
hostname "HPSwitch"
 interface AQ
  name "Print_Server@10.25.101.43
 exit

snmp-server community "public" Unrestricted
.
.
.
```

Uni-directional link detection (UDLD)

Uni-directional link detection (UDLD) monitors a link between two switches and blocks the ports on both ends of the link if the link fails at any point between the two devices. This feature is particularly useful for detecting failures in fiber links and trunks. **Figure 10: UDLD Example:** on page 89 shows an Example:.

Figure 10: *UDLD Example:*



In this Example:, each switch load balances traffic across two ports in a trunk group. Without the UDLD feature, a link failure on a link that is not directly attached to one of the HPE switches remains undetected. As a result, each switch continue to send traffic on the ports connected to the failed link. When UDLD is enabled on the trunk ports on each switch, the switches detect the failed link, block the ports connected to the failed link, and use the remaining ports in the trunk group to forward the traffic.

Similarly, UDLD is effective for monitoring fiber optic links that use two uni-direction fibers to transmit and receive packets. Without UDLD, if a fiber breaks in one direction, a fiber port may assume the link is still good (because the other direction is operating normally) and continue to send traffic on the connected ports. UDLD-enabled ports; however, will prevent traffic from being sent across a bad link by blocking the ports in the event that either the individual transmitter or receiver for that connection fails.

Ports enabled for UDLD exchange health-check packets once every five seconds (the link-keepalive interval). If a port does not receive a health-check packet from the port at the other end of the link within the keepalive interval, the port waits for four more intervals. If the port still does not receive a health-check packet after waiting for five intervals, the port concludes that the link has failed and blocks the UDLD-enabled port.

When a port is blocked by UDLD, the event is recorded in the switch log or via an SNMP trap (if configured); and other port blocking protocols, like spanning tree or meshing, will not use the bad link to load balance packets. The port will remain blocked until the link is unplugged, disabled, or fixed. The port can also be unblocked by disabling UDLD on the port.

Configuring UDLD

When configuring UDLD, keep the following considerations in mind:

- UDLD is configured on a per-port basis and must be enabled at both ends of the link. See the note below for a list of switches that support UDLD.
- To configure UDLD on a trunk group, you must configure the feature on each port of the group individually. Configuring UDLD on a trunk group's primary port enables the feature on that port only.
- Dynamic trunking is not supported. If you want to configure a trunk group that contains ports on which UDLD is enabled, you must remove the UDLD configuration from the ports. After you create the trunk group, you can re-add the UDLD configuration.

Configuring uni-directional link detection (UDLD) (CLI)

For detailed information about UDLD, see **Uni-directional link detection (UDLD)** on page 89.

Syntax:

[no] interface <*port-list*> link-keepalive

Enables UDLD on a port or range of ports.

To disable this feature, enter the `no` form of the command.

Default: UDLD disabled

Syntax:

link-keepalive interval <*interval*>

Determines the time interval to send UDLD control packets. The *interval* parameter specifies how often the ports send a UDLD packet. You can specify from 10 to 100, in 100-ms increments, where 10 is 1 second, 11 is 1.1 seconds, and so on.

Default: 50 (5 seconds)

Syntax:

link-keepalive retries <*num*>

Determines the maximum number of retries to send UDLD control packets. The `num` parameter specifies the maximum number of times the port will try the health check. You can specify a value from 3 to 10.

Default: 5

Syntax:

[no] interface <*port-list*> link-keepalive vlan <*vid*>

Assigns a VLAN ID to a UDLD-enabled port for sending tagged UDLD control packets.Under default settings, untagged UDLD packets can still be transmitted and received on tagged only ports; however, a warning message is logged.

The `no` form of the command disables UDLD on the specified ports.

Default: UDLD packets are untagged; tagged-only ports transmit and receive untagged UDLD control packets

Enabling UDLD (CLI)

UDLD is enabled on a per-port basis.

Example:

To enable UDLD on port a1, enter:

```
switch(config)#interface al link-keepalive
```

To enable the feature on a trunk group, enter the appropriate port range. For example:

```
switch(config)#interface al-a4 link-keepalive
```

When at least one port is UDLD-enabled, the switch will forward out UDLD packets that arrive on non-UDLD-configured ports out of all other non-UDLDconfigured ports in the same vlan. That is, UDLD control packets will “pass through” a port that is not configured for UDLD. However, UDLD packets will be dropped on any blocked ports that are not configured for UDLD.

Changing the keepalive interval (CLI)

By default, ports enabled for UDLD send a link health-check packet once every 5 seconds. You can change the interval to a value from 10 to 100 deciseconds, where 10 is 1 second, 11 is 1.1 seconds, and so on.

Example:

To change the packet interval to seven seconds, enter the following command at the global configuration level:

```
switch(config)# link-keepalive interval 70
```

Changing the keepalive retries (CLI)

By default, a port waits 5 seconds to receive a health-check reply packet from the port at the other end of the link. If the port does not receive a reply, the port tries four more times by sending up to four more health-check packets. If the port still does not receive a reply after the maximum number of retries, the port goes down.

You can change the maximum number of keepalive attempts to a value from 3 to 10.

Example:

To change the maximum number of attempts to four, enter the following command at the global configuration level:

```
switch(config)# link-keepalive retries 4
```

Configuring UDLD for tagged ports

The default implementation of UDLD sends the UDLD control packets untagged, even across tagged ports. If an untagged UDLD packet is received by a non-HPE switch, that switch may reject the packet. To avoid such an occurrence, you can configure ports to send out UDLD control packets that are tagged with a specified VLAN.

To enable ports to receive and send UDLD control packets tagged with a specific VLAN ID, enter a command such as the following at the interface configuration level:

```
switch(config)#interface link-keepalive vlan 22
```

- You must configure the same VLANs that will be used for UDLD on all devices across the network; otherwise, the UDLD link cannot be maintained.
- If a VLAN ID is not specified, UDLD control packets are sent out of the port as untagged packets.
- To re-assign a VLAN ID, re-enter the command with the new VLAN ID number. The new command overwrites the previous command setting.
- When configuring UDLD for tagged ports, you may receive a warning message if there are any inconsistencies with the VLAN configuration of the port.

  See **Status and parameters for each port type** for potential problems.

Viewing UDLD information (CLI)

Syntax:

show link-keepalive

Displays all the ports that are enabled for `link-keepalive`.

Syntax:

show link-keepalive statistics

Displays detailed statistics for the UDLD-enabled ports on the switch.

Syntax:

clear link-keepalive statistics

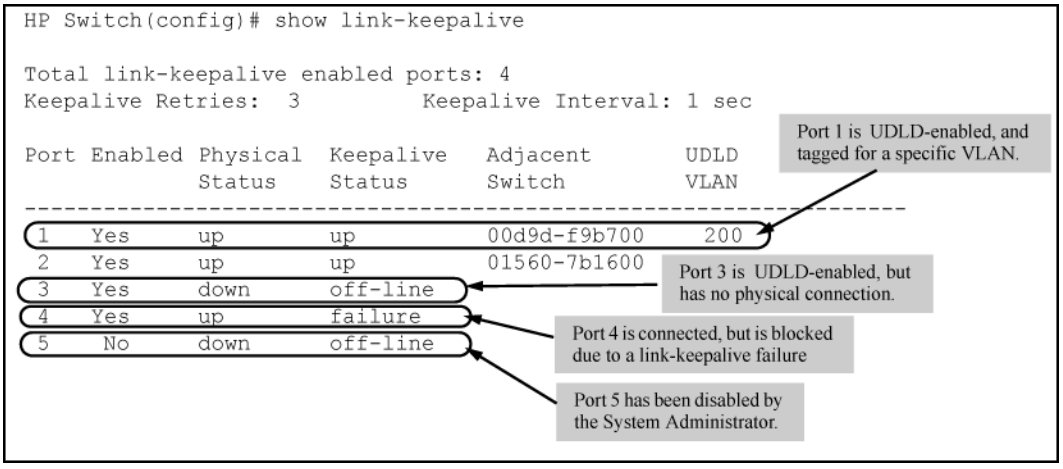
Clears UDLD statistics. This command clears the packets sent, packets received, and transitions counters in the `show link-keepalive statistics` display.

Viewing summary information on all UDLD-enabled ports (CLI)

Enter the `show link-keepalive` command.

Example:

Figure 11: *Example: of `show link-keepalive` command*



Viewing detailed UDLD information for specific ports (CLI)

Enter the `show link-keepalive statistics` command.

Example:

Figure 12: *Example: of* `show link-keepalive statistics` *command*

Clearing UDLD statistics (CLI)

Enter the following command:

switch# clear link-keepalive statistics

This command clears the packets sent, packets received, and transitions counters in the `show link keepalive statistics` display (see **Figure 12: Example: of show link-keepalive statistics command** on page 93 for an Example:).

Uplink failure detection

Uplink Failure Detection (UFD) is a network path redundancy feature that works in conjunction with NIC teaming functionality. UFD continuously monitors the link state of the ports configured as links-to-monitor (LtM), and when these ports lose link with their partners, UFD will disable the set of ports configured as links-to-disable (LtD.) When an uplink port goes down, UFD enables the switch to auto-disable the specific downlinks connected to the NICs. This allows the NIC teaming software to detect link failure on the primary NIC port and fail over to the secondary NIC in the team.

NIC teams must be configured for switch redundancy when used with UFD, that is, the team spans ports on both Switch A and Switch B. The switch automatically enables the downlink ports when the uplink returns to service. For an example of teamed NICs in conjunction with UFD, see **Figure 13: Teamed NICs in conjunction with UFD** on page 94.) For an example of teamed NICs with a failed uplink, see **Figure 14: Teamed NICs with a failed uplink** on page 94.

NOTE

For UFD functionality to work as expected, the NIC teaming must be in Network Fault Tolerance (NFT) mode.

Figure 13: *Teamed NICs in conjunction with UFD*

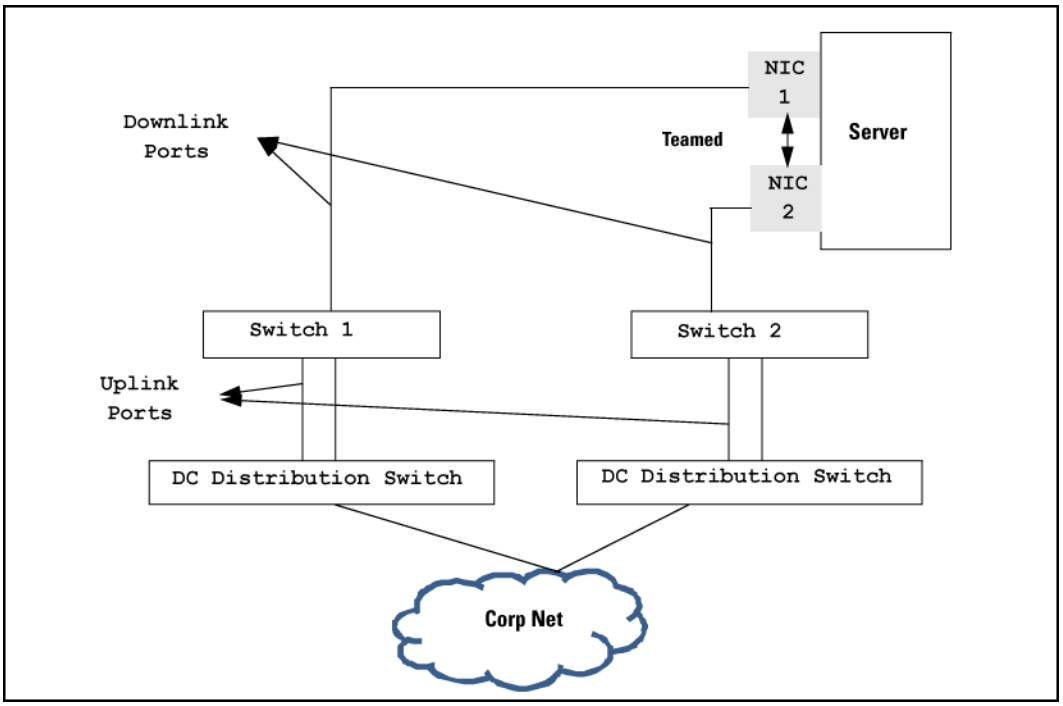
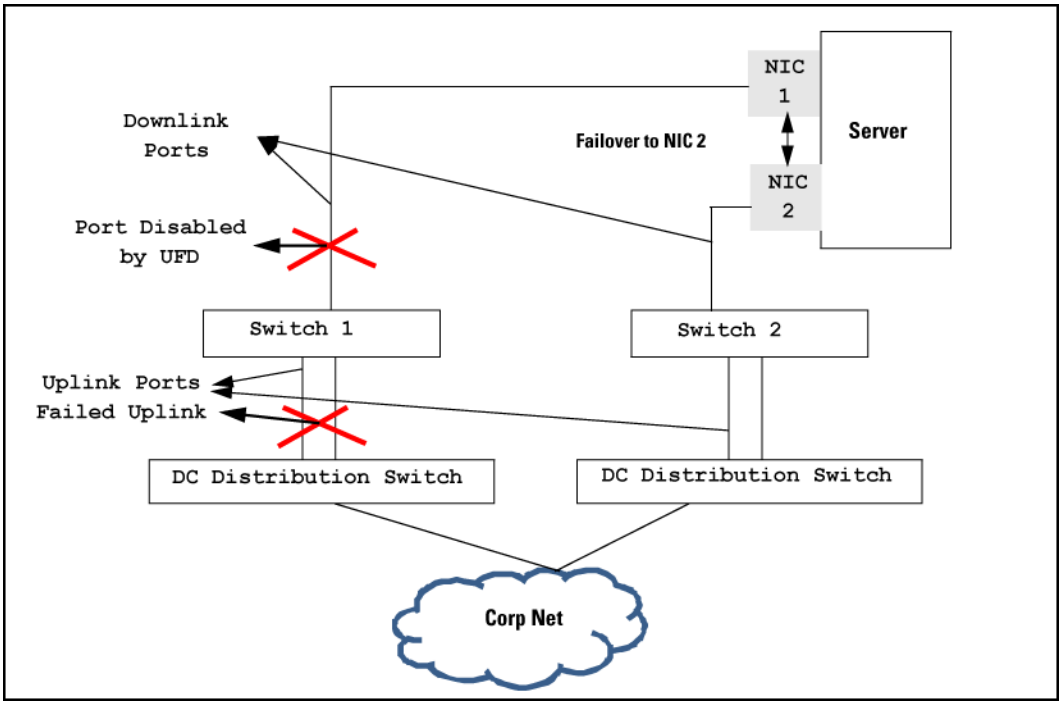


Figure 14: *Teamed NICs with a failed uplink*



Configuration guidelines for UFD

Below is a list of configuration guidelines to be followed for UFD. These are applicable only to blade switches where there is a clear distinction between downlink and uplink ports.

1. UFD is required only when uplink-path redundancy is not available on the blade switches.
2. An LtM can be either one or more uplink ports or one or more multi-link trunk group of uplink ports.
3. Ports that are already members of a trunk group are not allowed to be assigned to an LtM or LtD.
4. A trunk group configured as an LtM can contain multiple uplink ports, but no downlink ports or ISL (Inter-Switch-Link) ports.
5. A port cannot be added to a trunk group if it already belongs to an LtM or LtD.
6. An LtD can contain one or more ports, and/or one or more trunks
7. A trunk group configured as an LtD can contain multiple downlink ports, but no uplink ports or ISL (Inter-Switch-Link) ports.

A common API will be provided for higher layers, like CLI and SNMP, which will determine if a port-list can be an LtM or LtD. The API will handle the platform specific details and ensure a uniform code flow for blade and other switch families.

ProCurve and TOR switches do not have a clear distinction between uplink and downlink ports so some of the points listed above may not be applicable.

UFD enable/disable

Syntax:

uplink-failure-detection

Used to globally enable UFD. The `[no]` option globally disables UFD.

UFD track data configuration

Syntax:

uplink-failure-detection-track <*track-id*> links-to-monitor <*port-list*> links-to-disable <*port-list*>

Used to configure ports given as LtM and ports given as LtD for track-id. This command will also accept trunk interfaces.

Options

[no] ufd track-id <*track-id*>

From within track-id context:

[no] links-to-monitor <*port-list*>

[no] links-to-disable <*port-list*>

switch(config)# uplink-failure-detection-track 10 links-to-monitor 18,19,20 links-to-disable 1,2,3

The above command is used to configure ports 18,19,20 as LtM and ports 1,2,3 as LtD for track-id 10.

switch(config)# no uplink-failure-detection-track 10

This command will remove any track data associated with track-id 10.

switch(config)# no uplink-failure-detection-track 10 links-to-monitor 18 links-to-disable 1

This command will remove port 18 as LtM and port 1 as LtD from track-id 10. This command can be issued from track-id context as well.

UFD minimum uplink threshold configuration

Syntax:

uplink-failure-detection-track *<track-id>* minimum-uplink-threshold *<treshold value>*

Configures the minimum uplink threshold value to a number which is the same as the number of LtM ports that must fail to trigger the disabling of LtD ports. This number of LtM ports must be up to enable the LtD ports if in disable state.

failure-count	Specify the number of monitored links that must fail before disabling links-to-disable ports.
all	Set the failure-count equal to the number of links-to-monitor ports configured. Default is `all`.
<NUMBER>	The number of ports to be set as links-to-monitor ports failure count.

Options

Inside a track-id context:

monitor-threshold *treshold value* | *all*

show uplink-failure-detection

Syntax:

show uplink-failure-detection

```
switch(config)# show uplink-failure-detection

Uplink Failure Detection Information
UFD Enabled   : Yes
Track | Monitored    Links to     LtM    LtD            LtM      LtD
ID    | Links        Disable      State  State          Lacp Key Lacp Key
----- + ------------ ------------ ------ -------------- -------- --------
1     | Dyn1         Dyn2         Up     Up             100      200
2     |                           Down   Auto-Disabled  300      400
```

```
3     | 1             D3            Up     Up
10    | 2,3           D4,D5         Down   Auto-Disabled
11    | Trk1          D6            Up     Up
```

UFD operating notes

- A port cannot be added to a trunk group if it already belongs to an LtM or LtD.
- Ports that are already members of a trunk group cannot be assigned to an LtM or LtD.
- Trunks that are configured as LtM or LtD cannot be deleted.

Configuring ports as LtM and LtD for track 3

```
(HP_Switch_name#) uplink-failure-detection track 3 links-to-monitor 5,6,7
links-to-disable 8,9,10
```

Removing a LtM port and an LtD port for track 3

```
(HP_Switch_name#) no uplink-failure-detection track 3 links-to-monitor 5
links-to-disable 8
```

Error log

UFD will log messages in the following scenarios

- Admin status change.
- When an LtM looses link to its partner and as a result number of LtM ports down becomes equal or greater then the LtM failure count, UFD will disable the LtD.
- When an LtM returns to service and as a result the number of LtM ports down becomes lesser than the LtM failure count, UFD auto-enables the LtD.

Invalid port error messages

- When a user specifies an invalid LtM port, a message similar to the following is displayed.`Invalid port(s) specified as links-to-monitor.`
- When a user specifies an invalid LtD port, a message similar to the following is displayed.`Invalid port(s) specified as links-to-disable.`
- When user specifies an invalid threshold value an error message similar to the following is displayed. `Invalid threshold value.`
- When user tries to configure threshold value greater then number of LtM ports configured an error message similar to the following is displayed. `Invalid port(s) specified as links-to-disable.`
- When a user specifies an invalid LtD port an error message similar to the following is displayed.`Invalid port(s) specified as links-to-disable.`

Introduction to PoE

PoE technology allows IP telephones, wireless LAN access points, and other appliances to receive power and transfer data over existing ethernet LAN cabling. For more information about PoE technology, see the PoE/PoE+ planning and implementation guide, which is available on the HPE Networking website at **http://www.hpe.com/networking**. Enter your Switch number.

Additionally, PoE+ provides more power-management capability, allowing the switch to have more power available for more PDs. Power can be allocated exactly and automatically according to what the PD actually requires at a given time.

PoE terminology

PoE and PoE+ operate similarly in most cases. Any differences between PoE and PoE+ operation are noted; otherwise, the term "PoE" is used to designate both PoE and PoE+ functionality.

Planning and implementing a PoE configuration

This section provides an overview of some considerations for planning a PoE application. For additional information on this topic, refer to the HPE PoE/PoE+ planning and implementation guide which is available on the HPE Networking web site at **http://www.hpe.com/networking**.

Some of the elements you may want to consider for a PoE installation include:

- Port assignments to VLANs
- Use of security features
- Power requirements

This section can help you to plan your PoE installation. If you use multiple VLANs in your network, or if you have concerns about network security, you should read the first two topics. If your PoE installation comes close to (or is likely to exceed) the system's ability to supply power to all devices that may request it, then you should also read the third topic. (If it is unlikely that your installation will even approach a full utilization of the PoE power available, then you may find it unnecessary to spend much time on calculating PoE power scenarios.)

Power requirements

To get the best PoE performance, you should provide enough PoE power to exceed the maximum amount of power that is needed by all the PDs that are being used.

By connecting an external power supply you can optionally provision more PoE wattage per port and or supply the switch with redundant 12V power to operate should an internal power supply fail.

See the HPE PoE/PoE+ planning and implementation guide for detailed information about the PoE/PoE+ power requirements for your switch.

Assigning PoE ports to VLANs

If your network includes VLANs, you may want to assign various PoE-configured ports to specific VLANs. For example, if you are using PoE telephones in your network, you may want to assign ports used for telephone access to a VLAN reserved for telephone traffic.

Applying security features to PoE configurations

You can use the port security features built into the switch to control device or user access to the network through PoE ports in the same way as non-PoE ports. Using Port Security, you can configure each switch port with a unique list of MAC addresses for devices that are authorized to access the network through that port. For more information, refer to the titled “Configuring and Monitoring Port Security” in the access security guide for your switch.

Assigning priority policies to PoE traffic

You can use the configurable QoS (Quality of Service) features in the switch to create prioritization policies for traffic moving through PoE ports. The table below lists the available classifiers and their order of precedence.

Table 6: *Classifiers for prioritizing outbound packets*

Priority	QoS classifier
1	UDP/TCP application type (port)
2	Device priority (destination or source IP address)
3	IP type of service (ToS) field (IP packets only)
4	VLAN priority
5	Incoming source-port on the switch
6	Incoming 802.1 priority (present in tagged VLAN environments)

For more on this topic, refer to the titled “Quality of Service: Managing Bandwidth More Effectively” in the advanced traffic management guide for your switch.

PoE operation

Using the commands described in this chapter, you can:

- Enable or disable PoE operation on individual ports.
- Monitor PoE status and performance.
- Configure a non-default power threshold for SNMP and Event Log reporting of PoE consumption on either all PoE ports on the switch or on all PoE ports.
- Specify the port priority you want to use for provisioning PoE power in the event that the PoE resources become oversubscribed.

A PSE detects the power needed by a connected PD before supplying that power via a phase referred to as "searching". If the PSE cannot supply the required amount of power, it does not supply any power. For PoE using a Type 1 device, a PSE will not supply any power to a PD unless the PSE has at least 17 watts available. For example, if a PSE has a maximum available power of 382 watts and is already supplying 378 watts, and is then connected to a PD requiring 10 watts, the PSE will not supply power to the PD.

For PoE+ using Type 2 devices, the PSE must have at least 33 watts available.

Configuration options

In the default configuration, all ports in a switch covered in this guide are configured to support PoE operation. You can:

- Disable or re-enable per-port PoE operation on individual ports to help control power usage and avoid oversubscribing PoE resources.
- Configure per-port priority for allocating power in case a PoE device becomes oversubscribed and must drop power for some lower-priority ports to support the demand on other, higher-priority ports.
- Manually allocate the amount of PoE power for a port by usage, value, or class.
- Allocate PoE power based on the link-partner's capabilities via LLDP.

The ports support standard networking links and PoE links. You can connect either a non-PoE device or a PD to a port enabled for PoE without reconfiguring the port.

PD support

To best utilize the allocated PoE power, spread your connected PoE devices as evenly as possible. Depending on the amount of power the power supply device delivers to a PoE switch, there may or may not always be enough power available to connect and support PoE operation on all the ports. When a new PD connects to a PoE switch and the switch does not have enough power left for that port:

- If the new PD connects to a port "X" having a **higher** PoE priority than another port "Y" that is already supporting another PD, then the power is removed from port "Y" and delivered to port "X". In this case the PD on port "Y" loses power and the PD on port "X" receives power.
- If the new PD connects to a port "X" having a **lower** priority than all other PoE ports currently providing power to PDs, then power is not supplied to port "X" until one or more PDs using higher priority ports are removed.

In the default configuration (`usage`), when a PD connects to a PoE port and begins operating, the port retains only enough PoE power to support the PD's operation. Unused power becomes available for supporting other PD connections. However, if you configure the `poe-allocate-by` option to either `value` or `class`, all of the power configured is allocated to the port.

For PoE (not PoE+), while 17 watts must be available for a PoE module on the switch to begin supplying power to a port with a PD connected, 17 watts per port is not continually required if the connected PD requires less power. For example, with 20 watts of PoE power remaining available on a module, you can connect one new PD without losing power to any connected PDs on that module. If that PD draws only 3 watts, 17 watts remain available, and you can connect at least one more PD to that module without interrupting power to any other PoE devices connected to the same module. If the next PD you connect draws 5 watts, only 12 watts remain unused. With only 12 unused watts available, if you then connect yet another PD to a higher-priority PoE port, the lowest-priority port on the module loses PoE power and remains unpowered until the module once again has 17 or more watts available. (For information on power priority, see **Power priority operation** on page 100.)

For PoE+, there must be 33 watts available for the module to begin supplying power to a port with a PD connected.

Disconnecting a PD from a PoE port makes that power available to any other PoE ports with PDs waiting for power. If the PD demand for power becomes greater than the PoE power available, power is transferred from the lower-priority ports to the higher-priority ports. (Ports not currently providing power to PDs are not affected.)

Power priority operation

When is power allocation prioritized?

If a PSE can provide power for all connected PD demand, it does not use its power priority settings to allocate power. However, if the PD power demand oversubscribes the available power, then the power allocation is prioritized to the ports that present a PD power demand. This causes the loss of power from one or more lower-priority ports to meet the power demand on other, higher-priority ports. This operation occurs regardless of the order in which PDs connect to the switch's PoE-enabled ports.

How is power allocation prioritized?

There are two ways that PoE power is prioritized:

- Using a **priority class** method, a power priority of **Low** (the default), **High**, or **Critical** is assigned to each enabled PoE port.
- Using a **port-number priority** method, a lower-numbered port has priority over a higher-numbered port within the same configured priority class, For example, port A1 has priority over port A5 if both are configured with **High** priority.

Configuring PoE operation

In the default configuration, PoE support is enabled on the ports in a PoE switch. The default priority for all ports is **Low** and the default power notification threshold is **80** (%).

Using the CLI, you can:

- Disable or re-enable PoE operation on individual PoE ports
- Enable support for pre-standard devices
- Change the PoE priority level on individual PoE ports
- Change the threshold for generating a power level notice
- Manually allocate the amount of PoE power for a port by usage, value, or class
- Allocate PoE power based on the link-partner's capabilities via LLDP

Disabling or re-enabling PoE port operation

Syntax:

[no] interface <*port-list*> power-over-ethernet

Re-enables PoE operation on <*port-list*> and restores the priority setting in effect when PoE was disabled on <*port-list*>.

The `no` form of the command disables PoE operation on <*port-list*>.

Default: All PoE ports are initially enabled for PoE operation at **Low** priority. If you configure a higher priority, this priority is retained until you change it.

Enabling support for pre-standard devices

The HPE switches covered in this guide also support some pre-802.3af devices. For a list of the supported devices, see the FAQ for your switch model.

Syntax:

[no] power-over-ethernet pre-std-detect

Detects and powers pre-802.3af standard devices.

The default setting for the `pre-std-detect` PoE parameter changed. In earlier software the default setting is "on". The default setting is "off".

Configuring the PoE port priority

Syntax:

interface <*port-list*> power-over-ethernet [critical | high | low]

Reconfigures the PoE priority level on <*port-list*>. For a given level, ports are prioritized by port number in ascending order. For example, if ports A1-A24 have a priority level of critical, port A1 has priority over ports A2-A24.

If there is not enough power available to provision all active PoE ports at a given priority level, the lowest-numbered port at that level is provisioned first. PoE priorities are invoked only when all active PoE ports cannot be provisioned (supplied with PoE power)

`Critical`	Specifies the highest-priority PoE support for <*port-list*>. The active PoE ports at this level are provisioned before the PoE ports at any other level are provisioned.
`High`	Specifies the second priority PoE support for <*port-list*>. The active PoE ports at this level are provisioned before the `Low` priority PoE ports are provisioned.
`Low`	(Default) Specifies the third priority PoE support for <*port-list*>. The active PoE ports at this level are provisioned only if there is power available after provisioning any active PoE ports at the higher priority levels.

Controlling PoE allocation

The default option for PoE allocation is `usage`, which is what a PD attached to the port is allocated. You can override this value by specifying the amount of power allocated to a port by using the `class` or `value` options.

Syntax:

[no] int <*port-list*> poe-allocate-by [usage | class | value]

Allows you to manually allocate the amount of PoE power for a port by either its class or a defined value.

`usage`	The automatic allocation by a PD
`class`	Uses the power ramp-up signature of the PD to identify which power class the device will be in. Classes and their ranges are shown in the table below.
`value`	**A user-defined level of PoE power allocated for that port.**

The allowable PD requirements are lower than those specified for PSEs to allow for power losses along the Cat-5 cable.

Table 7: *Power classes and their values*

Power class	Value
0	Depends on cable type and PoE architecture. Maximum power level output of 15.4 watts at the PSE.This is the default class; if there is not enough information about the load for a specific classification, the PSE classifies the load as class 0 (zero).
1	Requires at least 4 watts at the PSE.
2	Requires at least 7 watts at the PSE.
3	15.4 watts
4	For PoE+Maximum power level output of 30 watts at the PSE.

Example:

To allocate by class for ports 6 to 8:

```
switch(config)# int 6-8 PoE-allocate-by class
```

Manually configuring PoE power levels

You can specify a power level (in watts) allocated for a port by using the `value` option. This is the maximum amount of power that will be delivered.

To configure a port by value:

Procedure

1. Set the PoE allocation by entering the `poe-allocate-by value` command:

   ```
   switch(config) # int A6 poe-allocate-by value
   ```

   or in interface context:

   ```
   switch(eth-A6) # poe-allocate-by value
   ```

2. Select a value:

   ```
   switch(config) # int A6 poe-value 15
   ```

   or in interface context:

   ```
   switch(eth-A6) # poe-value 15
   ```

To view the settings, enter the `show power-over-ethernet` command, shown in **Figure 15: PoE allocation by value and the maximum power delivered** on page 104.

Figure 15: *PoE allocation by value and the maximum power delivered*

```
switch(config)# show power-over-ethernet A6

 Status and Counters - Port Power Status for port A6

  Power Enable    : Yes
                            LLDP Detect    : enabled
  Priority        : low           Configured Type :
  AllocateBy      : value         Value          : 15 W [1]
  Detection Status : Delivering     Power Class    : 2

  Over Current Cnt : 0              MPS Absent Cnt  : 0
  Power Denied Cnt : 0              Short Cnt       : 0

  Voltage         : 55.1 V        Current        : 154 mA
  Power           : 8.4 W
```

- [1]Maximum power delivered.

If you set the PoE maximum value to less than what the PD requires, a fault occurs, as shown in **Figure 16: PoE power value set too low for the PD** on page 104.

Figure 16: *PoE power value set too low for the PD*

```
switch(config)# int A7 poe-value 4

switch(config)# show power-over-ethernet A7

 Status and Counters - Port Power Status for port A7

  Power Enable    : Yes
                            LLDP Detect    : enabled
  Priority        : low           Configured Type :
  AllocateBy      : value         Value          : 4 W
  Detection Status : fault [1]      Power Class    : 2

  Over Current Cnt : 1              MPS Absent Cnt  : 0
  Power Denied Cnt : 2              Short Cnt       : 0

  Voltage         : 55.1 V        Current        : 154 mA
  Power           : 8.4 W
```

- [1]'Fault' appears when the PoE power value is set too low.

Configuring PoE redundancy

When PoE redundancy is enabled, PoE redundancy occurs automatically. The switch keeps track of power use and will not supply PoE power to additional PoE devices trying to connect if that results in the switch not having enough power in reserve for redundancy if one of the power supplies should fail.

Syntax:

```
[no] power-over-ethernet redundancy [n+1 | full]
```

Allows you to set the amount of power held in reserve for redundancy.

`no`	Means that all available power can be allocated to PDs.Default: No PoE redundancy enforced.
`n+1`	One of the power supplies is held in reserve for redundancy. If a single power supply fails, no powered devices are shut down.If power supplies with different ratings are used, the highest-rated power supply is held in reserve to ensure full redundancy.
`full`	Half of the available power supply is held in reserve for redundancy. If power supplies with different ratings are used, the highest-rated power supply is held in reserve to ensure full redundancy.

For more information about PoE redundancy and power supplies, see the PoE/PoE+ planning and implementation guide, available on the HPE website at **http://www.hpe.com/networking**. Auto search the model number for your switch, For example, “Aruba switch 2930”, then select the device from the list, and click on **Product manuals**. Click on the “Setup and install — general” link under **Manuals**.

Changing the threshold for generating a power notice

You can configure one of the following thresholds:

- A global power threshold that applies to all ports on the switch. This setting acts as a trigger for sending a notice when the PoE power consumption on any PoE port installed in the switch crosses the configured global threshold level. (Crossing the threshold level in either direction—PoE power usage either increasing or decreasing— triggers the notice.) The default setting is 80%.
- A per-slot power threshold that applies to an individual PoE module installed in the designated slot. This setting acts as a trigger for sending a notice when the module in the specified slot exceeds or goes below a specific level of PoE power consumption.

Some switches covered by this manual provide a single fixed slot.

Syntax:

power-over-ethernet [slot < *slot-id-range* >] threshold <1-99>

This command specifies the PoE usage level (as a percentage of the PoE power available on a module) at which the switch generates a power usage notice. This notice appears as an SNMP trap and a corresponding Event Log message and occurs when a PoE module's power consumption crosses the configured threshold value. That is, the switch generates a notice whenever the power consumption on a module either exceeds or drops below the specified percentage of the total PoE power available on the module.

This command configures the notification threshold for PoE power usage on either a global or per-module (slot) basis.

Without the `[slot PoE <slot-id-range>]` option, the switch applies one power threshold setting on all PoE modules installed in the switch.

Example:

Suppose slots A, B, and C each have a PoE module installed. In this case, executing the following command sets the global notification threshold to 70% of available PoE power:

switch(config)# power-over-ethernet threshold 70

With this setting, if module B is allocated 100 watts of PoE power and is using 68 watts, and then another PD is connected to the module in slot B that uses 8 watts, the 70% threshold of 70 watts is exceeded. The switch sends an SNMP trap and generates this Event Log message:

Slot B POE usage has exceeded threshold of 70%.

If the switch is configured for debug logging, it also sends the Event Log message to the configured debug destination(s).

On any PoE module, if an increasing PoE power load (1) exceeds the configured power threshold (which triggers the log message and SNMP trap), and then (2) later decreases and drops below the threshold again, the switch generates another SNMP trap, plus a message to the Event Log and any configured Debug destinations.

To continue the preceding Example:, if the PoE power usage on the PoE module in slot B drops below 70%, another SNMP trap is generated and you will see this message in the Event Log:

Slot B POE usage is below threshold of 70%.

For a message listing, please see the event log message reference guide for your switch. Go to **http://www.hpe.com/networking**; auto search the model number for your switch, for Example: “Aruba Switch 2920”, then select the device from the list and click on **Product manuals**. Click on the “User guide” link under **Manuals**.

(Default Global PoE Power Threshold: **80**). By using the `[slot <slot-id-range>]` option, you can specify different notification thresholds for different PoE modules installed in the switch. For example, you could set the power threshold for a PoE module in slot “A” to 75% and the threshold for the module in slot “B” to 68% by executing the following two commands:

```
switch(config)# power-over-ethernet slot a threshold 75

switch(config)# power-over-ethernet slot b threshold 68
```

The last `threshold` command affecting a given slot supersedes the previous threshold command affecting the same slot. Thus, executing the following two commands in the order shown sets the threshold for the PoE module in slot “D” to 75%, but leaves the thresholds for any PoE modules in the other slots at 90%.

```
switch(config)# power-over-ethernet threshold 90

switch(config)# power-over-ethernet slot d threshold 75
```

If you reverse the order of the above two commands, all PoE modules in the switch will have a threshold of 90%.

PoE/PoE+ allocation using LLDP information

LLDP with PoE

When using PoE, enabling `poe-lldp-detect` allows automatic power configuration if the link partner supports PoE. When LLDP is enabled, the information about the power usage of the PD is available, and the switch can then comply with or ignore this information. You can configure PoE on each port according to the PD (IP phone, wireless device, and so on) specified in the LLDP field. The default configuration is for PoE information to be ignored if detected through LLDP.

Detecting PoE information via LLDP affects only power delivery; it does not affect normal Ethernet connectivity.

Enabling or disabling ports for allocating power using LLDP

Syntax:

int <*port-list*> poe-lldp-detect [enabled | disabled]

Enables or disables ports for allocating PoE power based on the link-partner's capabilities via LLDP.

Default: Disabled

Example:

You can enter this command to enable LLDP detection:

switch(config) # int A7 poe-lldp-detect enabled

or in interface context:

switch(eth-A7) # poe-lldp-detect enabled

Enabling PoE detection via LLDP TLV advertisement

Use this command and insert the desired port or ports:

switch(config) # lldp config <**port-number**> medTlvenable poe

LLDP with PoE+

Overview

The data link layer classification DLC for PoE provides more exact control over the power requirement between a PSE and PD. The DLC works in conjunction with the physical layer classification PLC and is mandatory for any Type-2 PD that requires more than 12.95 watts of input power.

DLC is defined as part of the IEEE 802.3at standard.

The power negotiation between a PSE and a PD can be implemented at the physical layer or at the data link layer. After the link is powered at the physical layer, the PSE can use LLDP to repeatedly query the PD to discover the power needs of the PD. Communication over the data link layer allows finer control of power allotment, which makes it possible for the PSE to supply dynamically the power levels needed by the PD. Using LLDP is optional for the PSE but mandatory for a Type 2 PD that requires more than 12.95 watts of power.

If the power needed by the PD is not available, that port is shut off.

PoE allocation

LLDP can negotiate power with a PD by using LLDP MED TLVs (disabled by default). This can be enabled using the `int <port-list> PoE-lldp-detect [enabled|disabled]` command, as shown below. LLDP MED TLVs sent by the PD are used to negotiate power only if the LLDP PoE+ TLV is disabled or inactive; if the LLDP PoE+ TLV is sent as well (not likely), the LLDP MED TLV is ignored.

Enabling `PoE-lldp-detect` allows the data link layer to be used for power negotiation. When a PD requests power on a PoE port, LLDP interacts with PoE to see if there is enough power to fulfill the request. Power is set at the level requested. If the PD goes into power-saving mode, the power supplied is reduced; if the need for power increases, the amount supplied is increased. PoE and LLDP interact to meet the current power demands.

Syntax:

int <*port-list*> poe-lldp-detect [enabled | disabled]

Allows the data link layer to be used for power negotiation between a PD on a PoE port and LLDP.

Default: Disabled

Example:

You can enter this command to enable LLDP detection:

switch(config) # int 7 PoE-lldp-detect enabled

or in interface context:

switch(eth-7) # PoE-lldp-detect enabled

Detecting PoE information via LLDP affects only power delivery; it does not affect normal Ethernet connectivity.

You can view the settings by entering the `show power-over-ethernet brief` command, as shown in **Port with LLDP configuration information obtained from the device** on page 108.

Port with LLDP configuration information obtained from the device

```
switch(config)# show power-over-ethernet brief

 Status and Counters - Port Power Status

  System Power Status  : No redundancy
  PoE Power Status     : No redundancy

  Available: 300 W Used: 0 W Remaining: 300 W

  Module A Power
  Available: 300 W Used: 5 W Remaining: 295 W

  POE    | Power   Power     Alloc Alloc  Actual Configured  Detection   Power
  Port   | Enable  Priority  By    Power  Power  Type        Status      Class
  ------ + ------- --------- ----- ------ ------ ----------- ----------- ----
  A1     | Yes     low       usage 17 W   0.0 W  Phone1      Delivering  1
  A2     | Yes     low       usage 17 W   0.0 W              Searching   0
  A3     | Yes     low       usage 17 W   0.0 W              Searching   0
  A4     | Yes     low       usage 17 W   0.0 W              Searching   0
  A5     | Yes     low       usage 17 W   0.0 W              Searching   0
  A6     | Yes     low       usage 17 W   0.0 W              Searching   0
```

Viewing PoE when using LLDP information

Viewing LLDP port configuration

To view information about LLDP port configuration, use the `show lldp config` command.

Syntax:

show lldp config <*port-list*>

Displays the LLDP port configuration information, including the TLVs advertised.

LLDP port configuration information with PoE

```
switch(config)# show lldp config 4

 LLCP Port Configuration Detail

  Port : 4
  AdminStatus [Tx_Rx] : Tx_Rx
  NotificationsEnabled [False] : False
  Med Topology Trap Enabled [False] : False


  TLVS Advertised:
   * port_descr
   * system_name
   * system_descr
   * system_cap

   * capabilities
   * network_policy
   * location_id
   * poe

   * macphy_config
   * poeplus_config

  IpAddress Advertised:
```

Local power information on page 109 shows an Example: of the local device power information using the `show lldp info local-device <port-list>` command.

Local power information

```
switch(config)# show lldp info local-device A1

 LLCP Local Port Information Detail

  Port     : A1
  PortType : local
  PortId   : 1
  PortDesc : A1
  Pvid     : 1

 Poe Plus Information Detail

     Poe Device Type           : Type2 PSE
     Power Source              : Primary
     Power Priority            : low
     PD Requested Power Value  : 20 Watts
     PSE Actual Power Value    : 20 Watts
```

Remote power information on page 109 shows the remote device power information using the `show lldp info remote-device <port-list>` command.

Remote power information

```
switch(config)# show lldp info remote-device A3
```

```
LLCP Remote Device Information Detail

 Local Port   : A3
 ChassisType  : mac-address
 ChassisId    : 00 16 35 ff 2d 40
 PortType     : local
 PortId       : 23
 SysName      : HPSwitch
 System Descr : HP Switch 3500-24, revision W.14.xx
 PortDescr    : 23
 Pvid         : 55

 System Capabilities Supported  : bridge, router
 System Capabilities Enabled    : bridge

 Remote Management Address
    Type    : ipv4
    Address : 10.0.102.198

 Poe Plus Information Detail

    Poe Device Type           : Type2 PD
    Power Source              : Only PSE
    Power Priority            : low
    PD Requested Power Value  : 20 Watts
    PSE Actual Power Value    : 20 Watts
```

Operating note

The advertisement of power with TLVs for LLDP PoE+ is enabled by default. If LLDP is disabled at runtime and a PD is using PoE+ power that has been negotiated through LLDP, there will be a temporary power drop. The port will begin using PoE+ power through the PLC. This event is recorded in the event log. An Example: message would look like the following:

```
W 08/04/13 13:35:50 02768 ports: Port A1 PoE power dropped.
Exceeded physical classification for a PoE Type1 device
(LLDP process disabled)
```

When LLDP is enabled again, it causes a temporary power drop. This event is also recorded in the event log. An Example: message looks like the following:

```
W 08/04/13 13:36:31 02771 ports: Port A1 PoE power dropped.
Exceeded physical classification due to change in
classification type (LLDP process enabled)
```

Viewing the global PoE power status of the switch

Syntax:

show power-over-ethernet [brief | [[ethernet] <*port-list*>] | [slot <*slot-id-range*> | all>]]

Displays the switch's global PoE power status, including:

- **Total Available Power**

  Lists the maximum PoE wattage available to provision active PoE ports on the switch. This is the amount of usable power for PDs.
- **Total Failover Power**

  Lists the amount of PoE power available in the event of a single power supply failure. This is the amount of power the switch can maintain without dropping any PDs.

- **Total Redundancy Power**

  Indicates the amount of PoE power held in reserve for redundancy in case of a power supply failure.
- **Total Remaining Power**

  The amount of PoE power still available.

`brief`	Displays PoE information for each port. See **Viewing PoE status on all ports** on page 111.
<port-list>	Displays PoE information for the ports in port-list. See **Viewing the PoE status on specific ports** on page 113.
<slot-id-range>	Displays PoE information for the selected slots. See **Showing the PoE information by slot**).Enter the `all` option to display the PoE information for all slots.

The `show power-over-ethernet` displays data similar to that shown in **show power-over-ethernet command output** on page 111.

`show power-over-ethernet` command output

```
switch(config)# show power-over-ethernet

 Status and Counters - System Power Status

  Pre-standard Detect  : On
  System Power Status  : No redundancy
  PoE Power Status     : No redundancy

 Chassis power-over-ethernet

  Total Available Power  :  600 W
  Total Failover Power   :  300 W
  Total Redundancy Power :    0 W
  Total Used Power       :    9 W +/- 6W
  Total Remaining Power  :  591 W

 Internal Power
        1  300W/POE  /Connected.
        2  300W/POE  /Connected.
        3  Not Connected.
        4  Not Connected.
 External Power
        EPS1  /Not Connected.
        EPS2  /Not Connected.
```

Viewing PoE status on all ports

Syntax:

show power-over-ethernet brief

Displays the port power status:

PoE Port	Lists all PoE-capable ports on the switch.
Power Enable	Shows **Yes** for ports enabled to support PoE (the default) and **No** for ports on which PoE is disabled.
Power Priority	Lists the power priority (**Low**, **High**, and **Critical**) configured on ports enabled for PoE. (For more information on this topic, see **Configuring PoE operation** on page 101.)
Alloc by	Displays how PoE is allocated (**usage**, **class**, **value**).
Alloc Power	The maximum amount of PoE power allocated for that port (expressed in watts).Default: 17 watts for PoE; 33 watts for PoE+.
Actual Power	The power actually being used on that port.
Configured Type	If configured, shows the user-specified identifier for the port. If not configured, this field is empty.
Detection Status	• **Searching:** The port is trying to detect a PD connection. • **Delivering:** The port is delivering power to a PD. • **Disabled:** On the indicated port, either PoE support is disabled or PoE power is enabled but the PoE module does not have enough power available to supply the port's power needs. • **Fault:** The switch detects a problem with the connected PD. • **Other Fault:** The switch has detected an internal fault that prevents it from supplying power on that port.
Power Class	Shows the 802.3af power class of the PD detected on the indicated port. Classes include: • **0:** 0.44 to 12.95 watts can be drawn by the PD. Default class. • **1:** 0.44 to 3.84 watts • **2:** 3.84 to 6.49 watts • **3:** 6.49 to 12.95 watts • **4:** For PoE+; up to 25.5 watts can be drawn by the PD

The `show power-over-ethernet brief` displays this output:

`show power-over-ethernet brief` command output

```
switch(config)# show power-over-ethernet brief

 Status and Counters - System Power Status

  System Power Status  : No redundancy
  PoE Power Status     : No redundancy

  Available: 600 W Used: 9 W Remaining: 591 W

  Module A Power
  Available: 408 W Used: 9 W Remaining: 399 W

  POE    | Power   Power     Alloc Alloc  Actual Configured  Detection  Power
  Port   | Enable  Priority  By    Power  Power  Type        Status     Class
  ------ + ------- --------- ----- ------ ------ ----------- ---------- ----
  A1     | Yes     low       usage 17 W   0.0 W              Searching  0
  A2     | Yes     low       usage 17 W   0.0 W              Searching  0
```

```
  A3    | Yes      low       usage 17 W   0.0 W              Searching  0
  A4    | Yes      low       usage 17 W   0.0 W              Searching  0
  A5    | Yes      low       usage 17 W   0.0 W              Searching  0
  A6    | Yes      low       usage 17 W   8.4 W              Delivering 2
  A7    | Yes      low       usage 17 W   0.0 W              Searching  0
  A8    | Yes      low       usage 17 W   0.0 W              Searching  0
  A9    | Yes      low       usage 17 W   0.0 W              Searching  0
```

You can also show the PoE information by slot:

Showing the PoE information by slot

```
switch(config)# show power-over-ethernet slot A

 Status and Counters - System Power Status for slot A

  Maximum Power       : 408 W           Operational Status  : On
  Power In Use        :   9 W +/- 6 W   Usage Threshold (%) : 80
```

Viewing the PoE status on specific ports

Syntax:

show power-over-ethernet <*port-list*>

Displays the following PoE status and statistics (since the last reboot) for each port in `<port-list>` :

Power Enable	Shows **Yes** for ports enabled to support PoE (the default) and **No** for ports on which PoE is disabled. For ports on which power is disabled, this is the only field displayed by `show power-over-ethernet <port-list>` .
Priority	Lists the power priority (**Low**, **High**, and **Critical**) configured on ports enabled for PoE. (For more on this topic, see **Configuring PoE operation** on page 101.)
Allocate by	How PoE is allocated (**usage**, **class**, **value**).
Detection Status	• **Searching:** The port is trying to detect a PD connection. • **Delivering:** The port is delivering power to a PD. • **Disabled:** On the indicated port, either PoE support is disabled or PoE power is enabled but the PoE module does not have enough power available to supply the port's power needs. • **Fault:** The switch detects a problem with the connected PD. • **Other Fault:** The switch has detected an internal fault that prevents it from supplying power on that port.
Over Current Cnt	Shows the number of times a connected PD has attempted to draw more than 15.4 watts for PoE or 24.5 watts for PoE+. Each occurrence generates an Event Log message.
Power Denied Cnt	Shows the number of times PDs requesting power on the port have been denied because of insufficient power available. Each occurrence generates an Event Log message.
Voltage	The total voltage, in volts, being delivered to PDs.
Power	The total power, in watts, being delivered to PDs.

Table Continued

LLDP Detect	Port is enabled or disabled for allocating PoE power, based on the link-partner's capabilities via LLDP.
Configured Type	If configured, shows the user-specified identifier for the port. If not configured, the field is empty.
Value	The maximum amount of PoE power allocated for that port (expressed in watts). Default: **17 watts** for PoE; **33 watts** for PoE+
Power Class	Shows the power class of the PD detected on the indicated port. Classes include: • **0:** 0.44 to 12.95 watts • **1:** 0.44 to 3.84 watts • **2:** 3.84 to 6.49 watts • **3:** 6.49 to 12.95 watts • **4:** For PoE+; up to 25.5 watts can be drawn by the PD
MPS Absent Cnt	Shows the number of times a detected PD has no longer requested power from the port. Each occurrence generates an Event Log message. ("MPS" refers to the "maintenance power signature.")
Short Cnt	Shows the number of times the switch provided insufficient current to a connected PD.
Current	The total current, in mA, being delivered to PDs.

If you want to view the PoE status of ports A6 and A7, you would use `show power-over-ethernet A6-A7` to display the data:

`show power-over-ethernet <port-list>` output

```
switch(config)# show power-over-ethernet slot A6-A7

 Status and Counters - Port Power Status for port A6

  Power Enable      : Yes
                                      LLDP Detect     : enabled
  Priority          : low             Configured Type :
  AllocateBy        : value           Value           : 17 W
  Detection Status  : Delivering      Power Class     : 2

  Over Current Cnt  :0                MPS Absent Cnt  : 0
  Power Denied Cnt  :0                Short Cnt       : 0

  Voltage           : 55.1 V          Current         : 154 mA
  Power             : 8.4 W

 Status and Counters - Port Power Status for port A7

  Power Enable      : Yes
                                      LLDP Detect     : disabled
  Priority          : low             Configured Type :
  AllocateBy        : value           Value           : 17 W
  Detection Status  : Searching       Power Class     : 0

  Over Current Cnt  :0                MPS Absent Cnt  : 0
  Power Denied Cnt  :0                Short Cnt       : 0
```

```
  Voltage            : 0 V                Current          : 0 mA
  Power              : 0 W
```

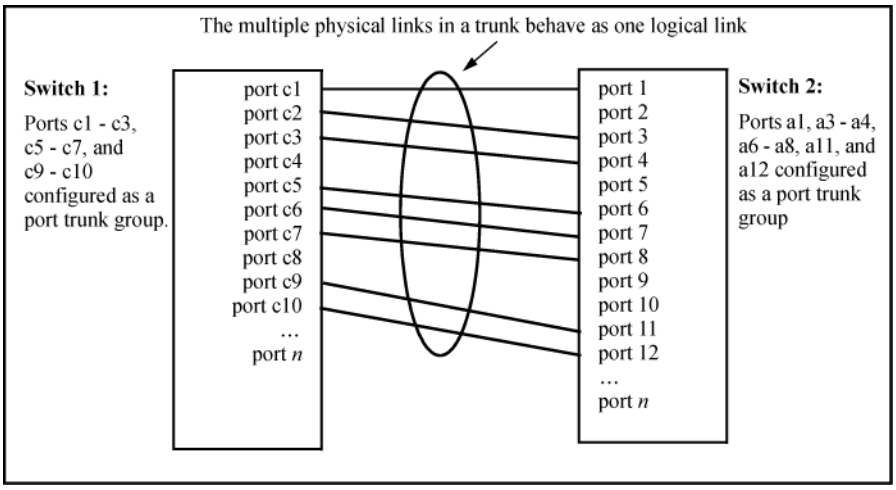
PoE Event Log messages

Please see the event log message reference guide for information about Event Log messages. To see these manuals, go to **http://www.hpe.com/networking**. Auto search the model number for your switch, for Example: “HPE Switch 2920”, then select the device from the list and click on **Product manuals**. Click on the “User guide” link under **Manuals**.

Overview of port trunking

Port trunking allows you to assign up to eight physical links to one logical link (trunk) that functions as a single, higher-speed link providing dramatically increased bandwidth. This capability applies to connections between backbone devices as well as to connections in other network areas where traffic bottlenecks exist. A **trunk group** is a set of up to eight ports configured as members of the same port trunk. The ports in a trunk group do not have to be consecutive. For Example:

Figure 17: *Conceptual Example: of port trunking*



With full-duplex operation in a eight-port trunk group, trunking enables the following bandwidth capabilities:

Port connections and configuration

All port trunk links must be point-to-point connections between a switch and another switch, router, server, or workstation configured for port trunking. No intervening, non-trunking devices are allowed. It is important to note that ports on both ends of a port trunk group must have the same mode (speed and duplex) and flow control settings.

NOTE

Link connections	The switch does not support port trunking through an intermediate, non-trunking device such as a hub, or using more than onemedia type in a port trunk group. Similarly, for proper trunk operation, all links in the same trunk group must have the samespeed, duplex, and flow control.
Port security restriction	Port security does not operate on a trunk group. If you configure port security on one or more ports that are later added to a trunk group, the switch resets the port security parameters for those ports to the factory-default configuration.

CAUTION

To avoid broadcast storms or loops in your network while configuring a trunk, first disable or disconnect all ports you want to add to or remove from the trunk. After you finish configuring the trunk, enable or re-connect the ports.

Port trunk features and operation

The switches covered in this guide offer these options for port trunking:

- LACP: IEEE 802.3ad—**Trunk group operation using LACP** on page 128
- Trunk: Non-Protocol—**Trunk group operation using the "trunk" option** on page 134

Up to 60 trunk groups are supported on the switches. The actual maximum depends on the number of ports available on the switch and the number of links in each trunk. (Using the link aggregation control protocol—LACP—option, you can include standby trunked ports in addition to the maximum of eight actively trunking ports.) The trunks do not have to be the same size; For example, 100 two-port trunks and 11 eight-port trunks are supported.

LACP requires full-duplex (FDx) links of the same media type (10/100Base-T, 100FX, and so on) and the same speed, and enforces speed and duplex conformance across a trunk group. For most installations, Hewlett Packard Enterprise Switch recommends that you leave the port Mode settings at `Auto` (the default). LACP also operates with `Auto-10`, `Auto-100`, and `Auto-1000 (if negotiation selects FDx)`, and `10FDx`, `100FDx`, and `1000FDx` settings. (The 10-gigabit ports available for some switch models allow only the `Auto` setting.)

Fault tolerance

If a link in a port trunk fails, the switch redistributes traffic originally destined for that link to the remaining links in the trunk. The trunk remains operable as long as there is at least one link in operation. If a link is restored, that link is automatically included in the traffic distribution again. The LACP option also offers a standby link capability, which enables you to keep links in reserve for service if one or more of the original active links fails. (See **Trunk group operation using LACP** on page 128.)

Trunk configuration methods

Dynamic LACP trunk

The switch automatically negotiates trunked links between LACP-configured ports on separate devices, and offers one dynamic trunk option: LACP. To configure the switch to initiate a dynamic LACP trunk with another device, use the `interface` command in the CLI to set the default LACP option to `active` on the ports you want to use for the trunk. For example, the following command sets ports C1 to C4 to `LACP active`:

```
switch(config) int c1-c4 lacp active
```

The preceding Example: works if the ports are not already operating in a trunk. To change the LACP option on ports already operating as a trunk, you must first remove them from the trunk. For example, if ports C1 to C4 are LACP-active and operating in a trunk with another device, you would do the following to change them to LACP-passive:

```
switch(config)# no int c1-c4 lacp
```

Removes the ports from the trunk.

```
switch(config)# int c1-c4 lacp passive
```

Configures LACP passive.

Using keys to control dynamic LACP trunk configuration

The `lacp key` option provides the ability to control dynamic trunk configuration. Ports with the same key will be aggregated as a single trunk.

There are two types of keys associated with each port, the Admin key and the Operational key. The Operational key is the key currently in use. The Admin key is used internally to modify the value of the Operational key. The Admin and Operational key are usually the same, but using static LACP can alter the Operational key during runtime, in which case the keys would differ.

The `lacp key` command configures both the Admin and Operational keys when using dynamic LACP trunks. It only configures the Admin key if the trunk is a static LACP trunk. It is executed in the interface context.

Syntax:

[no] lacp [active | passive | key <0-65535>]

Sets the LACP key. During dynamic link aggregation using LACP, ports with the same key are aggregated as a single trunk.

Enabling LACP and configuring an LACP key

```
switch(config)# int A2-A3 lacp active
switch(config)# int A2-A3 lacp key 500

switch(config)# show lacp

                          LACP
      LACP    Trunk   Port            LACP    Admin  Oper
 Port Enabled Group   Status  Partner Status  Key    Key
 ---- ------- ------- ------- ------- ------- ------ ------
 A2   Active  A2      Down    No      Success 500    500
 A3   Active  A3      Down    No      Success 500    500
```

An interface configured with a different LACP key

```
switch(config)# int A5 lacp active
switch(config)# int A5 lacp key 250

switch# show lacp
                          LACP
      LACP    Trunk   Port            LACP    Admin  Oper
 Port Enabled Group   Status  Partner Status  Key    Key
 ---- ------- ------- ------- ------- ------- ------ ------
 A1   Active  Dyn1    Up      Yes     Success 100    100
 A2   Active  Dyn1    Up      Yes     Success 100    100
 A3   Active  Dyn1    Up      Yes     Success 100    100
 A4   Active  Dyn1    Up      Yes     Success 100    100
 A5   Active  A5      Up      No      Success 250    250
```

Static trunk

The switch uses the links you configure with the Port/Trunk Settings screen in the menu interface or the `trunk` command in the CLI to create a static port trunk. The switch offers two types of static trunks: LACP and Trunk.

Table 8: *Trunk types used in static and dynamic trunk groups*

Trunking method	LACP	Trunk
Dynamic	Yes	No
Static	Yes	Yes

The following table describes the trunking options for LACP and Trunk protocols.

Table 9: *Trunk configuration protocols*

Protocol	Trunking Options
LACP (802.3ad)	Provides dynamic and static LACP trunking options. • **Dynamic LACP** — Use the switch-negotiated dynamic LACP trunk when: ◦ The port on the other end of the trunk link is configured for Active or Passive LACP. ◦ You want fault-tolerance for high-availability applications. If you use an eight-link trunk, you can also configure one or more additional links to operate as standby links that will activate only if another active link goes down. • **Static LACP** — Use the manually configured static LACP trunk when: ◦ The port on the other end of the trunk link is configured for a static LACP trunk. ◦ You want to configure non-default spanning tree or IGMP parameters on an LACP trunk group. ◦ You want an LACP trunk group to operate in a VLAN other than the default VLAN and GVRP is disabled. (See **VLANs and dynamic LACP** on page 132.) ◦ You want to use a monitor port on the switch to monitor an LACP trunk. For more information, see **Trunk group operation using LACP** on page 128.
Trunk (non-protocol)	Provides manually configured, static-only trunking to: • Most HPE Switch and routing switches not running the 802.3ad LACP protocol. • Windows NT and HP-UX workstations and servers Use the Trunk option when: • The device to which you want to create a trunk link is using a non-802.3ad trunking protocol. • You are unsure which type of trunk to use, or the device to which you want to create a trunk link is using an unknown trunking protocol. • You want to use a monitor port on the switch to monitor traffic on a trunk. See **Trunk group operation using the "trunk" option** on page 134.

Table 10: *General operating rules for port trunks*

Media:	For proper trunk operation, all ports on both ends of a trunk group must have the same media type and mode (speed and duplex). (For the switches, HPE Switch recommends leaving the port Mode setting at `Auto` or, in networks using Cat 3 cabling, `Auto-10`.)
Port Configuration:	The default port configuration is `Auto`, which enables a port to sense speed and negotiate duplex with an auto-enabled port on another device. HPE recommends that you use the `Auto` setting for all ports you plan to use for trunking. Otherwise, you must manually ensure that the mode setting for each port in a trunk is compatible with the other ports in the trunk. **See: Recommended port mode setting for LACP example** All of the following operate on a per-port basis, regardless of trunk membership: • Enable/Disable • Flow control (Flow Ctrl) LACP is a full-duplex protocol. See **Trunk group operation using LACP** on page 128.
Trunk configuration:	All ports in the same trunk group must be the same trunk type (LACP or trunk). All LACP ports in the same trunk group must be either all static LACP or all dynamic LACP.A trunk appears as a single port labeled`Dyn1`(for an LACP dynamic trunk) or `Trk1` (for a static trunk of type LACP, Trunk) on various menu and CLI screens. For a listing of which screens show which trunk types, see **How the switch lists trunk data** on page 134.For spanning-tree or VLAN operation, configuration for all ports in a trunk is done at the trunk level. (You cannot separately configure individual ports within a trunk for spanning-tree or VLAN operation.)
Traffic distribution:	All of the switch trunk protocols use the SA/DA (source address/destination address) method of distributing traffic across the trunked links. See **Outbound traffic distribution across trunked links** on page 134.

Table Continued

Spanning Tree:	802.1D (STP) and 802.1w (RSTP) Spanning Tree operate as a global setting on the switch (with one instance of Spanning Tree per switch). 802.1s (MSTP) Spanning Tree operates on a per-instance basis (with multiple instances allowed per switch). For each Spanning Tree instance, you can adjust Spanning Tree parameters on a per-port basis.A static trunk of any type appears in the Spanning Tree configuration display, and you can configure Spanning Tree parameters for a static trunk in the same way that you would configure Spanning Tree parameters on a non-trunked port. (Note that the switch lists the trunk by name—such as Trk1—and does not list the individual ports in the trunk.) For example, if ports C1 and C2 are configured as a static trunk named Trk1, they are listed in the Spanning Tree display as Trk1 and do not appear as individual ports in the Spanning Tree displays. See **A port trunk in a Spanning Tree listing** on page 122.When Spanning Tree forwards on a trunk, all ports in the trunk will be forwarding. Conversely, when Spanning Tree blocks a trunk, all ports in the trunk are blocked. A dynamic LACP trunk operates only with the default Spanning Tree settings. Also, this type of trunk appears in the CLI `show spanning-tree` display, but not in the Spanning Tree Operation display of the Menu interface. If you remove a port from a static trunk, the port retains the same Spanning Tree settings that were configured for the trunk.In the below Example:, ports C1 and C2 are members of TRK1 and do not appear as individual ports in the port configuration part of the listing.**See: A port trunk in a Spanning Tree listing example**
IP multicast protocol (IGMP):	A static trunk of any type appears in the IGMP configuration display, and you can configure IGMP for a static trunk in the same way that you would configure IGMP on a non-trunked port. (Note that the switch lists the trunk by name—such as Trk1—and does not list the individual ports in the trunk.) Also, creating a new trunk automatically places the trunk in IGMP Auto status if IGMP is enabled for the default VLAN.A dynamic LACP trunk operates only with the default IGMP settings and does not appear in the IGMP configuration display or `show ip igmp` listing.
VLANs:	Creating a new trunk automatically places the trunk in the DEFAULT_VLAN, regardless of whether the ports in the trunk were in another VLAN. Similarly, removing a port from a trunk group automatically places the port in the default VLAN. You can configure a static trunk in the same way that you configure a port for membership in any VLAN. For a dynamic LACP trunk to operate in a VLAN other than the default VLAN (DEFAULT_VLAN), GVRP must be enabled. See **Trunk group operation using LACP** on page 128.
Port security:	Trunk groups (and their individual ports) cannot be configured for port security, and the switch excludes trunked ports from the `show port-security` listing. If you configure non-default port security settings for a port, then subsequently try to place the port in a trunk, you see the following message and the command is not executed:`< port-list>` Command cannot operate over a logical port.
Monitor port:	A trunk cannot be a monitor port. A monitor port can monitor a static trunk but cannot monitor a dynamic LACP trunk.

Recommended port mode setting for LACP

```
switch(config)# show interfaces config

 Port Settings

  Port  Type       | Enabled Mode          Flow Ctrl MDI
  ----- ---------- + ------- ------------ --------- ----
  1     10/100TX   | Yes     Auto         Enable    Auto
  2     10/100TX   | Yes     Auto         Enable    MDI
```

A port trunk in a Spanning Tree listing

```
Port  Type       Cost Priority State      | Designated Bridge
----- ---------- ---- -------- ---------- + -----------------
C3    100/1000T 5    12B      Forwarding | 0020c1-b27ac0
C4    100/1000T 5    12B      Forwarding | 0060b0-889e00
C5    100/1000T 5    12B      Disabled   |
C6    100/1000T 5    12B      Disabled   |
Trk1            1    64       Forwarding | 0001e7-a0ec00
```

Viewing and configuring a static trunk group (Menu)

Configure port trunking **before** you connect the trunked links to another switch, routing switch, or server. Otherwise, a broadcast storm could occur. (If you need to connect the ports before configuring them for trunking, you can temporarily disable the ports until the trunk is configured. See "Enabling or Disabling Ports and Configuring Port Mode".)

This procedure uses the Port/Trunk Settings screen to configure a static port trunk group on the switch.

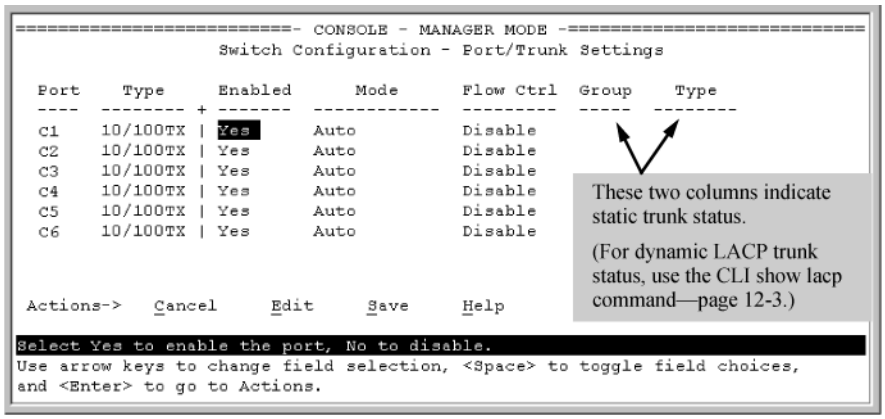
Procedure

1. Follow the procedures in the preceding IMPORTANT note.
2. From the Main Menu, select:

   2. Switch Configuration…

   2. Port/Trunk Settings
3. Press **[E]** (for `Edit`) and then use the arrow keys to access the port trunk parameters.

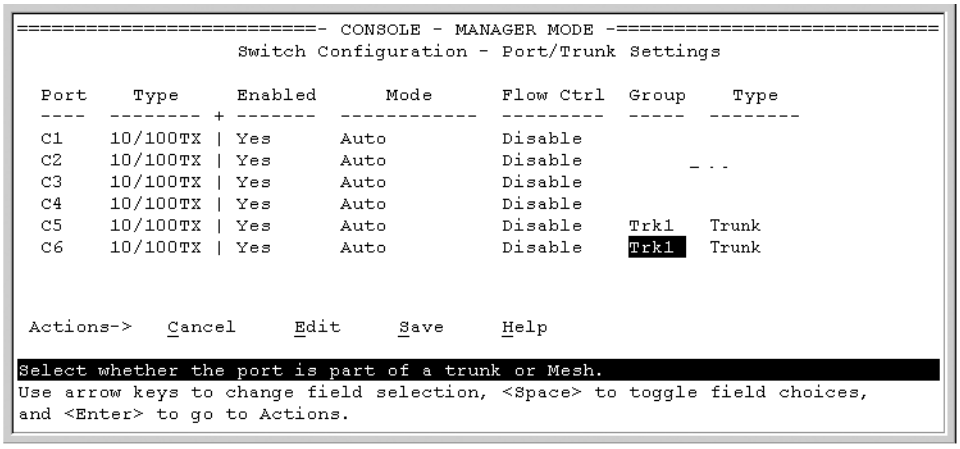
Figure 18: *Example: of the menu screen for configuring a port trunk group*



4. In the Group column, move the cursor to the port you want to configure.
5. Use the Space bar to choose a trunk group assignment (`Trk1`, `Trk2`, and so on) for the selected port.
   a. For proper trunk operation, all ports in a trunk must have the same media type and mode (such as 10/100TX set to 100FDx, or 100FX set to 100FDx). The flow control settings must also be the same for all ports in a given trunk. To verify these settings, see "Viewing Port Status and Configuring Port Parameters".
   b. You can configure the trunk group with up to eight ports per trunk. If multiple VLANs are configured, all ports within a trunk will be assigned to the same VLAN or set of VLANs. (With the 802.1Q VLAN capability built into the switch, more than one VLAN can be assigned to a trunk. See the "Static Virtual LANs (VLANs)" in the advanced traffic management guide for your switch.)

      (To return a port to a non-trunk status, keep pressing the Space bar until a blank appears in the highlighted Group value for that port.)

Figure 19: *Example: of the Configuration for a Two-Port Trunk Group*



6. Move the cursor to the Type column for the selected port and use the Space bar to select the trunk type:
   a. LACP
   b. Trunk (the default type if you do not specify a type)

      All ports in the same trunk group on the same switch must have the same Type (`LACP` or `Trunk`).
7. When you are finished assigning ports to the trunk group, press **[Enter]** , then **[S]** (for `Save`) and return to the Main Menu. (It is not necessary to reboot the switch.)

   During the Save process, traffic on the ports configured for trunking is delayed for several seconds. If the Spanning Tree Protocol is enabled, the delay may be up to 30 seconds.
8. Connect the trunked ports on the switch to the corresponding ports on the opposite device. If you previously disabled any of the trunked ports on the switch, enable them now. (See "Viewing Port Status and Configuring Port Parameters")

Check the Event Log ("Using the Event Log for Troubleshooting Switch Problems") to verify that the trunked ports are operating properly.

Viewing and configuring port trunk groups (CLI)

You can list the trunk type and group for all ports on the switch or for selected ports. You can also list LACP-only status information for LACP-configured ports.

Viewing static trunk type and group for all ports or for selected ports

Syntax:

show trunks [< *port-list* >]

Omitting the <*port-list*> parameter results in a static trunk data listing for all LAN ports in the switch.

Example:

In a switch where ports A4 and A5 belong to Trunk 1 and ports A7 and A8 belong to Trunk 2, you have the options shown in **Listing specific ports belonging to static trunks** on page 124 and **A show trunk listing without specifying ports** on page 124 for displaying port data for ports belonging to static trunks.

Using a port list specifies, for switch ports in a static trunk group, only the ports you want to view. In this case, the command specifies ports A5 through A7. However, because port A6 is not in a static trunk group, it does not appear in the resulting listing:

Listing specific ports belonging to static trunks

```
switch# show trunks e 5-7

 Load Balancing

  Port | Name                      Type      | Group Type
  ---- + ------------------------ --------- + ----- -----
  5    | Print-Server-Trunk       10/100TX  | Trk1  Trunk
  7    |                          10/100TX  | Trk2  Trunk
```

The `show trunks` <*port-list*> command in the above Example: includes a port list, and thus shows trunk group information only for specific ports that have membership in a static trunk. In **A show trunk listing without specifying ports** on page 124, the command does not include a port list, so the switch lists all ports having static trunk membership.

A show trunk listing without specifying ports

```
switch# show trunks

 Load Balancing

 Port | Name                      Type      | Group Type
 ---- + ------------------------ --------- + ----- -----
 4    | Print-Server-Trunk       10/100TX  | Trk1  Trunk
 5    | Print-Server-Trunk       10/100TX  | Trk1  Trunk
 7    |                          10/100TX  | Trk2  Trunk
 8    |                          10/100TX  | Trk2  Trunk
```

Viewing static LACP and dynamic LACP trunk data

Syntax:

show lacp

Lists data for only the LACP-configured ports.

Example:

Ports A1 and A2 have been previously configured for a static LACP trunk. (For more on the `Active` parameter, see table "**LACP port status data**".)

A show LACP listing

```
switch# show lacp

                          LACP
```

```
        LACP     Trunk    Port              LACP     Admin  Oper
Port    Enabled  Group    Status   Partner  Status   Key    Key
----    -------  -------  -------  -------  -------  ------ ------
A1      Active   Trk1     Up       Yes      Success  0      250
A2      Active   Trk1     Up       Yes      Success  0      250
A3      Active   A3       Down     No       Success  0      300
A4      Passive  A4       Down     No       Success  0      0
A5      Passive  A5       Down     No       Success  0      0
A6      Passive  A6       Down     No       Success  0      0
```

For a description of each of the above-listed data types, see table "**LACP port status data**".

Dynamic LACP Standby Links

Dynamic LACP trunking enables you to configure standby links for a trunk by including more than eight ports in a dynamic LACP trunk configuration. When eight ports (trunk links) are up, the remaining link(s) will be held in standby status. If a trunked link that is “Up” fails, it will be replaced by a standby link, which maintains your intended bandwidth for the trunk. (Refer to also the “Standby” entry under “Port Status” in "Table 4-5. LACP Port Status Data".) In the next Example:, ports A1 through A9 have been configured for the same LACP trunk. Notice that one of the links shows Standby status, while the remaining eight links are “Up”.

A Dynamic LACP trunk with one standby link

```
switch# show lacp
                              LACP
        LACP      Trunk    Port                LACP    Admin    Oper
Port    Enabled   Group    Status   Partner    Status  Key      Key
----    -------   -----    ------   -------    ------  ----     -----
A1      Active     Dyn1     Up         Yes     Success   100      100
A2      Active     Dyn1     Up         Yes     Success   100      100
A3      Active     Dyn1     Up         Yes     Success   100      100
A4      Active     Dyn1     Up         Yes     Success   100      100
A5      Active     Dyn1     Up         Yes     Success   100      100
A6      Active     Dyn1     Up         Yes     Success   100      100
A7      Active     Dyn1     Up         Yes     Success   100      100
A8      Active     Dyn1     Up         Yes     Success   100      100
A9      Active     Dyn1    Standby     Yes     Success   100      100
```

Configuring a static trunk or static LACP trunk group

Configure port trunking **before** you connect the trunked links between switches. Otherwise, a broadcast storm could occur. (If you need to connect the ports before configuring them for trunking, you can temporarily disable the ports until the trunk is configured. See "Enabling or Disabling Ports and Configuring Port Mode".)

The **"Port trunk features and operation"** section describes the maximum number of trunk groups you can configure on the switch. An individual trunk can have up to eight links, with additional standby links if you’re using LACP. You can configure trunk group types as follows:

Trunk Type	Trunk Group Membership	
	Trk**X** (Static)	Dyn**X** (Dynamic)
LACP	Yes	Yes
Trunk	Yes	No

The following examples show how to create different types of trunk groups.

Syntax:

trunk < *port-list* > < *trk1 ... trk60* > {<trunk | lacp>}

Configures the specified static trunk type.

Example:

This Example: uses ports C4 to C6 to create a non-protocol static trunk group with the group name `Trk2`.

```
switch(config)# trunk c4-c6 trk2 trunk
```

Removing ports from a static trunk group

Removing a port from a trunk can create a loop and cause a broadcast storm. When you remove a port from a trunk where spanning tree is not in use, HPE Switch recommends that you first disable the port or disconnect the link on that port.

Syntax:

no trunk <*port-list*>

Removes the specified ports from an existing trunk group.

Example:

To remove ports C4 and C5 from an existing trunk group:

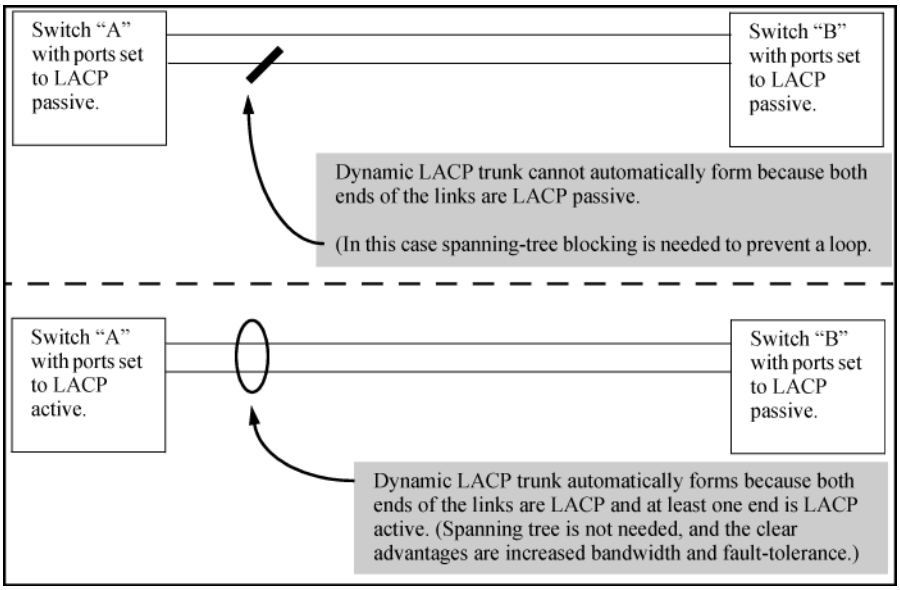
```
switch(config)# no trunk c4-c5
```

Enabling a dynamic LACP trunk group

In the default port configuration, all ports on the switch are set to disabled. To enable the switch to automatically form a trunk group that is dynamic on both ends of the link, the ports on one end of a set of links must be LACP Active. The ports on the other end can be either LACP Activeor LACP Passive. The `active` command enables the switch to automatically establish a (dynamic) LACP trunk group when the device on the other end of the link is configured for LACP Passive.

Example:

Figure 20: *Criteria for automatically forming a dynamic LACP trunk*



Syntax:

interface <*port-list*> lacp active

Configures `<port-list>` as LACP active. If the ports at the other end of the links on `<port-list>` are configured as LACP passive, this command enables a dynamic LACP trunk group on `<port-list>` .

Example:

This Example: uses ports C4 and C5 to enable a dynamic LACP trunk group.

```
switch(config)# interface c4-c5 lacp active
```

Removing ports from a dynamic LACP trunk group

To remove a port from dynamic LACP trunk operation, you must turn off LACP on the port. (On a port in an operating, dynamic LACP trunk, you cannot change between LACP `Active` and LACP `passive` without first removing LACP operation from the port.)

Unless spanning tree is running on your network, removing a port from a trunk can result in a loop. To help prevent a broadcast storm when you remove a port from a trunk where spanning tree is not in use, Hewlett Packard Enterprise recommends that you first disable the port or disconnect the link on that port.

Syntax:

no interface <*port-list*> lacp

Removes `<port-list>` from any dynamic LACP trunk and returns the ports in `<port-list>` to passive LACP.

Example:

Port C6 belongs to an operating, dynamic LACP trunk. To remove port C6 from the dynamic trunk and return it to passive LACP, do the following:

```
switch(config)# no interface c6 lacp
switch(config)# interface c6 lacp passive
```

In the above Example:, if the port on the other end of the link is configured for active LACP or static LACP, the trunked link will be re-established almost immediately.

Viewing existing port trunk groups (WebAgent)

While the WebAgent does not enable you to configure a port trunk group, it does provide a view of an existing trunk group.

To view any port trunk groups:

1. In the navigation pane, click **Interface**.
2. Click **Port Info/Config**. The trunk information for the port displays in the **Port Properties** box.

Trunk group operation using LACP

The switch can automatically configure a dynamic LACP trunk group, or you can manually configure a static LACP trunk group.

LACP requires full-duplex (FDx) links of the same media type (10/100Base-T, 100FX, and so on) and the same speed and enforces speed and duplex conformance across a trunk group. For most installations, HPE Switch recommends that you leave the port mode settings at `Auto` (the default). LACP also operates with `Auto-10`, `Auto-100`, and `Auto-1000` (if negotiation selects FDx), and `10FDx`, `100FDx`, and `1000FDx` settings.

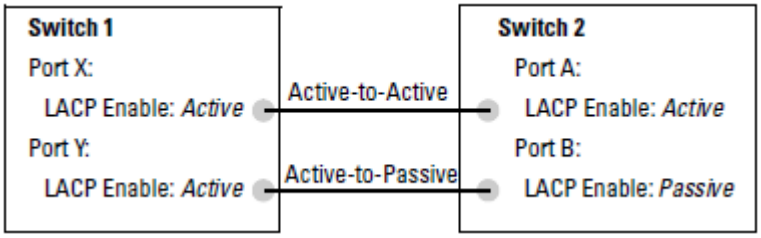
LACP trunk status commands include:

Trunk display method	Static LACP trunk	Dynamic LACP trunk
CLI `show lacp` command	Included in listing.	Included in listing.
CLI `show trunk` command	Included in listing.	Not included.
Port/Trunk Settings screen in menu interface	Included in listing.	Not included

Thus, to display a listing of dynamic LACP trunk ports, you must use the `show lacp` command.

In most cases, trunks configured for LACP on the switches operate as described in the following table.

Table 11: *LACP trunk types*

LACP port trunk configuration	Operation
Dynamic LACP	This option automatically establishes an 802.3ad-compliant trunk group, with **LACP** for the port Type parameter and **DynX** for the port Group name, where **X** is an automatically assigned value from 1 to 60, depending on how many dynamic and static trunks are currently on the switch. (The switch allows a maximum of 60 trunk groups in any combination of static and dynamic trunks.) Dynamic LACP trunks operate only in the default VLAN (unless GVRP is enabled and `Forbid` is used to prevent the trunked ports from joining the default VLAN). Thus, if an LACP dynamic port forms using ports that are not in the default VLAN, the trunk automatically moves to the default VLAN unless GVRP operation is configured to prevent this from occurring. In some cases, this can create a traffic loop in your network. For more information on this topic, see **VLANs and dynamic LACP** on page 132 . Under the following conditions, the switch automatically establishes a dynamic LACP port trunk group and assigns a port Group name: • The ports on both ends of each link have compatible mode settings (speed and duplex). • The port on one end of each link must be configured for LACP Active and the port on the other end of the same link must be configured for either LACP Passive or LACP Active. For Example:  Either of the above link configurations allows a dynamic LACP trunk link. **Backup Links:** A maximum of eight operating links are allowed in the trunk, but, with dynamic LACP, you can configure one or more additional (backup) links that the switch automatically activates if a primary link fails. To configure a link as a standby for an existing eight-port dynamic LACP trunk, ensure that the ports in the standby link are configured as either active-to-active or active-to-passive between switches. **Displaying dynamic LACP trunk data:** To list the configuration and status for a dynamic LACP trunk, use the CLI `show lacp` command. The dynamic trunk is automatically created by the switch and is not listed in the static trunk listings available in the menu interface or in the CLI `show trunk` listing.
Static LACP	Provides a manually configured, static LACP trunk to accommodate these conditions:

LACP port trunk configuration	Operation
	• The port on the other end of the trunk link is configured for a static LACP trunk. • You want to configure non-default Spanning Tree or IGMP parameters on an LACP trunk group. • You want an LACP trunk group to operate in a VLAN other than the default VLAN and GVRP is disabled. (See **VLANs and dynamic LACP** on page 132.) • You want to use a monitor port on the switch to monitor an LACP trunk. The trunk operates if the trunk group on the opposite device is running one of the following trunking protocols: • Active LACP • Passive LACP • Trunk This option uses **LACP** for the port Type parameter and **TrkX** for the port Group parameter, where **X** is an automatically assigned value in a range corresponding to the maximum number of trunks the switch allows. (See **Port trunk features and operation** for the maximum number of trunk groups allowed on the switches.) **Displaying static LACP trunk data :** To list the configuration and status for a static LACP trunk, use the CLI `show lacp` command. To list a static LACP trunk with its assigned ports, use the CLI `show trunk` command or display the menu interface Port/Trunk Settings screen.Static LACP does not allow standby ports.

Default port operation

In the default configuration, LACP is disabled for all ports. If LACP is not configured as Active on at least one end of a link, the port does not try to detect a trunk configuration and operates as a standard, untrunked port. The following table lists the elements of per-port LACP operation. To display this data for a switch, execute the following command in the CLI:

```
switch# show lacp
```

Table 12: *LACP port status data*

Status name	Meaning
Port Numb	Shows the physical port number for each port configured for LACP operation (C1, C2, C3 …). Unlisted port numbers indicate that the missing ports that are assigned to a static trunk group are not configured for any trunking.
LACP Enabled	**Active:** The port automatically sends LACP protocol packets. **Passive:** The port does not automatically send LACP protocol packets and responds only if it receives LACP protocol packets from the opposite device.A link having either two active LACP ports or one active port and one passive port can perform dynamic LACP trunking. A link having two passive LACP ports does not perform LACP trunking because both ports are waiting for an LACP protocol packet from the opposite device. In the default switch configuration, LACP is disabled for all ports.

Table Continued

Status name	Meaning
Trunk Group	**TrkX:** This port has been manually configured into a static LACP trunk. **Trunk group same as port number:** The port is configured for LACP, but is not a member of a port trunk.
Port Status	**Up:** The port has an active LACP link and is not blocked or in standby mode. **Down:** The port is enabled, but an LACP link is not established. This can indicate, For example, a port that is not connected to the network or a speed mismatch between a pair of linked ports. **Disabled:** The port cannot carry traffic. **Blocked:** LACP, Spanning Tree has blocked the port. (The port is not in LACP standby mode.) This may be caused by a (brief) trunk negotiation or a configuration error, such as differing port speeds on the same link or trying to connect the switch to more trunks than it can support. (See **Trunk configuration protocols**.) Some older devices are limited to four ports in a trunk. When eight LACP-enabled ports are connected to one of these older devices, four ports connect, but the other four ports are blocked. **Standby:** The port is configured for dynamic LACP trunking to another device, but the maximum number of ports for the dynamic trunk to that device has already been reached on either the switch or the other device. This port will remain in reserve, or "standby" unless LACP detects that another, active link in the trunk has become disabled, blocked, or down. In this case, LACP automatically assigns a standby port, if available, to replace the failed port.
LACP Partner	**Yes:** LACP is enabled on both ends of the link. **No:** LACP is enabled on the switch, but either LACP is not enabled or the link has not been detected on the opposite device.
LACP Status	**Success:** LACP is enabled on the port, detects and synchronizes with a device on the other end of the link, and can move traffic across the link. **Failure:** LACP is enabled on a port and detects a device on the other end of the link, but is not able to synchronize with this device, and therefore is not able to send LACP packets across the link. This can be caused, For example, by an intervening device on the link (such as a hub), a bad hardware connection, or if the LACP operation on the opposite device does not comply with the IEEE 802.3ad standard.

LACP notes and restrictions

802.1X (Port-based access control) configured on a port

To maintain security, LACP is not allowed on ports configured for 802.1X authenticator operation. If you configure port security on a port on which LACP (active or passive) is configured, the switch removes the LACP configuration, displays a notice that LACP is disabled on the port, and enables 802.1X on that port.

```
switch(config)# aaa port-access authenticator b1
LACP has been disabled on 802.1x port(s).
switch(config)#
```

The switch does not allow you to configure LACP on a port on which port access (802.1X) is enabled. For Example:

```
switch(config)# int b1 lacp passive
Error configuring port < port-number > : LACP and 802.1x cannot
```

```
be run together.
switch(config)#
```

To restore LACP to the port, you must first remove the 802.1X configuration of the port and then re-enable LACP active or passive on the port.

Port security configured on a port

To maintain security, LACP is not allowed on ports configured for port security. If you configure port security on a port on which LACP (active or passive) is configured, the switch removes the LACP configuration, displays a notice that LACP is disabled on the port, and enables port security on that port. For example:

```
switch(config)# port-security a17 learn-mode static address-
limit 2 LACP has been disabled on secured port(s).
switch(config)#
```

The switch does not allow you to configure LACP on a port on which port security is enabled. For example:

```
switch(config)# int a17 lacp passive
Error configuring port A17: LACP and port security cannot be
run together.
switch(config)#
```

To restore LACP to the port, you must remove port security and re-enable LACP active or passive.

Changing trunking methods

To convert a trunk from static to dynamic, you must first eliminate the static trunk.

Static LACP trunks

When a port is configured for LACP (active or passive), but does not belong to an existing trunk group, you can add that port to a static trunk. Doing so disables dynamic LACP on that port, which means you must manually configure both ends of the trunk.

Dynamic LACP trunks

You can configure a port for LACP-active or LACP-passive, but on a dynamic LACP trunk you cannot configure the other options that you can on static trunks. If you want to manually configure a trunk, use the `trunk` command.

VLANs and dynamic LACP

A dynamic LACP trunk operates only in the default VLAN (unless you have enabled GVRP on the switch and use `Forbid` to prevent the ports from joining the default VLAN).

If you want to use LACP for a trunk on a non-default VLAN and GVRP is disabled, configure the trunk as a static trunk.

Blocked ports with older devices

Some older devices are limited to four ports in a trunk. When eight LACP-enabled ports are connected to one of these older devices, four ports connect, but the other four ports are blocked. The LACP status of the blocked ports is shown as "Failure."

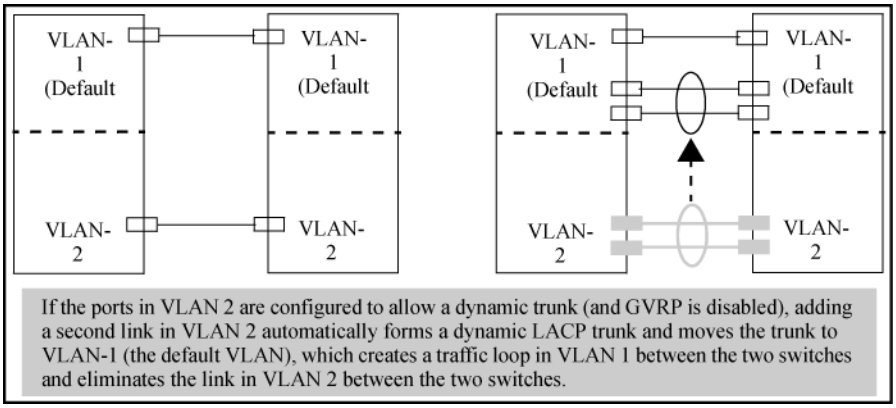
If one of the other ports becomes disabled, a blocked port replaces it (Port Status becomes "Up"). When the other port becomes active again, the replacement port goes back to blocked (Port Status is "Blocked"). It can take a few seconds for the switch to discover the current status of the ports.

Blocked ports with LACP

```
switch(eth-B1-B8)# show lacp

                          LACP

  PORT    LACP      TRUNK    PORT      LACP      LACP
  NUMB    ENABLED   GROUP    STATUS    PARTNER   STATUS
  ----    -------   ------   ------    -------   ------
  B1      Active    Dyn1     Up        Yes       Success
  B2      Active    Dyn1     Up        Yes       Success
  B3      Active    Dyn1     Up        Yes       Success
  B4      Active    Dyn1     Up        Yes       Success
  B5      Active    Dyn1     Blocked   Yes       Failure
  B6      Active    Dyn1     Blocked   Yes       Failure
  B7      Active    B7       Down      No        Success
  B8      Active    B8       Down      No        Success
```

If there are ports that you do not want on the default VLAN, ensure that they cannot become dynamic LACP trunk members. Otherwise a traffic loop can unexpectedly occur. For Example:

Figure 21: *A dynamic LACP trunk forming in a VLAN can cause a traffic loop*



If the ports in VLAN 2 are configured to allow a dynamic trunk (and GVRP is disabled), adding a second link in VLAN 2 automatically forms a dynamic LACP trunk and moves the trunk to VLAN-1 (the default VLAN), which creates a traffic loop in VLAN 1 between the two switches and eliminates the link in VLAN 2 between the two switches.

Easy control methods include either disabling LACP on the selected ports or configuring them to operate in static LACP trunks.

Spanning Tree and IGMP

If Spanning Tree, IGMP, or both are enabled in the switch, a dynamic LACP trunk operates only with the default settings for these features and does not appear in the port listings for these features.

Half-duplex, different port speeds, or both not allowed in LACP trunks

Theports on both sides of an LACP trunk must be configured for the same speed and for full-duplex (FDx). The 802.3ad LACP standard specifies a full-duplex (FDx) requirement for LACP trunking. (10-gigabit ports operate only at FDx.)

A port configured as LACP passive and not assigned to a port trunk can be configured to half-duplex (HDx). However, in any of the following cases, a port cannot be reconfigured to an HDx setting:

- If the port is a 10-gigabit port.
- If a port is set to LACP Active, you cannot configure it to HDx.
- If a port is already a member of a static or dynamic LACP trunk, you cannot configure it to HDx.
- If a port is already set to HDx, the switch does not allow you to configure it for a static or dynamic LACP trunk.

Dynamic/static LACP interoperation

A port configured for dynamic LACP can properly interoperate with a port configured for static (TrkX) LACP, but any ports configured as standby LACP links are ignored.

Trunk group operation using the "trunk" option

This method creates a trunk group that operates independently of specific trunking protocols and does not use a protocol exchange with the device on the other end of the trunk. With this choice, the switch simply uses the SA/DA method of distributing outbound traffic across the trunked ports without regard for how that traffic is handled by the device at the other end of the trunked links. Similarly, the switch handles incoming traffic from the trunked links as if it were from a trunked source.

When a trunk group is configured with the `trunk` option, the switch automatically sets the trunk to a priority of "4" for Spanning Tree operation (even if Spanning Tree is currently disabled). This appears in the running-config file as `spanning-tree Trkn priority 4`. Executing `write memory` after configuring the trunk places the same entry in the startup-config file.

Use the `trunk` option to establish a trunk group between a switch and another device, where the other device's trunking operation fails to operate properly with LACP trunking configured on the switches.

How the switch lists trunk data

Static trunk group	Appears in the menu interface and the output from the CLI `show trunk` and `show interfaces` commands.
Dynamic LACP trunk group	Appears in the output from the CLI `show lacp` command.

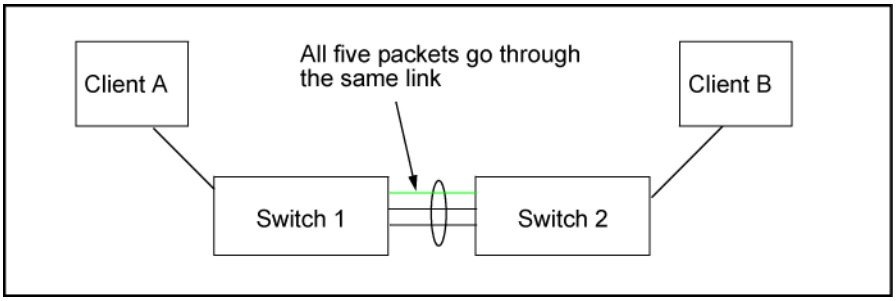
Interface option	Dynamic LACP trunk group	Static LACP trunk group	Static non-protocol
Menu interface	No	Yes	Yes
CLI `show trunk`	No	Yes	Yes
CLI `show interfaces`	No	Yes	Yes
CLI `show lacp`	Yes	Yes	No
CLI `show spanning-tree`	No	Yes	Yes
CLI `show igmp`	No	Yes	Yes
CLI `show config`	No	Yes	Yes

Outbound traffic distribution across trunked links

The two trunk group options (LACP and trunk) use SA/DA pairs for distributing outbound traffic over trunked links. That is, the switch sends traffic from the same source address to the same destination address through the same trunked link, and may also send traffic from the same source address to a different destination address through the same link or a different link, depending on the mapping of path assignments among the links in the trunk. Likewise, the switch distributes traffic for the same destination address but from different source addresses through links depending on the path assignment.

The load-balancing is done on a per-communication basis. Otherwise, traffic is transmitted across the same path as shown in the figure below. That is, if Client A attached to Switch 1 sends five packets of data to Server A attached to Switch 2, the same link is used to send all five packets. The SA/DA address pair for the traffic is the same. The packets are not evenly distributed across any other existing links between the two switches; they all take the same path.

Figure 22: *Example: of single path traffic through a trunk*



The actual distribution of the traffic through a trunk depends on a calculation using bits from the SA/DA. When an IP address is available, the calculation includes the last five bits of the IP source address and IP destination address; otherwise, the MAC addresses are used. The result of that process undergoes a mapping that determines which link the traffic goes through. If you have only two ports in a trunk, it is possible that all the traffic will be sent through one port even if the SA/DA pairs are different. The more ports you have in the trunk, the more likely it is that the traffic will be distributed among the links.

When a new port is added to the trunk, the switch begins sending traffic, either new traffic or existing traffic, through the new link. As links are added or deleted, the switch redistributes traffic across the trunk group. For example, in the figure below showing a three-port trunk, traffic could be assigned as shown in the following table.

Figure 23: *Example: of port-trunked network*

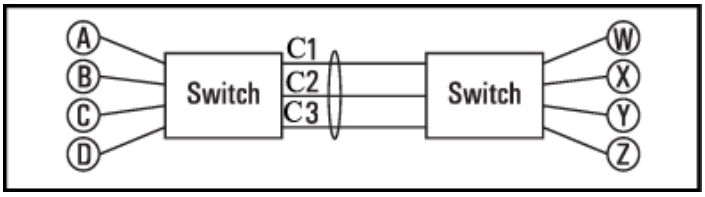


Table 13: *Example: of link assignments in a trunk group (SA/DA distribution)*

Source	Destination	Link
Node A	Node W	1
Node B	Node X	2
Node C	Node Y	3
Node D	Node Z	1
Node A	Node Y	2
Node B	Node W	3

Because the amount of traffic coming from or going to various nodes in a network can vary widely, it is possible for one link in a trunk group to be fully utilized while other links in the same trunk have unused bandwidth capacity, even if the assignments were evenly distributed across the links in a trunk.

Trunk load balancing using port layers

Trunk load balancing using port layers allows the use of TCP/UDP source and destination port number for trunk load balancing. This is in addition to the current use of source and destination IP address and MAC addresses. Configuration of Layer 4 load balancing would apply to all trunks on the switch. Only non-fragmented packets will have their TCP/UDP port number used by load balancing. This ensures that all frames associated with a fragmented IP packet are sent through the same trunk on the same physical link.

The priority for using layer packet information when this feature is enabled is as follows:

Procedure

1. L4-based: If the packet protocol is an IP packet, use Layer 4, or Layer 3, or Layer 2 information, whichever is present, in that order.
2. L3-based: If the packet protocol is an IP packet, use Layer 3, or Layer 2 information, whichever is present, in that order.
3. L2-based: If the packet protocol is an IP packet use Layer 2 information.
4. For all options, if the packet is not an IP packet, use Layer 2 information.

Enabling trunk load balancing

Enter the following command to enable load balancing.

Syntax:

trunk-load-balance L3-based | [L4-based >]

This option enables load balancing based on port layer information. The configuration is executed in global configuration context and applies to the entire switch.

Default: L3-based load balancing

L2-based:	Load balance based on Layer 2 information.
L3-based:	Load balance based on Layer 3 information if present, or Layer 2 information.
L4-based:	Load balance on Layer 4 port information if present, or Layer 3 if present, or Layer 2.

Enabling L4-based trunk load balancing

```
switch(config)# trunk-load-balance L4 based
```

Output when L4-based trunk load balancing is enabled

```
HP Switch(config)# show trunk

Load Balancing Method: L4-based

 Port | Name                           Type      | Group  Type
 ---- + ------------------------------ --------- + ------ -------
 41                                    100/1000T   Trk1   Trunk
 42                                    100/1000T   Trk1   Trunk
```

Note in **Running config file when L4-based trunk load balancing is enabled** on page 137 that in if L4 trunk load balancing is enabled, a line appears in the running-config file. If it is not enabled, nothing appears as this is the default and the default values are not displayed.

Running config file when L4-based trunk load balancing is enabled

```
switch(config)# show running-config

Running configuration

; J9091A Configuration Editor; Created on release #XX.15.02.0001x

hostname "Switch"
module 1 type J8702A
module 5 type J9051A
module 7 type J8705A
module 10 type J8708A
module 12 type J8702A
trunk-load-balance L4-based
vlan 1
   name "DEFAULT_VLAN"
   untagged A1-A24, G1-G24, J1-J4, L1-L24
   ip address dhcp-bootp
   tagged EUP
   no untagged EDP
   exit
snmp-server community "public" unrestricted
```

Rate-limiting

Rate-limiting is intended for use on edge ports in a network. It is not recommended for use on links to other switches, routers, or servers within a network, or for use in the network core. Doing so can interfere with applications the network requires to function properly.

All traffic rate-limiting

Rate-limiting for all traffic operates on a per-port basis to allow only the specified bandwidth to be used for inbound or outbound traffic. When traffic exceeds the configured limit, it is dropped. This effectively sets a usage level on a given port and is a tool for enforcing maximum service level commitments granted to network users. This feature operates on a per-port level and is not configurable on port trunks. Rate-limiting is designed to be applied at the network edge to limit traffic from non-critical users or to enforce service agreements such as those offered by Internet Service Providers (ISPs) to provide only the bandwidth for which a customer has paid.

Rate-limiting also can be applied by a RADIUS server during an authentication client session. Applying rate-limiting to desirable traffic is **not recommended**. For further details, see "RADIUS Authentication and Accounting" in the access security guide for your switch.

The switches also support ICMP rate-limiting to mitigate the effects of certain ICMP-based attacks.

ICMP traffic is necessary for network routing functions. For this reason, blocking all ICMP traffic is not recommended.

Configuring in/out rate-limiting

Syntax:

[no] int <*port-list*> rate-limit all <in|out> percent <0-100>|kbps <0-100000000>>

Configures a traffic rate limit (on non-trunked ports) on the link. The `no` form of the command disables rate-limiting on the specified ports.

The `rate-limit all` command controls the rate of traffic sent or received on a port by setting a limit on the bandwidth available. It includes options for:

- Rate-limiting on inbound or outbound traffic.
- Specifying the traffic rate as either a percentage of bandwidth, or in terms of bits per second.

(Default: Disabled.)

`in` **or** `out`	Specifies a traffic rate limit on inbound traffic passing through that port or on outbound traffic.
`percent` **or** `kbps`	Specifies the rate limit as a percentage of total available bandwidth, or in kilobits per second.

NOTE

The granularity of actual limits may vary across different switch models.

For more details on configuring rate-limiting, see **All traffic rate-limiting** on page 138.

Notes:

- The `rate-limit icmp` command specifies a rate limit on inbound ICMP traffic only (see **ICMP rate-limiting** on page 142).
- Rate-limiting does not apply to trunked ports (including meshed ports).
- Kbps rate-limiting is done in segments of 1% of the lowest corresponding media speed. For example, if the media speed is 1 Kbps, the value would be 1 Mbps. A 1-100 Kbps rate-limit is implemented as a limit of 100 Kbps; a limit of 100-199 Kbps is also implemented as a limit of 100 Kbps, a limit of 200-299 Kbps is implemented as a limit of 200 Kbps, and so on.
- Percentage limits are based on link speed. For example, if a 100 Mbps port negotiates a link at 100 Mbps and the inbound rate-limit is configured at 50%, then the traffic flow through that port is limited to no more than 50 Mbps. Similarly, if the same port negotiates a 10 Mbps link, then it allows no more than 5 Mbps of inbound traffic.Configuring a rate limit of 0 (zero) on a port **blocks all traffic on that port**. However, if this is the desired behavior on the port, Hewlett Packard Enterprise recommends using the `<port-list>` disable command instead of configuring a rate limit of 0.

You can configure a rate limit from either the global configuration level or from the port context level. For example, either of the following commands configures an inbound rate limit of 60% on ports 3 – 5:

```
switch(config)# int 3-5 rate-limit all in percent 60
switch(eth-3-5)# rate-limit all in percent 60
```

Displaying the current rate-limit configuration

The `show rate-limit all` command displays the per-port rate-limit configuration in the running-config file.

Syntax:

show rate-limit all [<*port-list*>]

Without **`[port-list]`** , this command lists the rate-limit configuration for all ports on the switch.

With **`[port-list]`** , this command lists the rate-limit configuration for the specified ports. This command operates the same way in any CLI context.

If you want to view the rate-limiting configuration on the first six ports:

Example:

Listing the rate-limit configuration on page 139 shows a rate-limiting configuration for the first six ports. In this instance:

- Ports 1–4 are configured with an outbound rate limit of 200 Kbps.
- Port 5 is configured with an inbound rate limit of 20%.
- Port 6 is not configured for rate-limiting.

Listing the rate-limit configuration

```
switch# show rate-limit all 1-6

 All-Traffic Rate Limit Maximum %

         | Inbound            Radius      | Outbound           Radius
```

```
  Port    | Limit     Mode     Override     | Limit     Mode     Override
  ------ + --------- -------- ------------ + --------- -------- --------
  1       | Disabled  Disabled No-override | 200       kbps     No-override
  2       | Disabled  Disabled No-override | 200       kbps     No-override
  3       | Disabled  Disabled No-override | 200       kbps     No-override
  4       | Disabled  Disabled No-override | 200       kbps     No-override
  5       | 20        %        No-override | Disabled  Disabled No-override
  6       | Disabled  Disabled No-override | Disabled  Disabled No-override
```

To view **RADIUS**-assigned rate-limit information, use one of the following command options:

```
show port-access
    web-based clients <port-list> detailed
    mac-based clients <port-list> detailed
    authenticator clients <port-list> detailed
```

For more on **RADIUS**-assigned rate-limits, see title "Configuring RADIUS Server Support for Switch Services" in the latest Management and Configuration Guide for your switch.

The `show running` command displays the currently applied setting for any interfaces in the switch configured for all traffic rate-limiting and ICMP rate limiting.

The `show config` command displays this information for the configuration currently stored in the `startup-config` file. (Note that configuration changes performed with the CLI, but not followed by a `write mem` command, do not appear in the `startup-config` file.)

Rate-limit settings listed in the `show config` output

```
switch# show config

Startup configuration: 3

; J9727A Configuration Editor; Created on release #WB.15.18.0000x
; Ver #09:14.29.eb.8f.fc.f3.ff.37.2d:ba

hostname "HP-2920-24G-PoEP"
module 1 type j9727a
interface 1
   rate-limit all out kbps 200
   exit
interface 2
   rate-limit all out kbps 200
   exit
interface 3
   rate-limit all out kbps 200
   exit
interface 4
   rate-limit all out kbps 200
   exit
interface 5
   rate-limit all in percent 20
   exit
```

Operating notes for rate-limiting

- **Rate-limiting operates on a per-port basis, regardless of traffic priority.** Rate-limiting is available on all types of ports (other than trunked ports) and at all port speeds configurable for these switches.
- **Rate-limiting on a trunk is not allowed for the `all`, `bcast`, `icmp`, and `mcast` traffic types.** Rate-limiting is not supported on ports configured in a trunk group (including mesh ports). Configuring a port for rate-limiting and then adding it to a trunk suspends rate-limiting on the port while it is in the trunk. Attempting to configure

rate-limiting on a port that already belongs to a trunk generates the following message:`<port-list> : Operation is not allowed for a trunked port.`

- **Rate-limiting and hardware.** The hardware will round the actual Kbps rate down to the nearest multiple of 64 Kbps.
- **Rate-limiting is visible as an outbound forwarding rate.** Because inbound rate-limiting is performed on packets during packet-processing, it is not shown via the inbound drop counters. Instead, this limit is verifiable as the ratio of outbound traffic from an inbound rate-limited port versus the inbound rate. For outbound rate-limiting, the rate is visible as the percentage of available outbound bandwidth (assuming that the amount of requested traffic to be forwarded is larger than the rate-limit).
- **Operation with other features.** Configuring rate-limiting on a port where other features affect port queue behavior (such as flow control) can result in the port not achieving its configured rate-limiting maximum. For example, in a situation where flow control is configured on a rate-limited port, there can be enough "back pressure" to hold high-priority inbound traffic from the upstream device or application to a rate that is lower than the configured rate limit. In this case, the inbound traffic flow does not reach the configured rate and lower priority traffic is not forwarded into the switch fabric from the rate-limited port. (This behavior is termed "head-of-line blocking" and is a well-known problem with flow-control.)In another type of situation, an outbound port can become oversubscribed by traffic received from multiple rate-limited ports. In this case, the actual rate for traffic on the rate-limited ports may be lower than configured because the total traffic load requested to the outbound port exceeds the port's bandwidth, and thus some requested traffic may be held off on inbound.
- **Traffic filters on rate-limited ports.** Configuring a traffic filter on a port does not prevent the switch from including filtered traffic in the bandwidth-use measurement for rate-limiting when it is configured on the same port. For example, ACLs, source-port filters, protocol filters, and multicast filters are all included in bandwidth usage calculations.
- **Monitoring (mirroring) rate-limited interfaces.** If monitoring is configured, packets dropped by rate-limiting on a monitored interface are still forwarded to the designated monitor port. (Monitoring shows what traffic is inbound on an interface, and is not affected by "drop" or "forward" decisions.)
- **Optimum rate-limiting operation.** Optimum rate-limiting occurs with 64-byte packet sizes. Traffic with larger packet sizes can result in performance somewhat below the configured bandwidth. This is to ensure the strictest possible rate-limiting of all sizes of packets.

NOTE

Rate-limiting is applied to the available bandwidth on a port and not to any specific applications running through the port. If the total bandwidth requested by all applications is less than the configured maximum rate, then no rate-limit can be applied. This situation occurs with a number of popular throughput-testing applications, as well as most regular network applications. Consider the following Example: that uses the minimum packet size:

The total available bandwidth on a 100 Mbps port "X" (allowing for Inter-packet Gap—IPG), with no rate-limiting restrictions, is:

(((100,000,000 bits) / 8) / 84) × 64 = 9,523,809 bytes per second

where:

- The divisor (84) includes the 12-byte IPG, 8-byte preamble, and 64-bytes of data required to transfer a 64-byte packet on a 100 Mbps link.
- Calculated "bytes-per-second" includes packet headers and data. This value is the maximum "bytes-per-second" that 100 Mbps can support for minimum-sized packets.

Suppose port "X" is configured with a rate limit of 50% (4,761,904 bytes). If a throughput-testing application is the only application using the port and transmits 1 Mbyte of data through the port, it uses only 10.5% of the port's available bandwidth, and the rate-limit of 50% has no effect. This is because the maximum rate permitted (50%) exceeds the test application's bandwidth usage (126,642-164,062 bytes, depending upon packet size, which is only 1.3% to 1.7% of the available total). Before rate-limiting can occur, the test application's bandwidth usage must exceed 50% of the port's total available bandwidth. That is, to test the rate-limit setting, the following must be true:

bandwidth usage (0.50 × 9,523,809)

ICMP rate-limiting

In IP networks, ICMP messages are generated in response to either inquiries or requests from routing and diagnostic functions. These messages are directed to the applications originating the inquiries. In unusual situations, if the messages are generated rapidly with the intent of overloading network circuits, they can threaten network availability. This problem is visible in denial-of-service (DoS) attacks or other malicious behaviors where a worm or virus overloads the network with ICMP messages to an extent where no other traffic can get through. (ICMP messages themselves can also be misused as virus carriers). Such malicious misuses of ICMP can include a high number of ping packets that mimic a valid source IP address and an invalid destination IP address (spoofed pings), and a high number of response messages (such as Destination Unreachable error messages) generated by the network.

ICMP rate-limiting provides a method for limiting the amount of bandwidth that may be used for inbound ICMP traffic on a switch port. This feature allows users to restrict ICMP traffic to percentage levels that permit necessary ICMP functions, but throttle additional traffic that may be caused by worms or viruses (reducing their spread and effect). In addition, ICMP rate-limiting preserves inbound port bandwidth for non-ICMP traffic.

CAUTION

ICMP is necessary for routing, diagnostic, and error responses in an IP network. ICMP rate-limiting is primarily used for throttling worm or virus-like behavior and should normally be configured to allow one to five percent of available inbound bandwidth (at 10 Mbps or 100 Mbps speeds) or 100 to 10,000 kbps (1Gbps or 10 Gbps speeds) to be used for ICMP traffic. **This feature should not be used to remove all ICMP traffic from a network.**

NOTE

ICMP rate-limiting does not throttle non-ICMP traffic. In cases where you want to throttle both ICMP traffic and all other inbound traffic on a given interface, you can separately configure both ICMP rate-limiting and all-traffic rate-limiting.

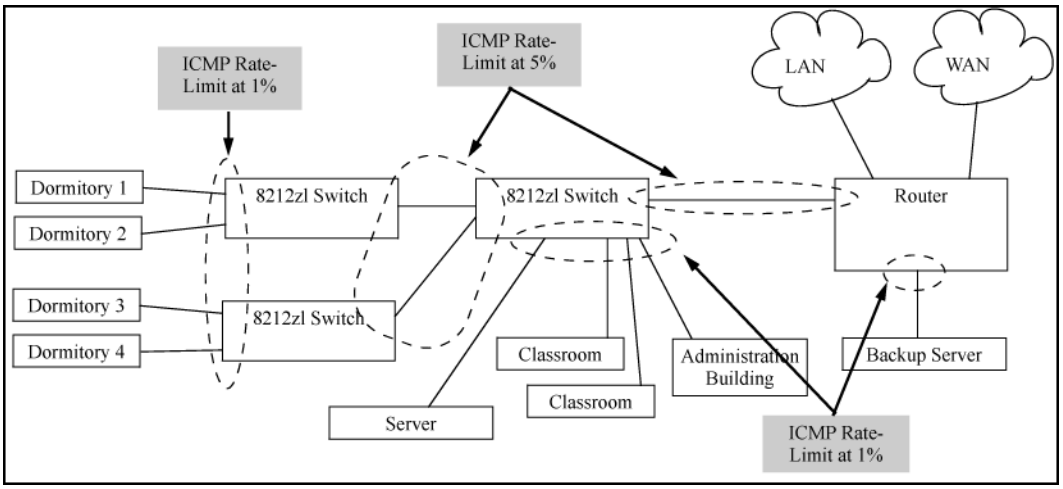
The all-traffic rate-limiting command (`rate-limit all`) and the ICMP rate-limiting command (`rate-limit icmp`) operate differently:

- All-traffic rate-limiting applies to both inbound and outbound traffic and can be specified either in terms of a percentage of total bandwidth or in terms of bits per second;
- ICMP rate-limiting applies only to inbound traffic and can be specified as only a percentage of total bandwidth.

Guidelines for configuring ICMP rate-limiting

Apply ICMP rate-limiting on all connected interfaces on the switch to effectively throttle excessive ICMP messaging from any source. **Figure 24: Example: of ICMP rate-limiting** on page 143 shows an Example: of how to configure this for a small to mid-sized campus though similar rate-limit thresholds are applicable to other network environments. On edge interfaces, where ICMP traffic should be minimal, a threshold of 1% of available bandwidth should be sufficient for most applications. On core interfaces, such as switch-to-switch and switch-to-router, a maximum threshold of 5% should be sufficient for normal ICMP traffic. ("Normal" ICMP traffic levels should be the maximums that occur when the network is rebooting.)

Figure 24: *Example: of ICMP rate-limiting*



Configuring ICMP rate-limiting

For detailed information about ICMP rate-limiting, see **ICMP rate-limiting** on page 142.

The `rate-limit icmp` command controls inbound usage of a port by setting a limit on the bandwidth available for inbound ICMP traffic.

Syntax:

[no] int <*port-list*> rate-limit icmp {< percent < *0-100* > | kbps < *0-10000000* > | [trap-clear>]}

Configures inbound ICMP traffic rate-limiting. You can configure a rate limit from either the global configuration level (as shown above) or from the interface context level. The `no` form of the command disables ICMP rate-limiting on the specified interfaces.

(Default: Disabled.)

`percent <1-100>`	Values in this range allow ICMP traffic as a percentage of the bandwidth available on the interface.
`kbps <0-10000000>`	Specifies the rate at which to forward traffic in kilobits per second.
`0`	Causes an interface to drop all incoming ICMP traffic and is not recommended. See the **caution**.
`trap-clear`	Clears existing ICMP rate limiting trap condition.

Note: ICMP rate-limiting is not supported on meshed ports. (Rate-limiting can reduce the efficiency of paths through a mesh domain).

Example:

Either of the following commands configures an inbound rate limit of 1% on ports A3 to A5, which are used as network edge ports:

```
switch(config) # int a3-a5 rate-limit icmp 1
switch(eth-A3-A5) # rate-limit icmp 1
```

When using kbps-mode ICMP rate-limiting, the rate-limiting only operates on the IP payload part of the ICMP packet (as required by metering RFC 2698). This means that effective metering is at a rate greater than the configured rate, with the disparity increasing as the packet size decreases (the packet to payload ratio is higher).

Also, in kbps mode, metering accuracy is limited at low values, For example, less than 45 Kbps. This is to allow metering to function well at higher media speeds such as 10 Gbps.

For information on using ICMP rate-limiting and all-traffic rate-limiting on the same interface, see**Using both ICMP rate-limiting and all-traffic rate-limiting on the same interface** on page 144.

Using both ICMP rate-limiting and all-traffic rate-limiting on the same interface

ICMP and all-traffic rate-limiting can be configured on the same interface. All-traffic rate-limiting applies to all inbound or outbound traffic (including ICMP traffic), while ICMP rate-limiting applies only to inbound ICMP traffic.

If the all-traffic load on an interface meets or exceeds the currently configured all-traffic inbound rate-limit while the ICMP traffic rate-limit on the same interface has not been reached, all excess traffic is dropped, including any inbound ICMP traffic above the all-traffic limit (regardless of whether the ICMP rate-limit has been reached).

Example:

Suppose:

- The all-traffic inbound rate-limit on port "X" is configured at 55% of the port's bandwidth.
- The ICMP traffic rate-limit on port "X" is configured at 2% of the port's bandwidth.

If at a given moment:

- Inbound ICMP traffic on port "X" is using 1% of the port's bandwidth, and
- Inbound traffic of all types on port "X" demands 61% of the ports's bandwidth,

all inbound traffic above 55% of the port's bandwidth, including any additional ICMP traffic, is dropped as long as all inbound traffic combined on the port demands 55% or more of the port's bandwidth.

Viewing the current ICMP rate-limit configuration

The `show rate-limit icmp` command displays the per-interface ICMP rate-limit configuration in the running-config file.

Syntax:

show rate-limit icmp [< *port-list* >]

Without [*port-list*], this command lists the ICMP rate-limit configuration for all ports on the switch.

With [*port-list*], this command lists the rate-limit configuration for the specified interfaces. This command operates the same way in any CLI context

If you want to view the rate-limiting configuration on ports 1–6:

Listing the rate-limit configuration

```
switch(config)# show rate-limit icmp 1-6

 Inbound ICMP Rate Limit Maximum Percentage

        |          Rate
  Port  | Mode     Limit
  ----- + -------- --------
  1     | Disabled Disabled
  2     | kbps     100
  3     | %        5
  4     | %        1
  5     | %        1
  6     | Disabled Disable
```

The `show running` command displays the currently applied setting for any interfaces in the switch configured for all traffic rate-limiting and ICMP rate-limiting.

The `show config` command displays this information for the configuration currently stored in the `startup-config` file. (Note that configuration changes performed with the CLI, but not followed by a `write mem` command, do not appear in the `startup-config` file.)

For more information on ICMP rate-limiting, see **Operating notes for ICMP rate-limiting** on page 145.

Operating notes for ICMP rate-limiting

ICMP rate-limiting operates on an interface (per-port) basis to allow, on average, the highest expected amount of legitimate, inbound ICMP traffic.

- **Interface support:** ICMP rate-limiting is available on all types of ports (other than trunk ports or mesh ports), and at all port speeds configurable for the switch.
- **Rate-limiting is not permitted on mesh ports:** Either type of rate-limiting (all-traffic or ICMP) can reduce the efficiency of paths through a mesh domain.
- **Rate-limiting on a trunk is not allowed for the `all`, `bcast`, `icmp`, and `mcast` traffic types.** Neither all-traffic nor ICMP rate-limiting are supported on ports configured in a trunk group.
- **ICMP percentage-based rate-limits are calculated as a percentage of the negotiated link speed:** For example, if a 100 Mbps port negotiates a link to another switch at 100 Mbps and is ICMP rate-limit configured at 5%, the inbound ICMP traffic flow through that port is limited to 5 Mbps. Similarly, if the same port negotiates a 10 Mbps link, it allows 0.5 Mbps of inbound traffic. If an interface experiences an inbound flow of ICMP traffic in excess of its configured limit, the switch generates a log message and an SNMP trap (if an SNMP trap receiver is configured).

- **ICMP rate-limiting is port-based:** ICMP rate-limiting reflects the available percentage of an interface's entire inbound bandwidth. The rate of inbound flow for traffic of a given priority and the rate of flow from an ICMP rate-limited interface to a particular queue of an outbound interface are not measures of the actual ICMP rate limit enforced on an interface.
- **Below-maximum rates:** ICMP rate-limiting operates on a per-interface basis, regardless of traffic priority. Configuring ICMP rate-limiting on an interface where other features affect inbound port queue behavior (such as flow control) can result in the interface not achieving its configured ICMP rate-limiting maximum. For example, in some situations with flow control configured on an ICMP rate-limited interface, there can be enough "back pressure" to hold high-priority inbound traffic from the upstream device or application to a rate that does not allow bandwidth for lower-priority ICMP traffic. In this case, the inbound traffic flow may not permit the forwarding of ICMP traffic into the switch fabric from the rate-limited interface. (This behavior is termed "head-of-line blocking" and is a well-known problem with flow-control.) In cases where both types of rate-limiting (`rate-limit all` and `rate-limit icmp`) are configured on the same interface, this situation is more likely to occur.

  In another type of situation, an outbound interface can become oversubscribed by traffic received from multiple ICMP rate-limited interfaces. In this case, the actual rate for traffic on the rate-limited interfaces may be lower than configured because the total traffic load requested to the outbound interface exceeds the interface's bandwidth, and thus some requested traffic may be held off on inbound.
- **Monitoring (mirroring) ICMP rate-limited interfaces:** If monitoring is configured, packets dropped by ICMP rate-limiting on a monitored interface are still forwarded to the designated monitor port. (Monitoring shows what traffic is inbound on an interface, and is not affected by "drop" or "forward" decisions.)
- **Optimum rate-limiting operation:** Optimum rate-limiting occurs with 64-byte packet sizes. Traffic with larger packet sizes can result in performance somewhat below the configured inbound bandwidth. This is to ensure the strictest possible rate-limiting of all sizes of packets.
- **Outbound traffic flow:** Configuring ICMP rate-limiting on an interface does **not** control the rate of outbound traffic flow on the interface.

Notes on testing ICMP rate-limiting

ICMP rate-limiting is applied to the available bandwidth on an interface. If the total bandwidth requested by all ICMP traffic is less than the available, configured maximum rate, no ICMP rate-limit can be applied. That is, an interface must be receiving more inbound ICMP traffic than the configured bandwidth limit allows. If the interface is configured with both `rate-limit all` and `rate-limit icmp`, the ICMP limit can be met or exceeded only if the rate limit for all types of inbound traffic has not already been met or exceeded. Also, to test the ICMP limit you need to generate ICMP traffic that exceeds the configured ICMP rate limit. Using the recommended settings —1% for edge interfaces and 5% maximum for core interfaces—it is easy to generate sufficient traffic. However, if you are testing with higher maximums, you need to ensure that the ICMP traffic volume exceeds the configured maximum.

When testing ICMP rate-limiting where inbound ICMP traffic on a given interface has destinations on multiple outbound interfaces, the test results must be based on the received outbound ICMP traffic.

ICMP rate-limiting is not reflected in counters monitoring inbound traffic because inbound packets are counted before the ICMP rate-limiting drop action occurs.

ICMP rate-limiting trap and Event Log messages

If the switch detects a volume of inbound ICMP traffic on a port that exceeds the ICMP rate-limit configured for that port, it generates one SNMP trap and one informational Event Log message to notify the system operator of the condition. (The trap and Event Log message are sent within two minutes of when the event occurred on the port.) For Example:

```
I 06/30/05 11:15:42 RateLim: ICMP traffic exceeded configured limit on port A1
```

These trap and Event Log messages provide an advisory that inbound ICMP traffic on a given interface has exceeded the configured maximum. The additional ICMP traffic is dropped, but the excess condition may indicate an infected host (or other traffic threat or network problem) on that interface. The system operator should

investigate the attached devices or network conditions further; the switch does not send more traps or Event Log messages for excess ICMP traffic on the affected port until the system operator resets the port's ICMP trap function.

The switch does not send more traps or Event Log messages for excess ICMP traffic on the affected port until the system operator resets the port's ICMP trap function. The reset can be done through SNMP from a network management station or through the CLI with the `trap-clear` command option.

Syntax:

interface <*port-list*> rate-limit icmp trap-clear

On a port configured with ICMP rate-limiting, this command resets the ICMP trap function, which allows the switch to generate a new SNMP trap and an Event Log message if ICMP traffic in excess of the configured limit is detected on the port.

Example:

An operator noticing an ICMP rate-limiting trap or Event Log message originating with port 1 on a switch would use the following command to reset the port to send a new message if the condition occurs again:

HP Switch(config)# interface 1 rate-limit icmp trap-clear

Determining the switch port number used in ICMP port reset commands

To enable excess ICMP traffic notification traps and Event Log messages, use the `setmib` command described on **ICMP rate-limiting trap and Event Log messages** on page 146. The port number included in the command corresponds to the internal number the switch maintains for the designated port and not the port's external identity.

To match the port's external slot/number to the internal port number, use the `walkmib ifDescr` command, as shown in the following example:

Matching internal port numbers to external port numbers

```
switch# walkmib ifDescr
ifDescr.1 = 1
ifDescr.2 = 2
ifDescr.3 = 3
ifDescr.4 = 4
ifDescr.5 = 5
ifDescr.6 = 6
ifDescr.7 = 7
ifDescr.8 = 8
ifDescr.9 = 9
ifDescr.10 = 10
ifDescr.11 = 11
ifDescr.12 = 12
ifDescr.13 = 13
ifDescr.14 = 14
ifDescr.15 = 15
ifDescr.16 = 16
ifDescr.17 = 17
ifDescr.18 = 18
ifDescr.19 = 19
ifDescr.20 = 20
ifDescr.21 = 21
ifDescr.22 = 22
ifDescr.23 = 23
ifDescr.24 = 24
ifDescr.210 = Trk1
```

```
ifDescr.211 = Trk2
ifDescr.330 = DEFAULT_VLAN
ifDescr.4425 = HP Switch software loopback interface
ifDescr.4426 = HP Switch software loopback interface
.
.
.
```

Configuring inbound rate-limiting for broadcast and multicast traffic

You can configure rate-limiting (throttling) of inbound broadcast and multicast traffic on the switch, which helps prevent the switch from being disrupted by traffic storms if they occur on the rate-limited port. The rate-limiting is implemented as a percentage of the total available bandwidth on the port.

The `rate-limit` command can be executed from the global or interface context, for Example:

```
switch(config)# interface 3 rate-limit bcast in percent 10
```

or

```
switch(config)# interface 3
switch(eth-3)# rate-limit bcast in percent 10
```

Syntax:

rate-limit {< bcast | mcast >} in percent < *0-100* >

Option

in percent <*0-100*>

Also supports configuring limit in *kbps*

[no] rate-limit {<bcast | [mcast >]} in

Enables rate-limiting and sets limits for the specified inbound broadcast or multicast traffic. Only the amount of traffic specified by the percent is forwarded.

Default: Disabled

If you want to set a limit of 50% on inbound broadcast traffic for port 3, you can first enter interface context for port 3 and then execute the `rate-limit` command, as shown in **Inbound broadcast rate-limiting of 50% on port 3** on page 148. Only 50% of the inbound broadcast traffic will be forwarded.

Inbound broadcast rate-limiting of 50% on port 3

```
switch(config)# int 3
switch(eth-3)# rate-limit bcast in percent 50

switch(eth-3)# show rate-limit bcast
 Broadcast-Traffic Rate Limit Maximum %

  Port   | Inbound Limit Mode      Radius Override
  ------ + ------------- --------- ---------------
  1      | Disabled      Disabled  No-override
  2      | Disabled      Disabled  No-override
```

```
  3     | Disabled      %         No-override
  4     | Disabled      Disabled  No-override
  5     | Disabled      Disabled  No-override
```

If you rate-limit multicast traffic on the same port, the multicast limit is also in effect for that port, as shown in **Inbound multicast rate-limiting of 20% on port 3** on page 149. Only 20% of the multicast traffic will be forwarded.

Inbound multicast rate-limiting of 20% on port 3

```
switch(eth-3)# rate-limit mcast in percent 20
switch(eth-3)# show rate-limit mcast

 Multicast-Traffic Rate Limit Maximum %

  Port   | Inbound Limit Mode      Radius Override
  ------ + ------------- --------- ---------------
  1      | Disabled      Disabled  No-override
  2      | Disabled      Disabled  No-override
  3      | 20            %         No-override
  4      | Disabled      Disabled  No-override
```

To disable rate-limiting for a port enter the `no` form of the command, as shown in **Disabling inbound multicast rate-limiting for port 3** on page 149.

Disabling inbound multicast rate-limiting for port 3

```
switch(eth-3)# no rate-limit mcast in

switch(eth-3)# show rate-limit mcast

 Multicast-Traffic Rate Limit Maximum %

  Port   | Inbound Limit Mode      Radius Override
  ------ + ------------- --------- ---------------
  1      | Disabled      Disabled  No-override
  2      | Disabled      Disabled  No-override
  3      | Disabled      Disabled  No-override
  4      | Disabled      Disabled  No-override
```

Operating Notes

The following information is displayed for each installed transceiver:

- Port number on which transceiver is installed.
- Type of transceiver.
- Product number — Includes revision letter, such as A, B, or C. If no revision letter follows a product number, this means that no revision is available for the transceiver.
- Part number — Allows you to determine the manufacturer for a specified transceiver and revision number.
- For a non-HPE switches installed transceiver (see **line 23 of "The show tech transceivers command" example**), no transceiver type, product number, or part information is displayed. In the Serial Number field, `non-operational` is displayed instead of a serial number.
- The following error messages may be displayed for a non-operational transceiver:
  - `Unsupported Transceiver. (SelfTest Err#060)`
  - `This switch only supports revision B and above transceivers.`
  - `Self test failure.`
  - `Transceiver type not supported in this port.`

- Transceiver type not supported in this software version.
- Not an HPE Switch Transceiver.

Guaranteed minimum bandwidth (GMB)

GMB provides a method for ensuring that each of a given port's outbound traffic priority queues has a specified minimum consideration for sending traffic out on the link to another device. This can prevent a condition where applications generating lower-priority traffic in the network are frequently or continually "starved" by high volumes of higher-priority traffic. You can configure GMB per-port and, in the case of the HPE 2920, 3800, and 5400R switches, per static trunk.

GMB operation

Earlier software releases supported GMB configuration on a per-port basis. Beginning with software release 15.18, the HPE 2920, 3800, and 5400R switches also support GMB configuration on static trunks. (GMB configuration is not supported on dynamic LACP or distributed (DT) trunks.

For application to static trunk interfaces (HPE 2920, 3800, and 5400r only), GMB enforcement is applied individually to each port belonging to the trunk, and not to the trunk as a whole.

For any port, group of ports or, static trunks, you can use the default minimum bandwidth settings for each outbound priority queue or a customized bandwidth profile. It is also possible to disable the feature entirely.

The switch services per-port outbound traffic in a descending order of priority; that is, from the highest priority to the lowest priority. By default, each port (including each port in a static trunk) offers eight prioritized, outbound traffic queues. Tagged VLAN traffic is prioritized according to the 802.1p priority the traffic carries. Untagged VLAN traffic is assigned a priority of **0** (normal).

Table 14: *Per-port outbound priority queues*

802.1p Priority settings in tagged VLAN packets[1]	Outbound priority queue for a given port
1 (low)	1
2 (low)	2
0 (normal)	3
3 (normal)	4
4 (medium)	5
5 (medium)	6
6 (high)	7
7 (high)	8

[1] *The switch processes outbound traffic from an untagged port at the "0" (normal) priority level.*

You can use GMB to reserve a specific percentage of each port's available outbound bandwidth for each of the eight priority queues. This means that regardless of the amount of high-priority outbound traffic on a port (including each port in a static trunk), you can ensure that there will always be bandwidth reserved for lower-priority traffic.

Since the switch services outbound traffic according to priority (highest to lowest), the highest-priority outbound traffic on a given port automatically receives the first priority in servicing. Thus, in most applications, it is

necessary only to specify the minimum bandwidth you want to allocate to the lower priority queues. In this case, the high-priority traffic automatically receives all unassigned bandwidth without starving the lower-priority queues.

Conversely, configuring a bandwidth minimum on only the high-priority outbound queue of a port or static trunk (and not providing a bandwidth minimum for the lower-priority queues) is not recommended, because it may "starve" the lower-priority queues.

For a given port, when the demand on one or more outbound queues exceeds the minimum bandwidth configured for those queues, the switch apportions unallocated bandwidth to these queues on a priority basis. As a result, specifying a minimum bandwidth for a high-priority queue but not specifying a minimum for lower-priority queues can starve the lower-priority queues during periods of high demand on the high priority queue. For example, if a port or static trunk configured to allocate a minimum bandwidth of 80% for outbound high-priority traffic experiences a demand above this minimum, this burst starves lower-priority queues that **do not have a minimum configured**. Normally, this will not altogether halt lower priority traffic on the network, but will likely cause delays in the delivery of the lower-priority traffic.

The sum of the GMB settings for all outbound queues on a given port or static trunk cannot exceed 100%.

Impacts of QoS queue configuration on GMB operation

The section **Configuring GMB for outbound traffic** on page 152 assumes the ports on the switch offer eight prioritized, outbound traffic queues. This may not always be the case, however, because the switch supports a QoS queue configuration feature that allows you to reduce the number of outbound queues from eight (the default) to four queues, or two.

Changing the number of queues affects the GMB commands (`interface bandwidth-min` and `show bandwidth output`) such that they operate only on the number of queues currently configured. If the queues are reconfigured, the guaranteed minimum bandwidth per queue is automatically re-allocated according to the following percentages:

Table 15: *Default GMB percentage allocations per QoS queue configuration*

802.1p priority	8 queues (default)	4 queues	2 queues
1 (lowest)	2%	10%	90%
2	3%		
0 (normal)	30%	70%	
3	10%		
4	10%	10%	10%
5	10%		
6	15%	10%	
7 (highest)	20%		

For more information on queue configuration and the associated default minimum bandwidth settings, see the "Quality of Service (QoS): managing bandwidth more effectively" in the advanced traffic management guide for your switch.

Configuring GMB for outbound traffic

For any port, group of ports, or static trunk, you can configure either the default minimum bandwidth settings for each outbound priority queue or a customized bandwidth allocation. For most applications, Hewlett Packard Enterprise recommends configuring GMB with the same values on all ports on the switch so that the outbound traffic profile is consistent for all outbound traffic. However, there may be instances where it may be advantageous to configure special profiles on connections to servers or to the network infrastructure (such as links to routers, other switches, or to the network core).

Syntax:

[no] int *<port-list|trk_#>* bandwidth-min output

Configures the default minimum bandwidth allocation for the outbound priority queue for each port or static trunk in the `<port-list|trk_#>` . In the eight-queue configuration, the default values per priority queue are:

- Queue 1 (low priority): 2%
- Queue 2 (low priority): 3%
- Queue 3 (normal priority): 30%
- Queue 4 (normal priority): 10%
- Queue 5 (medium priority): 10%
- Queue 6 (medium priority): 10%
- Queue 7 (high priority): 15%
- Queue 8 (high priority): 20%

The `no` form of the command disables GMB for all ports and trunks in the `<port-list>` . In this state, which is the equivalent of setting all outbound queues on a port or static trunk to **0** (zero), a high level of higher-priority traffic can starve lower-priority queues, which can slow or halt lower-priority traffic in the network.

You can configure bandwidth minimums from either the global configuration level (as shown above) or from the port or static trunk context level. For information on outbound port queues, see **Per-port outbound priority queues**.

Syntax:

[no] int <*<port-list|trk_#>*> bandwidth-min output [0-100|strict] [0-100]

Select a minimum bandwidth.

For ports and trunks in `<port-list|trk_#>` , specifies the minimum outbound bandwidth as a percent of the total bandwidth for each outbound queue. The queues receive service in descending order of priority of each port.

For application to static trunk interfaces (HPE 2920, 3800, and 5400R only), GMB enforcement is applied individually to each port belonging to the trunk, and not to the trunk as a whole.

You must specify a bandwidth percent value for all except the highest priority queue, which may instead be set to "strict" mode. The sum of the bandwidth percentages below the top queue cannot exceed 100%. (**0** is a value for a queue percentage setting.)

Configuring a total of less than 100% across the eight queues results in unallocated bandwidth that remains harmlessly unused unless a given queue becomes oversubscribed. In this case, the unallocated bandwidth is apportioned to oversubscribed queues in descending order of priority. For example, if you configure a minimum of 10% for queues 1 to 7 and 0% for queue 8, the unallocated bandwidth is available to all eight queues in the following prioritized order:

Queue 8 (high priority)
Queue 7 (high priority)

Queue 6 (medium priority)
Queue 5 (medium priority)
Queue 4 (normal priority)
Queue 3 (normal priority)
Queue 2 (low priority)
Queue 1 (low priority)

A setting of **0** (zero percent) on a queue means that no bandwidth minimum is specifically reserved for that queue for each of the ports (including trunked ports) in the `<port-list|trk_#>` .

Also, there is no benefit to setting the high-priority queue (queue 8) to **0** (zero) unless you want the medium queue (queues 5 and 6) to be able to support traffic bursts above its guaranteed minimum.

`[strict]`: Provides the ability to configure the highest priority queue as `strict`. Per-queue values must be specified in priority order, with queue 1 having the lowest priority and queue 8 (or 4, or 2) having the highest priority (the highest queue is determined by how many queues are configured on the switch. Two, four, and eight queues are permitted (see the `qos queue-config` command). The strict queue is provided all the bandwidth it needs. Any remaining bandwidth is shared among the non-strict queues based on need and configured bandwidth profiles (the profiles are applied to the leftover bandwidth in this case). The total sum of percentages for non-strict queues must not exceed 100.

Configuring 0% for a queue can result in that queue being starved if any higher queue becomes over-subscribed and is then given all unused bandwidth.

The switch applies the bandwidth calculation to the link speed the port or trunk is currently using. For example, if a 10/100 Mbs port negotiates to 10 Mbps on the link, it bases its GMB calculations on 10 Mbps, not 100 Mbps.

Use `show bandwidth output <<port-list|trk_#>>` to display the current GMB configuration. (The `show config` and `show running` commands do not include GMB configuration data.)

Example:

For example, suppose you want to configure the following outbound minimum bandwidth availability for ports 1 and 2:

Priority of outbound port queue	Minimum bandwidth %	Effect on outbound bandwidth allocation
8	20%	Queue 8 has the first priority use of all outbound bandwidth not specifically allocated to queues 1 to 7. If, For example, bandwidth allocated to queue 5 is not being used and queues 7 and 8 become oversubscribed, queue 8 has first-priority use of the unused bandwidth allocated to queue 5.
7	15%	Queue 7 has a GMB of 15% available for outbound traffic. If queue 7 becomes oversubscribed and queue 8 is not already using all of the unallocated bandwidth, queue 7 can use the unallocated bandwidth. Also, any unused bandwidth allocated to queues 6 to queue 1 is available to queue 7 if queue 8 has not already claimed it.

Table Continued

Priority of outbound port queue	Minimum bandwidth %	Effect on outbound bandwidth allocation
6	10%	Queue 6 has a GMB of 10% and, if oversubscribed, is subordinate to queues 8 and 7 in priority for any unused outbound bandwidth available on the port.
5	10%	Queue 5 has a GMB of 10% and, if oversubscribed, is subordinate to queues 8, 7, and 6 for any unused outbound bandwidth available on the port.
4	10%	Queue 4 has a GMB of 10% and, if oversubscribed, is subordinate to queues, 8, 7, 6, and 5 for any unused outbound bandwidth available on the port.
3	30%	Queue 3 has a GMB of 30% and, if oversubscribed, is subordinate to queues, 8, 7, 6, 5, and 4 for any unused outbound bandwidth available on the port.
2	3%	Queue 2 has a GMB of 3% and, if oversubscribed, is subordinate to queues, 8, 7, 6, 5, 4, and 3 for any unused outbound bandwidth available on the port.
1	2%	Queue 1 has a GMB of 2% and, if oversubscribed, is subordinate to all the other queues for any unused outbound bandwidth available on the port.

Either of the following commands configures ports 1 through 5 with bandwidth settings:

HP Switch(config) # int 1-5 bandwidth-min output 2 3 30 10 10 10 15 strict

HP Switch(interface 1–5) # bandwidth-min output 2 3 30 10 10 10 15 strict

Viewing the current GMB configuration

This command displays the per-port GMB configuration in the `running-config` file.

Syntax:

show bandwidth output *<port-list|trk_#>*

Without *<port-list|trk_#>* , this command lists the GMB configuration for all ports and static trunks on the switch.

With *<port-list|trk_#>* , this command lists the GMB configuration for the specified ports and static trunks.

This command operates the same way in any CLI context. If the command lists `Disabled` for a port or trunk, there are no bandwidth minimums configured for any queue on the port or trunk. (See the description of the `no` form of the `bandwidth-min output` command.)

Listing the GMB configuration on page 155 displays the GMB configuration resulting from either of the above commands.

Listing the GMB configuration

```
switch(config)# show bandwidth output 1-5, trk1
 Outbound Guaranteed Minimum Bandwidth %
  Port   Q1  Q2     Q3  Q4     Q5  Q6  Q7  Q8
  ------ --- ------ --- ------ --- --- --- ------
  1      2   3      30  10     10  10  15  strict
  2      2   3      30  10     10  10  15  strict
  3      2   3      30  10     10  10  15  strict
  4      2   3      30  10     10  10  15  strict
  5      2   3      30  10     10  10  15  strict
  Trk1   2   3      30  10     10  10  15  strict
```

GMB operating notes

Impact of QoS queue configuration on GMB commands

Changing the number of queues causes the GMB commands (`interface bandwidth-min` and `show bandwidth output`) to operate only on the number of queues currently configured. In addition, when the `qos queue-config` command is executed, any previously configured `bandwidth-min output` settings are removed from the startup configuration. For the default GMB percentage allocations per number of queues, see **Default GMB percentage allocations per QoS queue configuration**.

Jumbo frames

The maximum transmission unit(MTU) is the maximum size IP frame the switch can receive for Layer 2 frames inbound on a port. The switch drops any inbound frames larger than the MTU allowed on the port. Ports operating at a minimum of 1 Gbps can accept forward frames of up to 9220 bytes (including four bytes for a VLAN tag) when configured for jumbo traffic. You can enable inbound jumbo frames on a per-VLAN basis. That is, on a VLAN configured for jumbo traffic, all ports belonging to that VLAN and **operating** at a minimum of 1 Gbps allow inbound jumbo frames of up to 9220 bytes.

Operating rules

- **Required port speed**: This feature allows inbound and outbound jumbo frames on ports operating at a minimum of 1 Gbps.
- **GVRP operation**: A VLAN enabled for jumbo traffic cannot be used to create a dynamic VLAN. A port belonging to a statically configured, jumbo-enabled VLAN cannot join a dynamic VLAN.
- **Port adds and moves**: If you add a port to a VLAN that is already configured for jumbo traffic, the switch enables that port to receive jumbo traffic. If you remove a port from a jumbo-enabled VLAN, the switch disables jumbo traffic capability on the port only if the port is not currently a member of another jumbo-enabled VLAN. This same operation applies to port trunks.
- **Jumbo traffic sources**: A port belonging to a jumbo-enabled VLAN can receive inbound jumbo frames through any VLAN to which it belongs, including non-jumbo VLANs. For example, if VLAN 10 (without jumbos enabled) and VLAN 20 (with jumbos enabled) are both configured on a switch, and port 1 belongs to both VLANs, port 1 can receive jumbo traffic from devices on either VLAN. For a method to allow only some ports in a VLAN to receive jumbo traffic, see **Configuring a maximum frame size** on page 159.

Jumbo traffic-handling

- HPE does not recommend configuring a voice VLAN to accept jumbo frames. Voice VLAN frames are typically small, and allowing a voice VLAN to accept jumbo frame traffic can degrade the voice transmission performance.
- You can configure the default, primary, and/or (if configured) the management VLAN to accept jumbo frames on all ports belonging to the VLAN.

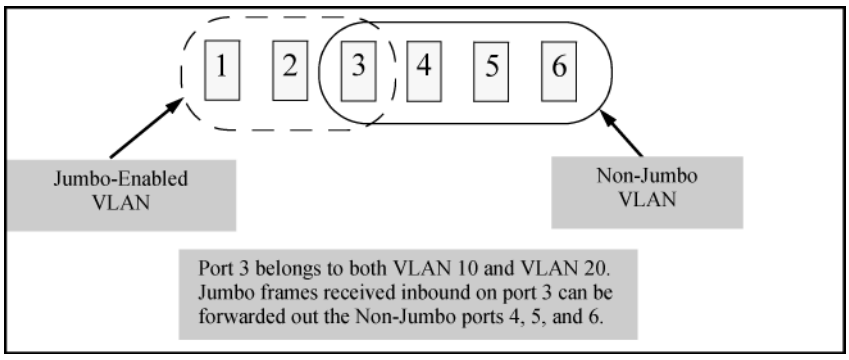
- When the switch applies the default MTU (1522-bytes including 4 bytes for the VLAN tag) to a VLAN, all ports in the VLAN can receive incoming frames of up to 1522 bytes. When the switch applies the jumbo MTU (9220 bytes including 4 bytes for the VLAN tag) to a VLAN, all ports in that VLAN can receive incoming frames of up to 9220 bytes. A port receiving frames exceeding the applicable MTU drops such frames, causing the switch to generate an Event Log message and increment the "Giant Rx" counter (displayed by `show interfaces <port-list>`).
- The switch allows flow control and jumbo frame capability to co-exist on a port.
- The default MTU is 1522 bytes (including 4 bytes for the VLAN tag). The jumbo MTU is 9220 bytes (including 4 bytes for the VLAN tag).
- When a port is not a member of any jumbo-enabled VLAN, it drops all jumbo traffic. If the port is receiving "excessive"inbound jumbo traffic, the port generates an Event Log message to notify you of this condition. This same condition also increments the switch's "Giant Rx" counter.
- If you do not want all ports in a given VLAN to accept jumbo frames, you can consider creating one or more jumbo VLANs with a membership comprising only the ports you want to receive jumbo traffic. Because a port belonging to one jumbo-enabled VLAN can receive jumbo frames through any VLAN to which it belongs, this method enables you to include both jumbo-enabled and non-jumbo ports within the same VLAN.

  For example, suppose you want to allow inbound jumbo frames only on ports 6, 7, 12, and 13. However, these ports are spread across VLAN 100 and VLAN 200 and also share these VLANs with other ports you want excluded from jumbo traffic. A solution is to create a third VLAN with the sole purpose of enabling jumbo traffic on the desired ports, while leaving the other ports on the switch disabled for jumbo traffic. That is:

	VLAN 100	VLAN 200	VLAN 300
Ports	6-10	11-15	6, 7, 12, and 13
Jumbo-enabled?	No	No	Yes

  If there are security concerns with grouping the ports as shown for VLAN 300, you can either use source-port filtering to block unwanted traffic paths or create separate jumbo VLANs, one for ports 6 and 7, and another for ports 12 and 13.
- **Outbound jumbo traffic.** Any port operating at 1 Gbps or higher can transmit outbound jumbo frames through any VLAN, regardless of the jumbo configuration. The VLAN is not required to be jumbo-enabled, and the port is not required to belong to any other, jumbo-enabled VLANs. This can occur in situations where a non-jumbo VLAN includes some ports that do not belong to another, jumbo-enabled VLAN and some ports that do belong to another, jumbo-enabled VLAN. In this case, ports capable of receiving jumbo frames can forward them to the ports in the VLAN that do not have jumbo capability, as shown in **Figure 25: Forwarding jumbo frames through non-jumbo ports** on page 156.

  Figure 25: *Forwarding jumbo frames through non-jumbo ports*



  Jumbo frames can also be forwarded out non-jumbo ports when the jumbo frames received inbound on a jumbo-enabled VLAN are routed to another, non-jumbo VLAN for outbound transmission on ports that have no memberships in other, jumbo-capable VLANs. Where either of the above scenarios is a possibility, the

downstream device must be configured to accept the jumbo traffic. Otherwise, this traffic will be dropped by the downstream device.

Configuring jumbo frame operation

For detailed information about jumbo frames, see **Jumbo frames** on page 155.

Overview

1. Determine the VLAN membership of the ports or trunks through which you want the switch to accept inbound jumbo traffic. For operation with GVRP enabled, refer to the GVRP topic under “Operating Rules”, above.
2. Ensure that the ports through which you want the switch to receive jumbo frames are operating at least at gigabit speed. (Check the Mode field in the output for the `show interfaces brief <port-list>` command.)
3. Use the `jumbo` command to enable jumbo frames on one or more VLANs statically configured in the switch. (All ports belonging to a jumbo-enabled VLAN can receive jumbo frames.
4. Execute `write memory` to save your configuration changes to the `startupconfig` file.

Viewing the current jumbo configuration

Syntax:

show vlans

Lists the static VLANs configured on the switch and includes a Jumbo column to indicate which VLANs are configured to support inbound jumbo traffic. All ports belonging to a jumbo-enabled VLAN can receive jumbo traffic. (For more information, see **Configuring a maximum frame size** on page 159.) See Figure **Figure 26: Example: listing of static VLANs to show jumbo status per VLAN** on page 157.

Figure 26: *Example: listing of static VLANs to show jumbo status per VLAN*

```
HP Switch(config)# show vlans
 Status and Counters - VLAN Information

  Maximum VLANs to support : 256
  Primary VLAN : DEFAULT_VLAN
  Management VLAN :

  VLAN ID Name                             Status       Voice Jumbo
  ------- -------------------------------- ------------ ----- -----
  1       DEFAULT_VLAN                     Port-based   No    Yes
  5       VLAN5                            Port-based   No    No
  22      VLAN22                           Port-based   No    No
```

Indicates which static VLANs are configured to enable jumbo frames.

Syntax:

show vlans ports <*port-list*>

Lists the static VLANs to which the specified ports belong, including the `Jumbo` column to indicate which VLANs are configured to support jumbo traffic.

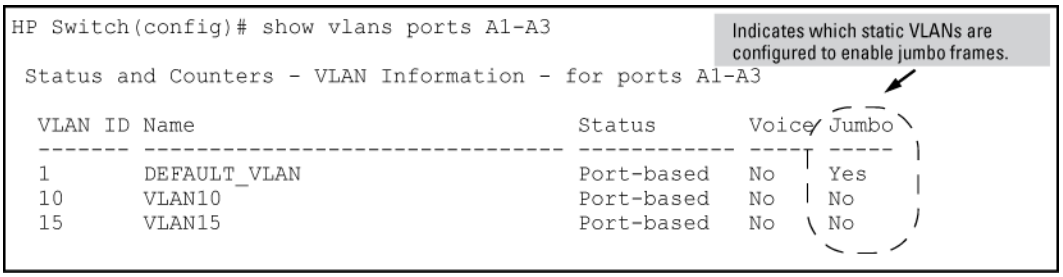
Entering only one port in <*port-list* > results in a list of all VLANs to which that port belongs.

Entering multiple ports in <*port-list* > results in a superset list that includes the VLAN memberships of all ports in the list, even though the individual ports in the list may belong to different subsets of the complete VLAN listing.

Example:

If port 1 belongs to VLAN 1, port 2 belongs to VLAN 10, and port 3 belongs to VLAN 15, executing this command with a *port-list* of **1 - 3** results in a listing of all three VLANs, even though none of the ports belong to all three VLANS. (See **Figure 27: Listing the VLAN memberships for a range of ports** on page 158.)

Figure 27: *Listing the VLAN memberships for a range of ports*

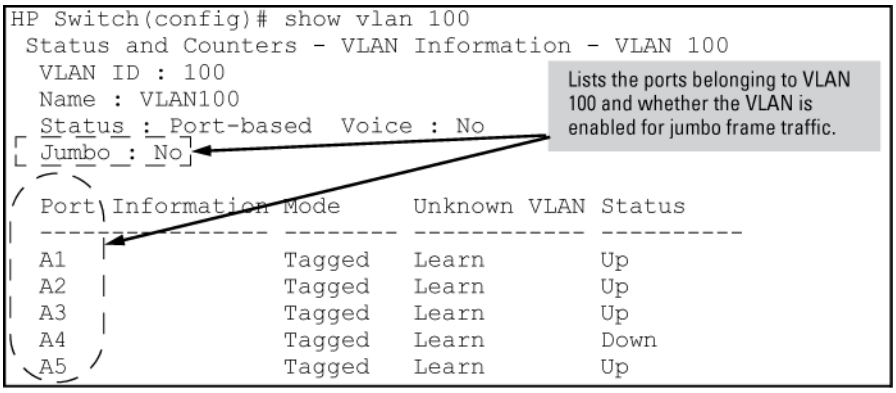


Syntax:

show vlans <*vid*>

Shows port membership and jumbo configuration for the specified *vid* . (See **Figure 28: Example: of listing the port membership and jumbo status for a VLAN** on page 158.)

Figure 28: *Example: of listing the port membership and jumbo status for a VLAN*



Enabling or disabling jumbo traffic on a VLAN

Syntax:

vlan <*vid*> jumbo

[no] vlan <*vid*> jumbo

Configures the specified VLAN to allow jumbo frames on all ports on the switch that belong to that VLAN. If the VLAN is not already configured on the switch, `vlan <vid> jumbo` also creates the VLAN.

A port belonging to one jumbo VLAN can receive jumbo frames through any other VLAN statically configured on the switch, regardless of whether the other VLAN is enabled for jumbo frames.

The `[no]` form of the command disables inbound jumbo traffic on all ports in the specified VLAN that do not also belong to another VLAN that is enabled for jumbo traffic. In a VLAN context, the command forms are `jumbo` and `no jumbo`.

(Default: Jumbos disabled on the specified VLAN.)

Configuring a maximum frame size

You can globally set a maximum frame size for jumbo frames that will support values from 1518 bytes to 9216 bytes for untagged frames.

Syntax:

jumbo max-frame-size <*size*>

Sets the maximum frame size for jumbo frames. The range is from 1518 bytes to 9216 bytes. (Default: 9216 bytes)

The jumbo `max-frame-size` is set on a GLOBAL level.

Default: 9216 bytes

Configuring IP MTU

The following feature is available on the switches covered in this guide. `jumbos` support is required for this feature. On switches that do not support this command, the IP MTU value is derived from the maximum frame size and is not configurable.

You can set the IP MTU globally by entering this command. The value of `max-frame-size` must be greater than or equal to 18 bytes more than the value selected for `ip-mtu`. For example, if `ip-mtu` is set to 8964, the `max-frame-size` is configured as 8982.

Syntax:

jumbo ip-mtu <*size*>

Globally sets the IP MTU size. Values range between 1500 and 9198 bytes. This value must be 18 bytes less than the value of `max-frame-size`.

(Default: 9198 bytes)

SNMP implementation

Jumbo maximum frame size

The maximum frame size for jumbos is supported with the following proprietary MIB object:

`hpSwitchMaxFrameSize OBJECT-TYPE`

This is the value of the global `max-frame-size` supported by the switch. The default value is set to 9216 bytes.

Jumbo IP MTU

The IP MTU for jumbos is supported with the following proprietary MIB object:

`hpSwitchIpMTU OBJECT-TYPE`

This is the value of the global jumbos IP MTU (or L3 MTU) supported by the switch. The default value is set to 9198 bytes (a value that is 18 bytes less than the largest possible maximum frame size of 9216 bytes). This object can be used only in switches that support `max-frame-size` and `ip-mtu` configuration.

Displaying the maximum frame size

Use the `show jumbos` command to display the globally configured untagged maximum frame size for the switch, as shown in the following Example:.

```
switch(config)# show jumbos

 Jumbos Global Values

  Configured : MaxFrameSize : 9216   Ip-MTU : 9198
  In Use     : MaxFrameSize : 9216   Ip-MTU : 9198
```

For more information about frame size, see **Jumbo frames** on page 155.

Operating notes for maximum frame size

- When you set a maximum frame size for jumbo frames, it must be on a global level. You cannot use the `jumbo max-frame-size` command on a per-port or per-VLAN basis.
- The original way to configure jumbo frames remains the same, which is per-VLAN, but you cannot set a maximum frame size per-VLAN.
- Jumbo support must be enabled for a VLAN from the CLI or through SNMP.
- Setting the maximum frame size does not require a reboot.
- When you upgrade to a version of software that supports setting the maximum frame size from a version that did not, the `max-frame-size` value is set automatically to 9216 bytes.
- Configuring a jumbo maximum frame size on a VLAN allows frames up to `max-frame-size` even though other VLANs of which the port is a member are not enabled for jumbo support.

Troubleshooting

A VLAN is configured to allow jumbo frames, but one or more ports drops all inbound jumbo frames

The port may not be operating at a minimum of 1 Gbps on the other switches covered in this guide. Regardless of a port's configuration, if it is actually operating at a speed lower than 1 Gbps for the other switches, it drops inbound jumbo frames. For example, if a port is configured for `Auto` mode (`speed-duplex auto`), but has negotiated a 7 Mbps speed with the device at the other end of the link, the port cannot receive inbound jumbo frames. To determine the actual operating speed of one or more ports, view the `Mode` field in the output for the following command:

`show interfaces brief <port-list>`

A non-jumbo port is generating "Excessive undersize/giant frames" messages in the Event Log

The switches can transmit outbound jumbo traffic on any port, regardless of whether the port belongs to a jumbo VLAN. In this case, another port in the same VLAN on the switch may be jumbo-enabled through membership in a different, jumbo-enabled VLAN, and may be forwarding jumbo frames received on the jumbo VLAN to non-jumbo ports.

Overview

Detection of link-flap and taking action on the port is done via fault-finder command at 3 different sensitivity levels (low, medium and high). The configuration in fault-finder for link-flap is a global configuration affecting all ports on the switch. To provide further granularity to link-flap detection and action which provides different link-flap detection and action configuration for each port rather than the same configuration for all ports on the switch. The per-port configuration will supersede the global configuration for fault-finder link-flap.

A configurable option to re-enable ports disabled by link-flap after a waiting period is also been added. The waiting period time is expressed in unit of seconds in the range 0 to 604800. Maximum allowed waiting period is one week. Zero is the default value, meaning that the port will not be re-enabled automatically.

A very important point is the wording of “link-flap” itself – i.e. the word “link”. This condition should be at the link/port-level granular, allowing alerts and actions only on those certain links/ports where the functionality is needed.

Fault-finder link-flap

Syntax

In the config context:

[no] fault-finder link-flap [ethernet] *PORT-LIST* action warn | warn-and-disable *SECONDS* sensitivity low | medium | high

Description

Configures the link-flap on a port. The default value is `warn`.

Options

link-flap	Configure link-flap control.
warn	Log the event only.
warn-and-disable	Log the event and disable the port.
seconds	Re-enable the port after waiting for the specified number of seconds. The default value is 0, which indicates that the port will not be automatically enabled.
sensitivity	Indicate the sensitivity of the link-flap control threshold within a 10-second interval. • Low indicates 10 link-flaps. • Medium indicates 6 link-flaps. • High indicates 3 link-flaps.

Parameters

action	Configure the action taken when a fault is detected.

ethernet *PORT-LIST*	Enable link-flap control on a list of ports.
warn	Warn about faults found.
warn-and-disable	Warn and disable faulty component.
seconds	Configure the number of seconds for which the port remains disabled. A value of 0 means that the port will remain disabled until manually re-enabled.
sensitivity	Configure the fault sensitivity level.
low	Low sensitivity.
medium	Medium sensitivity
high	High sensitivity.

Subcommand Syntax

[no] fault-finder link-flap ethernet *PORT-LIST*

Description

To remove the current configuration of link-flap on a port

Usage

Enable a linkFault-Finder check and set parameters for it. These commands may be repeated to enable additional checks. The default sensitivity is medium and the default action is warn.

[no] fault-finder all | fault sensitivity low | medium | high action warn | warn-and-disable

[no] fault-finder broadcast-storm sensitivity low | medium | high action warn | warn-and-disable *SECONDS*

[no] fault-finder link-flap sensitivity low | medium | high action warn | warn-and-disable

[no] fault-finder link-flap *PORT-LIST* action warn | warn-and-disable *SECONDS* sensitivity low | medium | high

Configure ports for link-flap detection with high sensitivity

Configure ports A1 to A5 for link-flap detection with sensitivity of high (3 flaps over 10s) and to log and disable port for 65535s if the link-flap threshold is exceeded.

```
switch(config)# fault-finder link-flap ethernet A1-A5 action warn-and-disable
65535
sensitivity high
```

Configure ports for link-flap detection with medium sensitivity

Configure ports A8 for link-flap detection with sensitivity of medium (6 flaps over 10s) and to log and disable port if the link-flap threshold is exceeded. User will need to re-enable the port if disabled.

```
switch(config)# fault-finder link-flap ethernet A8 action warn-and-disable 0
sensitivity medium
```

Configure ports for link-flap detection with low sensitivity

Configure ports A22 for link-flap detection with sensitivity of low (10 flaps over 10s) and to log if the link-flap threshold is exceeded

```
switch(config)# fault-finder link-flap ethernet A22 action warn sensitivity low
```

Disable link-flap detection

Disable link-flap detection for port A5

```
switch(config)# no fault-finder link-flap ethernet A5
```

Show fault-finder link-flap

Syntax

show fault-finder link-flap ethernet *PORT-LIST*

Description

Display the link-flap control configuration.

Show fault-finder link-flap

```
switch# show fault-finder link-flap A1

         Link   | Port                                    Disable    Disable Time
  Port   Flap   | Status Sensitivity Action                Timer      Left
  ------ ------ + ------ ----------- ------------------ ---------- ------------
  A1     Yes      Down      Low         warn-and-disable 65535      45303

switch# show fault-finder link-flap
         Link   | Port                                      Disable    Disable Time
  Port   Flap   | Status Sensitivity Action                  Timer      Left
  ------ ------ + ------ ----------- -------------------- ---------- ------------
  A1     Yes      Down      Low         warn-and-disable   65535      45303
  A5     No       Up        None        None                 -          -
  A22    Yes      Down      Low         warn-and-disable     -          -
  A23    Yes      Down      High        warn-and-disable   100          -
```

This example displays only the list of ports configured via the above per-port config commands, does not include the global configuration ports.

Event Log

Cause

Message	Cause
FFI: port <ID>- Excessive link state transitions.	Link-flap is detected by fault-finder per the sensitivity configured.
FFI: port <ID>- Excessive link state transitions.FFI: port <ID>-Port disabled by Fault-finder.FFI: port <ID>-Administrator action is required to re-enable.ports: Fault-finder (71) has disabled port <ID>.ports: port <ID> is now offline.vlan: VLAN<VLAN-ID> virtual LAN is disabled.	Link-flap is detected and the action is to disable the port with no disable timer.
FFI: port <ID>- Excessive link state transitions.FFI: port <ID>-Port disabled by Fault-finder.ports: Fault-finder(71) has disabled port <ID> for <SECONDS> seconds.ports: port <ID> is now off-line.vlan: VLAN<VLAN-ID> virtual LAN is disabled.	Link-flap is detected and the action is to disable the port with disable timer.
port <ID> timer (71) has expired.ports: port <ID> is now on-line.vlan: VLAN<VLAN-ID> virtual LAN is enabled.	The port is enabled when the disable timer expires.

Restrictions

- Per port configuration for options – link-flap only. Global settings for other options.
- No support for menu interface.
- No support for Web UI.
- No changes to PCM.
- No changes to IDM.
- No support for trunks.

Current default traps

The default event scenarios for currently generated traps on ArubaOS-Switches are:

- Device cold start notifications
- Device warm start notifications
- Port down notifications
- Port up notifications
- Authentication failure notifications
- Enterprise change notifications
- Intrusion alarm notifications

Event scenario matrix

Different event scenarios for which traps are generated:

Event Id	Severity	Action	Message
68	Info	Slot Insertion	I 06/20/16 09:18:43 00068 chassis: AM1: Slot C Inserted
67	Info	Slot Removal	I 06/20/16 09:18:50 00067 chassis: AM1: Slot C Removed
405	Info	Transceiver Insertion	I 06/20/16 09:18:56 00405 ports: AM1: port A23 xcvr hot-swap insert
406	Info	Transceiver Removal	I 06/20/16 09:19:04 00406 ports: AM1: port A23 xcvr hot-swap remove
552	Warning	Stacking module Insertion	W 04/20/16 09:20:43 00552 chassis: ST1-CMDR: Stacking Module insertion detected: Reboot required
552	Warning	Stacking module Removal	W 06/20/16 09:19:43 00552 chassis: ST1-CMDR: Stacking Module removal detected: Reboot required

Enabling and disabling traps

Action	Command
Disable both the log and trap	`setMib eventType.<event_Id> -i 1 – to disable both log & Trap`
Enable log only	`setMib eventType.<event_Id> -i 2 – to allow only log`
Enable both the log and trap (Default)	`setMib eventType.<event_Id> -i 4 – to allow both log & Trap`
Enable trap only	`setMib eventType.<event_Id> -i 3 – to allow only trap`

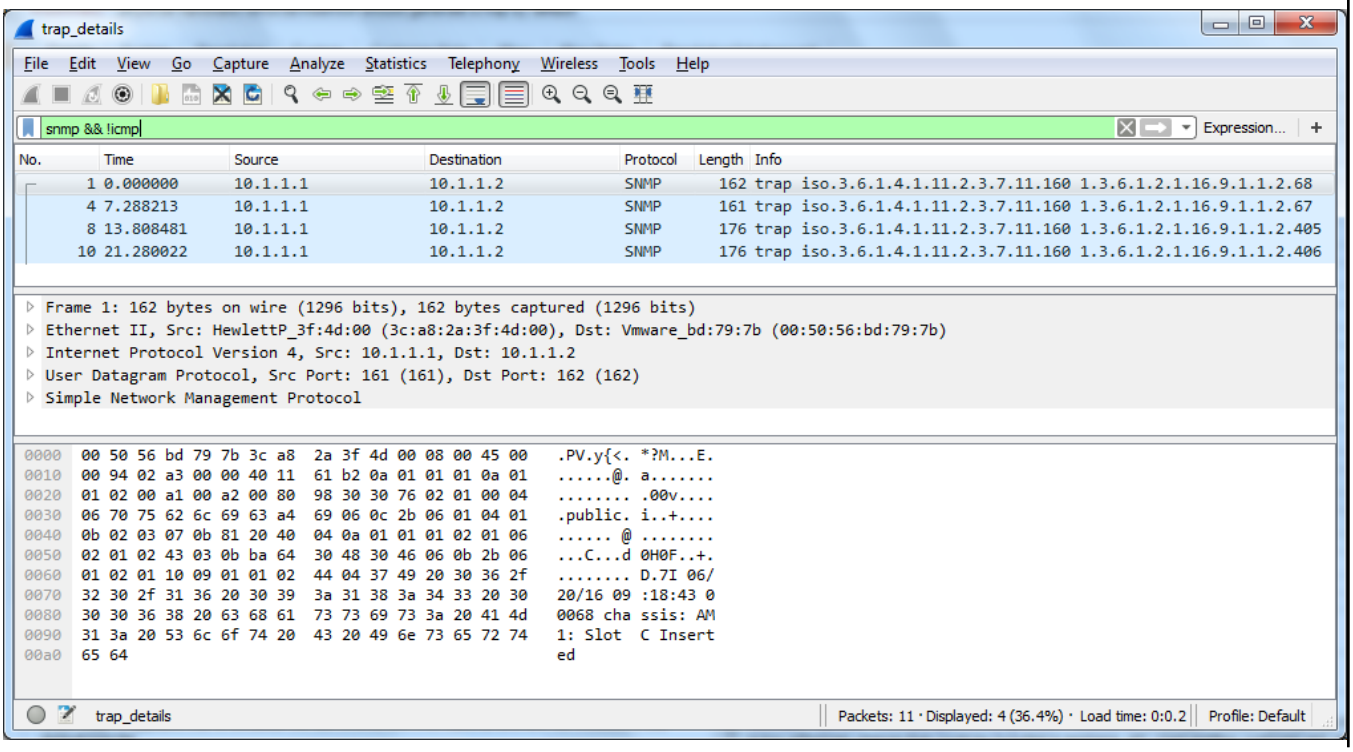
NOTE

If the event is configured to disable a trap, then the trap will not be sent for that particular event. In all other scenarios, a trap is generated for the listed events.

SNMP trap captures examples

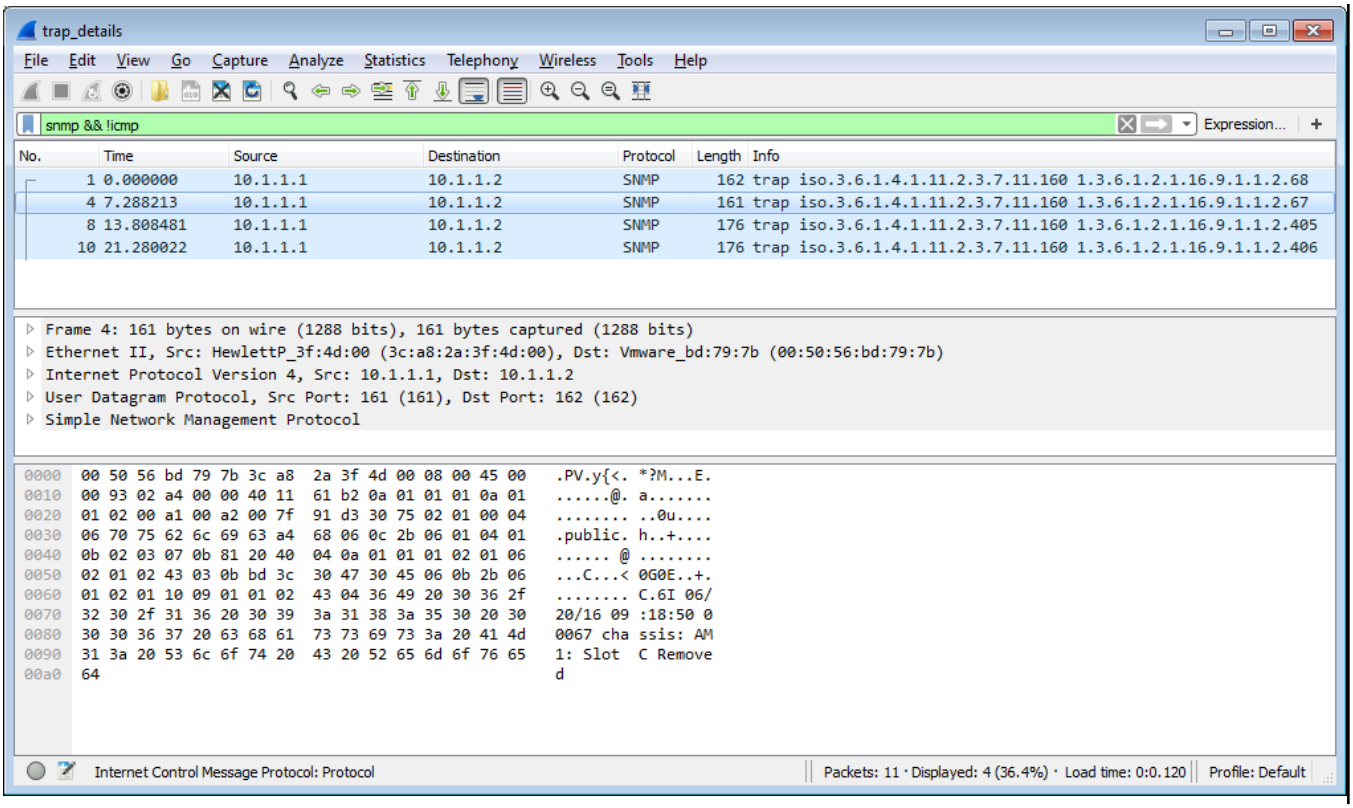
Inserting a slot module

Event Id: 68



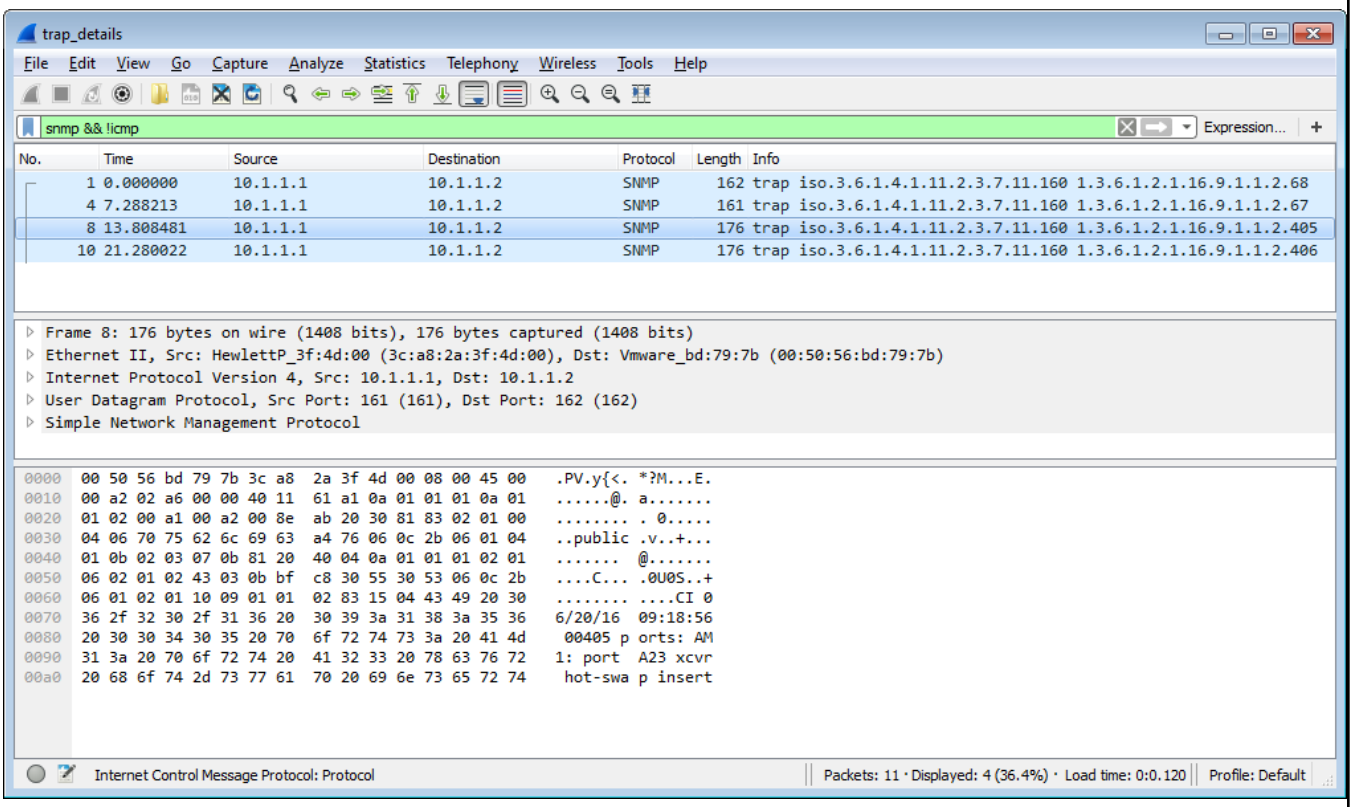
Removing a slot module

Event Id: 67

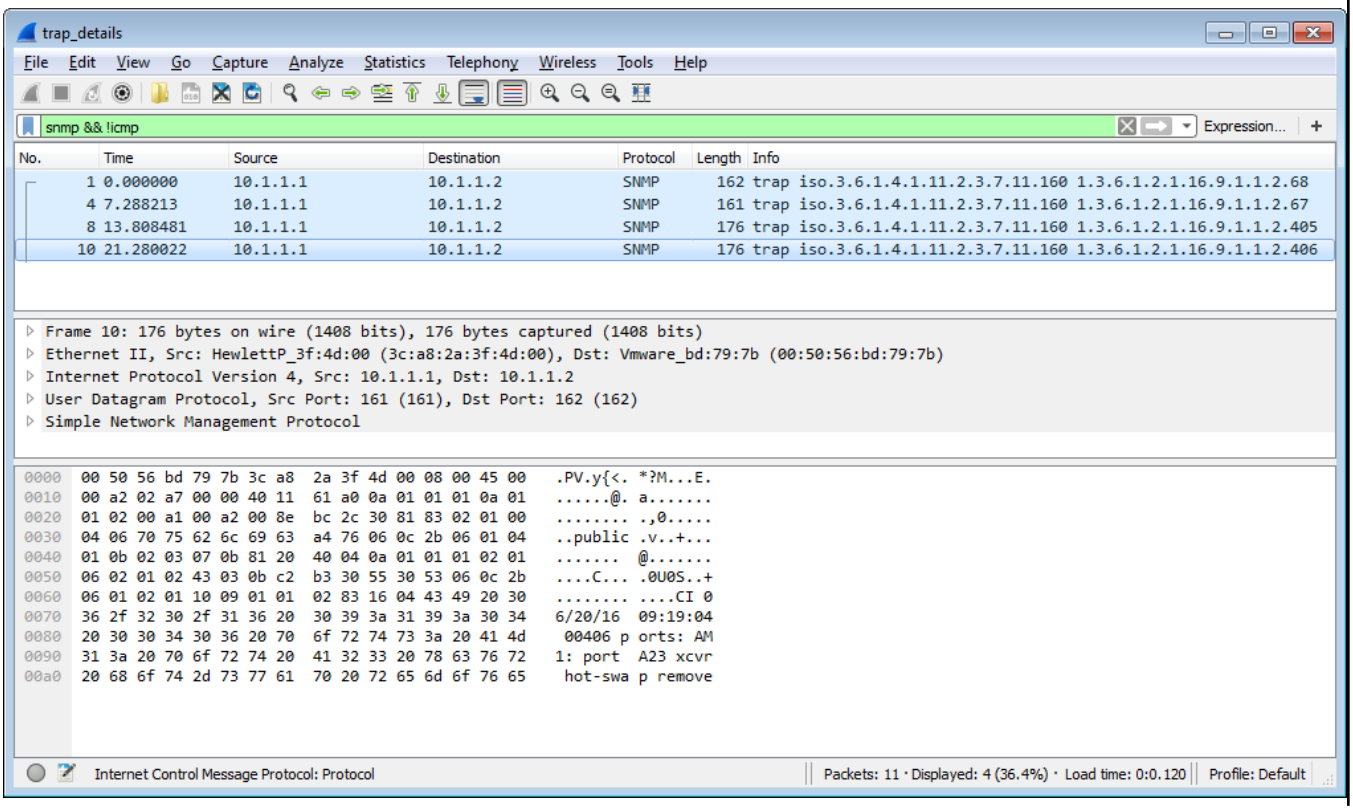


Inserting transceiver

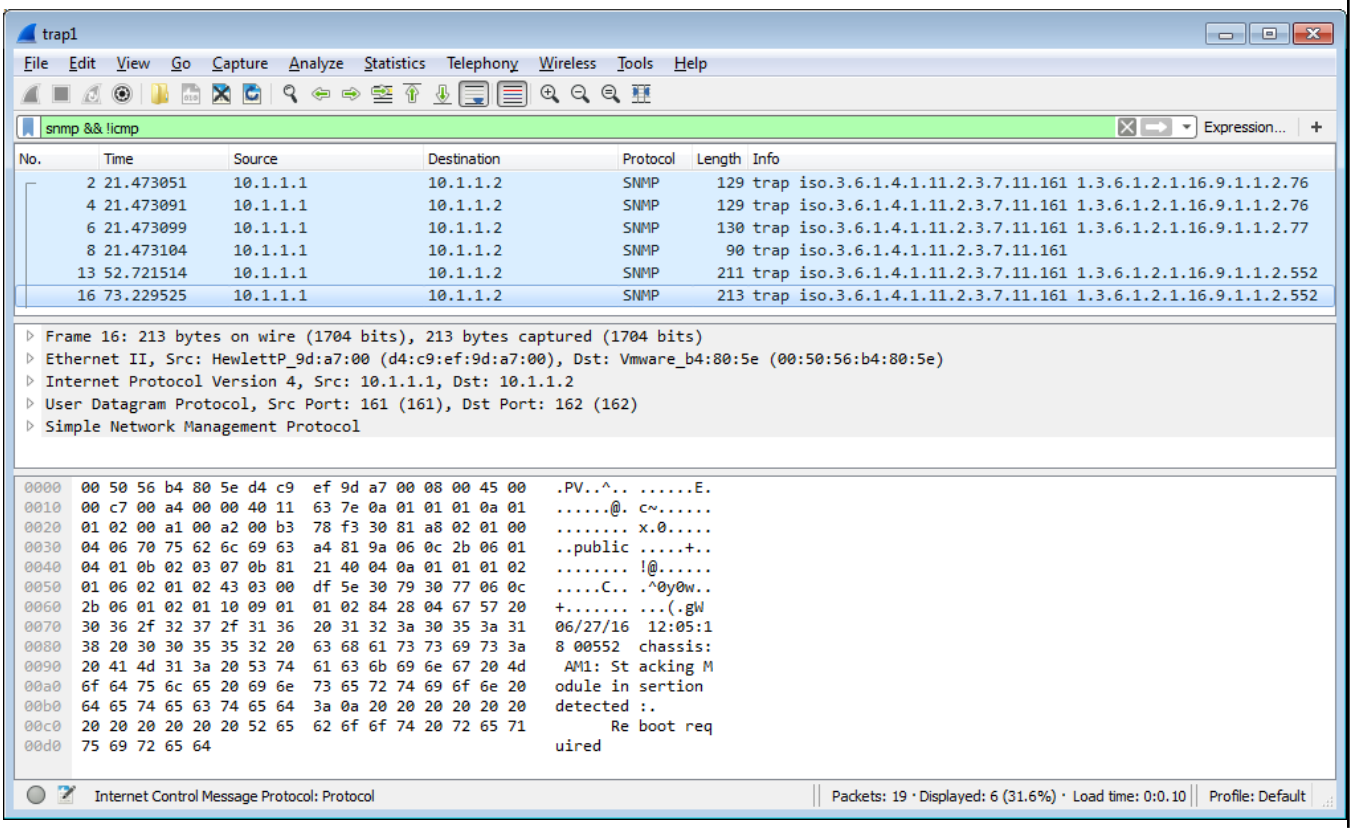
Event Id: 405



Removing a transceiver



Inserting a stack-module



Using SNMP tools to manage the switch

SNMP is a management protocol that allows an SNMP client application to retrieve device configuration and status information and to configure the device (**get** and **set**). You can manage the switch via SNMP from a network management station running an application such as PCM+. For more information on PCM+, see the HPE website at: **http://www.hpe.com/networking**.

From the **Products** menu, select **Network Management**. The click on **PCM+ Network Management** under the **HPE Network Management** bar.

To implement SNMP management, the switch must have an IP address configured either manually or dynamically (using DHCP or Bootp). If multiple VLANs are configured, each VLAN interface should have its own IP address. For DHCP use with multiple VLANs, see section "The Primary VLAN" in the "Static Virtual LANs (VLANs)" of the advanced traffic management guide for your switch.

If you use the switch's Authorized IP Managers and Management VLAN features, ensure that the SNMP management station, the choice of switch port used for SNMP access to the switch, or both, are compatible with the access controls enforced by these features. Otherwise, SNMP access to the switch will be blocked.

For more information on Authorized IP Managers, see the access security guide for your switch. (The latest version of this guide is available on the HPE Networking website.) For information on the Management VLAN feature, see the section "The Secure Management VLAN" in the "Static Virtual LANs (VLANs)" chapter of the advanced traffic management guide for your switch.

SNMP management features

SNMP management features on the switch include:

- SNMP version 1, version 2c, or version 3 over IP
- Security via configuration of SNMP communities (**SNMPv3 communities** on page 176)
- Security via authentication and privacy for SNMPv3 access
- Event reporting via SNMP
  - Version 1 traps
  - RMON: groups 1, 2, 3, and 9
- Flow sampling using sFlow
- Standard MIBs, such as the Bridge MIB (RFC 1493), Ethernet MAU MIB (RFC 1515), and others.

The switch SNMP agent also uses certain variables that are included in an HPE proprietary MIB (management information base) file. If you are using HPE OpenView, you can ensure that it is using the latest version of the MIB file by downloading the file to the OpenView database. To do so, go to the HPE Networking website at: **http://www.hpe.com/networking**.

1. Type a model number of your switch (For example, 8212) or product number in the **Auto Search** text box.
2. Select an appropriate product from the drop down list.
3. Click the Display selected button.
4. From the options that appear, select Software downloads.
5. MIBs are available with switch software in the Other category.

Click on `software updates`, then `MIBs`.

SNMPv1 and v2c access to the switch

SNMP access requires an IP address and subnet mask configured on the switch. If you are using DHCP/Bootp to configure the switch, ensure that the DHCP/Bootp process provides the IP address.

Once an IP address is configured, the main steps for configuring SNMPv1 and v2c access management features are:

Procedure

1. Configure the appropriate SNMP communities. (See **SNMPv3 communities** on page 176.)
2. Configure the appropriate trap receivers.

In some networks, authorized IP manager addresses are not used. In this case, all management stations using the correct community name may access the switch with the View and Access levels that have been set for that community. If you want to restrict access to one or more specific nodes, you can use the switch's IP Authorized Manager feature. (See the access security guide for your switch.)

For PCM/PCM+ version 1.5 or earlier (or any TopTools version), deleting the "public" community disables some network management functions (such as traffic monitoring, SNMP trap generation, and threshold setting). If network management security is a concern, and you are using the above software versions, Hewlett Packard Enterprise recommends that you change the write access for the "public" community to "Restricted."

SNMPv3 access to the switch

SNMPv3 access requires an IP address and subnet mask configured on the switch. (See "IP Configuration" on page 8-2.) If you are using DHCP/Bootp to configure the switch, ensure that the DHCP/Bootp process provides the IP address. (See "DHCP/Bootp Operation".)

Once you have configured an IP address, the main steps for configuring SNMPv3 access management features are the following:

Procedure

1. Enable SNMPv3 for operation on the switch (see **Enabling SNMPv3** on page 172).
2. Configure the appropriate SNMP users (see **SNMPv3 users** on page 173).
3. Configure the appropriate SNMP communities (see **SNMPv3 communities** on page 176).
4. Configure the appropriate trap receivers (see **SNMP notifications** on page 180).

In some networks, authorized IP manager addresses are not used. In this case, all management stations using the correct User and community name may access the switch with the View and Access levels that have been set for that community. If you want to restrict access to one or more specific nodes, you can use the IP Authorized Manager feature for the switch. (See the access security guide for your switch.)

SNMP version 3 (SNMPv3) adds some new commands to the CLI for configuring SNMPv3 functions. To enable SNMMPv3 operation on the switch, use the `snmpv3 enable` command. An initial user entry will be generated with MD5 authentication and DES privacy.

You may (optionally) restrict access to only SNMPv3 agents by using the `snmpv3 only` command. To restrict write-access to only SNMPv3 agents, use the `snmpv3 restricted-access` command.

Restricting access to only version 3 messages will make the community named “public” inaccessible to network management applications (such as autodiscovery, traffic monitoring, SNMP trap generation, and threshold setting) from operating in the switch.

Enabling and disabling switch for access from SNMPv3 agents

This includes the creation of the initial user record.

Syntax:

[no] snmpv3 enable

Enabling or disabling restrictions to access from only SNMPv3 agents

When enabled, the switch rejects all non-SNMPv3 messages.

Syntax:

[no] snmpv3 only

Enabling or disabling restrictions from all non-SNMPv3 agents to read-only access

Syntax:

[no] snmpv3 restricted-access

Viewing the operating status of SNMPv3

Syntax:

show snmpv3 enable

Viewing status of message reception of non-SNMPv3 messages

Syntax:

show snmpv3 only

Viewing status of write messages of non-SNMPv3 messages

Syntax:

show snmpv3 restricted-access

Enabling SNMPv3

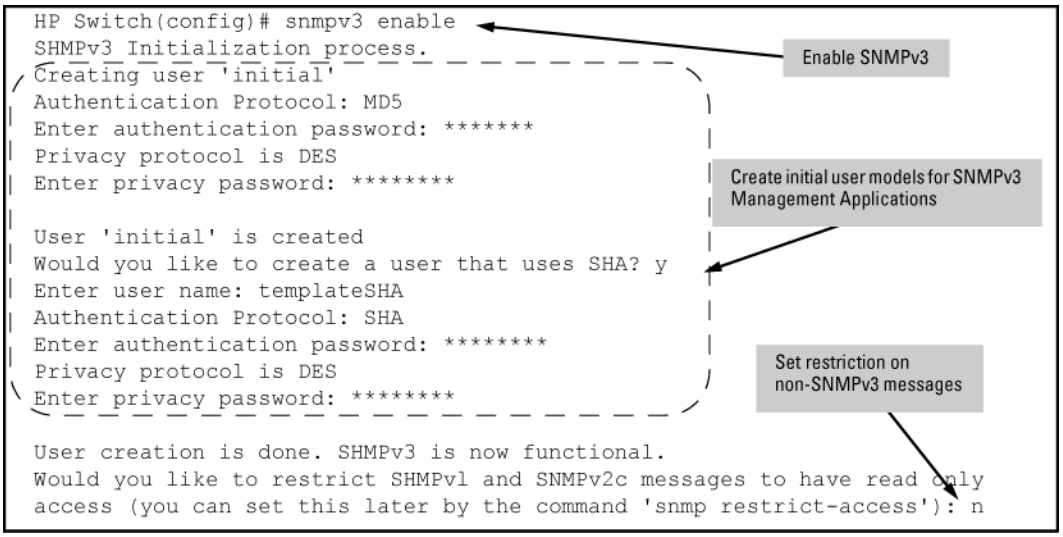
The `snmpv3 enable` command allows the switch to:

- Receive SNMPv3 messages.
- Configure initial users.
- Restrict non-version 3 messages to "read only" (optional).

Restricting access to only version 3 messages makes the community named "public" inaccessible to network management applications (such as autodiscovery, traffic monitoring, SNMP trap generation, and threshold setting) from running on the switch.

Example:

SNMP version 3 `enable` command



SNMPv3 users

NOTE

To create new users, most SNMPv3 management software requires an initial user record to clone. The initial user record can be downgraded and provided with fewer features, but not upgraded by adding new features. For this reason, Hewlett Packard Enterprise recommends that when you enable SNMPv3, you also create a second user with SHA authentication and DES privacy.

To use SNMPv3 on the switch, you must configure the users that will be assigned to different groups:

Procedure

1. Configure users in the User Table with the `snmpv3 user` command.

   To view the list of configured users, enter the `show snmpv3 user` command (see **Adding users** on page 174)
2. Assign users to Security Groups based on their security model with the `snmpv3 group` command (see **Assigning users to groups (CLI)** on page 175).

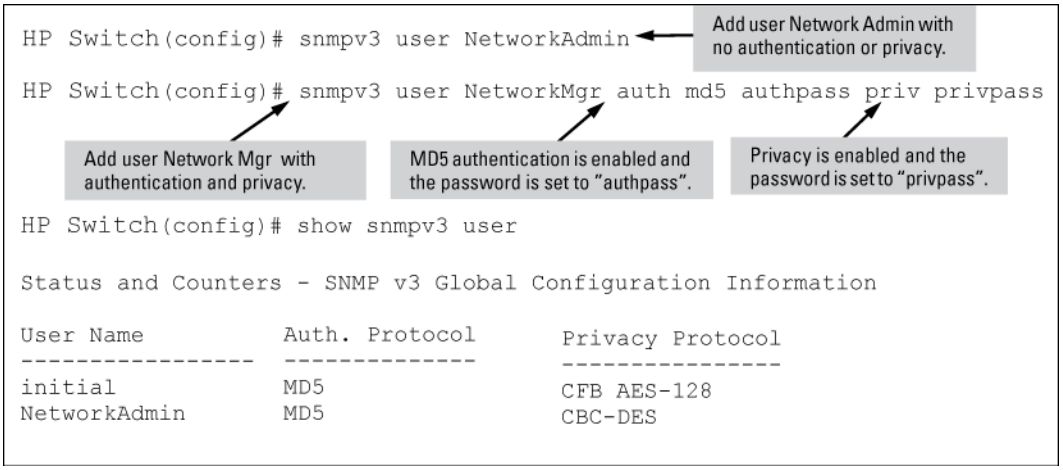
CAUTION

If you add an SNMPv3 user without authentication, privacy, or both, to a group that requires either feature, the user will not be able to access the switch. Ensure that you add a user with the appropriate security level to an existing security group.

Adding users

To configure an SNMPv3 user, you must first add the user name to the list of known users with the `snmpv3 user` command, as shown in **Figure 29: Adding SNMPv3 users and displaying SNMPv3 configuration** on page 174.

Figure 29: *Adding SNMPv3 users and displaying SNMPv3 configuration*



SNMPv3 user commands

Syntax:

[no] snmpv3 user <*user_name*>

Adds or deletes a user entry for SNMPv3. Authorization and privacy are optional, but to use privacy, you must use authorization. When you delete a user, only the *user_name* is required.

[auth < {md5 | sha>} < *auth_pass*>]

With authorization, you can set either MD5 or SHA authentication. The authentication password <*auth_pass*> must be 6 to 32 characters and is mandatory when you configure authentication.

Default: None

Listing Users

To display the management stations configured to access the switch with SNMPv3 and view the authentication and privacy protocols that each station uses, enter the `show snmpv3 user` command.

Syntax:

show snmpv3 user

Display of the management stations configured on VLAN 1 on page 174 displays information about the management stations configured on VLAN 1 to access the switch.

Display of the management stations configured on VLAN 1

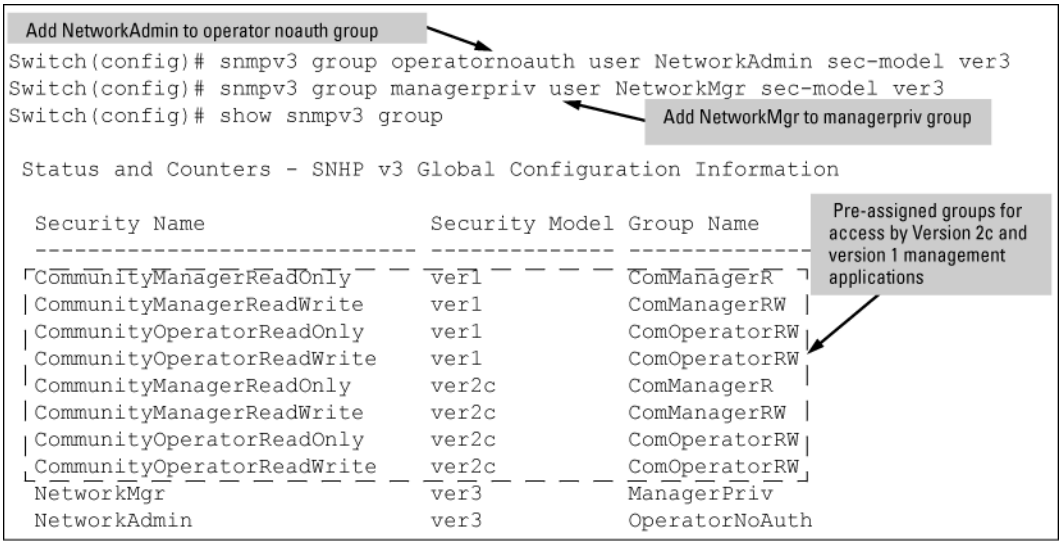
```
switch# configure terminal
switch(config)# vlan 1
switch(vlan-1)# show snmpv3 user
```

```
Status and Counters - SNMPv3 Global Configuration Information

 User Name       Auth. Protocol   Privacy Protocol
 -----------     --------------   -----------------
 initial         MD5              CFB AES-128
 NetworkAdmin    MD5              CBC-DES
```

Assigning users to groups (CLI)

Next you must set the group access level for the user by assigning the user to a group. This is done with the `snmpv3 group` command, as shown in **Figure 30: Example: of assigning users to groups** on page 175. For more details on the MIBs access for a given group, see **Group access levels** on page 175.

Figure 30: *Example: of assigning users to groups*



Syntax:

[no] snmpv3 group

Assigns or removes a user to a security group for access rights to the switch. To delete an entry, all of the following three parameters must be included in the command:

`group <group_name>`	Identifies the group that has the privileges that will be assigned to the user. For more details, see **Group access levels** on page 175.
`user <user_name>`	Identifies the user to be added to the access group. This must match the user name added with the `snmpv3 user` command.
`sec-model {<ver1 | ver2c | ver3>`	Defines which security model to use for the added user. An SNMPv3 access group should use only the ver3 security model.

Group access levels

The switch supports eight predefined group access levels, shown in the following table. There are four levels for use by version 3 users and four are used for access by version 2c or version 1 management applications.

Table 16: *Predefined group access levels*

Group name	Group access type	Group read view	Group write view
managerpriv	Ver3 Must have Authentication and Privacy	ManagerReadView	ManagerWriteView
managerauth	Ver3 Must have Authentication	ManagerReadView	ManagerWriteView
operatorauth	Ver3 Must have Authentication	OperatorReadView	DiscoveryView
operatornoauth	Ver3 No Authentication	OperatorReadView	DiscoveryView
commanagerrw	Ver2c or Ver1	ManagerReadView	ManagerWriteView
commanagerr	Ver2c or Ver1	ManagerReadView	DiscoveryView
comoperatorrw	Ver2c or Ver1	OperatorReadView	OperatorReadView
comoperatorr	Ver2c or Ver1	OperatorReadView	DiscoveryView

Each view allows you to view or modify a different set of MIBs:

- **Manager Read View** – access to all managed objects
- **Manager Write View** – access to all managed objects except the following:
  - vacmContextTable
  - vacmAccessTable
  - vacmViewTreeFamilyTable
- **OperatorReadView** – no access to the following:
  - icfSecurityMIB
  - hpSwitchIpTftpMode
  - vacmContextTable
  - vacmAccessTable
  - vacmViewTreeFamilyTable
  - usmUserTable
  - snmpCommunityTable
- **Discovery View** – Access limited to samplingProbe MIB.

All access groups and views are predefined on the switch. There is no method to modify or add groups or views to those that are predefined on the switch.

SNMPv3 communities

SNMP commuities are supported by the switch to allow management applications that use version 2c or version 1 to access the switch. The communities are mapped to Group Access Levels that are used for version 2c or version 1 support. This mapping happens automatically based on the communities access privileges, but special mappings can be added with the `snmpv3 community` command (see **Mapping SNMPv3 communities (CLI)** on page 177).

Mapping SNMPv3 communities (CLI)

SNMP commuities are supported by the switch to allow management applications that use version 2c or version 1 to access the switch. For more details, see **SNMPv3 communities** on page 176.

Syntax:

[no] snmpv3 community

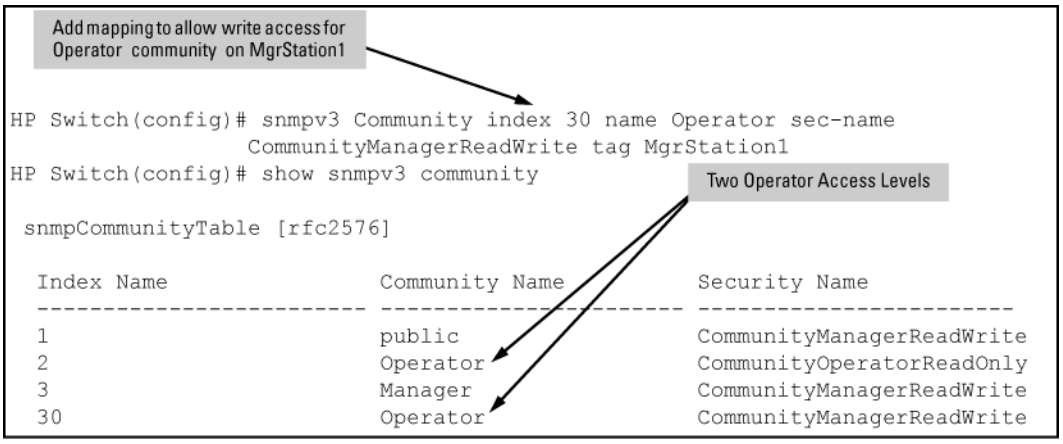
Maps or removes a mapping of a community name to a group access level. To remove a mapping you need to specify only the `index_name` parameter.

`index <index_name>`	An index number or title for the mapping. The values of 1 to 5 are reserved and can not be mapped.
`name <community_name>`	The community name that is being mapped to a group access level.
`sec-name <security_name>`	The group level to which the community is being mapped.
`tag <tag_value>`	This is used to specify which target address may have access by way of this index reference.

Example:

Figure 31: Assigning a community to a group access level on page 177 shows the assigning of the Operator community on MgrStation1 to the CommunityOperatorReadWrite group. Any other Operator has an access level of CommunityOperatorReadOnly.

Figure 31: *Assigning a community to a group access level*



SNMP community features

Use SNMP communities to restrict access to the switch by SNMP management stations by adding, editing, or deleting SNMP communities. You can configure up to five SNMP communities, each with either an operator-level or a manager-level view and either restricted or unrestricted write access.

Using SNMP requires that the switch have an IP address and subnet mask compatible with your network.

CAUTION

For PCM/PCM+ version 1.5 or earlier (or any TopTools version), deleting the "public" community disables some network management functions (such as traffic monitoring, SNMP trap generation, and threshold setting). If network management security is a concern, and if you are using the above software versions, Hewlett Packard Enterprise recommends that you change the write access for the "public" community to "Restricted."

Viewing and configuring non-version-3 SNMP communities (Menu)

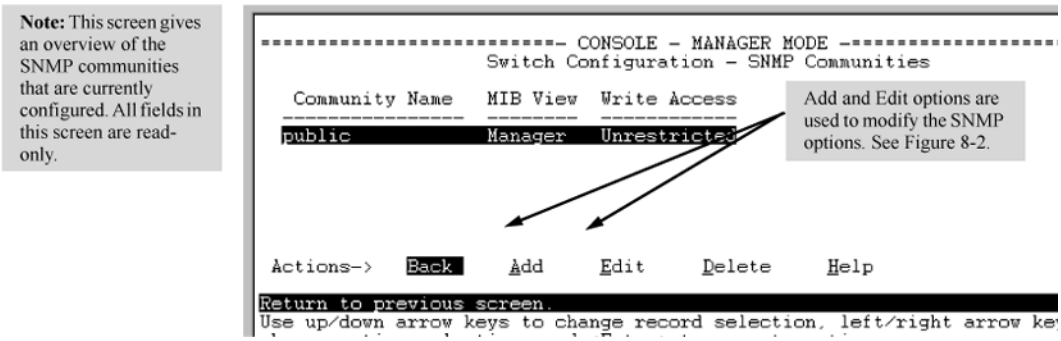
Procedure

1. From the Main Menu, select:

   2. Switch Configuration…

   6. SNMP Community Names

   Figure 32: *The SNMP Communities screen (default values)*



2. Press **[A]** (for **Add**).

   If you need information on the options in each field, press **[Enter]** to move the cursor to the Actions line, then select the Help option. When you are finished with Help, press **[E]** (for Edit) to return the cursor to the parameter fields.
3. Enter the name you want in the Community Name field, and use the Space bar to select the appropriate value in each of the other fields. (Use the **[Tab]** key to move from one field to the next.)
4. Press **[Enter]** , then **[S]** (for **Save**).

Listing community names and values (CLI)

This command lists the data for currently configured SNMP community names (along with trap receivers and the setting for authentication traps—see **SNMP notifications** on page 180).

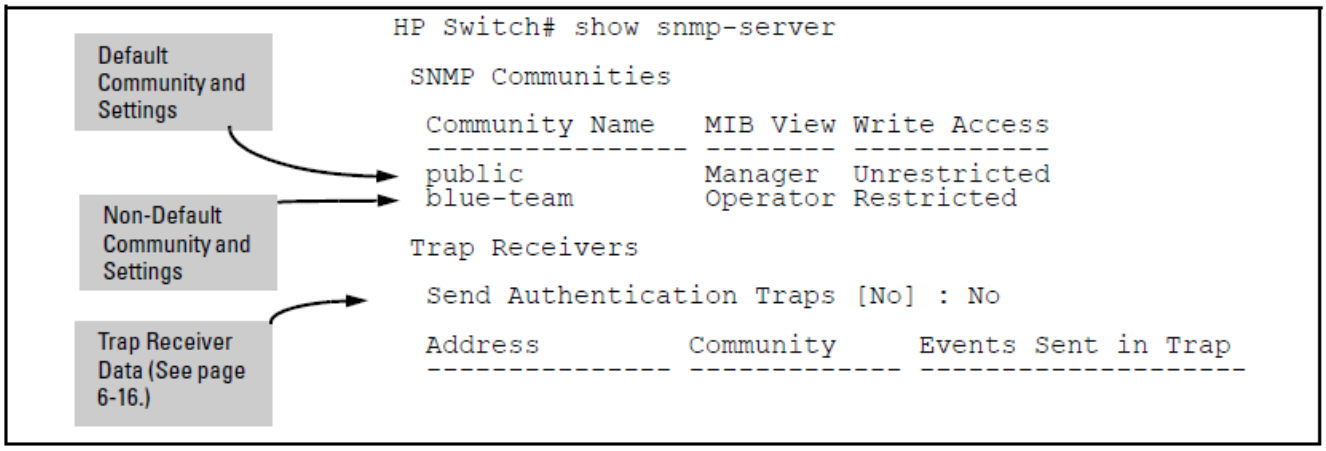
Syntax:

show snmp-server [< *community-string* >]

Example:

Lists the data for all communities in a switch; that is, both the default "public" community name and another community named "blue-team."

Figure 33: *Example: of the SNMP community listing with two communities*



To list the data for only one community, such as the "public" community, use the above command with the community name included. For Example:

```
switch# show snmp-server public
```

Configuring community names and values (CLI)

The `snmp-server` command enables you to add SNMP communities with either default or specific access attributes, and to delete specific communities.

Syntax:

[no] snmp-server community <*community-name*>

Configures a new community name.

- If you do not also specify `operator` or `manager`, the switch automatically assigns the community to the `operator` MIB view.
- If you do not specify `restricted` or `unrestricted`, the switch automatically assigns the community to `restricted` (read-only) access.

The `no` form uses only the <*community-name*> variable and deletes the named community from the switch.

`[operator | manager]`	Optionally assigns an access level. • At the `operator` level, the community can access all MIB objects except the CONFIG MIB. • At the `manager` level, the community can access all MIB objects.
`[restricted | unrestricted]`	Optionally assigns MIB access type. • Assigning the `restricted` type allows the community to read MIB variables, but not to set them. • Assigning the `unrestricted` type allows the community to read and set MIB variables.

Example:

To add the following communities:

Community	Access Level	Type of Access
red-team	manager (**Access to all MIB objects**.)	unrestricted (**read/write**)
blue-team	operator (**Access to all MIB objects except the CONFIG MIB**.)	restricted (**read-only**)

```
switch(config)# snmp-server community red-team
   manager unrestricted
switch(config)# snmp-server community blue-team
   operator restricted
```

To eliminate a previously configured community named "gold-team":

```
switch(config) # no snmp-server community gold-team
```

SNMP notifications

The switches:

- Fixed or “Well-Known” Traps: A switch automatically sends fixed traps (such as “coldStart”, “warmStart”, “linkDown”, and “linkUp”) to trap receivers using the public community name, which is the default. These traps can also be sent to non-public communities.
- SNMPv2c informs
- SNMP v3 notification process, including traps

This section describes how to configure a switch to send network security and link-change notifications to configured trap receivers.

Supported Notifications

By default, the following notifications are enabled on a switch:

- Manager password changes
- SNMP authentication failure
- Link-change traps: when the link on a port changes from up to down (linkDown) or down to up (linkUp)
- Port-security (web, MAC, or 802.1X) authentication failure
- Invalid password entered in a login attempt through a direct serial, Telnet, or SSH connection
- Inability to establish a connection with the RADIUS or TACACS+ authentication server
- DHCP snooping events
- ARP protection events

General steps for configuring SNMP notifications

Procedure

1. Determine the versions of SNMP notifications that you want to use in your network.

   If you want to use SNMPv1 and SNMPv2c traps, you must also configure a trap receiver. See the following sections and follow the required configuration procedures:

- **SNMPv1 and SNMPv2c Traps** on page 181
- **Configuring an SNMP trap receiver (CLI)** on page 181
- **Enabling SNMPv2c informs (CLI)** on page 183

If you want to use SNMPv3 notifications (including traps), you must also configure an SNMPv3 management station. Follow the required configuration procedure in **Configuring SNMPv3 notifications (CLI)** on page 184.

2. To reconfigure any of the SNMP notifications that are enabled by default to be sent to a management station (trap receiver), see **Enabling Link-Change Traps (CLI)** on page 189.
3. (Optional) See the following sections to configure optional SNMP notification features and verify the current configuration:

- **Configuring the source IP address for SNMP notifications (CLI)** on page 190
- **Viewing SNMP notification configuration (CLI)** on page 191

SNMPv1 and SNMPv2c Traps

The switches support the following functionality from earlier SNMP versions (SNMPv1 and SNMPv2c):

- **Trap receivers**: A **trap receiver** is a management station to which the switch sends SNMP traps and (optionally) event log messages sent from the switch. From the CLI you can configure up to ten SNMP trap receivers to receive SNMP traps from the switch.
- **Fixed or "Well-Known" Traps**: A switch automatically sends fixed traps (such as "coldStart", "warmStart", "linkDown", and "linkUp") to trap receivers using the `public` community name. These traps cannot be redirected to other communities. If you change or delete the default `public` community name, these traps are not sent.
- **Thresholds**: A switch automatically sends all messages created when a system threshold is reached to the network management station that configured the threshold, regardless of the trap receiver configuration.

SNMP trap receivers

Use the `snmp-server host` command to configure a trap receiver that can receive SNMPv1 and SNMPv2c traps, and (optionally) Event Log messages. When you configure a trap receiver, you specify its community membership, management station IP address, and (optionally) the type of Event Log messages to be sent.

If you specify a community name that does not exist—that is, has not yet been configured on the switch—the switch still accepts the trap receiver assignment. However, no traps are sent to that trap receiver until the community to which it belongs has been configured on the switch.

To replace one community name with another for the same IP address, you must first enter the

no snmp-server host <*community-name*> {< *ipv4-address* | *ipv6-address* >}

command to delete the unwanted community name. Otherwise, if you add a new community name with an IP address that is already used with a different community name, two valid community name entries are created for the same management station.

If you do not specify the event level (`[none|all|not-info|critical|debug]`), the switch does not send Event Log messages as traps. However, "well-known" traps and threshold traps (if configured) are still sent.

Configuring an SNMP trap receiver (CLI)

Syntax:

snmp-server host {< *ipv4-addr* | *ipv6-addr* >} < *community name*>

Configures a destination network management station to receive SNMPv1/v2c traps and (optionally) Event Log messages sent as traps from the switch, using the specified community name and destination IPv4 or IPv6 address. You can specify up to ten trap receivers (network management stations). (The default community name is `public`.)

[{<none | all | not-info | critical | debug>}]	(Optional) Configures the security level of the Event Log messages you want to send as traps to a trap receiver (see the following table). • The type of Event Log message that you specify applies only to Event Log messages, not to threshold traps. • For each configured event level, the switch continues to send threshold traps to all network management stations that have the appropriate threshold level configured. • If you do not specify an event level, the switch uses the default value (none) and sends no Event Log messages as traps.
[<inform>]	(Optional) Configures the switch to send SNMPv2 inform requests when certain events occur. For more information, see **Enabling SNMPv2c informs (CLI)**.

Table 17: *Security levels for Event Log messages sent as traps*

Security Level	Action
None (default)	Sends no Event Log messages.
All	Sends all Event Log messages.
Not-Info	Sends all Event Log messages that are not for information only.
Critical	Sends only Event Log messages for critical error conditions.
Debug	Sends only Event Log messages needed to troubleshoot network- and switch-level problems.

Example:

To configure a trap receiver in a community named "red-team" with an IP address of 10.28.227.130 to receive only "critical" event log messages, you can enter the following command:

```
switch(config)# snmp-server host 10.28.227.130 red-team critical
```

SNMP trap when MAC address table changes

An SNMP trap is generated when a laptop/PC is removed from the back of an IP phone and the laptop/PC MAC address ages out of the MAC table for the Aruba 2920 switch.

The mac-notify trap feature globally enables the generation of SNMP trap notifications on MAC address table changes (learns/moves/removes/ages.)

The following command enables trap for aged MAC addresses:

Syntax:

switch(config)# [no] mac-notify traps [*port-list*] aged

Example:

For port 1 the command is:

Syntax:

switch(config)# mac-notify traps 1 aged

show command

Use the following show command to display the different mac-notify traps configured on an interface:

Syntax:

HP Switch # show mac-notify traps

Displays the following information:

```
Mac Notify Trap Information
Mac-notify Enabled : No
Mac-move Enabled : No
Trap-interval : 30
Port   MAC Addresses trap learned/removed/aged
------ ------------------------------------
1       Learned, Removed & Aged
2            Removed & Aged
3            Learned & Aged
4            Learned & Removed
5            Aged
6            Learned
7            Removed
```

Example:

For port 1 the command would be as follows

HP Switch # show mac-notify traps 1

Displays the following information:

```
1 Aged
```

SNMPv2c informs

On a switch enabled for SNMPv2c, you can use the `snmp-server host inform` command (**Enabling SNMPv2c informs (CLI)** on page 183) to send inform requests when certain events occur. When an SNMP Manager receives an inform request, it can send an SNMP response back to the sending agent on the switch to let the agent know that the inform request reached its destination.

If the sending agent on the switch does not receive an SNMP response back from the SNMP Manager within the timeout period, the inform request may be resent, based on the retry count value.

When you enable SNMPv2c inform requests to be sent, you must specify the IP address and community name of the management station that will receive the inform notification.

Enabling SNMPv2c informs (CLI)

For information about enabling SNMPv2c informs, see **SNMPv2c informs** on page 183.

Syntax:

[no] snmp-server host {< *ipv4-addr* | *ipv6-addr* >} <*community name*> inform [retries < *count* >] [timeout < *interval* >]

Enables (or disables) the `inform` option for SNMPv2c on the switch and allows you to configure options for sending SNMP inform requests.

`retries`	Maximum number of times to resend an `inform` request if no SNMP response is received. (Default: 3)
`timeout`	Number of seconds to wait for an acknowledgement before resending the `inform` request. (Default: 15 seconds)

The `retries` and `timeout` values are not used to send trap requests.

To verify the configuration of SNMPv2c informs, enter the `show snmp-server` command, as shown in **Display of SNMPv2c inform configuration** on page 184 (note indication of inform Notify Type in bold below):

Display of SNMPv2c inform configuration

```
switch(config)# show snmp-server

 SNMP Communities

  Community Name   MIB View Write Access
  ---------------- -------- ------------ public          Manager  Unrestricted

 Trap Receivers

  Link-Change Traps Enabled on Ports [All] : All
  ...
  Address               Community       Events Sent Notify Type Retry Timeout
  --------------------- --------------- ----------- ----------- ----- --------
  15.28.333.456         guest           All         inform      3     15

 Excluded MIBs

 Snmp Response Pdu Source-IP Information

  Selection Policy   : Default rfc1517

 Trap Pdu Source-IP Information
  Selection Policy   : Configured IP
  Ip Address        : 10.10.10.10
```

Configuring SNMPv3 notifications (CLI)

The SNMPv3 notification process allows messages that are passed via SNMP between the switch and a network management station to be authenticated and encrypted.

Procedure

1. Enable SNMPv3 operation on the switch by entering the `snmpv3 enable` command (See "SNMP Version 3 Commands" on page N-7).

When SNMPv3 is enabled, the switch supports:

- Reception of SNMPv3 notification messages (traps and informs)
- Configuration of initial users
- (Optional) Restriction of non-SNMPv3 messages to "read only"

2. Configure SNMPv3 users by entering the `snmpv3 user` command (see **SNMPv3 users** on page 173). Each SNMPv3 user configuration is entered in the User Table.
3. Assign SNMPv3 users to security groups according to their level of access privilege by entering the `snmpv3 group` command (see **Assigning users to groups (CLI)** on page 175).
4. Define the name of an SNMPv3 notification configuration by entering the `snmpv3 notify` command.

   Syntax:

   [no] snmpv3 notify <*notify_name*> tagvalue <*tag_name*>

   Associates the name of an SNMPv3 notification configuration with a tag name used (internally) in SNMPv3 commands. To delete a notification-to-tag mapping, enter `no snmpv3 notify notify_name` .

`notify <notify_name>`	Specifies the name of an SNMPv3 notification configuration.
`tagvalue <tag_name>`	Specifies the name of a tag value used in other SNMPv3 commands, such as `snmpv3 targetaddress params taglist tag_name` in Step 5.

5. Configure the target address of the SNMPv3 management station to which SNMPv3 informs and traps are sent by entering the `snmpv3 targetaddress` command.

   Syntax:

   [no] snmpv3 targetaddress {< *ipv4-addr* | *ipv6-addr* >} <*name*>

   Configures the IPv4 or IPv6 address, name, and configuration filename of the SNMPv3 management station to which notification messages are sent.

`params <parms_name>`	Name of the SNMPv3 station's parameters file.The parameters filename configured with `params params_name` must match the `params params_name` value entered with the `snmpv3 params` command in Step 6.
`taglist <tag_name> [tag_name] …`	Specifies the SNMPv3 notifications (identified by one or more *tag_name* values) to be sent to the IP address of the SNMPv3 management station. You can enter more than one *tag_name* value. Each *tag_name* value must be already associated with the name of an SNMPv3 notification configuration entered with the `snmpv3 notify` command in Step 4.Use a blank space to separate *tag_name* values. You can enter up to 103 characters in *tag_name* entries following the `taglist` keyword.

Table Continued

`[filter {<none | debug | all | not-info | critical>}]`	(Optional) Configures the type of messages sent to a management station.(Default: none.)
`[udp-port < port >]`	(Optional) Specifies the UDP port to use.(Default: 162.)
`[port-mask < mask >]`	(Optional) Specifies a range of UDP ports. (Default: 0.)
`[addr-mask < mask >]`	(Optional) Specifies a range of IP addresses as destinations for notification messages.(Default: 0.)
`[retries < value >]`	(Optional) Number of times a notification is retransmitted if no response is received. Range: 1-255.(Default: 3.)
`[timeout < value >]`	(Optional) Time (in millisecond increments) allowed to receive a response from the target before notification packets are retransmitted. Range: 0-2147483647.[Default: 1500 (15 seconds).]
`[max-msg-size < size >]`	(Optional) Maximum number of bytes supported in a notification message to the specified target. (Default: 1472)

6. Create a configuration record for the target address with the `snmpv3 params` command.

Syntax:

[no] snmpv3 params <*params_name*> user <*user_name*>

Applies the configuration parameters and IP address of an SNMPv3 management station (from the `params` *`params_name`* value configured with the `snmpv3 targetaddress` command in Step 5) to a specified SNMPv3 user (from the `user` *`user_name`* value configured with the `snmpv3 user` command in Step 2).

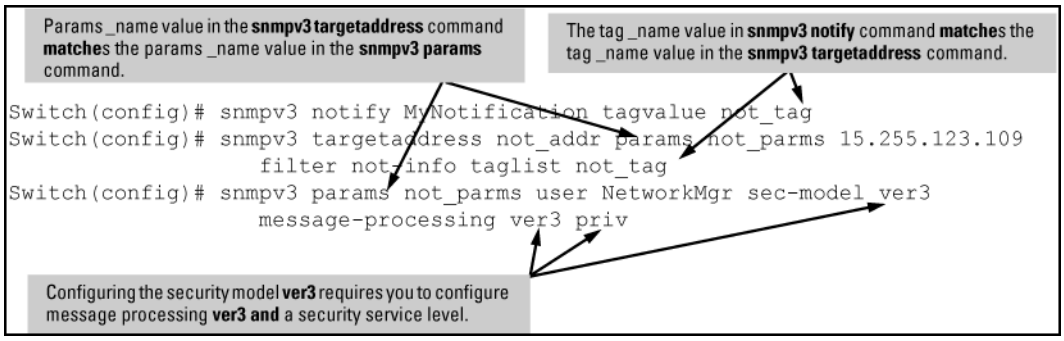
If you enter the `snmpv3 params user` command, you must also configure a security model (`sec-model`) and message processing algorithm (`msg-processing`).

`{<sec-model [ver1 | ver2c | ver3>]}`	Configures the security model used for SNMPv3 notification messages sent to the management station configured with the `snmpv3 targetaddress` command in Step 5. If you configure the security model as `ver3`, you must also configure the message processing value as `ver3`.
`{msg-processing {<ver1 | ver2c | ver3>} [noaut | auth | priv]}`	Configures the algorithm used to process messages sent to the SNMPv3 target address. If you configure the message processing value as `ver3` and the security model as `ver3`, you must also configure a security services level (`noauth`, `auth`, or `priv`).

Example:

An Example: of how to configure SNMPv3 notification is shown here:

Figure 34: *Example: of an SNMPv3 notification configuration*



Network security notifications

By default, a switch is enabled to send the SNMP notifications listed in **Supported Notifications** on page 180 when a network security event (For example, authentication failure) occurs. However, before security notifications can be sent, you must first configure one or more trap receivers or SNMPv3 management stations as described in:

- **Configuring an SNMP trap receiver (CLI)** on page 181
- **Configuring SNMPv3 notifications (CLI)** on page 184

You can manage the default configuration of the switch to disable and re-enable notifications to be sent for the following types of security events:

- ARP protection events
- Inability to establish a connection with the RADIUS or TACACS+ authentication server
- DHCP snooping events
- Dynamic IP Lockdown hardware resources consumed
- Link change notification
- Invalid password entered in a login attempt through a direct serial, Telnet, or SSH connection
- Manager password changes
- Port-security (web, MAC, or802.1X) authentication failure
- SNMP authentication failure
- Running configuration changes

Enabling or disabling notification/traps for network security failures and other security events (CLI)

For more information, see **Network security notifications** on page 187.

Syntax:

[no] snmp-server enable traps [snmp-auth | password-change-mgr | login-failure-mgr | port-security | auth-server-fail | dhcp-snooping | arp-protect | running-config-change]

Enables or disables sending one of the security notification types listed below to configured trap receivers. (Unless otherwise stated, all of the following notifications are enabled in the default configuration.)

The notification sends a trap:

`arp-protect`	If ARP packets are received with an invalid source or destination MAC address, an invalid IP address, or an invalid IP-to-MAC binding.
`auth-server-fail`	If the connection with a RADIUS or TACACS+ authentication server fails.
`dhcp-snooping`	If DHCP packets are received from an untrusted source or if DHCP packets contain an invalid IP-to-MAC binding.
`dhcpv6-snooping`	Set the traps for DHCPv6 snooping.
`dyn-ip-lockdown`	If the switch is out of hardware resources needed to program a dynamic IP lockdown rule
`dyn-ipv6-lockdown`	Enable traps for Dynamic IPv6 lockdown..
`link-change <port-list>`	When the link state on a port changes from up to down, or the reverse.
`login-failure-mgr`	For a failed login with a manager password.
`password-change-mgr`	When a manager password is reset.
`mac-notify`	Globally enables the generation of SNMP trap notifications upon MAC address table changes.
`nd-snooping`	Set the trap for nd snooping
`port-security`	For a failed authentication attempt through a web, MAC, or 801.X authentication session.
`running-config-change`	When changes to the running configuration file are made.
`snmp-authentication [extended | standard]`	For a failed authentication attempt via SNMP.(Default: extended.)
`Startup-config-change`	Sends a trap when changes to the startup configuration file are made. See “Enabling SNMP Traps on Startup Configuration Changes” on page 6–34. (Default: Disabled)

To determine the specific cause of a security event, check the Event Log in the console interface to see why a trap was sent. For more information, see "Using the Event Log for Troubleshooting Switch Problems".

Viewing the current configuration for network security notifications (CLI)

Enter the `show snmp-server traps` command, as shown in **Display of configured network security notifications** on page 189. Note that command output is a subset of the information displayed with the `show snmp-server` command in **Display of SNMP notification configuration**.

Display of configured network security notifications

```
switch(config)# show snmp-server traps

 Trap Receivers

  Link-Change Traps Enabled on Ports [All] : A1-A24

  Traps Category                   Current Status
  ------------------------------  -------------------------
  SNMP Authentication            : Extended
  Password change                : Enabled
  Login failures                 : Enabled
  Port-Security                  : Enabled
  Authorization Server Contact   : Enabled
  DHCP Snooping                  : Enabled
  Dynamic ARP Protection         : Enabled
  Dynamic IP Lockdown            : Enabled


  Address                 Community  Events Sent Notify Type Retry Timeout
  ---------------------- ---------- ----------- ----------- ----- -------
  15.255.5.225            public     All         trap          3   15
  2001:0db8:0000:0001
    :0000:0000:0000:0121 user_1     All         trap          3   15

  Excluded MIBs
```

Enabling Link-Change Traps (CLI)

By default, a switch is enabled to send a trap when the link state on a port changes from up to down (linkDown) or down to up (linkUp). To reconfigure the switch to send link-change traps to configured trap receivers, enter the `snmp-server enable traps link-change` command.

Syntax:

[no] snmp-server enable traps link-change <*port-list*> [all]

Enables or disables the switch to send a link-change trap to configured trap receivers when the link state on a port goes from up to down or down to up.

Enter `all` to enable or disable link-change traps on all ports on the switch.

Readable interface names in traps

The SNMP trap notification messages for linkup and linkdown events on an interface includes IfDesc and IfAlias var-bind information.

Source IP address for SNMP notifications

The switch uses an interface IP address as the source IP address in IP headers when sending SNMP notifications (traps and informs) or responses to SNMP requests.

For multi-netted interfaces, the source IP address is the IP address of the outbound interface of the SNMP reply, which may differ from the destination IP address in the IP header of the received request. For security reasons, it may be desirable to send an SNMP reply with the IP address of the destination interface (or a specified IP address) on which the corresponding SNMP request was received.

To configure the switch to use the source IP address on which an SNMP request was received in SNMP notification/traps and replies, enter the `snmp-server response-source` and `snmp-server trap-source` commands (**Configuring the source IP address for SNMP notifications (CLI)**).

Configuring the source IP address for SNMP notifications (CLI)

For more information, see **Source IP address for SNMP notifications** on page 189.

Syntax:

[no] snmp-server response-source [dst-ip-of-request | [*ipv4-addr* | *ipv6-addr*] | loopback <0-7>]

Specifies the source IP address of the SNMP response PDU. The default SNMP response PDU uses the IP address of the active interface from which the SNMP response was sent as the source IP address.

The `no` form of the command resets the switch to the default behavior (compliant with rfc-1517).

(Default: Interface IP address)

`dst-ip-of-request`	Destination IP address of the SNMP request PDU that is used as the source IP address in an SNMP response PDU.
[*ipv4-addr* | *ipv6-addr*]	User-defined interface IP address that is used as the source IP address in an SNMP response PDU. Both IPv4 and IPv6 addresses are supported.
`loopback <0-7>`	IP address configured for the specified loopback interface that is used as the source IP address in an SNMP response PDU. If multiple loopback IP addresses are configured, the lowest alphanumeric address is used.

To use the IP address of the destination interface on which an SNMP request was received as the source IP address in the IP header of SNMP traps and replies, enter the following command:

```
switch(config)# snmp-server response-source dst-ip-of-request
```

Syntax:

[no] snmp-server trap-source [*ipv4-addr* | loopback <0-7>]

Specifies the source IP address to be used for a trap PDU. To configure the switch to use a specified source IP address in generated trap PDUs, enter the `snmp-server trap-source` command.

The `no` form of the command resets the switch to the default behavior (compliant with rfc-1517).

(Default: Use the interface IP address in generated trap PDUs)

ipv4-addr	User-defined interface IPv4 address that is used as the source IP address in generated traps. IPv6 addresses are not supported.
`loopback <0-7>`	P address configured for the specified loopback interface that is used as the source IP address in a generated trap PDU. If multiple loopback IP addresses are configured, the lowest alphanumeric address is used.

NOTE

When you use the `snmp-server response-source` and `snmp-server trap-source` commands, note the following behavior:

- The `snmp-server response-source` and `snmp-server trap-source` commands configure the source IP address for IPv4 interfaces only.
- You must manually configure the `snmp-server response-source` value if you wish to change the default user-defined interface IP address that is used as the source IP address in SNMP traps (RFC 1517).
- The values configured with the `snmp-server response-source` and `snmp-server trap-source` commands are applied globally to all interfaces that are sending SNMP responses or SNMP trap PDUs.
- Only the source IP address field in the IP header of the SNMP response PDU can be changed.
- Only the source IP address field in the IP header and the SNMPv1 Agent Address field of the SNMP trap PDU can be changed.

Verifying the configuration of the interface IP address used as the source IP address in IP headers for SNMP replies and traps sent from the switch (CLI)

Enter the `show snmp-server` command to display the SNMP policy configuration, as shown in **Display of source IP address configuration** on page 191.

Display of source IP address configuration

```
switch(config)# show snmp-server

 SNMP Communities

  Community Name   MIB View Write Access
  ---------------- -------- ------------
  public           Manager  Unrestricted

 Trap Receivers
  Link-Change Traps Enabled on Ports [All] : All

  ...

 Excluded MIBs
 Snmp Response Pdu Source-IP Information
  Selection Policy : dstIpOfRequest [1]

 Trap Pdu Source-IP Information
  Selection Policy : Configured IP
```

[1] dstIpOfRequest: The destination IP address of the interface on which an SNMP request is received i s used as the source IP address in SNMP replies.

Viewing SNMP notification configuration (CLI)

Syntax:

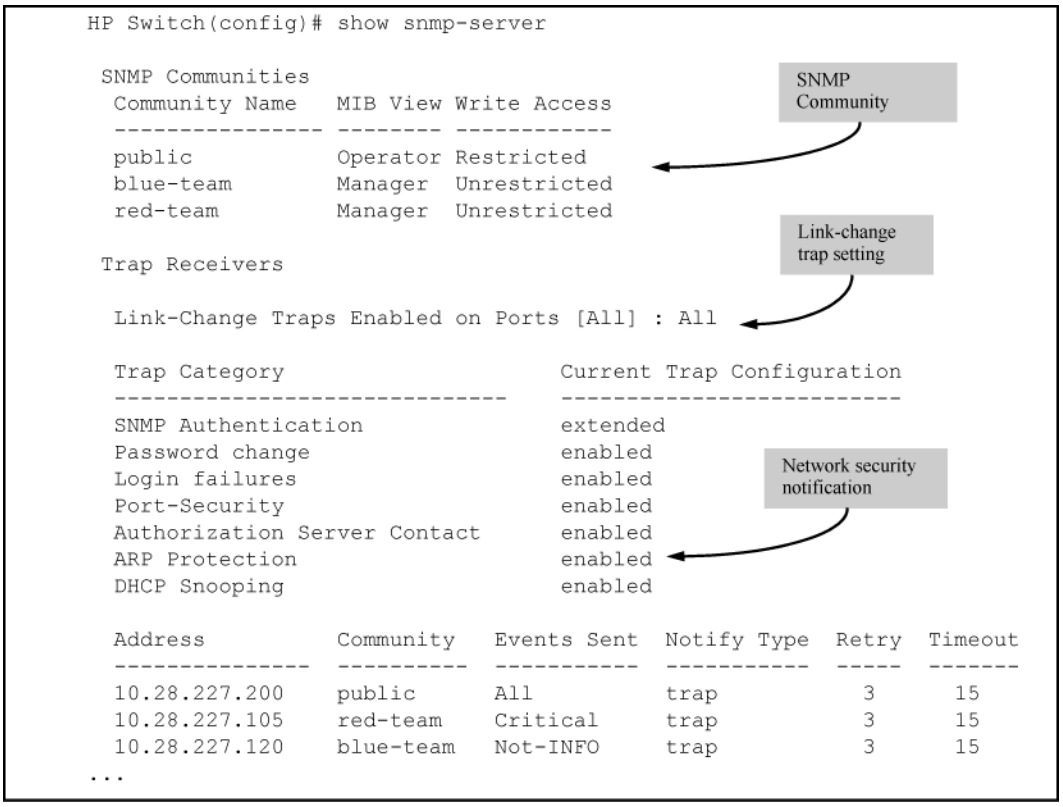
show snmp-server

Displays the currently configured notification settings for versions SNMPv1 and SNMPv2c traps, including SNMP communities, trap receivers, link-change traps, and network security notifications.

Example:

In the following Example:, the `show snmp-server` command output shows that the switch has been configured to send SNMP traps and notifications to management stations that belong to the "public," "red-team," and "blue-team" communities.

Figure 35: *Display of SNMP notification configuration*



Configuring the MAC address count option

The MAC Address Count feature provides a way to notify the switch management system when the number of MAC addresses learned on a switch port exceeds the permitted configurable number.

To enable the mac-count-notify option, enter this command in global config context.

Syntax:

[no] snmp-server enable traps mac-count-notify

Sends a trap when the number of MAC addresses learned on the specified ports exceeds the configured `<learned-count>` value.

To configure the mac-count-notify option on a port or ports, enter this command. When the configured number of MAC addresses is exceeded (the learned-count), a trap is sent.

Syntax:

[no] mac-count-notify traps <port-list> [<learned-count>]

Configures `mac-count-notify traps` on the specified ports (or all) for the entire switch.

The `[no]` form of the command disables `mac-count-notify traps`.

[<learned-count>]: The number of MAC addresses learned before sending a trap. Values range between 1-128.

Default: 32

Configuring mac-count notify traps on ports 5–7

```
switch (config)# mac-count-notify traps 5-7 50
```

Displaying information about the mac-count-notify option

Use the show mac-count-notify traps [<port-list>] command to display information about the configured value for sending a trap, the current count, and if a trap has been sent.

Information displayed for the `show mac-count-notify traps` command

```
switch(config)# show mac-count-notify traps

Mac-count-notify Enabled: Yes

Port    Count for        Count    Trap Sent
        sending Trap
------  ---------------  -------  ------------
1
2
3
4
5          50             0        No
6          50             2        No
7          50             0        No
8
9
...
```

The interface context can be used to configure the value for sending a trap.

Configuring mac-count-notify traps from the interface context

```
switch(config)# interface 5

HP Switch (eth-5)# mac-count-notify traps 35
```

The `show snmp-server traps` command displays whether the MAC Address Count feature is enabled or disabled.

Information about SNMP traps, including MAC address count being Enabled/Disabled

```
switch(config)# show snmp-server traps

 Trap Receivers

  Link-Change Traps Enabled on Ports [All] : All

  Traps Category                  Current Status
  ______________________________  ____________________
  SNMP Authentication           : Extended
  Password change               : Enabled
  Login failures                : Enabled
  Port-Security                 : Enabled
```

```
  Authorization Server Contact : Enabled
  DHCP-Snooping                : Enabled
  Dynamic ARP Protection       : Enabled
  Dynamic IP Lockdown          : Enabled


  MAC address table changes    : Disabled
  MAC Address Count            : Enabled [1]

  Address          Community   Events  Type   Retry  Timeout
  ---------------- ----------- ------- ------ ------ -------
  15.146.194.77    public      None    trap   3      15
  15.255.134.252   public      None    trap   3      15
  16.181.49.167    public      None    trap   3      15
  16.181.51.14     public      None    trap   3      15

Excluded MIBs
```

- [1]The notify option is enabled.

Advanced management: RMON

The switch supports RMON (remote monitoring) on all connected network segments. This allows for troubleshooting and optimizing your network.

The following RMON groups are supported:

- Ethernet Statistics (except the numbers of packets of different frame sizes)
- Alarm
- History (of the supported Ethernet statistics)
- Event

The RMON agent automatically runs in the switch. Use the RMON management station on your network to enable or disable specific RMON traps and events. Note that you can access the Ethernet statistics, Alarm, and Event groups from the HPE Switch Manager network management software. For more information on PCM+, see the HPE Networking web site at **http://www.hpe.com/networking**.

From the Products menu, select Network Management. Then click on PCM+ Network Management under the Network Management bar.

CLI-configured sFlow with multiple instances

sFlow can also be configured via the CLI for up to three distinct sFlow instances: once enabled, an sFlow receiver/destination can be independently configured for full flow-sampling and counter-polling. CLI-configured sFlow instances may be saved to the startup configuration to persist across a switch reboot.

Configuring sFlow (CLI)

The following sFlow commands allow you to configure sFlow instances via the CLI. For more information, see **Advanced management: RMON** on page 194.

Syntax:

[no] sflow <*receiver-instance*> destination <*ip-address*> [< *udp-port-num* >]

Enables an sFlow receiver/destination. The receiver-instance number must be a 1, 2, or 3.

By default, the udp destination port number is 6343.

To disable an sFlow receiver/destination, enter `no sflow` *`receiver-instance`* .

Syntax:

sflow <*receiver-instance*> sampling <*port-list*> <*sampling rate*>

Once an sFlow receiver/destination has been enabled, this command enables flow sampling for that instance. The receiver-instance number is 1, 2, or 3, and the sampling rate is the allowable non-zero skipcount for the specified port or ports.

To disable flow-sampling for the specified port-list, repeat the above command with a sampling rate of `0`.

Syntax:

sflow <*receiver-instance*> polling <*port-list*> <*polling interval*>

Once an sFlow receiver/destination has been enabled, this command enables counter polling for that instance. The receiver-instance number is 1, 2, or 3, and the polling interval may be set to an allowable non-zero value to enable polling on the specified port or ports.

To disable counter-polling for the specified port-list, repeat the above command with a polling interval of `0`.

Under the multiple instance implementation, sFlow can be configured via the CLI or via SNMP. However, CLI-owned sFlow configurations cannot be modified via SNMP, whereas SNMP-owned instances can be disabled via the CLI using the `no sflow <receiver-instance>` command.

Viewing sFlow Configuration and Status (CLI)

The following sFlow commands allow you to display sFlow configuration and status via the CLI. **Viewing sFlow destination information** on page 196 is an Example: of `sflow agent` information.

Syntax:

show sflow agent

Displays sFlow agent information. The agent address is normally the IP address of the first VLAN configured.

The `show sflow agent` command displays read-only switch agent information. The version information shows the sFlow version, MIB support, and software versions; the agent address is typically the IP address of the first VLAN configured on the switch.

Viewing `sflow agent` information

```
switch# show sflow agent

  Version          1.3;HP;XX.11.40
  Agent Address    10.0.10.228
```

Syntax:

show sflow <*receiver instance*> destination

Displays information about the management station to which the sFlow sampling-polling data is sent.

The `show sflow instance destination` command includes information about the management-station's destination address, receiver port, and owner, as shown in **Viewing sFlow destination information** on page 196.

Viewing `sFlow destination` information

```
switch# show sflow 2 destination

  Destination Instance          2
  sflow                         Enabled
  Datagrams Sent                221
  Destination Address           10.0.10.41
  Receiver Port                 6343
  Owner                         Administrator, CLI-owned, Instance 2
  Timeout (seconds)             99995530
  Max Datagram Size             1400
  Datagram Version Support      5
```

Note the following details:

- **Destination Address** remains blank unless it has been configured.
- **Datagrams Sent** shows the number of datagrams sent by the switch agent to the management station since the switch agent was last enabled.
- **Timeout** displays the number of seconds remaining before the switch agent will automatically disable sFlow (this is set by the management station and decrements with time).
- **Max Datagram Size** shows the currently set value (typically a default value, but this can also be set by the management station).

Syntax:

show sflow <*receiver instance*> sampling-polling <*port-list/range*>

Displays status information about sFlow sampling and polling.

The `show sflow` *`instance`* `sampling-polling [`*`port-list`*`]` command displays information about sFlow sampling and polling on the switch, as shown in **Figure 36: Example: of viewing sFlow sampling and polling information** on page 196. You can specify a list or range of ports for which to view sampling information.

Figure 36: *Example: of viewing sFlow sampling and polling information*

```
HP Switch# show sflow 2 sampling-polling A1-A4
```

Number denotes the sampling/polling instance to which the receiver is coupled.

Port	Sampling Enabled	Rate	Header	Dropped Samples	Polling Enabled	Interval
A1	Yes(2)	40	128	1234567890	---	---
A2	---	---	---	0	Yes(1)	60
A3	No(1)	0	100	898703	No	30
A4	Yes(3)	50	128	0	No(3)	0

NOTE

The sampling and polling instances (noted in parentheses) coupled to a specific receiver instance are assigned dynamically, and so the instance numbers may not always match. The key thing to note is whether sampling or polling is enabled on a port, and the sampling rates or polling intervals for the receiver instance configured on each port.

Configuring UDLD Verify before forwarding

When an UDLD enabled port transitions to link-up, the port will begin with a UDLD blocking state. UDLD will probe via protocol packet exchange to determine the bidirectional state of the link. Until UDLD has completed the

probe, all data traffic will be blocked. If the link is found to be bidirectional, UDLD will unblock the port for data traffic to pass. Once UDLD unblocks the port, other protocols will see the port as up and data traffic can be safely forwarded.

The default mode of a switch is “forward first then verify”. Enabling UDLD link-up will default to “forward first then verify”. To change the mode to “verify then forward”, you need to configure using the commands found in section 6.72.

Link-UP data traffic will resumed after probing the link partner completes. All other protocols running will see the port as down.

UDLD time delay

UDLD protocol informs the link partner simultaneously as it detects a state change from unidirectional to bidirectional traffic. Additional packet exchanges will be carried out by UDLD in addition to the existing UDLD exchanges whenever state changes from unidirectional to bidirectional.

Table 18: *Peer state transition timings*

Interval Time	Interval 1	Interval 1 + delta	Interval 2	Interval 3
	5 sec	5+(<5) sec*	10 sec	15 sec
With triggered updates	State = blockedPeer State = blocked	Inform PeerState = unblockedPeer State = unblocked	Regular UDLD TX	Regular UDLD TX
Without triggered updates	State = blockedPeer State = blocked	State = unblockedPeer State = blocked	Inform PeerState = unblockedPeer State = unblocked	Regular UDLD TX
*delta is the time when the unblock event occurs on local side				

Restrictions

- There is no support available when configuring this mode from the web and menu interface.
- There are no new packet types are introduced with UDLD.
- There are no new UDLD timers being introduced.

UDLD configuration commands

Syntax:

HP Switch(config)# link-keepalive mode [verify-then-forward | forward-then-verify]

This command configures the link-keepalive mode.

Link-keepalive provides two modes of operation; `verify-then-forward` and `forward-then-verify`.

When using the `verify-then-forward` mode, the port is in a blocking state until the link configured for UDLD establishes bidirectional communication. When using the `forward-then-verify` mode, the port forwards the data then verifies the status of the link-in state.

When a unidirectional state is detected, the port is moved to a blocked state.

When a bidirectional state is detected, the data is forwarded without interruption.

Syntax:

HP Switch(config)# link-keepalive mode verify-then-forward

Keeps the port in a logically blocked state until the link configured for UDLD has been successfully established in bi-directional communication.

Syntax:

HP Switch(config)# link-keepalive mode forward-then-verify

Forwards the data then verifies the status of the link. If a unidirectional state is detected, the port is then moved to a blocked state.

Syntax:

HP Switch(config)# link-keepalive interval <deciseconds>

Configure the interval for `link-keepalive`. The `link-keepalive` interval is the time between sending two UDLD packets. The time interval is entered in deciseconds (1/10 sec). The default keepalive interval is 50 deciseconds.

Example:

A value of 10 is 1 sec., 11 is 1.1 sec.

Syntax:

HP Switch(config)# link-keepalive retries <number>

Maximum number of sending attempts for UDLD packets before declaring the link as faulty.

Default keepalive attempt is 4.

Show commands

Syntax:

switch(config)# show link-keepalive

Sample output:

```
Total link-keepalive enabled ports: 8
Keepalive Retries : 4
Keepalive Interval: 5 sec
Keepalive Mode : verify-then-forward
Physical Keepalive Adjacent UDLD

Port  Enabled Status           Status    Switch       VLAN
----- ------- ---------------- --------- ------------ ----------
1     Yes     down             off-line  000000-000000 untagged
2     Yes     down             off-line  000000-000000 untagged
3     Yes     down             off-line  000000-000000 untagged
4     Yes     down             off-line  000000-000000 untagged
5     Yes     down             off-line  000000-000000 untagged
6     Yes     down             off-line  000000-000000 untagged
```

```
7     Yes     down             off-line  000000-000000 untagged
8     Yes     down             off-line  000000-000000 untagged
```

RMON generated when user changes UDLD mode

RMON events are generated when UDLD is configured. The first time you configure the mode, the UDLD states will be re-initialized. An event log entry is initiated to include the reason for the initial UDLD blocking state during link up.

Example:

UDLD mode `[verify-then-forward | forward-then-verify]` is configured

Severity: - Info.

LLDP

To standardize device discovery on all HPE switches, LLDP is implemented while offering limited read-only support for CDP, as documented in this manual. For the latest information on your switch model, consult the Release Notes (available on the HPE Networking website). If LLDP has not yet been implemented (or if you are running an older version of software), consult a previous version of the *Management and Configuration Guide* for device discovery details.

LLDP (Link Layer Discovery Protocol): provides a standards-based method for enabling the switches covered in this guide to advertise themselves to adjacent devices and to learn about adjacent LLDP devices.

LLDP-MED (LLDP Media Endpoint Discovery): Provides an extension to LLDP and is designed to support VoIP deployments.

LLDP-MED is an extension for LLDP, and the switch requires that LLDP be enabled as a prerequisite to LLDP-MED operation.

An SNMP utility can progressively discover LLDP devices in a network by:

Procedure

1. Reading a given device's Neighbors table (in the Management Information Base, or MIB) to learn about other, neighboring LLDP devices.
2. Using the information learned in step 1 to find and read the neighbor devices' Neighbors tables to learn about additional devices, and so on.

Also, by using `show` commands to access the switch's neighbor database for information collected by an individual switch, system administrators can learn about other devices connected to the switch, including device type (capability) and some configuration information. In VoIP deployments using LLDP-MED on the switches, additional support unique to VoIP applications is also available. See **LLDP-MED (media-endpoint-discovery)** on page 213.

General LLDP operation

An LLDP packet contains data about the transmitting switch and port. The switch advertises itself to adjacent (neighbor) devices by transmitting LLDP data packets out all ports on which outbound LLDP is enabled and by reading LLDP advertisements from neighbor devices on ports that are inbound LLDP-enabled. (LLDP is a one-way protocol and does not include any acknowledgement mechanism.) An LLDP-enabled port receiving LLDP packets inbound from neighbor devices stores the packet data in a Neighbor database (MIB).

LLDP-MED

This capability is an extension to LLDP and is available on the switches. See **LLDP-MED (media-endpoint-discovery)** on page 213.

Packet boundaries in a network topology

- Where multiple LLDP devices are directly connected, an outbound LLDP packet travels only to the next LLDP device. An LLDP-capable device does not forward LLDP packets to any other devices, regardless of whether they are LLDP-enabled.
- An intervening hub or repeater forwards the LLDP packets it receives in the same manner as any other multicast packets it receives. Thus, two LLDP switches joined by a hub or repeater handle LLDP traffic in the same way that they would if directly connected.
- Any intervening 802.1D device or Layer-3 device that is either LLDP-unaware or has disabled LLDP operation drops the packet.

LLDP operation configuration options

In the default configuration, LLDP is enabled and in both transmit and receive mode on all active ports. The LLDP configuration includes global settings, which apply to all active ports on the switch, and per-port settings, which affect only the operation of the specified ports.

The commands in the LLDP sections affect both LLDP and LLDP-MED operation. For information on operation and configuration unique to LLDP-MED, see **LLDP-MED (media-endpoint-discovery)** on page 213.

Enable or disable LLDP on the switch

In the default configuration, LLDP is globally enabled on the switch. To prevent transmission or receipt of LLDP traffic, you can disable LLDP operation.

Enable or disable LLDP-MED

In the default configuration for the switches, LLDP-MED is enabled by default. (Requires that LLDP is also enabled.) For more information, see **LLDP-MED (media-endpoint-discovery)** on page 213.

Change the frequency of LLDP packet transmission to neighbor devices

On a global basis, you can increase or decrease the frequency of outbound LLDP advertisements.

Change the Time-To-Live for LLDP packets sent to neighbors

On a global basis, you can increase or decrease the time that the information in an LLDP packet outbound from the switch will be maintained in a neighbor LLDP device.

Transmit and receive mode

With LLDP enabled, the switch periodically transmits an LLDP advertisement (packet) out each active port enabled for outbound LLDP transmissions and receives LLDP advertisements on each active port enabled to receive LLDP traffic (**Configuring per-port transmit and receive modes (CLI)** on page 209). Per-port configuration options include four modes:

- Transmit and receive (`tx_rx`): This is the default setting on all ports. It enables a given port to both transmit and receive LLDP packets and to store the data from received (inbound) LLDP packets in the switch's MIB.
- Transmit only (`txonly`): This setting enables a port to transmit LLDP packets that can be read by LLDP neighbors. However, the port drops inbound LLDP packets from LLDP neighbors without reading them. This prevents the switch from learning about LLDP neighbors on that port.
- Receive only (`rxonly`): This setting enables a port to receive and read LLDP packets from LLDP neighbors and to store the packet data in the switch's MIB. However, the port does not transmit outbound LLDP packets. This prevents LLDP neighbors from learning about the switch through that port.
- Disable (`disable`): This setting disables LLDP packet transmissions and reception on a port. In this state, the switch does not use the port for either learning about LLDP neighbors or informing LLDP neighbors of its presence.

SNMP notification

You can enable the switch to send a notification to any configured SNMP trap receiver(s) when the switch detects a remote LLDP data change on an LLDP-enabled port (**Configuring SNMP notification support** on page 208).

Per-port (outbound) data options

The following table lists the information the switch can include in the per-port, outbound LLDP packets it generates. In the default configuration, all outbound LLDP packets include this information in the TLVs transmitted to neighbor devices. However, you can configure LLDP advertisements on a per-port basis to omit some of this information (**Configuring a remote management address for outbound LLDP advertisements (CLI)** on page 209).

Table 19: *Data available for basic LLDP advertisements*

Data type	Configuration options	Default	Description
Time-to-Live	[1]	120 Seconds	The length of time an LLDP neighbor retains the advertised data before discarding it.
Chassis Type[2,3]	N/A	Always Enabled	Indicates the type of identifier used for Chassis ID.
Chassis ID[3]	N/A	Always Enabled	Uses base MAC address of the switch.
Port Type[4,3]	N/A	Always Enabled	Uses "Local," meaning assigned locally by LLDP.
Port Id[3]	N/A	Always Enabled	Uses port number of the physical port. This is an internal number reflecting the reserved slot/port position in the chassis. For more information on this numbering scheme, see the appendix "MAC Address Management".
Remote Management Address			
Type[3,5]	N/A	Always Enabled	Shows the network address type.
Address[5]	Default or Configured	Uses a default address selection method unless an optional address is configured. See **Remote management address** on page 202.	
System Name[3]	Enable/Disable	Enabled	Uses the switch's assigned name.

Table Continued

Data type	Configuration options	Default	Description
System Description[3]	Enable/Disable	Enabled	Includes switch model name and running software version, and ROM version.
Port Description[3]	Enable/Disable	Enabled	Uses the physical port identifier.
System capabilities supported[3,6]	Enable/Disable	Enabled	Identifies the switch's primary capabilities (bridge, router).
System capabilities enabled[3,6]	Enable/Disable	Enabled	Identifies the primary switch functions that are enabled, such as routing.

[1] The Packet Time-to-Live value is included in LLDP data packets.

[2] Subelement of the Chassis ID TLV.

[3] Populated with data captured internally by the switch. For more on these data types, refer to the IEEE P802.1AB Standard.

[4] Subelement of the Port ID TLV.

[5] Subelement of the Remote-Management-Address TLV.

[6] Subelement of the System Capability TLV.

Remote management address

The switch always includes an IP address in its LLDP advertisements. This can be either an address selected by a default process or an address configured for inclusion in advertisements. See **IP address advertisements** on page 203.

Debug logging

You can enable LLDP debug logging to a configured debug destination (Syslog server, a terminal device, or both) by executing the `debug lldp` command. (For more information on Debug and Syslog, see the "Troubleshooting" appendix in this guide.) Note that the switch's Event Log does not record usual LLDP update messages.

Options for reading LLDP information collected by the switch

You can extract LLDP information from the switch to identify adjacent LLDP devices. Options include:

- Using the switch's `show lldp info` command options to display data collected on adjacent LLDP devices—as well as the local data the switch is transmitting to adjacent LLDP devices (**Displaying the global LLDP, port admin, and SNMP notification status (CLI)** on page 203).
- Using an SNMP application that is designed to query the Neighbors MIB for LLDP data to use in device discovery and topology mapping.
- Using the`walkmib` command to display a listing of the LLDP MIB objects

LLDP and LLDP-MED standards compatibility

The operation covered by this section is compatible with these standards:

- IEEE P802.1AB
- RFC 2922 (PTOPO, or Physical Topology MIB)
- RFC 2737 (Entity MIB)

- RFC 2863 (Interfaces MIB)
- ANSI/TIA-1057/D6 (LLDP-MED; refer to **LLDP-MED (media-endpoint-discovery)** on page 213.)

LLDP operating rules

For additional information specific to LLDP-MED operation, see **LLDP-MED (media-endpoint-discovery)** on page 213.

Port trunking

LLDP manages trunked ports individually. That is, trunked ports are configured individually for LLDP operation, in the same manner as non-trunked ports. Also, LLDP sends separate advertisements on each port in a trunk, and not on a per-trunk basis. Similarly, LLDP data received through trunked ports is stored individually, per-port.

IP address advertisements

In the default operation, if a port belongs to only one static VLAN, the port advertises the lowest-order IP address configured on that VLAN. If a port belongs to multiple VLANs, the port advertises the lowest-order IP address configured on the VLAN with the lowest VID. If the qualifying VLAN does not have an IP address, the port advertises 127.0.0.1 as its IP address. For example, if the port is a member of the default VLAN (VID=1), and there is an IP address configured for the default VLAN, the port advertises this IP address. In the default operation, the IP address that LLDP uses can be an address acquired by DHCP or Bootp.

You can override the default operation by configuring the port to advertise any IP address that is manually configured on the switch, even if the port does not belong to the VLAN configured with the selected IP address (**Configuring a remote management address for outbound LLDP advertisements (CLI)** on page 209). (Note that LLDP cannot be configured through the CLI to advertise an addresses acquired through DHCP or Bootp. However, as mentioned above, in the default LLDP configuration, if the lowest-order IP address on the VLAN with the lowest VID for a given port is a DHCP or Bootp address, the switch includes this address in its LLDP advertisements unless another address is configured for advertisements on that port.) Also, although LLDP allows configuring multiple remote management addresses on a port, only the lowest-order address configured on the port will be included in outbound advertisements. Attempting to use the CLI to configure LLDP with an IP address that is either not configured on a VLAN or has been acquired by DHCP or Bootp results in the following error message.

```
xxx.xxx.xxx.xxx: This IP address is not configured or is a DHCP address.
```

Spanning-tree blocking

Spanning tree does not prevent LLDP packet transmission or receipt on STP-blocked links.

802.1X blocking

Ports blocked by 802.1X operation do not allow transmission or receipt of LLDP packets.

Configuring LLDP operation

Displaying the global LLDP, port admin, and SNMP notification status (CLI)

In the default configuration, LLDP is enabled and in both transmit and receive mode on all active ports. The LLDP configuration includes global settings that apply to all active ports on the switch, and per-port settings that affect only the operation of the specified ports.

The commands in this section affect both LLDP and LLDP-MED operation. for information on operation and configuration unique to LLDP-MED, refer to “LLDP-MED (Media-Endpoint-Discovery)”.

Syntax:

show lldp config

Displays the LLDP global configuration, LLDP port status, and SNMP notification status. For information on port admin status, see **Configuring per-port transmit and receive modes (CLI)** on page 209.

`show lldp config` produces the following display when the switch is in the default LLDP configuration:

Viewing the general LLDP configuration

```
switch(config)# show lldp config

 LLDP Global Configuration

  LLDP Enabled [Yes] : Yes
  LLDP Transmit Interval     [30] : 30
  LLDP Hold time Multiplier   [4] : 4
  LLDP Delay Interval         [2] : 2
  LLDP Reinit Interval        [2] : 2
  LLDP Notification Interval  [5] : 5
  LLDP Fast Start Count       [5] : 5

 LLDP Port Configuration

  Port | AdminStatus NotificationEnabled  Med Topology Trap Enabled
  ---- + ----------- -------------------  -------------------------
  A1   | Tx_Rx       False                False
  A2   | Tx_Rx       False                False
  A3   | Tx_Rx       False                False
  A4   | Tx_Rx       False                False
  A5   | Tx_Rx       False                False
  A6   | Tx_Rx       False                False
  A7   | Tx_Rx       False                False
  A8   | Tx_Rx       False                False
```

The values displayed in the LLDP column correspond to the `lldp refresh-interval` command

Viewing port configuration details (CLI)

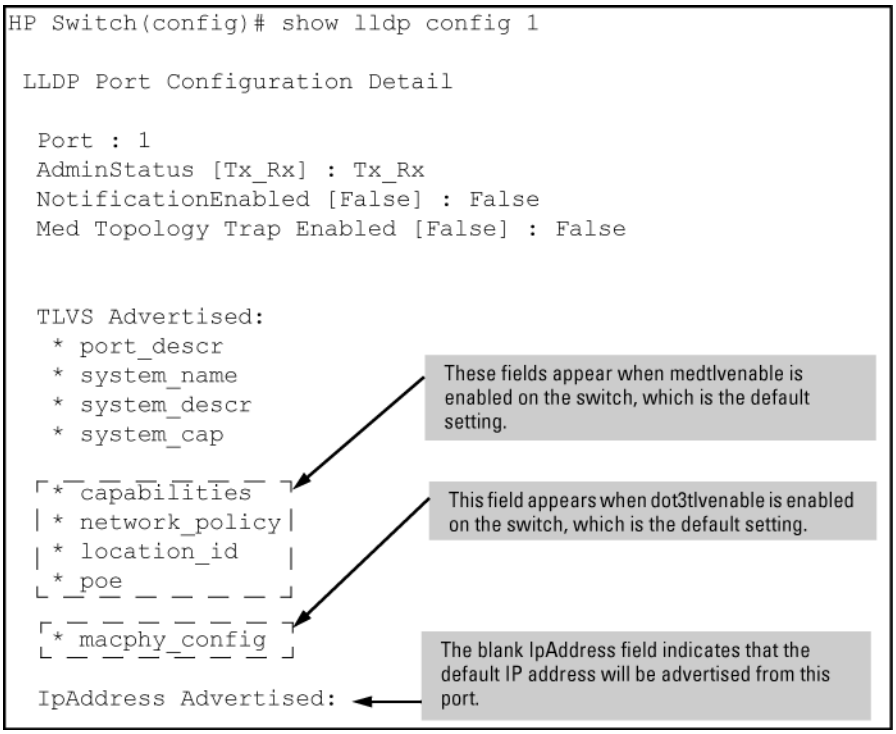
Syntax:

show lldp config <*port-list*>

Displays the LLDP port-specific configuration for all ports in <*port-list*>, including which optional TLVs and any non-default IP address that are included in the port's outbound advertisements.

For information on the notification setting, see **Configuring SNMP notification support** on page 208. For information on the other configurable settings displayed by this command, see **Configuring per-port transmit and receive modes (CLI)** on page 209.

Figure 37: *Per-port configuration display*



Configuring Global LLDP Packet Controls

The commands in this section configure the aspects of LLDP operation that apply the same to all ports in the switch.

LLDP operation on the switch

Enabling LLDP operation (the default) causes the switch to:

- Use active, LLDP-enabled ports to transmit LLDP packets describing itself to neighbor devices.
- Add entries to its neighbors table based on data read from incoming LLDP advertisements.

Enabling or disabling LLDP operation on the switch (CLI)

For more information, see **LLDP operation on the switch** on page 205.

Syntax:

[no] lldp run

Enables or disables LLDP operation on the switch.

The `no` form of the command, regardless of individual LLDP port configurations, prevents the switch from transmitting outbound LLDP advertisements and causes the switch to drop all LLDP advertisements received from other devices.

The switch preserves the current LLDP configuration when LLDP is disabled. After LLDP is disabled, the information in the LLDP neighbors database remains until it times-out.

(Default: Enabled)

Disabling LLDP

```
switch(config)# no lldp run
```

Changing the packet transmission interval (CLI)

This interval controls how often active ports retransmit advertisements to their neighbors.

Syntax:

lldp refresh-interval <5-32768>

Changes the interval between consecutive transmissions of LLDP advertisements on any given port.

(Default: 30 seconds)

The `refresh-interval` must be greater than or equal to (4 x `delay-interval`). (The default `delay-interval` is 2). For example, with the default `delay-interval`, the lowest `refresh-interval` you can use is 8 seconds (4 x 2=8). Thus, if you want a `refresh-interval` of 5 seconds, you must first change the delay interval to 1 (that is, 4 x 1 5). If you want to change the `delay-interval`, use the `setmib` command.

Time-to-Live for transmitted advertisements

The Time-to-Live value (in seconds) for all LLDP advertisements transmitted from a switch is controlled by the switch that generates the advertisement and determines how long an LLDP neighbor retains the advertised data before discarding it. The Time-to-Live value is the result of multiplying the `refresh-interval` by the `holdtime-multiplier`.

Changing the time-to-live for transmitted advertisements (CLI)

For more information, see **Time-to-Live for transmitted advertisements** on page 206.

Syntax:

lldp holdtime-multiplier <2-10>

Changes the multiplier an LLDP switch uses to calculate the Time-to-Live for the LLDP advertisements it generates and transmits to LLDP neighbors. When the Time-to-Live for a given advertisement expires, the advertised data is deleted from the neighbor switch's MIB.

(Default: 4; Range 2–10)

Example:

If the refresh-interval on the switch is 15 seconds and the `holdtime-multiplier` is at the default, the Time-to-Live for advertisements transmitted from the switch is 60 seconds (4 x 15).

To reduce the Time-to-Live, you could lower the `holdtime-interval` to 2, which would result in a Time-to-Live of 30 seconds.

```
switch(config)# lldp holdtime-multiplier 2
```

Delay interval between advertisements generated by value or status changes to the LLDP MIB

The switch uses a **delay-interval** setting to delay transmitting successive advertisements resulting from these LLDP MIB changes. If a switch is subject to frequent changes to its LLDP MIB, lengthening this interval can

reduce the frequency of successive advertisements. You can change the delay-interval by using either an SNMP network management application or the CLI `setmib` command.

Changing the delay interval between advertisements generated by value or status changes to the LLDP MIB (CLI)

Syntax:

setmib lldpTxDelay.0 -i <1-8192>

Uses `setmib` to change the minimum time (delay-interval) any LLDP port will delay advertising successive LLDP advertisements because of a change in LLDP MIB content.

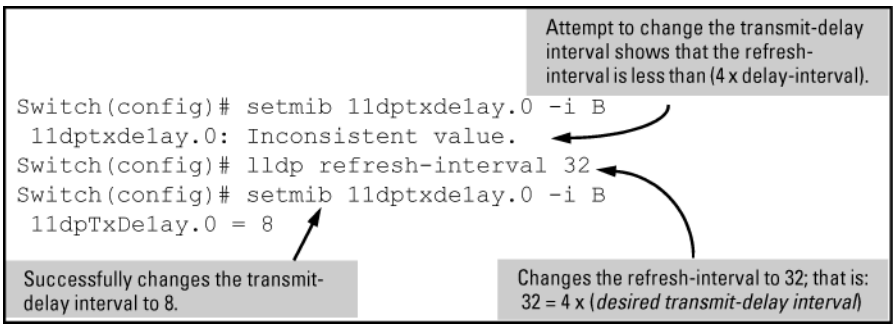
(Default: 2; Range 1–8192)

The LLDP refresh-interval (transmit interval) must be greater than or equal to (4 x delay-interval). The switch does not allow increasing the delay interval to a value that conflicts with this relationship. That is, the switch displays `Inconsistent value` if (4 x delay-interval) exceeds the current transmit interval, and the command fails. Depending on the current refresh-interval setting, it may be necessary to increase the refresh-interval before using this command to increase the delay-interval.

Example:

To change the delay-interval from 2 seconds to 8 seconds when the refresh-interval is at the default 30 seconds, you must first set the refresh-interval to a minimum of 32 seconds (32 = 4 x 8). (See **Figure 38: Changing the transmit-delay interval** on page 207.)

Figure 38: *Changing the transmit-delay interval*



Reinitialization delay interval

In the default configuration, a port receiving a `disable` command followed immediately by a `txonly`, `rxonly`, or `tx_rx` command delays reinitializing for two seconds, during which LLDP operation remains disabled. If an active port is subjected to frequent toggling between the LLDP disabled and enabled states, LLDP advertisements are more frequently transmitted to the neighbor device. Also, the neighbor table in the adjacent device changes more frequently as it deletes, then replaces LLDP data for the affected port which, in turn, generates SNMP traps (if trap receivers and SNMP notification are configured). All of this can unnecessarily increase network traffic. Extending the reinitialization-delay interval delays the ability of the port to reinitialize and generate LLDP traffic following an LLDP disable/enable cycle.

Changing the reinitialization delay interval (CLI)

Syntax:

setmib lldpReinitDelay.0 -i <1-10>

Uses `setmib` to change the minimum time (reinitialization delay interval) an LLDP port will wait before reinitializing after receiving an LLDP disable command followed closely by a txonly or tx_rx command. The delay interval commences with execution of the `lldp admin-status port-list disable` command.

(Default: 2 seconds; Range 1–10 seconds)

Example:

The following command changes the reinitialization delay interval to five seconds:

```
switch(config)# setmib lldpreinitdelay.0 -i 5
```

Configuring SNMP notification support

You can enable SNMP trap notification of LLDP data changes detected on advertisements received from neighbor devices, and control the interval between successive notifications of data changes on the same neighbor.

Enabling LLDP data change notification for SNMP trap receivers (CLI)

Syntax:

[no] lldp enable-notification <*port-list*>

Enables or disables each port in *port-list* for sending notification to configured SNMP trap receivers if an LLDP data change is detected in an advertisement received on the port from an LLDP neighbor.

(Default: Disabled)

For information on configuring trap receivers in the switch, see **SNMP notifications** on page 180.

Example:

This command enables SNMP notification on ports 1 - 5:

```
switch(config)# lldp enable-notification 1-5
```

Changing the minimum interval for successive data change notifications for the same neighbor

If LLDP trap notification is enabled on a port, a rapid succession of changes in LLDP information received in advertisements from one or more neighbors can generate a high number of traps. To reduce this effect, you can globally change the interval between successive notifications of neighbor data change.

Syntax:

setmib lldpnotificationinterval.0 -i <*1-3600*>

Globally changes the interval between successive traps generated by the switch. If multiple traps are generated in the specified interval, only the first trap is sent. The remaining traps are suppressed. (A network management application can periodically check the switch MIB to detect any missed change notification traps. See IEEE P802.1AB or later for more information.)

(Default: 5 seconds)

Example:

The following command limits change notification traps from a particular switch to one per minute.

```
switch(config)# setmib lldpnotificationinterval.0 -i 60 lldpNotificationInterval.
0=60
```

Configuring per-port transmit and receive modes (CLI)

Syntax:

lldp admin-status <*port-list*> {<txonly | rxonly | tx_rx | disable>}

With LLDP enabled on the switch in the default configuration, each port is configured to transmit and receive LLDP packets. These options enable you to control which ports participate in LLDP traffic and whether the participating ports allow LLDP traffic in only one direction or in both directions.

`txonly`	Configures the specified ports to transmit LLDP packets, but block inbound LLDP packets from neighbor devices.
`rxonly`	Configures the specified ports to receive LLDP packets from neighbors, but block outbound packets to neighbors.
`tx_rx`	Configures the specified ports to both transmit and receive LLDP packets. (This is the default setting.)
`disable`	Disables LLDP packet transmit and receive on the specified ports.

Basic LLDP per-port advertisement content

In the default LLDP configuration, outbound advertisements from each port on the switch include both mandatory and optional data.

Mandatory Data

An active LLDP port on the switch always includes the mandatory data in its outbound advertisements. LLDP collects the mandatory data, and, except for the Remote Management Address, you cannot use LLDP commands to configure the actual data.

- Chassis Type (TLV subelement)
- Chassis ID (TLV)
- Port Type (TLV subelement)
- Port ID (TLV)
- Remote Management Address (TLV; actual IP address is a subelement that can be a default address or a configured address)

Configuring a remote management address for outbound LLDP advertisements (CLI)

This is an optional command you can use to include a specific IP address in the outbound LLDP advertisements for specific ports. For more information, see **Basic LLDP per-port advertisement content** on page 209.

Syntax:

[no] lldp config <*port-list*> ipAddrEnable <*ip-address*>

Replaces the default IP address for the port with an IP address you specify. This can be any IP address configured in a static VLAN on the switch, even if the port does not belong to the VLAN configured with the selected IP address.

The `no` form of the command deletes the specified IP address.

If there are no IP addresses configured as management addresses, the IP address selection method returns to the default operation.

Default: The port advertises the IP address of the lowest-numbered VLAN (VID) to which it belongs. If there is no IP address configured on the VLANs to which the port belongs, and if the port is not configured to advertise an IP address from any other (static) VLAN on the switch, the port advertises an address of 127.0.0.1.)

This command does not accept either IP addresses acquired through DHCP or Bootp, or IP addresses that are not configured in a static VLAN on the switch.

Example:

If port 3 belongs to a subnetted VLAN that includes an IP address of 10.10.10.100 and you want port 3 to use this secondary address in LLDP advertisements, you need to execute the following command:

```
switch(config)# lldp config 3 ipAddrEnable 10.10.10.100
```

Syntax:

[no] lldp config <*port-list*> basicTlvEnable <*TLV-Type*>

`port_descr`	For outbound LLDP advertisements, this TLV includes an alphanumeric string describing the port.(Default: Enabled)
`system_name`	For outbound LLDP advertisements, this TLV includes an alphanumeric string showing the assigned name of the system.(Default: Enabled)
`system_descr`	For outbound LLDP advertisements, this TLV includes an alphanumeric string describing the full name and version identification for the hardware type, software version, and networking application of the system.(Default: Enabled)
`system_cap`	For outbound advertisements, this TLV includes a bitmask of supported system capabilities (device functions). Also includes information on whether the capabilities are enabled. (Default: Enabled)

Example:

If you want to exclude the system name TLV from the outbound LLDP advertisements for all ports on a switch, use this command:

```
switch(config)# no lldp config 1-24 basicTlvEnable system_name
```

If you later decide to reinstate the system name TLV on ports 1-5, use this command:

```
switch(config)# lldp config 1-5 basicTlvEnable system_name
```

Optional Data

You can configure an individual port or group of ports to exclude one or more of the following data types from outbound LLDP advertisements.

- Port description (TLV)
- System name (TLV)
- System description (TLV)
- System capabilities (TLV)
  - System capabilities Supported (TLV subelement)
  - System capabilities Enabled (TLV subelement)
- Port speed and duplex (TLV subelement)

Optional data types, when enabled, are populated with data internal to the switch; that is, you cannot use LLDP commands to configure their actual content.

Support for port speed and duplex advertisements

This feature is optional for LLDP operation, but is **required** for LLDP-MED operation.

Port speed and duplex advertisements are supported on the switches to inform an LLDP endpoint and the switch port of each other's port speed and duplex configuration and capabilities. Configuration mismatches between a switch port and an LLDP endpoint can result in excessive collisions and voice quality degradation. LLDP enables discovery of such mismatches by supporting SNMP access to the switch MIB for comparing the current switch port and endpoint settings. (Changing a current device configuration to eliminate a mismatch requires intervention by the system operator.)

An SNMP network management application can be used to compare the port speed and duplex data configured in the switch and advertised by the LLDP endpoint. You can also use the CLI to display this information. For more information on using the CLI to display port speed and duplex information, see**Viewing the current port speed and duplex configuration on a switch port** on page 224.

Configuring support for port speed and duplex advertisements (CLI)

For more information, see **Support for port speed and duplex advertisements** on page 211.

Syntax:

[no] lldp config <*port-list*> dot3TlvEnable macphy_config

Options

`macphy_config`	MAC Physical Config TLV
`poeplus_config`	Power Via MDI Config TLV
`eee_config`	EEE Config TLV

For outbound advertisements, this TLV includes the (local) switch port's current speed and duplex settings, the range of speed and duplex settings the port supports, and the method required for reconfiguring the speed and duplex settings on the device (autonegotiation during link initialization, or manual configuration).

Using SNMP to compare local and remote information can help in locating configuration mismatches.

(Default: Enabled)

For LLDP operation, this TLV is optional. For LLDP-MED operation, this TLV is mandatory.

Port VLAN ID TLV support on LLDP

The `port-vlan-id` option enables advertisement of the port VLAN ID TLV as part of the regularly advertised TLVs. This allows discovery of a mismatch in the configured native VLAN ID between LLDP peers. The information is visible using `show` commands and is logged to the Syslog server.

Configuring the VLAN ID TLV

This TLV advertisement is enabled by default. To enable or disable the TLV, use this command. For more information, see **Port VLAN ID TLV support on LLDP** **Port VLAN ID TLV support on LLDP** on page 211.

Syntax:

[no] lldp config <*port-list*> dot1TlvEnable port-vlan-id

Enables the VLAN ID TLV advertisement.

The `no` form of the command disables the TLV advertisement.

Default: Enabled.

Options

`port-vlan-id`	Specifies the 802.1 TLV list to advertise.
`vlan-name`	Specifies that the VLAN name TLV is to be advertised.

Enabling the VLAN ID TLV

```
HP Switch(config)# lldp config a1 dot1TlvEnable port-vlan-id
```

Viewing the TLVs advertised

The show commands display the configuration of the TLVs. The command `show lldp config` lists the TLVs advertised for each port, as shown in the following examples.

Displaying the TLVs for a port

```
switch(config)# show lldp config a1

 LLDP Port Configuration Detail

  Port   : A1
  AdminStatus [Tx_Rx] : Tx_Rx
  NotificationEnabled [False] : False
  Med Topology Trap Enabled [False] : False

  TLVS Advertised:
  * port_descr
  * system_name
  * system_descr
  * system_cap

  * capabilities
  * network_policy
  * location_id
  * poe

  * macphy_config

  * port_vlan_id [1]

 IpAddress Advertised:
```

```
  :
  :
```

- [1]The VLAN ID TLV is being advertised.

Local device LLDP information

```
switch(config)# show lldp config info local-device a1

 LLDP Port Configuration Information Detail

  Port     : A1
  PortType : local
  PortId   : 1
  PortDesc : A1

  Port VLAN ID : 1 [1]
```

- [1]The information that LLDP used in its advertisement.

Remote device LLDP information

```
switch(config)# show lldp info remote-device a1

LLDP Remote Device Information Detail

  Local Port   : A1
  ChassisType  : mac-address
  ChassisId    : 00 16 35 22 ca 40
  PortType     : local
  PortID       : 1
  SysName      : esp-dback
  System Descr : HP J8693A Switch 3500yl-48G, revision XX.13.03, ROM...
  PortDescr    : A1

  System Capabilities Supported : bridge, router
  System Capabilities Enabled   : bridge, router

  Port VLAN ID : 200

  Remote Management Address
     Type    : ipv4
     Address : 192.168.1.1
```

SNMP support

The LLDP-EXT-DOT1-MIB has the corresponding MIB variables for the Port VLAN ID TLV. The TLV advertisement can be enabled or disabled using the MIB object `lldpXdot1ConfigPortVlanTxEnable` in the `lldpXdot1ConfigPortVlanTable`.

The port VLAN ID TLV local information can be obtained from the MIB object `lldpXdot1LocPortVlanId` in the local information table `lldpXdot1LocTable`.

The port VLAN ID TLV information about all the connected peer devices can be obtained from the MIB object `lldpXdot1RemPortVlanId` in the remote information table `lldpXdot1RemTable`.

LLDP-MED (media-endpoint-discovery)

LLDP-MED (ANSI/TIA-1057/D6) extends the LLDP (IEEE 802.1AB) industry standard to support advanced features on the network edge for Voice Over IP (VoIP) endpoint devices with specialized capabilities and LLDP-MED standards-based functionality. LLDP-MED in the switches uses the standard LLDP commands described

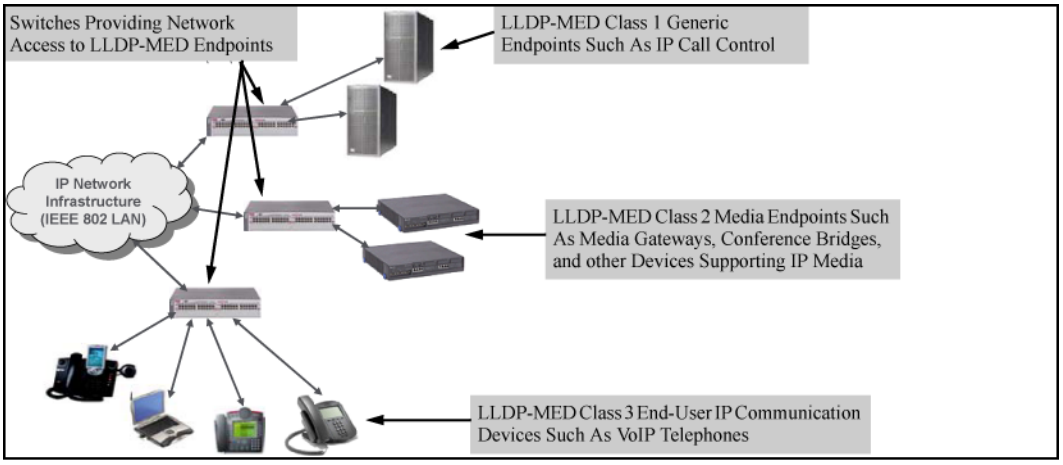
earlier in this section, with some extensions, and also introduces new commands unique to LLDP-MED operation. The `show` commands described elsewhere in this section are applicable to both LLDP and LLDP-MED operation. LLDP-MED benefits include:

- Plug-and-play provisioning for MED-capable, VoIP endpoint devices
- Simplified, vendor-independent management enabling different IP telephony systems to interoperate on one network
- Automatic deployment of convergence network policies (voice VLANs, Layer 2/CoS priority, and Layer 3/QoS priority)
- Configurable endpoint location data to support the Emergency Call Service (ECS) (such as Enhanced 911 service, 999, 112)
- Detailed VoIP endpoint data inventory readable via SNMP from the switch
- Power over Ethernet (PoE) status and troubleshooting support via SNMP
- support for IP telephony network troubleshooting of call quality issues via SNMP

This section describes how to configure and use LLDP-MED features in the switches to support VoIP network edge devices (media endpoint devices) such as:

- IP phones
- Voice/media gateways
- Media servers
- IP communications controllers
- Other VoIP devices or servers

Figure 39: *Example: of LLDP-MED network elements*



LLDP-MED endpoint support

LLDP-MED interoperates with directly connected IP telephony (endpoint) clients having these features and services:

- Autonegotiate speed and duplex configuration with the switch
- Use the following network policy elements configured on the client port
  - Voice VLAN ID
  - 802.1p (Layer 2) QoS
  - Diffserv codepoint (DSCP) (Layer 3) QoS
- Discover and advertise device location data learned from the switch
- Support ECS (such as E911, 999, and 112)
- Advertise device information for the device data inventory collected by the switch, including:

◦ Hardware revision ◦ Firmware revision	◦ Software revision ◦ Serial number	◦ Manufacturer name ◦ Model name	◦ Asset ID

- Provide information on network connectivity capabilities (For example, a multi-port VoIP phone with Layer 2 switch capability)
- Support the fast-start capability

LLDP-MED is intended for use with VoIP endpoints and is not designed to support links between network infrastructure devices, such as switch-to-switch or switch-to-router links.

LLDP-MED endpoint device classes

LLDP-MED endpoint devices are, by definition, located at the network edge and communicate using the LLDP-MED framework. Any LLDP-MED endpoint device belongs to one of the following three classes:

- Class 1 (generic endpoint devices): These devices offer the basic LLDP discovery services, network policy advertisement (VLAN ID, Layer 2/802.1p priority, and Layer 3/DSCP priority), and PoE management. This class includes such devices as IP call controllers and communication-related servers.
- Class 2 (media endpoint devices): These devices offer all Class 1 features plus media-streaming capability, and include such devices as voice/media gateways, conference bridges, and media servers.
- Class 3 (communication devices): These devices are typically IP phones or end-user devices that otherwise support IP media and offer all Class 1 and Class 2 features, plus location identification and emergency 911 capability, Layer 2 switch support, and device information management.

LLDP-MED operational support

The switches offer two configurable TLVs supporting MED-specific capabilities:

- medTlvEnable (for per-port enabling or disabling of LLDP-MED operation)
- medPortLocation (for configuring per-port location or emergency call data)

LLDP-MED operation also requires the port speed and duplex TLV (dot3TlvEnable), which is enabled in the default configuration.

Topology change notifications provide one method for monitoring system activity. However, because SNMP normally employs UDP, which does not guarantee datagram delivery, topology change notification should not be relied upon as the sole method for monitoring critical endpoint device connectivity.

LLDP-MED fast start control

Syntax:

lldp fast-start-count <1-10>

An LLDP-MED device connecting to a switch port may use the data contained in the MED TLVs from the switch to configure itself. However, the `lldp refresh-interval` setting (default: 30 seconds) for transmitting advertisements can cause an unacceptable delay in MED device configuration.

To support rapid LLDP-MED device configuration, the `lldp fast-start-count` command temporarily overrides the `refresh-interval` setting for the `fast-start-count` advertisement interval. This results in the port initially advertising LLDP-MED at a faster rate for a limited time. Thus, when the switch detects a new LLDP-MED device on a port, it transmits one LLDP-MED advertisement per second out the port for the duration of the `fast-start-count` interval. In most cases, the default setting should provide an adequate `fast-start-count` interval.

(Default: 5 seconds)

NOTE

This global command applies only to ports on which a new LLDP-MED device is detected. It does not override the `refresh-interval` setting on ports where non-MED devices are detected.

Advertising device capability, network policy, PoE status and location data

The medTlvEnable option on the switch is enabled in the default configuration and supports the following LLDP-MED TLVs:

- LLDP-MED capabilities: This TLV enables the switch to determine:
  - Whether a connected endpoint device supports LLDP-MED
  - Which specific LLDP-MED TLVs the endpoint supports
  - The device class (1, 2, or 3) for the connected endpoint

  This TLV also enables an LLDP-MED endpoint to discover what LLDP-MED TLVs the switch port currently supports.
- Network policy operating on the port to which the endpoint is connected (VLAN, Layer 2 QoS, Layer 3 QoS)
- PoE (MED Power-over-Ethernet)
- Physical location data (see **Configuring location data for LLDP-MED devices** on page 219)

NOTE

LLDP-MED operation requires the macphy_config TLV subelement (enabled by default) that is optional for IEEE 802.1AB LLDP operation. For more information, see the `dot3TlvEnable macphy_config` command (**Configuring support for port speed and duplex advertisements (CLI)** on page 211).

Network policy advertisements

Network policy advertisements are intended for real-time voice and video applications, and include these TLV subelements:

- Layer 2 (802.1p) QoS
- Layer 3 DSCP (diffserv code point) QoS
- Voice VLAN ID (VID)

VLAN operating rules

These rules affect advertisements of VLANs in network policy TLVs:

- The VLAN ID TLV subelement applies only to a VLAN configured for voice operation (`vlan <vid> voice`).
- If there are multiple voice VLANs configured on a port, LLDP-MED advertises the voice VLAN having the lowest VID.
- The voice VLAN port membership configured on the switch can be tagged or untagged. However, if the LLDP-MED endpoint expects a tagged membership when the switch port is configured for untagged, or the reverse, a configuration mismatch results. (Typically, the endpoint expects the switch port to have a tagged voice VLAN membership.)
- If a given port does not belong to a voice VLAN, the switch does not advertise the VLAN ID TLV through this port.

Policy elements

These policy elements may be statically configured on the switch or dynamically imposed during an authenticated session on the switch using a RADIUS server and 802.1X or MAC authentication. (Web authentication does not apply to VoIP telephones and other telecommunications devices that are not capable of accessing the switch through a Web browser.) The QoS and voice VLAN policy elements can be statically configured with the following CLI commands:

`vlan <vid> voice`

```
vlan <vid> {<tagged | untagged> <port-list>}
int <port-list> qos priority <0-7>
vlan <vid> qos dscp <codepoint>
```

NOTE

A codepoint must have an 802.1p priority before you can configure it for use in prioritizing packets by VLAN-ID. If a codepoint you want to use shows `No Override` in the `Priority` column of the DSCP policy table (display with `show qos-dscp map`, then use `qos-dscp map <codepoint> priority <0-7>` to configure a priority before proceeding. For more information on this topic, see the "Quality of Service (QoS): Managing Bandwidth More Effectively" in the advanced traffic management guide for your switch.

Enabling or Disabling medTlvEnable

In the default LLDP-MED configuration, the TLVs controlled by medTlvEnable are enabled. For more information, see **Advertising device capability, network policy, PoE status and location data** on page 216.

Syntax:

[no] lldp config <*port-list*> medTlvEnable <*medTlv*>

Enables or disables advertisement of the following TLVs on the specified ports:

- Device capability TLV
- Configured network policy TLV
- Configured location data TLV (see **Configuring location data for LLDP-MED devices** on page 219.)
- Current PoE status TLV

(Default: All of the above TLVs are enabled.)

Helps to locate configuration mismatches by allowing use of an SNMP application to compare the LLDP-MED configuration on a port with the LLDP-MED TLVs advertised by a neighbor connected to that port.

`capabilities`	This TLV enables the switch to determine: • Which LLDP-MED TLVs a connected endpoint can discover • The device class (1, 2, or 3) for the connected endpoint This TLV also enables an LLDP-MED endpoint to discover what LLDP-MED TLVs the switch port currently supports.(Default: enabled) This TLV cannot be disabled unless the `network_policy`, `poe`, and `location_id` TLVs are already disabled.
`network_policy`	This TLV enables the switch port to advertise its configured network policies (voice VLAN, Layer 2 QoS, Layer 3 QoS), and allows LLDP-MED endpoint devices to autoconfigure the voice network policy advertised by the switch. This also enables the use of SNMP applications to troubleshoot statically configured endpoint network policy mismatches.(Default: Enabled) Network policy is advertised only for ports that are configured as members of the voice VLAN. If the port belongs to more than one voice VLAN, the voice VLAN with the lowest-numbered VID is selected as the VLAN for voice traffic. Also, this TLV cannot be enabled unless the `capability` TLV is already enabled. For more information, see **Network policy advertisements** on page 216.

Table Continued

`location_id`	This TLV enables the switch port to advertise its configured location data (if any). For more information on configuring location data, see **Configuring location data for LLDP-MED devices** on page 219.(Default: Enabled) When disabled, this TLV cannot be enabled unless the capability TLV is already enabled.
`poe`	This TLV enables the switch port to advertise its current PoE state and to read the PoE requirements advertised by the LLDP-MED endpoint device connected to the port.(Default: Enabled) When disabled, this TLV cannot be enabled unless the `capability` TLV is already enabled. For more on this topic, see **PoE advertisements** on page 218.

PoE advertisements

These advertisements inform an LLDP-MED endpoint of the power (PoE) configuration on switch ports. Similar advertisements from an LLDP-MED endpoint inform the switch of the endpoint's power needs and provide information that can be used to identify power priority mismatches.

PoE TLVs include the following power data:

- **Power type**: indicates whether the device is a power-sourcing entity (PSE) or a PD. Ports on the J8702A PoE zl module are PSE devices. A MED-capable VoIP telephone is a PD.
- **Power source**: indicates the source of power in use by the device. Power sources for PDs include PSE, local (internal), and PSE/local. The switches advertise Unknown.
- **Power priority**: indicates the power priority configured on the switch (PSE) port or the power priority configured on the MED-capable endpoint.
- **Power value**: indicates the total power in watts that a switch port (PSE) can deliver at a particular time, or the total power in watts that the MED endpoint (PD) requires to operate.

Viewing PoE advertisements

To display the current power data for an LLDP-MED device connected to a port, use the following command:

```
show lldp info remote-device <port-list>
```

For more information on this command, see page A-60.

To display the current PoE configuration on the switch, use the following commands:

```
show power brief <port-list>
```

```
show power <port-list>
```

For more information on PoE configuration and operation, see **Power Over Ethernet (PoE/PoE+) Operation**.

Location data for LLDP-MED devices

You can configure a switch port to advertise location data for the switch itself, the physical wall-jack location of the endpoint (recommended), or the location of a DHCP server supporting the switch, endpoint, or both. You also have the option of configuring these different address types:

- **Civic address**: physical address data such as city, street number, and building information
- **ELIN (Emergency Location Identification Number)**: an emergency number typically assigned to MLTS (Multiline Telephone System) Operators in North America
- **Coordinate-based location**: attitude, longitude, and altitude information (Requires configuration via an SNMP application.)

Configuring location data for LLDP-MED devices

Syntax:

[no] lldp config <*port-list*> medPortLocation <*Address-Type*>

Configures location of emergency call data the switch advertises per port in the `location_id` TLV. This TLV is for use by LLDP-MED endpoints employing location-based applications.

The switch allows one medPortLocation entry per port (without regard to type). Configuring a new medPortLocation entry of any type on a port replaces any previously configured entry on that port.

civic-addr <*COUNTRY-STR*> <*WHAT*> <*CA-TYPE*> <*CA-VALUE*> … [< *CA-TYPE* > < *CA-VALUE* >] … [< *CA-TYPE* > < *CA-VALUE* >]

Enables configuration of a physical address on a switch port and allows up to 75 characters of address information.

`COUNTRY-STR`	A two-character country code, as defined by ISO 3166. Some examples include `FR` (France), `DE` (Germany), and `IN` (India). This field is required in a `civic-addr` command. (For a complete list of country codes, visit **http://www.iso.org**.)
`WHAT`	A single-digit number specifying the type of device to which the location data applies: **0**: Location of DHCP server **1**: Location of switch **2**: Location of LLDP-MED endpoint (recommended application) This field is required in a `civic-addr` command.

Table Continued

`Type/Value Pairs (CA-TYPE and CA-VALUE)`	A series of data pairs, each composed of a location data "type" specifier and the corresponding location data for that type. That is, the first value in a pair is expected to be the civic address "type" number (`CA-TYPE`), and the second value in a pair is expected to be the corresponding civic address data (`CA-VALUE`). For example, if the `CA-TYPE` for "city name" is "3," the type/value pair to define the city of Paris is "3 Paris." Multiple type/value pairs can be entered in any order, although Hewlett Packard Enterprise recommends that multiple pairs be entered in ascending order of the `CA-TYPE`. When an emergency call is placed from a properly configured class 3 endpoint device to an appropriate PSAP, the country code, device type, and type/value pairs configured on the switch port are included in the transmission. The "type" specifiers are used by the PSAP to identify and organize the location data components in an understandable format for response personnel to interpret. A `civic-addr` command requires a minimum of one type/value pair, but typically includes multiple type/value pairs as needed to configure a complete set of data describing a given location. `CA-TYPE`: This is the first entry in a type/value pair and is a number defining the type of data contained in the second entry in the type/value pair (`CA-VALUE`). Some examples of `CA-TYPE` specifiers include: • 3=city • 6=street (name) • 25=building name (Range: 0 - 255)For a sample listing of `CA-TYPE` specifiers, see **Some location codes used in CA-TYPE fields**. `CA-VALUE`: This is the second entry in a type/value pair and is an alphanumeric string containing the location information corresponding to the immediately preceding `CA-TYPE` entry. Strings are delimited by either blank spaces, single quotes (' … '), or double quotes ("… "). Each string should represent a specific data type in a set of unique type/value pairs comprising the description of a location, and each string must be preceded by a `CA-TYPE` number identifying the type of data in the string. A switch port allows one instance of any given `CA-TYPE`. For example, if a type/value pair of 6 Atlantic (to

Table Continued

	specify "Atlantic" as a street name) is configured on port A5 and later another type/value pair of 6 Pacific is configured on the same port, Pacific replaces Atlantic in the civic address location configured for port A5.
`elin-addr <emergency-number>`	This feature is intended for use in ECS applications to support class 3 LLDP-MED VoIP telephones connected to a switch in an MLTS infrastructure. An ELIN is a valid NANP format telephone number assigned to MLTS operators in North America by the appropriate authority. The ELIN is used to route emergency (E911) calls to a PSAP. (Range: 1-15 numeric characters)

Configuring coordinate-based locations

Latitude, longitude, and altitude data can be configured per switch port using an SNMP management application. For more information, see the documentation provided with the application. A further source of information on this topic is RFC 3825-Dynamic host configuration protocol option for coordinate-based location configuration information.

Endpoint use of data from a medPortLocation TLV sent by the switch is device-dependent. See the documentation provided with the endpoint device.

Table 20: *Some location codes used in CA-TYPE fields*

Location element	Code[1]	Location element	Code
national subdivision	1	street number	19
regional subdivision	2	additional location data	22
city or township	3	unit or apartment	26
city subdivision	4	floor	27
street	6	room number	28
street suffix	18		

[1] *The code assignments in this table are examples from a work-in-progress (the internet draft titled "Dynamic Host Configuration Protocol (DHCPv4 and DHCPv6) Option for Civic Addresses Configuration Information draft-ietf-geopriv-dhcp-civil-06" dated May 30, 2005.) For the actual codes to use, contact the PSAP or other authority responsible for specifying the civic addressing data standard for your network.*

Example:

Suppose a system operator wants to configure the following information as the civic address for a telephone connected to her company's network through port A2 of a switch at the following location:

CA-type	CA-type	CA-VALUE
national subdivision	1	CA

Table Continued

city	3	Widgitville
street	6	Main
street number	19	1433
unit	26	Suite 4-N
floor	27	4
room number	28	N4-3

The following example shows the commands for configuring and displaying the above data.

A civic address configuration

```
switch(config)# lldp config 2 medportlocation civic-addr US 2 1 CA 3
Widgitville 6 Main 19 1433 26 Suite_4—N 27 4 28 N4—3

switch(config)# show lldp config 2
 LLDP Port Configuration Detail
  Port : A2
  AdminStatus [Tx_Rx] : Tx_Rx
  NotificationEnabled [False] : False
  Med Topology Trap Enabled [False] : False
  Country Name          : US
  What                  : 2
  Ca-Type               : 1
  Ca-Length             : 2
  Ca-Value              : CA
  Ca-Type               : 3
  Ca-Length             : 11
  Ca-Value              : Widgitville
  Ca-Type               : 6
  Ca-Length             : 4
  Ca-Value              : Main
  Ca-Type               : 19
  Ca-Length             : 4
  Ca-Value              : 1433
  Ca-Type               : 26
  Ca-Length             : 9
  Ca-Value              : Suite_4-N
  Ca-Type               : 27
  Ca-Length             : 1
  Ca-Value              : 4
  Ca-Type               : 28
  Ca-Length             : 4
  Ca-Value              : N4-3
```

Viewing switch information available for outbound advertisements

Syntax:

show lldp info local-device [*port-list*]

Without the `[port-list]` option, displays the global switch information and the per-port information currently available for populating outbound LLDP advertisements.

With the `[port-list]` option, displays only the following port-specific information that is currently available for outbound LLDP advertisements on the specified ports:

- `PortType`
- `PortId`
- `PortDesc`

This command displays the information available on the switch. Use the `lldp config <port-list>` command to change the selection of information that is included in actual outbound advertisements. In the default LLDP configuration, all information displayed by this command is transmitted in outbound advertisements.

In the default configuration, the switch information currently available for outbound LLDP advertisements appears similar to the display in the following example.

Displaying the global and per-port information available for outbound advertisements

```
switch(config)# show lldp info local-device

 LLDP Local Device Information

  Chassis Type : mac-address
  Chassis Id : 00 23 47 4b 68 DD
  System Name : HP Switch1
  System Description : HP J9091A Switch 3500yl, revision XX.15.06...
  System Capabilities Supported:bridge
  System Capabilities Enabled:bridge

  Management Address [1]
     Type:ipv4
     Address:

  LLDP Port Information

   Port   | PortType  PortId  PortDesc
   ------ + --------- ------- ---------
   1      | local     1       1
   2      | local     2       2
   3      | local     3       3
   4      | local     4       4
   5      | local     5       5
```

- [1]

  The Management Address field displays only the LLDP-configurable IP addresses on the switch. (Only manually-configured IP addresses are LLDP-configurable.) If the switch has only an IP address from a DHCP or Bootp server, then the Management Address field is empty (because there are no LLDP-configurable IP addresses available.

The default per-port information content for ports 1 and 2

```
switch(config)# show lldp info local 1-2

  LLDP Local Port Information Detail

   Port     : 1
   PortType : local
   PortId   : 1
   PortDesc : 1
```

```
---------------------------------------
   Port     : 2
   PortType : local
   PortId   : 2
   PortDesc : 2
```

Displaying the current port speed and duplex configuration on a switch port

You can compare port speed and duplex information for a switch port and a connected LLDP-MED endpoint for configuration mismatches by using an SNMP application. You can also use the switch CLI to display this information, if necessary. The `show interfaces brief <port-list>` and `show lldp info remote-device [port-list]` (**Remote power information** on page 109) commands provide methods for displaying speed and duplex information for switch ports. For information on displaying the currently configured port speed and duplex on an LLDP-MED endpoint, see **Viewing the current port speed and duplex configuration on a switch port** on page 224.

Viewing the current port speed and duplex configuration on a switch port

Syntax:

show interfaces brief <*port-list*>

Includes port speed and duplex configuration in the `Mode` column of the resulting display.

Viewing advertisements currently in the neighbors MIB

Syntax:

show lldp info remote-device [*port-list*]

Without the `[port-list]` option, provides a global list of the individual devices it has detected by reading LLDP advertisements. Discovered devices are listed by the inbound port on which they were discovered.

Multiple devices listed for a single port indicates that such devices are connected to the switch through a hub.

Discovering the same device on multiple ports indicates that the remote device may be connected to the switch in one of the following ways:

- Through different VLANS using separate links. (This applies to switches that use the same MAC address for all configured VLANs.)
- Through different links in the same trunk.
- Through different links using the same VLAN. (In this case, spanning-tree should be invoked to prevent a network topology loop. Note that LLDP packets travel on links that spanning-tree blocks for other traffic types.)

With the `[port-list]` option, provides a listing of the LLDP data that the switch has detected in advertisements received on the specified ports.

For descriptions of the various types of information displayed by these commands, see **Data available for basic LLDP advertisements**.

A global listing of discovered devices

```
switch(config)# show lldp info remote

 LLDP Remote Devices Information

  LocalPort | ChassisId                 PortId PortDescr SysName
  --------- + ------------------------- ------ --------- -------------
```

```
  1          | 00 11 85 35 3b 80          6       6          HP Switch
  2          | 00 11 85 cf 66 60          8       8          HP Switch
```

An LLLDP-MED listing of an advertisement received from an LLDP-MED (VoIP telephone) source

```
switch(config)# show lldp info remote-device 1

 LLDP Remote Device Information Detail

  Local Port   : A2
  ChassisType  : network-address
  ChassisId    : 0f ff 7a 5c
  PortType     : mac-address
  PortId       : 08 00 0f 14 de f2
  SysName      : HP Switch
  System Descr : HP Switch, revision xx.15.06.0000x
  PortDescr    : LAN Port

  System Capabilities Supported : bridge, telephone
  System Capabilities Enabled   : bridge, telephone

  Remote Management Address

  MED Information Detail [1]
    EndpointClass           :Class3
    Media Policy Vlan id    :10
    Media Policy Priority   :7
    Media Policy Dscp       :44
    Media Policy Tagged     :False
    Poe Device Type         :PD
    Power Requested         :47
    Power Source            :Unknown
    Power Priority          :High
```

- [1]Indicates the policy configured on the telephone. A configuration mismatch occurs if the supporting port is configured differently.

Displaying LLDP statistics

LLDP statistics are available on both a global and a per-port levels. Rebooting the switch resets the LLDP statistics counters to zero. Disabling the transmit and/or receive capability on a port "freezes" the related port counters at their current values.

Viewing LLDP statistics

For more information, see **Displaying LLDP statistics** on page 225.

Syntax:

show lldp stats [*port-list*]

The **global LLDP** statistics command displays an overview of neighbor detection activity on the switch, plus data on the number of frames sent, received, and discarded per-port.

The **per-port LLDP** statistics command enhances the list of per-port statistics provided by the global statistics command with some additional per-port LLDP statistics.

Global LLDP Counters:

`Neighbor Entries List Last Updated`	The elapsed time since a neighbor was last added or deleted.
`New Neighbor Entries Count`	The total of new LLDP neighbors detected since the last switch reboot. Disconnecting, and then reconnecting a neighbor increments this counter.
`Neighbor Entries Deleted Count`	The number of neighbor deletions from the MIB for AgeOut Count and forced drops for all ports.For example, if the admin status for port on a neighbor device changes from `tx_rx` or `txonly` to `disabled` or `rxonly`, the neighbor device sends a "shutdown" packet out the port and ceases transmitting LLDP frames out that port.The device receiving the shutdown packet deletes all information about the neighbor received on the applicable inbound port and increments the counter.
`Neighbor Entries Dropped Count`	The number of valid LLDP neighbors the switch detected, but could not add.This can occur, For example, when a new neighbor is detected when the switch is already supporting the maximum number of neighbors. See **Neighbor maximum** on page 227.
`Neighbor Entries AgeOut Count`	The number of LLDP neighbors dropped on all ports because of Time-to-Live expiring.

Per-Port LLDP Counters:

`NumFramesRecvd`	The total number of valid, inbound LLDP advertisements received from any neighbors on *`port-list`* .Where multiple neighbors are connected to a port through a hub, this value is the total number of LLDP advertisements received from all sources.
`NumFramesSent`	The total number of LLDP advertisements sent from *port-list*.
`NumFramesDiscarded`	The total number of inbound LLDP advertisements discarded by *port-list*.This can occur, For example, when a new neighbor is detected on the port, but the switch is already supporting the maximum number of neighbors. See **Neighbor maximum** on page 227. This can also be an indication of advertisement formatting problems in the neighbor device.
`Frames Invalid`	The total number of invalid LLDP advertisements received on the port.An invalid advertisement can be caused by header formatting problems in the neighbor device.
`TLVs Unrecognized`	The total number of LLDP TLVs received on a port with a type value in the reserved range.This can be caused by a basic management TLV from a later LLDP version than the one currently running on the switch.
`TLVs Discarded`	The total number of LLDP TLVs discarded for any reason. In this case, the advertisement carrying the TLV may be accepted, but the individual TLV is not usable.
`Neighbor Ageouts`	The number of LLDP neighbors dropped on the port because of Time-to-Live expiring.

Examples:

A global LLDP statistics display

```
switch(config)# show lldp stats

 LLDP Device Statistics

  Neighbor Entries List Last Updated : 2 hours
  New Neighbor Entries Count : 20
  Neighbor Entries Deleted Count : 20
  Neighbor Entries Dropped Count : 0
  Neighbor Entries AgeOut Count : 20

 LLDP Port Statistics

  Port   | NumFramesRecvd NumFramesSent NumFramesDiscarded
  ------ + -------------- ------------- ------------------
  A1     | 97317          97843         0
  A2     | 21             12            0
  A3     | 0              0             0
  A4     | 446            252           0
  A5     | 0              0             0
  A6     | 0              0             0
  A7     | 0              0             0
  A8     | 0              0             0
```

A per-port LLDP statistics display

```
switch(config)# show lldp stats 1

 LLDP Port Statistics Detail

  PortName : 1
  Frames Discarded  : 0
  Frames Invalid    : 0
  Frames Received   : 7309
  Frames Sent       : 7231
  TLVs Unrecognized : 0
  TLVs Discarded    : 0
  Neighbor Ageouts  : 0
```

LLDP Operating Notes

Neighbor maximum

The neighbors table in the switch supports as many neighbors as there are ports on the switch. The switch can support multiple neighbors connected through a hub on a given port, but if the switch neighbor maximum is reached, advertisements from additional neighbors on the same or other ports will not be stored in the neighbors table unless some existing neighbors time-out or are removed.

LLDP packet forwarding

An 802.1D-compliant switch does not forward LLDP packets, regardless of whether LLDP is globally enabled or disabled on the switch.

One IP address advertisement per port

LLDP advertises only one IP address per port, even if multiple IP addresses are configured by `lldp config` *`port-list`* `ipAddrEnable` on a given port.

802.1Q VLAN Information

LLDP packets do not include 802.1Q header information and are always handled as untagged packets.

Effect of 802.1X Operation

If 802.1X port security is enabled on a port, and a connected device is not authorized, LLDP packets are not transmitted or received on that port. Any neighbor data stored in the neighbor MIB for that port prior to the unauthorized device connection remains in the MIB until it ages out. If an unauthorized device later becomes authorized, LLDP transmit and receive operation resumes.

Neighbor data can remain in the neighbor database after the neighbor is disconnected

After disconnecting a neighbor LLDP device from the switch, the neighbor can continue to appear in the switch's neighbor database for an extended period if the neighbor's `holdtime-multiplier` is high; especially if the `refresh-interval` is large. See **Changing the time-to-live for transmitted advertisements (CLI)** on page 206.

Mandatory TLVs

All mandatory TLVs required for LLDP operation are also mandatory for LLDP-MED operation.

LLDP and CDP data management

This section describes points to note regarding LLDP and CDP (Cisco Discovery Protocol) data received by the switch from other devices. LLDP operation includes both transmitting LLDP packets to neighbor devices and reading LLDP packets received from neighbor devices. CDP operation is limited to reading incoming CDP packets from neighbor devices. (HPE switches do not generate CDP packets.)

Incoming CDP and LLDP packets tagged for VLAN 1 are processed even if VLAN 1 does not contain any ports. VLAN 1 must be present, but it is typically present as the default VLAN for the switch.

The switch may pick up CDP and LLDP multicast packets from VLAN 1 even when CDP- and /or LLDP-enabled ports are not members of VLAN 1.

LLDP and CDP neighbor data

With both LLDP and (read-only) CDP enabled on a switch port, the port can read both LLDP and CDP advertisements, and stores the data from both types of advertisements in its neighbor database. (The switch **stores** only CDP data that has a corresponding field in the LLDP neighbor database.) The neighbor database itself can be read by either LLDP or CDP methods or by using the `show lldp` commands. Take note of the following rules and conditions:

- If the switch receives both LLDP and CDP advertisements on the same port from the same neighbor, the switch stores this information as two separate entries if the advertisements have different chassis ID and port ID information.
- If the chassis and port ID information are the same, the switch stores this information as a single entry. That is, LLDP data overwrites the corresponding CDP data in the neighbor database if the chassis and port ID information in the LLDP and CDP advertisements received from the same device is the same.
- Data read from a CDP packet does not support some LLDP fields, such as "System Descr," "SystemCapSupported," and "ChassisType." For such fields, LLDP assigns relevant default values. Also:
  - The LLDP "System Descr" field maps to CDP's "Version" and "Platform" fields.
  - The switch assigns "ChassisType" and "PortType" fields as "local" for both the LLDP and the CDP advertisements it receives.
  - Both LLDP and CDP support the "System Capability" TLV. However, LLDP differentiates between what a device is capable of supporting and what it is actually supporting, and separates the two types of information into subelements of the System Capability TLV. CDP has only a single field for this data. Thus,

when CDP System Capability data is mapped to LLDP, the same value appears in both LLDP System Capability fields.

- System Name and Port Descr are not communicated by CDP, and thus are not included in the switch's Neighbors database.

NOTE

Because HPE switches do not generate CDP packets, they are not represented in the CDP data collected by any neighbor devices running CDP.

A switch with CDP disabled forwards the CDP packets it receives from other devices, but does not store the CDP information from these packets in its own MIB.

LLDP data transmission/collection and CDP data collection are both enabled in the switch's default configuration. In this state, an SNMP network management application designed to discover devices running either CDP or LLDP can retrieve neighbor information from the switch regardless of whether LLDP or CDP is used to collect the device-specific information.

Protocol state	Packet generation	Inbound data management	Inbound packet forwarding
CDP Enabled[1]	N/A	Store inbound CDP data.	No forwarding of inbound CDP packets.
CDP Disabled	N/A	No storage of CDP data from neighbor devices.	Floods inbound CDP packets from connected devices to outbound ports.
LLDP Enabled[1]	Generates and transmits LLDP packets out all ports on the switch.	Store inbound LLDP data.	No forwarding of inbound LLDP packets.
LLDP Disabled	No packet generation.	No storage of LLDP data from neighbor devices.	No forwarding of inbound LLDP packets.

[1] Both CDP data collection and LLDP transmit/receive are enabled in the default configuration. If a switch receives CDP packets and LLDP packets from the same neighbor device on the same port, it stores and displays the two types of information separately if the chassis and port ID information in the two types of advertisements is different. In this case, if you want to use only one type of data from a neighbor sending both types, disable the unwanted protocol on either the neighbor device or on the switch. However, if the chassis and port ID information in the two types of advertisements is the same, the LLDP information overwrites the CDP data for the same neighbor device on the same port.

CDP operation and commands

By default the switches have CDP enabled on each port. This is a read-only capability, meaning that the switch can receive and store information about adjacent CDP devices but does not generate CDP packets.

When a CDP-enabled switch receives a CDP packet from another CDP device, it enters that device's data in the CDP Neighbors table, along with the port number where the data was received—and does not forward the packet. The switch also periodically purges the table of any entries that have expired. (The hold time for any data entry in the switch's CDP Neighbors table is configured in the device transmitting the CDP packet and cannot be controlled in the switch receiving the packet.) A switch reviews the list of CDP neighbor entries every three seconds and purges any expired entries.

NOTE

For details on how to use an SNMP utility to retrieve information from the switch's CDP Neighbors table maintained in the switch's MIB, see the documentation provided with the particular SNMP utility.

Viewing the current CDP configuration of the switch

CDP is shown as enabled/disabled both globally on the switch and on a per-port basis.

Syntax:

show cdp

Lists the global and per-port CDP configuration of the switch.

The following example shows the default CDP configuration.

Default CDP configuration

```
switch(config)# show cdp

 Global CDP information

  Enable CDP [Yes] : Yes (Receive Only)


  Port CDP
  ---- --------
  1    enabled
  2    enabled
  3    enabled
  .      .
  .      .
  .      .
```

Viewing the current CDP neighbors table of the switch

Devices are listed by the port on which they were detected.

Syntax:

show cdp neighbors

Lists the neighboring CDP devices the switch detects, with a subset of the information collected from the device's CDP packet.

[[e] port-numb [detail]]	Lists the CDP device connected to the specified port. (Allows only one port at a time.)Using `detail` provides a longer list of details on the CDP device the switch detects on the specified port.
[detail [[e] port-numb]]	Provides a list of the details for all of the CDP devices the switch detects.Using `port-num` produces a list of details for the selected port.

The following example displays the CDP devices that the switch has detected by receiving their CDP packets.

CDP neighbors table listing

```
switch(config)# show cdp neighbors

 CDP neighbors information
```

```
Port Device ID                    | Platform                    Capability
---- ---------------------------- + --------------------------- -----------
1    Accounting (0030c1-7fcc40)   | J4812A HP Switch. . .       S
2    Resear¢1-1 (0060b0-889e43)   | J4121A HP Switch. . .       S
4    Support (0060b0_761a45)      | J4121A HP Switch. . .       S
7    Marketing (0030c5_33dc59)    | J4313A HP Switch. . .       S
12   Mgmt NIC(099a05-09df9b       | NIC Model X666              H
12   Mgmt NIC(099a05-09df11       | NIC Model X666              H
```

Enabling and Disabling CDP Operation

Enabling CDP operation (the default) on the switch causes the switch to add entries to its CDP Neighbors table for any CDP packets it receives from other neighboring CDP devices.

Disabling CDP operation clears the switch's CDP Neighbors table and causes the switch to drop inbound CDP packets from other devices without entering the data in the CDP Neighbors table.

Syntax:

[no] cdp run

Enables or disables CDP read-only operation on the switch.

(Default: Enabled)

Example:

To disable CDP read-only on the switch:

switch(config)# no cdp run

When CDP is disabled:

- `show cdp neighbors`

  displays an empty CDP Neighbors table
- `show cdp`

  displaysGlobal CDP informationEnable CDP [Yes]: No

Enabling or disabling CDP operation on individual ports

In the factory-default configuration, the switch has all ports enabled to receive CDP packets. Disabling CDP on a port causes it to drop inbound CDP packets without recording their data in the CDP Neighbors table.

Syntax:

[no] cdp enable {< [e] *port-list* >}

Example:

To disable CDP on port A1:

```
switch(config)# no cdp enable a1
```

Configuring CDPv2 for voice transmission

Legacy Cisco VOIP phones only support manual configuration or using CDPv2 for voice VLAN auto-configuration. LLDP-MED is not supported. CDPv2 exchanges information such as software version, device capabilities, and voice VLAN information between directly connected devices such as a VOIP phone and a switch.

When the Cisco VOIP phone boots up (or sometimes periodically), it queries the switch and advertises information about itself using CDPv2. The switch receives the VOIP VLAN Query TLV (type 0x0f) from the phone and then immediately sends the voice VLAN ID in a reply packet to the phone using the VLAN Reply TLV (type 0x0e). The phone then begins tagging all packets with the advertised voice VLAN ID.

A voice VLAN must be configured before the voice VLAN can be advertised. For example, to configure VLAN 10 as a voice VLAN tagged for ports 1 through 10, enter these commands:

```
switch(config)# vlan 10
switch(vlan-10)# tagged 1-10
switch(vlan-10)# voice
switch(vlan-10)# exit
```

The switch CDP packet includes these TLVs:

- CDP Version: 2
- CDP TTL: 180 seconds
- Checksum
- Capabilities (type 0x04): 0x0008 (is a switch)
- Native VLAN: The PVID of the port
- VOIP VLAN Reply (type 0xe): voice VLAN ID (same as advertised by LLDPMED)
- Trust Bitmap (type 0x12): 0x00
- Untrusted port COS (type 0x13): 0x00

CDP should be enabled and running on the interfaces to which the phones are connected. Use the `cdp enable` and `cdp run` commands.

The `pre-standard-voice` option for the `cdp mode` command allows the configuration of CDP mode so that it responds to received CDP queries from a VoIP phone.

Syntax:

[no] cdp mode pre-standard-voice [admin-status < *port-list* > [tx_rx | rxonly]]

Enable CDP-compatible voice VLAN discovery with pre-standard VoIP phones. In this mode, when a CDP VoIP VLAN query is received on a port from pre-standard phones, the switch replies back with a CDP packet that contains the VID of the voice VLAN associated with that port.

Not recommended for phones that support LLDP-MED.

pre-standard-voice	Enables CDP-compatible voice VLAN discovery with pre-standard VoIP phones.
admin-status	Sets the port in either transmit and receive mode, or receive mode only.Default: tx-rx. **<port-list>** Sets this port in transmit and receive mode, or receive mode only. **rxonly** Enable receive-only mode of CDP processing. **tx_rx** Enable transmit and receive mode.

```
switch(config)# cdp mode pre-standard-voice admin-status A5 rxonly
```

The `show cdp` output when `CDP Run` is disabled

```
switch(config)# show cdp
Global CDP information
Enable CDP [yes] : no
```

The `show cdp` output when `cdp run` and `sdp mode` are enabled

```
switch(config)# show cdp

 Global CDP Information

  Enable CDP [Yes]  : Yes
  CDP mode [rxonly] : pre-standard-voice
  CDP Hold Time [180] : 180
  CDP Transmit Interval [60] : 60

  Port CDP       admin-status
  ---- --------- ------------
  A1   enabled   rxonly
  A2   enabled   tx_rx
  A3   enabled   tx_rx
```

When CDP mode is not `pre-standard voice`, the admin-status column is note displayed.

The `show cdp` output when `cdp run` and `cdp mode rxonly` are enabled

```
switch(config)# show cdp

 Global CDP Information

  Enable CDP [Yes} : Yes
  CDP mode [rxonly] : rxonly

  Port CDP
  ---- --------
  A1   enabled
  A2   enabled
  A3   enabled
```

The `show running-config` when admin-status is configured

```
switch(config)# show running-config

Running configuration:

; J9477A Configuration Editor; Created on release #XX.16.09.0000x
; Ver #03:01:1f:ef:f2
hostname "HPSwitch"
module 1 type J9307A
cdp mode pre-standard-voice admin-status A5 RxOnly
```

Filtering CDP information

In some environments it is desirable to be able to configure a switch to handle CDP packets by filtering out the MAC address learns from untagged VLAN traffic from IP phones. This means that normal protocol processing occurs for the packets, but the addresses associated with these packets is not learned or reported by the software

address management components. This enhancement also filters out the MAC address learns from LLDP and 802.1x EAPOL packets on untagged VLANs.

The feature is configured per-port.

Configuring the switch to filter untagged traffic

Enter this command to configure the switch not to learn CDP, LLDP, or EAPOL traffic for a set of interfaces.

Syntax:

[no] ignore-untagged-mac <*port-list*>

Prevents MAC addresses from being learned on the specified ports when the VLAN is untagged and the destination MAC address is one of the following:

- 01000C-CCCCCC (CDP)
- 0180c2- 00000e (LLDP)
- 0180c2-000003 (EAPOL)

Configuring the switch to ignore packet MAC address learns for an untagged VLAN

```
switch(config) ignore-untagged-mac 1-2
```

Displaying the configuration

Enter the `show running-config` command to display information about the configuration.

Configuration showing interfaces to ignore packet MAC address learns

```
switch(config) show running-config

Running configuration:

; J9627 Configuration Editor; Created on release XX.15.XX
; Ver #03:03.1f.ef:f0

hostname “HP Switch”
interface 1
   ignore-untagged-mac
   exit
interface 2
   ignore-untagged-mac
   exit
.
.
.
vlan 1
   name “DEFAULT_VLAN”
   untagged 1-24
   ip address dhcp-bootp
   exit
.
.
.
```

Filtering PVID mismatch log messages

This enhancement filters out PVID mismatch log messages on a per-port basis. PVID mismatches are logged when there is a difference in the PVID advertised by a neighboring switch and the PVID of the switch port which receives the LLDP advertisement. Logging is an LLDP feature that allows detection of possible vlan leakage between adjacent switches. However, if these events are logged too frequently, they can overwhelm the log buffer and push relevant logging data out of log memory, making it difficult to troubleshoot another issue.

Logging is disabled and enabled with the support of CLI commands.

This enhancement also includes displaying the Mac-Address in the PVID mismatch log message when the port ID is Mac-Address instead of displaying garbage characters in the peer device port ID field.

Use the following command to disable the logging of the PVID mismatch log messages:

Syntax:

logging filter [*filter-name*][*sub filter id*] <regularexpression> deny

Regular-expression The regular expression should match the message which is to be filtered.

Syntax:

logging filter [*filter-name*] enable

DHCPv4 server

Introduction to DHCPv4

The Dynamic Host Configuration Protocol (DHCP) is a network protocol that enables a server to automate assignment of IP addresses to hosts. A DHCP server can be configured to provide other network information like IP addresses of TFTP servers, DNS server, boot file name and vendor specific options. Commonly there are two types of address assignments, dynamic and manual. The lease of dynamic addresses is renewed periodically; manual leases are permanently assigned to hosts. With this feature, you can configure multiple pools of IP addresses for IP address assignment and tracking.

IP pools

A DHCP server is configured with IP pools. The server is then instructed to use IP addresses falling into the specified range of IP while offering leases. Multiple IP pools are configured to not have duplicate or overlapping IP subnets. You can also configure a DHCP server with multiple IP ranges within an IP subnet; this confines the allocatable IP addresses within the configured IP pool.

An IP pool will be claimed valid only if it is either:

- Dynamic pool – Has a network address, subnet mask and IP range(s)
- Static pool – Should have a static IP-to-MAC binding.

The DHCP server will discard the invalid and incomplete pools and will only operate on the valid IP pools. The DHCP server will require at least one valid pool to start.

DHCP options

On a DHCP server, an IP pool is configured with various options. These options signify additional information about the network. Options are supported with explicit commands such as `boot-file`. Option codes that

correspond to explicit commands can not be configured with a generic option command; the generic option command requires an option code and TLV.

RFC 2132 defines various network information that a client may request when trying to get the lease.

BootP support

The DHCP server also functions as BootP server. A manual binding configured in a static IP Pool may either service a BootP client request or a DHCP client request.

Authoritative server and support for DHCP inform packets

The server message `DHCPinform`may be received when the server is already configured for static IPv4 addresses so that the server can to get configuration parameters dynamically.

RFC 2131 states that if a client has obtained a network address through some other means (e.g., manual configuration), it may use a `DHCPinform` request message to obtain other local configuration parameters. Servers receiving a `DHCPinform` message construct a `DHCPACK` message with any local configuration parameters appropriate for the client without: allocating a new address, checking for an existing binding, filling in `yiaddr` or including lease time parameters.

Authoritative pools

To process the `DHCPINFORM` packets received from a client within the given IP pool, a DHCP server has to be configured as `authoritative` for that IP pool. The server is the sole authority for this IP pool so when a client requests an IP address lease where the server is authoritative, and the server has no record of that IP address, the server will respond with `DHCPNAK` message which indicates that the client should no longer use that IP address. Any `DHCPINFORM` packet received for a non-authoritative pool will be ignored by the DHCP server.

The `authoritative` command has no effect when configured on a static pool or an incomplete pool without a network statement. In such cases, the server intentionally not send an error message.

A CLI toggle is provided under the **pool** context that will allow the `authoritative` configuration.

The `authoritative` command requires a network statement to be configured on a pool.

Authoritative dummy pools

A dummy pool, without the range statement, can be configured and made authoritative. A dummy pool allows static-bind entries which do not have matching dynamic pools with network statements to be configured. By creating a dummy pool on a DHCP server, the support for `DHCPinform` packets will not be actively serving the client on this pool. No active leases or resource consumption will be sent to the DHCP server when this option is used.

Dummy pools help the DHCP server learn the network topology.

Example

```
dhcp-server pool dummy192
network 192.168.10.0 255.255.255.255
option 1…
option 2…
```

```
:
option n…
authoritative
exit
```

Change in server behavior

Making the server authoritative for an IP pool changes how the server processes `DHCP REQUEST` packets.

The table below exhibits the behavior on the receiving `DHCP REQUEST` and `DHCP INFORM` packets, from DHCP clients residing on either authoritative or non-authoritative pools.

Table 21: *Authoritative and non-authoritative pools*

	Authoritative Pool			Non-authoritative pool		
When a DHCP client sending..	For Own IP	For IP belonging to different client	Unknown IP falling outside the range	For Own IP	For IP belonging to different client	Unknown IP falling outside the range
DHCP INFORM	send ACK	send ACK	send ACK	DROP	DROP	DROP
DHCP REQUEST	send ACK	send NACK	send NACK	send ACK	DROP	DROP

DHCPv4 configuration commands

Enable/disable the DHCPv4 server

Syntax

[no] dhcp-server [enable | disable]

To enable/disable the DHCPv4 server in a switch.

- Enable the DHCPv4 server on the device. The `no` form of this command will remove all DHCPv4 server configurations.
- Disable the DHCPv4 server on the device. The `no` form of this command will remove all DHCPv4 server configurations.

The default is disabled.

Configuring the DHCP address pool name

Use the following command in the global configuration mode to configure the DHCP address pool name and enter the DHCP pool context.

A maximum of 128 pools are supported.

Syntax

[no] dhcp-server pool < pool-name>

Configure the DHCPv4 server IP address pool with either a static IP or a network IP range.

pool	DHCPv4 server IP address pool.
ASCII-STR	Enter an ASCII string.
authoritative	Configure the DHCP server authoritative for a pool.
bootfile-name	Specify the boot file name which is used as a boot image.
default-router	List of IP addresses of the default routers.
dns-server	List of IP addresses of the DNS servers.
domain-name	Configure the DNS (Domain Name System) domain name for translation of hostnames to IP addresses.
lease	Lease period of an IP address.
netbios-name-server	List of IP addresses of the NetBIOS (WINS) name servers.
netbios-node-type	NetBIOS node type for a Microsoft DHCPv4 client.
network	Subnet IP and mask of the DHCPv4 server address pool.
option	Raw DHCPv4 server options.
range	Range of IP addresses for the DHCPv4 server address pool.
static-bind	Static binding information for the DHCPv4 server address pool.
tftp-server	Configure a TFTP server for the DHCPv4 server address pool.

Validations

Validation	Error/Warning/Prompt
Configuring pool when maximum Number of pools already configured.	Maximum number of pools (128) has already been reached
Configuring Pool with a name that exceeds the maximum length requirement.	String %s too long. Allowed length is 32 characters.
Trying to delete non existing pool	The specified address pool does not exist.
Only alphanumeric characters, numerals and underscore is allowed in the pool name. Violating this would throw the following error message.	Invalid name. Only alphanumeric characters and hyphen are allowed.
Trying to delete existing pool or adding new pool when DHCP server enabled.	DHCP server should be disabled before changing the configuration.

Authoritative

Syntax

[no] authoritative

authoritative Configure the DHCP server authoritative for a pool.

The DHCP server is the sole authority for the network configured under this pool. When the DHCP server is configured as authoritative, the server will respond with DHCP ACK or NACK as appropriate for all the received `DHCP REQUEST` and `DHCP INFORM` packets belonging to the subnet.

Non-authoritative `DHCP INFORM` packets received from the clients on a non-authoritative pool will be ignored.

Specify a boot file for the DHCP client

Syntax

[no] bootfile-name<filename>

Specify the boot file name to be used as the boot image.

Configure a default router for a DHCP client

Syntax

[no] default-router <IP-ADDR-STR> [IP-ADDR2 ... IP-ADDR8]

Configure the DHCP pool context to the default router for a DHCP client. List all of the IP addresses of the default routers.

Two IP addresses must be separated by a comma.

A maximum of eight default routers can be configured.

Configure the DNS IP servers

Syntax

[no] dns-server <IP-ADDR> [IP-ADDR2 ... IP-ADDR8]

Configure the DHCP pool context to the DNS IP servers that are available to a DHCP client. List of IP addresses of the DNS servers.

Two IP addresses must be separated by comma.

A maximum of eight DNS servers can be configured.

Configure a domain name

Syntax

[no] domain-name <name>

Configure the DNS domain name for translation of hostnames to IP addresses.

Configure lease time

Syntax

[no] lease [DD:HH:MM | infinite]

DD:HH:MM	Enter lease period.
Lease	Lease period of an IP address.

Configure the lease time for an IP address in the DHCP pool. Lease time is infinite for static pools.

The default lease period is one day.

Configure the NetBIOS WINS servers

Syntax

[no] netbios-name-server <IP-ADDR-STR> [IP-ADDR2 ... IP-ADDR8]

Configure the DHCP pool for the NetBIOS WINS servers that are available to a Microsoft DHCP client. List all IP addresses of the NetBIOS(WINS) name servers. The Windows Internet Naming Service (WINS) is a name resolution service that Microsoft DHCP clients use to correlate host names to IP addresses within a general grouping of networks.

Two IP addresses must be separated by a comma.

A maximum of 8 NetBIOS (WINS) name servers can be configured.

Configure the NetBIOS node type

Syntax

[no] netbios-node-type [broadcast | hybrid | mixed | peer-to-peer]

broadcast	Broadcast node.
hybrid	Hybrid node.
mixed	Mixed node.
peer-to-peer	Peer to peer node.

Configure the DHCP pool mode to the NetBIOS node type for a Microsoft DHCP. The NetBIOS node type for Microsoft DHCP clients can be one of four settings: broadcast, peer-to-peer, mixed, or hybrid.

Configure subnet and mask

Syntax

[no] network <ip-addr/mask-lenght>

ip-addr/mask-length	Interface IP address/mask.

Configure the DHCPv4 server pool subnet and mask for the DHCP server address pool.

Range is configured to enable pool.

Configure DHCP server options

Syntax

[no] option <CODE> {ascii <ascii-string>|hex <hex-string>|ip <IP-ADDR-STR>[IP-ADDR2 … IP-ADDR8]}

ascii	Specify ASCII string as option code value.
hex	Specify hexadecimal string as option code value.
ip	Specify one or more IP addresses as option code value.
ip-addr-str	Specify IP address.
ascii-str	Enter an ASCII string.
hex-str	Specify Hexadecimal string.

Configure the raw DHCP server options.

Configure the range of IP address

Syntax

[no] range <IP-ADDR>[<IP-ADDR>]

range	Range of IP addresses for the DHCPv4 server address pool.
ip-addr	Low IP address. High IP address.

Configure the DHCP pool to the range of IP address for the DHCP address pool.

Configure the static binding information

Syntax

[no] static-bind ip<IP-ADDR/MASK-LENGTH> mac <MAC-ADDR>

ip	Specify client IP address.
static-bind	Static binding information for the DHCPv4 server address pool.
ip-addr / mask-length	Interface IP address or mask.
mac	Specify client MAC address.
mac-addr	Enter a MAC address.

Configure static binding information for the DHCPv4 server address pool. Manual bindings are IP addresses that have been manually mapped to the MAC addresses of hosts that are found in the DHCP database. Manual

bindings are just special address pools. There is no limit on the number of manual bindings but you can only configure one manual binding per host pool.

Configure the TFTP server domain name

Syntax

[no] tftp-server [server-name <server-name> | server-ip < ip-address >]

tftp-server	Configure a TFTP server for the DHCPv4 server address pool.
server-name	TFTP server name for the DHCPv4 server address pool.

Configure the TFTP server domain name for the DHCP address pool.

Configure the TFTP server address

Syntax

[no] tftp-server server-ip <ip-address>

server-ip	TFTP server IP addresses for the DHCPv4 server address pool.
ip-addr	Specify TFTP server IP address.

Configure the TFTP server address for the DHCP address pool.

Change the number of ping packets

Syntax

[no] dhcp-server ping [packets <0-10>|timeout <0-10>]

ping	Specify DHCPv4 ping parameters.
packets	Specify number of ping packets.
<0-10>	Number of ping packets (0 disables ping).

Specify, in the global configuration context, the number of ping packets the DHCP server will send to the pool address before assigning the address. The default is two packets.

Change the amount of time

Syntax

[no] dhcp-server ping timeout <1-10>

timeout	Ping timeout.
<1-10>	Ping timeout in seconds.

Amount of time the DHCPv4 server must wait before timing out a ping packet. The default is one second.

Configure DHCP Server to save automatic bindings

Syntax

[no] dhcp-server database [file ASCII-STR] [delay<15-86400>][timeout <0-86400>]

delay	Seconds to delay writing to the lease database file.
file	URL Format: "tftp://<ip-address>/<filename>".
database	Specifies DHCPv4 database agent and the interval between database updates and database transfers.
timeout	Seconds to wait for the transfer before failing.
ascii-str	Database URL.
<15-86400>	Delay in seconds.
<0-86400>	Timeout in seconds.

Specifies DHCPv4 database agent and the interval between database updates and database transfers.

Configure a DHCP server to send SNMP notifications

Syntax

[no] snmp-server enable traps dhcp-server

dhcp-server	Traps for DHCP-Server.

Configure a DHCP server to send SNMP notifications to the SNMP entity. This command enables or disables event traps sent by the switch.

Enable conflict logging on a DHCP server

Syntax

[no] dhcp-server conflict-logging

conflict-logging	Enable DHCPv4 server address conflict logging.

Enable conflict logging on a DHCP server. Default is disabled.

Enable the DHCP server on a VLAN

Syntax

[no] dhcp-server

dhcp-server Enable DHCPv4 server on a VLAN (VLAN context command).

Enable DHCPv4 server on a VLAN. DHCPv4 client or DHCPv4 relay cannot co-exist with DHCPv4 server on a VLAN.

Clear commands

Syntax

clear dhcp-server conflicts [ip-addr]

dhcp-server Clears theDHCPv4 server information.

ip-addr Specify the IP address whose conflict is to be cleared.

Reset DHCPv4 server conflicts database. If IP address is specified, reset only that conflict.

Reset all DHCP server and BOOTP counters

Syntax

clear dhcp-server statistics

statistics Reset DHCPv4 server and BOOTP counters.

Reset all DHCP server and BOOTP counters

Delete an automatic address binding

Syntax

clear dhcp-server binding ip-addr

binding Reset DHCPv4 server automatic address bindings.

ip-addr Specify IP address of the binding is to be cleared.

Delete an automatic address binding from the DHCP server database.

Show commands

Display the DHCPv4 server address bindings

Syntax

show dhcp-server binding

dhcp-server Show DHCPv4 server global configuration information for the device.

binding Show DHCPv4 server IP binding information for the device.

Display the DHCPv4 server address bindings on the device.

Display address conflicts

Syntax

show dhcp-server conflicts

conflicts Show DHCPv4 server conflicts information for the device.

Display address conflicts found by a DHCPv4 server when addresses are offered by a client.

Display DHCPv4 server database agent

Syntax

show dhcp-server database

Database Show DHCPv4 server database information for the device.

Display DHCPv4 server database agent information.

Display DHCPv4 server statistics

Syntax

show dhcp-server statistics

statistics Show DHCPv4 server statistics information for the device.

Display DHCPv4 server statistics.

Display the DHCPv4 server IP pool information

Syntax

show dhcp-server pool <pool-name>

Pool Show DHCPv4 server pool information for the device.

Display the DHCPv4 server IP pool information.

Display DHCPv4 server global configuration information

Syntax

show dhcp-server

dhcp-server Show DHCPv4 server global configuration information for the device.

Display DHCPv4 server global configuration information.

Event log

Event Log Messages

Table 22: *Event Log Messages*

Events	Debug messages
DHCP server is enabled globally.	`DHCP server is enabled globally.`
DHCP server is enabled globally.Warnings - One or more incomplete pool configurations are found during the server startup. A dynamic pool is considered invalid, if network IP or subnet mask is not configured. A static pool is considered incomplete, if network IP, subnet mask or MAC address is not configured.	`DHCP server is enabled globally.Warning -One or more incomplete pool configurations are found during the server startup.`
DHCP server failed to start. The reason for failure is printed as the argument.	`DHCP server failed to start: %s "with a manual binding.`
DHCP server is disabled globally.	`DHCP server is disabled globally.`
The DHCP server configurations are deleted.	`The DHCP server configurations are deleted`
Decline from client when server assigns an illegal Ipv6 address.	`%s: Decline offer from %x (server) of %x because the address is illegal.`
DHCP server is enabled on a specific VLAN.	`DHCP server is enabled on VLAN %d`
DHCP server is disabled on a specific VLAN.	`DHCP server is disabled on VLAN %d`
Ping check is enabled and configured with specified retry count and timeout values	`Ping-check configured with retry count = %d, timeout = %d`
Ping check is disabled	`Ping-check is disabled`
Conflict-logging is enabled	`Conflict-logging is enabled`
Conflict-logging is disabled.	`Conflict-logging is disabled.`
A specific IP address is removed from the conflict logging database.	`IP address %s is removed from the conflict-logging database.`
All IP addresses are removed from the conflict-logging database.	`All IP addresses are removed from the conflict-logging database`
Dynamic binding for a specific IP address is freed.	`Dynamic binding for IP address %s is freed`
All the dynamic IP bindings are freed.	`All the dynamic IP bindings are freed`

Table Continued

Events	Debug messages
Remote binding database is configured for a specific URL.	`Remote binding database is configured at %s`
Remote biding database is disabled.	`Remote binding database is disabled`
Binding database is read from the specified URL at the specified time	`Binding database read from %s at %s`
Failed to read the remote binding from the specified URL.	`Failed to read the remote binding database at %s`
Binding database is written to the specified URL at the specified time.	`Binding database written to %s at %s`
Failed to write the binding database to the specified URL. The reason for failure is printed as argument.	`Failed to write the binding database to %s. Error: %s`
Invalid bindings are found in the database at the specified URL.	`Invalid binding database at %s`
The specified VLAN does not have a matching IP pool configured. This occurs when the DHCP-server is enabled on the specified VLAN, but no IP pool is configured with a network IP matching the VLAN network IP.	`VLAN %d does not have a matching IP pool`
Binding database is replicated to standby management module.	`Binding database is replicated to standby management module`
DHCP server is listening for DHCP packets. This message is displayed when DHCP server is enabled globally and DHCP server is enabled on at-least one VLAN.	`DHCP server is listening for DHCP packets`
DHCP server is disabled on all the VLANs. Server is no longer listening for DHCP packets.	`DHCP server is disabled on all the VLANs. Server is no longer listening for DHCP packets`
The specified IP is not offered to the DHCP client, as it is already in use.	`IP address %s is not offered, as it is already in use`
No IP addresses available on the specified pool.	`No IP addresses to offer from pool %s`
High threshold reached for the specified pool. Count of Active bindings and Free bindings are printed as arguments.	`High threshold reached for pool %s. Active bindings: %d, Free bindings: %d`

Table Continued

Events	Debug messages
Low threshold reached for the specified pool. Count of Active bindings and Free bindings are printed as arguments.	`Low threshold reached for pool %s. Active bindings: %d, Free bindings: %d`
No active VLAN with an IP address is available to read binding database from the configured URL.	`No active Vlan with an IP address available to read binding database`

The Captive Portal feature allows the support of the ClearPass Policy Manager (CPPM) into the ArubaOS-Switch product line. The switch provides configuration to allow you to enable or disable the Captive Portal feature. By default, Captive Portal is disabled to avoid impacting existing installations as this feature is mutually exclusive with the following web-based authentication mechanisms: Web Authentication, EWA, MAFR, and BYOD Redirect.

Captive Portal is user-based, rather than port or VLAN-based, therefore the configuration is on a switch global basis. ArubaOS-Switch supports the following authentication types on the switch with RADIUS for Captive Portal:

- Media Access Control (MAC)
- 802.1X

Once you enable Captive Portal, the redirect functionality is triggered only if a redirect URL attribute is provided as part of the RADIUS Access-Accept response from an authentication request of type 802.1X or MAC. The redirect enables the client to self-register or directly login with valid credentials via the CPPM. Upon subsequent re-authentication, it provides access to the network per the CPPM configured policies that are communicated via the RADIUS attributes.

The redirect feature offers:

- Client self-registration
- Client direct login with valid credentials via CPPM Captive Portal
- On-boarding
- Ability to quarantine devices to remedy their status

Requirements

- HTTPS support requires a certificate to be configured on the switch with a usage type of `all` or `captive-portal`.

Best Practices

- Use the Port Bounce VSA via a CoA message, instead of the Disconnect message, to cause the second RADIUS authentication to occur during the Captive Portal exchange. This is the more reliable method for forcing a re-DHCP for the client.
- Configure Captive Portal such that the first `ACCESS_ACCEPT` returns a rate limit VSA to reduce the risk of DoS attacks. This configuration enables rate limiting for the HTTP/HTTPS ACL for traffic sent to CPPM.
- Do not use the keyword `cpy` in any other `NAS-Filter-Rules`. The keyword `cpy` in the enforcement profile attributes is specific to CPPM use. It is only supported with the `deny` attribute. If you configure the `cpy` keyword to `permit`, no ACL will be applied.

Limitations

- Captive Portal is supported in CPPM versions 6.5.5 and later. However, by manually modifying the RADIUS dictionary files, any CPPM version 6.5.* can be used.
- Captive Portal does not support v1 modules, and will not work unless compatibility mode is turned off.
- Captive Portal does not support IPv6.
- Simultaneous Captive Portal client connections: maximum of 512
- Captive Portal does not support web proxy. The permit CPPM ACLs and the steal ACLs only use port 80 and 443. Non-standard ports for HTTP and HTTPS are not supported.

- Captive Portal is mutually exclusive with the following web-based authentication mechanisms: Web Authentication, EWA, MAFR, and BYOD.
- URL-string limitation of 253 characters.

Features

High Availability

Captive Portal includes support for High Availability (HA). The Captive Portal configurations (such as enablement, authenticated clients, and redirect URLs) are replicated to standby or other members.

If the feature is enabled and a failover occurs, clients in the process of onboarding are still redirected to Captive Portal, and authenticated clients continue to have the same access to the network.

Clients that are in the process of authenticating via MAC or 802.1X authentication will not be replicated to the standby. Replication of client data is only done when MAC or 802.1X authentication has resulted in a successful authentication.

Load balancing and redundancy

The following options are available to create load balancing and provide redundancy for CPPM:

- Virtual IP use for a CPPM server cluster
- CPPM servers configured in the switch RADIUS server group
- External load balancer

Captive Portal when disabled

By default, Captive Portal is disabled. If the Captive Portal feature is disabled and the switch receives a redirect URL attribute from the RADIUS server as part of the Access-Accept, it will view the redirect as an error. The authentication success will be overridden, the session will be flushed, and the switch will send the Accounting Start and Accounting Stop messages to indicate the client is no longer authenticated.

The Captive Portal feature may be disabled while there are in flight authentication requests. These are authentication sessions that have not finished the final authentication with the switch. The switch flushes all sessions with a redirect URL associated with them when Captive Portal is disabled.

Fully authenticated sessions are not impacted when Captive Portal is disabled. If CPPM deems these sessions to be invalid, a RADIUS Disconnect can be sent to flush all these sessions.

Disabling Captive Portal

To disable Captive Portal, enter one of the following:

```
switch(config)# aaa authentication captive-portal disable
```

```
switch(config)# no aaa authentication captive-portal enable
```

Configuring Captive Portal on CPPM

Procedure

1. **Import the HP RADIUS dictionary**
2. **Create enforcement profiles**

3. **Create a ClearPass guest self-registration**
4. **Configure the login delay**

Import the HP RADIUS dictionary

For CPPM versions 6.5.*, you must update the HP RADIUS dictionary. To import the dictionary in CPPM, follow these steps:

Procedure

1. Go to **Administration** -> **Dictionaries** -> **RADIUS** and click **Import**.
2. Select the XML HP RADIUS Dictionary from your Hard Drive.
3. Click **Import**.

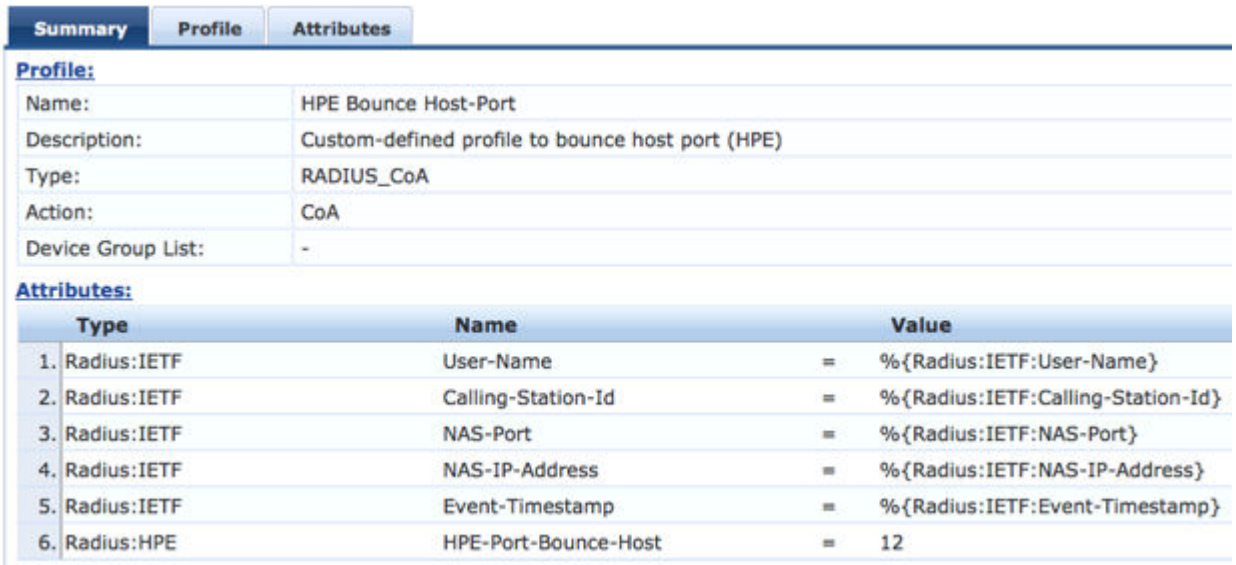
Create enforcement profiles

Create the HPE Bounce Host-Port profile and the Guest Login profile only if they do not already exist.

For the HPE Bounce Host-Port profile, configure Captive Portal so that the RADIUS CoA message that includes the Port Bounce VSA is sent to force the second RADIUS re-authentication after the user registers their device and makes it known.

Procedure

1. In CPPM, go to **Configuration** -> **Enforcement** -> **Profiles**
2. Click **Add**.
3. Enter the Profile Name: **HPE Bounce Host-Port**
4. Enter the Description: **Custom-defined profile to bounce host port (HPE)**.
5. Select the type **RADIUS_CoA**.
6. Select the action **CoA**.
7. Add all of the attributes required for a CoA message, and specify the port bounce duration (valid values are between 0 and 60). This is the amount of time in seconds the port will be held in the down state. The recommended setting is 12 seconds.



Summary | Profile | Attributes

Profile:

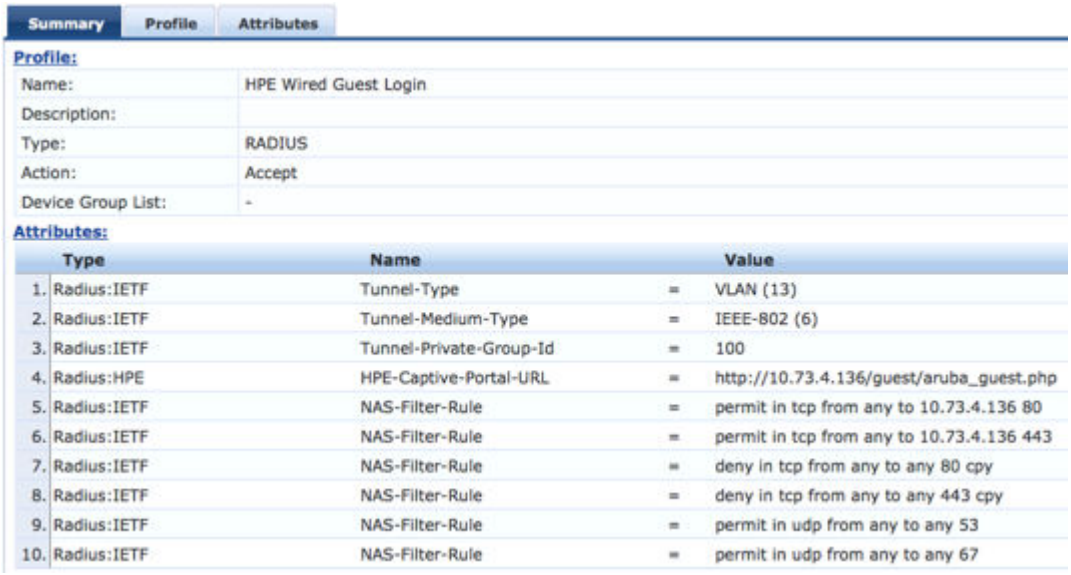
Name:	HPE Bounce Host-Port
Description:	Custom-defined profile to bounce host port (HPE)
Type:	RADIUS_CoA
Action:	CoA
Device Group List:	-

Attributes:

	Type	Name		Value
1.	Radius:IETF	User-Name	=	%{Radius:IETF:User-Name}
2.	Radius:IETF	Calling-Station-Id	=	%{Radius:IETF:Calling-Station-Id}
3.	Radius:IETF	NAS-Port	=	%{Radius:IETF:NAS-Port}
4.	Radius:IETF	NAS-IP-Address	=	%{Radius:IETF:NAS-IP-Address}
5.	Radius:IETF	Event-Timestamp	=	%{Radius:IETF:Event-Timestamp}
6.	Radius:HPE	HPE-Port-Bounce-Host	=	12

8. Repeat **Step 2** to **Step 6** to configure the Guest Login profile that will be sent as part of the first RADIUS Access-Accept and enforce the redirect to the Captive Portal on CPPM. For this profile, select **RADIUS** as the type and **Accept** as the action.
9. Add all of the NAS-Filter-Rule attributes specified below, replacing the IP address in the first two NAS-Filter-Rule attributes with your CPPM address. Add the HPE-Captive-Portal-URL attribute to specify the redirect URL, replacing the IP address with your CPPM address. This will cause the client to be redirected to the Captive Portal on CPPM. You can add other attributes, such as a VLAN to isolate onboarding clients, or a rate limit to help prevent DoS attacks.

The `HPE-Captive-Portal-URL` value must be a URL normalized string. The scheme and host must be in lower case, for example `http://www.example.com/`.



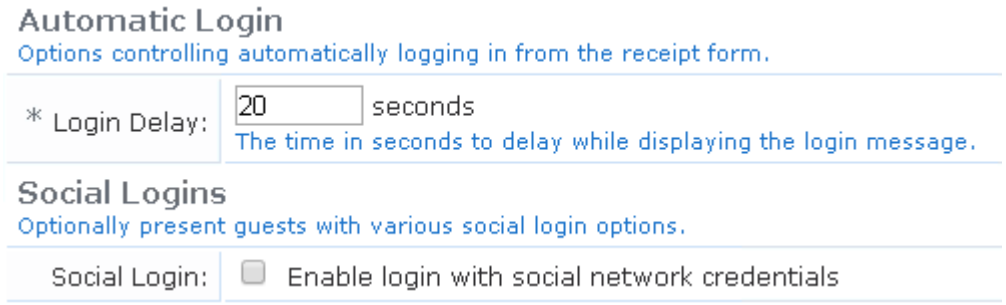
Create a ClearPass guest self-registration

Procedure

1. From the Customize Guest Registration window, select **Server-initiated** as the Login Method.
2. Optionally, under Security Hash, select the level of checking to apply to the redirect URL.

Configure the login delay

Enter the **Login Delay** value. The value must be greater than the `HPE-Port-Bounce-Host` attribute. In this example, we set the login delay value to 20 seconds.



Configuring the switch

Once you have configured Captive Portal, you can configure the switch. To configure the switch, you must first configure the switch as a RADIUS client, then configure the ports that will be used for Captive Portal, as follows:

Procedure

1. Configure the switch as a RADIUS client. In this example, the CPPM IP address is `10.73.4.136` and `secret` is the secret key shared with the RADIUS server:
   a. `switch(config)# radius-server host 10.73.4.136 key "secret"`
   b. `switch(config)# radius-server host 10.73.4.136 dyn-authorization`
   c. `switch(config)# radius-server host 10.73.4.136 time-window 0`

   NOTE

   Make sure to set your time-window to `0`. See **Event Timestamp not working**.

2. Configure the ports that will be used for Captive Portal. In this example, the commands enable ports `B3-B5` for MAC Authentication:

   a. `switch(config)# aaa authentication port-access chap-radius`
   b. `switch(config)# aaa port-access mac-based B3-B5`
3. If you configured the `Security Hash` to `Deny login on validation error` in **Create a ClearPass guest self-registration** on page 252, configure the URL key.

   See **Configure the URL key** on page 254.
4. Configure the certificate. See **Configuring a certificate for Captive Portal usage** on page 254
5. Enable Captive portal:

   ```
   switch(config)# aaa authentication captive-portal enable
   ```

   By default, Captive Portal is disabled. Once enabled, you are redirected to the URL supplied via the HPE-Captive-Portal-URL VSA. Captive Portal is enabled on a global/switch wide basis.

Configure the URL key

You can optionally configure a URL hash key to provide some security for the Captive Portal exchange with CPPM. The key is a shared secret between CPPM and the switch. When configured, the switch generates a HMAC-SHA1 hash of the entire redirect URL, and appends the hash to the URL to be sent to CPPM as part of the HTTP redirect. If CPPM is configured to check the hash, it will generate the hash of the URL using its version of the URL hash key and compare against the value provided by the switch. The action taken by CPPM upon a match or mismatch is determined by what is configured on CPPM.

CPPM provides the following options:

- Do not check - login will always be permitted
- Deny login on validation error - login will not be permitted

The URL hash key is globally configured and will be used for all redirects to Captive Portal. This key is not configured on a per CPPM or RADIUS server basis. If the key is not specified, the hash is not added to the URL. The URL hash key is an ASCII string with a maximum length of 64 characters.

The URL key supports the FIPS certification feature encrypt-credentials and can optionally be encrypted for more robust security. This option is only available when the global encrypt-credentials is enabled.

To configure a plain text captive-portal URL key:

```
switch(config)# aaa authentication captive-portal url-hash-key plaintext <KEY>
```

To configure an encrypted captive-portal URL key when encrypt-credentials is enabled:

```
switch(config)# aaa authentication captive-portal url-hash-key encrypted
<ENCRYPTED-KEY>
```

To clear a captive-portal URL key:

```
switch(config)# no aaa authentication captive-portal url-hash-key
```

Configuring a certificate for Captive Portal usage

HTTPS support requires the use of a certificate. If a certificate for Captive Portal does not exist, the certificate designated for all use is used instead.

To create a certificate signing request for Captive Portal, enter:

```
switch(config)# crypto pki create-csr certificate-name <cert-name> usage captive-
portal
```

To create a self-signed certificate for Captive Portal, enter:

```
switch(config)# crypto pki enroll-self-signed certificate-name
```

Display Captive Portal configuration

To display the Captive Portal configuration settings, enter the `show captive-portal` command:

```
switch(config)# show captive-portal

Captive Portal Configuration
 Redirection Enabled    : Yes
 URL Hash Key Configured : No
```

Show certificate information

To view the certificate information, enter:

```
switch(config)# show crypto pki local-certificate
```

Name	Usage	Expiration	Parent / Profile
cp	Captive Portal	2016/08/14	default

Troubleshooting

Event Timestamp not working

Symptom

The client gets a credentials request on the web browser even though the valid credentials were already provided, or the client is not redirected to the Captive Portal.

Cause

- ClearPass 6.5.x does not support the sending of `Event Timestamp` in automated workflows (manual via Access Tracker works).
- The switch will reject CoA requests when the time on CPPM is ahead of the switch time by even a second.

Action

Procedure

1. Set the time-window security feature in PVOS to 0:

```
radius-server host<CLEARPASS-IP> time-window 0
```

Cannot enable Captive Portal

Symptom

When running the `aaa authentication captive-portal enable` command, getting the following error message:

```
Captive portal cannot be enabled when BYOD redirect, MAC authentication failure
redirect, or web-based authentication are enabled.
```

Cause

The failure is due to a mutual exclusion restriction.

Action

Procedure

1. Check which one of the following are enabled: BYOD redirect, MAC authentication failure redirect, or web-based authentication.
2. Disabled the enabled authentication method found in step 1.
3. Run the `aaa authentication captive-portal enable` command.

Unable to enable feature

Symptom

One of the following messages is displayed:

- `BYOD redirect cannot be enabled when captive portal is enabled.`
- `MAC authentication failure redirect cannot be enabled when captive portal is enabled.`
- `Web-based authentication cannot be enabled when captive portal is enabled.`
- `V1 compatibility mode cannot be enabled when captive portal is enabled.`

Cause

You cannot enable these features when Captive Portal is already enabled. They are mutually exclusive.

Action

Procedure

1. You can either disable Captive Portal or avoid enabling these features.

Authenticated user redirected to login page

Symptom

User is redirected back to the login page to submit credentials even after getting fully authenticated.

Solution 1

Cause

The status is not changed to Known.

Action

Procedure

1. After the client submits the credentials, the CPPM service must change the Endpoint Status to `Known`.

Solution 2

Cause

The cache value is set.

Action

Procedure

1. Clear the CPPM Cache Timeout of the Endpoint Repository.

Unable to configure a URL hash key

Symptom

The following message is displayed:

```
Key exceeds the maximum length of 64 characters.
```

Cause

The URL hash key is not valid.

Action

Procedure

1. Select a key that is 64 or less ASCII text. For example:

```
switch(config)# aaa authentication captive-portal url-hash-key plaintext
“8011A89FEAE0234BCCA”
```

authentication command

Use the following authentication commands to configure ClearPass Captive Portal.

Command	Description
`aaa authentication captive-portal enable`	Enables redirection to a Captive Portal server for additional client authentication.

`aaa authentication captive-portal disable`
or
`no aaa authentication captive-portal enable`
	Disables redirection to a Captive Portal server for additional client authentication.

`aaa authentication captive-portal url-hash-key`	Configures a hash key used to verify the integrity of the portal URL.

show command

Use the following show commands to view the various configurations and certificates.

Command	Description
`show running-config`	Shows the running configuration.
`show config`	Shows the saved configuration.
`show ip`	Shows the switch IP addresses.
`show captive-portal`	Captive portal configuration.
`show port-access clients [port] [detailed]`	Consolidated client view; the `detailed` option shows the Access Policy that is applied. The IP address is only displayed if `dhcp-snooping` is enabled. For the summary view (without the detailed option), only the untagged VLAN is displayed.
`show radius authentication`	Displays NAS identifier and data on the configured RADIUS server and switch interactions with this server.
`show radius dyn-authorization`	Statistics for Radius CoA and Disconnect.
`show radius accounting`	Statistics for Radius accounting.
`show crypto pki local-certificate [summary]`	Installed certificates.

Debug command

Use the `debug` command to help you debug your issues.

Command	Description
`debug security captive-portal`	Enables debug logging for the Captive Portal sub-system.
`debug security port-access mac-based`	Enables debug logging for the MAC-auth sub-system.
`debug security port-access authenticator`	Enables debug logging for the 802.1X authenticator sub-system.
`debug security radius-server`	Enables debug logging for the Radius sub-system.
`debug destination session`	Prints debug messages to terminal.
`debug destination logging`	Sends debug messages to the syslog server.
`debug destination buffer`	Prints debug messages to a buffer in memory.

AirWave is a Network Management Solution (NMS) tool. Once connected to AirWave using the WebUI and CLI interfaces, you can:

- Configure your switches using Zero Touch Provisioning (ZTP)
- Configure your switches using the CLI
- Troubleshoot your switches
- Monitor your switches
- Upgrade your firmware for your switches

Once you have configured your switch, you can monitor, manage, and upgrade your hardware using the AirWave Management Platform.

Requirements

- DHCP server
- AirWave NMS
- HPE Aruba switches

Best Practices

- Implement ZTP in a secure and private environment. Any public access may compromise the security of the switch, as follows:
  - ZTP is enabled only on the factory default configuration of the switch. DHCP snooping is not enabled. You must manage the Rogue DHCP server.
  - The DHCP offer is in plain data without encryption. Therefore, the offer can be listened by any device on the network and they can in turn obtain the AirWave information.
  - The TLS certificate of the server is not validated by the switch during the HTTPs check-in to AirWave. The AirWave server is in the private environment of the switch.

Limitations

- The DNS/hostname in option 66 is not supported, only the IPv4 address.
- The switch does not validate peer certificate of the AirWave server as part of the TLS handshake.
- The HTTPS check-in to AirWave does not support HTTPS proxy.
- For non-ZTP cases, the AirWave check-in starts by validating the following condition: Primary or Management VLAN must be configured with the IP address and one of the interface must be `UP`. By default, `VLAN 1` is the primary VLAN.

Switch configuration

To configure your switch, follow these steps:

1. **Configure AirWave details in DHCP (preferred method)** on page 261.

   If you are using existing HPE switches and using the DHCP server for the configuration or firmware management, you can configure the AirWave details in DHCP using this method: **Configure AirWave details in DHCP (alternate method)** on page 266

2. If you are configuring the switch using a CLI, see **Configure a switch using the CLI** on page 274.

If you are using ZTP, the configuration is automatic and does not require any user interaction, see **Zero Touch Provisioning**

The switch contacts the AirWave server that is configured on the switch and initiates the check-in process.

Once you have configured the DHCP server, the AirWave details received from the DHCP options are stored in the switch configuration. This assures that the configuration is retained across reboots.

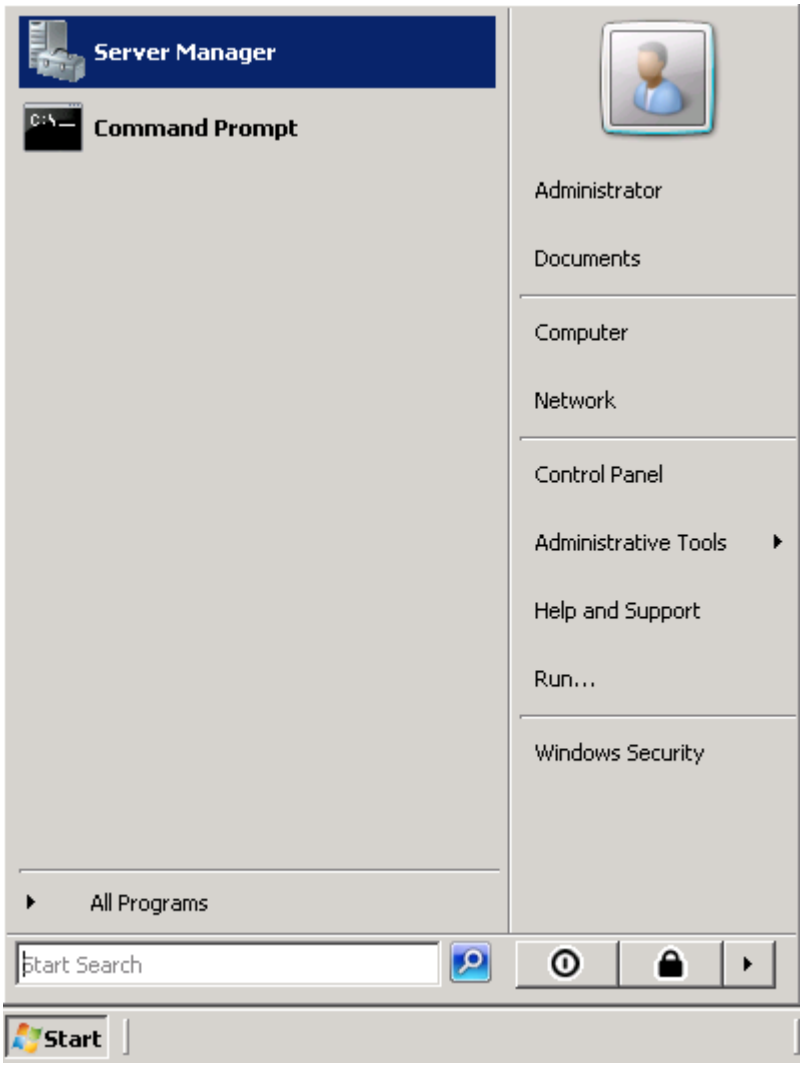
Once AirWave completes the switch check-in, it lists the first switch as `New Devices`. The first switch is used to create a new configuration template for the specific group and device type. With this new template, the required configuration is generated for the group. Subsequent switch of the specific type and joining the same group as the first device are added directly to the group and the configuration is pushed using the configuration template via a SSH connection.

Configure AirWave details in DHCP (preferred method)

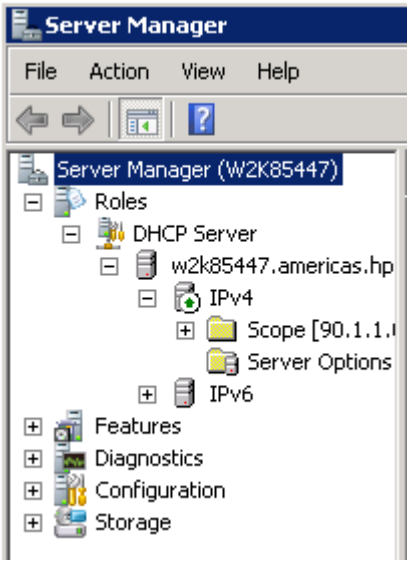
To configure a DHCP server for AirWave, from a Windows Server 2008, do the following steps:

Procedure

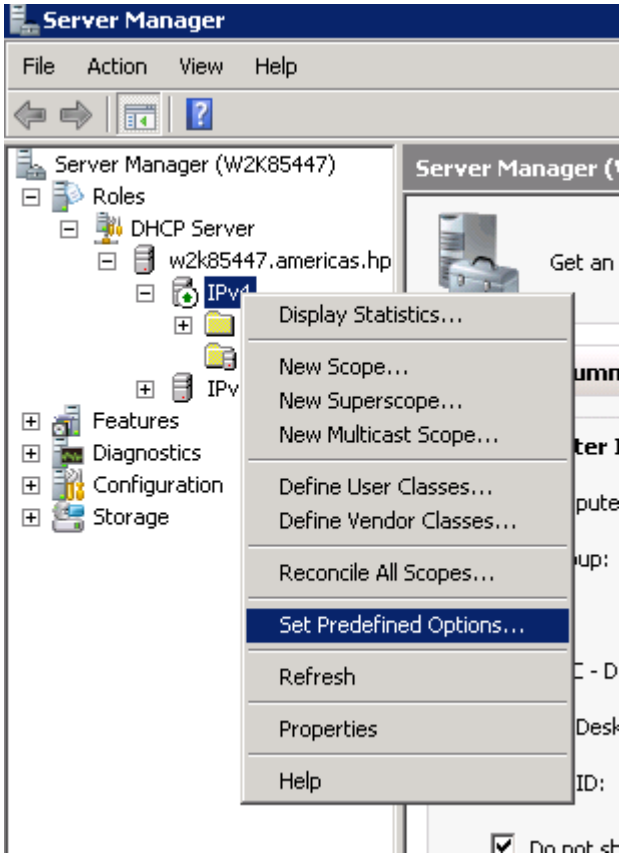
1. From the **Start** menu, select **Server Manager**.



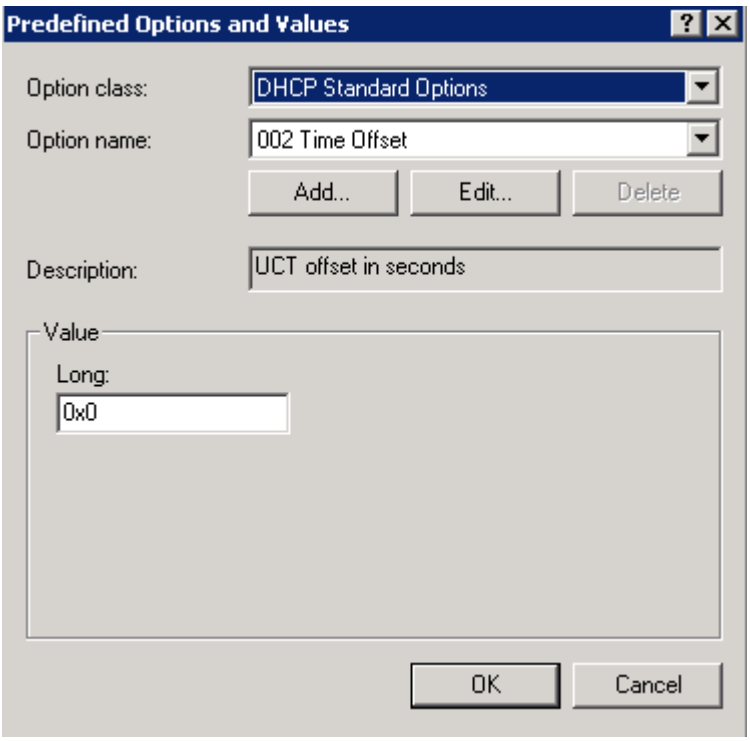
2. Select **Roles -> DHCP -> Server -> w2k8 -> IPv4**.



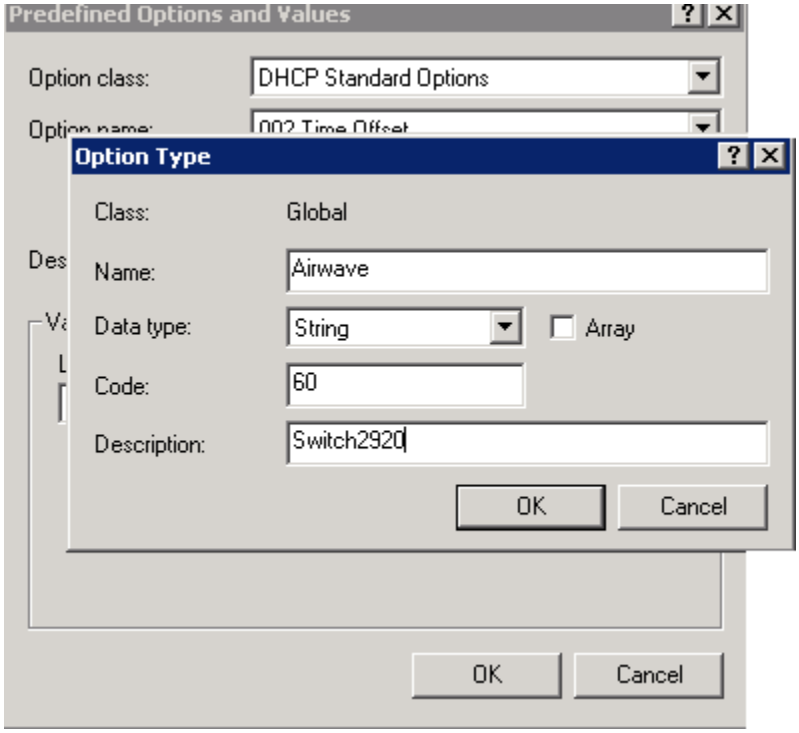
3. Right click on **IPv4** and select **Set Predefined Options...**



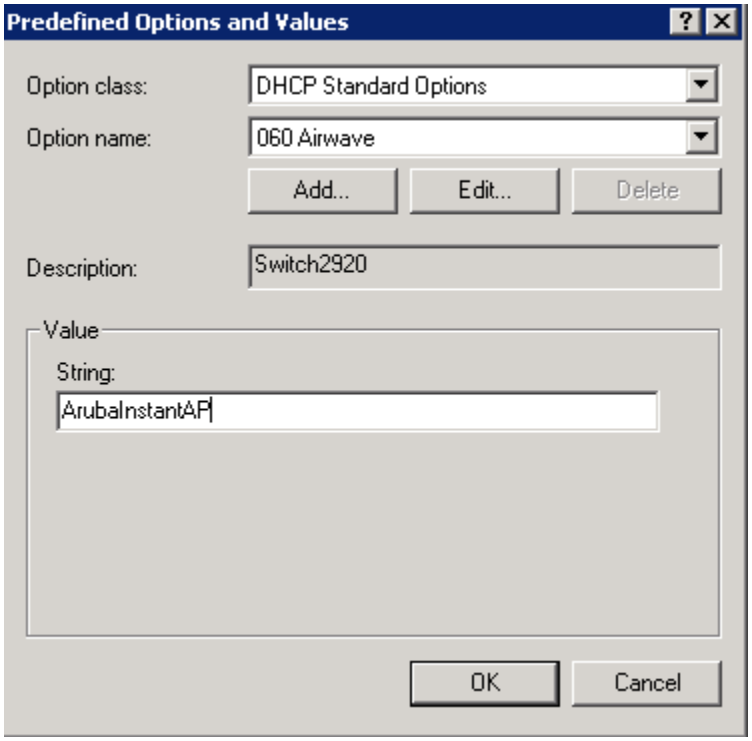
4. The Predefined Options and Values screen is displayed. Click **Add...**.



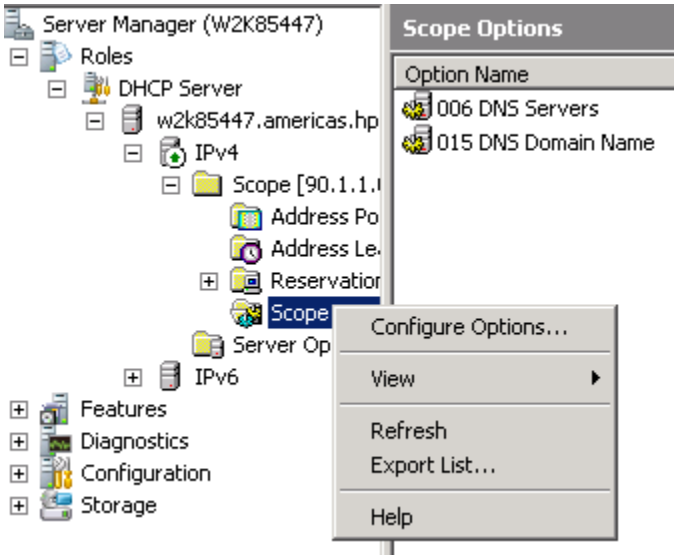
5. Enter the desired **Name** (any), **Data type** (select **String**), **Code** (enter **60**), and **Description** (any).



6. Click **OK**.
7. From the Predefined Options and Values screen, under Value, enter the String **ArubaInstantAP**. The string is case sensitive and must be `ArubaInstantAP`.



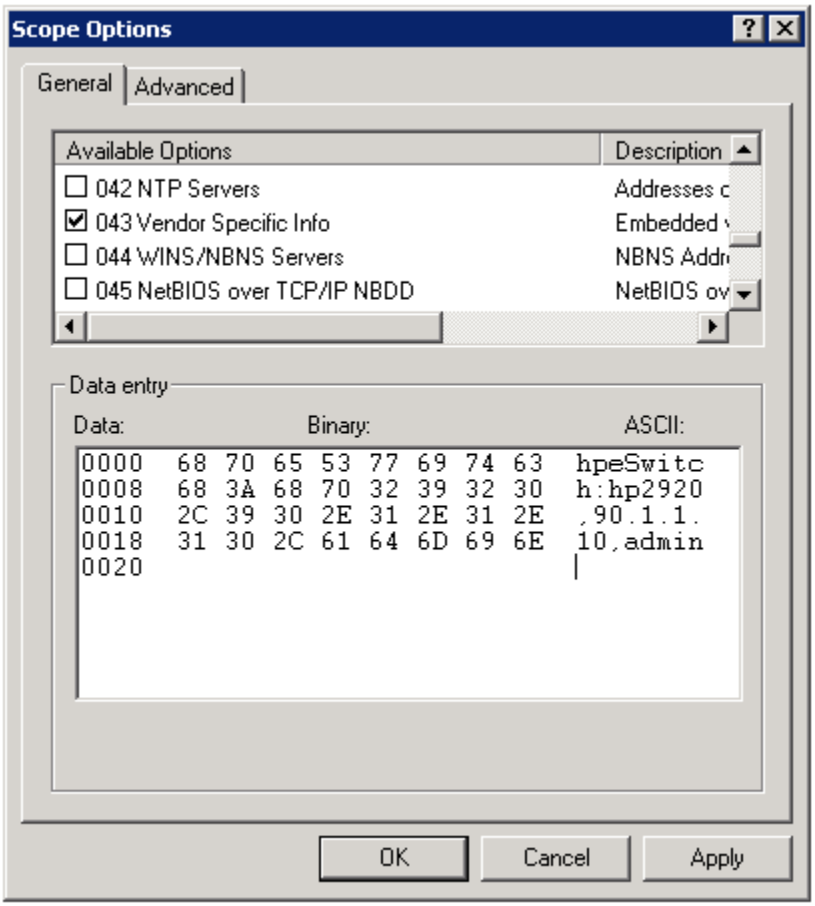
8. Click **OK**.
9. Under IPv4, expand **Scope**. Right click on **Scope Options** and select **Configure Options...**



10. Under the General tab, select **043 Vendor Specific Info**. The Data entry data appears. Under ASCII, enter **hpeSwitch:hp2920,90.1.1.10,admin**. The ASCII value has the following format:
`<Group>:<Topfolder>,<AMP IP>,<shared secret>`

    If you need to add sub-folders, use the following format:

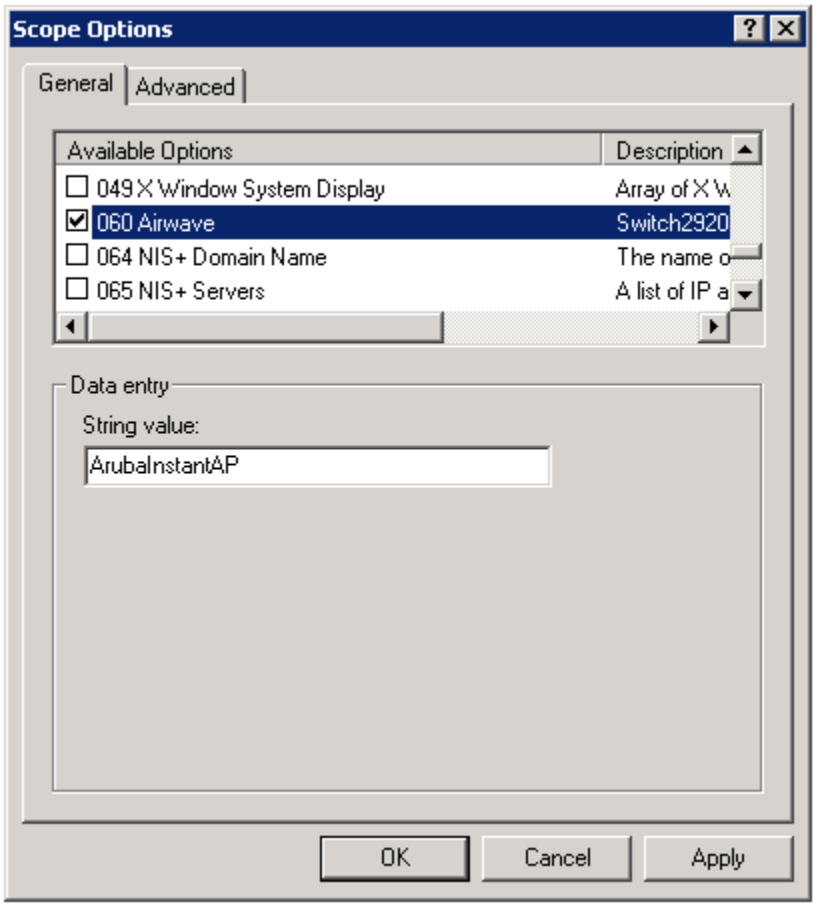
    `<Group>:<Topfolder>:<folder1>,<AMP IP>,<shared secret>`
11.



12. Under the General tab, select **060 Airwave**. Click **OK**.

NOTE

No changes are required to the 060 option.



13. You can verify the AirWave details as follows:

```
switch# show amp-server
switch# show run
```

Configure AirWave details in DHCP (alternate method)

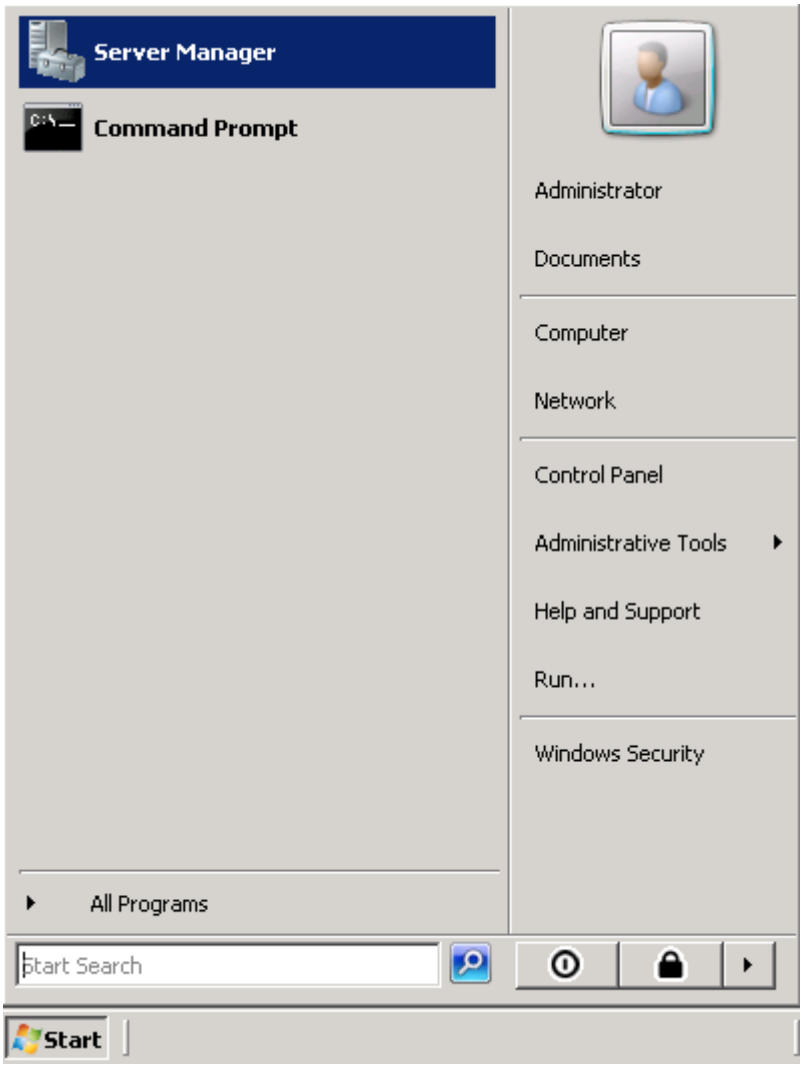
To configure a DHCP server for ZTP and AirWave, from a Windows Server 2008, do the following steps:

NOTE

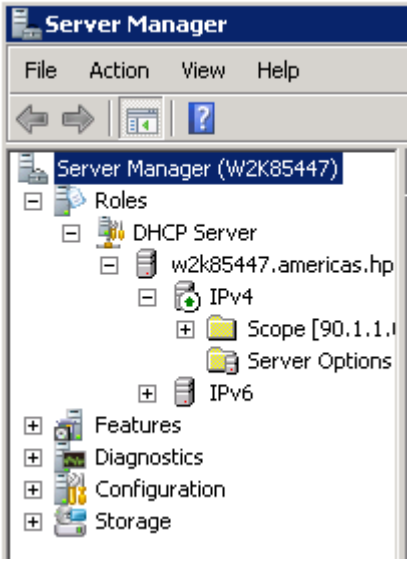
You must repeat these steps for every type of switch that needs to be configured for ZTP, selecting a different Vendor Class for each type of switch.

Procedure

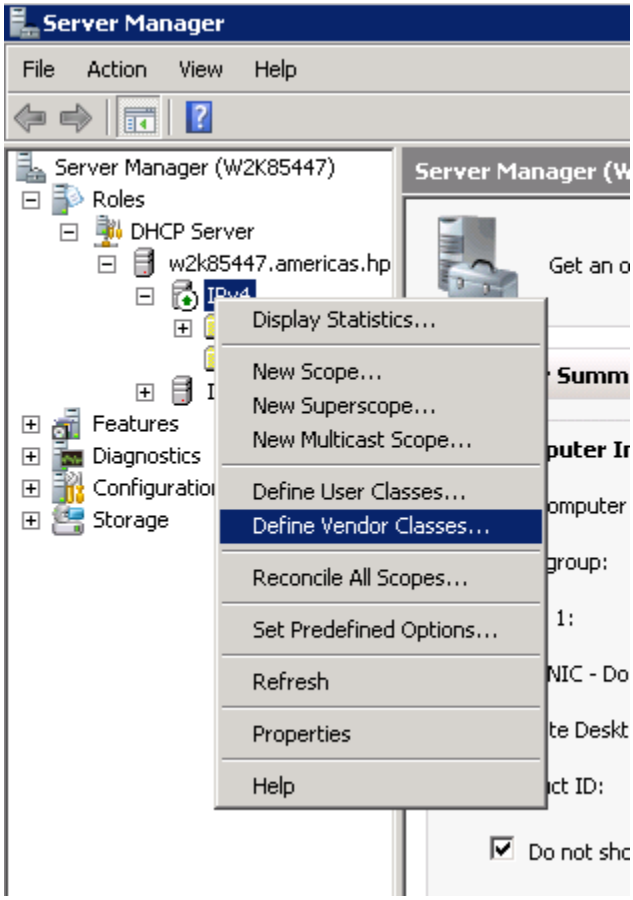
1. From the **Start** menu, select **Server Manager**.



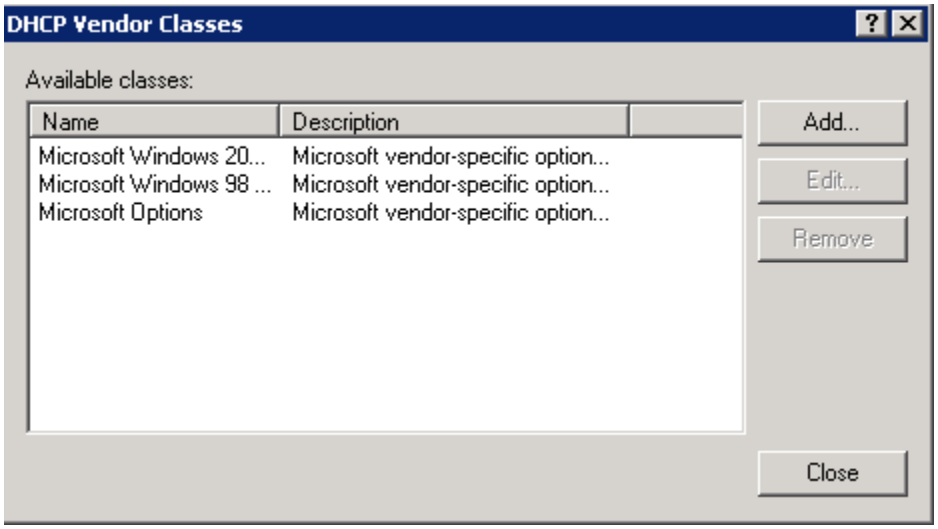
2. Select **Roles -> DHCP -> Server -> w2k8 -> IPv4**.



3. Right click on **IPv4** and select **Define Vendor Classes...**



4. The DHCP Vendor Classes window is displayed. Click **Add...**.



5. To get the vendor-specific value of a switch, go to the switch console and enter:

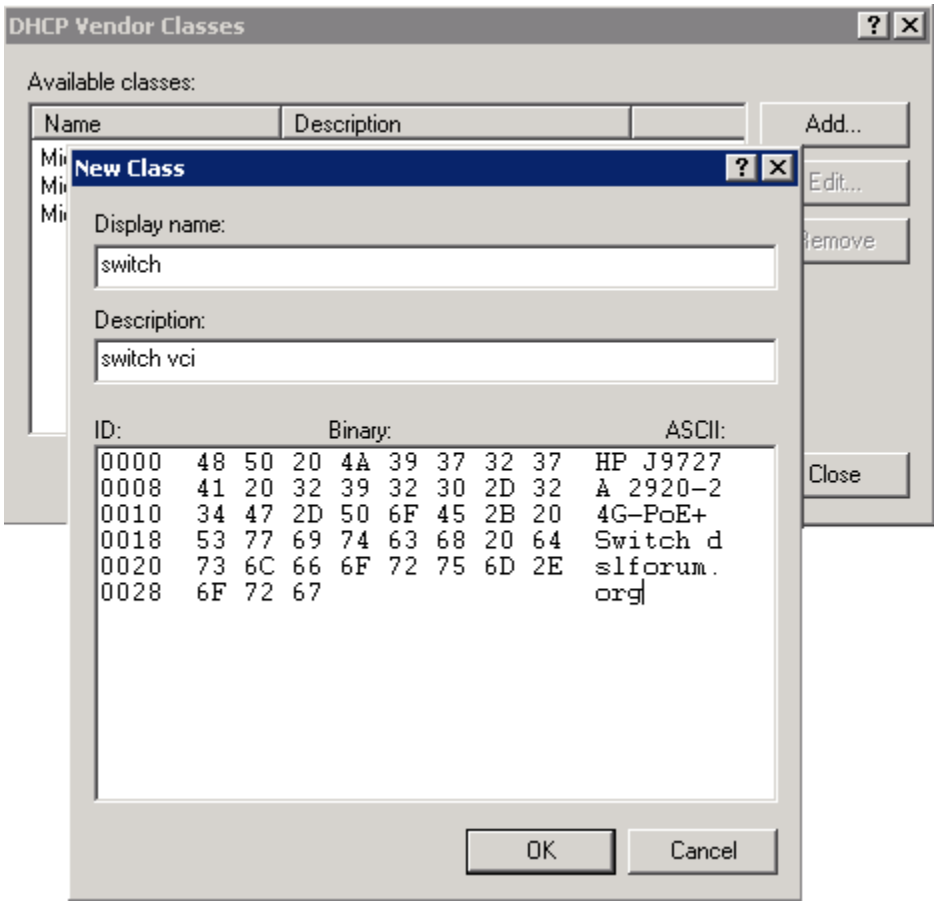
```
switch# show dhcp client vendor-specific
```

In our example, the command returns the following value:

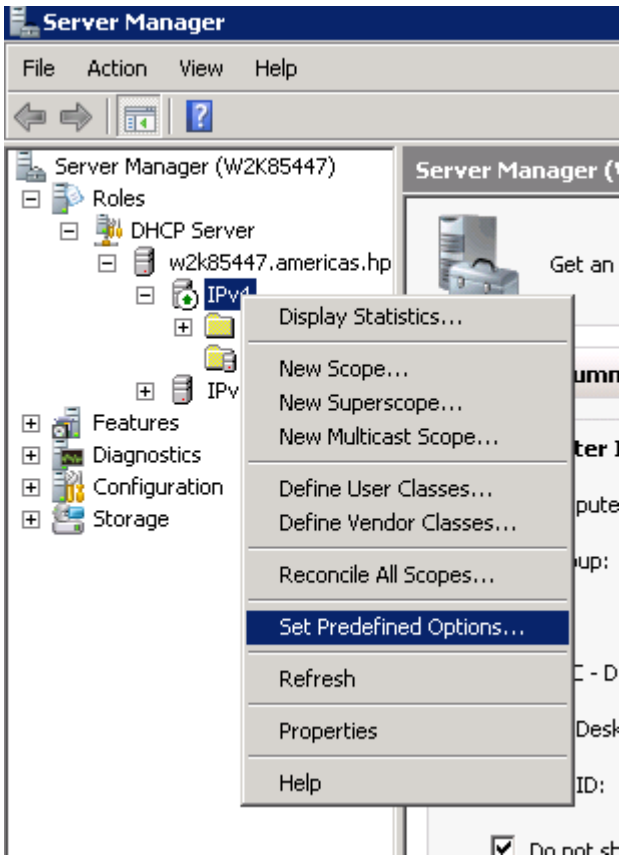
```
    Vendor Class Id = HP J9729A 2920-24G-PoE+ Switch dslforum.org
```

Processing of Vendor Specific Configuration is enabled

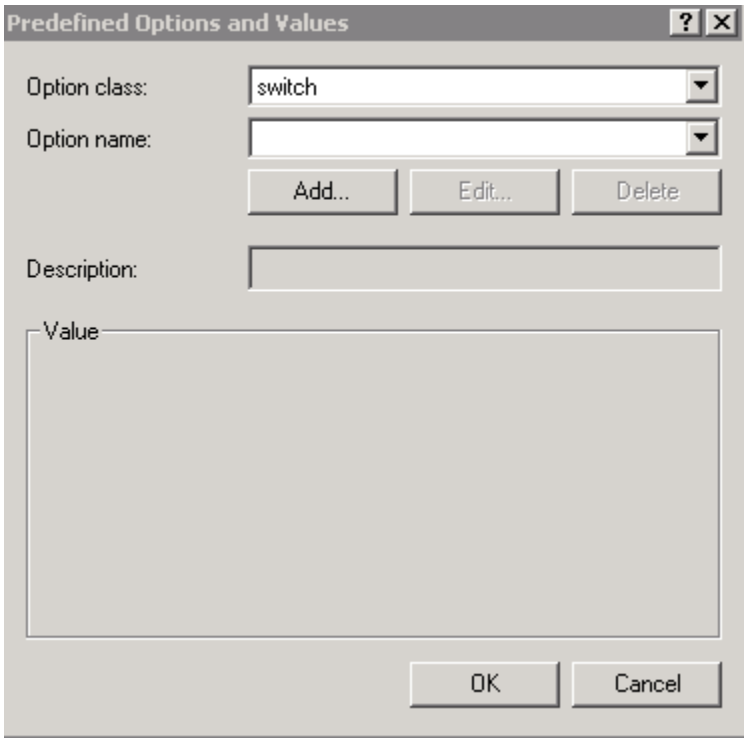
6. From the New Class window, enter the desired **Display name** (any) and the **Description** (any). For the **ASCII** field, enter the exact value that you got by executing the `show` command performed in the previous step. In this example, **HP J9729A 2920-24G-PoE+ Switch dslforum.org**.



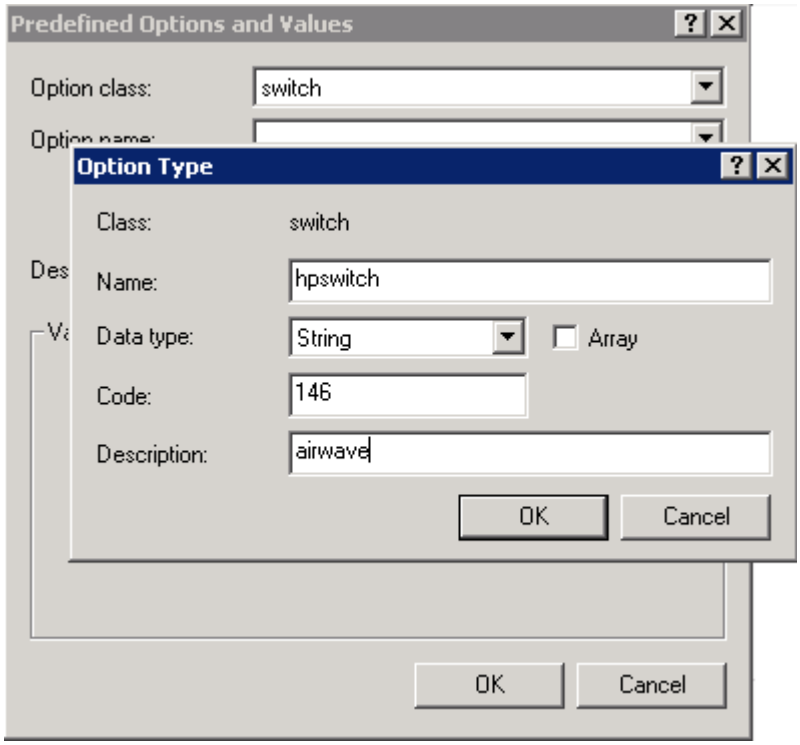
7. Click **OK**.
8. Right click on **IPv4** and select **Set Predefined Options...**.



9. From the Predefined Options and Values window, select **Option class**. The Option Class displayed is the one that you configured under **DHCP Vendor Class**. In this example, the Option Class is **switch**.

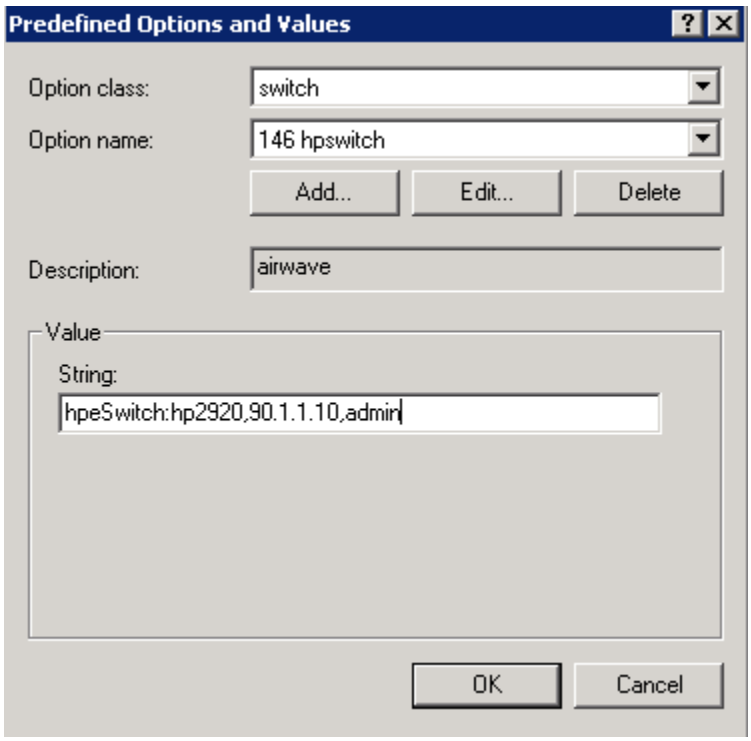


10. Click **Add...**.
11. From the Option Type window, enter the desired **Class** (any), the **Data type** (select **string**), the **Code** (enter **146**), and the **Description** (any).

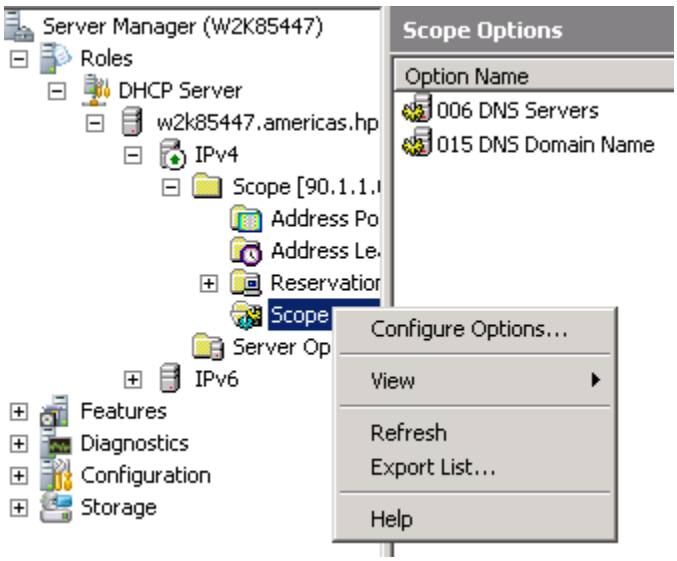


12. Click **OK**.
13. Under the Predefined Options and Values window, enter the Value String. In this example, we enter **hpeSwitch:hp2920,90.1.1.10,admin**. The String has the following format: `<Group>:<Topfolder>,<AMP IP>,<shared secret>`

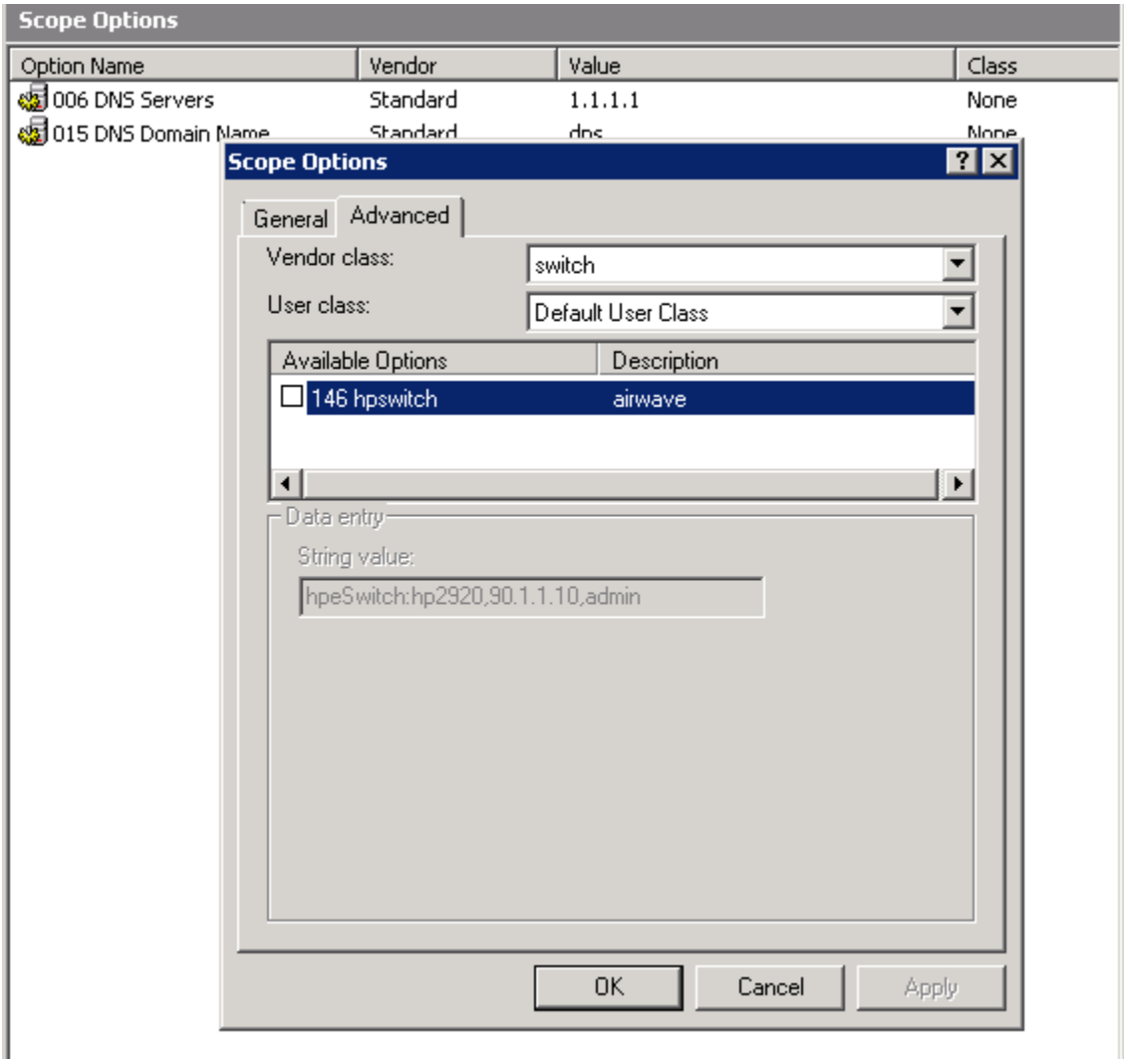
    If you need to add sub-folders, use the following format:`<Group>:<Topfolder>:<folder1>,<AMP IP>,<shared secret>`



14. Click **OK**.
15. Under **IPv4**, expand **Scope**. Right click on **Scope Options** and select **Configure Options...**



16. From the Scope Options window:
    a. Select the **Advanced** tab.
    b. Under Vendor class, select the desired switch. In this example, **switch**.
    c. Select the **146 hpswitch** option.
    d. Click **OK**.



17. You can verify the AirWave details as follows:

```
switch# show amp-server
switch# show run
```

Zero Touch Provisioning

The Zero Touch Provisioning (ZTP) solution enables the auto-configuration of your switches on the first boot without requiring any administrator's intervention at the switch. The switches use DHCP server option configurations to support ZTP.

NOTE

If the switch does not contain the minimal configuration set, ZTP will get disabled. See **Image Upgrade**.

Auto-configuration using ZTP

ZTP auto-configures your switches as follows:

Procedure

1. The switch boots up with the factory default configuration.

2. The switch sends out a DHCP discovery from the primary VLAN interface.
   a. The preferred configuration method uses DHCP option 43 value as a string to parse Airwave configuration. Switch would expect a DHCP option 60 with value `ArubaInstantAP` along with DHCP option 43 to parse Airwave details
   b. The alternate configuration method supports both encapsulated values from option 43 and direct value from option 43. Encapsulated vendor-specific sub options, with sub-option code 146 is for Airwave details.
3. After the AirWave details are verified and configured, the switch initiates the check-in into the AirWave server using the HTTPS communication.

The AirWave configuration must be in the following format:

<Group>:<Topfolder>:<folder1>,<AMP IP >,<shared secret>

4. After a successful registration, AirWave can monitor, configure, and troubleshoot the switches. Refer to *Aruba Networks and AirWave Switch Configuration Guide*.
5. Check-in failure retry is done every 60 seconds for 10 retries.
6. If the DHCP options are not configured for AirWave, the switch is left in its default state for manual configuration.

Disabling ZTP

Zero touch provisioning is disabled if you make any of the following changes to the switch's configuration:

- Enter the switch configuration mode using the `configure terminal` command.
- Enter into Menu and exit without doing any configuration
- Make any successful configuration that changes the running-configuration of the switch using a CLI, SNMP, REST APIs, menu interface, or the web GUI.
- If you upgrade with non-minimal configuration set from any 15.xx version to version 16.01, see **Image Upgrade**

Image Upgrade

If you upgrade from any 15.xx version to version 16.01, the following minimal set of configuration is validated to enable or disable the ZTP process:

- If the switch has any other VLAN apart from the default VLAN, ZTP gets disabled.
- In default VLAN, if the IPv4 address is not set as DHCP (default option is DHCP), ZTP gets disabled.
- In default VLAN, if IPv6 is enabled or configured, ZTP gets disabled.

If you have any other configuration during the upgrade, ZTP will be in the enabled state only.

Configure a switch using the CLI

Use the `amp-server` command to configure the AirWave IP address, group, folder, and shared secret. You must have the `manager` role to execute this command.

For example:

```
HP switch(config)# amp-server ip 172.16.185.23 group 2530 folder 2530 secret secret
```

The `show amp-server` command shows the configuration details:

```
switch# show amp-server
Airwave Configuration details
  AMP Server IP           : 172.16.185.23
  AMP Server Group        : 2530
```

```
  AMP Server Folder       : 2530
  AMP Server Secret       : secret
  AMP Server Config status: Configured
```

Troubleshooting

Cause

You can troubleshoot switches by using the SSH connection and the device logs available in AirWave. For a list of all RMON message, refer to *HPE ArubaOS-Switch Event Log Message Reference Guide*.

You can enable the debug logging with the `debug ztp` command, see **debug ztp**.

View AMP server messages

To display the AMP server debug messages, enter:

```
switch# debug ztp
```

To print the debug messages to the terminal, enter:

```
switch# debug destination session
```

Validation Rules

Validation	Error/Warning
Invalid AirWave IP address	Invalid input: 300.300.300.300
Group name exceeds max length	String %s too long. Allowed length is 32 characters.
Folder name exceeds max length	String %s too long. Allowed length is 128 characters.
Secret name exceeds max length	String %s too long. Allowed length is 32 characters.
AirWave IP address or Group or folder or secret is not configured.	Incomplete input: amp-server

View configuration details

to view the AirWave configuration details, use the `show amp-server` command. For example:

Airwave Configuration details

AMP Server IP : 192.168.1.1
AMP Server Group : HP_GROUP
AMP Server Folder : folder
AMP Server Secret : secret123
AMP Server Config Status: Configured

The `show amp-server` command displays the following values for the above configuration details. The `show running` command also displays the AirWave configuration details.

For example, to show details of the running configuration:

```
switch# show running-config
hostname "Aruba-2930F-24G"
module 1 type j9726a
snmp-server community "public" unrestricted
vlan 1
  name "DEFAULT_VLAN"
  untagged 1-24
  ip address dhcp-bootp
  exit
amp-server ip 192.168.1.1 group "group" folder "folder" secret "secret123"
```

amp-server

Syntax

`[no] amp-server ip <IP ADDRESS> group <GROUP> folder <FOLDER> secret <SECRET>`

Description

The `amp-server` command configures the AirWave Management Platform (AMP) IP address, group, folder, and shared secret and triggers the device registration with AMP.

Only the `manager` role can execute this command.

Parameters

`ip`

AMP server IP address.

`group`

AMP server group name.

`folder`

AMP server folder name.

`secret`

AMP server shared secret string.

Options

`no`

The `no amp-server` command removes the configuration for the AMP server.

Permissions

Only the `manager` role can execute this command.

debug ztp

Syntax

`[no] debug ztp`

Description

Enables or disables ZTP debug logging.

Parameters

`ztp`

Zero Touch Provisioning.

Options

`no`

The `no debug ztp` command disables the ZTP debug logging.

Auto device detection and configuration

The auto device detection and configuration detects a directly connected Aruba AP dynamically and applies predefined configurations to ports on which the Aruba AP is detected.

You can create port configuration profiles, associate them to a device type, and enable or disable a device type. The only device type supported is `aruba-ap` and it is used to identify all the Aruba APs.

When a configured device type is connected on a port, the system automatically applies the corresponding port profile. Connected devices are identified using LLDP. When the LLDP information on the port ages out, the device profile is removed.

By default, the device profile feature is disabled. When you enable the device profile support for a device type, if no other device profile is mapped to the device type, the default device profile `default-ap-profile` is associated with the device type. You can modify the AP default device profile configuration but you cannot delete it. The `default-ap-profile` command supports only the AP device type.

Requirements

- Only APs directly connected to the switch will be detected.

Limitations

- Only one device type is supported, `aruba-ap`, and it is used to identify all the Aruba APs.
- You can modify the configuration parameters of the default profile, `default-ap-profile`, but you cannot delete it or change its name.
- The maximum value for `poe-max-power` is 33 W.
- If the port was part of any protocol VLANs prior to the device profile application, those VLANs will not be removed while applying the device profile.
- Egress rate limiting is not supported for devices running on:
  - Aruba 2530 Switch Series
  - Aruba 2620 Switch Series
- The `egress-bandwidth` is only supported for devices running on:
  - Aruba 2920 Switch Series
  - Aruba 2930F Switch Series
  - Aruba 5400R zl2 Switch Series v2 & v3 modules
  - Aruba 3800 Switch Series
- The `egress-bandwidth` option is not supported and not displayed in the CLI running on:
  - Aruba 2530 Switch Series
  - Aruba 2620 Switch Series

Feature Interactions

Profile Manager and 802.1X

Profile Manager interoperates with RADIUS when it is working in the client mode. When a port is blocked due to 802.1X authentication failure, the LLDP packets cannot come in on that port. Therefore, the Aruba AP cannot be

detected and the device profile cannot be applied. When the port gets authenticated, the LLDP packets comes in, the AP is detected, and the device profile is applied.

You must ensure that the RADIUS server will not supply additional configuration such as VLAN or CoS during the 802.1X authentication as they will conflict with the configuration applied by the Profile Manager. If the RADIUS server supplies any such configurations to a port, the device profile will not be applied on such ports.

Profile Manager and LMA/WMA/MAC-AUTH

If either LMA, WMA, or MAC-AUTH is enabled on an interface, all the MAC addresses reaching the port must be authenticated. If LMA, WMA, or MAC-AUTH is configured on an interface, the user can have more granular control and does not need the device profile configuration. Therefore, the device profile will not be applied on such interface.

Profile manager and Private VLANs

When the device profile is applied, a check is performed to verify if the VLAN addition violates any PVLAN requirements. The following PVLAN related checks are done before applying the VLANs configured in the device profile to an interface:

- A port can be a member of only one VLAN from a given PVLAN instance.
- A promiscuous port cannot be a member of a secondary VLAN.

Creating a profile and associate a device type

Procedure

1. Create a new profile:

```
switch# device-profile <profile-name>
```

2. Enable the `aruba-ap` device type:

```
switch# device-profile type aruba-ap enable
```

3. Associate the new profile to the `aruba-ap` device type:

```
switch# device-profile type aruba-ap associate <profile-name>
```

For example, to add the profile `abc` and associate it with the `aruba-ap` type, enter:.

```
switch# device-profile name abc
switch# device-profile type aruba-ap enable
switch# device-profile type aruba-ap associate abc
```

device-profile name

Syntax

```
[no] device-profile name <PROFILE-NAME> [untagged-vlan <VLAN-ID> |
             tagged-vlan <VLAN-LIST> |
             cos <COS-VALUE> |
             ingress-bandwidth <Percentage> |
             egress-bandwidth <Percentage> |
             {poe-priority {critical | high | low} |
             speed-duplex {auto | auto-10 | auto-100 | ...} |
             poe-max-power <Watts>]
```

Description

This command is used to create an user-defined profile. A profile is a named collection of port settings applied as a group. You can modify the default profile, `default-ap-profile`, but you cannot delete it. You can create four additional profiles.

The `default-ap-profile` has the following values:

- `untagged-vlan`: 1
- `tagged-vlan`: None
- `ingress-bandwidth`: 100
- `egress-bandwidth`: 100
- `cos`: 0
- `speed-duplex`: auto
- `poe-max-power`: 33
- `poe-priority`: critical

You can modify these parameters. For example, you can execute `no untagged-vlan` to create a device profile with tagged only ports.

Parameters

`name`

Specifies the name of the profile to be configured. The profile names can be at most 32 characters long.

`cos`

The Class of Service (CoS) priority for traffic from the device.

`untagged-vlan`

The port is an untagged member of specified VLAN.

`tagged-vlan`

The port is a tagged member of the specified VLANs.

`ingress-bandwidth`

The ingress maximum bandwidth for the device port.

`egress-bandwidth`

The egress maximum bandwidth for the device port.

`poe-priority`

The PoE priority for the device port.

`speed-duplex`

The speed and duplex for the device port.

`poe-max-power`

The maximum PoE power for the device port.

Options

`no`

Removes the user-defined profiles.

Restrictions

- You can modify the configuration parameters of the default profile, `default-ap-profile`, but you cannot delete it or change its name.
- For Aruba 5400R Switch Series and Aruba 2930F Switch Series devices, the maximum value for `poe-max-power` is 30 W. For all other devices, the maximum value for `poe-max-power` is 33 W.

- Egress rate limiting is not supported for devices running on:
  - Aruba 2530 Switch Series
  - Aruba 2540 Switch Series
  - Aruba 2620 Switch Series
  - Aruba 2930F Switch Series
- The `egress-bandwidth` is only supported for Aruba 2920 Switch Series, Aruba 5400R Switch Series v2 & v3 modules, and Aruba 3800 Switch Series.
- The `egress-bandwidth` option is not supported and not displayed in the CLI for devices on: Aruba 2530 Switch Series and Aruba 2620 Switch Series.
- The profile configuration is only applicable to access points.

device-profile type

Syntax

```
device-profile type <DEVICE> [associate <PROFILE-NAME> | enable | disable ]
```

Description

This command specifies an approved device type in order to configure and attach a profile to it. The profile's configuration is applied to any port where a device of this type is connected.

Parameters

`type`

An approved device type in order to configure and attach a profile to it. The only device type supported is `aruba-ap` and it is used to identify all the Aruba APs.

APs.

`associate`

Associates a profile with a device type.

`enable`

Enables automatic profile association.

`disable`

Disables automatic profile association.

Options

`no`

Removes the device type association and disables the feature for the device type. By default, this feature is disabled.

Restrictions

Only one device type is supported, `aruba-ap`, and it is used to identify all the Aruba access points.

Rogue AP Isolation

The Rogue AP Isolation feature detects and blocks any unauthorized APs in the network. You can either log or block the rogue device. If the action requested is to log the rogue device, the MAC address of the rogue device is logged in the system logs (RMON). If the action is to block the rogue device, the traffic to and from the MAC address of the rogue device is blocked. The MAC is also logged in the system log.

When an Aruba AP detects a rogue AP on the network, it sends out the MAC address of the AP as well as the MAC of the clients connected to the AP to the switch using the ArubaOS-Switch proprietary LLDP TLV protocol.

The switch then adds a rule in its hardware table to block all the traffic originating from the rogue AP's MAC address.

The `rogue-ap-isolation` command configures the rogue AP isolation for the switch and gives the option to enable or disable the rogue AP isolation feature. The `rogue-ap-isolation action` command gives you the ability to block the traffic to or from the rogue device or log the MAC of the rogue device. When the action is set to block, the rogue MAC is logged as well. By default, the action is set to block.

The `rogue-ap-isolation whitelist` command lets you add devices detected as possible rogue APs to the whitelist. A maximum of 128 MAC addresses are supported for the whitelist.

The `clear rogue-aps` command clears the detected rogue AP device MAC address.

Limitations

- You can add a maximum of 128 MAC addresses to the whitelist.
- When a MAC is already authorized by any of the port security features such as LMA, WMA, or 802.1X, the MAC is logged but you cannot block it using the `rogue-ap-isolation` feature. A RMON event is logged to notify the user.
- When a MAC is already configured as an IP received MAC of a VLAN interface, the MAC is logged but you cannot block it by using the `rogue-ap-isolation` feature. A RMON event is logged to notify the user.
- When a MAC is already locked out via `lockout-mac` or locked down using the `static-mac` configuration, the MAC is logged but you cannot block it using the `rogue-ap-isolation` feature. A RMON event is logged to notify the user.
- The number of rogue MACs supported on a switch is a function of the value of `max-vlans` at boot time. Since the resources are shared with the `lockout-mac` feature, the scale is dependent on how many lockout addresses have been configured on the switch using the `lockout-mac` feature. The following table lists the scale when there are no lockout addresses configured on the switch:

Max VLAN	Supported MACs
0 < VLAN <= 8	200
8 < VLAN <= 16	100
16 < VLAN <= 256	64
256 < VLAN <= 1024	16
1024 < VLAN <= 2048	8
2048 < VLAN <= 4094	4

The switch will create an RMON log entry and the rogue MAC will be ignored when the limit is reached.

If the `max-vlans` value is changed to a different value, the scale of rogue MACs supported will not change until the next reboot.

Feature Interactions

MAC lockout and lockdown

The Rogue AP isolation feature uses the MAC lockout feature to block MACs in hardware. Therefore, any MAC blocked with the Rogue AP isolation feature cannot be added with the `lockout-mac` or `static-mac` command if the action type is set to `block`.

For example:

```
switch# lockout-mac 247703-7a8950
Cannot add the entry for the MAC address 247703-7a8950 because it is already
blocked by rogue-ap-isolation.
```

```
switch# static-mac 247703-7a8950 vlan 1 interface 1
Cannot add the entry for the MAC address 247703-7a8950 because it is already
blocked by rogue-ap-isolation.
```

Similarly, any MAC that was added with the `lockout-mac` or `static-mac` command and that is being detected as rogue will be logged, but not blocked in hardware as it already is set to block. If the MAC is removed from `lockout-mac` or `static-mac` but is still in the rogue device list, it will be blocked back in hardware if the action type is `block`.

LMA/WMA/802.1X/Port-Security

Any configuration using LMA, WMA, 802.1X, or Port-Security will not be blocked if the Rogue AP isolation feature is enabled. All these features act only when a packet with the said MAC is received on a port.

If `rogue-ap-isolation` blocks a MAC before it is configured to be authorized, packets from such MACs will be dropped until one of the following happens:

- Rogue action is changed to LOG.
- Rogue-AP isolation feature is disabled.
- The MAC is not detected as rogue anymore.
- LLDP is disabled on the port (or globally).

Once a MAC has been authorized by one of these features, it will not be blocked by Rogue AP isolation. A RMON will be logged to indicate the failure to block.

The Rogue AP module will retry to block any such MACs periodically. In the event of the MAC no longer being authorized, Rogue AP isolation will block the MAC again. No RMON is logged to indicate this event.

L3 MAC

The Rogue AP isolation feature will not block a MAC configured as an IP receive MAC address on a VLAN interface. This event will be logged in RMON if such MACs are detected as rogue.

Conversely, any MAC already blocked by Rogue AP isolation will not be allowed to be configured as an IP receive MAC address of a VLAN interface.

For example:

```
switch# vlan 1 ip-recv-mac-address 247703-3effbb
Cannot add an entry for the MAC address 247703-3effbb because it is already
blocked by rogue-ap-isolation.
```

Using the Rogue AP Isolation feature

Procedure

1. Check the feature state:

   ```
   switch# show rogue-ap-isolation

    Rogue AP Isolation
   ```

```
 Rogue AP Status : Disabled
 Rogue AP Action : Block

 Rogue MAC Address Neighbour MAC Address
 ----------------- --------------------
```

2. Enable the feature:

```
switch# rogue-ap-isolation enable
switch# show rogue-ap-isolation

 Rogue AP Isolation

  Rogue AP Status : Enabled
  Rogue AP Action : Block

  Rogue MAC Address Neighbour MAC Address
  ----------------- --------------------
```

3. Change the action type from block to log:

```
switch# rogue-ap-isolation action log
switch# show rogue-ap-isolation

 Rogue AP Isolation

  Rogue AP Status : Enabled
  Rogue AP Action : Log

  Rogue MAC Address Neighbour MAC Address
  ----------------- --------------------
```

4. List the current whitelist entries:

```
switch# show rogue-ap-isolation whitelist

Rogue AP Whitelist Configuration

 Rogue AP MAC
 ------------------
```

5. Add a new whitelist entry:

```
switch# rogue-ap-isolation whitelist 005056-00326a
switch# show rogue-ap-isolation whitelist

Rogue AP Whitelist Configuration

 Rogue AP MAC
 ------------------
 00:50:56:00:32:6a
```

rogue-ap-isolation

syntax

```
rogue-ap-isolation {enable | disable}
```

Description

Configures the rogue AP isolation for the switch.

Parameters

`enable`

Enables the rogue AP isolation.

`disable`

Disables the rogue AP isolation.

rogue-ap-isolation action

syntax

```
rogue-ap-isolation action {log | block}
```

Description

Configures the action to take for the rogue AP packets. This function is disabled by default.

Parameters

`action`

Configure the action to take for rogue AP packets. By default, the rogue AP packets are blocked.

Options

`log`

Logs traffic to or from any rogue access points.

`block`

Blocks and logs traffic to or from any rogue access points.

rogue-ap-isolation whitelist

syntax

```
[no] rogue-ap-isolation whitelist <MAC-ADDRESS>
```

Description

Configures the rogue AP Whitelist MAC addresses for the switch. Use this command to add to the whitelist the MAC addresses of approved access points or MAC addresses of clients connected to the rogue access points. These approved access points will not be added to the rogue AP list even if they are reported as rogue devices.

Parameters

`MAC-ADDRESS`

Specifies the MAC address of the device to be moved from the rogue AP list to the whitelist.

Options

`no`

Removes the MAC address individually by specifying the MAC.

Restrictions

You can add a maximum of 128 MAC addresses to the whitelist.

clear rogue-ap-isolation

syntax

```
clear rogue-ap-isolation { <MAC-ADDRESS> | all }
```

Description

Removes the MAC addresses from the rogue AP list.

Parameters

`MAC-ADDRESS`

Specifies the MAC address of the device to be moved from the rogue AP list.

`all`

Clears all MAC addresses from the rogue AP list.

Restrictions

The MAC addresses cleared using this option will be added back to the rogue list under the following cases:

1. The LLDP administrator status of the port on which the AP that reported the MAC is disabled and enabled back.
2. The data that is in the rogue AP TLV sent from the AP that informed the rogue MAC has changed.
3. To permanently ignore a MAC from being detected as rogue, add it to the whitelist.

Troubleshooting

Dynamic configuration not displayed when using “show running-config”

Symptom

The `show running-config` command does not display the dynamic configuration applied through the device profile.

Cause

The `show running-config` command shows only the permanent user configuration and parameters configured through device profile.

Action

Procedure

1. Use the specific `show device-profile` command to display the parameters dynamically configured through the device profile.

Switch does not detect the rogue AP TLVs

Symptom

The switch does not detect the rogue AP TLVs that could be sent from the neighboring device.

Cause

The LLDP administrator status of a port is moved from `txOnly` to `tx_rx` or `rx_only` within 120 seconds of the previous state change to `txOnly`.

Action

Procedure

1. Wait for 120 seconds before moving from the state `txOnly` to the state `tx_rx` or `rx_only`.

2. Move the administrator status to `disable` and then back to `tx_rx` or `rx_only`.

The `show run` command displays non-numerical value for untagged-vlan

Symptom

The `show run` command displays one of the following values for `untagged-vlan`:

- `no untagged-vlan`
- `untagged-vlan : None`

Cause

The `no device-profile` or the `no rogue-ap-isolation whitelist` command is executed to configure `untagged-vlan` to `0`.

Action

Procedure

1. No action is required.

Show commands

Use the following show commands to view the various configurations and status.

Command	Description
`show device-profile`	Shows the device profile configuration and status.
`show device-profile config`	Shows the device profile configuration details for a single profile or all profiles.
`show device-profile status`	Shows currently applied device profiles.
`show rogue-ap-isolation`	Shows the following information: • The status of the feature: enabled or disabled. • The current action type for the rogue MACs detected. • The list of MAC addresses detected as rogue and the MAC address of the AP that reported them.
`show rogue-ap-isolation whitelist`	Shows the rogue AP whitelist configuration.
`show run`	Shows the running configuration.

Validation Rules

Validation	Error/Warning/Prompt
`device-profile profile-name default-ap-profile`	Maximum tagged VLANs that can be associated with a device-profile is 256.
`device-profile profile-name` creation.	String too long. Allowed length is 32 characters.
`device-profile profile-name` creation.	Device profile <> already exists.
`device-profile profile-name` creation.	The maximum number of device profiles allowed is 5.
`device-profile profile-name` deletion.	Device profile <> does not exist.
`device-profile profile-name` deletion.	Cannot delete profile <> when associated with a device type.
`device-profile profile-name` deletion.	Default profile cannot be deleted.
`device-profile profile-name` modification via SNMP.	Default profile name cannot be changed.
`device-profileprofile-name` creation/ modification via SNMP.	Device profile index cannot be greater than 5.
`untagged-vlan`	Invalid VLAN.
`untagged-vlan`	Cannot configure the VLAN <> as an untagged VLAN because this is already used as a tagged VLAN.
`tagged-vlan 1-1000`	The maximum number of tagged VLANs in a profile is less than 512 or the maximum VLANs, `MAX_VLANs`, configurable in the system.
`tagged-vlan`	Cannot configure the VLAN <> as a tagged VLAN because this is already used as an untagged VLAN.
`ingress-bandwidth`	SNMP should return `WRONG_VALUE_ERROR`.
`egress-bandwidth`	SNMP should return `WRONG_VALUE_ERROR`.
`cos`	SNMP should return `WRONG_VALUE_ERROR`.
`speed-duplex`	SNMP should return `WRONG_VALUE_ERROR`.
`poe-max-power`	SNMP should return `WRONG_VALUE_ERROR`.
`poe-priority`	SNMP should return `WRONG_VALUE_ERROR`.
`device-profile type aruba-ap profile-name`	String <> too long. Allowed length is 32 characters.

Table Continued

Validation	Error/Warning/Prompt
`device-profile type aruba-ap profile-name`	Device profile <> does not exist.
`device-profile type aruba-switch-router`	Device type is not supported.
`rogue-ap-whitelist`	Whitelist MAC address already exists in the list.
`rogue-ap-whitelist`	Whitelist MAC address does not exist in the list.
`rogue-ap-whitelist`	The maximum number of whitelist MACs allowed is 128.
`rogue-ap-whitelist <MAC>`	Cannot add the whitelist entry because the specified MAC address is already configured as a lock-out MAC.
`lock-out <MAC>`	Cannot add the lock-out entry because the specified MAC address is already configured as a whitelist MAC.
`lockout-mac <MAC-ADDRESS>`OR`static-mac <MAC-ADDRESS> vlan <vlan-id> interface <interface>`OR`vlan <vlan-id> ip-recv-mac-address <MAC-ADDRESS`	Cannot add an entry for the MAC address <`MAC-ADDRESS`> because it is already blocked by `rogue-ap-isolation`.

LACP-MAD commands

Configuration command

The following command defines whether LACP is enabled on a port, and whether it is in active or passive mode when enabled. When LACP is enabled and active, the port sends LACP packets and listens to them. When LACP is enabled and passive, the port sends LACP packets only if it is spoken to. When LACP is disabled, the port ignores LACP packets. If the command is issued without a mode parameter, 'active' is assumed. During dynamic link aggregation using LACP, ports with the same key are aggregated as a single trunk. MAD passthrough applies only to trunks and not to physical ports.

```
switch# [no] interface <port-list> lacp [mad-passthrough <enable|disable>|active|passive|key <key>]
```

show commands

LACP-MAD supports the following show commands:

- show LACP-MAD passthrough configuration on LACP trunks

```
switch# show lacp [counters [<port-list>] | local [<port-list>] |peer [<port-list>] | distributed | mad-passthrough [counters [<port-list>]]]
```

- show LACP-MAD passthough counters on ports

```
switch# show lacp mad-passthrough counters [<port-list>]
```

clear command

Clear all LACP statistics including MAD passthrough counters. Resets LACP packets sent and received on all ports.

```
switch# clear lacp statistics
```

LACP-MAD overview

Link Aggregation Control Protocol-Multi-Active Detection (LACP-MAD) is a detection mechanism deployed by switches to recover from a breakup of the Vertical Switching Framework (VSF) stack due to link or other failure.

LACP-MAD is implemented by sending extended LACP data units (LACPDUs) with a type length value (TLV) that conveys the active ID of an VSF virtual device. The active ID is identical to the member ID of the master and is thus unique to the VSF virtual device. When LACP MAD detection is enabled, the members exchange their active IDs by sending extended LACPDUs.

- When the VSF virtual device operates normally, the active IDs in the extended LACPDUs sent by all members are the same, indicating that there is no multi-active collision.
- When there is a breakup in the VSF stack, the active IDs in the extended LACPDUs sent by the members in different VSF virtual devices are different, indicating that there are multi-active collisions.

LACP-MAD passthrough helps VSF-capable devices detect multi-access and take corrective action. These devices do not initiate transmission of LACP-MAD frames or participate in any MAD decision making process. These devices simply forward LACP-MAD TLVs received on one interface to the other interfaces on the trunk. LACP-MAD passthrough can be enabled for 24 LACP trunks. By default, LACP-MAD passthrough is disabled.

The following table lists the switch scalability values for the areas of VLANs, ACLs, hardware, ARP, and routing.

Subject	Maximum
IPv4 ACLs	
total named (extended or standard)	Up to 2048 (minus any IPv4 numeric standard or extended ACL assignments and any RADIUS-assigned ACLs)[1]
total numbered standard	Up to 99[1]
total numbered extended	Up to 100[1]
total ACEs in all IPv4 ACLs	Up to 3072[1]
Layer-3	
VLANs with at least one IP Address	512
IP addresses per system	2048 IPv4 2048 IPv6[2]
IP addresses per VLAN	32[3]
Static routes (IPv4 and IPv6 combined)	256
IPv4 host hardware table	72 K (8K internal, 64K external)
IPv4 BMP hardware table	2 K
ARP	
ARP entries	25,000
Packets held for ARP resolution	25
Dynamic Routing	
Total routes supported	IPv4 only: 10,000 (including ARP) IPv4 and IPv6: 10 K (IPv4) and 3 K (IPv6)[4] IPv6 only: 5 K[5]
IPv4 Routing Protocol	
RIP interfaces	128

Table Continued

Subject	Maximum
IPv6 Routing Protocol	
DHCPv6 Helper Addresses	32 unique addresses; multiple instances of same address counts as 1 towards maximum

[1] Actual availability depends on combined resource usage on the switch. See **Monitoring resources** on page 63.

[2] These limits apply only to user-configured addresses and not to auto-configured link local and prefix IPv6 addresses. A maximum configuration could support up to 2048 user-configured and 2048 auto-configured IPv6 addresses for a total of 4096.

[3] There can be up to 32 IPv4 and 32 user-configured IPv6 addresses on a single VLAN. In addition, each VLAN is limited to 3 auto-configured prefix-based IPv6 addresses.

[4] Configured as an ABR for OSPF with four IPv4 areas and four IPv6 areas.

[5] Configured as an ABR for OSPF with two IPv6 OSPF areas.

Overview

The switches support several methods for transferring files to and from a physically connected device or via the network, including TFTP and Xmodem. This appendix explains how to download new switch software, upload or download switch configuration files and software images, and upload command files for configuring ACLs.

Downloading switch software

HPE Switch periodically provides switch software updates through the Switch Networking website. For more information, see the support and warranty booklet shipped with the switch, or visit **http://www.hpe.com/networking** and click on **software updates**.

This manual uses the terms **switch software** and **software image** to refer to the downloadable software files the switch uses to operate its networking features. Other terms sometimes include **Operating System**, or **OS**.

General software download rules

- Switch software that you download via the menu interface always goes to primary flash.
- After a software download, you must reboot the switch to implement the new software. Until a reboot occurs, the switch continues to run on the software it was using before the download.

Downloading new switch software does not change the current switch configuration. The switch configuration is contained in separate files that can also be transferred. See **Transferring switch configurations** on page 309.

In most cases, if a power failure or other cause interrupts a flash image download, the switch reboots with the image previously stored in primary flash. In the unlikely event that the primary image is corrupted (which may occur if a download is interrupted by a power failure), the switch goes into boot ROM mode. In this case, use the boot ROM console to download a new image to primary flash.

Using TFTP to download software from a server

This procedure assumes that:

- A software version for the switch has been stored on a TFTP server accessible to the switch. (The software file is typically available from the HPE Switch Networking website at **http://www.hpe.com/networking**.)
- The switch is properly connected to your network and has already been configured with a compatible IP address and subnet mask.
- The TFTP server is accessible to the switch via IP.

Before you use the procedure, do the following:

- Obtain the IP address of the TFTP server in which the software file has been stored.
- If VLANs are configured on the switch, determine the name of the VLAN in which the TFTP server is operating.
- Determine the name of the software file stored in the TFTP server for the switch (For example, E0820.swi).

NOTE

If your TFTP server is a UNIX workstation, ensure that the case (upper or lower) that you specify for the filename is the same case as the characters in the software filenames on the server.

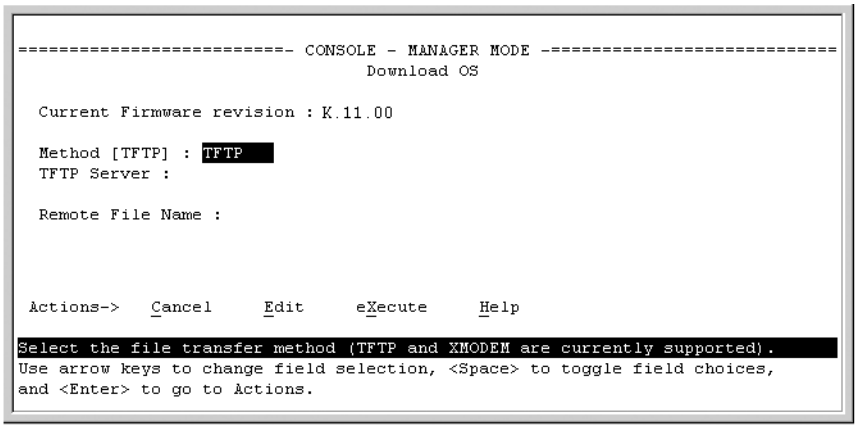
Downloading from a server to primary flash using TFTP (Menu)

Note that the menu interface accesses only the primary flash.

Procedure

1. In the console Main Menu, select **Download OS** to display the screen in **Figure 40: Example: of a download OS (software) screen (default values)** on page 295. (The term "OS" or "operating system" refers to the switch software):

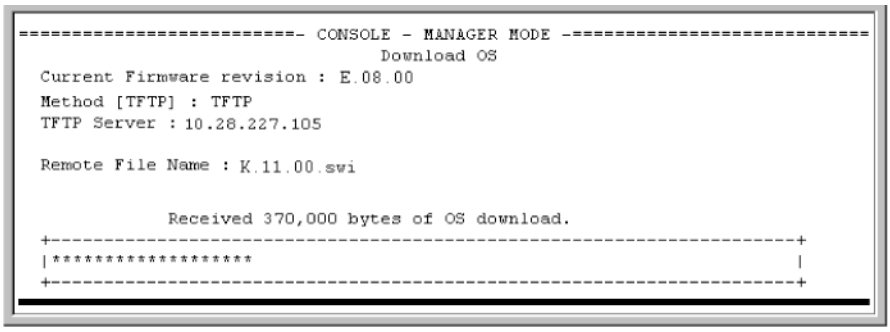
   Figure 40: *Example: of a download OS (software) screen (default values)*



2. Press **[E]** (for **Edit**).
3. Ensure that the **Method** field is set to **TFTP** (the default).
4. In the **TFTP Server** field, enter the IP address of the TFTP server in which the software file has been stored.
5. In the **Remote File Name** field, enter the name of the software file (if you are using a UNIX system, remember that the filename is case-sensitive).
6. Press **[Enter]**, then **[X]** (for **eXecute**) to begin the software download.

   The following screen appears:

   Figure 41: *Example: of the download OS (software) screen during a download*



   A "progress" bar indicates the progress of the download. When the entire software file has been received, all activity on the switch halts and you will see **Validating and writing system software to FLASH...**
7. After the primary flash memory is updated with the new software, you must reboot the switch to implement the newly downloaded software. Return to the Main Menu and press **[6]** (for **Reboot Switch**).

You will see this prompt:

```
Continue reboot of system? : No
```

Press the space bar once to change **No** to **Yes**, then press **[Enter]** to begin the reboot.

NOTE

When you use the menu interface to download a switch software, the new image is always stored in primary flash. Also, using the `Reboot Switch` command in the Main Menu always reboots the switch from primary flash. Rebooting the switch from the CLI provides more options. See "Rebooting the Switch" in the basic operation guide.

8. After you reboot the switch, confirm that the software downloaded correctly:
   a. From the Main Menu, select

      2. Switch Configuration...

      2. Port/Trunk Settings
   b. Check the **Firmware revision** line.

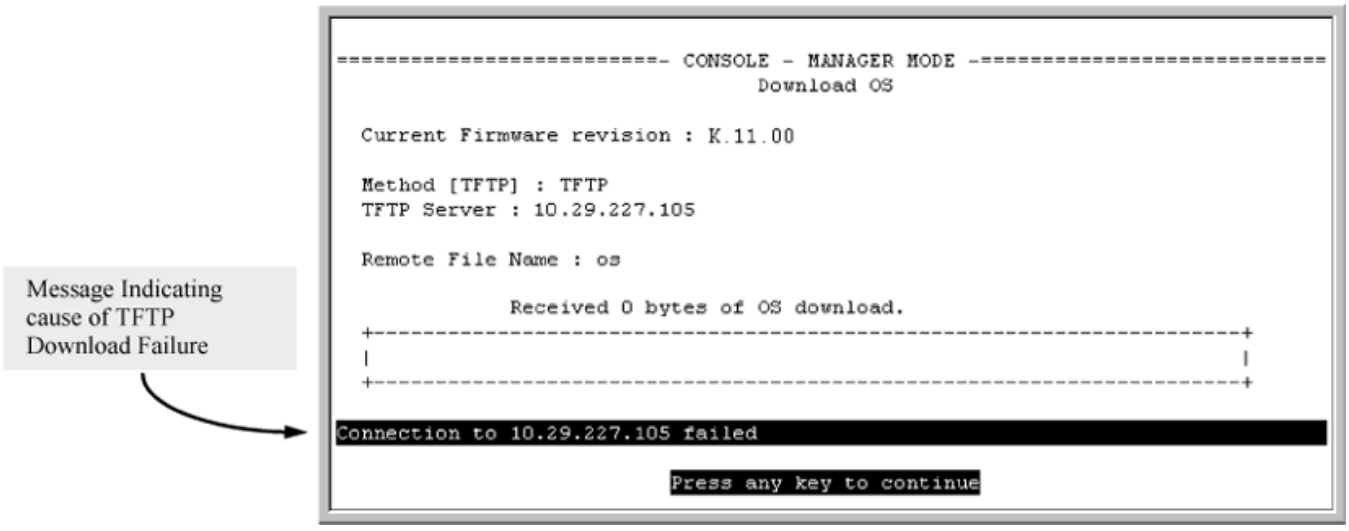
For troubleshooting information on download failures, see **Troubleshooting TFTP download failures** on page 296.

Troubleshooting TFTP download failures

Cause

When using the menu interface, if a TFTP download fails, the Download OS (Operating System, or software) screen indicates the failure as seen in the following figure.

Figure 42: *Example: of message for download failure*



Some of the causes of download failures include:

- Incorrect or unreachable address specified for the **TFTP Server** parameter. This may include network problems.
- Incorrect VLAN.
- Incorrect name specified for the **Remote File Name** parameter, or the specified file cannot be found on the TFTP server. This can also occur if the TFTP server is a UNIX machine and the case (upper or lower) for the filename on the server does not match the case for the filename entered for the **Remote File Name** parameter in the **Download OS** (Operating System, or software) screen.
- One or more of the switch's IP configuration parameters are incorrect.

- For a UNIX TFTP server, the file permissions for the software file do not allow the file to be copied.
- Another console session (through either a direct connection to a terminal device or through Telnet) was already running when you started the session in which the download was attempted.

To find more information on the cause of a download failure:

- Examine the messages in the switch's Event Log by executing the `show log tftp` command from the CLI.
- For descriptions of individual Event Log messages, see the latest version of the event log message reference guide for your switch, available on the HPE Switch website. (See "Getting Documentation From the Web".)

If an error occurs in which normal switch operation cannot be restored, the switch automatically reboots itself, and an appropriate message is displayed after the reboot.

Downloading from a server to flash using TFTP (CLI)

Syntax:

copy tftp flash <*ip-address*> <*remote-file*> [<primary | secondary>]

Automatically downloads a switch software file to primary or secondary flash. If you do not specify the flash destination, the TFTP download defaults to primary flash.

Example:

To download a switch software file named k0800.swi from a TFTP server with the IP address of 10.28.227.103 to primary flash:

Procedure

1. Execute `copy` as shown below:
   The command to download an OS (switch software)

```
switch# copy tftp flash 10.28.227.103 k0800.swi
The primary OS Image will be deleted, continue [y/n]? y [1]
01431K [2]
```

   - [1]This message means that the image you want to upload will replace the image currently in primary flash.
   - [2]Dynamic counter continually displays the number of bytes transferred.

   When the switch finishes downloading the software file from the server, it displays this progress message:

```
Validating and Writing System Software to FLASH ...
```

2. When the download finishes, you must reboot the switch to implement the newly downloaded software image. To do so, use one of the following commands:

   Syntax:

   boot system flash {<primary | secondary>}

   Boots from the selected flash.

   Syntax:

   reload

Boots from the flash image and startup-config file. A switch covered in this guide (with multiple configuration files), also uses the current startup-config file.

For more information on these commands, see "Rebooting the Switch" in the basic operation guide for your switch.

3. To confirm that the software downloaded correctly, execute `show system` and check the **Firmware revision** line.

For information on primary and secondary flash memory and the boot commands, see "Using Primary and Secondary Flash Image Options" in the basic operation guide for your switch.

If you use `auto-tftp` to download a new image in a redundant management system, the active management module downloads the new image to both the active and standby modules. Rebooting after the `auto-tftp` process completes reboots the entire system.

Enabling TFTP (CLI)

TFTP is enabled by default on the switch. If TFTP operation has been disabled, you can re-enable it by specifying TFTP client or server functionality with the `tftp [client|server]` command at the global configuration level.

Syntax:

[no] tftp [client | server]

Disables/re-enables TFTP for client or server functionality so that the switch can:

- Use TFTP client functionality to access TFTP servers in the network to receive downloaded files.
- Use TFTP server functionality to upload files to other devices on the network.

Usage notes

To disable all TFTP client or server operation on the switch except for the auto-TFTP feature, enter the `no tftp [client|server]` command.

When IP SSH file transfer is used to enable SCP and SFTP functionality on the switch, this disables TFTP client and server functionality. Once ip ssh file transfer is enabled, TFTP and auto-TFTP cannot be re-enabled from the CLI.

When TFTP is disabled, instances of TFTP in the CLI `copy` command and the Menu interface "Download OS" screen become unavailable.

The `no tftp [client|server]` command does not disable auto-TFTP operation. To disable an auto-TFTP command configured on the switch, use the `no auto-tftp` command to remove the command entry from the switch's configuration.

For information on how to configure TFTP file transfers on an IPv6 network, see the "IPv6 Management Features" in the IPv6 configuration guide for your switch.

Configuring the switch to download software automatically from a TFTP server using auto-TFTP (CLI)

The `auto-tftp` command lets you configure the switch to download software automatically from a TFTP server.

At switch startup, the auto-TFTP feature automatically downloads a specified software image to the switch from a specified TFTP server and then reboots the switch. To implement the process, you must first reboot the switch using one of the following methods:

- Enter the `boot system flash primary` command in the CLI.
- With the default flash boot image set to primary flash (the default), enter the `boot` or the `reload` command, or cycle the power to the switch. (To reset the boot image to primary flash, use `boot set-default flash primary`.)

Syntax:

auto-tftp <*ip-addr*> <*filename*>

By default, auto-TFTP is disabled. This command configures the switch to automatically download the specified software file from the TFTP server at the specified IP address. The file is downloaded into primary flash memory at switch startup; the switch then automatically reboots from primary flash.

To enable auto-TFTP to copy a software image to primary flash memory, the version number of the downloaded software file (For example, XX_14_01.swi) must be different from the version number currently in the primary flash image.

The current TFTP client status (enabled or disabled) does not affect auto-TFTP operation. (See **Enabling TFTP (CLI)** on page 298.)

Completion of the auto-TFTP process may require several minutes while the switch executes the TFTP transfer to primary flash and then reboots again.

The `no` form of the command disables auto-TFTP operation by deleting the `auto-tftp` entry from the startup configuration.

The `no auto-tftp` command does not affect the current TFTP-enabled configuration on the switch. However, entering the `ip ssh filetransfer` command automatically disables both `auto-tftp` and `tftp` operation.

Using SCP and SFTP

For some situations you may want to use a secure method to issue commands or copy files to the switch. By opening a secure, encrypted SSH session and enabling ip ssh file transfer, you can then use a third-party software application to take advantage of SCP and SFTP. SCP and SFTP provide a secure alternative to TFTP for transferring information that may be sensitive (like switch configuration files) to and from the switch. Essentially, you are creating a secure SSH tunnel as a way to transfer files with SFTP and SCP channels.

Once you have configured your switch to enable secure file transfers with SCP and SFTP, files can be copied to or from the switch in a secure (encrypted) environment and TFTP is no longer necessary.

To use these commands, you must install on the administrator workstation a third-party application software client that supports the SFTP and/or SCP functions. Some examples of software that supports SFTP and SCP are PuTTY, Open SSH, WinSCP, and SSH Secure Shell. Most of these are freeware and may be downloaded without cost or licensing from the internet. There are differences in the way these clients work, so be sure you also download the documentation.

As described earlier in this chapter you can use a TFTP client on the administrator workstation to update software images. This is a plain-text mechanism that connects to a standalone TFTP server or another HPE switch acting as a TFTP server to obtain the software image files. Using SCP and SFTP allows you to maintain your switches with greater security. You can also roll out new software images with automated scripts that make it easier to upgrade multiple switches simultaneously and securely.

SFTP is unrelated to FTP, although there are some functional similarities. Once you set up an SFTP session through an SSH tunnel, some of the commands are the same as FTP commands. Certain commands are not allowed by the SFTP server on the switch, such as those that create files or folders. If you try to issue commands such as `create` or `remove` using SFTP, the switch server returns an error message.

You can use SFTP just as you would TFTP to transfer files to and from the switch, but with SFTP, your file transfers are encrypted and require authentication, so they are more secure than they would be using TFTP. SFTP works only with SSH version 2 (SSH v2).

NOTE

SFTP over SSH version 1 (SSH v1) is not supported. A request from either the client or the switch (or both) using SSH v1 generates an error message. The actual text of the error message differs, depending on the client software in use. Some examples are:

```
Protocol major versions differ: 2 vs. 1
Connection closed

Protocol major versions differ: 1 vs. 2
Connection closed

Received disconnect from <ip-addr> : /usr/local/libexec/
sftp-server: command not supported
Connection closed
```

SCP is an implementation of the BSD `rcp` (Berkeley UNIX remote copy) command tunneled through an SSH connection.

SCP is used to copy files to and from the switch when security is required. SCP works with both SSH v1 and SSH v2. Be aware that the most third-party software application clients that support SCP use SSHv1.

The general process for using SCP and SFTP involves three steps:

Procedure

1. Open an SSH tunnel between your computer and the switch if you have not already done so.

   (This step assumes that you have already set up SSH on the switch.)
2. Execute `ip ssh filetransfer` to enable secure file transfer.
3. Use a third-party client application for SCP and SFTP commands.

Enabling SCP and SFTP

For more information about secure copy and SFTP, see **Using SCP and SFTP** on page 299.

Procedure

1. Open an SSH session as you normally would to establish a secure encrypted tunnel between your computer and the switch.

   For more detailed directions on how to open an SSH session, see "Configuring secure shell (SSH)" in the access security guide for your switch. Please note that this is a one-time procedure for new switches or connections. If you have already done it once you should not need to do it a second time.
2. To enable secure file transfer on the switch (once you have an SSH session established between the switch and your computer), open a terminal window and enter the following command:

   ```
   switch(config)# ip ssh filetransfer
   ```

For information on disabling TFTP and auto-TFTP, see **Disabling TFTP and auto-TFTP for enhanced security** on page 300.

Disabling TFTP and auto-TFTP for enhanced security

Using the `ip ssh filetransfer` command to enable SFTP automatically disables TFTP and auto-TFTP (if either or both are enabled), as shown in **Switch configuration with SFTP enabled** on page 300.

Switch configuration with SFTP enabled

```
switch(config)# ip ssh filetransfer
Tftp and auto-tftp have been disabled. [1]
switch(config)# sho run
```

```
Running configuration:

; J9091A Configuration Editor; Created on release #xx.15.xx

hostname "HP Switch"
module 1 type J8702A
module 2 type J702A
vlan 1
   name "DEFAULT_VLAN"
   untagged A1-A24,B1-B24
   ip address 10.28.234.176 255.255.240.0
   exit
ip ssh filetransfer [2]
no tftp-enable
password manager
password operator
```

[1] Enabling SFTP automatically disables TFTP and auto-tftp and displays this message.

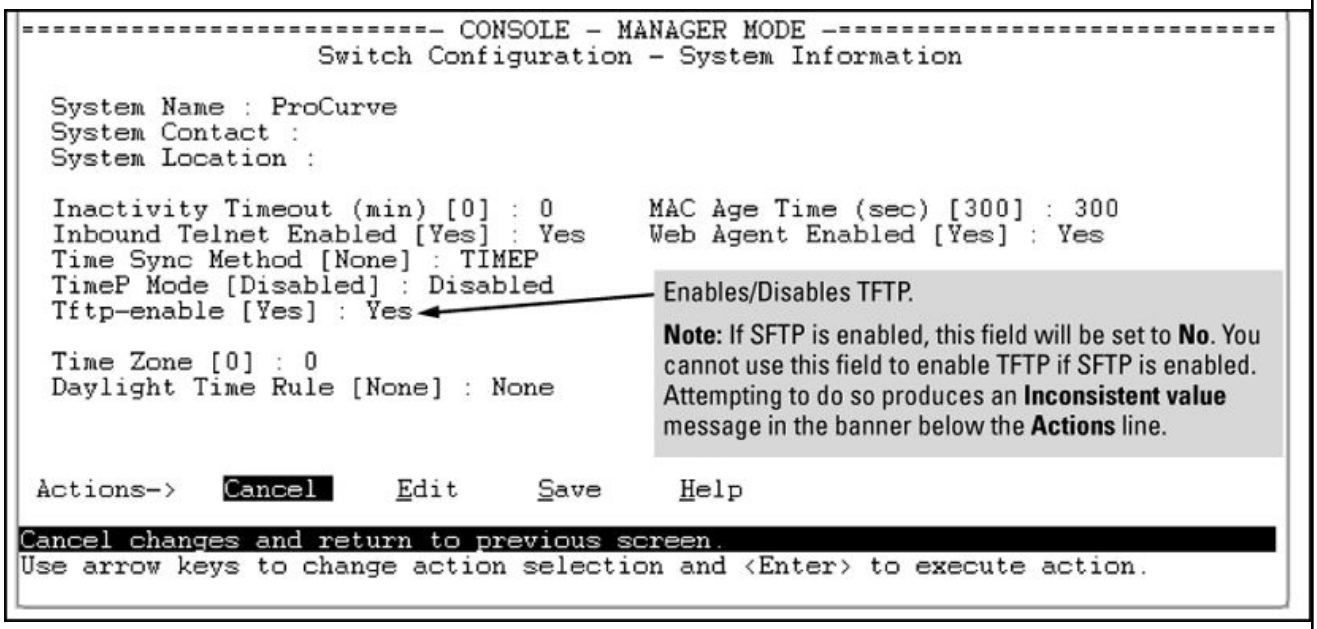
[2] Viewing the configuration shows that SFTP is enabled and TFTP is disabled.

If you enable SFTP and then later disable it, TFTP and auto-TFTP remain disabled unless they are explicitly re-enabled.

Operating rules are:

- The TFTP feature is enabled by default, and can be enabled or disabled through the CLI, the Menu interface (see **Figure 43: Using the Menu interface to disable TFTP** on page 301), or an SNMP application. Auto-TFTP is disabled by default and must be configured through the CLI.

  Figure 43: *Using the Menu interface to disable TFTP*



- While SFTP is enabled, TFTP and auto-TFTP cannot be enabled from the CLI. Attempting to enable either non-secure TFTP option while SFTP is enabled produces one of the following messages in the CLI:

```
SFTP must be disabled before enabling tftp.

SFTP must be disabled before enabling auto-tftp.
```

Similarly, while SFTP is enabled, TFTP cannot be enabled using an SNMP management application. Attempting to do so generates an "inconsistent value" message. (An SNMP management application cannot be used to enable or disable auto-TFTP.)

- To enable SFTP by using an SNMP management application, you must first disable TFTP and, if configured, auto-TFTP on the switch. You can use either an SNMP application or the CLI to disable TFTP, but you must use the CLI to disable auto-TFTP.

Enabling SSH V2 (required for SFTP)

```
switch(config)# ip ssh version 2
```

As a matter of policy, administrators should **not** enable the SSH V1-only or the SSH V1-or-V2 advertisement modes. SSHv1 is supported on only some legacy switches (such as the HPE Switch Series 2500 switches).

Confirming that SSH is enabled

```
switch(config)# show ip ssh
```

Once you have confirmed that you have enabled an SSH session (with the `show ip ssh` command), enter `ip ssh filetransfer` so that SCP and/or SFTP can run. You can then open your third-party software client application to begin using the SCP or SFTP commands to safely transfer files or issue commands to the switch.

Any attempts to use SCP or SFTP without using `ip ssh filetransfer` cause the SCP or SFTP session to fail. Depending on the client software in use, you will receive an error message on the originating console, for Example:

```
IP file transfer not enabled on the switch
```

Disabling secure file transfer

```
switch(config)# no ip ssh filetransfer
```

Authentication

Switch memory allows up to ten public keys. This means the authentication and encryption keys you use for your third-party client SCP/SFTP software can differ from the keys you use for the SSH session, even though both SCP and SFTP use a secure SSH tunnel.

SSH authentication is mutually exclusive with RADIUS servers.

Some clients, such as PSCP (PuTTY SCP), automatically compare switch host keys for you. Other clients require you to manually copy and paste keys to the **`$HOME/.ssh/known_hosts`** file. Whatever SCP/SFTP software tool you use, after installing the client software you must verify that the switch host keys are available to the client.

Because the third-party software utilities you may use for SCP/SFTP vary, you should refer to the documentation provided with the utility you select before performing this process.

SCP/SFTP operating notes

- Any attempts to use SCP or SFTP without using ip ssh filetransfer will cause the SCP or SFTP session to fail. Depending on the client software in use, you will receive an error message on the originating console, for Example:

    IP file transfer not enabled on the switch
- There is a delay when SFTP is copying an image onto the switch, and although the command prompt returns in a couple of seconds, the switch may take approximately a minute and half writing the image to flash. You can keep entering the show flash command to see when the copy is complete and the flash is updated. You can also check the log for an entry similar to the following:

    I 01/09/13 16:17:07 00150 update: Primary Image updated.

    I 01/09/13 16:13:22 00636 ssh: sftp session from 15.22.22.03
- When an SFTP client connects, the switch provides a file system displaying all of its available files and folders. No file or directory creation is permitted by the user. Files may be only uploaded or downloaded, according to the permissions mask. All of the necessary files the switch needs are already in place on the switch. You do not need to (nor can you) create new files.
- The switch supports one SFTP session or one SCP session at a time.
- All files have read-write permission. Several SFTP commands, such as `create` or `remove`, are not allowed and return an error message. The switch displays the following files:

```
/
+---cfg
|   running-config
|   startup-config
+---log
|   crash-data
|   crash-data-a
|   crash-data-b
|   crash-data-c
|   crash-data-d
|   crash-data-e            "      "
|   crash-data-f ""
|   crash-data-g
|   crash-data-h            "      "
|   crash-data-I ""
|   crash-data-J ""
|   crash-data-K ""
|   crash-data-L "    "
|   crash-log
|   crash-log-a
|   crash-log-b
|   crash-log-c
|   crash-log-d
|   crash-log-e""
|   crash-log-f""
|   crash-log-g
|   crash-log-h" "
|   crash-log-I" "
|   crash-log-J" "
|   crash-log-K" "
|   crash-log-L" "
|   event log
+---os
|   primary
|   secondary
\---ssh
    +---mgr_keys
```

```
    |   authorized_keys
    \---oper_keys
    |   authorized_keys
\---core
|   port_1-24.cor    core-dump for ports 1-24 (stackable switches only)
|   port_25-48.cor   core-dump for ports 25-48 (stackable switches only)
```

Once you have configured your switch for secure file transfers with SCP and SFTP, files can be copied to or from the switch in a secure (encrypted) environment and TFTP is no longer necessary.

Troubleshooting SSH, SFTP, and SCP operations

Cause

You can verify secure file transfer operations by checking the switch's event log, or by viewing the error messages sent by the switch that most SCP and SFTP clients print out on their console.

Messages that are sent by the switch to the client depend on the client software in use to display them on the user console.

Broken SSH connection

If an ssh connection is broken at the wrong moment (for instance, the link goes away or spanning tree brings down the link), a fatal exception occurs on the switch. If this happens, the switch gracefully exits the session and produces an Event Log message indicating the cause of failure. The following three examples show the error messages that may appear in the log, depending on the type of session that is running (SSH, SCP, or SFTP):

```
ssh: read error Bad file number, session aborted I 01/01/90
00:06:11 00636 ssh: sftp session from ::ffff:10.0.12.35 W
01/01/90 00:06:26 00641 ssh:

sftp read error Bad file number, session aborted I 01/01/90
00:09:54 00637 ssh: scp session from ::ffff:10.0.12.35 W 01/
01/90

ssh: scp read error Bad file number, session aborted
```

The `Bad file number` is from the system error value and may differ depending on the cause of the failure. In the third Example:, the device file to read was closed as the device read was about to occur.

Attempt to start a session during a flash write

If you attempt to start an SCP (or SFTP) session while a flash write is in progress, the switch does not allow the SCP or SFTP session to start. Depending on the client software in use, the following error message may appear on the client console:

```
Received disconnect from 10.0.12.31: 2: Flash access in
progress

lost connection
```

Failure to exit from a previous session

This next Example: shows the error message that may appear on the client console if a new SCP (or SFTP) session is started from a client before the previous client session has been closed (the switch requires approximately ten seconds to timeout the previous session):

```
Received disconnect from 10.0.12.31: 2: Wait for previous
session to complete
```

```
lost connection
```

Attempt to start a second session

The switch supports only one SFTP session or one SCP session at a time. If a second session is initiated (For example, an SFTP session is running and then an SCP session is attempted), the following error message may appear on the client console:

```
Received disconnect from 10.0.12.31: 2: Other SCP/SFTP
session running

lost connection
```

Using Xmodem to download switch software from a PC or UNIX workstation

This procedure assumes that:

- The switch is connected via the Console RS-232 port to a PC operating as a terminal. (For information on connecting a PC as a terminal and running the switch console interface, see the installation and getting started guide you received with the switch.)
- The switch software is stored on a disk drive in the PC.
- The terminal emulator you are using includes the Xmodem binary transfer feature. (For example, in the HyperTerminal application included with Windows NT, you would use the **Send File** option in the **Transfer** drop-down menu.)

Downloading to primary flash using Xmodem (Menu)

The menu interface accesses only the primary flash.

Procedure

1. From the console Main Menu, select

   7. Download OS
2. Press **[E]** (for **Edit**).
3. Use the Space bar to select **XMODEM** in the **Method** field.
4. Press **[Enter]**, then **[X]** (for **eXecute**) to begin the software download.

   The following message appears:

   Press enter and then initiate Xmodem transfer from the attached computer.....
5. Press **[Enter]** and then execute the terminal emulator commands to begin Xmodem binary transfer.

   For example, using HyperTerminal:

   a. Click on **Transfer**, then **Send File**.
   b. Enter the file path and name in the Filename field.
   c. In the Protocol field, select **Xmodem**.
   d. Click on the **[Send]** button.

   The download then commences. It can take several minutes, depending on the baud rate set in the switch and in your terminal emulator.
6. After the primary flash memory has been updated with the new software, you must reboot the switch to implement the newly downloaded software. Return to the Main Menu and press **[6]** (for **Reboot Switch**). You then see the following prompt:

Continue reboot of system? : No

Press the space bar once to change **No** to **Yes**, then press **[Enter]** to begin the reboot.

7. To confirm that the software downloaded correctly:
   a. From the Main Menu, select

      1. Status and Counters

      1. General System Information
   b. Check the **Firmware revision** line.

Downloading to primary or secondary flash using Xmodem and a terminal emulator (CLI)

Syntax:

copy xmodem flash [<primary | secondary>]

Downloads a software file to primary or secondary flash. If you do not specify the flash destination, the Xmodem download defaults to primary flash.

Example:

To download a switch software file named `E0822.swi` from a PC (running a terminal emulator program such as HyperTerminal) to primary flash:

Procedure

1. Execute the following command in the CLI:

```
switch# copy xmodem flash
Press 'Enter and start XMODEM on your host...
```

2. Execute the terminal emulator commands to begin the Xmodem transfer. For example, using HyperTerminal:
   a. Click on **Transfer**, then **Send File**.
   b. Type the file path and name in the Filename field.
   c. In the Protocol field, select **Xmodem**.
   d. Click on the **[Send]** button.

   The download can take several minutes, depending on the baud rate used in the transfer.
3. When the download finishes, you must reboot the switch to implement the newly downloaded software. To do so, use one of the following commands:
   Syntax:

   boot system flash {<primary | secondary>}

   Reboots from the selected flash

   Syntax:

   reload

   Reboots from the flash image currently in use

   For more information on these commands, see “Rebooting the Switches” in the basic operation guide for your switch.
4. To confirm that the software downloaded correctly:

```
switch# show system
```

Check the **Firmware revision** line. It should show the software version that you downloaded in the preceding steps.

If you need information on primary/secondary flash memory and the boot commands, see "Using Primary and Secondary Flash Image Options" in the basic operation guide for your switch.

Switch-to-switch download

You can use TFTP to transfer a software image between two switches of the same series. The CLI enables all combinations of flash location options. The menu interface enables you to transfer primary-to-primary or secondary-to-primary.

Switch-to-switch download to primary flash (Menu)

Using the menu interface, you can download a switch software file from either the primary or secondary flash of one switch to the primary flash of another switch of the same series.

Procedure

1. From the switch console Main Menu in the switch to receive the download, select **7. Download OS** screen.
2. Ensure that the **Method** parameter is set to **TFTP** (the default).
3. In the **TFTP Server** field, enter the IP address of the remote switch containing the software file you want to download.
4. For the **Remote File Name** , enter one of the following:
   a. To download the software in the primary flash of the source switch, enter
      `flash`
      in lowercase characters.
   b. To download the software in the secondary flash of the source switch, enter
      `/os/secondary`
      .
5. Press **[Enter]**, and then **[X]** (for **eXecute**) to begin the software download.

   A "progress" bar indicates the progress of the download. When the entire switch software download has been received, all activity on the switch halts and the following messages appear:

   Validating and writing system software to FLASH...
6. After the primary flash memory has been updated with the new software, you must reboot the switch to implement the newly downloaded software. Return to the Main Menu and press **[6]** (for **Reboot Switch**). You then see this prompt:

   Continue reboot of system? : No

   Press the space bar once to change `No` to `Yes`, then press **[Enter]** to begin the reboot.
7. To confirm that the software downloaded correctly:
   a. From the Main Menu, select

      Status and Counters

      General System Information
   b. Check the **Firmware revision** line.

Downloading the OS from another switch (CLI)

Where two switches in your network belong to the same series, you can download a software image between them by initiating a `copy tftp` command from the destination switch. The options for this CLI feature include:

- Copy from primary flash in the source to either primary or secondary in the destination.
- Copy from either primary or secondary flash in the source to either primary or secondary flash in the destination.

Downloading from primary only (CLI)

Syntax:

copy tftp flash <*ip-addr*> flash [primary | secondary]

When executed in the destination switch, downloads the software flash in the source switch's primary flash to either the primary or secondary flash in the destination switch.

If you do not specify either a primary or secondary flash location for the destination, the download automatically goes to primary flash.

To download a software file from primary flash in a switch with an IP address of 10.29.227.103 to the primary flash in the destination switch, you would execute the following command in the destination switch's CLI:

Switch-to-switch, from primary in source to either flash in destination

```
switch# copy tftp flash 10.29.227.13 flash
Device will be rebooted, do you want to continue [y/n]? y
00107K [1]
```

- [1]Running Total of Bytes Downloaded

Downloading from either flash in the source switch to either flash in the destination switch (CLI)

Syntax:

copy tftp flash <*ip-addr*> {</os/primary> | </os/secondary>} [primary | secondary]

This command (executed in the destination switch) gives you the most options for downloading between switches. If you do not specify either a primary or secondary flash location for the destination, the download automatically goes to primary flash.

To download a software file from secondary flash in a switch with an IP address of 10.28.227.103 to the secondary flash in a destination switch, you would execute the following command in the destination switch's CLI:

Switch-to-switch, from either flash in source to either flash in destination

```
switch# copy tftp flash 10.29.227.13 flash /os/secondary secondary
Device will be rebooted, do you want to continue [y/n]? y
00184K
```

Using AirWave to update switch software

AirWave can be used to update HPE switch products. For further information, refer to the **ZTP with Airwave network Management** chapter in this manual.

Using IMC to update switch software

IMC includes a software update utility for updating on HPE switch products. For further information, refer to the getting started guide and the administrator’s guide, provided electronically with the application.

Copying software images

For details on how switch memory operates, including primary and secondary flash, see “Switch Memory and Configuration” in the basic operation guide for your switch.

TFTP: Copying a software image to a remote host (CLI)

Syntax:

copy flash tftp <*ip-addr*> <*filename*>

Copies the primary flash image to a TFTP server.

Example:

To copy the primary flash to a TFTP server having an IP address of 10.28.227.105:

```
switch# copy flash tftp 10.28.227.105 k0800.swi
```

where `k0800.swi` is the filename given to the flash image being copied.

Xmodem: Copying a software image from the switch to a serially connected PC or UNIX workstation (CLI)

To use this method, the switch must be connected via the serial port to a PC or UNIX workstation.

Syntax:

copy flash xmodem {[<pc] | unix>}

Uses Xmodem to copy a designated configuration file from the switch to a PC or UNIX workstation.

Example:

To copy the primary flash image to a serially connected PC:

Procedure

1. Execute the following command:

```
switch# copy xmodem flash
Press 'Enter' and start XMODEM on your host...
```

2. After you see the above prompt, press **[Enter]**.
3. Execute the terminal emulator commands to begin the file transfer.

Transferring switch configurations

Using the CLI commands described in the section beginning with **TFTP: Copying a configuration file to a remote host (CLI)** on page 310, you can copy switch configurations to and from a switch, or copy a software image to configure or replace an ACL in the switch configuration.

NOTE

For greater security, you can perform all TFTP operations using SFTP, as described in the section **Using SCP and SFTP** on page 299.

You can also use the `include-credentials` command to save passwords, secret keys, and other security credentials in the running config file. For more information, see the section on "Saving Security Credentials in a Config File" in the access security guide for your switch.

TFTP: Copying a configuration file to a remote host (CLI)

Syntax:

copy {<startup-config | running-config>} tftp < *ip-addr* > < *remote-file* > [pc | unix]

copy config <*filename*> tftp <*ip-addr*> <*remote-file*> [pc | unix]

This command can copy a designated config file in the switch to a TFTP server. For more information, see "Multiple Configuration Files" in the basic operation guide for your switch.

Example:

To upload the current startup configuration to a file named **`sw8200`** in the configs directory on drive **"d"** in a TFTP server having an IP address of 10.28.227.105:

```
switch# copy startup-config tftp 10.28.227.105
   d:\configs\sw8200
```

TFTP: Copying a configuration file from a remote host (CLI)

Syntax:

copy tftp {<startup-config | running-config> < *ip-address* > < *remote-file* >} [pc | unix]

copy tftp config <*filename*> <*ip-address*> <*remote-file*> [pc | unix]

This command can copy a configuration from a remote host to a designated config file in the switch. For more information, see "Multiple Configuration Files" in the basic operation guide for your switch.

For more information on flash image use, see "Using Primary and Secondary Flash Image Options" in the basic operation guide for your switch.

Example:

To download a configuration file named **`sw8200`** in the **`configs`** directory on drive **"d"** in a remote host having an IP address of 10.28.227.105:

```
switch# copy tftp startup-config 10.28.227.105
   d:\configs\sw8200
```

TFTP: Copying a customized command file to a switch (CLI)

Using the `copy tftp` command with the `show-tech` option provides the ability to copy a customized command file to the switch. When the `show tech custom` command is executed, the commands in the custom file are executed instead of the hard-coded list of commands. If no custom file is found, the current hard-coded list is executed. This list contains commands to display data, such as the image stamp, running configuration, boot history, port settings, and so on.

Syntax:

copy tftp show-tech <*ipv4 or ipv6 address*> <*filename*>

Copies a customized command file to the switch (see **Using the copy tftp show-tech command to upload a customized command file** on page 311).

Using the copy tftp show-tech command to upload a customized command file

```
switch(config)# copy tftp show-tech 10.10.10.3 commandfile1
```

Syntax:

show tech custom

Executes the commands found in a custom file instead of the hard-coded list.

Exit the global config mode (if needed) before executing `show tech` commands.

You can include `show tech` commands in the custom file, with the exception of `show tech custom`. For example, you can include the command `show tech all`.

If no custom file is found, a message displays stating "No SHOW-TECH file found." (No custom file was uploaded with the `copy tftp show-tech` command.)

The `show tech custom` command

```
switch# show tech custom
No SHOW-TECH file found.
```

Xmodem: Copying a configuration file to a serially connected PC or UNIX workstation (CLI)

To use this method, the switch must be connected via the serial port to a PC or UNIX workstation. You will need to:

- Determine a filename to use
- Know the directory path you will use to store the configuration file.

Syntax:

copy {<startup-config | running-config>} xmodem {<pc | unix>}

copy config <*filename*> xmodem {<pc | unix>}

Uses Xmodem to copy a designated configuration file from the switch to a PC or UNIX workstation. For more information, see "Multiple Configuration Files" in the basic operation guide for your switch.

Example:

To copy a configuration file to a PC serially connected to the switch:

1. Determine the file name and directory location on the PC.
2. Execute the following command:

```
switch# copy startup-config xmodem pc
Press 'Enter' and start XMODEM on your host...
```

3. After you see the above prompt, press **[Enter]**.
4. Execute the terminal emulator commands to begin the file transfer.

Xmodem: Copying a configuration file from a serially connected PC or UNIX workstation (CLI)

To use this method, the switch must be connected via the serial port to a PC or UNIX workstation on which is stored the configuration file you want to copy. To complete the copying, you need to know the name of the file to copy and the drive and directory location of the file.

Syntax:

copy xmodem startup-config {<pc | unix>}

copy xmodem config <*filename*> < {pc | unix>}

Copies a configuration file from a serially connected PC or UNIX workstation to a designated configuration file on the switch.

For more information, see "Multiple Configuration Files" in the basic operation guide for your switch.

Example:

To copy a configuration file from a PC serially connected to the switch:

Procedure

1. Execute the following command:

```
switch# copy xmodem startup-config pc
Device will be rebooted, do you want to continue [y/n]? y
Press 'Enter' and start XMODEM on your host...
```

2. After you see the above prompt, press **[Enter]**.
3. Execute the terminal emulator commands to begin the file transfer.
4. When the download finishes, you must reboot the switch to implement the newly downloaded software. To do so, use one of the following commands:

   Syntax:

   boot system flash [primary | secondary]

   boot system flash [config < *filename* >]

   Switches boot from the designated configuration file. For more information, see "Multiple Configuration Files" in the basic operation guide for your switch.

Syntax:

reload

Reboots from the flash image currently in use.

(For more on these commands, see "Rebooting the Switch" in the basic operation guide for your switch.)

Transferring ACL command files

This section describes how to upload and execute a command file to the switch for configuring or replacing an ACL in the switch configuration. Such files should contain only access control entry (ACE) commands. For more on this general topic, including an Example: of an ACL command file created offline, see the section "Editing ACLs and Creating an ACL Offline" in the "Access Control Lists (ACLs)" of the latest access security guide for your switch.

TFTP: Uploading an ACL command file from a TFTP server (CLI)

Syntax:

copy tftp command-file <*ip-addr*> <*filename*.txt> {<unix | pc>}

Copies and executes the named text file from the specified TFTP server address and executes the ACL commands in the file.

<ip-addr>	The IP address of a TFTP server available to the switch
<filename.txt>	A text file containing ACL commands and stored in the TFTP directory of the server identified by *ip-addr*
{<unix | pc>}	The type of workstation used for serial, Telnet, or SSH access to the switch CLI

Depending on the ACL commands used, this action does one of the following in the `running-config` file:

- Creates a new ACL.
- Replaces an existing ACL. (See "Creating an ACL Offline" in the "Access Control Lists (ACLs)" in the latest access security guide for your switch.)
- Adds to an existing ACL

Example:

Suppose you:

- Created an ACL command file named **`vlan10_in.txt`** to update an existing ACL.
- Copied the file to a TFTP server at 18.38.124.16.

Using a PC workstation, you then execute the following from the CLI to upload the file to the switch and implement the ACL commands it contains:

```
switch(config)# copy tftp command-file 18.38.124.16
vlan10_in.txt pc
```

The switch displays this message:

```
Running configuration may change, do you want to continue
[y/n]?
```

To continue with the upload, press the **[Y]** key. To abort the upload, press the **[N]** key. Note that if the switch detects an illegal (non-ACL) command in the file, it bypasses the illegal command, displays a notice (as shown in **Figure 44: Using the copy command to download and configure an ACL** on page 314), and continues to implement the remaining ACL commands in the file.

Figure 44: *Using the `copy` command to download and configure an ACL*

```
switch(config)# copy tftp command-file 10.38.124.18 v1an10_in.txt pc
Running configuration may change, do you want to continue [y/n]? y
  1. ip access-list extended "155"
  2. deny tcp 0.0.0.0 255.255.255.255 10.10.10.2 0.0.0.0 eq 23 1og
  3. permit ip 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
  4. show running
Command files are limited to access-list commands. [1]
  5. exit
Switch(config)# show running [2]
Running configuration:

; J9091A Configuration Editor; Created on release #W.15.05.0000x
; Ver #01:01:00

hostname "HP Switch"
cdp run
ip default-gateway 10.38.248.1
logging 10.38.227.2
snmp-server community "public" unrestricted
ip access-list extended "155"
deny tcp 0.0.0.0 255.255.255.255 10.10.10.2 0.0.0.0 eq 23 1og
permit ip 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
exit
```

[1]This message indicates that the `show running` command just above it is not an ACL command and will be ignored by the switch.

[2]Manually executing the `show running` from the CLI indicates that the file was implemented, creating ACL 155 in the switch's running configuration.

Xmodem: Uploading an ACL command file from a serially connected PC or UNIX workstation (CLI)

Syntax:

```
copy xmodem command-file {<unix | pc>}
```

Uses Xmodem to copy and execute an ACL command from a PC or UNIX workstation. Depending on the ACL commands used, this action does one of the following in the running-config file:

- Creates a new ACL.
- Replaces an existing ACL. (See "Creating an ACL Offline" in the "Access Control Lists (ACLs)" in the latest access security guide for your switch.)
- Adds to an existing ACL.

Single copy command

When a switch crashes, five files relating to the crash; core-dump, crash-data, crash-log, fdr-log, and event-log are created and should be copied for review. All five files (core-dump, crash-data, crash-log, fdr-log, and event-log) should be copied to a destination specified under a directory by file name.

TFTP A destination directory and files can be created for all crash files (core-dump, crash-data, crash-log, fdr-log, and event-log) on an TFTP server (with write permissions).

SFTP Files are auto created on the SFTP server as a secured transfer. The destination directories however can be manually created on the server.

Specified directories can be used for the TFTP/SFTP transfers in the `copy` command. If the directory is specified, all files will be copied under one directory, otherwise all files will be copied to the TFTP/SFTP server home directory. It is mandatory to specify the directory name.

Single copy command

Syntax

copy *source destination options*

Copy data files to and from the switch.

Source Specify the source of data using any of the following destinations.

Destination	Operation note
Flash	n/a
SFTP	For transfer of crash-files via SFTP, the destination directory must exist on the SFTP server with write permissions. File creation is not mandatory as files are automatically created with the chassis serial number suffix to the filename when using SFTP.
TFTP	For transfer of crash-files via TFTP, the destination directory along with the file names (core-dump, crash-data, crash-log, fdr-log, and event-log) must exist on the TFTP server with write permissions.
Xmodem	n/a

Data Files Specify the data file to be copied from the source.

Data file	Operation note
`command-output` *`command`*	Specify a command to copy output. When using `command-output`, place the desired CLI command in double-quotes. For example: "show system".
`config` *`file-name`*	Copy named configuration file. The `file-name` option is the source configuration file being copied.
`core-dump`	Copy core-dump file from flash.
`crash-data`	Copy the switch crash-data file.
`crash-log` *`a|b|c|d|e|f|g|h|master`*	Copy the switch crash-log file.
`crash-files`	Copy core-dump, crash-data, crash-log, fdr-log, and event-log files to an SFTP/TFTP server, or xmodem terminal. When using the `crash-files` option, the destination directory alone must be specified as the destination path. Specifying the file names is not mandatory.
`default-config`	Copy custom default-config file.
`event-log`	Copy event-log file.
`fdr-log`	Copy FDR-og file from the switch to an SFTP/TFTP server or xmodem terminal.
`flash`	Copy the switch system image file.
`SFTP server`	Copy data from a SFTP server.
`startup-config`	Copy in-flash configuration file.
`ssh-client-known-hosts`	Copy the known hosts file.
`ssh-server-pub-key`	Copy the switch's SSH server public key.
`running-config`	Copy running configuration file.
`TFTP`	Copy data from a TFTP server.
`xmodem`	Use xmodem on the terminal as the data source.

Destination Specify the copy target.

Destination
SFTP
TFTP
USB
xmodem

Destination
SFTP
TFTP
xmodem

Data Files Specify the data file name at the target.

Data file
`autorun-cert-file`
`autorun-key-file`
`command file`
`config`
`default-config`
`flash`
`pub-key-file`
`show-tech`
`startup-config`
`ssh-client-key`
`ssh-client-known-hosts`

Options

Option	Operation note	Requirement
append	Add the keys for operator access.	n/a
directory	Directory name to upload.	Required for TFTP and SFTP transfers.
filename	File-name to upload/download.	Required for TFTP and SFTP transfers.

Table Continued

Option	Operation note	Requirement
hostname	Hostname of the TFTP, SFTP server.	Required for TFTP, SFTP transfers.
IPv4 address	TFTP, SFTP server IPv4 address.	Required for TFTP, SFTP transfers.
IPv6 address	TFTP, SFTP server IPv6 address.	Required for TFTP, SFTP transfers.
manager	Replace the keys for manager access; follow with the `append` option to add the keys.	n/a
operator	Replace the keys for operator access (default); follow with the `append` option to add the keys.	n/a
pc		n/a
unix		n/a

Multiple management switches

Syntax

copy crash-files

interfaces Copy interfaces crash files.

management Copy management crash files.

	Destination		
	SFTP	TFTP	Xmodem
Slot-ID	X	X	X
MM-active	X	X	X
MM-standby	X	X	X

Standalone switches

Syntax

copy crash-files

Options

Option	Destination		
	SFTP	TFTP	xmodem
management	X	X	X
interfaces	X	X	X

Crash file options

Syntax

copy crash-files crash-file-options *host-name-str* | *ip-addr* | *ipv6-addrsftp dirname-str*

Options

host-name-str	Specify hostname of the SFTP server.
ip-addr	Specify SFTP server IPv4 address.
ipv6–addr	Specify SFTP server IPv6 address.
user	Specify the username on the remote system.
username@ip-str	Specify the username along with remote system. Information (hostname, IPv4 or IPv6 address).
dirname-str	Specify the destination directory name.

Destination options

management	Copy management crash files.

Flight Data Recorder (FDR)

The Flight Data Recorder (FDR) log collects information that is "interesting" when the switch is not performing correctly, but has not crashed. Runtime logs are written to FDR memory while the switch is running and crashtime logs are collected and stored in the FDR buffer during a switch crash.

Syntax:

copy fdr-log [[slot < *slot-list* >] | [mm-active [[current] | [previous]]] | [mm-standby] | [all]] tftp [[< *hostname*] | [*ip-addr* >]] <*filename*>

Copies `fdr-log` files to a user-specified file.

`all`	Copies all the log files from both management modules and all slots.
`mm-active`	Copies the active management module's log.
`mm-standby`	Copies the standby management module's log.

`slot`	Retrieves the crash log from the module in the identified slots.

Overview

The switches have several built-in tools for monitoring, analyzing, and troubleshooting switch and network operation:

- **Status:** Includes options for displaying general switch information, management address data, port status, port and trunk group statistics, MAC addresses detected on each port or VLAN, and STP, IGMP, and VLAN data.
- **Counters:** Display details of traffic volume on individual ports.
- **Event Log:** Lists switch operating events (**Using the Event Log for troubleshooting switch problems** on page 430).
- **Alert Log:** Lists network occurrences detected by the switch—in the System > Logging screen of the WebAgent.
- **Configurable trap receivers:** Uses SNMP to enable management stations on your network to receive SNMP traps from the switch.
- **Port monitoring (mirroring):** Copy all traffic from the specified ports to a designated monitoring port.

Link test and ping test—analysis tools in troubleshooting situations—are described in **Troubleshooting** on page 401. See **Diagnostic tools** on page 468.

Switch and network operations

The switches have several built-in tools for monitoring, analyzing, and troubleshooting switch and network operation:

- Status

  Includes options for displaying general switch information, management address data, port status, port and trunk group statistics, MAC addresses detected on each port or VLAN, and STP, IGMP, and VLAN data.
- Counters

  Display details of traffic volume on individual ports (**Accessing port and trunk statistics (Menu)** on page 334.)
- Event Log

  Lists switch operating events. See the HPE ProVision switch software troubleshooting guide for troubleshooting information.
- Configurable trap receivers

  Uses SNMP to enable management stations on your network to receive SNMP traps from the switch.
- Port monitoring (mirroring)

  Copy all traffic from the specified ports to a designated monitoring port .

Link test and ping test—analysis tools in troubleshooting situations—are described in the *ProVision Switch Software Troubleshooting Guide*.

Status and counters data

This section describes the status and counters screens available through the switch console interface and/or the WebAgent.

NOTE

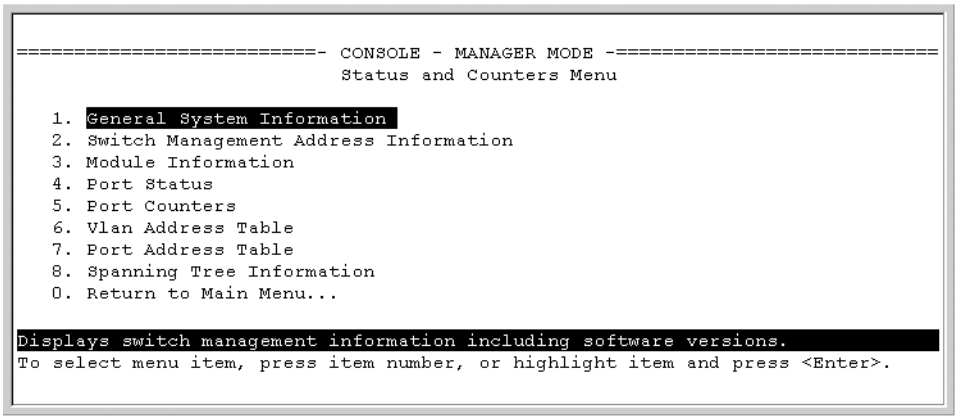
You can access all console screens from the WebAgent via Telnet to the console. Telnet access to the switch is available in the **Device View** window under the **Configuration** tab.

Accessing status and counters (Menu)

Beginning at the Main Menu, display the Status and Counters menu by selecting:

1. Status and Counters

Figure 45: *The Status and Counters menu*



Each of the above menu items accesses the read-only screens described on the following pages. See the online help for a description of the entries displayed in these screens.

show system

Syntax

`show system [chassislocate|information|fans]`

Description

Displays global system information and operational parameters for the switch.

Parameters and options

`chassislocate`	Displays the chassisLocator LED status. Possible values are ON, Off, or Blink. When the status is On or Blink, the number of minutes that the Locator LED will continue to be on or to blink is displayed. (See **Figure 46: Command results for show system chassislocate command** on page 323.)
`information`	Displays global system information and operational parameters for the switch. (See **Figure 48: Switch system information** on page 323.)
`power-supply`	Shows chassis power supply and settings.
`temperature`	Shows system temperature and settings.
`fans`	Shows system fan status. (See **Figure 47: System fan status** on page 323.)

show system chassislocate command

Figure 46: *Command results for* `show system chassislocate` *command*

```
HP Switch(config)# show system chassislocate

Chassis Locator LED: ON 5 minutes 5 seconds

HP Switch(config)# show system chassislocate

Chassis Locator LED: BLINK 10 minutes 6 seconds

HP Switch(config)# show system chassislocate

Chassis Locator LED: OFF
```

Figure 47: *System fan status*

```
HP Switch(config)# show system fans

Fan Information
  Num   | State       | Failures
--------+-------------+----------
Sys-1   | Fan OK      |   0

0 / 1 Fans in Failure State
0 / 1 Fans have been in Failure State
```

Figure 48: *Switch system information*

```
HP Switch(config)# show system

 Status and Counters - General System Information

  System Name         : HP Switch Switch
  System Contact      :
  System Location     :

  MAC Age Time (sec) : 300

  Time Zone           : 0
  Daylight Time Rule : None


  Software revision  : T.13.XX          Base MAC Addr       : 001635-b57cc0
  ROM Version        : K.12.12          Serial Number       : LP621KI005

  Up Time            : 51 secs          Memory    - Total   : 152,455,616
  CPU Util (%)       : 3                            Free    : 110,527,264

  IP Mgmt  - Pkts Rx : 0                Packet    - Total   : 6750
             Pkts Tx : 0                Buffers     Free    : 5086
                                                    Lowest  : 5086
                                                    Missed  : 0
```

chassislocate

Syntax

Description

Identifies the location of a specific switch by activating the blue locator LED on the front panel of the switch.

`chassislocate [blink|on|off]`

Parameters and options

blink *<1-1440>*	Blinks the chassis locate LED for a specified number of minutes (Default: 30 min.)
on *<1-1440>*	Turns the chassis locate LED on for a specified number of minutes (Default: 20 min.)
off	Turns the chassis locate LED off.

Chassislocate at startup

The chassislocate command has an optional parameter that configures it to run in the future instead of immediately.

Syntax

`chassislocate [on|blink] <MINUTES> at [now|startup]`

`chassislocate off`

Parameters and options

<MINUTES>	Specify the number of minutes for the chassis locate LED to remain on or blink.
at	Specify when the command is applied (default immediately.)
now	Turn on the chassis locate LED immediately.
startup	Turn on the chassis locate LED at switch startup.
off	Turn off the chassis locate LED switch

chassislocate at startup

```
chassislocate blink 10 at startup
```

show system chassislocate

Syntax

`show system chassislocate`

Description

Displays the current status of the `chassislocate` settings.

Display locator LED status

```
Locator LED Status
          Current    Time
Member    State      Remaining  Configuration
------    -------    ---------  -------------
1         blink      00:27:05   blink 30 at startup
2         on         01:05:27
3         off
```

General system information

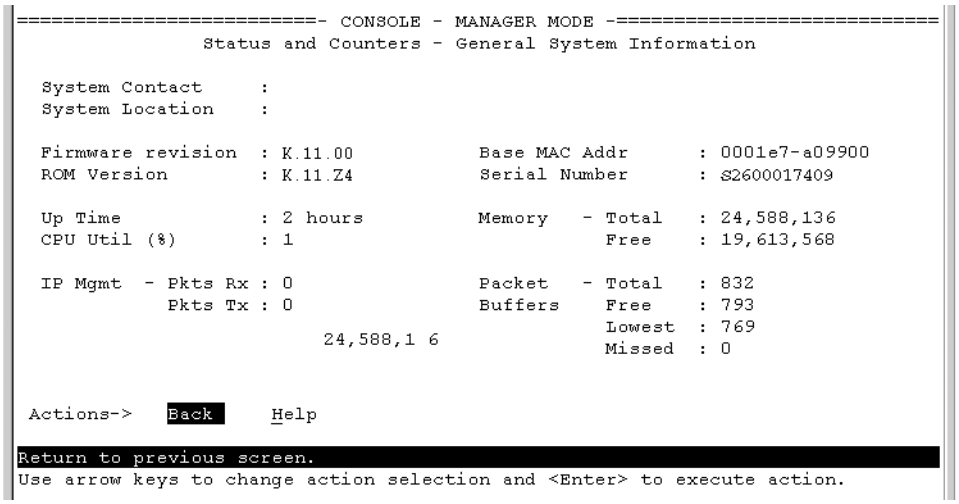
Accessing system information (Menu)

From the console Main Menu, select:

1. Status and Counters

1. General System Information

Figure 49: *Example: of general switch information*



This screen dynamically indicates how individual switch resources are being used. See the online Help for details.

Accessing system information (CLI)

Syntax:

show system [chassislocate | information | fans | power-supply | temperature]

Displays global system information and operational parameters for the switch.

chassislocate	Shows the chassisLocator LED status. Possible values are On, Off, or Blink.When the status is On or Blink, the number of minutes that the Locator LED will continue to be on or to blink is displayed. (See **Command results for show system chassislocate command** on page 325)
information	Shows global system information and operational parameters for the switch. (See **Switch system information** on page 326.)
fans	Shows system fan status. (See **System fan status** on page 326.)

Command results for show system chassislocate command

```
switch(config)# show system chassislocate

Chassis Locator LED: ON 5 minutes 5 seconds

switch(config)# show system chassislocate

Chassis Locator LED: BLINK 10 minutes 6 seconds
```

```
switch(config)# show system chassislocate

Chassis Locator LED: OFF
```

System fan status

```
switch(config)# show system fans

Fan Information
   Num | State | Failures
-------+-------------+----------
 Sys-1 | Fan OK | 0

0 / 1 Fans in Failure State
0 / 1 Fans have been in Failure State
```

Switch system information

```
switch(config)# show system

 Status and Counters - General System Information

  System Name         : HP Switch
  System Contact      :
  System Location     :

  MAC Age Time (sec)  : 300

  Time Zone           : 0
  Daylight Time Rule  : None

  Software revision   : T.13.XX      Base MAC Addr    : 001635-b57cc0
  ROM Version         : XX.12.12      Serial Number    : LP621KI005

  Up Time             : 51 secs      Memory - Total   : 152,455,616
  CPU Util (%)        : 3                    Free    : 100,527,264

  IP Mgmt - Pkts Rx   :0             Packet - Total   : 6750
            Pkts Tx   :0             Buffers  Free    : 5086
                                              Lowest  : 5086
                                              Missed  : 0
```

Collecting processor data with the task monitor (CLI)

The task monitor feature allows you to enable or disable the collection of processor utilization data. The `task-monitor cpu` command is equivalent to the existing debug mode command `taskusage -d`.

When the `task-monitor` command is enabled, the `show cpu` command summarizes the processor usage by protocol and system functions.

Syntax:

[no] task-monitor cpu

Allows the collection of processor utilization data.

Only manager logins can execute this command.

The settings are not persistent, that is, there are no changes to the configuration.

(Default: Disabled)

The `task-monitor cpu` command and `show cpu` output

```
switch(config)# task-monitor cpu
switch(config)# show cpu

2 percent busy, from 2865 sec ago
1 sec ave: 9 percent busy
5 sec ave: 9 percent busy
1 min ave: 1 percent busy


 % CPU | Description
-------+-----------------
    99 | Idle
```

task-monitor cpu

Syntax

[no] `task-monitor cpu`

Description

Enables or disables the collection of processor utilization data, and requires a manager log in. Settings are not persistent; there are no changes to the configuration. Defaults to disabled.

task-monitor cpu command

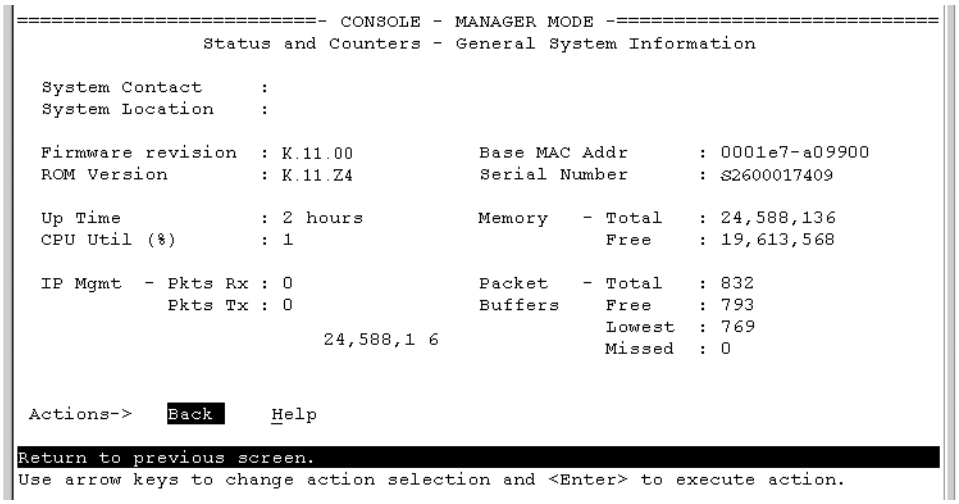
Figure 50: *The `task-monitor cpu` command and `show cpu` output*

```
HP Switch(config)# task-monitor cpu
HP Switch(config)# show cpu

2 percent busy, from 2865 sec ago
1 sec ave: 9 percent busy
5 sec ave: 9 percent busy
1 min ave: 1 percent busy


 % CPU | Description
-------+---------------------------
    99 | Idle
```

Accessing system information (Menu)

From the console Main Menu, select **1. Status and Counters**, and then select **1. General System Information**.

Figure 51: *Example of general switch information*



This screen dynamically indicates how individual switch resources are being used. See the online help for details.

Switch management address information access

show management

Syntax

```
show management
```

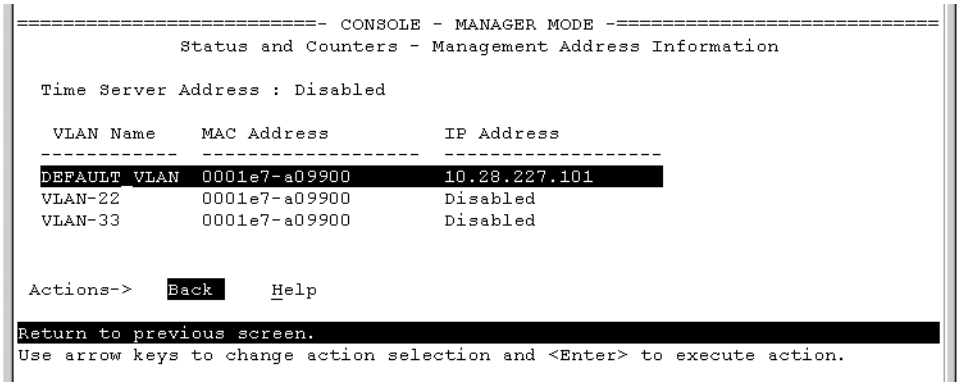
Description

Displays switch management address information.

Accessing switch management address information (Menu)

From the Main Menu, select **1. Status and Counters ...** , and then select **2. Switch Management Address Information**.

Figure 52: *Example of management address information with VLANs configured*



This screen displays addresses that are important for management of the switch. If multiple VLANs are **not configured**, this screen displays a single IP address for the entire switch. See the online help for details.

As shown in **Figure 52: Example of management address information with VLANs configured** on page 328, all VLANs on the switches use the same **MAC address**. (This includes both the statically configured VLANs and any dynamic VLANs existing on the switch as a result of GVRP operation.)

Also, the switches use a multiple forwarding database. When using multiple VLANs and connecting a switch to a device that uses a single forwarding database, such as a Switch 4000M, there are cabling and tagged port VLAN requirements.

Component information views

The CLI `show modules` command displays additional component information for the following:

- SSM—identification, including serial number
- Mini-GBICS—a list of installed mini-GBICs displaying the type, "J" number, and serial number (when available)

show modules

Syntax

`show modules`

Description

Displays information about the installed modules (**Figure 53: The show modules command output** on page 329), including:

- The slot in which the module is installed
- The module description
- The serial number

Additionally, this command displays the part number (J number) and serial number of the chassis. (See **Figure 54: The show modules details command for the 8212zl, showing SSM and mini-GBIC information** on page 330.)

show modules command

Figure 53: *The show modules command output*

```
HP Switch(config)# show modules

 Status and Counters - Module Information

  Chassis: 5406zl J8697A         Serial Number:   SG560TN124
  Slot  Module Description                      Serial Number
  ----- --------------------------------------- --------------
  A     HP Switch J8706A 24p SFP zl Module       AD722BX88F
  B     HP Switch J8702A 24p Gig-T zl Module     FE999CV77F
  C     HP Switch J8707A 4p 10-Gbe zl Module     FB345DC99D
```

show modules details command

Figure 54: *The show modules details command for the 8212zl, showing SSM and mini-GBIC information*

```
HP Switch(config)# show modules details

 Status and Counters - Module Information

  Chassis: 8212zl J8715A        Serial Number:   SG560TN124
  Slot  Module Description                        Serial Number   Status
  ----- ---------------------------------------   --------------  -------
  MM1   HP Switch J9092A Management Module 8200zl   AD722BX88F      Active
  SSM   HP Switch J8784A System Support Module      AF988DC78G      Active
  C     HP Switch J8750A 20p +4 Mini-GBIC Module    446S2BX007      Active
         GBIC 1: J4859B  1GB LX-LC                 4720347DFED734
         GBIC 2: J4859B  1GB LX-LC                 4720347DFED735
```

Viewing port status (Menu)

From the Main Menu, select **1. Status and Counters ...** , and then select **3. Module Information**.

Task usage reporting

The task usage reporting feature provides the ability to collect and display CPU usage data (with a refresh rate of 5 seconds) of running tasks on the switch. It includes the following commands:

- `process-tracking`: This command is used to enable/disable the task-usage collecting capability for a specific module on the switch.
- `show cpu process`: This command is used to display task-usage statistics for a specific module.

Syntax:

`[no] process-tracking [slot[SLOT-LIST] [<time>]] [<time>]`

Enables/disables module process-tracking functionality.

`process-tracking <tab>`

`slot`	Enables/disables process-tracking for a module.
`INTEGER`	Specifies time to track value between 1 second to 30 seconds.
`<cr>`	

`process-tracking slot <tab>`

`SLOT-ID-RANGE`	Enter an alphabetic device slot identifier or slot range.

`process-tracking slot A`

`INTEGER`	Specifies time to track value between 1 second to 30 seconds.
`<cr>`	

`process-tracking slot A 10 <tab>`

`<cr>`	

`process-tracking 10 <tab>`

<cr>	

Syntax:

show cpu [<*CHASSIS_MIN_CPU_UTIL_INDEX-CHASSIS_MAX_CPU_UTIL_INDEX*>]

[slot <*SLOT-LIST*>

[<*CHASSIS_MIN_CPU_UTIL_INDEX-CHASSIS_MODULE_MAX_CPU_UTIL_INDEX*>]]

[process [[slot <*SLOT-LIST*>] [refresh <*iterations*>]]

[refresh <*iterations*>]

Shows average CPU utilization over the last 1, 5, and 60 seconds, or the number of seconds specified.

Use the `slot` option to display CPU utilization for the specified modules, rather than the chassis CPU.

Use the `process` option to display module process usages.

Syntax:

show cpu process [slot [SLOT-LIST][refresh <*iterations*>]]

[refresh <*iterations*>]

Displays module process usage.

show cpu <*tab*>

process	Displays process usage.
slot	Displays module CPU statistics.
<1-300>	Time (in seconds) over which to average CPU utilization.
<cr>	

show cpu process <*tab*>

refresh	Number of times to refresh process usage display.
slot	Displays module process usage.
<cr>	

show cpu process refresh <*tab*>

INTEGER	Enter an integer number.

show cpu process refresh 10 <*tab*>

<cr>	

show cpu process slot <*tab*>

SLOT-ID-RANGE	Enter an alphabetic device slot identifier or slot range.

show cpu process slot A <*tab*>

refresh	Number of times to refresh process usage display.
<cr>	

`show cpu process slot A refresh <tab>`

INTEGER	Enter an integer number.

`show cpu process slot A refresh 10 <tab>`

<cr>	

Output for the show cpu process command

```
switch# show cpu process

                                | Recent |   %    | Time Since | Times   | Max
Process Name       | Priority   | Time   | CPU    | Last Ran   | Ran     | Time
------------------ + ---------- + ------ + ---- + ---------- + ------ + -------
Idle-1             | 226        | 10 s   | 41     | 57 us      | 380986 | 69 us
Idle-3             | 1          | 5 s    | 20     | 52 us      | 761665 | 55 us
Idle-0             | 226        | 8 s    | 33     | 19 us      | 380867 | 66 us
Sessions & I/O-24  | 171        | 926 ms | 3      | 1 ms       | 150    | 335 ms
```

Output for the show cpu process slot <slot-list> command

```
switch# show cpu process slot A
slot a:

                                | Recent |   %    | Time Since | Times   | Max
Process Name       | Priority   | Time   | CPU    | Last Ran   | Ran     | Time
------------------ + ---------- + ------ + ---- + ---------- + ------ + -------
System Services-2  | 156        | 253 ms | 2      | 767 ms     | 12      | 35 ms
Idle-3             | 1          | 3 s    | 28     | 13 ms      | 101309 | 150 us
Hardware Mgmt-2    | 192        | 282 ms | 2      | 303 us     | 44      | 12 ms
Idle-1             | 226        | 6 s    | 55     | 13 ms      | 50793   | 233 us
Idle-0             | 226        | 1 s    | 9      | 14 ms      | 50633   | 106 us
```

Switch management address information

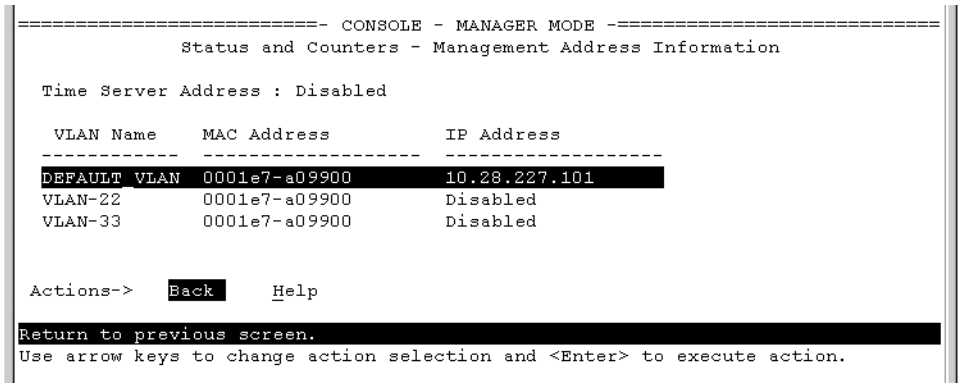
Accessing switch management address information (Menu)

From the Main Menu, select:

1. Status and Counters ...

2. Switch Management Address Information

Figure 55: *Example: of management address information with VLANs configured*



This screen displays addresses that are important for management of the switch. If multiple VLANs are **not configured**, this screen displays a single IP address for the entire switch. See the online Help for details.

NOTE

As shown in **Figure 55: Example: of management address information with VLANs configured** on page 333, all VLANs on the switches use the same **MAC address**. (This includes both the statically configured VLANs and any dynamic VLANs existing on the switch as a result of GVRP operation.)

Also, the switches use a multiple forwarding database. When using multiple VLANs and connecting a switch to a device that uses a single forwarding database, such as a Switch 4000M, there are cabling and tagged port VLAN requirements. For more information on this topic, see "Multiple VLAN Considerations" in the "Static Virtual LANs (VLANs)" of the advanced traffic management guide for your switch.

Accessing switch management address information (CLI)

Syntax:

show management

Port Status

The WebAgent and the console interface show the same port status data.

Viewing port status (CLI)

Syntax:

show interfaces brief

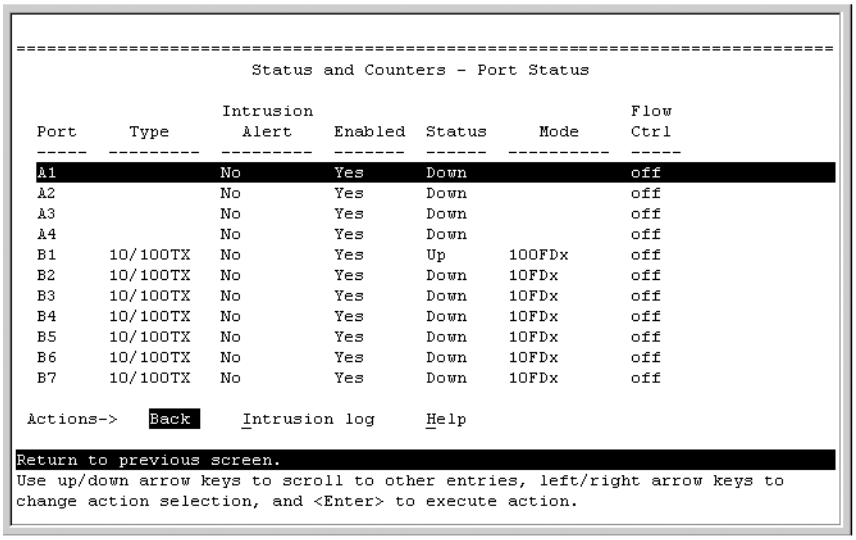
Viewing port status (Menu)

From the Main Menu, select:

1. Status and Counters ...

4. Port Status

Figure 56: *Example: of port status on the menu interface*



Viewing port and trunk group statistics (WebAgent)

1. In the navigation pane of the WebAgent, click Interface.
2. Click Port Info/Config.

For information about this screen, click **?** in the upper right corner of the WebAgent screen.

NOTE

To reset the port counters to zero, you must reboot the switch.

Port and trunk group statistics and flow control status

The features described in this section enable you to determine the traffic patterns for each port since the last reboot or reset of the switch. You can display:

- A general report of traffic on all LAN ports and trunk groups in the switch, along with the per-port flow control status (On or Off).
- A detailed summary of traffic on a selected port or trunk group.

You can also reset the counters for a specific port.

The menu interface provides a dynamic display of counters summarizing the traffic on each port. The CLI lets you see a static "snapshot" of port or trunk group statistics at a particular moment.

As mentioned above, rebooting or resetting the switch resets the counters to zero. You can also reset the counters to zero for the current session. This is useful for troubleshooting. See the Note, below.

NOTE

The **Reset** action resets the counter display to zero for the current session, but does not affect the cumulative values in the actual hardware counters. (In compliance with the SNMP standard, the values in the hardware counters are not reset to zero unless you reboot the switch.) Exiting from the console session and starting a new session restores the counter displays to the accumulated values in the hardware counters.

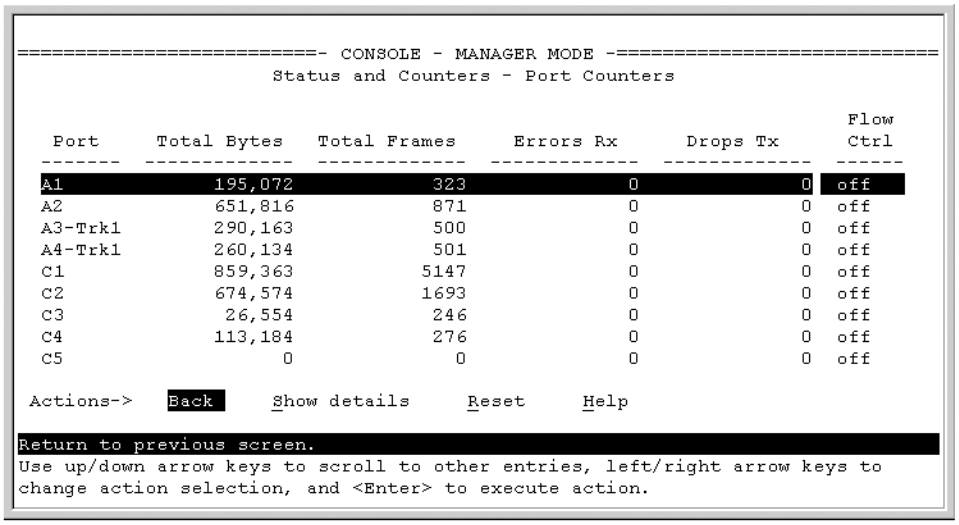
Accessing port and trunk statistics (Menu)

From the Main Menu, select:

1. Status and Counters ...

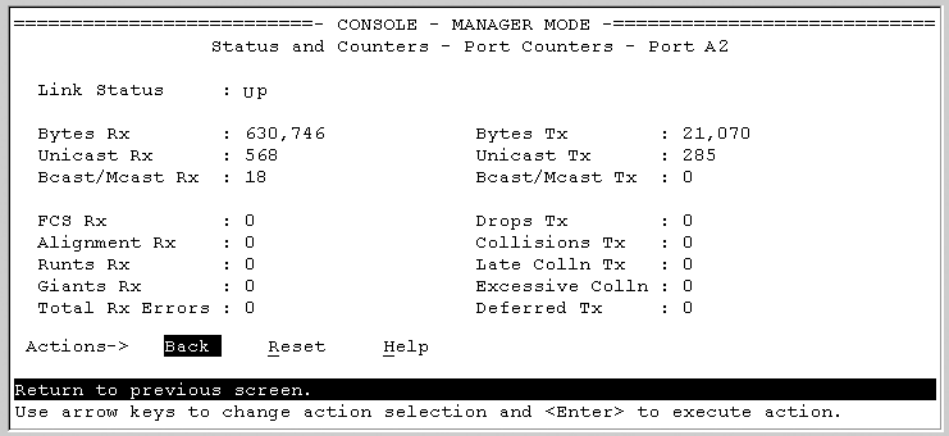
4. Port Counters

Figure 57: *Example: of port counters on the menu interface*



To view details about the traffic on a particular port, use the ↓ key to highlight that port number, then select **Show Details** . For example, selecting port A2 displays a screen similar to **Figure 58: Example: of the display for Show Details on a selected port** on page 335, below.

Figure 58: *Example: of the display for* `Show Details` *on a selected port*



This screen also includes the **Reset** action for the current session.

Once cleared, statistics cannot be reintroduced.

Accessing port and trunk group statistics (CLI)

Viewing the port counter summary report

Syntax:

show interfaces

Provides an overview of port activity for all ports on the switch.

Viewing a detailed traffic summary for specific ports

Syntax:

show interfaces <*port-list*>

Provides traffic details for the ports you specify.

Displaying trunk load balancing statistics

To display trunk counters information since the trunk was formed with the given ports. If ports are added or removed from the trunk-groups, statistical data is reset.

Syntax:

show trunk-statistics <*trunk-group*>

Displays the trunk counter information since the trunk was formed.

Ouptut for the show trunk-statistics command

```
switch(config)# show trunk-statistics trk1

 Group : Trk1 Ports : 3,4
 Monitoring time : 23 hours 15 minutes

 Totals

  Packets Rx : 3,452,664 Bytes Rx : 14,004,243
  Packets Tx : 2,121,122 Bytes Tx : 2,077,566
  Packets Tx Drop :

  Rates (5 minute weighted average):
   Trunk utilization Rx : 30.2 %
   Trunk utilization Tx : 78.2 %

 Traffic Spread past 5 minutes

  Port | %Tx    | %Rx    | Bytes Rx    | Bytes Tx    | Dropped Frame-Tx
  ---- + ------ + ------ + ----------- + ----------- + ----------------
  3    | 27     | 42     | 1,223,445   | 2,112,122   | 123,122
  4    | 73     | 58     | 356,233     | 993,222     | 0
```

Clearing trunk load balancing statistics

To display trunk counters information since the trunk was formed with the given ports. If ports are added or removed from the trunk-groups, statistical data is reset. The data is for a specific trunk.

Syntax:

clear trunk-statistics <*trunk-group*>

Clears statistics for all trunks if no trunks identified.

trunk-group: Clears specific trunk counter information since the trunk was formed.

Resetting the port counters

It is useful to be able to clear all counters and statistics without rebooting the switch when troubleshooting network issues. The `clear statistics global` command clears all counters and statistics for all interfaces except SNMP. You can also clear the counters and statistics for an individual port using the `clear statistics <port-list>` command.

Syntax:

clear statistics {<< *port-list* > | global>}

When executed with the *port-list* option, clears the counters and statistics for an individual port.

When executed with the `global` option, clears all counters and statistics for all interfaces except SNMP.

The `show interfaces [<port-list>]` command displays the totals accumulated since the last boot or the last `clear statistics` command was executed. The menu page also displays these totals.

SNMP displays the counter and statistics totals accumulated since the last reboot; it is not affected by the `clear statistics global` command or the `clear statistics <port-list>` command. An SNMP trap is sent whenever the statistics are cleared.

Viewing the switch's MAC address tables

Accessing MAC address views and searches (CLI)

Syntax:

show mac-address
[vlan < *vlan-id*>]
[<*port-list*>]
[< *mac-addr* >]

Listing all learned MAC addresses on the switch, with the port number on which each MAC address was learned

```
HP Switch# show mac-address
```

Listing all learned MAC addresses on one or more ports, with their corresponding port numbers

For example, to list the learned MAC address on ports A1 through A4 and port A6:

```
HP Switch# show mac-address a1-a4,a6
```

Listing all learned MAC addresses on a VLAN, with their port numbers

This command lists the MAC addresses associated with the ports for a given VLAN. For Example:

```
HP Switch# show mac-address vlan 100
```

The switches operate with a multiple forwarding database architecture.

Finding the port on which the switch learned a specific MAC address

For example, to find the port on which the switch learns a MAC address of 080009-21ae84:

```
Select VLAN : DEFAULT_VLAN
```

Accessing MAC address views and searches (Menu)
Viewing and searching per-VLAN MAC-addresses

This feature lets you determine which switch port on a selected VLAN is being used to communicate with a specific device on the network.

From the Main Menu, select:

1. Status and Counters ...

5. VLAN Address Table

Procedure

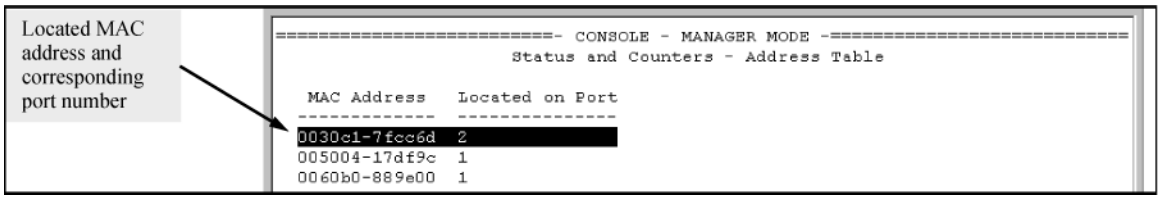
1. The switch then prompts you to select a VLAN.

```
=========================- CONSOLE - MANAGER MODE -============================
                      Status and Counters - Address Table

  MAC Address   Located on Port
  ------------  ---------------
  0030c1-7f49c0  A3
  0030c1-7fec40  A1
  0030c1-b29ac0  A3
  0060b0-17de5b  A3
  0060b0-880a80  A2
  0060b0-df1a00  A3
  0060b0-df2a00  A3
  0060b0-e9a200  A3
  009027-e74f90  A3
  080009-21ae84  A3
  080009-62c411  A3
  080009-6563e2  A3

 Actions->   Back     Search     Next page     Prev page     Help

Return to previous screen.
Use up/down arrow keys to scroll to other entries, left/right arrow keys to
change action selection, and <Enter> to execute action.
```

2. Use the Space bar to select the VLAN you want, and then press **[Enter]**.

   The switch then displays the MAC address table for that VLAN:

   Figure 59: *Example: of the address table*



   To page through the listing, use **Next page** and **Prev page**

Finding the port connection for a specific device on a VLAN

This feature uses a device's MAC address that you enter to identify the port used by that device.

Procedure

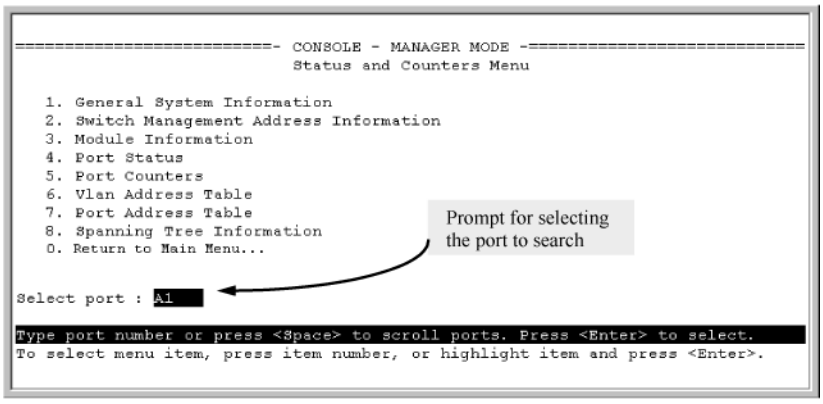
1. Proceeding from the figure above, press **[S]** (for **Search**), to display the following prompt:

```
Enter MAC address: _
```

2. Enter the MAC address you want to locate and press **[Enter]**.

The address and port number are highlighted if found (figure below). If the switch does not find the MAC address on the currently selected VLAN, it leaves the MAC address listing empty.

Figure 60: *Example: of menu indicating located MAC address*



3. Press **[P]** (for **Prev page**) to return to the full address table listing.

Viewing and searching port-level MAC addresses

This feature displays and searches for MAC addresses on the specified port instead of for all ports on the switch.

Procedure

1. From the Main Menu, select:

   1. Status and Counters ...

   7. Port Address Table
2. Use the Space bar to select the port you want to list or search for MAC addresses, then press **[Enter]** to list the MAC addresses detected on that port.

Determining whether a specific device is connected to the selected port

Proceeding from Step 2, above:

Procedure

1. Press **[S]** (for **Search**), to display the following prompt:

   ```
   Enter MAC address: _
   ```
2. Enter the MAC address you want to locate and press **[Enter]**.

   The address is highlighted if found. If the switch does not find the address, it leaves the MAC address listing empty.
3. Press **[P]** (for **Prev page**) to return to the previous per-port listing.

Accessing MSTP Data (CLI)

Syntax:

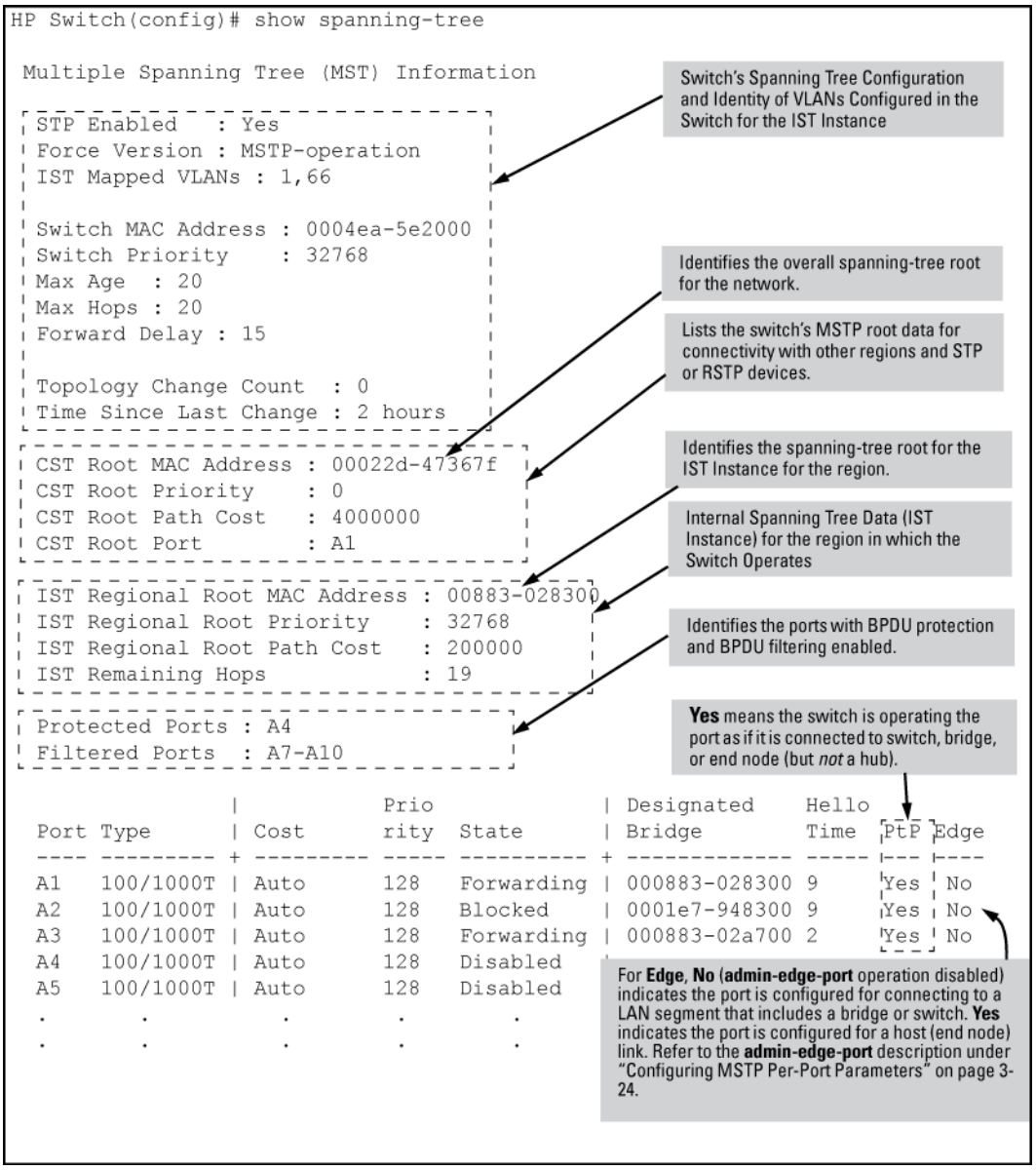
show spanning-tree

Displays the switch's global and regional spanning-tree status, plus the per-port spanning-tree operation at the regional level.

Values for the following parameters appear only for ports connected to active devices: `Designated Bridge`, `Hello Time`, `PtP`, and `Edge`.

Example:

Figure 61: *Output from* `show spanning-tree` *command*



Viewing internet IGMP status (CLI)

The switch uses the CLI to display the following IGMP status on a per-VLAN basis:

Show command	Output
`show ip igmp`	Global command listing IGMP status for all VLANs configured in the switch: • VLAN ID (VID) and name • Querier address • Active group addresses per VLAN • Number of report and query packets per group • Querier access port per VLAN
`show ip igmp config`	Displays the IGMP configuration information, including VLAN ID, VLAN name, status, forwarding, and Querier information.
`show ip igmp <vlan-id>`	Per-VLAN command listing above, IGMP status for specified VLAN (VID)
`show ip igmp group <ip-addr>`	Lists the ports currently participating in the specified group, with port type, Access type, Age Timer data and Leave Timer data.
`show ip igmp groups`	Displays VLAN-ID, group address, uptime, expiration time, multicast filter type, and the last reporter for IGMP groups.
`show ip igmp statistics`	Displays IGMP operational information, such as VLAN IDs and names, and filtered and flooding statistics.

Output from `show ip igmp config` command

```
switch(config)# show ip igmp config

 IGMP Service

                       IGMP    Forward with  Querier Querier
 VLAN ID VLAN Name     Enabled High Priority Allowed Internal
 ------- ------------ ------- ------------- ------- --------
 1       DEFAULT_VLAN No      No            Yes     125
 2       VLAN2        Yes     No            Yes     125
 12      New_VLAN     No      No            Yes     125
```

IGMP statistical information

```
switch(vlan-2)# show ip igmp statistics

 IGMP Service Statistics

  Total VLANs with IGMP enabled               : 1
  Current count of multicast groups joined    : 1


 IGMP Joined Groups Statistics

  VLAN ID VLAN Name                          Filtered     Flood
  ------- ---------------------------------- ------------ ------------
  2       VLAN2                              2            1
```

Viewing VLAN information (CLI)

Show command	Output
`show vlan`	Lists: • Maximum number of VLANs to support • Existing VLANs • Status (static or dynamic) • Primary VLAN
`show vlan <vlan-id>`	For the specified VLAN, lists: • Name, VID, and status (static/dynamic) • Per-port mode (tagged, untagged, forbid, no/auto) • "Unknown VLAN" setting (Learn, Block, Disable) • Port status (up/down)

Example:

Suppose that your switch has the following VLANs:

Ports	VLAN	VID
A1-A12	DEFAULT_VLAN	1
A1, A2	VLAN-33	33
A3, A4	VLAN-44	44

The next three examples show how you could list data on the above VLANs.

Listing the VLAN ID (vid) and status for specific ports

```
HP Switch# show vlan ports A1-A2

 Status and Counters = VLAN Information - for ports A1,A2

  802.1Q VLAN ID Name         Status
  -------------- ------------ ------
  1              DEFAULT_VLAN Static
  33             VLAN-33      Static
```

Note: Because ports A1 and A2 are not members of VLAN-44, it does not appear in this listing.

VLAN listing for the entire switch

```
HP Switch# show vlan
 Status and Counters = VLAN Information

 VLAN support : Yes
 Maximum VLANs to support : 9
 Primary VLAN: DEFAULT_VLAN

 802.1Q VLAN ID Name         Status
 -------------- ------------ ------
 1              DEFAULT_VLAN Static
```

```
 33              VLAN-33       Static
 44              VLAN-44       Static
```

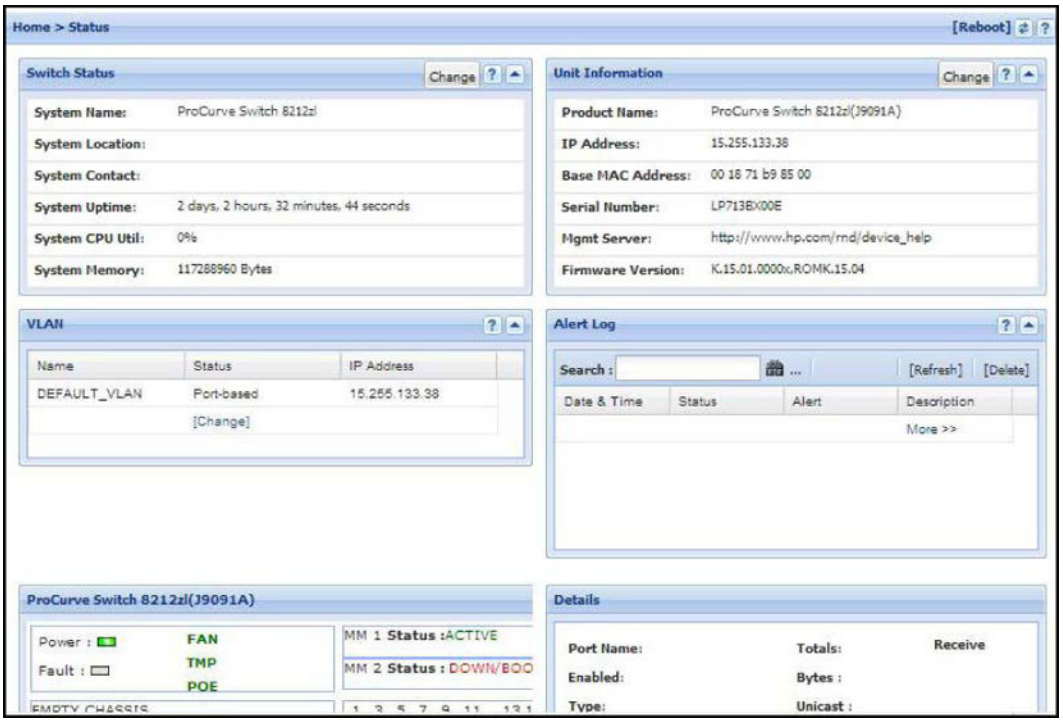
Port listing for an individual VLAN

```
switch(config)# show vlan 1

 Status and Counters - VLAN Information - VLAN 1

  VLAN ID : 1
  Name : DEFAULT_VLAN
  Status : Static
  Voice : Yes
  Jumbo : No

  Port Information Mode     Unknown VLAN Status
  ---------------- -------- ------------ ------
  A1               Untagged Learn        Up
  A2               Untagged Learn        Up
  A3               Untagged Learn        Up
  A4               Untagged Learn        Down
  A5               Untagged Learn        Up
  A6               Untagged Learn        Up
  A7               Untagged Learn        Up
```

WebAgent status information

The WebAgent Status screen provides an overview of the status of the switch. Scroll down to view more details. For information about this screen, click on **?** in the upper right corner of the WebAgent screen. For an Example: of a status screen, see **Figure 62: Example: of a WebAgent status screen** on page 343.

Figure 62: *Example: of a WebAgent status screen*



Compatibility mode for v2 zl and zl modules

In the following context, v2 zl modules are the second version of the current zl modules.

Compatibility Mode allows the inter-operation of v2 zl modules with zl modules in a chassis switch. When in Compatibility Mode, the switch accepts either v2 zl or zl modules. The default is Compatibility Mode enabled. If Compatibility Mode is disabled by executing the `no allow-v1-modules` command, the switch will only power up v2 zl modules.

allow-v1-modules

Syntax

```
[no] allow-v1-modules
```

Enables Compatibility Mode for interoperation of v2 zl and zl modules in the same chassis. (See **Figure 63: Enabling compatibility mode** on page 344.) The `no` form of the command disables Compatibility Mode. Only the v2 zl modules are powered up. (See **Figure 64: Disabling compatibility mode** on page 344.) Defaults to enabled.

allow-v1–modules

Figure 63: *Enabling compatibility mode*

```
HP Switch(config)# allow-v1-modules
This will erase the configuration and reboot the switch.
Continue [y/n]?
```

no allow-v1–modules

Figure 64: *Disabling compatibility mode*

```
HP Switch(config)# no allow-v1-modules
All V1 modules will be disabled. Continue [y/n]?
```

Port status

You can view port status using either the CLI or the menu.

show interfaces brief

Syntax

show interfaces brief

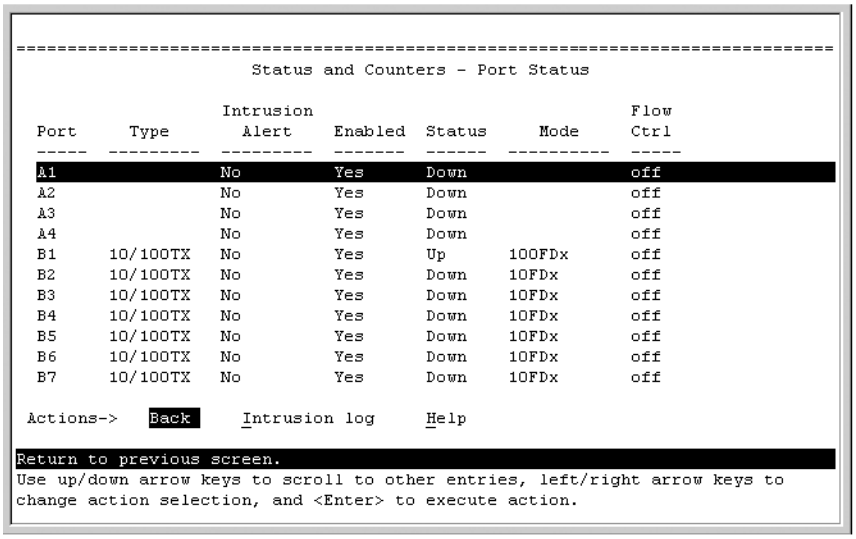
Description

View the port status.

Viewing port status (menu)

From the Main Menu, select **1. Status and Counters ...** , and then select **4. Port Status**.

Figure 65: *Example of port status on the menu interface*



Accessing port and trunk group statistics

Use the CLI to view port counter summary reports, and to view detailed traffic summary for specific ports.

show interfaces

Syntax

show interfaces <*PORT-LIST*>

Description

Provides an overview of port activity for all ports on the switch or for the ports you specify. Displays the totals accumulated since the last boot or the last execution of the `clear statistics` command.

Parameters and options

<PORT-LIST>	View port activity for specific ports.

Reset port counters

When troubleshooting network issues, you can clear all counters and statistics without rebooting the switch using the `clear statistics global` command or using the menu.

SNMP displays the counter and statistics totals accumulated since the last reboot, and it is not affected by the `clear statistics global` command or the `clear statistics <PORT-LIST>` command. Clearing statistics initiates an SNMP trap.

Once cleared, statistics cannot be reintroduced.

clear statistics

Syntax

clear statistics [<*PORT-LIST*>|global]

Description

This command clears all counters and statistics for all interfaces except SNMP.

Parameters and options

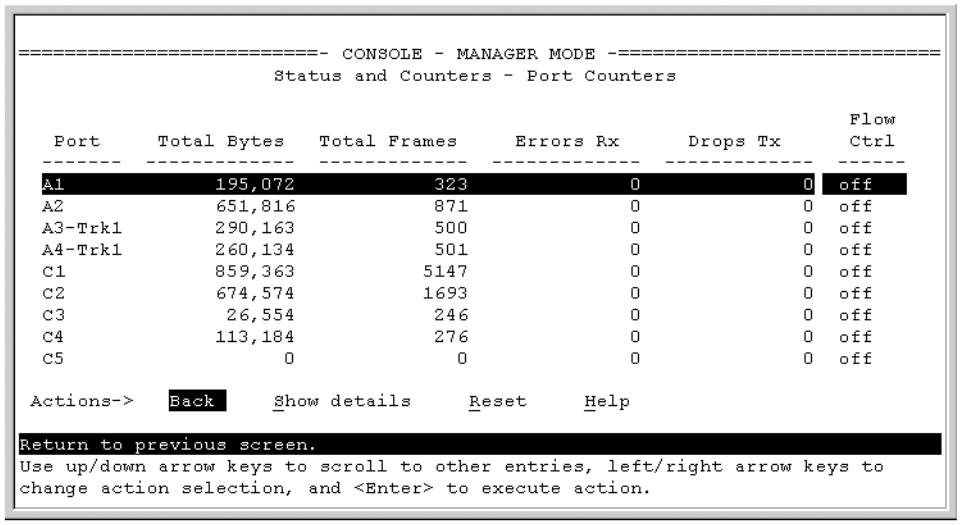
<PORT-LIST>	Clears the counters and statistics for specific ports.
global	Clears all counters and statistics for all interfaces except SNMP.

Accessing port and trunk statistics (Menu)

Procedure

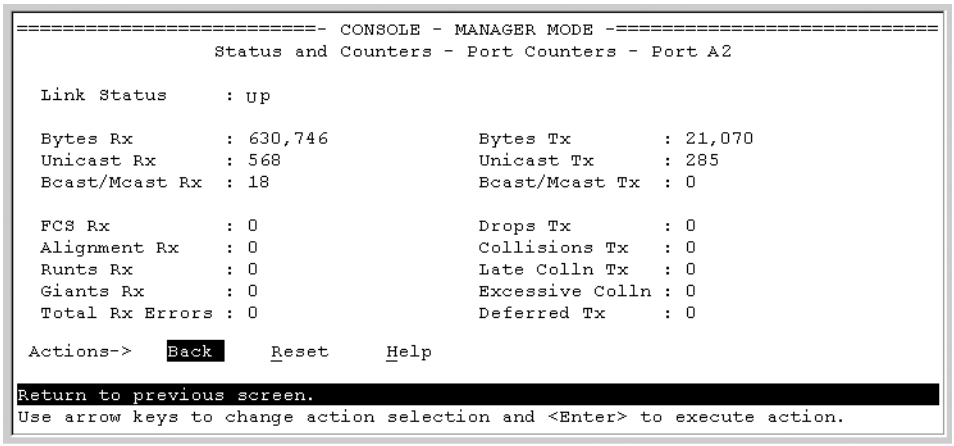
1. From the Main Menu, select **1. Status and Counters ...** , and then select **4. Port Counters**.

   Figure 66: *Example of port counters on the menu interface*



2. To view details about the traffic on a particular port, use the ↓ key to highlight that port number, and then select **Show Details** . For example, selecting port A2 displays a screen similar to the example below.

   Figure 67: *Example of the display for* `Show Details` *on a selected port*



   This screen also includes the **Reset** action for the current session.

MAC address tables

MAC address views and searches

You can view and search MAC addresses using the CLI or the menu.

show mac-address

Syntax

`show mac-address [vlan <VLAN-ID>] [<PORT-LIST>] [<MAC-ADDR>]`

Description

Lists all MAC addresses on the switch and their corresponding port numbers. You can also choose to list specific addresses and ports, or addresses and ports on a VLAN. The switches operate with a multiple forwarding database architecture.

List all learned MAC addresses on the switch and corresponding port numbers

```
switch# show mac-address
```

List all learned MAC addresses on one or more ports and corresponding port numbers

```
switch# show mac-address a1-a4,a6
```

List all learned MAC addresses on a VLAN and corresponding port numbers

```
switch# show mac-address vlan 100
```

List the port on which the switch learned a specific MAC address

To find the port on which the switch learns a MAC address of 080009-21ae84:

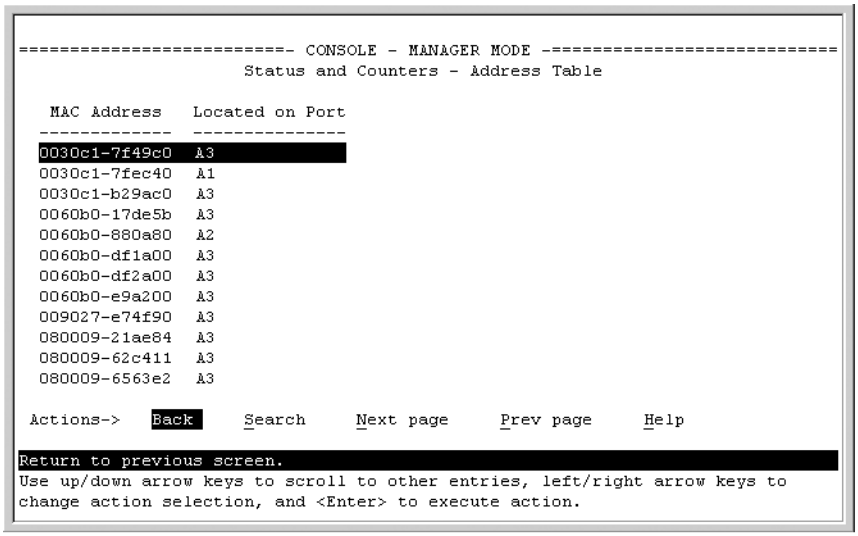
```
Select VLAN : DEFAULT_VLAN
```

Using the menu to view and search MAC addresses

To determine which switch port on a selected VLAN the switch uses to communicate with a specific device on the network:

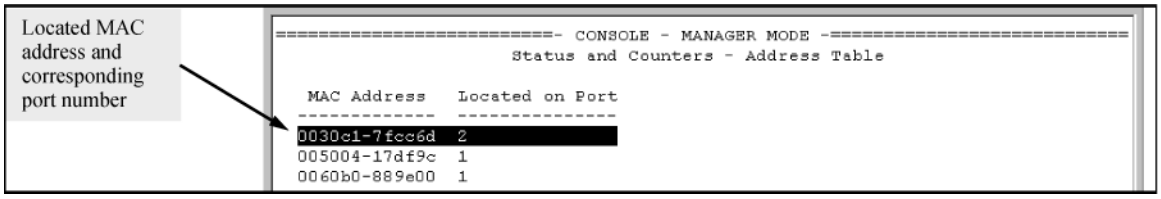
Procedure

1. From the Main Menu, select **1. Status and Counters ...** , and then select **5. VLAN Address Table**.
2. Use the arrow keys to scroll to the VLAN you want, and then press **Enter** on the keyboard to select it.



The switch then displays the MAC address table for that VLAN (**Figure 68: Example of the address table** on page 349.)

Figure 68: *Example of the address table*



3. To page through the listing, use **Next page** and **Prev page** .

Finding the port connection for a specific device on a VLAN

This feature uses a device's MAC address that you enter to identify the port used by that device.

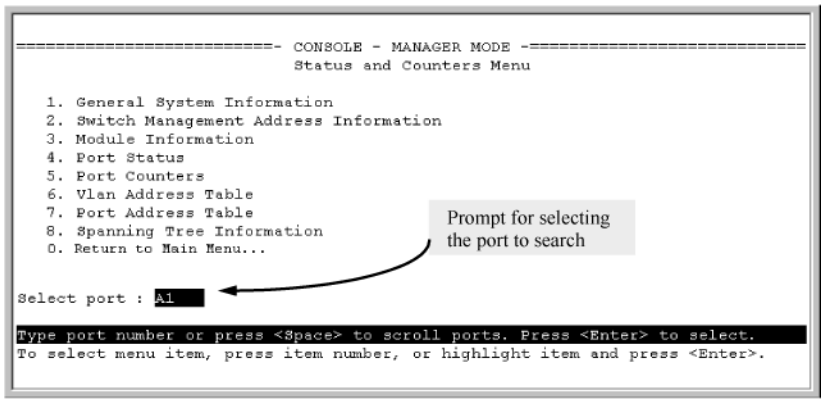
Procedure

1. Proceeding from **Figure 68: Example of the address table** on page 349, press **[S]** (for **Search**), to display the following prompt:

```
Enter MAC address: _
```

2. Enter the MAC address you want to locate and press **[Enter]**.
3. The address and port number are highlighted if found (**Figure 69: Example of menu indicating located MAC address** on page 349.) If the switch does not find the MAC address on the currently selected VLAN, it leaves the MAC address listing empty.

Figure 69: *Example of menu indicating located MAC address*



4. Press **[P]** (for **Prev page**) to return to the full address table listing.

Viewing and searching port-level MAC addresses

This feature displays and searches for MAC addresses on the specified port instead of for all ports on the switch.

Procedure

1. From the Main Menu, select:

   1. Status and Counters ...

   7. Port Address Table
2. Use the Space bar to select the port you want to list or search for MAC addresses, then press **[Enter]** to list the MAC addresses detected on that port.

Determining whether a specific device is connected to the selected port

Proceeding from Step 2, above:

Procedure

1. Press **[S]** (for **Search**), to display the following prompt:

   ```
   Enter MAC address: _
   ```

2. Enter the MAC address you want to locate and press **[Enter]**.

   The address is highlighted if found. If the switch does not find the address, it leaves the MAC address listing empty.

3. Press **[P]** (for **Prev page**) to return to the previous per-port listing.

MSTP data

show spanning-tree

Syntax

show spanning-tree

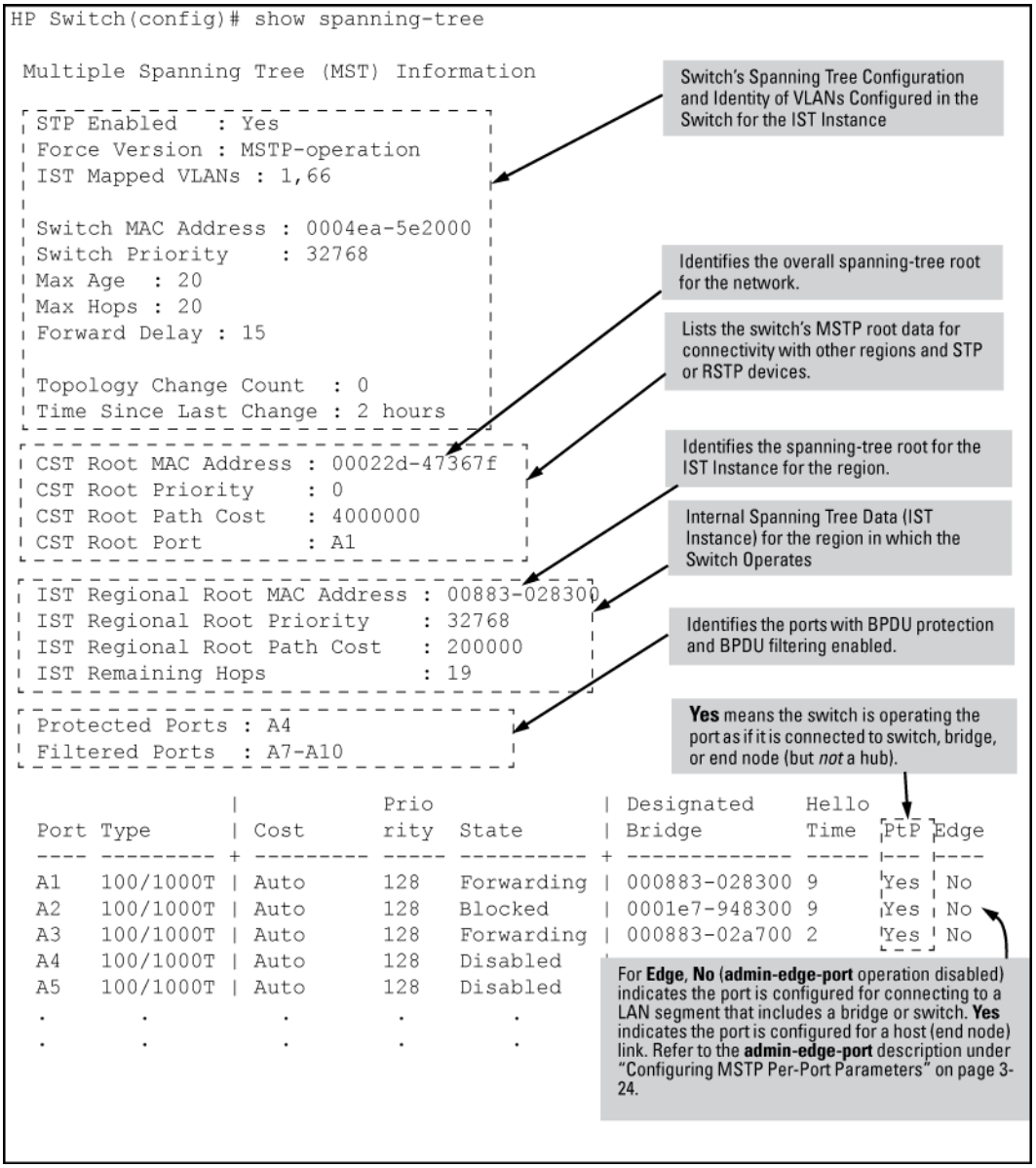
Description

Displays the global and regional spanning-tree status for the switch, and displays the per-port spanning-tree operation at the regional level.

Values for the following parameters appear only for ports connected to active devices: `Designated Bridge`, `Hello Time`, `PtP`, and `Edge`.

show spanning-tree command output

Figure 70: *show spanning-tree command output*



IP IGMP status

show ip igmp

Syntax

show ip igmp <*VLAN-ID*> [config] [group <*IP-ADDR*>|groups] [statistics]

Description

Global command that lists IGMP status for all VLANs configured in the switch, including:

- VLAN ID (VID) and name
- Querier address
- Active group addresses per VLAN
- Number of report and query packets per group
- Querier access port per VLAN

Parameters and options

`config`	Displays the IGMP configuration information, including VLAN ID, VLAN name, status, forwarding, and Querier information.
`vlan-id`	Per-VLAN command listing above, IGMP status for specified VLAN (VID).
`group <`*`IP-ADDR`*`>`	Lists the ports currently participating in the specified group, with port type, Access type, Age Timer data and Leave Timer data.
`groups`	Displays VLAN-ID, group address, uptime, expiration time, multicast filter type, and the last reporter for IGMP groups.
`statistics`	Displays IGMP operational information, such as VLAN IDs and names, and filtered and flooding statistics.

Output from `show ip igmp config` command

```
HP Switch(config)# show ip igmp config

 IGMP Service

                      IGMP    Forward with  Querier Querier
 VLAN ID VLAN Name    Enabled High Priority Allowed Interval
 ------- ------------ ------- ------------- ------- --------
 1       DEFAULT_VLAN No      No            Yes     125
 2       VLAN2        Yes     No            Yes     125
 12      New_Vlan     No      No            Yes     125
```

IGMP statistical information

```
switch(vlan-2)# show ip igmp statistics

 IGMP Service Statistics

  Total VLANs with IGMP enabled               : 1
  Current count of multicast groups joined    : 1


 IGMP Joined Groups Statistics

  VLAN ID VLAN Name                         Filtered     Flood
  ------- --------------------------------- ------------ ------------
  2       VLAN2                             2            1
```

VLAN information

show vlan

Syntax

show vlan <*VLAN-ID*>

Description

Lists the maximum number of VLANs to support, existing VLANS, VLAN status (static or dynamic), and primary VLAN.

Parameters and options

<VLAN-ID> Lists the following for the specified VLAN:

- Name, VID, and status (static/dynamic)
- Per-port mode (tagged, untagged, forbid, no/auto)
- "Unknown VLAN" setting (Learn, Block, Disable)
- Port status (up/down)

List data on specific VLANs

The next three figures show how you can list data for the following VLANs:

Ports	VLAN	VID
A1-A12	DEFAULT_VLAN	1
A1, A2	VLAN-33	33
A3, A4	VLAN-44	44

Figure 71: *Listing the VLAN ID (vid) and status for specific ports*

```
HP Switch# show vlan ports A1-A2

 Status and Counters = VLAN Information - for ports A1,A2

  802.1Q VLAN ID Name          Status
  -------------- ------------- -------
  1              DEFAULT_VLAN  Static
  33             VLAN-33       Static
```

Because ports A1 and A2 are not members of VLAN-44, it does not appear in this listing.

Figure 72: *Example of VLAN listing for the entire switch*

```
HP Switch# show vlan
 Status and Counters - VLAN Information

  VLAN support : Yes
  Maximum VLANs to support : 9
  Primary VLAN: DEFAULT_VLAN

  802.1Q VLAN ID Name          Status
  -------------- ------------- -------
  1              DEFAULT_VLAN  Static
  33             VLAN-33       Static
  44             VLAN-44       Static
```

Figure 73: *Port listing for an individual VLAN*

```
HP Switch(config)# show vlan 1

 Status and Counters - VLAN Information - VLAN 1

  VLAN ID : 1
  Name : DEFAULT_VLAN
  Status : Static
  Voice : Yes
  Jumbo : No

  Port Information Mode     Unknown VLAN Status
  --------------- -------- ------------ ----------
  A1              Untagged Learn        Up
  A2              Tagged   Learn        Up
  A3              Untagged Learn        Up
  A4              Untagged Learn        Down
  A5              Untagged Learn        Up
  A6              Untagged Learn        Up
  A7              Untagged Learn        Up
```

Configuring local mirroring

To configure a local mirroring session in which the mirroring source and destination are on the same switch, follow these general steps:

Procedure

1. Determine the session and local destination port:
   a. Session number (1-4) and (optional) alphanumeric name

b. Exit port (any port on the switch except a monitored interface used to mirror traffic)

Hewlett Packard Enterprise strongly discourages connecting a mirroring exit port to a network because doing so can result in serious network performance problems. Only connect an exit port to a network analyzer, IDS, or other network edge device that has no connection to other network resources.

2. Enter the `mirror session-# [name session-name ] port port-#` command to configure the session.
3. Determine the traffic to be selected for mirroring by any of the following methods and the appropriate configuration level (VLAN, port, mesh, trunk, switch):
   a. Direction: inbound, outbound, or both
   b. Classifier-based mirroring policy: inbound only for IPv4 or IPv6 traffic
   c. MAC source and/or destination address: inbound, outbound, or both
4. Enter the `monitor` command to assign one or more source interfaces to the session.

After you complete step 4, the switch begins mirroring traffic to the configured exit port.

The following commands configure mirroring for a local session in which the mirroring source and destination are on the same switch.

- The `mirror` command identifies the destination in a mirroring session.
- The `interface` and `vlan` commands identify the mirroring source, including source interface, traffic direction, and traffic-selection criteria for a specified session.

NOTE

With no **allow-v2-modules** specified in the configuration of a switch with V3 modules on KB firmware, Egress VLAN ACLs do not filter mirrored traffic. You must use a port ACL to filter mirrored traffic.

Local mirroring sessions

Syntax

[no] mirror 1 - 4 port <*EXIT-PORT-#*> [name <*NAME-STR*>]

Description

Configure local mirroring sessions.

Parameters and options

no When used with `no mirror session-# port` command, removes the mirroring session and any mirroring source previously assigned to that session by the following commands.

Traffic-direction criteria

interface monitor all

Syntax

Description

`[no] [interface <PORT> |<TRUNK> |<MESH>]|vlan <VID-#>] monitor all in|out|both mirror <SESSION> [session ...] [no-tag-added]`

ACL criteria for inbound traffic — deprecated

interface monitor ip

Syntax

```
[no] [interface <PORT> |<TRUNK> |<MESH>]|vlan <VID-#>] monitor ip access-group
<ACL-NAME> in mirror session [session ...]
```

Mirror policy for inbound traffic

class [ipv4|ipv6]

Syntax

```
class [ipv4|ipv6] <CLASSNAME> [no] [seq-number] [match|ignore] <IP-PROTOCOL>
<SOURCE-ADDRESS> <DESTINATION-ADDRESS>][precedence <PRECEDENCE-VALUE>][tos <TOS-
VALUE>][ip-dscp <CODEPOINTS>][vlan <VLAN-ID>]
```

Description

Configures the mirroring policy for inbound traffic on the switch.

Parameters and options

policy mirror

Syntax

```
policy mirror <POLICY-NAME> [no] <SEQ-NUMBER> [class [ipv4|ipv6] <CLASSNAME> action
mirror <SESSION>] [action mirror <SESSION>] [no] default-class action mirror
<SESSION> [no] [interface <PORT/TRUNK>| vlan <VID-#>] service-policy <MIRROR-
POLICY-NAME> in
```

Description

The `[no] [interface <PORT/TRUNK>| vlan <VID-#>] service-policy <MIRROR-POLICY-NAME> in` command removes the mirroring policy from a port, VLAN, trunk, or mesh interface for a specified session, but leaves the session available for other assignments.

Parameters and options

mirror *<SESSION>*	Accepts either a number (1 to 4) or a name. To use a name, you must first configure the `name <NAME-STR>` parameter option for the specified mirroring session using the `policy mirror` command.

MAC-based criteria to select traffic

monitor mac

Syntax

[no] monitor mac *<MAC-ADDR>* [src|dst|both] mirror session

Description

Configures traffic using MAC-based criteria.

Parameters and options

no Use the `no` form of the complete Command syntax (for example, `no monitor mac 112233-445566 src mirror 3`) to remove a MAC address as mirroring criteria from an active session on the switch without removing the session itself.

mirror Enter the `monitor mac mirror` command at the global configuration level.

Remote mirroring destination on a remote switch

Syntax

mirror endpoint ip <*SRC-IP*> <*SRC-UDP-PORT* > <*DST-IP*> <*EXIT-PORT*> [truncation]

Description

Configures a remote mirroring destination on a remote switch.

Parameters and options

Remote mirroring destination on a local switch

mirror remote ip

Syntax

mirror <*SESSION*> remote ip <*SRC-IP*> <*SRC-UDP-PORT*> <*DST-IP*>

Description

Configures a remote mirroring destination on a local switch.

Parameters and options

Local mirroring destination on the local switch

mirror port

Syntax

mirror <*SESSION*> port <*EXIT-PORT*>

Description

Configures a local mirroring destination on a local switch.

Parameters and options

Monitored traffic

interface

Syntax

`interface <PORT/TRUNK/MESH>`

Description

Parameters and options

monitor all

Syntax

`monitor all [in|out|both] mirror <SESSION> [no-tag-added]`

`monitor ip access-group ACL-NAME in mirror <SESSION>`

`monitor mac <MAC-ADDR> [src|dest|both] mirror`

`show monitor [endpoint|<SESSION-NUMBER>|name <SESSION-NAME>`

service-policy

Syntax

`service-policy <mirror-policy-name> in`

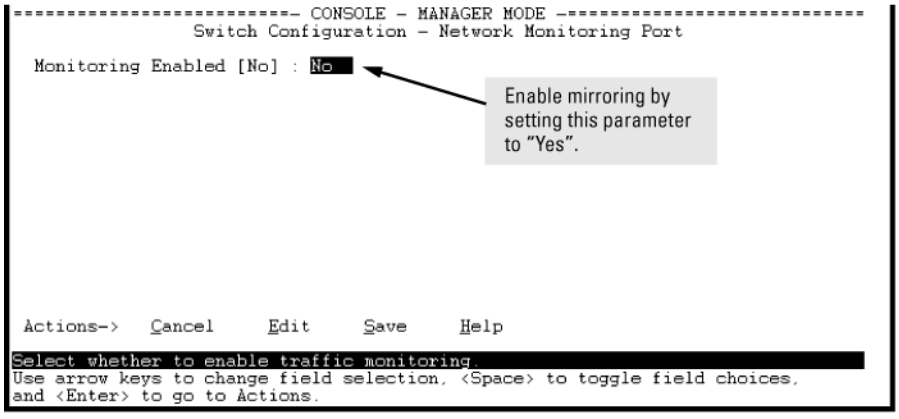
Configuring local mirroring (Menu)

If mirroring has already been enabled on the switch, the Menu screens appear different from the one shown in this section.

Procedure

1. From the Main Menu, select **1. Switch Configuration ...** , and then select **3. Network Monitoring Port**.

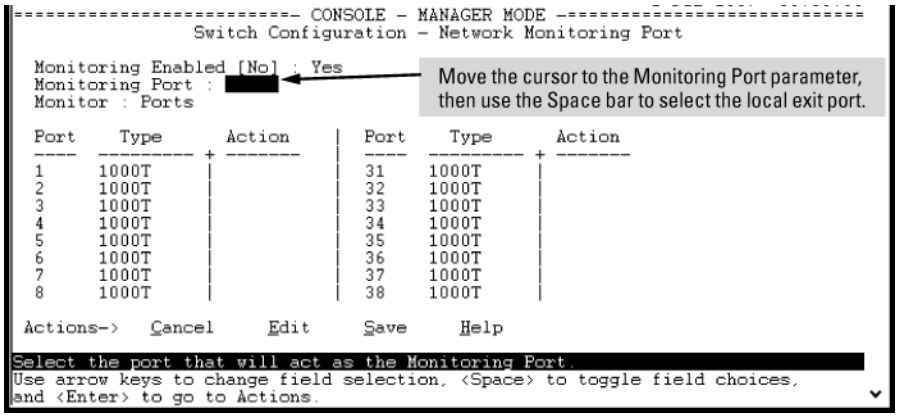
   Figure 74: *The default network mirroring configuration screen*



2. In the Actions menu, press **[E]** (for **Edit**.)
3. If mirroring is currently disabled for session 1 (the default), enable it by pressing the Space bar (or **[Y]**) to select **Yes**.

4. Press the down arrow key to display a screen similar to the figure below, and move the cursor to the **Monitoring Port** parameter.

   Figure 75: *How to select a local exit port*



5. Use the Space bar to select the port to use for sending mirrored traffic to a locally connected traffic analyzer or IDS.

   (The selected interface must be a single port. It cannot be a trunk or mesh.) In this example, port 5 is selected as the local exit port.

6. Highlight the Monitor field and use the Space bar to select the interfaces to mirror:

   Ports: Use for mirroring ports, static trunks, or the mesh.

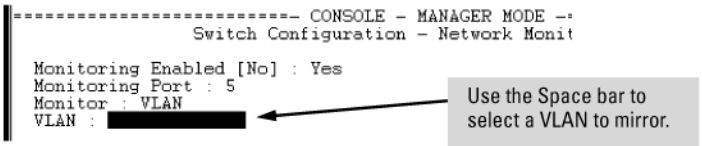
   VLAN: Use for mirroring a VLAN.

7. Do one of the following:

   a. If you are mirroring ports, static trunks, or the mesh, go to **8** on page 359

   b. If you are mirroring a VLAN:

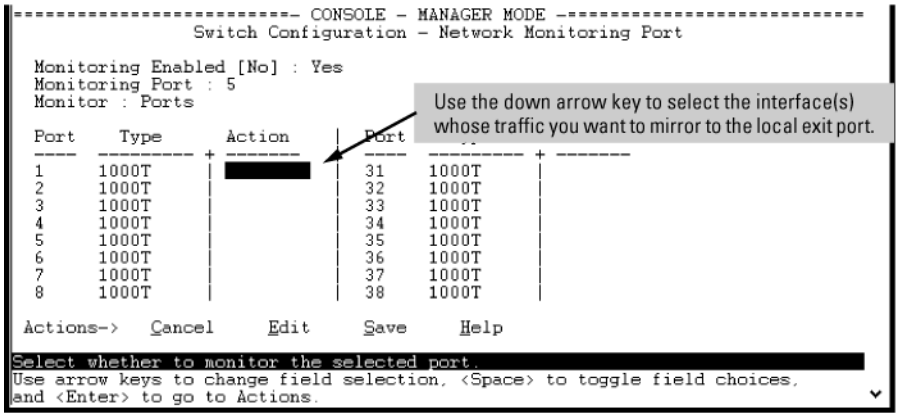
      I. Press **[Tab]** or the down arrow key to move to the **VLAN** field.



      II. Use the Space bar to select the **VLAN** you want to mirror.

      III. Go to **10** on page 360.

8. Use the down arrow key to move the cursor to the **Action** column for the individual port interfaces and position the cursor at a port, trunk, or mesh you want to mirror.



9. Press the Space bar to select **Monitor** for the ports, trunks, mesh, or any combination of these that you want mirrored.

   Use the down arrow key to move from one interface to the next in the **Action** column. (If the mesh or any trunks are configured, they appear at the end of the port listing.)
10. When you finish selecting interfaces to mirror, press **[Enter]**, then press **[S]** (for **Save**) to save your changes and exit from the screen.
11. Return to the Main Menu.

You can also use the CLI to configure a mirroring session for a destination device connected to an exit port on either:

- The same switch as the source interface (local mirroring.)
- A different switch (remote mirroring.) The remote switch must be an switch offering the full mirroring capabilities described in this chapter.

After you configure a mirroring session with traffic-selection criteria and a destination, the switch immediately starts to mirror traffic to each destination device connected to an exit port.

In a remote mirroring session that uses IPv4 encapsulation, if the exit switch is not already configured as the destination for the session, its performance may be adversely affected by the stream of mirrored traffic.

For this reason, Switch strongly recommends that you configure the exit switch for a remote mirroring session before configuring the source switch for the same session.

Destination mirror on a remote switch

mirror endpoint

Syntax

mirror endpoint ip *<SRC-IP-ADDR>* *<SRC-UDP-PORT>* *<DST-IP-ADDR>* port *<EXIT-PORT>*

Description

Enter this command on a remote switch to configure the exit port to use in a remote mirroring session. Use **Source mirror on the local switch** to configure the mirroring source on the local switch.

The `mirror endpoint ip` command configures:

- The unique UDP port number to be used for the mirroring session on the source switch. The recommended port range is from 7933 to 65535.
- The IP address of the source switch to use in the session.
- The IP address and exit-port number on the remote (endpoint) switch.

In a remote mirroring endpoint, the IP address of exit port and the remote destination switch can belong to different VLANs.

Source mirror on the local switch

mirror remote ip

Syntax

`[no] mirror 1 - 4 [name <NAME-STR>] remote ip <SRC-IP> <SRC-UDP-PORT> <DST-IP> [truncation]`

Description

Configures the mirroring source on the local switch.

Parameters and options

`no mirror 1–4` Removes both the mirroring session and any mirroring sources previously assigned to the session by the following commands.

Traffic-direction criteria

Syntax

[no] [interface <*PORT*> <*TRUNK*> <*MESH*>|vlan <*VID-#*>] monitor all in|out|both mirror 1–4|<*NAME-STR*> [1 — 4|<*NAME-STR . . .*>]

Description

Configures traffic direction criteria for specific traffic

Configure ACL criteria to select inbound

interface monitor ip access-group

Syntax

[no] [interface <*PORT*> <*TRUNK*> <*MESH*>|vlan <*VID-#*>] monitor ip access—group <ACL—NAME> inmirror [1–4|<*NAME-STR*>] [1 — 4|<*NAME-STR . . .*>]

Configuring a destination switch in a remote mirroring session

When configuring a remote mirroring session, **always** configure the destination switch first. Configuring the source switch first can result in a large volume of mirrored, IPv4-encapsulated traffic arriving at the destination without an exit path, which can slow switch performance.

Syntax

mirror endpoint ip *src-ip src-udp-port dst-ip exit-port-#* no mirror endpoint ip *src-ip src-udp-port dst-ip*

Used on a destination switch to configure the remote endpoint of a mirroring session. The command uniquely associates the mirrored traffic from the desired session on a monitored source with a remote exit port on the destination switch. You must use the same set of source and destination parameters used when you configure the same session on both the source and destination switches.

For a given mirroring session, the same *`src-ip`* , *`src-udp-port`* and *`dst-ip`* values must be entered with the `mirror endpoint ip` command on the destination switch, and later with the `mirror remote ip` command on the source switch.

Do not remove the configuration of a remote mirroring endpoint support for a given session if there are source switches currently configured to mirror traffic to the endpoint.

src-ip	Must exactly match the *src-ip* address you configure on the source switch for the remote session.
src-udp-port	Must exactly match the *src-udp-port* value you configure on the source switch for the remote session. The recommended port range is 7933 to 65535.This setting associates the monitored source with the desired remote endpoint in the remote session by using the same, unique UDP port number to identify the session on the source and remote switches.
dst-ip	Must exactly match the *dst-ip* setting you configure on the source switch for the remote session.
exit-port-#	Exit port for mirrored traffic in the remote session, to which a traffic analyzer or IDS is connected.

The no form of the command deletes the mirroring endpoint for the configured session on the remote destination switch.

Configuring a source switch in a local mirroring session

Enter the mirror port command on the source switch to configure an exit port on the same switch. To create the mirroring session, use the information gathered in **High-level overview of the mirror configuration process** on page 385.

Syntax

mirror 1 - 4 port *exit-port-#* [name *name-str*] no mirror 1- 4

Assigns the exit port to use for the specified mirroring session and must be executed from the global configuration level.

1 - 4	Identifies the mirroring session created by this command. (Multiple sessions on the switch can use the same exit port.)
name *name-str*	Optional alphanumeric name string used to identify the session (up to 15 characters)
port *exit-port-#*	Exit port for mirrored traffic in the remote session. This is the port to which a traffic analyzer or IDS is connected.

The no form of the command removes the mirroring session and any mirroring source previously assigned to that session.

Configuring a source switch in a remote mirroring session

Syntax

[no] mirror 1 - 4 [name *name-str*] remote ip *src-ip src-udp-port dst-ip* [truncation]

Used on the source switch to uniquely associate the mirrored traffic in the specified session with a remote destination switch. You must configure the same source and destination parameters when you configure the same session on both the source and destination switches. (If multiple remote sessions use the same source and destination IP addresses, each session must use a unique UDP port value.)

When you execute this command, the following message is displayed:

```
Caution: Please configure destination switch first.
          Do you want to continue [y/n]?
```

- If you have not yet configured the session on the remote destination switch, follow the configuration procedure in **Configure a mirroring destination on a remote switch** on page 385 before using this command.
- If you have already configured the session on the remote destination switch, enter **y** (for "yes") to complete this command.

`1 - 4`	Identifies the mirroring session created by this command.
`name` *`name-str`*	Optional alphanumeric name string used as an additional session identifier (up to 15 characters.)
`src-ip`	The IP address of the VLAN or subnet on which the traffic to be mirrored enters or leaves the switch.
`src-udp-port`	Associates the remote session with a UDP port number. When multiple sessions have the same source IP address *`src-ip`* and destination IP address *`dst-ip`* , the UDP port number must be unique in each session. The UDP port number used for a given session should be in the range of 7933 to 65535. CAUTION: UDP port numbers below 7933 are reserved for various IP applications. Using them for mirroring can result in the interruption of other IP functions and in non-mirrored traffic being received on the destination switch and sent to a device connected to the remote exit port. The configured UDP port number is included in the frames mirrored from the source switch to the remote destination switch (`mirror endpoint`), and enables the remote switch to match the frames to the exit port configured for the combined UDP port number, source IP address, and destination IP address..
`dst-ip`	For the remote session specified in the command, this is the IP address of the VLAN or subnet on which the remote exit port exists. (The exit port to which a traffic analyzer or IDS is connected is configured on the remote switch in section.) .)
`[truncation]`	Enables truncation of oversize frames, causing the part of the frame in excess of the MTU size to be truncated. Unless truncation is enabled, oversize frames are dropped. The frame size is truncated to a multiple of 18 bytes—for example, if the MTU is 1000 bytes, the frame is truncated to 990 bytes (55 * 18 bytes.)

The `no` form of the command removes the mirroring session and any mirroring source previously assigned to the session. To preserve the session while deleting a monitored source assigned to it.

Selecting all traffic on a port interface for mirroring according to traffic direction

Syntax

[no] interface *port/trunk/mesh* monitor [in | out | both] [mirror 1 - 4 | *name-str*] [{1 - 4 | *name-str*} | {1 - 4 | *name-str*} | {1 - 4 | *name-str*}] [no-tag-added]

Assigns a mirroring source to a previously configured mirroring session on a source switch by specifying the port, trunk, and/or mesh sources to use, the direction of traffic to mirror, and the session.

`interface` *`port/trunk/mesh`*	Identifies the source ports, static trunks, and/or mesh on which to mirror traffic. Use a hyphen for a range of consecutive ports or trunks (`a5-a8`, `Trk2-Trk4`.) Use a comma to separate non-contiguous interfaces (`b11`, `b14`, `Trk4`, `Trk7`.)
monitor all [in | out | both]	For the interface specified by *port/trunk/mesh* , selects traffic to mirror based on whether the traffic is entering or leaving the switch on the interface: • `in`: Mirrors entering traffic. • `out`: Mirrors exiting traffic. • `both`: Mirrors traffic entering and exiting. If you enter the `monitor all` command without selection criteria or a session identifier, the command applies by default to session 1
mirror [1 - 4 | *name-str*]	Assigns the traffic specified by the interface and direction to a session by number or—if configured—by name. The session must have been previously configured. Depending on how many sessions are already configured on the switch, you can use the same command to assign the specified source to up to four sessions, for example, `interface a1 monitor all in mirror 1 2 4`. • `1 - 4`: Configures the selected port traffic to be mirrored in the specified session number. • `[ name` *`name-str`*`]`: Optional; configures the selected port traffic to be mirrored in the specified session name. The string can be used interchangeably with the session number when using this command to assign a mirroring source to a session.
`[no-tag-added]`	Prevents a VLAN tag from being added to the mirrored copy of an outbound packet sent to a local or remote mirroring destination.

The `no` form of the command removes a mirroring source assigned to the session, but does not remove the session itself. This enables you to repurpose a session by removing an unwanted mirroring source and adding another in its place.

Selecting all traffic on a VLAN interface for mirroring according to traffic direction

Syntax

vlan *vid-#* monitor all [in | out | both] [mirror 1 - 4 | *name-str*] [{1 - 4 | *name-str*} | {1 - 4 | *name-str*} | {1 - 4 | *name-str*}]

This command assigns a monitored VLAN source to a previously configured mirroring session on a source switch by specifying the VLAN ID, the direction of traffic to mirror, and the session.

`vlan vid-#`	Identifies the VLAN on which to mirror traffic.
`monitor all [in | out | both]`	Uses the direction of traffic on the specified `vid-#` to select traffic to mirror. If you enter the `monitor all` command without selection criteria or a session identifier, the command applies by default to session 1.
`mirror [1 - 4 | name-str]`	Assigns the VLAN traffic defined by the VLAN ID and traffic direction to a session number or name. Depending on how many sessions are already configured on the switch, you can use the same command to assign the specified VLAN source to up to four sessions, for example, `interface a1 monitor all in mirror 1 2 4`. • `1 - 4`: Configures the selected VLAN traffic to be mirrored in the specified session number. • `[name name-str]`: Optional; configures the selected port traffic to be mirrored in the specified session name. The string can be used interchangeably with the session number when using this command to assign a mirroring source to a session. To configure an alphanumeric name for a mirroring session, see the command description under **Configuring a source switch in a remote mirroring session** on page 362.

Assigning a VLAN to a mirroring session precludes assigning any other mirroring sources to the same session. If a VLAN is already assigned to a given mirroring session, using this command to assign another VLAN to the same mirroring session results in the second assignment replacing the first. Also, if there are other (port, trunk, or mesh) mirroring sources already assigned to a session, the switch displays a message similar to:

```
Mirror source port exists on session N. Can not add mirror
source VLAN.
```

The `no` form of the command removes a mirroring source assigned to the session, but does not remove the session itself. This allows you to repurpose a session by removing an unwanted mirroring source and adding another in its place.

Configuring a MAC address to filter mirrored traffic on an interface

Enter the `monitor mac mirror` command at the global configuration level.

Syntax

[no] monitor mac *mac-addr* [src | dest | both] {mirror 1 - 4 | *name-str*} [1 - 4 | *name-str*] [1 - 4 | *name-str*] [1 - 4 | *name-str*]

Use this command to configure a source and/or destination MAC address as criteria for selecting traffic in one or more mirroring sessions on the switch. The MAC address you enter is configured to mirror inbound (`src`), outbound (`dest`), or both inbound and outbound (`both`) traffic on any port or learned VLAN on the switch.

`monitor mac` *`mac-addr`*

Configures the MAC address as selection criteria for mirroring traffic on any port or learned VLAN on the switch.

{src | dest | both}

Specifies how the MAC address is used to filter and mirror packets in inbound and/or outbound traffic on the interfaces on which the mirroring session is applied:

- `src`: Mirrors all packets in inbound traffic that contain the specified MAC address as source address.
- `dest`: Mirrors all packets in outbound traffic that contain the specified MAC address as destination address.

The MAC address of the switch is not supported as either the source or destination MAC address used to select mirrored traffic.

- `both`: Mirrors all packets in both inbound and outbound traffic that contain the specified MAC address as either source or destination address.

mirror [1 - 4 | *name-str*]

Assigns the inbound and/or outbound traffic filtered by the specified MAC address to a previously configured mirroring session. The session is identified by a number or (if configured) a name.

Depending on how many sessions are configured on the switch, you can use the same command to configure a MAC address as mirroring criteria in up to four sessions. To identify a session, you can enter either its name or number; for example: `mirror 1 2 3 traffsrc4`

`1 - 4`: Specifies a mirroring session by number, for which the configured MAC address is used to select and mirror inbound and/or outbound traffic.

Packets that are sent or received on an interface configured with a mirroring session and that contain the MAC address as source and/or destination address are mirrored to a previously configured destination device.

To remove a MAC address as selection criteria in a mirroring session, you must enter the complete Command syntax, for example, `no monitor mac 998877-665544 dest mirror 4`.

The `no` form of the command removes the MAC address as a mirroring criteria from an active session, but does not remove the session itself. This enables you to repurpose a session by removing an unwanted mirroring criteria and adding another in its place.

Configuring classifier-based mirroring

For more information and a list of general steps for the process beginning with this command, see the information about restrictions on classifier-based mirroring.

Context: Global configuration

Syntax

[no] class [ipv4 | ipv6 *classname*]

Defines the name of a traffic class and specifies whether a policy is to be applied to IPv4 or IPv6 packets, where *classname* is a text string (64 characters maximum.)

After you enter the `class` command, you enter the class configuration context to specify match criteria. A traffic class contains a series of `match` and `ignore` commands, which specify the criteria used to classify packets.

To configure a default traffic class, use the `default-class` command as described below. A default class manages the packets that do not match the match/ignore criteria in any other classes in a policy.

Context: Class configuration

Syntax

[no] *`seq-number`*
[match | ignore *ip-protocol source-address destination-address*] [ip-dscp *codepoint*] [precedence *precedence-value*] [tos *tos-value*] [vlan *vlan-id*]

For detailed information about how to enter `match` and `ignore` commands to configure a traffic class, the *Advanced Traffic Management Guide*.

Context: Global configuration

Syntax

[no] policy mirror *policy-name*

Defines the name of a mirroring policy and enters the policy configuration context.

A traffic policy consists of one or more classes and one or more mirroring actions configured for each class of traffic. The configured actions are executed on packets that match a `match` statement in a class. No policy action is performed on packets that match an `ignore` statement.

Context: Policy configuration

Syntax

[no] *`seq-number`*
class [ipv4 | ipv6 *classname*] action mirror *session*

Defines the mirroring action to be applied on a pre-configured IPv4 or IPv6 traffic class when a packet matches the `match` criteria in the traffic class. You can enter multiple `class action mirror` statements in a policy.

`[seq-number]`	The (optional) `seq-number` parameter sequentially orders the mirroring actions that you enter in a policy configuration. Actions are executed on matching packets in numerical order. Default: Mirroring action statements are numbered in increments of 10, starting at 10.
`class [ipv4 | ipv6 classname]`	Defines the preconfigured traffic class on which the mirroring actions in the policy are executed and specifies whether the mirroring policy is applied to IPv4 or IPv6 traffic in the class. The classname is a text string (64 characters maximum.)
`action mirror session`	Configures mirroring for the destination and session specified by the `session` parameter.

Context: Policy configuration

Syntax

[no] default-class action mirror *session* [action mirror *session* ...]

Configures a default class that allows packets that are not matched nor ignored by any of the class configurations in a mirroring policy to be mirrored to the destination configured for the specified session.

Applying a mirroring policy on a port or VLAN interface

Enter one of the following `service-policy` commands from the global configuration context.

Context: Global configuration

Syntax

interface <*PORT-LIST*> service-policy *policy-name* in

Configures the specified ports with a mirroring policy that is applied to inbound traffic on each interface.

Separate individual port numbers in a series with a comma, for example, `a1,b4,d3`. Enter a range of ports by using a dash, for example, `a1-a5`.

The mirroring policy name you enter must be the same as the policy name you configured with the `policy mirror` command.

Syntax

vlan *vlan-id* service-policy *policy-name* in

Configures a mirroring policy on the specified VLAN that is applied to inbound traffic on the VLAN interface.

Valid VLAN ID numbers range from 1 to 4094.

The mirroring policy name you enter must be the same as the policy name you configured with the `policy mirror` command in the syntax **policy mirror**.

Viewing a classifier-based mirroring configuration

To display information about a classifier-based mirroring configuration or statistics on one or more mirroring policies, enter one of the following commands:

Syntax

show class [ipv4 *class-name* | ipv6 *class-name* | config]

Syntax

show policy [*policy-name* | config]

Syntax

show policy resources

Syntax

show statistics policy [policy-name] [interface *port-num* | vlan *vid* in]

Viewing all mirroring sessions configured on the switch

Syntax

show monitor

If a monitored source for a remote session is configured on the switch, the following information is displayed. Otherwise, the output displays: Mirroring is currently disabled.

Sessions	Lists the four configurable sessions on the switch.
Status	Displays the current status of each session: • active: The session is configured. • inactive: Only the destination has been configured; the mirroring source is not configured. • not defined: Mirroring is not configured for this session.
Type	Indicates whether the mirroring session is local (`port`), remote (`IPv4`), or MAC-based (`mac`) for local or remote sessions.
Sources	Indicates how many monitored source interfaces are configured for each mirroring session.
Policy	Indicates whether the source is using a classifier-based mirroring policy to select inbound IPv4 or IPv6 traffic for mirroring.

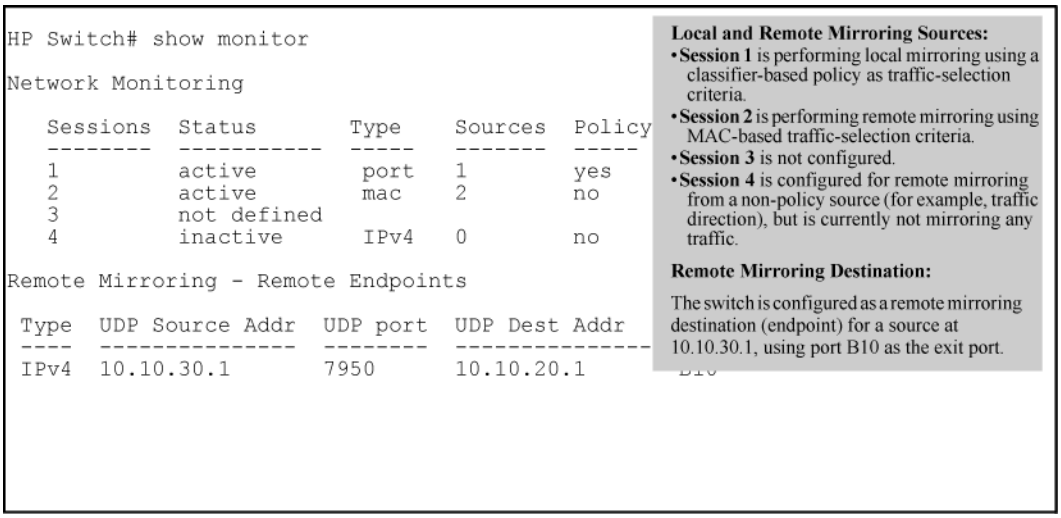
If a remote mirroring endpoint is configured on the switch, the following information is displayed. Otherwise, the output displays: There are no Remote Mirroring endpoints currently assigned.

Type	Indicates whether the mirroring session is local (`port`), remote (`IPv4`), or MAC-based (`mac`) for local or remote sessions.
UDP Source Addr	The IP address configured for the source VLAN or subnet on which the monitored source interface exists. In the configuration of a remote session, the same UDP source address must be configured on the source and destination switches.

Table Continued

UDP port	The unique UDP port number that identifies a remote session. In the configuration of a remote session, the same UDP port number must be configured on the source and destination switches.
UDP Dest Addr	The IP address configured for the destination VLAN or subnet on which the remote exit port exists. In the configuration of a remote session, the same UDP destination address must be configured on the source and destination switches.
Dest Port	Identifies the exit port for a remote session on a remote destination switch.

Figure 76: *Displaying the currently configured mirroring sessions on the switch*



Viewing the remote endpoints configured on the switch

Syntax

show monitor endpoint

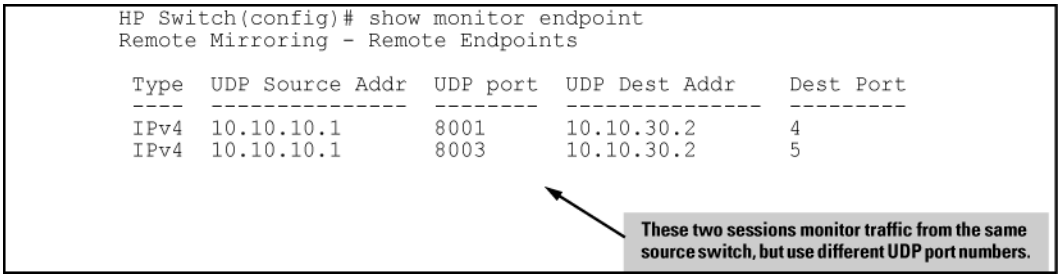
Displays the remote mirroring endpoints configured on the switch. Information on local sessions configured on the switch is not displayed. (To view the configuration of a local session, use the `show monitor [1-4 | name <name-str>]` command)

Type	Indicates whether the session is a `port` (local) or `IPv4` (remote) mirroring session.
show monitor endpoint	The IP address configured for the source VLAN or subnet on which the monitored source interface exists. In the configuration of a remote session, the same UDP source address must be configured on the source and destination switches.
UDP port	The unique UDP port number that identifies a remote session. In the configuration of a remote session, the same UDP port number must be configured on the source and destination switches.
UDP Dest Addr	The IP address configured for the destination VLAN or subnet on which the remote exit port exists. In the configuration of a remote session, the same UDP destination address must be configured on the source and destination switches.
Dest Port	fies the exit port for a remote session on a remote destination switch.

Example

In the following figure, the `show monitor endpoint` output shows that the switch is configured as the remote endpoint (destination) for two remote sessions from the same monitored source interface.

Figure 77: *Displaying the configuration of remote mirroring endpoints on the switch*



Viewing the mirroring configuration for a specific session

Syntax

show monitor [1 - 4 | name *name-str*]

Displays detailed configuration information for a specified local mirroring session on a source switch.

Session	Displays the number of the specified session.
Session Name	Displays the name of the session, if configured.
Policy	Indicates whether the source is using a classifier-based mirroring policy to select inbound IPv4 or IPv6 traffic for mirroring.
Mirroring Destination	For a local mirroring session, displays the port configured as the exit port on the source switch.
Monitoring Sources	For the specified local session, displays the source (port, trunk, or VLAN) interface and the MAC address (if configured) used to select mirrored traffic.
Direction	For the selected interface, indicates whether mirrored traffic is entering the switch (`in`), leaving the switch (`out`), or `both`.

Viewing a remote mirroring session

After you configure session 2 for remote mirroring (**Figure 78: Configuring a remote mirroring session and monitored source** on page 372), you can enter the `show monitor 2` command to verify the configuration (**Figure 79: Displaying the Configuration of a Remote Mirroring Session** on page 372.)

Figure 78: *Configuring a remote mirroring session and monitored source*

```
HP Switch(config)# mirror 2 name test-10 remote ip 10.10.10.1 8010 10.10.30.2
Caution: Please configure destination switch first.
         Do you want to continue [y/n]? y
HP Switch(config)# interface b1 monitor all both mirror 2
```

Figure 79: *Displaying the Configuration of a Remote Mirroring Session*

```
HP Switch(config)# show monitor 2
Network Monitoring

   Session: 2    Session Name: test-10
   Policy: no policy relationship exists

      Mirror Destination:  IPv4
         UDP Source Addr  UDP port  UDP Dest Addr    Status
         ---------------  --------  ---------------  --------
         10.10.10.1       8010      10.10.30.2       active

      Monitoring Sources  Direction
      ------------------  ---------
      Port: B1            Both
```

If no monitored (source) interface is configured for a mirroring session, no information is displayed in the Monitoring Sources and Direction columns.

Viewing a MAC-based mirroring session

After you configure a MAC-based mirroring session (**Figure 80: Configuring a MAC-based mirroring session** on page 372), you can enter the `show monitor 3` command to verify the configuration (**Figure 81: Displaying a MAC-based mirroring session** on page 372.)

Figure 80: *Configuring a MAC-based mirroring session*

```
HP Switch(config)# mirror 3 port a1
HP Switch# monitor mac 112233-445566 src mirror 3
```

Figure 81: *Displaying a MAC-based mirroring session*

```
HP Switch(config)# show monitor 3
Network Monitoring

   Session: 3    Session Name:
   Policy: no policy relationship exists

      Mirror Destination:  A1    (Port)

      Monitoring Sources  Direction
      ------------------  ---------
      MAC:  112233-445566 Source
```

The MAC address used to select packets in a local mirroring session is displayed in these columns.

Viewing a local mirroring session

When used to display the configuration of a local session, the `show monitor` command displays a subset of the information displayed for a remote mirroring session.

Example

Figure 82: Displaying the configuration of a local mirroring session on page 373 displays a local mirroring configuration for a session configured as follows:

- Session number: 1
- Session name: Detail
- Classifier-based mirroring policy, "MirrorAdminTraffic", is used to select inbound traffic on port B1.
- Mirrored traffic is sent to exit port B3.

Figure 82: *Displaying the configuration of a local mirroring session*

```
HP Switch(config)# show monitor 1
Network Monitoring

   Session: 1    Session Name: Detail
   Policy: MirrorAdminTraffic

      Mirror Destination:  B3    (Port)

      Monitoring Sources  Direction
      ------------------  ---------
      Port: B1            In
```

Viewing information on a classifier-based mirroring session

In the following example, a classifier-based mirroring policy (`mirrorAdminTraffic`) mirrors selected inbound IPv4 packets on VLAN 5 to the destination device configured for mirroring session 3.

Figure 83: *Configuring a classifier-based mirroring policy in a local mirroring session*

```
HP Switch(config)# mirror 3 port c1
Caution: Please configure destination switch first.
         Do you want to continue [y/n]? y
HP Switch(config)# class ipv4 AdminTraffic
HP Switch(config-class)# match ip 15.29.61.1 0.63.255.255 0.0.0.0
255.255.255.255
HP Switch(config-class)# match ip 0.0.0.0 255.255.255.255 15.29.61.1
0.63.255.255
HP Switch(config-class)# exit
HP Switch(config)# policy mirror MirrorAdminTraffic
HP Switch(config-policy)# class ipv4 AdminTraffic action mirror 3
HP Switch(config-policy)# exit
HP Switch(config)# vlan 5 service-policy MirrorAdminTraffic in
```

Displaying a classifier-based policy in a local mirroring session

```
switch(config)# show monitor 3

Network Monitoring

   Session: 3   Session Name:
   Policy: MirrorAdminTraffic

     Mirror Destination:  C1   (Port)

     Monitoring Sources  Direction
     ------------------  ---------
     VLAN: 5             Source
```

Viewing information about a classifier-based mirroring configuration

Syntax

show class ipv4 *classname*
show class ipv6 *classname*
show class config

`ipv4 classname`	Lists the statements that make up the IPv4 class identified by `classname`.
`ipv6 classname`	Lists the statements that make up the IPv6 class identified by `classname`.
`config`	Displays all classes, both IPv4 and IPv6, and lists the statements that make up each class.

Additional variants of the `show class …` command provide information on classes that are members of policies that have been applied to ports or VLANs.

Figure 84: *`show class` output for a mirroring policy*

```
HP Switch(config)# show class ipv4 AdminTraffic

Statements for Class ipv4 "AdminTraffic"

 10 match ip 15.29.16.1 0.63.255.255 0.0.0.0 255.255.255.255
 20 match ip 0.0.0.0 255.255.255.255 15.29.16.1 0.63.255.255
```

Viewing information about a classifier-based mirroring configuration

Syntax

show policy *policy-name*
show policy config

`policy-name`	Lists the statements that make up the specified policy.
`config`	Displays the names of all policies defined for the switch and lists the statements that make up each policy.

Additional variants of the `show policy` command provide information on policies that have been applied to ports or VLANs.

Figure 85: *`show policy` output for a mirroring policy*

```
HP Switch(config)# show policy MirrorAdminTraffic

Statements for Policy "MirrorAdminTraffic"

     10 class ipv4 "AdminTraffic" action mirror 3
```

Viewing resource usage for mirroring policies

Syntax

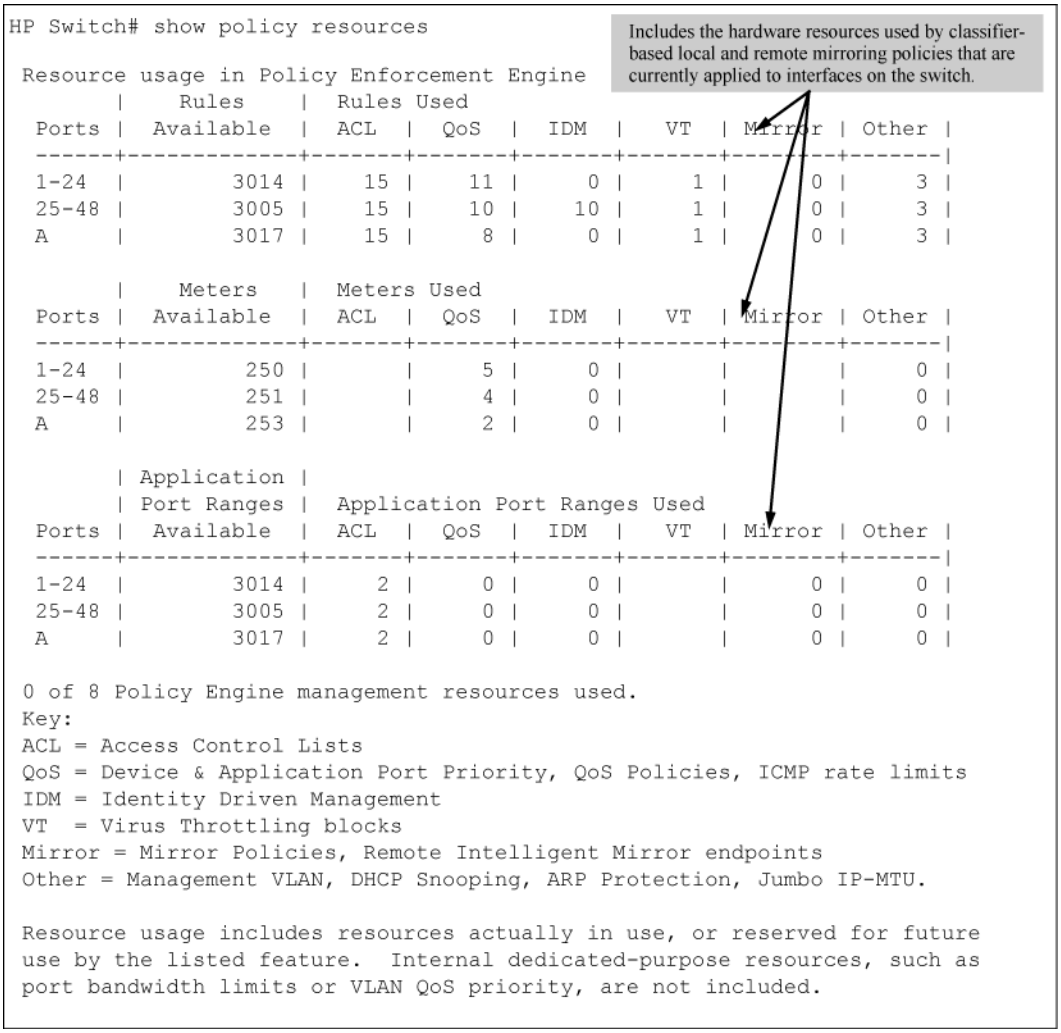
show policy resources

Displays the number of hardware resources (rules, meters, and application port ranges) used by classifier-based mirroring policies (local and remote) that are currently applied to interfaces on the switch, as well as QoS policies and other software features.

NOTE

The information displayed is the same as the output of the `show qos resources` and `show access-list resources` commands.

Figure 86: *Displaying the hardware resources used by currently configured mirroring policies*



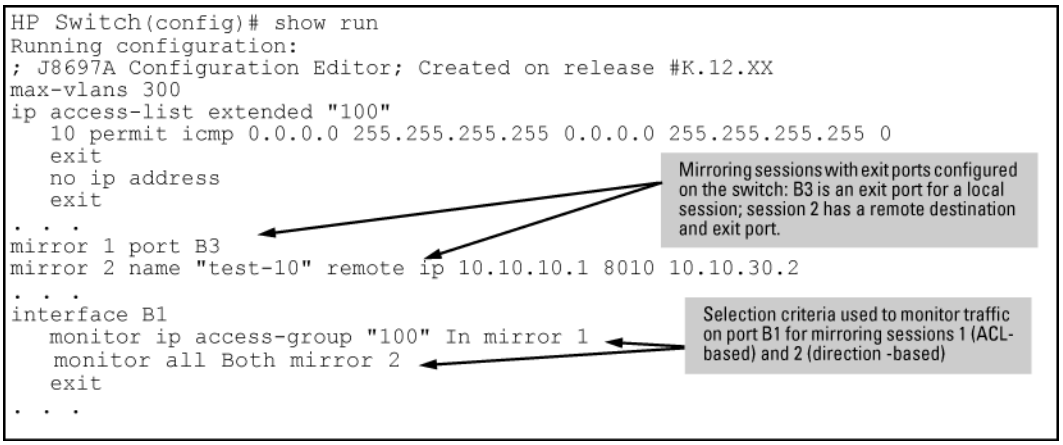

```
HP Switch# show policy resources

 Resource usage in Policy Enforcement Engine
        |    Rules     |  Rules Used
  Ports |  Available   |  ACL   |  QoS   |  IDM   |   VT   | Mirror | Other |
  ------+--------------+--------+--------+--------+--------+--------+-------|
  1-24  |         3014 |     15 |     11 |      0 |      1 |      0 |     3 |
  25-48 |         3005 |     15 |     10 |     10 |      1 |      0 |     3 |
  A     |         3017 |     15 |      8 |      0 |      1 |      0 |     3 |

        |    Meters    |  Meters Used
  Ports |  Available   |  ACL   |  QoS   |  IDM   |   VT   | Mirror | Other |
  ------+--------------+--------+--------+--------+--------+--------+-------|
  1-24  |          250 |        |      5 |      0 |        |        |     0 |
  25-48 |          251 |        |      4 |      0 |        |        |     0 |
  A     |          253 |        |      2 |      0 |        |        |     0 |

        | Application |
        | Port Ranges |  Application Port Ranges Used
  Ports |  Available   |  ACL   |  QoS   |  IDM   |   VT   | Mirror | Other |
  ------+--------------+--------+--------+--------+--------+--------+-------|
  1-24  |         3014 |      2 |      0 |      0 |        |      0 |     0 |
  25-48 |         3005 |      2 |      0 |      0 |        |      0 |     0 |
  A     |         3017 |      2 |      0 |      0 |        |      0 |     0 |

 0 of 8 Policy Engine management resources used.
 Key:
 ACL = Access Control Lists
 QoS = Device & Application Port Priority, QoS Policies, ICMP rate limits
 IDM = Identity Driven Management
 VT  = Virus Throttling blocks
 Mirror = Mirror Policies, Remote Intelligent Mirror endpoints
 Other = Management VLAN, DHCP Snooping, ARP Protection, Jumbo IP-MTU.

 Resource usage includes resources actually in use, or reserved for future
 use by the listed feature.  Internal dedicated-purpose resources, such as
 port bandwidth limits or VLAN QoS priority, are not included.
```

Viewing the mirroring configurations in the running configuration file

Use the `show run` command to view the current mirroring configurations on the switch. In the `show run` command output, information about mirroring sources in configured sessions begins with the `mirror` keyword; monitored source interfaces are listed per-interface.

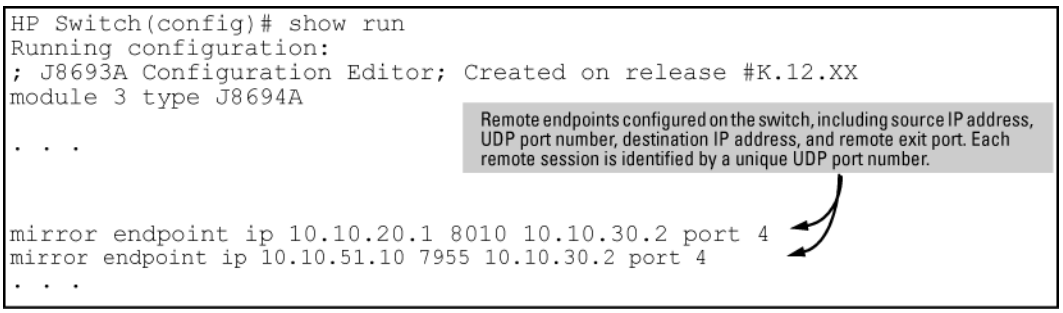
Example

Figure 87: *Displaying mirroring sources and sessions in the running configurations*



Information about remote endpoints configured for remote sessions on the switch begin with the `mirror endpoint` keywords. In the following example, two remote sessions use the same exit port:

Figure 88: *Displaying remote mirroring endpoints in the running configuration*



Compatibility mode

The following table shows how the v2 zl and zl modules behave in various combinations and situations when Compatibility mode is enabled and when it is disabled.

Table 23: *Compatibility mode enabled/disabled comparisons*

Modules	Compatibility mode enabled	Compatibility mode disabled
v2 zl modules only	Can insert zl module and the module will come up. Any v2 zl modules are limited to the zl configuration capacities.	v2 zl modules are at full capacity. zl modules are not allowed to power up.
Mixed v2 zl and zl modules	Can insert zl module and the module will come up. Any v2 zl modules are limited to the zl configuration capacities. If compatibility mode is disabled, the zl modules go down.	ZL modules are not allowed to power up.
zl modules only	Same as exists already. If a v2 zl module is inserted, it operates in the same mode as the zl module, but with performance increases.	The Management Module is the only module that powers up.
	In Compatibility Mode, no v2 zl features are allowed, whether the modules are all v2 zl or not.	If Compatibility Mode is disabled and then enabled, the startup config is erased and the chassis reboots.

Traffic mirroring overview

Traffic mirroring (Intelligent Mirroring) allows you to mirror (send a copy of) network traffic received or transmitted on a switch interface to a local or remote destination, such as a traffic analyzer or IDS.)

Traffic mirroring provides the following benefits:

- Allows you to monitor the traffic flow on specific source interfaces.
- Helps in analyzing and debugging problems in network operation resulting from a misbehaving network or an individual client. The mirroring of selected traffic to an external device makes it easier to diagnose a network problem from a centralized location in a topology spread across a campus.
- Supports remote mirroring to simultaneously mirror switch traffic on one or more interfaces to multiple remote destinations. (In remote mirroring, you must first configure the remote mirroring endpoint—remote switch and exit port—before you specify a mirroring source for a session.)

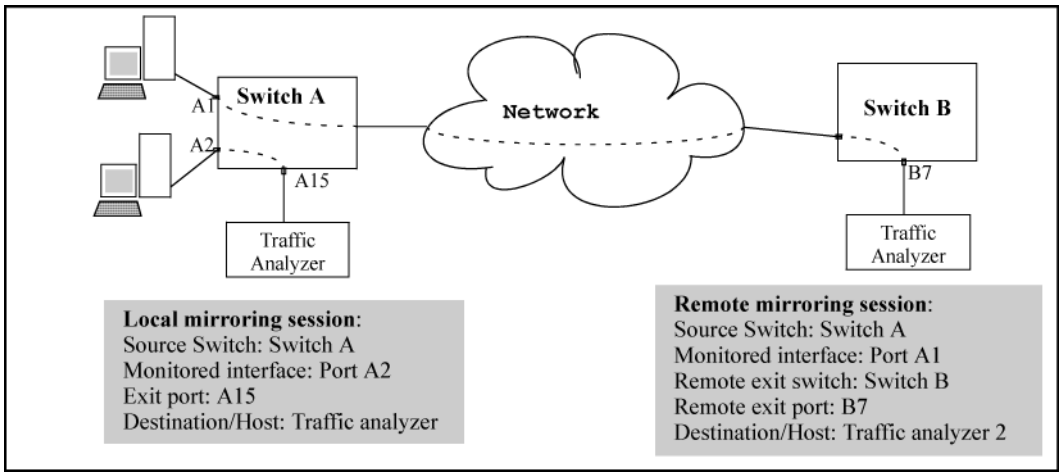
Mirroring overview

Figure 89: Local and remote sessions showing mirroring terms on page 378 shows an example of the terms used to describe the configuration of a sample local and remote mirroring session:

- In the local session, inbound traffic entering Switch A is monitored on port A2 and mirrored to a destination (host), traffic analyzer 1, through exit port A15 on the switch.A local mirroring session means that the monitored interface (A2) and exit port (A15) are on the same switch.
- In the remote session, inbound traffic entering Switch A is monitored on port A1. A mirrored copy of monitored traffic is routed through the network to a remote mirroring endpoint: exit port B7 on Switch B. A destination device, traffic analyzer 2, is connected to the remote exit port.A remote mirroring session means that:

- The monitored interface (A1) and exit port (B7) are on different switches.
- Mirrored traffic can be bridged or routed from a source switch to a remote switch.

Figure 89: *Local and remote sessions showing mirroring terms*



Mirroring destinations

Traffic mirroring supports destination devices that are connected to the local switch or to a remote switch:

- Traffic can be copied to a destination (host) device connected to the same switch as the mirroring source in a local mirroring session. You can configure up to four exit ports to which destination devices are connected.
- Traffic can be bridged or routed to a destination device connected to a different switch in a remote mirroring session. You can configure up to 32 remote mirroring endpoints (IP address and exit port) to which destination devices are connected.

Mirroring sources and sessions

Traffic mirroring supports the configuration of port and VLAN interfaces as mirroring sources in up to **four** mirroring sessions on a switch. Each session can have one or more sources (ports and/or static trunks, a mesh, or a VLAN interface) that monitor traffic entering and/or leaving the switch.

Using the CLI, you can make full use of the switch's local and remote mirroring capabilities. Using the Menu interface, you can configure only local mirroring for either a single VLAN or a group of ports, static trunks, or both.

In remote mirroring, a 54-byte remote mirroring tunnel header is added to the front of each mirrored frame for transport from the source switch to the destination switch. This may cause some frames that were close to the MTU size to exceed the MTU size. Mirrored frames exceeding the allowed MTU size are dropped, unless the optional `[truncation]` parameter is set in the `mirror` command.

Mirroring sessions

A mirroring session consists of a mirroring source and destination (endpoint.) Although a mirroring source can be one of several interfaces, as mentioned above, for any session, the destination must be a single (exit) port. The exit port cannot be a trunk, VLAN, or mesh interface.

You can map multiple mirroring sessions to the same exit port, which provides flexibility in distributing hosts, such as traffic analyzers or an IDS. In a remote mirroring endpoint, the IP address of the exit port and the remote destination switch can belong to different VLANs.

Mirroring sessions can have the same or a different destination. You can configure an exit port on the local (source) switch and/or on a remote switch as the destination in a mirroring session. When configuring a mirroring destination, consider the following options:

- Mirrored traffic belonging to different sessions can be directed to the same destination or to different destinations.
- You can reduce the risk of oversubscribing a single exit port by:
  - Directing traffic from different session sources to multiple exit ports.
  - Configuring an exit port with a higher bandwidth than the monitored source port.
- You can segregate traffic by type, direction, or source.

Mirroring session limits

A switch running software release K.12.**xx** or greater supports the following:

- A maximum of four mirroring (local and remote) sessions.
- A maximum of 32 remote mirroring endpoints (exit ports connected to a destination device that receive mirrored traffic originating from monitored interfaces on a different switch.)

Selecting mirrored traffic

You can use any of the following options to select the traffic to be mirrored on a port, trunk, mesh, or VLAN interface in a local or remote session:

- All traffic

  Monitors all traffic entering or leaving the switch on one or more interfaces (inbound and outbound.)
- Direction-based traffic selection

  Monitors traffic that is either entering or leaving the switch (inbound or outbound.) Monitoring traffic in only one direction improves operation by reducing the amount of traffic sent to a mirroring destination.
- MAC-based traffic selection

  Monitors only traffic with a matching source and/or destination MAC address in packet headers entering and/or leaving the switch on one or more interfaces (inbound and/or outbound.)
- Classifier-based service policy

  Provides a finer granularity of match criteria to zoom in on a subset of a monitored port or VLAN traffic (IPv4 or IPv6) and select it for local or remote mirroring (inbound only.)

Deprecation of ACL-based traffic selection

The use of ACLs for selecting traffic in a mirroring session has been deprecated and is replaced by the use of advanced classifier-based service policies.

As with ACL criteria, classifier-based match/ignore criteria allow you to limit a mirroring session to selected inbound packets on a given port or VLAN interface (instead of mirroring all inbound traffic on the interface.)

The following commands have been deprecated:

- `interface` *`port/trunk/mesh`* `monitor ip access-group` *`acl-name`* `in mirror [1 - 4 |` *`name-str`*`]`
- `vlan` *`vid-#`* `monitor ip access-group` *`acl-name`* `in mirror [1 - 4 |` *`name-str`*`]`

After you install and boot release K.14.01 or greater, ACL-based local and remote mirroring sessions configured on a port or VLAN interface are automatically converted to classifier-based mirroring policies.

If you are running software release K.13.XX or earlier, ACL permit/deny criteria are supported to select IP traffic entering a switch to mirror in a local or remote session, using specified source and/or destination criteria.

Mirrored traffic destinations

Local destinations

A local mirroring traffic destination is a port on the same switch as the source of the traffic being mirrored.

Remote destinations

A remote mirroring traffic destination is an switch configured to operate as the exit switch for mirrored traffic sessions originating on other switches.

After you configure a mirroring session with traffic-selection criteria and a destination, the switch immediately starts to mirror traffic to each destination device connected to an exit port. In a remote mirroring session that uses IPv4 encapsulation, if the intended exit switch is not already configured as the destination for the session, its performance may be adversely affected by the stream of mirrored traffic. For this reason, Switch strongly recommends that you configure the exit switch for a remote mirroring session before configuring the source switch for the same session.

Monitored traffic sources

You can configure mirroring for traffic entering or leaving the switch on:

- Ports and static trunks

  Provides the flexibility for mirroring on individual ports, groups of ports, static port trunks, or any combination of these..
- Meshed ports

  Enables traffic mirroring on all ports configured for meshing on the switch.
- Static VLANs

  Supports traffic mirroring on static VLANs configured on the switch. This option enables easy mirroring of traffic from all ports on a VLAN. It automatically adjusts mirroring to include traffic from newly added ports and to exclude traffic from ports removed from the VLAN.

Criteria for selecting mirrored traffic

On the monitored sources listed above, you can configure the following criteria to select the traffic you want to mirror:

- Direction of traffic movement (entering or leaving the switch, or both.)
- Type of IPv4 or IPv6 traffic entering the switch, as defined by a classifier-based service policy.
- Source and/or destination MAC addresses in packet headers.

Mirroring configuration

The table below shows the different types of mirroring that you can configure using the CLI, Menu, and SNMP interfaces.

Table 24: *Mirroring configuration options*

Monitoring interface and configuration level	Traffic selection criteria	Traffic direction		
		CLI config	Menu and web i/f config[1]	Snmp config
VLAN	All traffic	Inbound only Outbound only Both directions	All traffic (inbound and outbound combined)	Inbound only Outbound only Both directions
	ACL (IP traffic)	See **About selecting inbound traffic using advanced classifier-based mirroring**.		
	Classifier-based policy (IPv4 or IPv6 traffic)	Inbound only	Not available	Not available
Port(s)Trunk(s)Mesh	All traffic	Inbound only Outbound only Both directions	All traffic (inbound and outbound combined)	Inbound only Outbound only Both directions
	ACL (IP traffic)	See **About selecting inbound traffic using advanced classifier-based mirroring**.		
	Classifier-based policy (IPv4 or IPv6 traffic)	Inbound only	Not available	Not available
Switch (global)	MAC source/ destination address	Inbound only Outbound only Both directions	Not available	Inbound only Outbound only Both directions

[1] *Configures only session 1, and only for local mirroring.*

Configuration notes

Using the CLI, you can configure all mirroring options on a switch.

Using the Menu, you can configure only session 1 and only local mirroring in session 1 for traffic in both directions on specified interfaces. (If session 1 has been already configured in the CLI for local mirroring for inbound-only or outbound-only traffic, and you use the Menu to modify the session 1 configuration, session 1 is automatically reconfigured to monitor both inbound and outbound traffic on the assigned interfaces. If session 1 has been configured in the CLI with a classifier-based mirroring policy or as a remote mirroring session, an error message is displayed if you try to use the Menu to configure the session.)

You can use the CLI can configure sessions 1 to 4 for local or remote mirroring in any combination, and override a Menu configuration of session 1.

You can also use SNMP configure sessions 1 to 4 for local or remote mirroring in any combination and override a Menu configuration of session 1, **except** that SNMP cannot be used to configure a classifier-based mirroring policy.

Remote mirroring endpoint and intermediate devices

The remote mirroring endpoint that is used in a remote mirroring session must be an switch that supports the mirroring functions described in this chapter. (A remote mirroring endpoint consists of the remote switch and exit port connected to a destination device.) Because remote mirroring on an switch uses IPv4 to encapsulate mirrored traffic sent to a remote endpoint switch, the intermediate switches and routers in a layer 2/3 domain can be from any vendor if they support IPv4.

The following restrictions apply to remote endpoint switches and intermediate devices in a network configured for traffic mirroring:

- The exit port for a mirroring destination must be an individual port and **not** a trunk, mesh, or VLAN interface.
- A switch mirrors traffic on static trunks, but not on dynamic LACP trunks.
- A switch mirrors traffic at line rate. When mirroring multiple interfaces in networks with high-traffic levels, it is possible to copy more traffic to a mirroring destination than the link supports. However, some mirrored traffic may not reach the destination. If you are mirroring a high-traffic volume, you can reduce the risk of oversubscribing a single exit port by:
  - Directing traffic from different session sources to multiple exit ports.
  - Configuring an exit port with a higher bandwidth than the monitored source port.

Migration to release K.12.xx

On a switch that is running a software release earlier than K.12.xx with one or more mirroring sessions configured, when you download and boot release K.12.xx, the existing mirroring configurations are managed as follows:

- A legacy mirroring configuration on a port or VLAN interface maps to session 1.
- Traffic-selection criteria for session 1 is set to `both`; both inbound and outbound traffic (traffic entering **and** leaving the switch) on the configured interface is selected for mirroring.
- In a legacy mirroring configuration, a local exit port is applied to session 1.

Booting from software versions earlier than K.12.xx

If it is necessary to boot the switch from a legacy (pre-K.12.xx) software version after using version K.12.xx or greater to configure mirroring, remove mirroring from the configuration before booting with the earlier software.

Maximum supported frame size

The IPv4 encapsulation of mirrored traffic adds a 54-byte header to each mirrored frame. If a resulting frame exceeds the MTU allowed in the path from the mirroring source to the mirroring destination, the frame is dropped, unless the optional `[truncation]` parameter is set in the `mirror` command.

Frame truncation

Mirroring does not truncate frames unless the `truncation` parameter in the `mirror` command is set. If that parameter is not set, oversized mirroring frames are dropped. Also, remote mirroring does not allow downstream devices in a mirroring path to fragment mirrored frames.

Migration to release K.14.01 or greater

If a switch is running software release K.12.xx, you must first upgrade to release K.13.xx before migrating the switch to release K.14.01 or greater.

When you download and boot software release K.14.01 or greater on a switch that is running release K.13.xx and has one or more mirroring sessions configured, an ACL-based mirroring configuration on a port or VLAN interface is mapped to a class and policy configuration based on the ACL.

The new mirroring policy is automatically configured on the same port or VLAN interface on which the mirroring ACL was assigned. The behavior of the new class and mirroring-policy configuration exactly matches the traffic-selection criteria and mirroring destination used in the ACL-based session.)

Figure 90: Mirroring configuration in show run output in release K.13.xx on page 383 and **Figure 91: Mirroring configuration in show run output in release K.14.01 or greater** on page 383 show how ACL-based selection criteria in a mirroring session are converted to a classifier-based policy and class configuration when you install release K.14.01 or greater on a switch.

Figure 90: *Mirroring configuration in `show run` output in release K.13.xx*

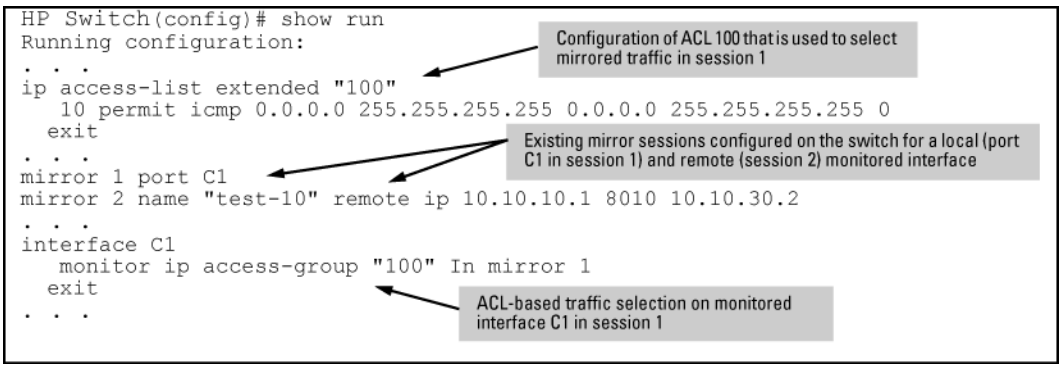
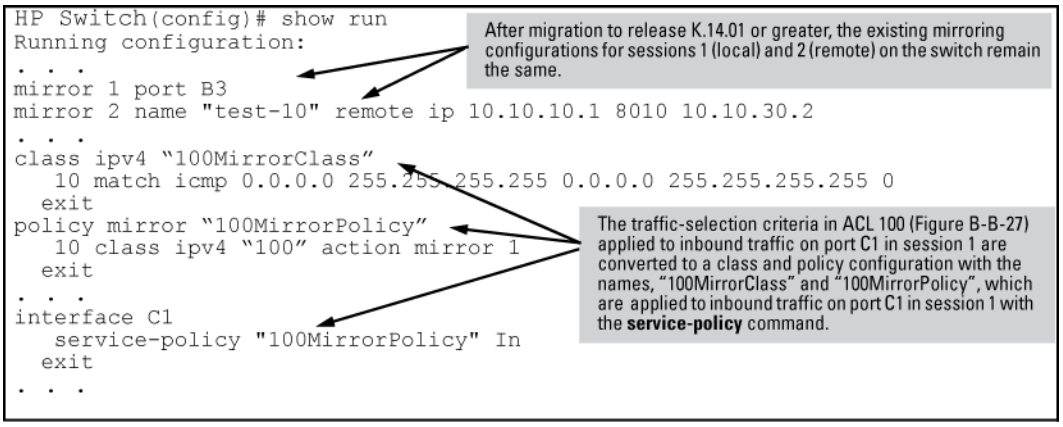


Figure 91: *Mirroring configuration in `show run` output in release K.14.01 or greater*



Using the Menu to configure local mirroring

Menu and WebAgent limits

You can use the Menu and WebAgent to quickly configure or reconfigure local mirroring on session 1 and allow one of the following two mirroring source options:

- Any combination of source ports, trunks, and a mesh.
- One static, source VLAN interface.

The Menu and WebAgent also has these limits:

- Configure and display only session 1 and only as a local mirroring session for traffic in **both** directions on the specified interface. (Selecting inbound-only or outbound-only is not an option.)
- If session 1 has been configured in the CLI for local mirroring for inbound-only or outbound-only traffic on one or more interfaces, using the Menu to change the session 1 configuration **automatically reconfigures the session** to monitor both inbound and outbound traffic on the designated interface(s.)

- If session 1 has been configured in the CLI with an ACL/classifier-based mirroring policy or as a remote mirroring session, the Menu is not available for changing the session 1 configuration.
- The CLI (and SNMP) can be used to override any Menu configuration of session 1.

Remote mirroring overview

To configure a remote mirroring session in which the mirroring source and destination are on different switches, follow these general steps:

After you complete **5.b** on page 384, the switch begins mirroring traffic to the remote destination (endpoint) configured for the session.

1. Determine the IP addressing, UDP port number, and destination (exit) port number for the remote session:
   a. Source VLAN or subnet IP address on the source switch.
   b. Destination VLAN or subnet IP address on the destination switch.
   c. Random UDP port number for the session (7933-65535.)
   d. Remote mirroring endpoint: Exit port and IP address of the remote destination switch (In a remote mirroring endpoint, the IP address of the exit port and remote switch can belong to different VLANs. Any loopback IP address can be used except the default loopback address 127.0.0.1.)

   Requirement: For remote mirroring, the same IP addressing and UDP port number must be configured on both the source and destination switches.
2. On the remote destination (endpoint) switch, enter the `mirror endpoint` command with the information from **1** on page 384 to configure a mirroring session for a specific exit port.
3. Determine the session (1 to 4) and (optional) alphanumeric name to use on the **source** switch.
4. Determine the traffic to be filtered by any of the following selection methods and the appropriate configuration level (VLAN, port, mesh, trunk, global):
   a. Direction: inbound, outbound, or both.
   b. Classifier-based mirroring policy: inbound only for IPv4 or IPv6 traffic.
   c. MAC source and/or destination address: inbound, outbound, or both.
5. On the **source** switch:
   a. Enter the `mirror` command with the session number (1 to 4) and the IP addresses and UDP port number from **1** on page 384 to configure a mirroring session. If desired, enter the `[truncation]` parameter to allow oversize packets to be truncated rather than dropped.
   b. Enter one of the following commands to configure one or more of the traffic-selection methods in **4** on page 384 for the configured session:

      interface *port/trunk/mesh* [monitor | service-policy *policy-name* in] vlan *vid* [monitor | service-policy *policy-name* in] monitor mac *mac-addr*

After you complete 5b, the switch begins mirroring traffic to the remote destination (endpoint) configured for the session.

Quick reference to remote mirroring setup

Commands to configure mirroring for a remote session in which the mirroring source and destination are on different switches:

- The `mirror` command identifies the destination in a mirroring session.
- The `interface` and `vlan` commands identify the monitored interface, traffic direction, and traffic-selection criteria for a specified session.

CAUTION

When configuring a remote mirroring session, always configure the destination switch first. Configuring the source switch first can result in a large volume of mirrored, IPv4-encapsulated traffic arriving at the destination without an exit path, which can slow switch performance.

High-level overview of the mirror configuration process

Determine the mirroring session and destination

For a local mirroring session

Determine the port number for the exit port (such as A5, B10, and so forth), then go to **Configure the monitored traffic in a mirror session**.

For a remote mirroring session

Determine the following information and then go to **Configure a mirroring destination on a remote switch** on page 385.

- The IP address of the VLAN or subnet on which the exit port exists on the destination switch.
- The port number of the remote exit port on the remote destination switch. (In a remote mirroring endpoint, the IP address of the exit port and the remote destination switch can belong to different VLANs.)
- The IP address of the VLAN or subnet on which the mirrored traffic enters or leaves the source switch.

CAUTION

Although the switch supports the use of UDP port numbers from 1 to 65535, UDP port numbers below 7933 are reserved for various IP applications. Using these port numbers for mirroring can result in an interruption of other IP functions, and in non-mirrored traffic being received on the destination (endpoint) switch and sent to the device connected to the remote exit port.

- The unique UDP port number to use for the session on the source switch. (The recommended port range is from 7933 to 65535.)

Configure a mirroring destination on a remote switch

This step is required only if you are configuring a remote mirroring session in which the exit port is on a different switch than the monitored (source) interface. If you are configuring local mirroring, go to **Configure a mirroring session on the source switch** on page 385.

For remote mirroring, you must configure the **destination** switch to recognize each mirroring session and forward mirrored traffic to an exit port before you configure the **source** switch. Configure the destination switch with the values you determined for remote mirroring in **Determine the mirroring session and destination**.

NOTE

A remote destination switch can support up to 32 remote mirroring endpoints (exit ports connected to a destination device in a remote mirroring session.)

Configure a destination switch in a remote mirroring session

Enter the `mirror endpoint ip` command on the remote switch to configure the switch as a remote endpoint for a mirroring session with a different source switch.

Configure a mirroring session on the source switch

To configure local mirroring, exit port number is all that is required.

If the exit port for a mirroring destination is on a remote switch instead of the local (source) switch, you must enter the source IP address, destination IP address, and UDP port number for the remote mirroring session. You may also wish to enable frame truncation to allow oversize frames to be truncated rather than dropped.

Frames that exceed the maximum size (MTU) are either dropped or truncated, according to the setting of the `[truncation]` parameter in the `mirror` command.

Frames that are near the MTU size may become oversize when the 54-byte remote mirroring tunnel header is added for transport between source switch and destination switch.

(The addition of the header is a frequent cause for frames becoming oversize, but note that all oversize frames, whatever the cause of their excess size, are dropped or truncated.) If a frame is truncated, bytes are removed from the end of the frame. This may cause the checksum in the original frame header to fail. Some protocol analyzers may flag such a checksum mismatch as an alert.

Note that if you enable jumbo frames to allow large frames to be transmitted, you must enable jumbo frames on all switches in the path between source and destination switches.

Configure a source switch in a remote mirroring session

Enter the `mirror remote ip` command on the source switch to configure a remote destination switch for a mirroring session on the source switch. The source IP address, UDP port number, and destination IP address that you enter must be the same values that you entered with the `mirror endpoint ip` command.

After you configure a mirroring session with traffic-selection criteria and a destination, the switch immediately starts to mirror traffic to the destination device connected to each exit port. In a remote mirroring session that uses IPv4 encapsulation, if the remote (endpoint) switch is not already configured as the destination for the session, its performance may be adversely affected by the stream of mirrored traffic. For this reason, Hewlett Packard Enterprise strongly recommends that you configure the endpoint switch in a remote mirroring session, as described in **For a remote mirroring session**, before using the `mirror remote ip` command in this section to configure the mirroring source for the same session.

Configure the monitored traffic in a mirror session

This step configures one or more interfaces on a source switch with traffic-selection criteria to select the traffic to be mirrored in a local session configured in section **Configure a mirroring session on the source switch** on page 385.

Traffic selection options

To configure traffic mirroring, specify the source interface, traffic direction, and criteria to be used to select the traffic to be mirrored by using the following options:

- Interface type
  - Port, trunk, and/or mesh
  - VLAN
  - Switch (global configuration level)
- Traffic direction and selection criteria
  - All inbound and/or outbound traffic on a port or VLAN interface
  - Only inbound IP traffic selected with an ACL (deprecated in software release K.14.01 and greater)
  - Only inbound IPv4 or IPv6 traffic selected with a classifier-based mirroring policy
  - All inbound and/or outbound traffic selected by MAC source and/or destination address

The different ways to configure traffic-selection criteria on a monitored interface are described in the following sections.

Mirroring-source restrictions

In a mirroring session, you can configure any of the following sources of mirrored traffic:

- Multiple port and trunk, and/or mesh interfaces
- One VLAN

  If you configure a VLAN as the source interface in a mirroring session and assign a second VLAN to the session, the second VLAN overwrites the first VLAN as the source of mirrored traffic.
- One classifier-based policy

  If you configure a mirroring policy on a port or VLAN interface to mirror inbound traffic in a session, you cannot configure a port, trunk, mesh, ACL, or VLAN as an additional source of mirrored traffic in the session.
- Up to 320 MAC addresses (used to select traffic according to source, destination MAC address, or both) in all mirroring sessions configured on a switch

About selecting all inbound/outbound traffic to mirror

If you have already configured session 1 with a local destination, you can enter the `vlan vid monitor` or `interface port monitor` command without additional parameters for traffic-selection criteria and session number to configure mirroring for all inbound and outbound traffic on the specified VLAN or port interfaces in session 1 with the preconfigured destination.

Untagged mirrored packets

Although a VLAN tag is added (by default) to the mirrored copy of untagged outbound packets to indicate the source VLAN of the packet, it is sometimes desirable to have mirrored packets look exactly like the original packet. The `no-tag-added` parameter gives you the option of not tagging mirrored copies of outbound packets, as shown in **Figure 92: Mirroring commands with the no-tag-added option** on page 387 and **Figure 93: Displaying a mirror session configuration with the no-tag-added option** on page 387.

Figure 92: *Mirroring commands with the `no-tag-added` option*

```
HP Switch(config)#interface 3 monitor all in mirror 1 no-tag-added

HP Switch(config)#interface mesh monitor all both mirror 1 no-tag-added
```

Figure 93: *Displaying a mirror session configuration with the `no-tag-added` option*

```
HP Switch# show monitor 1

Network Monitoring

   Session: 1   Session Name:
   ACL: no ACL relationship exists

      Mirror Destination: 48
      Untagged traffic  : untagged   <-- Indicates the no-tag-added option is configured.
      Monitoring Sources  Direction
      ------------------  ---------
      Port: 3             Both
```

About using SNMP to configure `no-tag-added`

The MIB object hpicfBridgeDontTagWithVlan is used to implement the `no-tag-added` option, as shown below:

```
hpicfBridgeDontTagWithVlan OBJECT-TYPE
   SYNTAX INTEGER
     {
     enabled(1),
     disabled(2)
    }
   MAX-ACCESS  read-write
   STATUS   current
   DESCRIPTION
    "This oid mentions whether VLAN tag is part of the
   mirror'ed copy of the packet. The value 'enabled'
   denotes that the VLAN tag shouldn't be part
   of the mirror'ed copy; 'disabled' does put
   the VLAN tag in the mirror'ed copy. Only one
   logical port is allowed.
   This object is persistent and when written
   the entity
     SHOULD save the change to non-volatile storage."
   DEFVAL { 2 }
  ::= { hpicfBridgeMirrorSessionEntry 2 }
```

Operating notes

The following conditions apply for the `no-tag-added` option:

- The specified port can be a physical port, trunk port, or mesh port.
- Only a single logical port (physical port or trunk) can be associated with a mirror session when the `no-tag-added` option is specified. No other combination of ACL mirroring, VLAN mirroring, or port mirroring can be associated with the mirror session. If more than one logical port is specified, the following error message is displayed:

  Cannot monitor more than one logical port with no-tag-added option
- If a port changes its VLAN membership and/or untagged status within the VLAN, the "untagged port mirroring" associated with that port is updated when the configuration change is processed.
- Only four ports or trunks can be monitored at one time when all four mirror sessions are in use (one logical port per mirror session) without VLAN tags being added to a mirrored copy.
- The `no-tag-added` option can also be used when mirroring is configured with SNMP.
- A VLAN tag is still added to the copies of untagged packets obtained via VLAN-based mirroring.

About selecting inbound/outbound traffic using a MAC address

Use the `monitor mac mirror` command at the global configuration level to apply a source and/or destination MAC address as the selection criteria used in a local or remote mirroring session.

While classifier-based mirroring allows you to mirror traffic using a policy to specify IP addresses as selection criteria, MAC-based mirroring allows you monitor switch traffic using a source and/or destination MAC address. You can apply MAC-based mirroring in one or more mirroring sessions on the switch to monitor:

- Inbound traffic
- Outbound traffic
- Both inbound and outbound traffic

MAC-based mirroring is useful in Switch Network Immunity security solutions that provide detection and response to malicious traffic at the network edge. After isolating a malicious MAC address, a security administrator can mirror all traffic sent to and received from the suspicious address for troubleshooting and traffic analysis.

The MAC address that you enter with the `monitor mac mirror` command is configured to select traffic for mirroring from all ports and learned VLANs on the switch. Therefore, a suspicions MAC address used in wireless applications can be continuously monitored as it re-appears in switch traffic on different ports or VLAN interfaces.

You can configure MAC-based mirroring from the CLI or an SNMP management station and use it to mirror:

- All inbound and outbound traffic from a group of hosts to one destination device.
- Inbound and/or outbound traffic from each host to a different destination device.
- Inbound and outbound traffic from all monitored hosts separately on two destination devices: mirroring all inbound traffic to one device and all outbound traffic to another device.

Restrictions

The following restrictions apply to MAC-based mirroring:

- Up to 320 different MAC addresses are supported for traffic selection in all mirroring sessions configured on the switch.
- A destination MAC address is not supported as mirroring criteria for routed traffic, because in routed packets, the destination MAC address is changed to the next-hop address when the packet is forwarded. Therefore, the destination MAC address that you want to mirror will not appear in routed packet headers.

  This restriction also applies to the destination MAC address of a host that is directly connected to a routing switch. (Normally, a host is connected to an edge switch, which is directly connected to the router.)

  To mirror routed traffic, we recommend that you use classifier-based policies to select IPv4 or IPv6 traffic for mirroring, as described in **About selecting inbound traffic using advanced classifier-based mirroring**.
- On a switch, you can use a MAC address only once as a source MAC address and only once as a destination MAC address to filter mirrored traffic.

  For example, after you enter the following commands:

  ```
  monitor mac 111111-222222 src mirror 1
  monitor mac 111111-222222 dest mirror 2
  ```

  The following commands are not supported:

  ```
  monitor mac 111111-222222 src mirror 3
  monitor mac 111111-222222 dest mirror 4
  ```

  In addition, if you enter the `monitor mac 111111-222222 both mirror 1` command, you cannot use the MAC address `111111-222222` in any other `monitor mac mirror` configuration commands on the switch.
- To re-use a MAC address that has already been configured as a source and/or destination address for traffic selection in a mirror session, you must first remove the configuration by entering the `no` form of the command and then re-enter the MAC address in a new `monitor mac mirror` command.

  For example, if you have already configured MAC address `111111-222222` to filter inbound and outbound mirrored traffic, and you decide to use it to filter only inbound traffic in a mirror session, you could enter the following commands:

  ```
  monitor mac 111111-222222 both mirror 1
  no monitor mac 111111-222222 both mirror 1
  monitor mac 111111-222222 src mirror 1
  ```
- A mirroring session in which you configure MAC-based mirroring is not supported on a port, trunk, mesh, or VLAN interface on which a mirroring session with a classifier-based mirroring policy is configured.

About selecting inbound traffic using advanced classifier-based mirroring

In addition to the traffic selection options described in **Configure the monitored traffic in a mirror session** on page 386, traffic mirroring supports the use of advanced classifier-based functions that provide:

- A finer granularity for selecting the inbound IP traffic that you want to mirror on an individual port or VLAN interface (instead of mirroring all inbound traffic on the interface)
- Support for mirroring both IPv4 and IPv6 traffic
- The ability to re-use the same traffic classes in different software-feature configurations; for example, you can apply both a QoS rate-limiting and mirroring policy on the same class of traffic.

Classifier-based mirroring policies provide greater precision when analyzing and debugging a network traffic problem. Using multiple match criteria, you can finely select and define the classes of traffic that you want to mirror on a traffic analyzer or IDS device.

Classifier-based mirroring configuration

1. Evaluate the types of traffic in your network and identify the traffic types that you want to mirror.
2. Create an IPv4 or IPv6 traffic class using the `class` command to select the packets that you want to mirror in a session on a preconfigured local or remote destination device. (See **Configuring classifier-based mirroring**).

   A traffic class consists of match criteria, which consist of match and ignore commands.

   - `match` commands define the values that header fields must contain for a packet to belong to the class and be managed by policy actions.
   - `ignore` commands define the values which, if contained in header fields, exclude a packet from the policy actions configured for the class.

   Be sure to enter match/ignore statements in the precise order in which you want their criteria to be used to check packets.

   The following match criteria are supported in match/ignore statements for inbound IPv4/IPv6 traffic:

   - IP source address (IPv4 and IPv6)
   - IP destination address (IPv4 and IPv6)
   - IP protocol (such as ICMP or SNMP)
   - Layer 3 IP precedence bits
   - Layer 3 DSCP codepoint
   - Layer 4 TCP/UDP application port (including TCP flags)
   - VLAN ID

   Enter one or more match or ignore commands from the class configuration context to filter traffic and determine the packets on which policy actions will be performed. (See **Configuring classifier-based mirroring**.)
3. Create a mirroring policy to configure the session and destination device to which specified classes of inbound traffic are sent by entering the `policy mirror` command from the global configuration context.

   Be sure to enter each class and its associated mirroring actions in the precise order in which you want packets to be checked and processed.

   To configure the mirroring actions that you want to execute on packets that match the criteria in a specified class, enter one or more class action mirror commands from the policy configuration context. (See **Configuring classifier-based mirroring**.)

   You can configure only one mirroring session (destination) for each class. However, you can configure the same mirroring session for different classes.

   A packet that matches the match criteria in a class is mirrored to the exit (local or remote) port that has been previously configured for the session, where session is a value from 1 to 4 or a text string (if you configured the session with a name when you entered the `mirror` command.)

   Prerequisite: The local or remote exit port for a session must be already configured before you enter the `mirror` *`session`* parameter in a class action statement:

- In a local mirroring session, the exit port is configured with the `mirror <session-number> port` command
- In a remote mirroring session, the remote exit port is configured with the `mirror endpoint ip` and `mirror <session-number> remote ip` commands.

Restriction: In a policy, you can configure only one mirroring session per class. However, you can configure the same session for different classes.

Mirroring is not executed on packets that match ignore criteria in a class.

The execution of mirroring actions is performed in the order in which the classes are numerically listed in the policy.

The complete no form of the `class action mirror` command or the `no <seq-number>` command removes a class and mirroring action from the policy configuration.

To manage packets that do not match the match or ignore criteria in any class in the policy, and therefore have no mirroring actions performed on them, you can enter an optional default class. The default class is placed at the end of a policy configuration and specifies the mirroring actions to perform on packets that are neither matched nor ignored.

4. (Optional) To configure a default-class in a policy, enter the `default-class` command at the end of a policy configuration and specify one or more actions to be executed on packets that are not matched and not ignored. (See **Configuring classifier-based mirroring**.)

   Prerequisite: The local or remote exit port for a session must be already configured with a destination device before you enter the `mirror <session>` parameter in a default-class action statement.
5. Apply the mirroring policy to inbound traffic on a port (`interface service-policy in` command) or VLAN (`vlan service-policy in` command) interface.

After you apply a mirroring policy for one or more preconfigured sessions on a port or VLAN interface, the switch immediately starts to use the traffic-selection criteria and exit port to mirror traffic to the destination device connected to each exit port.

In a remote mirroring session that uses IPv4 encapsulation, if the remote switch is not already configured as the destination for the session, its performance may be adversely affected by the stream of mirrored traffic.

For this reason, Hewlett Packard Enterprise strongly recommends that you first configure the exit switch in a remote mirroring session, as described in **Configure a mirroring destination on a remote switch** and **Configure a mirroring session on the source switch**, before you apply a mirroring service policy on a port or VLAN interface.

Restrictions: The following restrictions apply to a mirroring service policy:

- Only one mirroring policy is supported on a port or VLAN interface.
- If you apply a mirroring policy to a port or VLAN interface on which a mirroring policy is already configured, the new policy replaces the existing one.
- A mirroring policy is supported only on inbound traffic.

Because only one mirroring policy is supported on a port or VLAN interface, ensure that the policy you want to apply contains all the required classes and actions for your configuration.

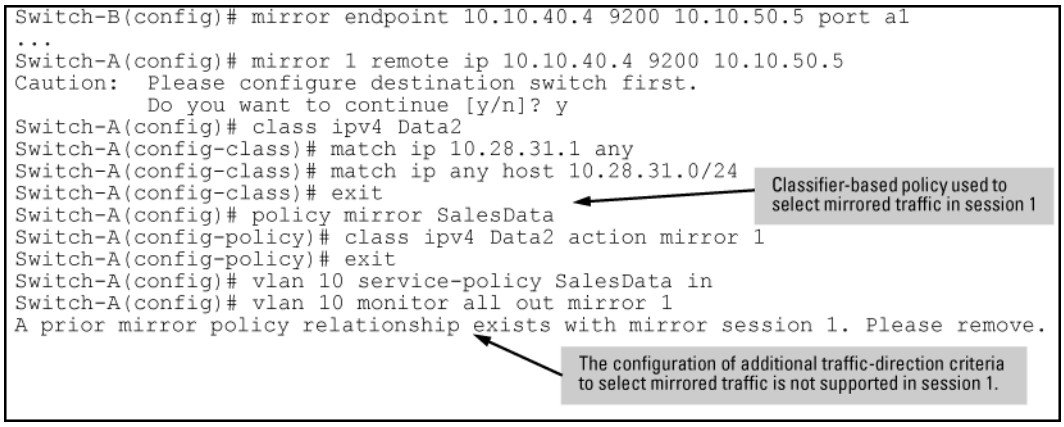
Classifier-based mirroring restrictions

The following restrictions apply to mirroring policies configured with the classifier-based model:

- A mirroring policy is supported only on **inbound** IPv4 or IPv6 traffic.
- A mirroring policy is not supported on a meshed port interface. (Classifier-based policies are supported only on a port, VLAN, or trunk interface.)
- Only one classifier-based mirroring policy is supported on a port or VLAN interface. You can, however, apply a classifier-based policy of a different type, such as QoS.

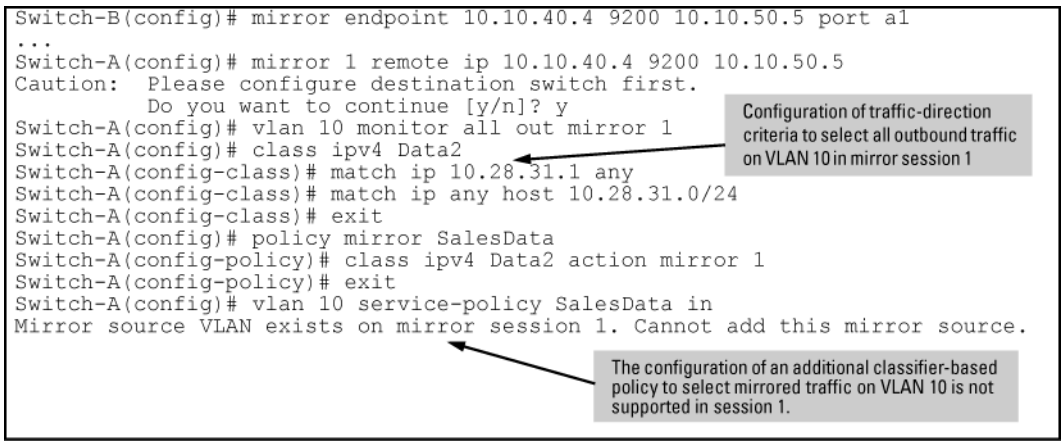
- You can enter multiple `class action mirror` statements in a policy.
  - You can configure only one mirroring session (destination) for each class.
  - You can configure the same mirroring session for different classes.
- If a mirroring session is configured with a classifier-based mirroring policy on a port or VLAN interface, no other traffic-selection criteria (MAC-based or all inbound and/or outbound traffic) can be added to the session.

Figure 94: *Mirroring configuration in which only a mirroring policy is supported*



- If a mirroring session is already configured with one or more traffic-selection criteria (MAC-based or all inbound and/or outbound traffic), the session does not support the addition of a classifier-based policy.

Figure 95: *Mirroring configuration in which only traffic-selection criteria are supported*



About applying multiple mirroring sessions to an interface

You can apply a mirroring policy to an interface that is already configured with another traffic-selection method (MAC-based or all inbound and/or outbound traffic) for a different mirroring session.

The classifier-based policy provides a finer level of granularity that allows you to zoom in on a subset of port or VLAN traffic and select it for local or remote mirroring.

In the following example, traffic on Port b1 is used as the mirroring source for two different, local mirroring sessions:

- All inbound and outbound traffic on Ports b1, b2, and b3 is mirrored in session 4.
- Only selected voice traffic on Port b1 is mirrored in session 2.

Figure 96: *Example of applying multiple sessions to the same interface*

```
HP Switch(config)# mirror 4 port a2
HP Switch(config)# interface b1-b3 monitor all both mirror 4
HP Switch(config)# mirror 2 port b4
HP Switch(config)# class ipv4 voice
HP Switch(config-class)# match ip any any ip-dscp ef
HP Switch(config-class)# exit
HP Switch(config)# policy mirror IPphones
HP Switch(config-policy)# class ipv4 voice action mirror 2
HP Switch(config-policy)# exit
HP Switch(config)# interface b1 service-policy IPphones in
```

Mirroring configuration examples

Local mirroring using traffic-direction criteria

An administrator wants to mirror the inbound traffic from workstation "X" on port A5 and workstation "Y" on port B17 to a traffic analyzer connected to port C24 (see **Figure 97: Local mirroring topology** on page 393.) In this case, the administrator chooses "1" as the session number. (Any unused session number from 1 to 4 is valid.) Because the switch provides both the source and destination for the traffic to monitor, local mirroring can be used. In this case, the command sequence is:

- Configure the local mirroring session, including the exit port.
- Configure the monitored source interfaces for the session.

Figure 97: *Local mirroring topology*

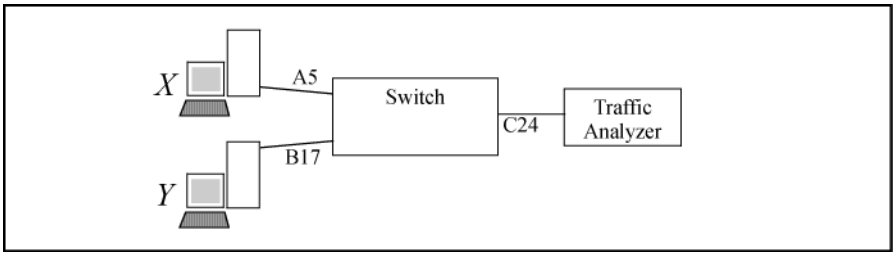
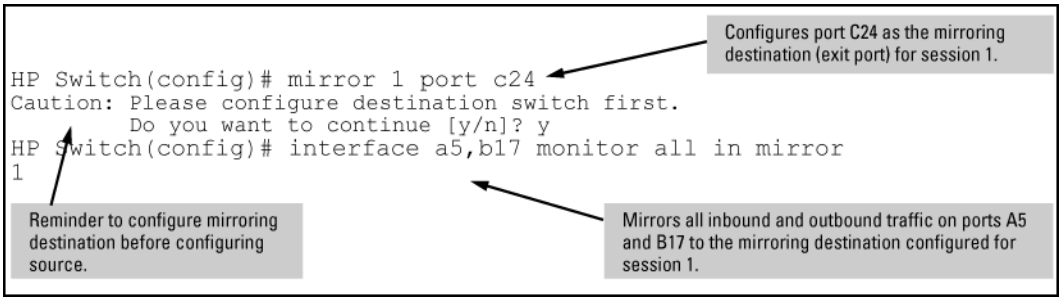


Figure 98: *Configuring a local mirroring session for all inbound and outbound port traffic*



Maximum supported frame size

The IPv4 encapsulation of mirrored traffic adds a 54-byte header to each mirrored frame. If a resulting frame exceeds the MTU allowed in the network, the frame is dropped or truncated.

NOTE

Oversized mirroring frames are dropped or truncated, according to the setting of the `[truncation]` parameter in the `mirror` command. Also, remote mirroring does not allow downstream devices in a mirroring path to fragment mirrored frames.

If jumbo frames are enabled on the mirroring source switch, the mirroring destination switch and all downstream devices connecting the source switch to the mirroring destination must be configured to support jumbo frames.

Enabling jumbo frames to increase the mirroring path MTU

On 1-Gbps and 10-Gbps ports in the mirroring path, you can reduce the number of dropped frames by enabling jumbo frames on all intermediate switches and routers. (The MTU on the switches covered by this manual is 9220 bytes for frames having an 802.1Q VLAN tag, and 9216 bytes for untagged frames.)

Table 25: *Maximum frame sizes for mirroring*

	Frame type configuration	Maximum frame size	VLAN tag	Frame mirrored to local port	Frame mirrored to remote port	
				Data	Data	IPv4 header
Untagged	Non-jumbo (default config.)	1518	0	1518	1464	54
	Jumbo[1] on all VLANs	9216	0	9216	9162	54
	Jumbo[1] On all but source VLAN	1518	0	n/a[2]	1464	54
Tagged	Non-jumbo	1522	4	1522	1468	54
	Jumbo[1] on all VLANs	9220	4	9218	9164	54
	Jumbo[1] On all but source VLAN	1522	4	n/a[2]	1468	54

[1] Jumbo frames are allowed on ports operating at or above 1 Gbps

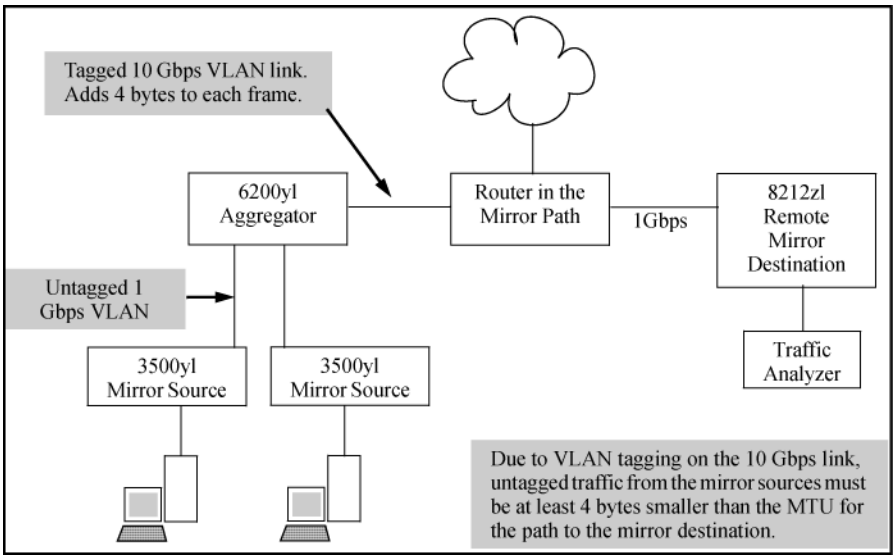
[2] For local mirroring, a non-jumbo configuration on the source VLAN dictates an MTU of 1518 bytes for untagged frames, and an MTU of 1522 for tagged frames, regardless of the jumbo configuration on any other VLANs on the switch.

Effect of downstream VLAN tagging on untagged, mirrored traffic

In a remote mirroring application, if mirrored traffic leaves the switch without 802.1Q VLAN tagging, but is forwarded through a downstream device that adds 802.1Q VLAN tags, the MTU for untagged mirrored frames leaving the source switch is reduced below the values shown in **Maximum frame sizes for mirroring**.

For example, if the MTU on the path to the destination is 1522 bytes, untagged mirrored frames leaving the source switch cannot exceed 1518 bytes. Likewise, if the MTU on the path to the destination is 9220 bytes, untagged mirrored frames leaving the source switch cannot exceed 9216 bytes.

Figure 99: *Effect of downstream VLAN tagging on the MTU for mirrored traffic*



Operating notes for traffic mirroring

- Mirroring dropped traffic

  When an interface is configured to mirror traffic to a local or remote destination, packets are mirrored regardless of whether the traffic is dropped while on the interface. For example, if an ACL is configured on a VLAN with a `deny` ACE that eliminates packets from a Telnet application, the switch still mirrors the Telnet packets that are received on the interface and subsequently dropped.
- Mirroring and spanning tree

  Mirroring is performed regardless of the STP state of a port or trunk. This means, for example, that inbound traffic on a port blocked by STP can still be monitored for STP packets during the STP setup phase.
- Tagged and untagged frames

  For a frame entering or leaving the switch on a mirrored port, the mirrored copy retains the tagged or untagged state the original frame carried when it entered into or exited from the switch. (The tagged or untagged VLAN membership of ports in the path leading to the mirroring destination does not affect the tagged or untagged status of the mirrored copy itself.)

  Thus, if a tagged frame arrives on a mirrored port, the mirrored copy is also tagged, regardless of the status of ports in the destination path. If a frame exits from the switch on a mirrored port that is a tagged member of a VLAN, the mirrored copy is also tagged for the same reason.

  To prevent a VLAN tag from being added to the mirrored copy of an outbound packet sent to a mirroring destination, you must enter the `no-tag-added` parameter when you configure a port, trunk, or mesh interface to select mirrored traffic.
- Effect of IGMP on mirroring

  If both inbound and outbound mirroring is operating when IGMP is enabled on a VLAN, two copies of mirrored IGMP frames may appear at the mirroring destination.
- Mirrored traffic not encrypted

  Mirrored traffic undergoes IPv4 encapsulation, but mirrored encapsulated traffic is not encrypted.
- IPv4 header added

The IPv4 encapsulation of mirrored traffic adds a 54-byte header to each mirrored frame. If a resulting frame exceeds the maximum MTU allowed in the network, it is dropped or truncated (according to the setting of the `[truncation]` parameter in the `mirror` command.)

To reduce the number of dropped frames, enable jumbo frames in the mirroring path, including all intermediate switches and/or routers. (The MTU on the switch is 9220 bytes, which includes 4 bytes for the 802.1Q VLAN tag.)

- Intercepted or injected traffic

  The mirroring feature does not protect against either mirrored traffic being intercepted or traffic being injected into a mirrored stream by an intermediate host.
- Inbound mirrored IPv4-encapsulated frames are not mirrored

  The switch does not mirror IPv4-encapsulated mirrored frames that it receives on an interface. This prevents duplicate mirrored frames in configurations where the port connecting the switch to the network path for a mirroring destination is also a port whose inbound or outbound traffic is being mirrored.

  For example, if traffic leaving the switch through ports B5, B6, and B7 is being mirrored through port B7 to a network analyzer, the mirrored frames from traffic on ports B5 and B6 will not be mirrored a second time as they pass through port B7.
- Switch operation as both destination and source

  A switch configured as a remote destination switch can also be configured to mirror traffic to one of its own ports (local mirroring) or to a destination on another switch (remote mirroring.)
- Monitor command note

  If session 1 is already configured with a destination, you can enter the `[no] vlan <VID>monitor` or `[no] interface <PORT> monitor` command without mirroring criteria and a mirror session number. In this case, the switch automatically configures or removes mirroring for inbound and outbound traffic from the specified VLAN or ports to the destination configured for session 1.
- Loss of connectivity suspends remote mirroring

  When a remote mirroring session is configured on a source switch, the switch sends an ARP request to the configured destination approximately every 60 seconds. If the source switch fails to receive the expected ARP response from the destination for the session, transmission of mirrored traffic in the session halts. However, because the source switch continues to send ARP requests for each configured remote session, link restoration or discovery of another path to the destination enables the source switch to resume transmitting the session's mirrored traffic after a successful ARP response cycle occurs.

  Note that if a link's connectivity is repeatedly interrupted ("link toggling"), little or no mirrored traffic may be allowed for sessions using that link. To verify the status of any mirroring session configured on the source switch, use the `show monitor` command.

Troubleshooting traffic mirroring

Cause

If mirrored traffic does not reach the configured remote destination (endpoint) switch or remote exit port, check the following configurations:

- In a remote mirroring session, the `mirror remote ip` command parameters configured on the source switch for source IP address, source UDP port, and destination IP address must be identical to the same parameters configured with the `mirror endpoint ip` command on the remote destination switch.
- The configured remote exit port must not be a member of a trunk or mesh.
- If the destination for mirrored traffic is on a different VLAN than the source, routing must be correctly configured along the path from the source to the destination.
- On the remote destination (endpoint) switch, the IP addresses of the remote exit port and the switch can belong to different VLANs.
- All links on the path from the source switch to the destination switch must be active.

CAUTION

A mirroring exit port should be connected only to a network analyzer, IDS, or other network edge device that has no connection to other network resources. Configuring a mirroring exit port connection to a network can result in serious network performance problems, and is strongly discouraged by HPE Aruba.

Interface monitoring features

You can designate monitoring of inbound and outbound traffic on:

- **Ports and static trunks:** Allows monitoring of individual ports, groups of contiguous ports, and static port trunks.
- **Static VLANs:** Allows traffic monitoring on one static VLAN.

The switch monitors network activity by copying all traffic inbound and outbound on the specified interfaces to the designated monitoring port, to which a network analyzer can be attached.

If a tagged packet arrives on a monitored port, the packet will remain tagged when it goes out a monitored port even if that port is configured as untagged. If the packet is untagged, it will remain untagged going out the monitor port. The monitor port state (tagged or untagged) does not affect the tagging of the packet. However, egress mirroring does not reflect the tagged or untagged characteristic to the mirror port, instead it reflects the tagged or untagged characteristic of the mirror port.

NOTE

When both inbound and outbound monitoring is done, and IGMP is enabled on any VLAN, you may get two copies of IGMP packets on the monitored port.

VLANs and port trunks cannot be used as a monitoring port.

The switch can monitor static LACP trunks, but not dynamic LACP trunks.

It is possible, when monitoring multiple interfaces in networks with high traffic levels, to copy more traffic to a monitor port than the link can support. In this case, some packets may not be copied to the monitor port.

Configuring port and static trunk monitoring (Menu)

This procedure describes configuring the switch for monitoring when monitoring is disabled. (If monitoring has already been enabled, the screens will appear differently than shown in this procedure.)

1. From the console Main Menu, select:

   2. Switch Configuration...

   3. Network Monitoring Port
2. In the Actions menu, press **[E]** (for Edit).
3. If monitoring is currently disabled (the default) then enable it by pressing the Space bar (or **[Y]**) to select Yes.
4. Press the down arrow key to display a screen similar to the following and move the cursor to the **Monitoring Port** parameter.
5. Use the Space bar to select the port to use for monitoring.
6. Highlight the Monitor field and use the Space bar to select the interfaces to monitor:

   Ports: Use for monitoring ports or static trunks.

   VLAN: Use for monitoring a VLAN.
7. Do one of the following:

   - If you are monitoring ports or static trunks go to step 8.
   - If you are monitoring a VLAN:

a. i. Press **[Tab]** or the down arrow key to move to the **VLAN** field.
b. Use the Space bar to select the VLAN you want to monitor.
c. Go to step 10.

8. Use the down arrow key to move the cursor to the **Action** column for the individual ports and position the cursor at a port you want to monitor.
9. Press the Space bar to select **Monitor** for each port and trunk that you want monitored. (Use the down arrow key to move from one interface to the next in the **Action** column.)
10. When you finish selecting ports to monitor, press **[Enter]**, then press **[S]** (for **Save**) to save your changes and exit from the screen.
11. Return to the Main Menu.

Configuring port and static trunk monitoring (CLI)

You must use the following configuration sequence to configure port and static trunk monitoring in the CLI:

1. Assign a monitoring (mirror) port.
2. Designate the port(s) and/or static trunk(s) to monitor.

Displaying the monitoring configuration

Syntax:

show monitor

This command lists the port assigned to receive monitored traffic and the ports and/or trunks being monitored.

For example, if you assign port 5 as the monitoring port and configure the switch to monitor ports 2-4, `show monitor` displays the following:

Monitored port listing

```
switch(config)# show monitor

 Network Monitoring Port

  Mirror Port: 5 [1]

  Monitoring sources [2]
  ------------------
  2
  3
  4
```

- [1]Port receiving monitored traffic.
- [2]Monitored Ports

Configuring the monitor port

Syntax:

[no] mirror-port [< *port-num* >]

This command assigns or removes a monitoring port, and must be executed from the global configuration level. Removing the monitor port disables port monitoring and resets the monitoring parameters to their factory-default settings.

For example, to assign port 6 as the monitoring port:

```
switch(config)# mirror-port 6
```

To turn off monitoring:

```
switch(config)# no mirror-port
```

Selecting or removing monitoring source interfaces

After you configure a monitor port you can use either the global configuration level or the interface context level to select ports, static trunks, or VLANs as monitoring sources. You can also use either level to remove monitoring sources.

Syntax:

[no] interface <*monitor-list*> monitor

<*monitor-list*>	Includes port numbers and static trunk names such as **4, 7, 5-8, trk1**.

Individual ports and static trunks can be monitored at the same time. However, if you configure the switch to monitor a VLAN, all other interfaces are removed from monitoring. Also, you can configure only one VLAN at a time for monitoring.

Elements in the monitor list can include port numbers and static trunk names at the same time.

For example, with a port such as port 5 configured as the monitoring (mirror) port, you would use either of the following commands to select these interfaces for monitoring:

- Ports 6-9, and 14
- Trunk 2

Selecting ports and static trunks as monitoring sources

```
switch(config)# int 6-9, 14 trk2, monitor
```

To monitor a VLAN:

Configuring VLAN monitoring

```
switch(config)# vlan 20 monitor
switch(config)# show monitor

 Network Monitoring Port

  Mirror Port: 5

  Monitoring sources
  ------------------
  VLAN_20
```

Disabling monitoring at the interface context and the global config level

```
switch(eth-1-3, 5)# no int 5 monitor [1]
switch(eth-1-3, 5)# no monitor
```

```
switch(config)# no int 5 monitor [2]
switch(config)# no int 1-3, 5 monitor
```

- [1]These two commands show how to disable monitoring at the interface context level for a single port or all ports in an interface context level.
- [2]These two commands show how to disable monitoring at the global config level for a single port or a group of ports.

Overview

This chapter addresses performance-related network problems that can be caused by topology, switch configuration, and the effects of other devices or their configurations on switch operation. (For switch-specific information on hardware problems indicated by LED behavior, cabling requirements, and other potential hardware-related problems, see the installation guide you received with the switch.)

HPE periodically places switch software updates on the HPE Switch Networking website. HPE recommends that you check this website for software updates that may have fixed a problem you are experiencing.

For information on support and warranty provisions, see the Support and Warranty booklet shipped with the switch.

Troubleshooting approaches

Cause

Use these approaches to diagnose switch problems:

- Check the HPE website for software updates that may have solved your problem: **http://www.hpe.com/networking**
- Check the switch LEDs for indications of proper switch operation:
  - Each switch port has a Link LED that should light whenever an active network device is connected to the port.
  - Problems with the switch hardware and software are indicated by flashing the Fault and other switch LEDs.For a description of the LED behavior and information on using the LEDs for troubleshooting, see the installation guide shipped with the switch.
- Check the network topology/installation. For topology information, see the installation guide shipped with the switch.
- Check cables for damage, correct type, and proper connections. You should also use a cable tester to check your cables for compliance to the relevant IEEE 802.3 specification. For correct cable types and connector pin-outs, see the installation guide shipped with the switch.
- Use HPE PCM+ to help isolate problems and recommend solutions.
- Use the Port Utilization Graph and Alert Log in the WebAgent included in the switch to help isolate problems. These tools are available through the WebAgent:
  - Port Utilization Graph
  - Alert log
  - Port Status and Port Counters screens
  - Diagnostic tools (Link test, Ping test, configuration file browser)
- For help in isolating problems, use the easy-to-access switch console built into the switch or Telnet to the switch console. For operating information on the Menu and CLI interfaces included in the console, see chapters 3 and 4. These tools are available through the switch console:
  - Status and Counters screens
  - Event Log
  - Diagnostics tools (Link test, Ping test, configuration file browser, and advanced user commands)

Browser or Telnet access problems

Cannot access the WebAgent

- Access may be disabled by the Web Agent Enabled parameter in the switch console. Check the setting on this parameter by selecting:

  2. Switch Configuration

  1. System Information
- The switch may not have the correct IP address, subnet mask, or gateway. Verify by connecting a console to the switch's Console port and selecting:

  2. Switch Configuration

  5. IP Configuration

  Note: If DHCP/Bootp is used to configure the switch, the IP addressing can be verified by selecting:

  1. Status and Counters...

  2. Switch Management Address Information

  Also check the DHCP/Bootp server configuration to verify correct IP addressing.
- If you are using DHCP to acquire the IP address for the switch, the IP address "lease time" may have expired so that the IP address has changed. For more information on how to "reserve" an IP address, see the documentation for the DHCP application that you are using.
- If one or more IP-authorized managers are configured, the switch allows inbound telnet access only to a device having an authorized IP address. For more information on IP Authorized managers, see the access security guide for your switch.
- Java™ applets may not be running on the web browser. They are required for the switch WebAgent to operate correctly. Refer to the online Help on your web browser for how to run the Java applets.

Cannot Telnet into the switch console from a station on the network

- Off-subnet management stations can lose Telnet access if you enable routing without first configuring a static (default) route. That is, the switch uses the IP default gateway only while operating as a Layer 2 device. While routing is enabled on the switch, the IP default gateway is not used. You can avoid this problem by using the ip route command to configure a static (default) route before enabling routing. For more information, see "IP Routing Features" in the multicast and routing guide for your switch.
- Telnet access may be disabled by the `Inbound Telnet Enabled` parameter in the System Information screen of the menu interface:

  2. Switch Configuration

  1. System Information
- The switch may not have the correct IP address, subnet mask, or gateway. Verify by connecting a console to the switch's Console port and selecting:

  2. Switch Configuration

  5. IP Configuration
- If you are using DHCP to acquire the IP address for the switch, the IP address "lease time" may have expired so that the IP address has changed. For more information on how to "reserve" an IP address, see the documentation for the DHCP application that you are using.
- If one or more IP-authorized managers are configured, the switch allows inbound telnet access only to a device having an authorized IP address. For more information on IP Authorized managers, see the access security guide for your switch.

Unusual network activity

Network activity that fails to meet accepted norms may indicate a hardware problem with one or more of the network components, possibly including the switch. Such problems can also be caused by a network loop or simply too much traffic for the network as it is currently designed and implemented. Unusual network activity is usually indicated by the LEDs on the front of the switch or measured with the switchconsole interface or with a network management tool such as HPE PCM+. For information on using LEDs to identify unusual network activity, see the installation guide you received with the switch.

A topology loop can also cause excessive network activity. The Event Log "FFI" messages can be indicative of this type of problem.

General problems

The network runs slow; processes fail; users cannot access servers or other devices

Broadcast storms may be occurring in the network. These may be caused by redundant links between nodes.

- If you are configuring a port trunk, finish configuring the ports in the trunk before connecting the related cables. Otherwise you may inadvertently create a number of redundant links (that is, topology loops) that will cause broadcast storms.
- Turn on STP to block redundant links
- Check for FFI messages in the Event Log

Duplicate IP addresses

This is indicated by this Event Log message:

`ip: Invalid ARP source: IP address on IP address`

where both instances of *IP address* are the same address, indicating that the switch's IP address has been duplicated somewhere on the network.

Duplicate IP addresses in a DHCP network

If you use a DHCP server to assign IP addresses in your network, and you find a device with a valid IP address that does not appear to communicate properly with the server or other devices, a duplicate IP address may have been issued by the server. This can occur if a client has not released a DHCP-assigned IP address after the intended expiration time and the server "leases" the address to another device. This can also happen, For example, if the server is first configured to issue IP addresses with an unlimited duration, and then is subsequently configured to issue IP addresses that will expire after a limited duration. One solution is to configure "reservations" in the DHCP server for specific IP addresses to be assigned to devices having specific MAC addresses. For more information, see the documentation for the DHCP server.

One indication of a duplicate IP address in a DHCP network is this Event Log message:

```
ip: Invalid ARP source: <IP-address>
       on <IP-address>
```

where both instances of *IP-address* are the same address, indicating that the IP address has been duplicated somewhere on the network.

The switch has been configured for DHCP/Bootp operation, but has not received a DHCP or Bootp reply

When the switch is first configured for DHCP/Bootp operation, or if it is rebooted with this configuration, it immediately begins sending request packets on the network. If the switch does not receive a reply to its DHCP/Bootp requests, it continues to periodically send request packets, but with decreasing frequency. Thus, if a DHCP

or Bootp server is not available or accessible to the switch when DHCP/Bootp is first configured, the switch may not immediately receive the desired configuration.

After verifying that the server has become accessible to the switch, reboot the switch to re-start the process.

802.1Q Prioritization problems

Ports configured for non-default prioritization (level 1 to 7) are not performing the specified action

If the ports were placed in a trunk group after being configured for non-default prioritization, the priority setting was automatically reset to zero (the default). Ports in a trunk group operate only at the default priority setting.

Addressing ACL problems

ACLs are properly configured and assigned to VLANs, but the switch is not using the ACLs to filter IP layer 3 packets

Procedure

1. The switch may be running with IP routing disabled. To ensure that IP routing is enabled, execute `show running` and look for the IP routing statement in the resulting listing. For Example:
   Indication that routing is enabled

```
switch(config)# show running
Running configuration:
; J9091A Configuration Editor; Created on release #XX.15.06
hostname " HPswitch "
ip default-gateway 10.33.248.1
ip routing [1]
logging 10.28.227.2
snmp-server community "public" Unrestricted
ip access-list extended "Controls for VLAN 20"
permit tcp 0.0.0.0 255.255.255.255 10.10.20.98 0.0.0.0 eq 80
permit tcp 0.0.0.0 255.255.255.255 10.10.20.21 0.0.0.0 eq 80
deny tcp 0.0.0.0 255.255.255.255 10.10.20.1 0.0.0.255 eq 80
deny tcp 10.10.20.1? 0.0.0.0 10.10.10.100 0.0.0.0 eq 20 log
deny tcp 10.10.20.20 0.0.0.0 10.10.10.100 0.0.0.0 eq 20 log
deny tcp 10.10.20.43 0.0.0.0 10.10.10.100 0.0.0.0 eq 20 log
permit ip 10.10.20.1 0.0.0.255 10.10.10.100 0.0.0.0
deny ip 10.10.30.1 0.0.0.255 10.10.10.100 0.0.0.0
permit ip 10.10.30.1 0.0.0.255 10.10.10.1 0.0.0.255
exit
```

   - [1]

     Indicates that routing is enabled, a requirement for ACL operation. (There is an exception. Refer to the **Note**, below.)

If an ACL assigned to a VLAN includes an ACE referencing an IP address on the switch itself as a packet source or destination, the ACE screens traffic to or from this switch address regardless of whether IP routing is enabled. This is a security measure designed to help protect the switch from unauthorized management access.

   If you need to configure IP routing, execute the `ip routing` command.
2. ACL filtering on the switches applies only to routed packets and packets having a destination IP address (DA) on the switch itself.

Also, the switch applies assigned ACLs only at the point where traffic enters or leaves the switch on a VLAN. Ensure that you have correctly applied your ACLs ("in" and/or "out") to the appropriate VLANs.

The switch does not allow management access from a device on the same VLAN

The implicit `deny any` function that the switch automatically applies as the last entry in any ACL always blocks packets having the same DA as the switch's IP address on the same VLAN. That is, bridged packets with the switch itself as the destination are blocked as a security measure.

To preempt this action, edit the ACL to include an ACE that permits access to the switch's DA on that VLAN from the management device.

Error (Invalid input) when entering an IP address

When using the "host" option in the Command syntax, ensure that you are not including a mask in either dotted decimal or CIDR format. Using the "host" option implies a specific host device and therefore does not permit any mask entry.

Correctly and incorrectly specifying a single host

```
Switch(config)# access-list 6 permit host 10.28.100.100 [1]

Switch(config)# access-list 6 permit host 10.28.100.100 255.255.255.255[2]
Invalid input: 255.255.255.255

Switch(config)# access-list 6 permit host 10.28.100.100/32 [3]
Invalid input: 10.28.100.100/32
```

- [1]Correct.
- [2]Incorrect. No mask needed to specify a single host.
- [3]Incorrect. No mask needed to specify a single host.

Apparent failure to log all "deny" matches

Where the `log` statement is included in multiple ACEs configured with a "deny" option, a large volume of "deny" matches generating logging messages in a short period of time can impact switch performance. If it appears that the switch is not consistently logging all "deny" matches, try reducing the number of logging actions by removing the `log` statement from some ACEs configured with the "deny" action.

The switch does not allow any routed access from a specific host, group of hosts, or subnet

The implicit `deny any` function that the switch automatically applies as the last entry in any ACL may be blocking all access by devices not specifically permitted by an entry in an ACL affecting those sources. If you are using the ACL to block specific hosts, a group of hosts, or a subnet, but want to allow any access not specifically permitted, insert `permit any` as the last explicit entry in the ACL.

The switch is not performing routing functions on a VLAN

Two possible causes of this problem are:

- Routing is not enabled. If `show running` indicates that routing is not enabled, use the `ip routing` command to enable routing.
- An ACL may be blocking access to the VLAN (on a switch covered in this guide). Ensure that the switch's IP address on the VLAN is not blocked by one of the ACE entries in an ACL applied to that VLAN. A common mistake is to either not explicitly permit the switch's IP address as a DA or to use a wildcard ACL mask in a `deny` statement that happens to include the switch's IP address. For an Example: of this problem, see section

"General ACL Operating Notes" in the "Access Control Lists (ACLs)" of the latest access security guide for your switch.

Routing through a gateway on the switch fails

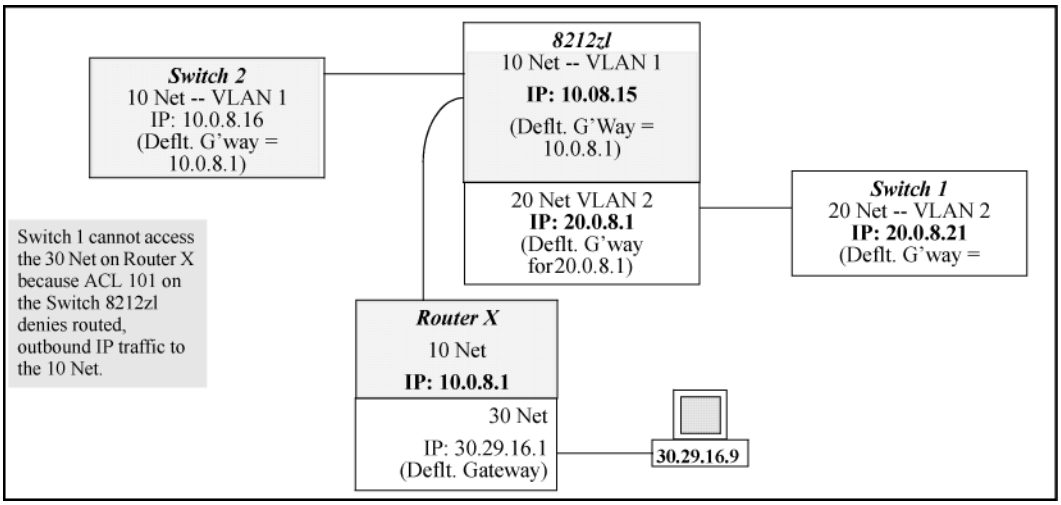
Configuring a "deny" ACE that includes a gateway address can block traffic attempting to use the gateway as a next-hop.

Remote gateway case

Configuring ACL "101" (example below) and applying it outbound on VLAN 1 in the figure below includes the router gateway (10.0.8.1) needed by devices on other networks. This can prevent the switch from sending ARP and other routing messages to the gateway router to support traffic from authorized remote networks.

In **Figure 100: Inadvertently blocking a gateway** on page 406, this ACE (see data in bold below) denies access to the 10 Net's 10.0.8.1 router gateway needed by the 20 Net (Subnet mask is 255.255.255.0).**See: example**

Figure 100: *Inadvertently blocking a gateway*



To avoid inadvertently blocking the remote gateway for authorized traffic from another network (such as the 20 Net in this Example:):

Procedure

1. Configure an ACE that specifically permits authorized traffic from the remote network.
2. Configure narrowly defined ACEs to block unwanted IP traffic that would otherwise use the gateway; such ACEs might deny traffic for a particular application, particular hosts, or an entire subnet.
3. Configure a "permit any" ACE to specifically allow any IP traffic to move through the gateway.

ACE blocking an entire subnet

```
switch(config)# access-list config

ip access-list extended "101"
  deny ip 0.0.0.0 255.255.255.255 10.0.8.30 0.0.0.255
  permit ip 0.0.0.0 255.255.255.255 0.0.0.00 255.255.255.255
  exit
```

Local gateway case

If you use the switch as a gateway for traffic you want routed between subnets, use these general steps to avoid blocking the gateway for authorized applications:

Procedure

1. Configure gateway security first for routing with specific permit and deny statements.
2. Permit authorized traffic.
3. Deny any unauthorized traffic that you have not already denied in step **1** on page 407.

IGMP-related problems

IP multicast (IGMP) traffic that is directed by IGMP does not reach IGMP hosts or a multicast router connected to a port

IGMP must be enabled on the switch and the affected port must be configured for "Auto" or "Forward" operation.

IP multicast traffic floods out all ports; IGMP does not appear to filter traffic

The IGMP feature does not operate if the switch or VLAN does not have an IP address configured manually or obtained through DHCP/Bootp. To verify whether an IP address is configured for the switch or VLAN, do one of the following:

- **Try using the WebAgent**: If you can access the WebAgent, then an IP address is configured.
- **Try to telnet to the switch console**: If you can Telnet to the switch, an IP address is configured.
- **Use the switch console interface**: From the Main Menu, check the Management Address Information screen by clicking on:

  1. Status and Counters

  2. Switch Management Address Information

LACP-related problems

Unable to enable LACP on a port with the `interface <port-number> lacp` command

In this case, the switch displays the following message:

> Operation is not allowed for a trunked port.

You cannot enable LACP on a port while it is configured as a static `Trunk` port. To enable LACP on a static-trunked port:

Procedure

1. Use the `no trunk <port-number>` command to disable the static trunk assignment.
2. Execute `interface <port-number> lacp .`

Removing a port from a trunk without first disabling the port can create a traffic loop that can slow down or halt your network. Before removing a port from a trunk, Hewlett Packard Enterprise recommends that you either disable the port or disconnect it from the LAN.

Port-based access control (802.1X)-related problems

To list the 802.1X port-access Event Log messages stored on the switch, use `show log 802`.

See also **Radius-related problems** on page 410.

The switch does not receive a response to RADIUS authentication requests

In this case, the switch attempts authentication using the secondary method configured for the type of access you are using (console, Telnet, or SSH).

There can be several reasons for not receiving a response to an authentication request. Do the following:

- Use `ping` to ensure that the switch has access to the configured RADIUS servers.
- Verify that the switch is using the correct encryption key (RADIUS secret key) for each server.
- Verify that the switch has the correct IP address for each RADIUS server.
- Ensure that the `radius-server timeout` period is long enough for network conditions.

The switch does not authenticate a client even though the RADIUS server is properly configured and providing a response to the authentication request

If the RADIUS server configuration for authenticating the client includes a VLAN assignment, ensure that the VLAN exists as a static VLAN on the switch. See "How 802.1X Authentication Affects VLAN Operation" in the access security guide for your switch.

During RADIUS-authenticated client sessions, access to a VLAN on the port used for the client sessions is lost

If the affected VLAN is configured as untagged on the port, it may be temporarily blocked on that port during an 802.1X session. This is because the switch has temporarily assigned another VLAN as untagged on the port to support the client access, as specified in the response from the RADIUS server. See "How 802.1X Authentication Affects VLAN Operation" in the access security guide for your switch.

The switch appears to be properly configured as a supplicant, but cannot gain access to the intended authenticator port on the switch to which it is connected

If `aaa authentication port-access` is configured for Local, ensure that you have entered the local **login** (operator-level) username and password of the authenticator switch into the `identity` and `secret` parameters of the supplicant configuration. If instead, you enter the enable (manager-level) username and password, access will be denied.

The supplicant statistics listing shows multiple ports with the same authenticator MAC address

The link to the authenticator may have been moved from one port to another without the supplicant statistics having been cleared from the first port. See "Note on Supplicant Statistics" in the chapter on Port-Based and User-Based Access Control in the access security guide for your switch.

The `show port-access authenticator <port-list>` command shows one or more ports remain open after they have been configured with `control unauthorized`

802.1X is not active on the switch. After you execute `aaa port-access authenticator active`, all ports configured with `control unauthorized` should be listed as `Closed`.

Authenticator ports remain "open" until activated

```
switch(config)# show port-access authenticator e 9
 Port Access Authenticator Status
  Port-access authenticator activated [No] : No
              Access Authenticator Authenticator
  Port Status Control  State Backend  State
  ---- ------ -------- -------------- --------------
  9    Open [1]   FU       Force Auth     Idle
```

```
Switch(config)# show port-access authenticator active
Switch(config)# show port-access authenticator e 9
 Port Access Authenticator Status
  Port-access authenticator activated [No] : Yes
                Access Authenticator Authenticator
  Port Status Control  State Backend  State
  ---- ------ -------- -------------- --------------
  9    Closed FU       Force Unauth   Idle
```

- [1]Port A9 shows an “Open” status even though Access Control is set to Unauthorized (Force Auth). This is because the port-access authenticator has not yet been activated.

RADIUS server fails to respond to a request for service, even though the server's IP address is correctly configured in the switch

Use `show radius` to verify that the encryption key (RADIUS secret key) the switch is using is correct for the server being contacted. If the switch has only a global key configured, it either must match the server key or you must configure a server-specific key. If the switch already has a server-specific key assigned to the server's IP address, it overrides the global key and must match the server key.

Displaying encryption keys

```
switch(config)# show radius
 Status and Counters - General RADIUS Information
  Deadtime(min) : 0
  Timeout(secs) : 5
  Retransmit Attempts : 3
  Global Encryption Key : My-Global-Key
  Dynamic Authorization UDP Port : 3799

                  Auth Acct DM/ Time
  Server IP Addr  Port Port CoA Window Encryption Key
  --------------- ---- ---- --- ------ ---------------
  10.33.18.119    1812 1813            119-only-key
```

Also, ensure that the switch port used to access the RADIUS server is not blocked by an 802.1X configuration on that port. For example, `show port-access authenticator <port-list>` gives you the status for the specified ports. Also, ensure that other factors, such as port security or any 802.1X configuration on the RADIUS server are not blocking the link.

The authorized MAC address on a port that is configured for both 802.1X and port security either changes or is re-acquired after execution of `aaa port-access authenticator <port-list> initialize`

If the port is force-authorized with `aaa port-access authenticator <port-list> control authorized` command and port security is enabled on the port, then executing `initialize` causes the port to clear the learned address and learn a new address from the first packet it receives after you execute `initialize`.

A trunked port configured for 802.1X is blocked

If you are using RADIUS authentication and the RADIUS server specifies a VLAN for the port, the switch allows authentication, but blocks the port. To eliminate this problem, either remove the port from the trunk or reconfigure the RADIUS server to avoid specifying a VLAN.

QoS-related problems

Loss of communication when using VLAN-tagged traffic

If you cannot communicate with a device in a tagged VLAN environment, ensure that the device either supports VLAN tagged traffic or is connected to a VLAN port that is configured as `Untagged`.

Radius-related problems

The switch does not receive a response to RADIUS authentication requests

In this case, the switch attempts authentication using the secondary method configured for the type of access you are using (console, Telnet, or SSH).

There can be several reasons for not receiving a response to an authentication request. Do the following:

- Use `ping` to ensure that the switch has access to the configured RADIUS server.
- Verify that the switch is using the correct encryption key for the designated server.
- Verify that the switch has the correct IP address for the RADIUS server.
- Ensure that the `radius-server timeout` period is long enough for network conditions.
- Verify that the switch is using the same UDP port number as the server.

Because of an inconsistency between the Windows XP 802.1x supplicant timeout value and the switch default timeout value, which is 5, when adding a backup RADIUS server, set the switch radius-server timeout value to 4. Otherwise, the switch may not failover properly to the backup RADIUS server.

RADIUS server fails to respond to a request for service, even though the server's IP address is correctly configured in the switch

Use `show radius` to verify that the encryption key the switch is using is correct for the server being contacted. If the switch has only a global key configured, it either must match the server key or you must configure a server-specific key. If the switch already has a server-specific key assigned to the server's IP address, it overrides the global key and must match the server key.

Global and unique encryption keys

```
Switch(config)# show radius
 Status and Counters - General RADIUS Information
  Deadtime(min) : 0
  Timeout(secs) : 5
  Retransmit Attempts : 3
  Global Encryption Key : My-Global-Key [1]
  Dynamic Authorization UDP Port : 3799

                  Auth Acct DM/ Time
  Server IP Addr  Port Port CoA Window Encryption Key
  --------------- ---- ---- --- ------ ---------------
  10.33.18.119    1812 1813           119-only-key [2]
```

- [1]

  Global RADIUS Encryption Key
- [2]

  Unique RADIUS Encryption Key for the RADIUS server at 10.33.18.119

MSTP and fast-uplink problems

If you enable MSTP, Hewlett Packard Enterprise recommends that you leave the remainder of the MSTP parameter settings at their default values until you have had an opportunity to evaluate MSTP performance in your network. Because incorrect MSTP settings can adversely affect network performance, you should avoid making changes without having a strong understanding of how MSTP operates. To learn the details of MSTP operation, see the IEEE802.1s standard.

Broadcast storms appearing in the network

This can occur when there are physical loops (redundant links) in the topology. Where this exists, you should enable MSTP on all bridging devices in the topology to detect the loop.

STP blocks a link in a VLAN even though there are no redundant links in that VLAN

In 802.1Q-compliant switches, MSTP blocks redundant physical links even if they are in separate VLANs. A solution is to use only one, multiple-VLAN (tagged) link between the devices. Also, if ports are available, you can improve the bandwidth in this situation by using a port trunk. See "Spanning Tree Operation with VLANs" in "Static Virtual LANs (VLANs)" in the advanced traffic management guide for your switch.

Fast-uplink troubleshooting

Some of the problems that can result from incorrect use of fast-uplink MSTP include temporary loops and generation of duplicate packets.

Problem sources can include:

- Fast-uplink is configured on a switch that is the MSTP root device.
- Either the `Hello Time` or the `Max Age` setting (or both) is too long on one or more switches. Return the `Hello Time` and `Max Age` settings to their default values (2 seconds and 20 seconds, respectively, on a switch).
- A "downlink" port is connected to a switch that is further away (in hop count) from the root device than the switch port on which fast-uplink MSTP is configured.
- Two edge switches are directly linked to each other with a fast-uplink (Mode = `Uplink`) connection.
- Fast uplink is configured on both ends of a link.
- A switch serving as a backup MSTP root switch has ports configured for fast-uplink MSTP and has become the root device because of a failure in the original root device.

SSH-related problems

Switch access refused to a client

Even though you have placed the client's public key in a text file and copied the file (using the `copy tftp pub-key-file` command) into the switch, the switch refuses to allow the client to have access. If the source SSH client is an SSHv2 application, the public key may be in the PEM format, which the switch (SSHv1) does not interpret. Check the SSH client application for a utility that can convert the PEM-formatted key into an ASCII-formatted key.

Executing IP SSH does not enable SSH on the switch

The switch does not have a host key. Verify by executing `show ip host-public-key`. If you see the message

```
ssh cannot be enabled until a host key is configured (use 'crypto' command).
```

you need to generate an SSH key pair for the switch. To do so, execute `crypto key generate` (see "Generating the switch's public and private key pair" in the SSH chapter of the access security guide for your switch.)

Switch does not detect a client's public key that does appear in the switch's public key file (`show ip client-public-key`)

The client's public key entry in the public key file may be preceded by another entry that does not terminate with a new line (CR). In this case, the switch interprets the next sequential key entry as simply a comment attached to the preceding key entry. Where a public key file has more than one entry, ensure that all entries terminate with a new line (CR). While this is optional for the last entry in the file, not adding a new line to the last entry creates an error potential if you either add another key to the file at a later time or change the order of the keys in the file.

An attempt to copy a client public-key file into the switch has failed and the switch lists one of the following messages

Download failed: overlength key in key file.

Download failed: too many keys in key file.

Download failed: one or more keys is not a valid RSA public key.

The public key file you are trying to download has one of the following problems:

- A key in the file is too long. The maximum key length is 1024 characters, including spaces. This could also mean that two or more keys are merged together instead of being separated by a <CR> <LF>.
- There are more than ten public keys in the key file.
- One or more keys in the file is corrupted or is not a valid rsa public key.

Client ceases to respond ("hangs") during connection phase

The switch does not support data compression in an SSH session. Clients often have compression turned on by default, but then disable it during the negotiation phase. A client that does not recognize the compression-request FAILURE response may fail when attempting to connect. Ensure that compression is turned **off** before attempting a connection to prevent this problem.

TACACS-related problems

Event Log

When troubleshooting TACACS+ operation, check the switch's Event Log for indications of problem areas.

All users are locked out of access to the switch

If the switch is functioning properly, but no username/password pairs result in console or Telnet access to the switch, the problem may be caused by how the TACACS+ server and/or the switch are configured. Use one of the following methods to recover:

- Access the TACACS+ server application and adjust or remove the configuration parameters controlling access to the switch.
- If the above method does not work, try eliminating configuration changes in the switch that have not been saved to flash (boot-up configuration) by causing the switch to reboot from the boot-up configuration (which includes only the configuration changes made prior to the last `write memory` command.) If you did not use `write memory` to save the authentication configuration to flash, pressing the `Reset` button reboots the switch with the boot-up configuration.

- Disconnect the switch from network access to any TACACS+ servers and then log in to the switch using either Telnet or direct console port access. Because the switch cannot access a TACACS+ server, it defaults to local authentication. You can then use the switch's local Operator or Manager username/password pair to log on.
- As a last resort, use the `Clear`/`Reset` button combination to reset the switch to its factory default boot-up configuration. Taking this step means you will have to reconfigure the switch to return it to operation in your network.

No communication between the switch and the TACACS+ server application

If the switch can access the server device (that is, it can `ping` the server), a configuration error may be the problem. Some possibilities include:

- The server IP address configured with the switch's `tacacs-serverhost` command may not be correct. (Use the switch's `show tacacs-server` command to list the TACACS+ server IP address.)
- The encryption key configured in the server does not match the encryption key configured in the switch (by using the `tacacs-server key` command). Verify the key in the server and compare it to the key configured in the switch. (Use `show tacacs-server` to list the global key. Use `show config` or `show config running` to list any server-specific keys.)
- The accessible TACACS+ servers are not configured to provide service to the switch.

Access is denied even though the username/password pair is correct

Some reasons for denial include the following parameters controlled by your TACACS+ server application:

- The account has expired.
- The access attempt is through a port that is not allowed for the account.
- The time quota for the account has been exhausted.
- The time credit for the account has expired.
- The access attempt is outside of the time frame allowed for the account.
- The allowed number of concurrent logins for the account has been exceeded.

For more help, see the documentation provided with your TACACS+ server application.

Unknown users allowed to login to the switch

Your TACACS+ application may be configured to allow access to unknown users by assigning them the privileges included in a *default user* profile. See the documentation provided with your TACACS+ server application.

System allows fewer login attempts than specified in the switch configuration

Your TACACS+ server application may be configured to allow fewer login attempts than you have configured in the switch with the `aaa authentication num-attempts` command.

TimeP, SNTP, or Gateway problems

The switch cannot find the time server or the configured gateway

TimeP, SNTP, and Gateway access are through the primary VLAN, which in the default configuration is the DEFAULT_VLAN. If the primary VLAN has been moved to another VLAN, it may be disabled or does not have ports assigned to it.

VLAN-related problems

Monitor port

When using the monitor port in a multiple-VLAN environment, the switch handles broadcast, multicast, and unicast traffic output from the monitor port as follows:

- If the monitor port is configured for tagged VLAN operation on the same VLAN as the traffic from monitored ports, the traffic output from the monitor port carries the same VLAN tag.
- If the monitor port is configured for untagged VLAN operation on the same VLAN as the traffic from the monitored ports, the traffic output from the monitor port is untagged.
- If the monitor port is not a member of the same VLAN as the traffic from the monitored ports, traffic from the monitored ports does not go out the monitor port.

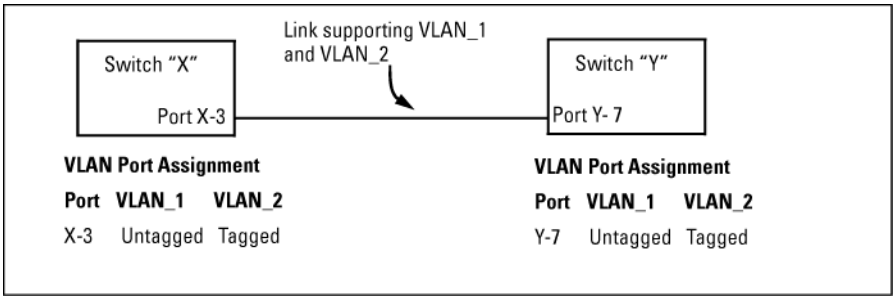
None of the devices assigned to one or more VLANs on an 802.1Q-compliant switch are being recognized

If multiple VLANs are being used on ports connecting 802.1Q-compliant devices, inconsistent VLAN IDs may have been assigned to one or more VLANs. For a given VLAN, the same VLAN ID must be used on all connected 802.1Q-compliant devices.

Link configured for multiple VLANs does not support traffic for one or more VLANs

One or more VLANs may not be properly configured as "Tagged" or "Untagged." A VLAN assigned to a port connecting two 802.1Q-compliant devices must be configured the same on both ports. For example, VLAN_1 and VLAN_2 use the same link between switch "X" and switch "Y," as shown in **Figure 101: Example: of correct VLAN port assignments on a link** on page 414.

Figure 101: *Example: of correct VLAN port assignments on a link*



- If VLAN_1 (VID=1) is configured as "Untagged" on port 3 on switch "X," it must also be configured as "Untagged" on port 7 on switch "Y." Make sure that the VLAN ID (VID) is the same on both switches.
- Similarly, if VLAN_2 (VID=2) is configured as "Tagged" on the link port on switch "A," it must also be configured as "Tagged" on the link port on switch "B." Make sure that the VLAN ID (VID) is the same on both switches.

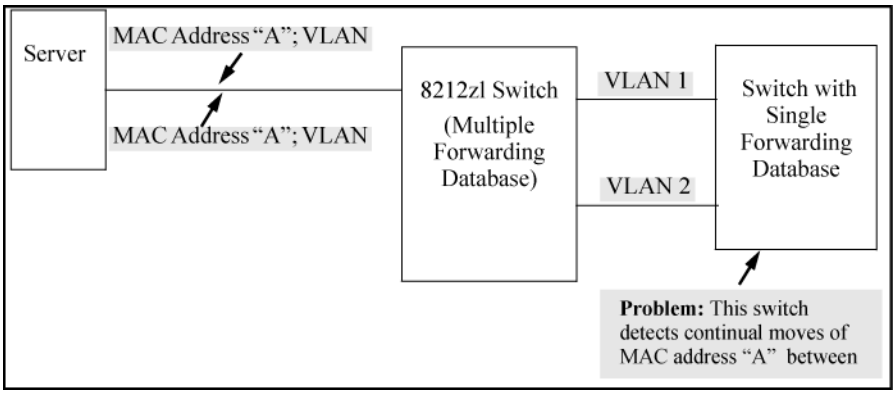
Duplicate MAC addresses across VLANs

The switches operate with multiple forwarding databases. Thus, duplicate MAC addresses occurring on different VLANs can appear where a device having one MAC address is a member of more than one 802.1Q VLAN, and the switch port to which the device is linked is using VLANs (instead of MSTP or trunking) to establish redundant links to another switch. If the other device sends traffic over multiple VLANs, its MAC address consistently appears in multiple VLANs on the switch port to which it is linked.

Be aware that attempting to create redundant paths through the use of VLANs causes problems with some switches. One symptom is that a duplicate MAC address appears in the Port Address Table of one port and then later appears on another port. While the switches have multiple forwarding databases and thus do not have this problem, some switches with a single forwarding database for all VLANs may produce the impression that a connected device is moving among ports because packets with the same MAC address but different VLANs are

received on different ports. You can avoid this problem by creating redundant paths using port trunks or spanning tree.

Figure 102: *Example: of duplicate MAC address*



Disabled overlapping subnet configuration

Previous software versions allowed configuration of VLAN IP addresses in overlapping subnets which can cause incorrect routing of packets and result in IP communication failure. As of software version WB.15.09, overlapping subnet configurations are no longer allowed. An overlapping subnet is determined by the configuration order. The subnet that is configured first is valid, but any subsequent IP addresses that overlap are not allowed.

When the switch is booted into software version WB.15.09 or later, and the configuration file includes overlapping subnets, the following occurs:

- The event log provides an error message in the format:

  ip: VLANx : IP initialization failed for vlan x.

  For a multinetted VLAN (multiple IP addresses assigned to the VLAN), only the IP addresses that are overlapping subnets are removed. The other IP addresses on the VLAN are retained and function correctly. The error message can be somewhat misleading; the IP addresses on the VLAN that are not overlapping are initialized correctly.
- The output of the `show ip` command correctly indicates that the overlapping IP address does not exist on the VLANs that have error messages in the event log.
- The output of the `show running-config` command incorrectly indicates that the overlapping IP address is configured. In **Figure 103: An IP address that is not actually configured on the VLAN** on page 415, the IP address shown in VLAN6 is not actually configured on the VLAN; it has been removed.

  Figure 103: *An IP address that is not actually configured on the VLAN*

```
switch(config)# show running-config

.
.
.
 vlan 5
   name "VLAN5"
   ip address 11.22.33.1 255.0.0.0
   exit
 vlan 6
   name "VLAN6"
   ip address 11.23.34.1 255.255.255.0
   exit
```

The information is retained in the config file to allow you to boot up the switch and have it function as it did when it was configured with earlier software that allows overlapping subnets.If you attempt to remove the overlapping subnet from the VLAN, the switch displays an error message similar to:

The IP address <*ip-address*> is not configured on this VLAN

This occurs because the overlapping IP address has been removed and is not visible to the switch. To resolve this:

- Enter the `show ip` command to determine which addresses are visible to the switch.
- Remove the erroneous IP addresses from the config file by entering the `no ip address` command to remove all the IP addresses from the specific VLAN. Be sure to document the other valid IP addresses on that VLAN so they can be restored after removing the erroneous IP addresses from the config file.

If you go back to a software version prior to WB.15.09 before removing the overlapping IP address, the prior software version enables the overlapping IP subnet.

Fan failure

Whenever a fan failure occurs, the Fan/Fault LEDs blink amber and a log entry is recorded. During a fan failure, all operational fans are automatically set to the maximum operating speed until the fan failure has been resolved. At that time, the fan speed is reset to the minimum operating speed.

Mitigating flapping transceivers

In traditional HPE switches, the state of a link is driven directly by the reported state of the port, which is required for rapid detection of link faults. However, the consequence of this is that a marginal transceiver, optical, or wire cabling, one that "flaps" up and down several times per second, can cause STP and other protocols to react poorly, resulting in a network outage. The link-flap option expands the functionality of the existing fault finder function to include a "link-flap" event and a new action of "warn-and-disable." Together, these additions allow the errant condition to be detected, and the port in question can be optionally disabled.

Syntax:

fault-finder <link-flap> sensitivity {<low | medium | high} > action {<warn | warn-and-disable>}

Default settings: Sensitivity = Medium; Action = Warn

Sensitivity thresholds are static. In a 10-second window, if more than the threshold number of link state transitions (up or down) are detected, the event is triggered. The 10-second window is statically determined, that is, the counters are reset every 10 seconds, as opposed to being a sliding window. The counters are polled twice per second (every 500 milliseconds), and the event is triggered if the sensitivity threshold is crossed at that time.

The sensitivity thresholds are:

High	3 transitions in 10 seconds
Medium	6 transitions in 10 seconds
Low	10 transitions in 10 seconds

Configuring the link-flap event and corresponding action applies to all ports and port types (it is a global setting per FFI event type). Note that normal link transition protocols may prevent link state changes from occurring fast enough to trigger the event for some port types, configurations, and sensitivity settings.

When the link-flap threshold is met for a port configured for `warn` (For example, `fault-finder link-flap sensitivity medium action warn`), the following message is seen in the switch event log.

02672 FFI: port <number>-Excessive link state transitions

When the link-flap threshold is met for a port configured for warn-and-disable (For example, `fault-finder linkflap sensitivity medium action warn-and-disable`), the following messages are seen in the switch event log.

02672 FFI: port <number>-Excessive link state transitions

02673 FFI: port <number>-Port disabled by Fault-finder.

02674 FFI: port <number>-Administrator action required to re-enable.

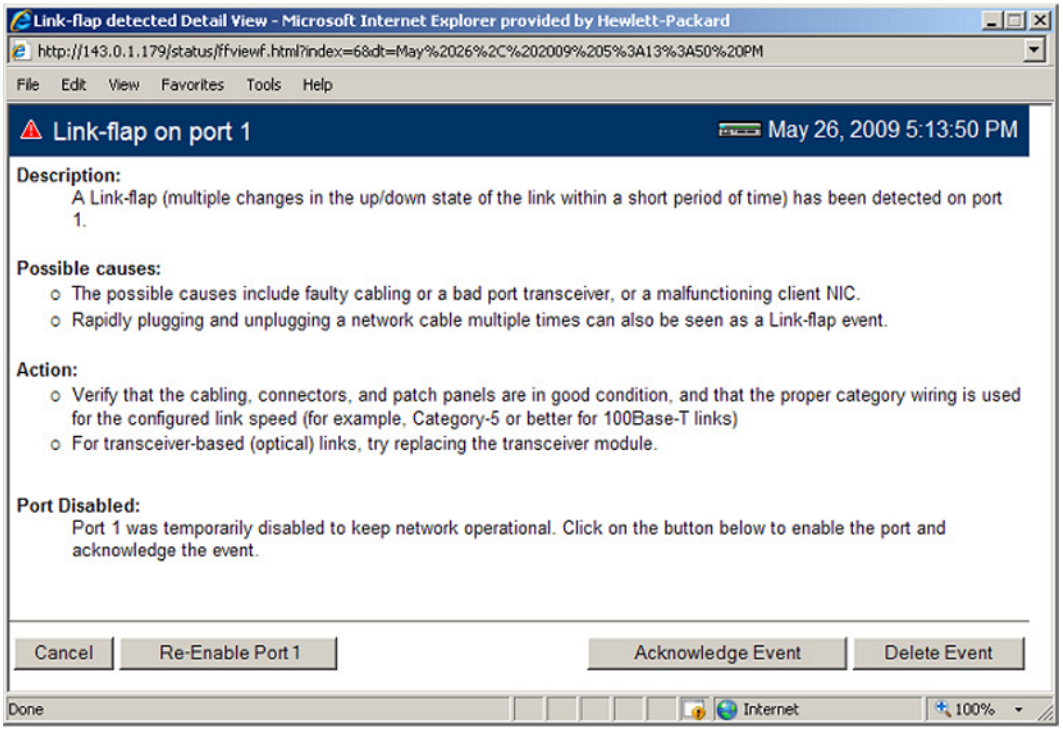
The warn-and-disable action is available for all fault-finder events on an individual basis. It may be used, For example, to disable a port when excessive broadcasts are received. Because the fault-generated disabling of a port requires operator intervention to re-enable the port, such configuration should be used with care. For example, link-flap-initiated disablement is not desired on ports that are at the client edge of the network, because link state changes there are frequent and expected.

Hewlett Packard Enterprise does not recommend automatic disabling of a port at the core or distribution layers when excessive broadcasts are detected, because of the potential to disable large parts of the network that may be uninvolved and for the opportunity to create a denial-of-service attack.

Within the Web Management interface, double-clicking an event on a port that was configured with warn-and-disable and that has met the threshold to trigger the disable action brings up a dialog box with the event details, as shown in **Figure 104: Link-flap on port 1 event detail dialog box** on page 418. The event dialog box now contains a button at the bottom of the page, which can be used to re-enable the disabled port. The button remains, even if the port has already been brought up through a prior exercise of it, or if the port was re-enabled

via some other interface (For example, the command line). Re-enabling an already enabled port has no effect. The button to acknowledge the event remains unchanged.

Figure 104: *Link-flap on port 1 event detail dialog box*



Fault finder thresholds

HPE switches feature automatic fault detection, which helps protect against network loops and defective equipment. The fault detection sensitivity setting determines the types of alerts reported to the Alert Log based on their level of severity or sensitivity. The sensitivity levels are:

- **High Sensitivity.**

  This policy directs the switch to send all alerts to the Alert Log. This setting is most effective on networks that have none or few problems.
- **Medium Sensitivity.** This policy directs the switch to send alerts related to network problems to the Alert Log. If you want to be notified of problems which cause a noticeable slowdown on the network, use this setting.
- **Low Sensitivity.** This policy directs the switch to send only the most severe alerts to the Alert Log. This policy is most effective on a network where there are normally a lot of problems and you want to be informed of only the most severe ones
- **Disabled.** Disables the Alert Log and transmission of alerts (traps) to the management server (in cases where a network management tool such as ProCurve Manager is in use). Use this option when you don't want to use the Alert Log.

Enabling fault finder using the CLI

Enter this CLI command to enable fault detection:

Syntax:

[no] fault-finder [fault][sensitivity <low|medium|high>][action <warn|warn-and-disable>]

Enables or disables Fault Finder and sets sensitivity.

When the `warn-and-disable` action option is configured, Fault Finder may also shut down a bad port in addition to sending an alert to the Alert Log.

Default setting: `fault-finder sensitivity medium action warn`

`[fault]`: Supported values are:

- `all`: All fault types
- `bad-driver`: Too many undersized/giant packets
- `bad-transceiver`: Excessive jabbering
- `bad-cable`: Excessive CRC/alignment errors
- `too-long-cable`: Excessive late collisions
- `over-bandwidth`: High collision or drop rate
- `broadcast-storm`: Excessive broadcasts
- `duplex-mismatch-HDx`: Duplex mismatch. Reconfigure to Full Duplex
- `duplex-mismatch-FDx`: Duplex mismatch. Reconfigure port to Auto
- `link-flap`: Rapid detection of link faults and recoveries
- `loss-of-link`: Link loss detected. (Sensitivity not applicable)

Examples:

To set Fault Finder with a `high` sensitivity to issue a warning and then disable a port on which there is a high collision or drop rate, you could configure these options:

```
switch(config)# fault-finder over-bandwidth sensitivity
high action warn-and-disable
```

To set Fault Finder with a `medium` sensitivity to issue a warning about excessive CRC or alignment errors on a port, you could configure these options:

```
switch(config)# fault-finder bad-cable sensitivity
medium action warn
```

To set Fault Finder with a `low` sensitivity to issue a warning about rapid detection of link faults, you could configure these options:

```
switch(config)# fault-finder link-flap sensitivity
low action warn
```

To disable Fault Finder, enter this command:

```
switch(config)# no fault-finder all
```

Table 26: *Fault finder sensitivities for supported conditions*

Condition triggering fault finder	Sensitivities			Units (in packets)	Time period	Fault finder reacts:
	High	Medium	Low			
Bad driver — Too many under-sized packets or too many giant packets	6	21	36	1/10,000 Incoming	20 secs	If (undersized/ total) >= (sensitivity/ 10,000)OrIf (giant/total) >= (sensitivity/ 10,000)
Bad transceiver — Excessive jabbering - Jabbers: (Jabbers are packets longer than the MTU) - Fragments: (packets shorter than they should be)	65	2110	3614	1/10,000 IncomingOne Fragments	20 secs20 secs	If (jabbers/ total) >= (sensitivity/ 10,000)Or If fragment count in the last 20 seconds >= sensitivity
Bad cable — Excessive CRC/ alignment errors	6	21	36	1/10,000 Incoming	20 secs	If (CRC and alignment errors/ total) >= (sensitivity/ 10,000)
Too Long Cable — Excessive late collisions (a late collision error occurs after the first 512 bit times)	6	21	36	1/10,000 Outgoing	20 secs	If (late collisions/ total) >= (sensitivity/ 10,000)

Table Continued

Condition triggering fault finder	Sensitivities			Units (in packets)	Time period	Fault finder reacts:
Over bandwidth - High collision rate -High drop rate	665	21257	36449	1/10,000 OutgoingOne Packet	5 mins5 mins	If (excessive collisions/ total) >= (sensitivity/ 10,000)The count of dropped packets >= sensitivity during the last 5 minutes.
Broadcast storm — Excessive broadcasts	2750	9200	15600	One Broadcast Packet	1 sec	If the average per second of broadcast packets in the last 20 seconds >= sensitivity
Duplex mismatch HDx	6	21	36	1/10,000 Outgoing	20 sec	If (late collisions/ total) >= (sensitivity/ 10,000)
Duplex mismatch FDx	6	21	36	1/10,000 Incoming	20 sec	If (CRC and alignment errors/ total) >= (sensitivity/ 10,000)
Link flap — Excessive transitions between link-up and link-down states.	4	7	11	One Transitions	10 secs	If the Transition count in the last 10s >= sensitivity.

Example: of sensitivity calculation:

If a sensitivity is set to High, and a bad cable is causing 15 CRC errors out of a total of 3500 packets transmitted in a 20 second period:

1. CRC errors/total must be >= (sensitivity/10,000) to trigger an alert.
2. CRC errors/total = 15/3500 = .00043
3. Sensitivity/10,000 = 6/10,000 = .0006
4. .00043 is not greater than or equal to .0006, so an alert is not triggered.

Viewing transceiver information

This features provides the ability to view diagnostic monitoring information for transceivers with Diagnostic Optical Monitoring (DOM) support. The following table indicates the support level for specific transceivers:

Product #	Description	Support[1]
J8436A	10GbE X2–SC SR Optic	V
J8437A	10GbE X2–SC LR Optic	V
J8440B	10GbE X2-CX4 Xcver	NA
J8440C	10GbE X2-CX4 Xcver	NA
J4858A	Gigabit-SX-LC Mini-GBIC	V
J4858B	Gigabit-SX-LC Mini-GBIC	V
J4858C	Gigabit-SX-LC Mini-GBIC	V (some)
J9054B	100-FX SFP-LC Transceiver	N
J8177C	Gigabit 1000Base-T Mini-GBIC	NA
J9150A	10GbE SFP+ SR Transceiver	D
J9151A	10GbE SFP+ LR Transceiver	D
J9152A	10GbE SFP+ LRM Transceiver	D
J9153A	10GbE SFP+ ER Transceiver	D
J9144A	10GbE X2-SC LRM Transceiver	D
J8438A	10Gbe X2-SC ER Transceiver	D

[1] Support indicators:

- V - Validated to respond to DOM requests
- N - No support of DOM
- D - Documented by the component suppliers as supporting DOM
- NA - Not applicable to the transceiver (copper transceiver)

NOTE

Not all transceivers support Digital Optical Monitoring. If DOM appears in the Diagnostic Support field of the `show interfaces transceiver detail` command, or the hpicfTransceiverMIB hpicfXcvrDiagnostics MIB object, DOM is supported for that transceiver.

Viewing information about transceivers (CLI)

Syntax:

show interfaces transceiver [port-list] [detail]

Displays information about the transceivers. If a port is specified, displays information for the transceiver in that port.

[detail]	Displays detailed transceiver information.

MIB support

The hpicfTransceiver MIB is available for displaying transceiver information.

Viewing transceiver information

The transceiver information displayed depends on the `show` command executed.

The output for `show interfaces transceiver [port-list]` is shown below. You can specify multiple ports, separated by commas, and the information for each transceiver will display.

Output for a specified transceiver

```
switch(config)# show interfaces transceiver 21

Transceiver Technical information:

                     Product      Serial              Part
 Port    Type        Number       Number              Number
 ------- ----------- ------------ ------------------- ----------
 21      1000SX      J4858C       MY050VM9WB          1990-3657
```

If there is no transceiver in the port specified in the command, the output displays as shown below.

Output when no transceiver is present in specified interface

```
switch(config)# show interfaces transceiver 22

 No Transceiver found on interface 22
```

When no ports are specified, information for all transceivers found is displayed.

Output when no ports are specified

```
switch(config)# show interfaces transceiver

 Transceiver Technical information:

                      Product      Serial              Part
```

```
 Port    Type         Number       Number              Number
 ------- ------------ ------------ ------------------- ----------
 21      1000SX       J4858C       MY050VM9WB          1990-3657
 22      1000SX       J4858B       P834DIP2
```

You can specify `all` for `port-list` as shown below.

Output when "all" is specified

```
switch(config)# show interfaces transceiver all

 No Transceiver found on interface 1

 No Transceiver found on interface 2
.
.
.
 No Transceiver found on interface 24

 Transceiver Technical information:

                      Product      Serial              Part
 Port    Type         Number       Number              Number
 ------- ------------ ------------ ------------------- ----------
 21      1000SX       J4858C       MY050VM9WB          1990-3657
 22      1000SX       J4858B       P834DIP2
```

Information displayed with the detail parameter

When the `show interfaces transceiver [port-list] detail` command is executed, the following information displays.

Table 27: *General transceiver information*

Parameter	Description
Interface Index	The switch interface number
Transceiver-type	Pluggable transceiver type
Transceiver model	Pluggable transceiver model
Connector-type	Type of connector of the transceiver
Wavelength	For an optical transceiver: the central wavelength of the laser sent, in nm. If the transceiver supports multiple wavelengths, the values will be separated by a comma.
Transfer Distance	Link-length supported by the transceiver in meters. The corresponding transfer medium is shown in brackets following the transfer distance value, For example, 50um multimode fiber. If the transceiver supports multiple transfer media, the values are separated by a comma.

Table Continued

Parameter	Description
Diagnostic Support	Shows whether the transceiver supports diagnostics: **None** Supported **DOM** Supported **VCT** Supported
Serial Number	Serial number of the transceiver

The information in the next three tables is only displayed when the transceiver supports DOM.

Table 28: *DOM information*

Parameter	Description
Temperature	Transceiver temperature (in degrees Centigrade)
Voltage	Supply voltage in transceiver (Volts)
Bias	Laser bias current (mA)
RX power	Rx power (mW and dBm))
TX power	Tx power (mW and dBm)

The alarm information for GBIC/SFP transceivers is shown in this table.

Table 29: *Alarm and error information (GBIC/SFP transceivers only)*

Alarm	Description
RX loss of signal	Incoming (RX) signal is lost
RX power high	Incoming (RX) power level is high
RX power low	Incoming (RX) power level is low
TX fault	Transmit (TX) fault
TX bias high	TX bias current is high
TX bias low	TX bias current is low
TX power high	TX power is high
TX power low	TX power is low
Temp high	Temperature is high

Table Continued

Alarm	Description
Temp low	Temperature is low
Voltage High	Voltage is high
Voltage Low	Voltage is low

The alarm information for XENPAK transceivers is shown in this table.

Table 30: *Alarm and error information (XENPAK transceivers)*

Alarm	Description
WIS local fault	WAN Interface Sublayer local fault
Receive optical power fault	Receive optical power fault
PMA/PMD receiver local fault	Physical Medium Attachment/Physical Medium Dependent receiver local fault
PCS receiver local fault	Physical Coding Sublayer receiver local fault
PHY XS receive local fault	PHY Extended Sublayer receive local fault
RX power high	RX power is high
RX power low	RX power is low
Laser bias current fault	Laser bias current fault
Laser temperature fault	Laser temperature fault
Laser output power fault	Laser output power fault
TX fault	TX fault
PMA/PMD transmitter local fault	PMA/PMD transmitter local fault
PCS Transmit local fault	PCS transmit local fault
PHY XS transmit local fault	PHY SX transmit local fault
TX bias high	TX bias current is high
TX bias low	TX bias current is low
TX power high	TX power is high
TX power low	TX power is low

Table Continued

Alarm	Description
Temp high	Temperature is high
Temp low	Temperature is low

An Example: of the output for the show interfaces transceiver [port-list] detail for a 1000SX transceiver is shown below.

Detailed information for a 1000SX Mini-GBIC transceiver

```
switch(config)# show interfaces transceiver 21 detail

 Transceiver in 21
  Interface index    : 21
  Type               : 1000SX
  Model              : J4858C
  Connector type     : LC
  Wavelength         : 850nm
  Transfer distance  : 300m (50um), 150m (62.5um),
  Diagnostic support : DOM
  Serial number      : MY050VM9WB

 Status
  Temperature : 50.111C
  Voltage     : 3.1234V
  TX Bias     : 6mA
  TX Power    : 0.2650mW, -5.768dBm
  RX Power    : 0.3892mW, -4.098dBm

 Time stamp   :  Mon Mar 7 14:22:13 2011
```

An Example: of the output for a 10GbE-LR transceiver is shown below.

Detailed information for a 10GbE-LR transceiver

```
switch(config)# show interfaces transceiver 23 detail

 Transceiver in 23
  Interface Index   : 24
  Type              : 10GbE-LR
  Model             : J8437A
  Connector type    : SC
  Wavelength        : Channel #0: 1310nm, #1:0nm, #2:0nm, #3:0nm
  Transfer distance : 10000m (SM)
  Diagnostic support: DOM
  Serial number     : ED456SS987

 Status
  Temperature : 32.754C
  TX Bias     : 42.700mA
  TX Power    : 0.5192mW, -2.847dBm
  RX Power    : 0.0040mW, -23.979dBm

 Recent Alarms:

  Rx power low alarm
  Rx power low warning

 Recent errors:
```

```
 Receive optical power fault
 PMA/PMD receiver local fault
 PMA/PMD transmitter local fault
 PCS receive local fault
 PHY XS transmit local fault

Time stamp : Mon Mar 7 16:26:06 2013
```

Viewing transceiver information for copper transceivers with VCT support

This feature provides the ability to view diagnostic monitoring information for copper transceivers with Virtual Cable Test (VCT) support. The cable quality of the copper cables connected between transceivers can be ascertained using the transceiver cable diagnostics. Results of the diagnostics are displayed with the appropriate CLI show commands and with SNMP using the hpicfTransceiver MIB.

The J8177C 1000Base-T Mini-GBIC is supported.

Testing the Cable

Enter the `test cable-diagnostics` command in any context to begin cable diagnostics for the transceiver. The diagnostic attempts to identify cable faults. The tests may take a few seconds to complete for each interface. There is the potential of link loss during the diagnostic.

Syntax:

test cable-diagnostics [port-list]

Invokes cable diagnostics and displays the results.

Output from test cable-diagnostics command

```
HP Switch # test cable-diagnostics a23-a24

 The 'test cable-diagnostics' command will cause a loss of link and will take a
few seconds per
 interface to complete.

 Continue (Y/N)? y


MDI  Cable     Distance  Pair  Pair      MDI
 Port  Pair  Status     to Fault  Skew  Polarity  Mode
 ----- ----- ---------- --------- ----- --------- ------
 A23   1-2   OK         0 m       6 ns  Normal    MDIX
       3-6   OK         0 m       0 ns  Normal
       4-5   OK         0 m       6 ns  Normal    MDIX
       7-8   OK         0 m       6 ns  Normal
 A24   1-2   Short      2 m
       3-6   Impedance  3 m
       4-5   Impedance  3 m
       7-8   Open       1 m
```

Copper cable diagnostic test results

```
switch# show interfaces transceiver a23 detail

 Transceiver in A23
  Interface Index   : 23
  Type              : 1000T-sfp
  Model             : J8177C
```

```
 Connector Type    : RJ45
 Wavelength        : n/a
 Transfer Distance : 100m (copper),
 Diagnostic Support : VCT
 Serial Number     : US051HF099

 Link Status       : Up
 Speed             : 1000
 Duplex            : Full

      MDI   Cable      Distance  Pair  Pair      MDI
Port  Pair  Status     to Fault  Skew  Polarity  Mode
----- ----- ---------- --------- ----- --------- -----
A23   1-2   OK         0 m       6 ns  Normal    MDIX
      3-6   OK         0 m       0 ns  Normal
      4-5   OK         0 m       6 ns  Normal    MDIX
      7-8   OK         0 m       6 ns  Normal

  Test Last Run   : Fri Apr 22 20:33:23 2011
```

General transceiver information

Parameter	Description
Interface Index	The switch interface number
Transceiver-type	Pluggable transceiver type
Transceiver model	Pluggable transceiver model
Connector-type	Type of connector of the transceiver
Wavelength	For an optical transceiver: the central wavelength of the laser sent, in nm. If the transceiver supports multiple wavelengths, the values will be separated by a comma. An electrical transceiver value is displayed as N/A.
Transfer Distance	Link-length supported by the transceiver in meters. The corresponding transfer medium is shown in brackets following the transfer distance value, For example, 50um multimode fiber. If the transceiver supports multiple transfer media, the values are separated by a comma.
Diagnostic Support	Shows whether the transceiver supports diagnostics: **None** Supported **DOM** Supported **VCT** Supported
Serial Number	Serial number of the transceiver
Link Status	Link up or down
Speed	Speed of transceiver in Mbps
Duplex	Type of duplexing

Table Continued

Parameter	Description
Cable Status	Values are OK, Open, Short, or Impedance
Distance to Fault	The distance in meters to a cable fault (accuracy is +/- 2 meters); displays 0 (zero) if there is no fault
Pair Skew	Difference in propagation between the fastest and slowest wire pairs
Pair Polarity	Signals on a wire pair are polarized, with one wire carrying the positive signal and one carrying the negative signal.
MDI Mode	The MDI crossover status of the two wire pairs (1&2, 3&6, 4&5, 7&8), will be either MDI or MDIX

Using the Event Log for troubleshooting switch problems

The Event Log records operating events in single- or double-line entries and serves as a tool to isolate and troubleshoot problems.

Once the log has received 2000 entries, it discards the oldest message each time a new message is received. The Event Log window contains 14 log entry lines. You can scroll through it to view any part of the log.

Once the log has received 2000 entries, it discards the oldest message each time a new message is received. The Event Log window contains 14 log-entry lines. You can scroll through it to view any part of the log.

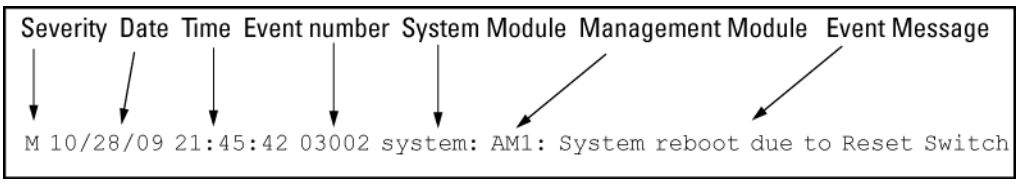
The Event Log is **erased** if power to the switch is interruptedor if you enter the `boot system` command. The contents of the Event Log are **not** erased if you:

- Reboot the switch by choosing the **Reboot Switch** option from the menu interface.
- Enter the `reload` command from the CLI.

Event Log entries

As shown in **Figure 105: Format of an event log entry** on page 430, each Event Log entry is composed of six or seven fields, depending on whether numbering is turned on or not:

Figure 105: *Format of an event log entry*



Item	Description
Severity	One of the following codes (from highest to lowest severity): **M**—(major) indicates that a fatal switch error has occurred. **E**—(error) indicates that an error condition occurred on the switch. **W**—(warning) indicates that a switch service has behaved unexpectedly.**I**—(information) provides information on normal switch operation. **D**—(debug) is reserved for HPE internal diagnostic information.
Date	The date in the format **mm/dd/yy** when an entry is recorded in the log.
Time	The time in the format **hh:mm:ss** when an entry is recorded in the log.
Event number	The number assigned to an event. You can turn event numbering on and off with the `[no] log-number` command.
System module	The internal module (such as "ports:" for port manager) that generated a log entry. If VLANs are configured, a VLAN name also appears for an event that is specific to an individual VLAN.
Event message	A brief description of the operating event.

Table 31: *Event Log system modules*

System module	Description	Documented in HPE Switch hardware/software guide
802.1x	802.1X authentication: Provides access control on a per-client or per-port basis: • Client-level security that allows LAN access to 802.1X clients (up to 32 per port) with valid user credentials • Port-level security that allows LAN access only on ports on which a single 802.1X-capable client (supplicant) has entered valid RADIUS user credentials	*Access Security Guide*
acl	ACLs: Filter layer-3 IP traffic to or from a host to block unwanted IP traffic and block or limit other protocol traffic such as TCP, UDP, IGMP, and ICMP. ACEs specify the filter criteria and an action (permit or deny) to take on a packet if it meets the criteria.	*Advanced Traffic Management Guide*

Table Continued

System module	Description	Documented in HPE Switch hardware/software guide
addrmgr	Address Table Manager: Manages MAC addresses that the switch has learned and are stored in the switch's address table.	*Management and Configuration Guide*
arp-protect	Dynamic ARP Protection: Protects the network from ARP cache poisoning. Only valid ARP requests and responses are relayed or used to update the local ARP cache. ARP packets with invalid IP-to-MAC address bindings advertised in the source protocol address and source physical address fields are discarded.	*Access Security Guide*
auth	Authorization: A connected client must receive authorization through web, AMC, RADIUS-based, TACACS+-based, or 802.1X authentication before it can send traffic to the switch.	*Access Security Guide*
cdp	Cisco Discovery Protocol: Supports reading CDP packets received from neighbor devices, enabling a switch to learn about adjacent CDP devices. HPE does not support the transmission of CDP packets to neighbor devices.	*Management and Configuration Guide*
chassis	Hardware operation, including modules and ports, power supply, fans, transceivers, CPU interrupt errors, switch temperature, and so on. Chassis messages include events on Power Over Ethernet (POE) operation.	*Installation and Getting Started Guide* *Management and Configuration Guide*

Table Continued

System module	Description	Documented in HPE Switch hardware/software guide
connfilt	Connection-rate filtering: Used on the network edge to protect the network from attack by worm-like malicious code by detecting hosts that are generating IP traffic that exhibits this behavior and (optionally) either throttling or dropping all IP traffic from the offending hosts.Connection-rate filtering messages include events on virus throttling. Virus throttling uses connection-rate filtering to stop the propagation of malicious agents.	*Access Security Guide*
console	Console interface used to monitor switch and port status, reconfigure the switch, and read the event log through an in-band Telnet or out-of-band connection.	*Installation and Getting Started Guide*
cos	Class of Service (CoS): Provides priority handling of packets traversing the switch, based on the IEEE 802.1p priority carried by each packet.CoS messages also include QoS events. The QoS feature classifies and prioritizes traffic throughout a network, establishing an end-to-end traffic priority policy to manage available bandwidth and improve throughput of important data.	*Advanced Traffic Management Guide*
dca	Dynamic Configuration Arbiter (DCA) determines the client-specific parameters that are assigned in an authentication session.	*Access Security Guide*
dhcp	Dynamic Host Configuration Protocol (DHCP) server configuration: Switch is automatically configured from a DHCP (Bootp) server, including IP address, subnet mask, default gateway, Timep Server address, and TFTP server address.	*Management and Configuration Guide*
dhcp v6c	DHCP for IPv6 prefix assignment	*IPv6 Configuration Guide*

Table Continued

System module	Description	Documented in HPE Switch hardware/software guide
dhcpr	DHCP relay: Forwards client-originated DHCP packets to a DHCP network server.	*Advanced Traffic Management Guide*
download	Download operation for copying a software version or files to the switch.	*Management and Configuration Guide*
dhcp-snoop	DHCP snooping: Protects your network from common DHCP attacks, such as address spoofing and repeated address requests.	*Access Security Guide*
dma	Direct Access Memory (DMA): Transmits and receives packets between the CPU and the switch.	—
fault	Fault Detection facility, including response policy and the sensitivity level at which a network problem should generate an alert.	*Management and Configuration Guide*
fdr-log	FDR collects information that is “interesting” at the time of the crash, as well as when the switch is misbehaving, but has not crashed. Runtime logs are written to FDR memory while the switch is running, and crashtime logs are collected and stored in the FDR buffer during a switch crash.	*Management and Configuration Guide*
ffi	Find, Fix, and Inform: Event or alert log messages indicating a possible topology loop that causes excessive network activity and results in the network running slow. FFI messages include events on transceiver connections with other network devices.	*Installation and Getting Started Guide* *Management and Configuration Guide*
garp	Generic Attribute Registration Protocol (GARP), defined in the IEEE 802.1D-1998 standard.	*Advanced Traffic Management Guide*

Table Continued

System module	Description	Documented in HPE Switch hardware/software guide
gvrp	GARP VLAN Registration Protocol (GVRP): Manages dynamic 802.1Q VLAN operations, in which the switch creates temporary VLAN membership on a port to provide a link to another port in the same VLAN on another device.	*Advanced Traffic Management Guide*
hpesp	Management module that maintains communication between switch ports.	*Installation and Getting Started Guide*
idm	Identity-driven Management: Optional management application used to monitor and control access to switch.	*Advanced Traffic Management Guide*
igmp	Internet Group Management Protocol: Reduces unnecessary bandwidth usage for multicast traffic transmitted from multimedia applications on a per-port basis.	*Multicast and Routing Guide*
inst-mon	Instrumentation Monitor: Identifies attacks on the switch by generating alerts for detected anomalies.	*Access Security Guide*
ip	IP addressing: Configures the switch with an IP address and subnet mask to communicate on the network and support remote management access; configures multiple IP addresses on a VLAN; enables IP routing on the switch.	*Management and Configuration Guide* *Multicast and Routing Guide*
ipaddrmgr	IP Address Manager: Programs IP routing information in switch hardware.	*Multicast and Routing Guide*
iplock	IP Lockdown: Prevents IP source address spoofing on a per-port and per-VLAN basis by forwarding only the IP packets in VLAN traffic that contain a known source IP address and MAC address binding for the port.	*Access Security Guide*

Table Continued

System module	Description	Documented in HPE Switch hardware/software guide
ipx	Novell Netware protocol filtering: On the basis of protocol type, the switch can forward or drop traffic to a specific set of destination ports on the switch.	*Access Security Guide*
kms	Key Management System: Configures and maintains security information (keys) for all routing protocols, including a timing mechanism for activating and deactivating an individual protocol.	*Access Security Guide*
lacp	LACP trunks: The switch can either automatically establish an 802.3ad-compliant trunk group or provide a manually configured, static LACP trunk.	*Management and Configuration Guide*
ldbal	Load balancing in LACP port trunks or 802.1s Multiple Spanning Tree protocol (MSTP) that uses VLANs in a network to improve network resource utilization and maintain a loop-free environment.Load-balancing messages also include switch meshing events. The switch meshing feature provides redundant links, improved bandwidth use, and support for different port types and speeds.	*Management and Configuration Guide* *Advanced Traffic Management Guide*
lldp	Link-Layer Discovery Protocol: Supports transmitting LLDP packets to neighbor devices and reading LLDP packets received from neighbor devices, enabling a switch to advertise itself to adjacent devices and to learn about adjacent LLDP devices.	*Management and Configuration Guide*
loop_protect	Loop protection: Detects the formation of loops when an unmanaged device on the network drops spanning tree packets and provides protection by transmitting loop protocol packets out ports on which loop protection has been enabled.	*Advanced Traffic Management Guide*

Table Continued

System module	Description	Documented in HPE Switch hardware/software guide
macauth	Web and MAC authentication: Port-based security employed on the network edge to protect private networks and the switch itself from unauthorized access using one of the following interfaces: • Web page login to authenticate users for access to the network • RADIUS server that uses a device's MAC address for authentication	*Access Security Guide*
maclock	MAC lockdown and MAC lockout • MAC lockdown prevents station movement and MAC address "hijacking" by requiring a MAC address to be used only on an assigned port on the switch. MAC Lockdown also restricts the client device to a specific VLAN. • MAC lockout blocks a specific MAC address so that the switch drops all traffic to or from the specified address.	*Access Security Guide*
mgr	HPE PCM and PCM+: Windows-based network management solutions for managing and monitoring performance of HPE switches. PCM messages also include events for configuration operations.	*Management and Configuration Guide*
mld	Multicast Listener Discovery (MLD): IPv6 protocol used by a router to discover the presence of multicast listeners. MLD can also optimize IPv6 multicast traffic flow with the snooping feature.	*Multicast and Routing Guide*
mtm	Multicast Traffic Manager (MTM): Controls and coordinates L3 multicast traffic for upper layer protocols.	*Multicast and Routing Guide*
netinet	Network Internet: Monitors the creation of a route or an Address Resolution Protocol (ARP) entry and sends a log message in case of failure.	*Advanced Traffic Management Guide*

Table Continued

System module	Description	Documented in HPE Switch hardware/software guide
pagp	Ports Aggregation Protocol (PAgP): Obsolete. Replaced by LACP (802.3ad).	—
ports	Port status and port configuration features, including mode (speed and duplex), flow control, broadcast limit, jumbo packets, and security settings. Port messages include events on POE operation and transceiver connections with other network devices.	*Installation and Getting Started Guide* *Management and Configuration Guide* *Access Security Guide*
radius	RADIUS (Remote Authentication Dial-In User Service) authentication and accounting: A network server is used to authenticate user-connection requests on the switch and collect accounting information to track network resource usage.	*Access Security Guide*
ratelim	Rate-limiting: Enables a port to limit the amount of bandwidth a user or device may utilize for inbound traffic on the switch.	*Management and Configuration Guide*
sflow	Flow sampling: sFlow is an industry standard sampling technology, defined by RFC 3176, used to continuously monitor traffic flows on all ports providing network-wide visibility into the use of the network.	*Management and Configuration Guide*
snmp	Simple Network Management Protocol: Allows you to manage the switch from a network management station, including support for security features, event reporting, flow sampling, and standard MIBs.	*Management and Configuration Guide*
sntp	Simple Network Time Protocol: Synchronizes and ensures a uniform time among interoperating devices.	*Management and Configuration Guide*

Table Continued

System module	Description	Documented in HPE Switch hardware/software guide
ssh	Secure Shell version 2 (SSHv2): Provides remote access to management functions on a switch via encrypted paths between the switch and management station clients capable of SSH operation.SSH messages also include events from the Secure File Transfer Protocol (SFTP) feature. SFTP provides a secure alternative to TFTP for transferring sensitive information, such as switch configuration files, to and from the switch in an SSH session.	*Access Security Guide*
ssl	Secure Socket Layer Version 3 (SSLv3), including Transport Layer Security (TLSv1) support: Provides remote web access to a switch via encrypted paths between the switch and management station clients capable of SSL/TLS operation.	*Access Security Guide*
stack	Stack management: Uses a single IP address and standard network cabling to manage a group (up to 16) of switches in the same IP subnet (broadcast domain), resulting in a reduced number of IP addresses and simplified management of small workgroups for scaling your network to handle increased bandwidth demand.	*Advanced Traffic Management Guide*
stp	Multiple-instance spanning tree protocol/MSTP (802.1s): Ensures that only one active path exists between any two nodes in a group of VLANs in the network. MSTP operation is designed to avoid loops and broadcast storms of duplicate messages that can bring down the network.	*Advanced Traffic Management Guide*

Table Continued

System module	Description	Documented in HPE Switch hardware/software guide
system	Switch management, including system configuration, switch bootup, activation of boot ROM image, memory buffers, traffic and security filters. System messages also include events from management interfaces (menu, CLI, and HPE PCM+) used to reconfigure the switch and monitor switch status and performance.	*Basic Operation Guide* *Access Security Guide*
tacacs	TACACS+ authentication: A central server is used to control access to the switches (and other TACACS-aware devices) in the network through a switch's console port (local access) or Telnet (remote access).	*Access Security Guide*
tcp	Transmission Control Protocol: A transport protocol that runs on IP and is used to set up connections.	*Advanced Traffic Management Guide*
telnet	Session established on the switch from a remote device through the Telnet virtual terminal protocol.	*Basic Operation Guide*
tftp	Trivial File Transfer Protocol: Supports the download of files to the switch from a TFTP network server.	*Basic Operation Guide*
timep	Time Protocol: Synchronizes and ensures a uniform time among interoperating devices.	*Management and Configuration Guide*
udld	Uni-directional Link Detection: Monitors a link between two switches and blocks the ports on both ends of the link if the link fails at any point between the two devices.	*Access Security Guide*
udpf	UDP broadcast forwarding: Supports the forwarding of client requests sent as limited IP broadcasts addressed to a UDP application port on a network server.	*Multicast and Routing Guide*

Table Continued

System module	Description	Documented in HPE Switch hardware/software guide
update	Updates (TFTP or serial) to HPE switch software and updates to running-config and start-up config files	*Basic Operation Guide*
vlan	Static 802.1Q VLAN operations, including port-and protocol-based configurations that group users by logical function instead of physical location • A port-based VLAN creates a layer-2 broadcast domain comprising member ports that bridge IPv4 traffic among themselves. • A protocol-based VLAN creates a layer-3 broadcast domain for traffic of a particular routing protocol, and comprises member ports that bridge traffic of the specified protocol type among themselves. VLAN messages include events from management interfaces (menu, CLI, and HPE PCM+) used to reconfigure the switch and monitor switch status and performance.	*Advanced Traffic Management Guide*
xmodem	Xmodem: Binary transfer feature that supports the download of software files from a PC or UNIX workstation.	*Basic Operation Guide*

Using the Menu

To display the Event Log from the Main Menu, select `Event Log`. The following example shows a sample event log display.

An event log display

```
Switch 5406zl                                    25-Oct-2013  18:02:52
=========================-CONSOLE - MANAGER MODE -
============================
M 10/25/13 16:30:02 sys: 'Operator cold reboot from CONSOLE session.'
I 10/25/13 17:42:51 00061 system: ----------------------------------------
-
I 10/25/13 17:42:51 00063 system: System went down : 10/25/13 16:30:02
I 10/25/13 17:42:51 00064 system: Operator cold reboot from CONSOLE session.
W 10/25/13 17:42:51 00374 chassis: WARNING: SSC is out of Date: Load 8.2 or
newer
I 10/25/13 17:42:51 00068 chassis: Slot D Inserted
```

```
I 10/25/13 17:42:51 00068 chassis: Slot E Inserted
I 10/25/13 17:42:51 00068 chassis: Slot F Inserted
I 10/25/13 17:42:51 00690 udpf: DHCP relay agent feature enabled
I 10/25/13 17:42:51 00433 ssh: Ssh server enabled
I 10/25/13 17:42:51 00400 stack: Stack Protocol disabled
I 10/25/13 17:42:51 00128 tftp: Enable succeeded
I 10/25/13 17:42:51 00417 cdp: CDP enabled

----  Log events stored in memory 1-751. Log events on screen 690-704.

  Actions->    Back    Next page    Prev page    End    Help

Return to previous screen.
Use up/down arrow to scroll one line, left/right arrow keys to
change action selection, and <Enter> to execute action.
```

The **log status line** below the recorded entries states the total number of events stored in the event log and which logged events are currently displayed.

To scroll to other entries in the Event Log, either preceding or following the currently visible portion, press the keys indicated at the bottom of the display (`Back`,`Nextpage`, `Prev page`, or `End`) or the keys described in the following table.

Event Log control keys

Key	Action
[N]	Advances the display by one page (next page).
[P]	Rolls back the display by one page (previous page).
[v]	Advances display by one event (down one line).
[^]	Rolls back display by one event (up one line).
[E]	Advances to the end of the log.
[H]	Displays Help for the Event Log.

Using the CLI

Syntax:

show logging [-a, -b, -r, -s, -t, -m, -e, -p, -w, -i, -d, command, filter] [< *option-str* >]

By default, the `show logging` command displays the log messages recorded since the last reboot in chronological order:

`-a`	Displays all recorded log messages, including those before the last reboot.
`-b`	Displays log events as the time since the last reboot instead of in a date/time format.
`-r`	Displays all recorded log messages, with themost recent entries listed first (reverse order).
`-s`	Displays the active management module (AM) and standby management module (SM) log events.

Table Continued

`-t`	Displays the log events with a granularity of 10 milliseconds.
`-m`	Displays only major log events.
`-e`	Displays only error event class.
`-p`	Displays only performance log events.
`-w`	Displays only warning log events.
`-i`	Displays only informational log events.
`-d`	Displays only debug log events.
`command`	Displays only command logs.
`filter`	Displays only log filter configuration and status information.
<option-str>	Displays all Event Log entries that contain the specified text. Use an *<option-str>* value with `-a` or `-r` to further filter `show logging` command output.

Example:

To display all Event Log messages that have "system" in the message text or module name, enter the following command:

```
switch# show logging -a system
```

To display all Event Log messages recorded since the last reboot that have the word "system" in the message text or module name, enter:

```
switch# show logging system
```

Clearing Event Log entries

Syntax:

clear logging [command]

Removes all entries from the event log display output.

Use the `clear logging` command to hide, but not erase, Event Log entries displayed in `show logging` command output. Only new entries generated after you enter the command will be displayed.

To redisplay all hidden entries, including Event Log entries recorded prior to the last reboot, enter the `show logging -a` command.

The `command` option removes all entries from the command log.

Turning event numbering on

Syntax:

[no] log-numbers

Turns event numbering on and off

Using log throttling to reduce duplicate Event Log and SNMP messages

A recurring event can generate a series of duplicate Event Log messages and SNMP traps in a relatively short time. As a result, the Event Log and any configured SNMP trap receivers may be flooded with excessive, exactly identical messages. To help reduce this problem, the switch uses **log throttle periods** to regulate (throttle) duplicate messages for recurring events, and maintains a counter to record how many times it detects duplicates of a particular event since the last system reboot.

When the first instance of a particular event or condition generates a message, the switch initiates a log throttle period that applies to all recurrences of that event. If the logged event recurs during the log throttle period, the switch increments the counter initiated by the first instance of the event, but does not generate a new message.

If the logged event repeats again after the log throttle period expires, the switch generates a duplicate of the first message, increments the counter, and starts a new log throttle period during which any additional instances of the event are counted, but not logged. Thus, for a particular recurring event, the switch displays only one message in the Event Log for each log throttle period in which the event reoccurs. Also, each logged instance of the event message includes counter data showing how many times the event has occurred since the last reboot. The switch manages messages to SNMP trap receivers in the same way.

Log throttle periods

The length of the log throttle period differs according to an event's severity level:

Severity level	Log throttle period
I (Information)	6000 Seconds
W (Warning)	600 Seconds
D (Debug)	60 Seconds
M (Major)	6 Seconds

Example:

Suppose that you configure VLAN 100 on the switch to support PIM operation, but do not configure an IP address. If PIM attempts to use VLAN 100, the switch generates the first instance of the following Event Log message and counter.

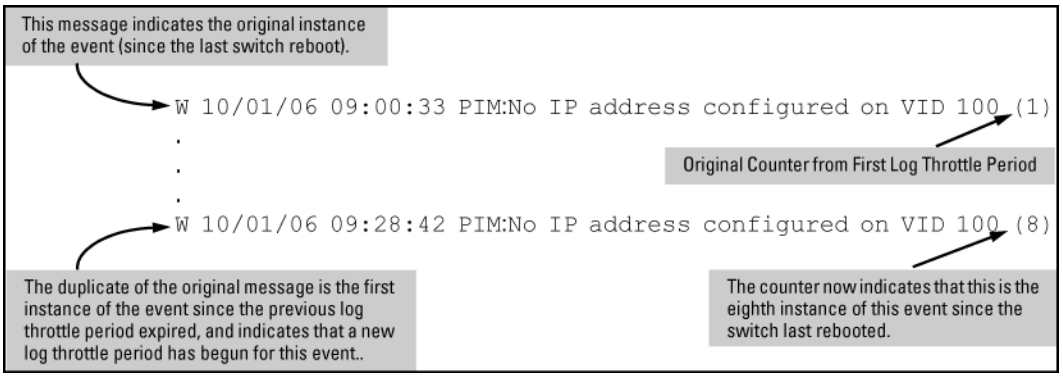
In **The first instance of an event message and counter** on page 444 the counter (1) indicates that this is the first instance of this event since the switch last rebooted.

The first instance of an event message and counter

```
W 10/01/12 09:00:33 PIM:No IP address configured on VID 100 (1)
```

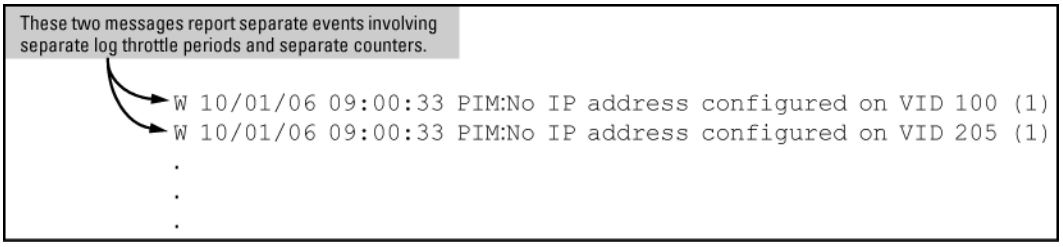
If PIM operation causes the same event to occur six more times during the initial log throttle period, there are no further entries in the Event Log. However, if the event occurs again after the log throttle period has expired, the switch repeats the message (with an updated counter) and starts a new log throttle period.

Figure 106: *Duplicate messages over multiple log throttling periods*



Note that if the same type of event occurs under different circumstances, the switch handles these as unrelated events for the purpose of Event Log messages. For example, if PIM operation simultaneously detects that VLANs 100 and 205 are configured without IP addresses, you see log messages similar to the following:

Figure 107: *Example: of log messages generated by unrelated events of the same type*



Example: of event counter operation

Suppose the switch detects the following after a reboot:

- Three duplicate instances of the PIM "Send error" during the first log throttle period for this event
- Five more instances of the same Send error during the second log throttle period for this event
- Four instances of the same Send error during the third log throttle period for this event

In this case, the duplicate message appears three times in the Event Log (once for each log throttle period for the event being described), and the duplicate message counter increments as shown in the following table. (The same operation applies for messages sent to any configured SNMP trap receivers.)

Table 32: *How the duplicate message counter increments*

Instances during 1st log throttle period	Instances during 2nd log throttle period	Instances during 3rd log throttle period	Duplicate message counter[1]
3			1
	5		4
		4	9

[1] *This value always comprises the first instance of the duplicate message in the current log throttle period plus all previous occurrences of the duplicate message occurring since the switch last rebooted.*

Reporting information about changes to the running configuration

Syslog can be used for sending notifications to a remote syslog server about changes made to the running configuration. The notifications in the syslog messages are sent in ASCII format and contain this information:

- Notice-Type: Describes the syslog notification as a “running config change”.
- Event-ID: Identifier for the running config change event that occurred on the switch.
- Config-Method: The source for the running config change.
- Device-Name: The managed device.
- User-Name: User who made the running config change.
- Remote-IP-Address: IP address of a remote host from which the user is connected.

Syntax:

[no] logging notify <*running-config-change*> [transmission-interval <0-4294967295>

Enables sending the running configuration change notifications to the syslog server.

The `no` form of the command disables sending the running configuration changes to the syslog server.

Default: Disabled

<*running-config-change* >	Mandatory option for the notify parameter. Specifies the type of notification to send.
`transmission-interval <0-4294967295>`	Specifies the time interval (in seconds) between the transmission of two consecutive notifications. Running config changes occurring within the specified interval will not generate syslog notifications.

A value of zero means there is no limit; a notification is sent for every running config change.

Default: Zero

Sending running config changes to the syslog server

```
switch(config)# logging notify running-config-change
transmission-interval 10
```

Debug/syslog operation

While the Event Log records switch-level progress, status, and warning messages on the switch, the debug/system logging (**syslog**) feature provides a way to record Event Log and debug messages on a remote device. For example, you can send messages about routing misconfigurations and other network protocol details to an external device, and later use them to debug network-level problems.

Debug/syslog messaging

The debug/syslog feature allows you to specify the types of Event Log and debug messages that you want to send to an external device. You can perform the following operations:

- Use the `debug` commandto configure messaging reports for the following event types:
  - ACL "deny" matches
  - Dynamic ARP protection events
  - DHCP snooping events
  - DIPLD events

- Events recorded in the switch's Event Log
- IP routing events (IPv4 and IPv6)
- LACP events
- LLDP events
- SNMP events
- SSH events

- Use the `logging` commandto select a subset of Event Log messages to send to an external device for debugging purposes according to:
  - Severity level
  - System module

Hostname in syslog messages

The syslog now messages the sender identified by hostname.

The hostname field identifies the switch that originally sends the syslog message. Configurable through the CLI and SNMP, the format of the hostname field supports the following formats:

- ip-address: The IP address of the sending interface will be used as the message origin identifier. This is the default format for the origin identifier. The IP address of the sending interface (in dotted decimal notation) is the default format.
- hostname: The hostname of the sending switch will be used as the message origin identifier.
- none: No origin identifier will be embedded in the syslog message. Nilvalue is used as defined by “-“.

This configuration is system-wide, not per syslog server.

There is no support in this feature for menu interface, WebUI or a fully qualified domain name. There are no changes in this feature to PCM or IDM. There are no new log events added in this feature.

Logging origin-id

Use the `logging origin-id` command to specify the content for the hostname field.

Syntax:

logging origin-id [ip-address|hostname|none]

[no] logging origin-id [ip-address|hostname|none]

To reset the hostname field content back to default (IP-address), use the `no` form of the command.

filter	Creates a filter to restrict which events are logged.
IP-ADDR	Adds an IPv4 address to the list of receiving syslog servers.
IPV6-ADDR	Adds an IPv6 address to the list of receiving syslog servers.
origin-id	Sends the Syslog messages with the specified origin-id.
notify	Notifies the specified type sent to the syslog server(s).
priority-descr	A text string associated with the values of facility, severity, and system-module.

severity	Event messages of the specified severity or higher sent to the syslog server.
system-module	Event messages of the specified system module (subsystem) sent to the syslog server.
hostname	Sets the hostname of the device as the origin-id.
none	Disables origin-id in the syslog message.

Add an IP address to the list of receiving syslog servers.

Use of `no` without an IP address specified will remove all IP addresses from the list of syslog receivers. If an IP address is specified, that receiver will be removed. Both link-local with zone ID and global IPv6 addresses are supported.

- Specify syslog server facility with the option <`facility`>. The command `no logging <facility>` sets the facility back to defaults.
- Specify filtering rules.
- Specify severity for event messages to be filtered to the syslog server with the option <`severity`>. The command `no logging <severity>` sets the severity back to default.
- Event messages of specified system module will be sent to the syslog server. Using `no` sends messages from all system modules. Messages are first filtered by selected severity.
- Specify syslog server transport layer with options `[udp]|[tcp]|[tls]`.
- Specify syslog server port number with options `[udp PORT-NUM]|[tcp PORT-NUM]|[tls PORT-NUM]`.
- Specify notification types to be sent to the syslog server.
- Use the option `transmission-interval` to control the egress rate limit for transmitting notifications, 0 value means there is no rate limit. The values are in seconds. Only one syslog message is allowed for transmission within specified time interval.
- Specify the origin information for the syslog messages with the option `origin-id`.

When the syslog server receives messages from the switch, the IPv6 address of the switch is partly displayed.

Example:

Configured Host Ipv6 Address: 2001::1

Expected Syslog message:

Syslog message: USER.INFO: Oct 11 02:40:02 2001::1 00025 ip: ST1CMDR: VLAN60: ip address 30.1.1.1/24 configured on vlan 60

Actual Truncated syslog message:

Syslog message: USER.INFO: Oct 11 02:40:02 2001:: 00025 ip: ST1CMDR: VLAN60: ip address 30.1.1.1/24 configured on vlan 60

Use the command in the following example to set the origin-id to the hostname.

Setting the origin-id to the hostname

```
switch(config)# logging origin-id hostname
```

The following syslog message will occur:

<14> Jan 1 00:15:35 HP-2910al-24G 00076 ports: port 2 is now on-line

Use the command in the following example to set the origin-id to none (nilvalue).

Setting the origin-id to none (nilvalue)

```
switch(config)# logging origin-id none
```

The following syslog message will occur:

<14> Jan 1 00:15:35 - 00076 ports: port 2 is now on-line

Use any of the commands in the following example to set the origin-id to ip-address (default).

Setting the origin-id to ip-address (default)

```
switch(config)# logging origin-id ip-address

switch(config)# no logging origin-id hostname

switch(config)# no logging origin-id none
```

The following syslog message will occur:

<14> Jan 1 00:15:35 169.254.230.236 00076 ports: port 2 is now on-line

Viewing the identification of the syslog message sender

Use the commands `show debug` or `show running-config` to display the identification of the syslog message sender. The default option for `origin-id` is `ip-address`. The command `show running-config` will not display the configured option when `origin-id` is set to the default value of `ip address`.

When `hostname` or `none` is configured using `logging origin-id`, the same displays as part of the `show running-config` command.

Syntax:

show debug

Default option is `ip-address`.

The following shows the output of the `show debug` command when configured without `loggin origin-id`.

Output of the show debug command when configured without login origin-id

```
Debug Logging
  Origin identifier: Outgoing Interface IP
  Destination:     None

Enabled debug types:
  None are enabled.
```

The command `logging origin-id hostname` will produce the syslog message shown in the following example.

Syslog message for logging origin-id hostname

```
Debug Logging
  Origin identifier: Hostname
  Destination:    None
```

```
Enabled debug types:
  None are enabled.
```

The command `logging origin-id none` will produce the syslog message shown in the following example.

Syslog message for logging origin-id none

```
Debug Logging
  Origin identifier: none
  Destination:    None

Enabled debug types:
  None are enabled.
```

Syntax:

show running-config

The following example shows the output of the `show running-config` command.

Output of the show running-config command

```
The command logging origin-id hostname will display the
following:
logging origin-id hostname
```

The command `logging origin-id none` will display as the following:

```
logging origin-id none
```

SNMP MIB

SNMP support will be provided through the following MIB objects.

HpicfSyslogOriginId = textual-convention

Description	This textual convention enumerates the origin identifier of syslog message.
Syntax: integer	ip-address hostname none
Status	current

hpicfSyslogOriginId OBJECT-TYPE

Description	Specifies the content of a Hostname field in the header of a syslog message.
Syntax:	**HpicfSyslogOriginId**

Max-access

- read-write

Status

- current

Default

- ip-address

Debug/syslog destination devices

To use debug/syslog messaging, you must configure an external device as the logging destination by using the `logging` and `debug destination` commands. For more information, see **Debug destinations** on page 461 and **Configuring a syslog server** on page 462.

A debug/syslog destination device can be a syslog server and/or a console session. You can configure debug and logging messages to be sent to:

- Up to six syslog servers
- A CLI session through a direct RS-232 console connection, or a Telnet or SSH session

Debug/syslog configuration commands

Event notification logging	—	Automatically sends switch-level event messages to the switch's Event Log. Debug and syslog do not affect this operation, but add the capability of directing Event Log messaging to an external device.
`logging` command	*<syslog-ip-addr>*	Enables syslog messaging to be sent to the specified IP address. IPv4 and IPv6 are supported.
	`facility`	(Optional) The `logging facility` command specifies the destination (facility) subsystem used on a syslog server for debug reports.
	`priority-desc`	A text string associated with the values of facility, severity, and system-module.
	`neighbor-adjacency [detail]`	Enables or disables OSPFv3 (IPv6) adjacency logging. Must be executed in OSPFv3 context. The `detail` option displays all the adjacency state transitions and adjacency-related errors.

Table Continued

	`severity`	Sends Event Log messages of equal or greater severity than the specified value to configured debug destinations. (The default setting is to send Event Log messages from all severity levels.)
	`system-module`	Sends Event Log messages from the specified system module to configured debug destinations. The severity filter is also applied to the system-module messages you select. The default setting is to send Event Log messages from all system modules. To restore the default setting, enter the `no logging system-module <system-module>` or `logging system-module all-pass` commands.
`debug` Command	`acl`	Sends ACL syslog logging to configured debug destinations. When there is a match with a "deny" statement, directs the resulting message to the configured debug destinations.
	`all`	Sends debug logging to configured debug destinations for all ACL, Event Log, IP-OSPF, and IP-RIP options.
	`cdp`	Displays CDP information.
	`destination`	`logging`: Disables or re-enables syslog logging on one or more syslog servers configured with the `logging syslog-ip-addr` command.`session`: Assigns or re-assigns destination status to the terminal device that was most recently used to request debug output.`buffer`: Enables syslog logging to send the debug message types specified by the `debug <debug-type>` command to a buffer in switch memory.

Table Continued

	`event`	Sends standard Event Log messages to configured debug destinations. (The same messages are also sent to the switch's Event Log, regardless of whether you enable this option.)

Table Continued

	ip	`fib`: Displays IP Forwarding Information Base messages and events.`forwarding`: Sends IPv4 forwarding messages to the debug destinations.`ospf`: Sends OSPF event logging to the debug destinations.`ospfv3`: Enables debug messages for OSPFv3.`packet`: Sends IPv4 packet messages to the debug destinations. `pim [packet [filter {source < ip-addr > | vlan < vid >}]]` : Enables or disables tracing of PIM messages.**Note**: When PIM debugging is enabled, the following message displays: `PIM Debugging can be extremely CPU intensive when run on a device with an existing high CPU load or on a switch with more than 10 PIM-enabled VLANs. In high load situations, the switch may suffer from protocol starvation, high latency, or even reload. When debugging a switch with more than 10 PIM-enabled VLANs, the "vlan" option in "debug ip pim packet" should be utilized. Debugging should only be used temporarily while troubleshooting problems. Customers are advised to exercise caution when running this command in a highstress production network.`  pbr: Logs a message when a PBR policy is applied, when the action in a class goes active or when it goes inactive.`rip`: Sends RIP event logging to the debug destinations.

Table Continued

	ipv6	dhcpv6-client: Sends DHCPv6 client debug messages to the configured debug destination.dhcpv6-relay: Sends DHCPv6 relay debug messages to the configured debug destination.forwarding: Sends IPv6 forwarding messages to the debug destination(s)nd: Sends IPv6 debug messages for IPv6 neighbor discovery to the configured debug destinations.
	lacp	event: Sends messages related to change events.packet: Sends messages when BPDUs are exchanged.
	lldp	Sends LLDP debug messages to the debug destinations.
	security	Sends security messages to the debug destination.
	services	Displays debug messages on the services module.
	snmp	Sends snmp messages to the debug destination.

Using the Debug/Syslog feature, you can perform the following operations:

- Configure the switch to send Event Log messages to one or more Syslog servers. In addition, you can configure the messages to be sent to the User log facility (default) or to another log facility on configured Syslog servers.
- Configure the switch to send Event Log messages to the current management- access session (serial-connect CLI, Telnet CLI, or SSH).
- Disable all Syslog debug logging while retaining the Syslog addresses from the switch configuration. This allows you to configure Syslog messaging and then disable and re-enable it as needed.
- Display the current debug configuration. If Syslog logging is currently active, the list f configured Syslog servers is displayed.
- Display the current Syslog server list when Syslog logging is disabled.

Configuring debug/syslog operation

Procedure

1. To use a syslog server as the destination device for debug messaging, follow these steps:
   a. Enter the `logging <syslog-ip-addr>` command at the global configuration level to configure the syslog server IP address and enable syslog logging. Optionally, you may also specify the destination subsystem to be used on the syslog server by entering the `logging facility` command.If no other syslog server IP addresses are configured, entering the `logging` command enables both debug

messaging to a syslog server and the event debug message type. As a result, the switch automatically sends Event Log messages to the syslog server, regardless of other debug types that may be configured.

   b. Re-enter the `logging` command in Step 1a to configure additional syslog servers. You can configure up to a total of six servers. (When multiple server IP addresses are configured, the switch sends the debug message types that you configure in **Step 3** to all IP addresses.)

2. To use a CLI session on a destination device for debug messaging:

   a. Set up a serial, Telnet, or SSH connection to access the switch's CLI.
   b. Enter the `debug destination session` command at the manager level.

3. Enable the types of debug messages to be sent to configured syslog servers, the current session device, or both by entering the `debug <debug-type>` command and selecting the desired options.

   Repeat this step if necessary to enable multiple debug message types.

   By default, Event Log messages are sent to configured debug destination devices. To block Event Log messages from being sent, enter the `no debug event` command.

4. If necessary, enable a subset of Event Log messages to be sent to configured syslog servers by specifying a severity level, a system module, or both using the following commands:

   ```
   switch(config)# logging severity <debug | major | error | warning | info>
   switch(config)# logging system-module <system-module>
   ```

   To display a list of valid values for each command, enter `logging severity` or `logging system-module` followed by `?` or pressing the Tab key.

   The severity levels in order from the highest to lowest severity are major, error, warning, info, and debug. For a list of valid values for the `logging system-module <system-module>` command, see **Event Log system modules**.

5. If you configure system-module, severity-level values, or both to filter Event Log messages, when you finish troubleshooting, you may want to reset these values to their default settings so that the switch sends all Event Log messages to configured debug destinations (syslog servers, CLI session, or both).

   To remove a configured setting and restore the default values that send all Event Log messages, enter one or both of the following commands:

   ```
   switch(config)# no logging severity <debug | major | error | warning | info>
   switch(config)# no logging system-module <system-module>
   ```

If you configure a severity-level, system-module, logging destination, or logging facility value and save the settings to the startup configuration (For example, by entering the `write memory` command), the debug settings are saved after a system reboot (power cycle or reboot) and re-activated on the switch. As a result, after switch startup, one of the following situations may occur:

- Only a partial set of Event Log messages may be sent to configured debug destinations.
- Messages may be sent to a previously configured syslog server used in an earlier debugging session.

Viewing a debug/syslog configuration

Use the `show debug` command to display the currently configured settings for:

- Debug message types and Event Log message filters (severity level and system module) sent to debug destinations
- Debug destinations (syslog servers or CLI session) and syslog server facility to be used

Syntax:

show debug

Displays the currently configured debug logging destinations and message types selected for debugging purposes. (If no syslog server address is configured with the `logging <syslog-ip-addr>` command, no `show debug` command output is displayed.)

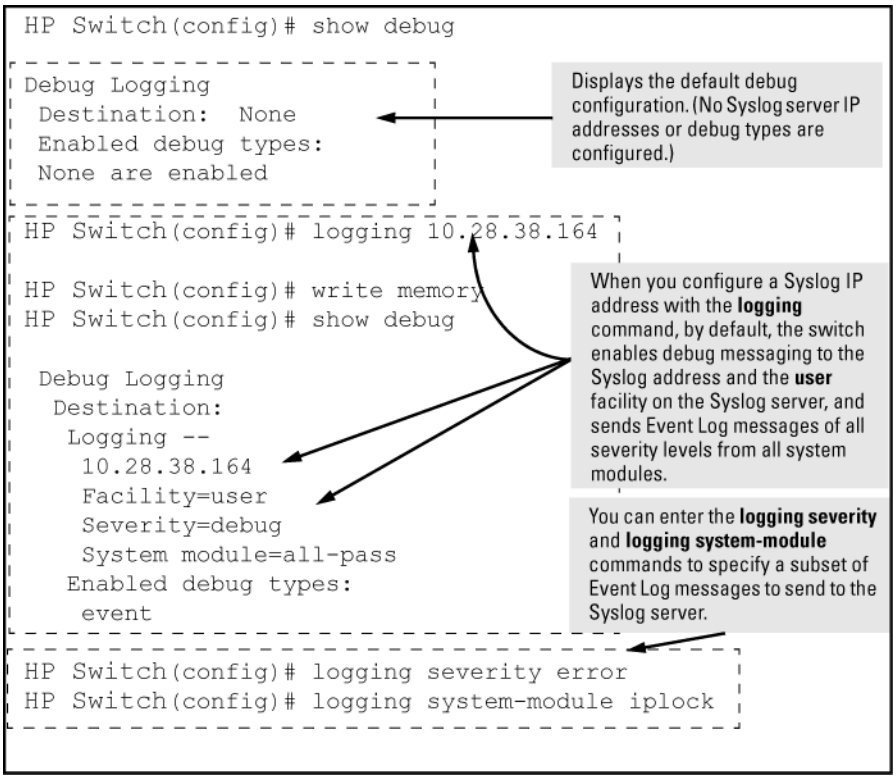
Output of the show debug command

```
switch(config)# show debug

 Debug Logging
  Destination:
   Logging --
    10.28.38.164
    Facility=kern
    Severity=warning
    System module=all-pass
   Enabled debug types:
    event
```

Example:

In the following Example:, no syslog servers are configured on the switch (default setting). When you configure a syslog server, debug logging is enabled to send Event Log messages to the server. To limit the Event Log messages sent to the syslog server, specify a set of messages by entering the `logging severity` and `logging system-module` commands.

Figure 108: *Syslog configuration to receive event log messages from specified system module and severity levels*



As shown at the top of **Figure 108: Syslog configuration to receive event log messages from specified system module and severity levels** on page 457, if you enter the `show debug` command when no syslog

server IP address is configured, the configuration settings for syslog server facility, Event Log severity level, and system module are not displayed. However, after you configure a syslog server address and enable syslog logging, all debug and logging settings are displayed with the `show debug` command.

If you do not want Event Log messages sent to syslog servers, you can block the messages from being sent by entering the `no debug event` command. (There is no effect on the normal logging of messages in the switch's Event Log.)

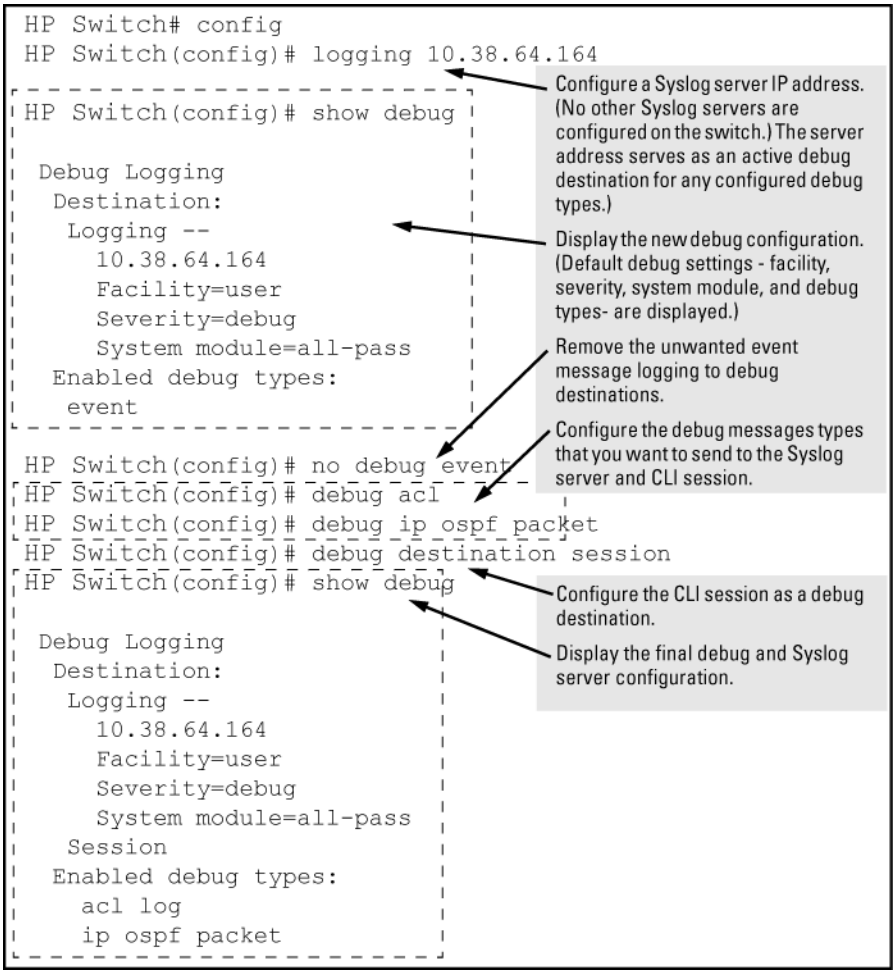
Example:

The next Example: shows how to configure:

- Debug logging of ACL and IP-OSPF packet messages on a syslog server at 18.38.64.164 (with user as the default logging facility).
- Display of these messages in the CLI session of your terminal device's management access to the switch.
- Blocking Event Log messages from being sent from the switch to the syslog server and a CLI session.

To configure syslog operation in these ways with the debug/syslog feature disabled on the switch, enter the commands shown in **Figure 109: Debug/syslog configuration for multiple debug types and multiple destinations** on page 458.

Figure 109: *Debug/syslog configuration for multiple debug types and multiple destinations*



Debug command

At the manager level, use the `debug` command to perform two main functions:

- Specify the types of event messages to be sent to an external destination.
- Specify the destinations to which selected message types are sent.

By default, no debug destination is enabled and only Event Log messages are enabled to be sent.

To configure a syslog server, use the `logging <syslog-ip-addr>` command. For more information, see **Configuring a syslog server** on page 462.

Debug messages

Syntax:

[no] debug <*debug-type*>

`acl`	When a match occurs on an ACL "deny" ACE (with `log` configured), the switch sends an ACL message to configured debug destinations. For information on ACLs, see the "Access Control Lists (ACLs)" in the latest version of the following guides: • IPv4 ACLs: access security guide • IPv6 ACLs: IPv6 configuration guide  ACE matches (hits) for permit and deny entries can be tracked using the `show statistics <aclv4|aclv6>` command. (Default: Disabled—ACL messages for traffic that matches "deny" entries are not sent.)
`all`	Configures the switch to send all debug message types to configured debug destinations.(Default: Disabled—No debug messages are sent.)
`cdp`	Sends CDP information to configured debug destinations.
`destination`	`logging`—Disables or re-enables syslog logging on one or more syslog servers configured with the `logging <syslog-ip-addr>` command.`session`—Assigns or re-assigns destination status to the terminal device that was most recently used to request debug output.`buffer`—Enables syslog logging to send the debug message types specified by the `debug <debug-type>` command to a buffer in switch memory.For more information on these options, see **Debug destinations** on page 461.

Table Continued

`event`		Configures the switch to send Event Log messages to configured debug destinations.  This value does not affect the reception of event notification messages in the Event Log on the switch. Event Log messages are automatically enabled to be sent to debug destinations in these conditions: • If no syslog server address is configured and you enter the `logging <syslog-ip-addr>` command to configure a destination address. • If at least one syslog server address is configured in the startup configuration, and the switch is rebooted or reset. Event log messages are the default type of debug message sent to configured debug destinations.
`ip [fib | forwarding | packet | rip]`		Sends IP messages to configured destinations.
	`ip [fib [events]]`	For the configured debug destinations:`events`—Sends IP forwarding information base events.
	`ip [packet]`	Enables the specified PIM message type.
	`ip [rip [database | event | trigger]]`	`rip {<database | event | trigger>}` —Enables the specified RIP message type for the configured destination(s). `database`—Displays database changes. `event`—Displays RIP events. `trigger`—Displays trigger messages.
`ipv6 [dhcpv6-client | nd | packet]`		 See the "IPv6 Diagnostic and Troubleshooting" in the IPv6 configuration guide for your switch for more detailed IPv6 debug options. When no debug options are included, displays debug messages for all IPv6 debug options. `dhcpv6-client [events | packet]`—Displays DHCPv6 client event and packet data.`nd`—Displays debug messages for IPv6 neighbor discovery.`packet`—Displays IPv6 packet messages.
`lldp`		Enables all LLDP message types for the configured destinations.
`security [arp-protect | dhcp-snooping | dynamic-ip-lockdown | port-access | port-security | radius-server | ssh | tacacs-server | user-profile-mib]`		`arp-protect`— Sends dynamic ARP protection debug messages to configured debug destinations.`dhcp-snooping`—Sends DHCP snooping debug messages to configured debug destinations. `agent`—Displays DHCP snooping agent messages. `event`—Displays DHCP snooping event messages. `packet`—Displays DHCP snooping packet messages. `dynamic-ip-lockdown`—Sends dynamic IP lockdown debug messages to the debug destination.`port-access`—Sends port-access debug messages to the debug destination.`radius-server`—Sends RADIUS debug messages to the debug destination.`ssh`—Sends SSH debug messages at the specified level to the debug destination. The levels are fatal, error, info, verbose, debug, debug2, and debug3.`tacacs-server`—Sends TACACS debug messages to the debug destination.`user-profile-mib`—Sends user profile MIB debug messages to the debug destination.

Table Continued

`services <slot-id-range>`	Displays debug messages on the services module. Enter an alphabetic module ID or range of module IDs for the <*slot-id-range*> parameter.
`snmp <pdu>`	Displays the SNMP debug messages.`pdu`—Displays SNMP pdu debug messages.

Debug destinations

Use the `debug destination` command to enable (and disable)syslog messaging on a syslog server or to a CLI session for specified types of debug and Event Log messages.

Syntax:

[no] debug destination {<logging | session | buffer>}

`logging`	Enables syslog logging to configured syslog servers so that the debug message types specified by the `debug <debug-type>` command (see **Debug messages** on page 459) are sent.(Default: Logging disabled)To configure a syslog server IP address, see **Configuring a syslog server** on page 462.  Debug messages from the switches covered in this guide have a debug severity level. Because the default configuration of some syslog servers ignores syslog messages with the debug severity level, ensure that the syslog servers you want to use to receive debug messages are configured to accept the debug level. For more information, see **Operating notes for debug and Syslog** on page 467.
`session`	Enables transmission of event notification messages to the CLI session that most recently executed this command. The session can be on any one terminal emulation device with serial, Telnet, or SSH access to the CLI at the Manager level prompt (`switch#_`).If more than one terminal device has a console session with the CLI, you can redirect the destination from the current device to another device. Do so by executing `debug destination session` in the CLI on the terminal device on which you now want to display event messages.Event message types received on the selected CLI session are configured with the `debug <debug-type>` command.
`buffer`	Enables syslog logging to send the debug message types specified by the `debug <debug-type>` command to a buffer in switch memory.To view the debug messages stored in the switch buffer, enter the `show debug buffer` command.

Logging command

At the global configuration level, the `logging`command allows you to enable debug logging on specified syslog servers and select a subset of Event Log messages to send for debugging purposes according to:

- Severity level
- System module

By specifying both a severity level and system module, you can use both configured settings to filter the Event Log messages you want to use to troubleshoot switch or network error conditions.

CAUTION

After you configure a syslog server and a severity level and/or system module to filter the Event Log messages that are sent, if you save these settings to the startup configuration file by entering the `write memory` command, these debug and logging settings are automatically re-activated after a switch reboot or power recycle. The debug settings and destinations configured in your previous troubleshooting session will then be applied to the current session, which may not be desirable.

After a reboot, messages remain in the Event Log and are not deleted. However, after a power recycle, all Event Log messages are deleted.

If you configure a severity level, system module, or both to temporarily filter Event Log messages, be sure to reset the values to their default settings by entering the `no` form of the following commands to ensure that Event Log messages of all severity levels and from all system modules are sent to configured syslog servers:

```
switch(config)# no logging severity <debug | major | error | warning |
info>
switch(config)# no logging system-module <system-module>
```

Configuring a syslog server

Syslog is a client-server logging tool that allows a client switch to send event notification messages to a networked device operating with syslog server software. Messages sent to a syslog server can be stored to a file for later debugging analysis.

To use the syslog feature, you must install and configure a syslog server application on a networked host accessible to the switch. For instructions, see the documentation for the syslog server application.

To configure a syslog service, use the `logging <syslog-ip-addr>` command as shown below.

When you configure a syslog server, Event Log messages are automatically enabled to be sent to the server. To reconfigure this setting, use the following commands:

- `debug`

  Specifies additional debug message types (see **Debug messages** on page 459).
- `logging`

  Configures the system module or severity level used to filter the Event Log messages sent to configured syslog servers. (See **Configuring the severity level for Event Log messages sent to a syslog server** on page 466 and **Configuring the system module used to select the Event Log messages sent to a syslog server** on page 466.)

To display the currently configured syslog servers as well as the types of debug messages and the severity-level and system-module filters used to specify the Event Log messages that are sent, enter the `show debug` command (See **Debug/syslog configuration commands** on page 451).

Syntax:

[no] logging <*syslog-ip-addr*>

Enables or disables syslog messaging to the specified IP address. You can configure up to six addresses. If you configure an address when none are already configured, this command enables destination logging (syslog) and the Event debug type. Therefore, at a minimum, the switch begins sending Event Log messages to configured syslog servers. The ACL, IP-OSPF, and/or IP-RIP message types are also sent to the syslog servers if they are currently enabled as debug types. (See **Debug messages** on page 459.)

`no logging`	Removes all currently configured syslog logging destinations from the running configuration.Using this form of the command to delete the only remaining syslog server address disables debug destination logging on the switch, but the default Event debug type does not change.
`no logging <syslog-ip-address>`	Removes only the specified syslog logging destination from the running configuration.Removing all configured syslog destinations with the `no logging` command (or a specified syslog server destination with the `no logging <syslog-ip-address>` command) does not delete the syslog server IP addresses stored in the startup configuration.

Deleting syslog addresses in the startup configuration

Enter a `no logging` command followed by the `write memory` command.

Verifying the deletion of a syslog server address

Display the startup configuration by entering the `show config` command.

Blocking the messages sent to configured syslog servers from the currently configured debug message type

Enter the `no debug <debug-type>` command. (See **Debug messages** on page 459.)

Disabling syslog logging on the switch without deleting configured server addresses

Enter the `no debug destination logging` command. Note that, unlike the case in which no syslog servers are configured, if one or more syslog servers are already configured and syslog messaging is disabled, configuring a new server address does not re-enable syslog messaging. To re-enable syslog messaging, you must enter the `debug destination logging` command.

Sending logging messages using TCP

Syntax:

[no] logging <*ip-addr*> [udp 1024-49151 | tcp 1024-49151]

Allows the configuration of the UDP or TCP transport protocol for the transmission of logging messages to a syslog server.

Specifying a destination port with UDP or TCP is optional.

Default ports: UDP port is 514

TCP port is 1470

Default Transport Protocol: UDP

Because TCP is a connection-oriented protocol, a connection must be present before the logging information is sent. This helps ensure that the logging message will reach the syslog server. Each configured syslog server needs its own connection. You can configure the destination port that is used for the transmission of the logging messages.

Configuring TCP for logging message transmission using the default port

```
switch(config)# logging 192.123.4.5 tcp
```

(Default TCP port 1470 is used.)

Configuring TCP for logging message transmission using a specified port

```
switch(config)# logging 192.123.4.5 9514
```

(TCP port 9514 is used.)

Configuring UDP for logging message transmission using the default port

```
switch(config)# logging 192.123.4.5 udp
```

(Default UDP port 514 is used.)

Configuring UDP for logging message transmission using a specified port

```
switch(config)# logging 192.123.4.5 9512
```

(UDP port 9512 is used.)

Syntax:

[no] logging facility <*facility-name*>

The logging facility specifies the destination subsystem used in a configured syslog server. (All configured syslog servers must use the same subsystem.) Hewlett Packard Enterprise recommends the default (user) subsystem unless your application specifically requires another subsystem. Options include:

`user`	(default) Random user-level messages
`kern`	Kernel messages
`mail`	Mail system
`daemon`	System daemons
`auth`	Security/authorization messages
`syslog`	Messages generated internally by syslog
`lpr`	Line-printer subsystem
`news`	Netnews subsystem
`uucp`	uucp subsystem
`cron`	cron/at subsystem
`sys9`	cron/at subsystem
`sys10 - sys14`	Reserved for system use
`local10 - local17`	Reserved for system use

Use the `no` form of the command to remove the configured facility and reconfigure the default (user) value.

Adding a description for a Syslog server

You can associate a user-friendly description with each of the IP addresses (IPv4 only) configured for syslog using the CLI or SNMP.

The Hewlett Packard Enterprise MIB hpicfSyslog.mib allows the configuration and monitoring of syslog for SNMP (RFC 3164 supported).

Entering the `no logging` command removes ALL the syslog server addresses without a verification prompt.

The CLI command is:

Syntax:

logging <*ip-addr*> [control-descr ZZZZTRISHZZZZ <*text_string*>]
no logging <*ip-addr*> [control-descr]

An optional user-friendly description that can be associated with a server IP address. If no description is entered, this is blank. If <*text_string*> contains white space, use quotes around the string. IPv4 addresses only.

Use the `no` form of the command to remove the description. Limit: 255 characters

To remove the description using SNMP, set the description to an empty string.

The `logging` command with a control description

```
switch(config)# logging 10.10.10.2 control-descr syslog_one
```

Adding a priority description

This description can be added with the CLI or SNMP. The CLI command is:

Syntax:

logging priority-descr <*text_string*>
no logging priority-descr

Provides a user-friendly description for the combined filter values of `severity` and `system module`. If no description is entered, this is blank.

If *text_string* contains white space, use quotes around the string.

Use the `no` form of the command to remove the description.

Limit: 255 characters

The logging command with a priority description

```
switch(config)# logging priority-descr severe-pri
```

NOTE

A notification is sent to the SNMP agent if there are any changes to the syslog parameters, either through the CLI or with SNMP.

Configuring the severity level for Event Log messages sent to a syslog server

Event Log messages are entered with one of the following severity levels (from highest to lowest):

`Major`	A fatal error condition has occurred on the switch.
`Error`	An error condition has occurred on the switch.
`Warning`	A switch service has behaved unexpectedly.
`Information`	Information on a normal switch event.
`Debug`	Reserved for HPE switch internal diagnostic information.

Using the `logging severity` command, you can select a set of Event Log messages according to their severity level and send them to a syslog server. Messages of the selected and higher severity will be sent. To configure a syslog server, see **Configuring a syslog server** on page 462.

Syntax:

[no] logging severity {< major | error | warning | info | debug >}

Configures the switch to send all Event Log messages with a severity level equal to or higher than the specified value to all configured Syslog servers.

Default: `debug` (Reports messages of all severity levels.)

Use the `no` form of the command to remove the configured severity level and reconfigure the default value, which sends Event Log messages of all severity levels to syslog servers.

NOTE

The severity setting does not affect event notification messages that the switch normally sends to the Event Log. All messages remain recorded in the Event Log.

Configuring the system module used to select the Event Log messages sent to a syslog server

Event Log messages contain the name of the system module that reported the event. Using the `logging system-module` command, you can select a set of Event Log messages according to the originating system module and send them to a syslog server.

Syntax:

[no] logging system-module <*system-module*>

Configures the switch to send all Event Log messages being logged from the specified system module to configured syslog servers. (To configure a syslog server, see **Configuring a syslog server**.)

See **Event Log system modules** for the correct value to enter for each system module.

Default: `all-pass` (Reports all Event Log messages.)

Use the `no` form of the command to remove the configured system module value and reconfigure the default value, which sends Event Log messages from all system modules to syslog servers.

You can select messages from only one system module to be sent to a syslog server; you cannot configure messages from multiple system modules to be sent. If you re-enter the command with a different system module name, the currently configured value is replaced with the new one.

This setting has no effect on event notification messages that the switch normally sends to the Event Log.

Enabling local command logging

Use this command to enable local command logging. This satisfies the NDcPP certification requirement that:

- All administrative actions (commands) are logged locally.
- Local command log storage can be enabled and disabled.
- The identity of the user causing an event is logged.
- When the command log is exhausted by 80% and wraparound occurs, the event is logged and a trap is generated.
- Log messages have a maximum of 240 characters (the RMON event maximum string length) and are stored in the command log buffer.
- Log messages greater than the maximum length are truncated and are not stored in the command log buffer.

Syntax:

[no] logging command

Operating notes for debug and Syslog

- Rebooting the switch or pressing the `Reset` button resets the debug configuration.

Debug option	Effect of a reboot or reset
logging (debug destination)	If syslog server IP addresses are stored in the startup-config file, they are saved across a reboot and the logging destination option remains enabled. Otherwise, the logging destination is disabled.
session (debug destination)	Disabled.
ACL (debug type)	Disabled.
All (debug type)	Disabled.
event (debug type)	If a syslog server IP address is configured in the startup-config file, the sending of Event Log messages is reset to `enabled`, regardless of the last active setting. If no syslog server is configured, the sending of Event Log messages is `disabled`.
IP (debug type)	Disabled.

- Debug commands do not affect normal message output to the Event Log.

Using the `debug event` command, you can specify that Event Log messages are sent to the debug destinations you configure (CLI session, syslog servers, or both) in addition to the Event Log.

- Ensure that your syslog servers accept debug messages.

  All syslog messages resulting from a debug operation have a "debug" severity level. If you configure the switch to send debug messages to a syslog server, ensure that the server's syslog application is configured to accept the "debug" severity level. (The default configuration for some syslog applications ignores the "debug" severity level.)
- Duplicate IP addresses are not stored in the list of syslog servers.
- If the default severity value is in effect, all messages that have severities greater than the default value are passed to syslog. For example, if the default severity is "debug," all messages that have severities greater than debug are passed to syslog.
- There is a limit of six syslog servers. All syslog servers are sent the same messages using the same filter parameters. An error is generated for an attempt to add more than six syslog servers.

Diagnostic tools

Port auto-negotiation

When a link LED does not light (indicating loss of link between two devices), the most common reason is a failure of port auto-negotiation between the connecting ports. If a link LED fails to light when you connect the switch to a port on another device, do the following:

Procedure

1. Ensure that the switch port and the port on the attached end-node are both set to `Auto` mode.
2. If the attached end-node does not have an `Auto` mode setting, you must manually configure the switch port to the same setting as the end-node port. See **Port Status and Configuration** on page 67.

Ping and link tests

The ping test and the link test are point-to-point tests between your switch and another IEEE 802.3-compliant device on your network. These tests can tell you whether the switch is communicating properly with another device.

To respond to a ping test or a link test, the device you are trying to reach must be IEEE 802.3-compliant.

Ping test

A test of the path between the switch and another device on the same or another IP network that can respond to IP packets (ICMP Echo Requests). To use the `ping` (or `traceroute`) command with host names or fully qualified domain names, see **DNS resolver** on page 484.

Link test

A test of the connection between the switch and a designated network device on the same LAN (or VLAN, if configured). During the link test, IEEE 802.2 test packets are sent to the designated network device in the same VLAN or broadcast domain. The remote device must be able to respond with an 802.2 Test Response Packet.

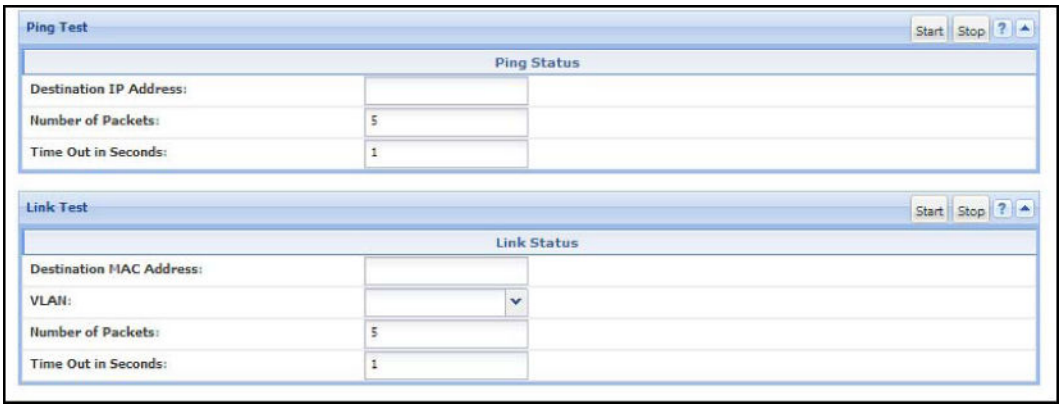
Executing ping or link tests (WebAgent)

To start a ping or link test in the WebAgent:

1. In the navigation pane, click **Troubleshooting**.
2. Click **Ping/Link Test**.
3. Click **Start**.
4. To halt a link or ping test before it concludes, click **Stop**.

For an Example: of the text screens, see **Figure 110: Ping test and link test screen on the WebAgent** on page 469.

Figure 110: *Ping test and link test screen on the WebAgent*



Destination IP Address is the network address of the target, or destination, device to which you want to test a connection with the switch. An IP address is in the X.X.X.X format where X is a decimal number between 0 and 255.

Number of Packets to Send is the number of times you want the switch to attempt to test a connection.

Timeout in Seconds is the number of seconds to allow per attempt to test a connection before determining that the current attempt has failed.

Testing the path between the switch and another device on an IP network

The ping test uses ICMP echo requests and ICMP echo replies to determine if another device is alive. It also measures the amount of time it takes to receive a reply from the specified destination. The `ping` command has several extended commands that allow advanced checking of destination availability.

Syntax:

ping {<ip-address | hostname>} [repetitions <1-10000>] [timeout <1-60>] [source < {ip-address | <vlan-id> | loopback <0-7>>}] [data-size <0-65471>] [data-fill <0-1024>] [ip-option {<record-route | loose-source-route | strict-source-route | include-timestamp | include-timestamp-and-address | include timestamp-from} >] [tos <0-255>]

ping6 {<ipv6-address | hostname>} [repetitions <1-10000>] [timeout <1-60>] [source < {ip-address | vlan-id | loopback <0-7>>}] [data-size <0-65471>] [data-fill <0-1024>]

Sends ICMP echo requests to determine if another device is alive.

`{< ip-address | hostname >}`	Target IP address or hostname of the destination node being pinged
`repetitions <1-10000>`	Number of ping packets sent to the destination address. Default: 1
`timeout <1-60>`	Timeout interval in seconds; the ECHO REPLY must be received before this time interval expires for the ping to be successful. Default: 5
`source {< ip-addr | vid | loopback <0-7>>}`	Source IP address, VLAN ID, or loopback address used for the ping. The source IP address must be owned by the router.If a VLAN is specified, the IP address associated with the specified VLAN is used.
`data-size <0-65471>`	Size of packet sent. Default: 0 (zero)
`data-fill <0-1024>`	The data pattern in the packet. Default: Zero length string
`ip-option`	Specify an IP option, such as loose or strict source routing, or an include-timestamp option:`include-timestamp`: Adds the timestamp option to the IP header. The timestamp displays the amount of travel time to and from a host. Default: 9`include-timestamp-and-address`: Records the intermediate router's timestamp and IP address. Default: 4`include-timestamp-from`: Records the timestamp of the specified router addresses.`loose-source-route <IP-addr>` : The `loose-source-route` option prompts for the IP address of each source IP on the path. It allows you to specify the IP addresses that you want the ping packet to go through; the packet may go through other IP addresses as well.`record-route <1-9>` : Displays the IP addresses of the interfaces that the ping packet goes through on its way to the destination and on the way back. When specified without loose or strict recording, the source route is not recorded. The source route is automatically recorded when loose or strict source routing is enabled. Default: 9`strict-source-route <IP-addr>` : Restricts the ping packet to only those IP addresses that have been specified and no other addresses.
`tos <0-255>`	Specifies the type of service to be entered in the header packet. Default: 0 (zero)

Ping tests

```
switch# ping 10.10.10.10
10.10.10.10 is alive, time = 15 ms
```

```
switch# ping 10.10.10.10 repetitions 3
10.10.10.10 is alive, iteration 1, time = 15 ms
10.10.10.10 is alive, iteration 1, time = 15 ms
10.10.10.10 is alive, iteration 1, time = 15 ms

switch# ping 10.10.10.10 timeout 2
10.10.10.10 is alive, time = 10 ms

switch# ping 10.11.12.13
The destination address is unreachable.
```

Halting a ping test

To halt a ping test before it concludes, press **[Ctrl] [C]**.

To use the `ping` (or `traceroute`) command with host names or fully qualified domain names, see **DNS resolver** on page 484.

Issuing single or multiple link tests

Single or multiple link tests can have varying repetitions and timeout periods. The defaults are:

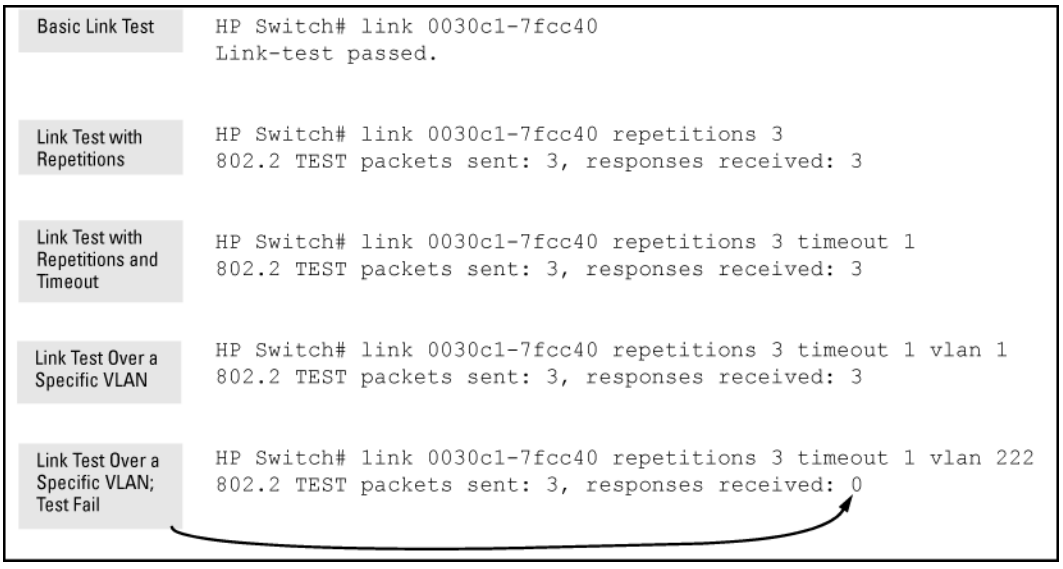
- Repetitions: 1 (1 to 999)
- Timeout: 5 seconds (1 to 256 seconds)

Syntax:

link <*mac-address*> [repetitions <1-999>] [timeout <1-256>] [vlan < *vlan-id* >]

Example:

Figure 111: *Link tests*



Tracing the route from the switch to a host address

The `traceroute` command enables you to trace the route from the switch to a host address.

This command outputs information for each (router) hop between the switch and the destination address. Note that every time you execute `traceroute`, it uses the same default settings unless you specify otherwise for that instance of the command.

Syntax:

traceroute {< ip-address | hostname >} [maxttl <1-255>] [minttl <1-255>] [probes <1-5>] [source {<ip-address | source-vlan <vid> | loopback <0-7>}] [dstport <1-34000>] [srcport <1-34000>] [ip-option {<record-route | loose-source-route | strict-source-route | include-timestamp | include-timestamp-and-address | include timestamp-from>}] [< timeout 1-120 >]

Lists the IP address or hostname of each hop in the route, plus the time in microseconds for the `traceroute` packet reply to the switch for each hop.

{< ip-address | hostname >}	The IP address or hostname of the device to which to send the traceroute.
[minttl < 1-255 >]	For the current instance of `traceroute`, changes the minimum number of hops allowed for each probe packet sent along the route. • If `minttl` is greater than the actual number of hops, the output includes only the hops at and above the `minttl` threshold. (The hops below the threshold are not listed.) • If `minttl` matches the actual number of hops, only that hop is shown in the output. • If `minttl` is less than the actual number of hops, all hops are listed. For any instance of `traceroute`, if you want a `minttl` value other than the default, you must specify that value.(Default: 1)
[maxttl < 1-255 >]	For the current instance of `traceroute`, changes the maximum number of hops allowed for each probe packet sent along the route.If the destination address is further from the switch than `maxttl` allows, `traceroute` lists the IP addresses for all hops it detects up to the `maxttl` limit.For any instance of `traceroute`, if you want a `maxttl` value other than the default, you must specify that value.(Default: 30)
[probes < 1-5 >]	For the current instance of `traceroute`, changes the number of queries the switch sends for each hop in the route.For any instance of `traceroute`, if you want a probes value other than the default, you must specify that value.(Default: 3)
[source {< ip-addr | vid | loopback <0-7> >}]	The source IPv4 address, VLAN ID, or Loopback address.
[dstport < 1-34000 >]	Destination port.

Table Continued

	Source port.
[srcport < 1-34000 >]	
[ip-option]	Specify an IP option, such as loose or strict source routing, or an include-timestamp option: `[include-timestamp]`: Adds the timestamp option to the IP header. The timestamp displays the amount of travel time to and from a host.Default: 9 `[include-timestamp-and-address]`: Records the intermediate router's timestamp and IP address.Default: 4 `[loose-source-route <IP-addr>]` : Prompts for the IP address of each source IP on the path.It allows you to specify the IP addresses that you want the ping packet to go through; the packet may go through other IP addresses as well. `[record-route <1-9>]` : Displays the IP addresses of the interfaces that the ping packet goes through on its way to the destination and on the way back.When specified without loose or strict recording, the source route is not recorded. The source route is automatically recorded when loose or strict source routing is enabled.Default: 9 `[strict-source-route <IP-addr>]` : Restricts the ping packet to only those IP addresses that have been specified and no other addresses. `[timeout <1-120>]`: For the current instance of `traceroute`, changes the timeout period the switch waits for each probe of a hop in the route.For any instance of `traceroute`, if you want a timeout value other than the default, you must specify that value.(Default: 5 seconds)

NOTE

For information about `traceroute6`, see the IPv6 configuration guide for your switch.

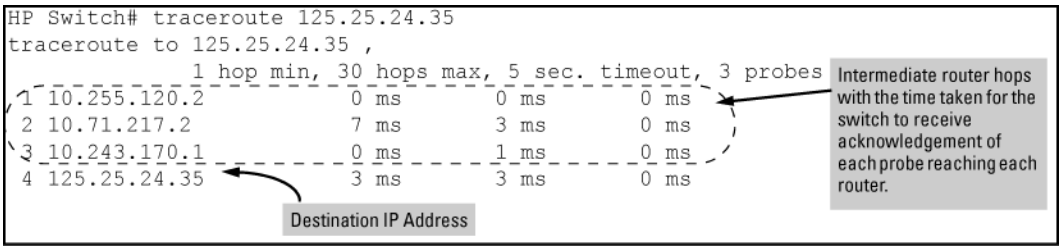
Halting an ongoing traceroute search

Press the **[Ctrl] [C]** keys.

A low maxttl causes traceroute to halt before reaching the destination address

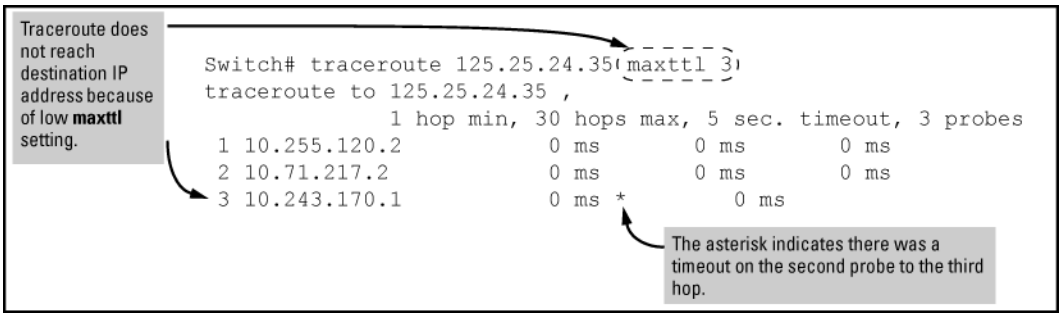
Executing `traceroute` with its default values for a destination IP address that is four hops away produces a result similar to this:

Figure 112: *A completed traceroute enquiry*



Continuing from the previous Example: (**Figure 112: A completed traceroute enquiry** on page 473), executing `traceroute` with an insufficient `maxttl` for the actual hop count produces an output similar to this:

Figure 113: *Incomplete `traceroute` because of low `maxttl` setting*



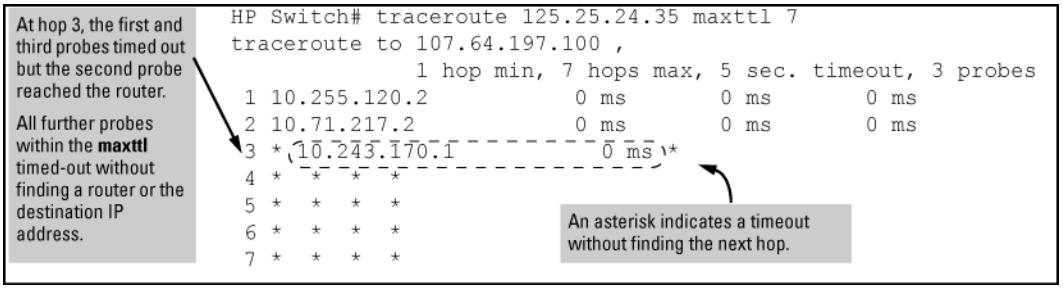
If a network condition prevents traceroute from reaching the destination

Common reasons for `traceroute` failing to reach a destination include:

- Timeouts (indicated by one asterisk per probe, per hop)
- Unreachable hosts
- Unreachable networks
- Interference from firewalls
- Hosts configured to avoid responding

Executing `traceroute` where the route becomes blocked or otherwise fails results in an output marked by timeouts for all probes beyond the last detected hop. For example, with a maximum hop count of 7 (`maxttl` = 7), where the route becomes blocked or otherwise fails, the output appears similar to this:

Figure 114: *Traceroute failing to reach the destination address*



Viewing switch configuration and operation

In some troubleshooting scenarios, you may need to view the switch configuration to diagnose a problem. The complete switch configuration is contained in a file that you can browse from the CLI using the commands described in this section.

Viewing the startup or running configuration file

Syntax:

write terminal

Displays the running configuration.

`show config`	Displays the startup configuration.
`show running-config`	Displays the running-config file.

For more information and examples of how to use these commands, see “Switch Memory and Configuration” in the basic operation guide.

Viewing the configuration file (WebAgent)

To display the running configuration using the WebAgent:

1. In the navigation pane, click **Troubleshooting**.
2. Click **Configuration Report**.
3. Use the right-side scroll bar to scroll through the configuration listing.

Viewing a summary of switch operational data

Syntax:

show tech

By default, the `show tech` command displays a single output of switch operating and running-configuration data from several internal switch sources, including:

- Image stamp (software version data)
- Running configuration
- Event Log listing
- Boot history
- Port settings
- Status and counters — port status
- IP routes
- Status and counters — VLAN information
- GVRP support
- Load balancing (trunk and LACP)

The show tech command on page 475 shows sample output from the `show tech` command.

The show tech command

```
switch# show tech

 show system

  Status and Counters - General System Information

   System Name         : Switch
   System Contact      :
   System Location     :

   MAC Age Time (sec)  : 300

   Time Zone           : 0
   Daylight Time Rule  : None

   Software revision   : XX.14.xx      Base MAC Addr   : 001871-c42f00
   ROM Version         : XX.12.12      Serial Number   : SG641SU00L
```

```
  Up Time             : 23 hours    Memory - Total :
  CPU Util (%)        : 10                   Free :

  IP Mgmt - Pkts Rx   : 759         Packet - Total : 6750
            Pkts Tx   : 2             Buffers Free : 5086
                                            Lowest : 4961
                                            Missed : 0

show flash
Image       Size(Bytes)    Date   Version
-----       -----------  ------ --------
```

To specify the data displayed by the `show tech` command, use the `copy show tech` command as described in **Customizing show tech command output** on page 477.

Saving show tech command output to a text file

When you enter the `show tech` command, a summary of switch operational data is sent to your terminal emulator. You can use your terminal emulator's text capture features to save the `show tech` data to a text file for viewing, printing, or sending to an associate to diagnose a problem.

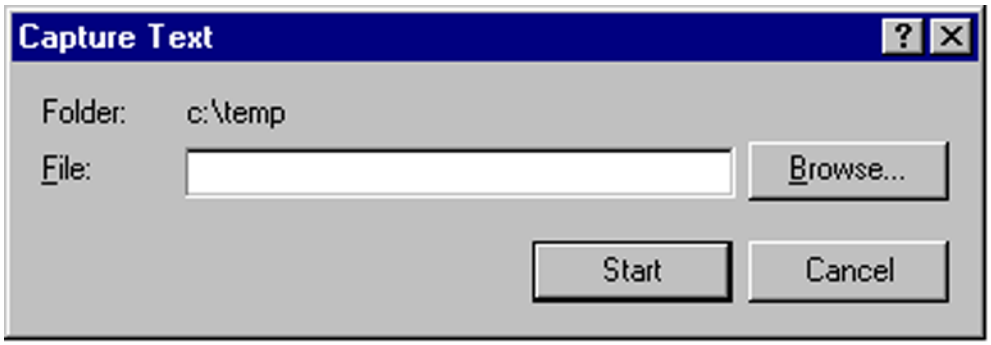
For example, if your terminal emulator is the Hyperterminal application available with Microsoft® Windows® software, you can copy the `show tech` output to a file and then use either Microsoft Word or Notepad to display the data. (In this case, Microsoft Word provides the data in an easier-to-read format.)

The following example uses the Microsoft Windows terminal emulator. If you are using a different terminal emulator application, see the documentation provided with the application.

Procedure

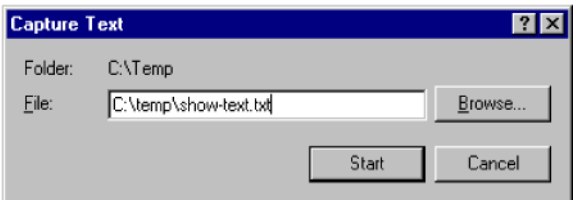
1. In Hyperterminal, click on `Transfer|Capture Text…`.

   Figure 115: *Capture text window of the Hyperterminal application*

2. In the `File` field, enter the path and file name in which you want to store the `show tech` output.

   Figure 116: *Entering a path and filename for saving show tech output*

3. Click **[Start]** to create and open the text file.
4. From the global configuration context, enter the `show tech` command:

   ```
   switch# show tech
   ```

The `show tech` command output is copied into the text file and displayed on the terminal emulator screen. When the command output stops and displays `-- MORE --`, press the Space bar to display and copy more information. The CLI prompt appears when the command output finishes.

5. Click on `Transfer|Capture Text|Stop` in HyperTerminal to stop copying data and save the text file.

   If you do not stop HyperTerminal from copying command output into the text file, additional unwanted data can be copied from the HyperTerminal screen.
6. To access the file, open it in Microsoft Word, Notepad, or a similar text editor.

Customizing show tech command output

Use the `copy show tech` command to customize the detailed switch information displayed with the `show tech` command to suit your troubleshooting needs.

To customize the information displayed with the `show tech` command:

Procedure

1. Determine the information that you want to gather to troubleshoot a problem in switch operation.
2. Enter the `copy show tech` command to specify the data files that contain the information you want to view.

Syntax:

copy <*source*> show-tech

Specifies the operational and configuration data from one or more source files to be displayed by the `show tech` command. Enter the command once for each data file that you want to include in the display.

Default: Displays data from all source files, where <*source*> can be any one of the following values:

`command-output "<command>"`	Includes the output of a specified command in `show-tech` command output. Enter the command name between double-quotation marks, For example, `copy "show system" show-tech`.
`crash-data [slot-id | master]`	Includes the crash data from all management and interface modules in `show tech` command output. To limit the amount of crash data displayed, specify an installed module or management modules, where: • `slot-id`: Includes the crash data from an installed module. Valid slot IDs are the letters `a` through `h`. • `master`: Includes the crash data from both management modules.
`crash-log [slot-id | master]`	Includes the crash logs from all management and interface modules in `show tech` command output. To limit the amount of crash-log data displayed, specify an installed module or management modules, where: `slot-id`: Includes the crash log from an installed module. Valid slot IDs are the letters `a` through `h`. `master`: Includes the crash log from both management modules.

Table Continued

`event-log`	Copies the contents of the Event Log to `show tech` command output.
`running-config`	Includes the contents of the running configuration file in `show tech` command output
`startup-config`	Includes the contents of the startup configuration file in `show tech` command output.
`tftp config {<startup-config | running-config} <ip-addr> <remote-file> {<pc | unix>}`	Downloads the contents of a configuration file from a remote host to `show tech` command output, where: `<ip-addr>` : Specifies the IP address of the remote host device. `<remote-file>`: Specifies the pathname on the remote host for the configuration file whose contents you want to include in the command output. `pc|unix`: Specifies whether the remote host is a DOS-based PC or UNIX workstation. For more information on using `copy tftp` commands, see **File Transfers** on page 294.
`xmodem config {<startup-config | config < filename > | command-file < acl-filename.txt >} {<pc | unix>}`	Copies the contents of a configuration file or ACL command file from a serially connected PC or UNIX workstation to `show tech` command output, where: `startup-config`: Specifies the name of the startup configuration file on the connected device. `config <filename>` : Specifies the pathname of a configuration file on the connected device. `command-file <acl-filename.txt>` : Specifies the pathname of an ACL command file on the connected device. `pc|unix`: Specifies whether the connected device is a DOS-based PC or UNIX workstation. For more information on using `copy xmodem` commands, see **File Transfers** on page 294.

Viewing more information on switch operation

Use the following commands to display additional information on switch operation for troubleshooting purposes.

Syntax:

show boot-history

Displays the crash information saved for each management module on the switch.

show history

Displays the current command history. This command output is used for reference or when you want to repeat a command (See **Displaying the information you need to diagnose problems** on page 481).

show system-information

Displays globally configured parameters and information on switch operation.

show version

Displays the software version currently running on the switch and the flash image from which the switch booted (primary or secondary). For more information, see "Displaying Management Information" in the "Redundancy (Switch 8212zl)" .

show interfaces

Displays information on the activity on all switch ports (see "Viewing Port Status and Configuring Port Parameters" in the "Port Status and Configuration").

show interfaces-display

Displays the same information as the `show interfaces` command and dynamically updates the output every three seconds. Press **Ctrl + C** to stop the dynamic updates of system information. Use the Arrow keys to view information that is off the screen.

Searching for text using pattern matching with show command

Selected portions of the output are displayed, depending on the parameters chosen.

Syntax:

show {< *command option* > | < include | exclude | begin >} <*regular expression*>

Uses matching pattern searches to display selected portions of the output from a `show` command. There is no limit to the number of characters that can be matched. Only regular expressions are permitted; symbols such as the asterisk cannot be substituted to perform more general matching.

`include`	Only the lines that contain the matching pattern are displayed in the output.
`exclude`	Only the lines that contain the matching pattern are **not** displayed in the output.
`begin`	The display of the output begins with the line that contains the matching pattern.

Pattern matching is case-sensitive.

Following are examples of what portions of the running config file display depending on the option chosen.

Pattern matching with include option

```
switch(config)# show run | include ipv6 [1]
   ipv6 enable
```

```
   ipv6 enable
ipv6 access-list "EH-01"
switch(config)#
```

- [1]Displays only lines that contain “ipv6”.

Pattern matching with exclude option

```
switch(config)# show run | exclude ipv6 [1]

Running configuration:

; J9299A Configuration Editor; Created on release #WB.15.XX

hostname "HP Switch"
snmp-server community "notpublic" Unrestricted
vlan 1
  name "DEFAULT_VLAN"
  untagged A1-A24,B1-B20
  ip address dhcp-bootp
  no untagged B21-B24
  exit
vlan 20
  name "VLAN20"
  untagged B21-B24
  no ip address
  exit
policy qos "michael"
  exit
  sequence 10 deny tcp 2001:db8:255::/48 2001:db8:125::/48
  exit
no autorun
password manager
```

- [1]Displays all lines that do not contain “ipv6”.

Pattern matching with begin option

```
switch(config)# show run | begin ipv6 [1]
   ipv6 enable
   no untagged 21-24
   exit
vlan 20
   name "VLAN20"
   untagged 21-24
   ipv6 enable
   no ip address
   exit
policy qos "michael"
   exit
ipv6 access-list "EH-01"
   sequence 10 deny tcp 2001:db8:255::/48 2001:db8:125::/48
   exit
no autorun
password manager
```

- [1]Displays the running config beginning at the first line that contains “ipv6”.

The following is an Example: of the `show arp` command output, and then the output displayed when the `include` option has the IP address of `15.255.128.1` as the regular expression.

The show arp command and pattern matching with the include option

```
switch(config)# show arp

 IP ARP table

  IP Address      MAC Address    Type    Port
  -------------   -------------- ------- ----
  15.255.128.1    00000c-07ac00  dynamic B1
  15.255.131.19   00a0c9-b1503d  dynamic
  15.255.133.150  000bcd-3cbeec  dynamic B1


switch(config)# show arp | include 15.255.128.1
  15.255.128.1    00000c-07ac00  dynamic B1
```

Displaying the information you need to diagnose problems

Use the following commands in a troubleshooting session to more accurately display the information you need to diagnose a problem.

Syntax:

alias

Creates a shortcut alias name for commonly used commands and command options.

Syntax:

kill

Terminates a currently running, remote troubleshooting session. Use the `show ip ssh command` to list the current management sessions.

Syntax:

[no] page

Toggles the paging mode for `show` commands between continuous listing and per-page listing.

Syntax:

repeat

Repeatedly executes one or more commands so that you can see the results of multiple commands displayed over a period of time. To halt the command execution, press any key on the keyboard.

Syntax:

setup

Displays the Switch Setup screen from the menu interface.

Restoring the factory-default configuration

As part of your troubleshooting process, it may become necessary to return the switch configuration to the factory default settings. This process:

- Momentarily interrupts the switch operation
- Clears any passwords
- Clears the console Event Log
- Resets the network counters to zero
- Performs a complete self test
- Reboots the switch into its factory default configuration, including deleting an IP address

There are two methods for resetting to the factory-default configuration:

- CLI
- `Clear`/`Reset` button combination

Hewlett Packard Enterprise recommends that you save your configuration to a TFTP server before resetting the switch to its factory-default configuration. You can also save your configuration via Xmodem to a directly connected PC.

Resetting to the factory-default configuration

Using the CLI

This command operates at any level **except** the Operator level.

Syntax:

erase startup-configuration

Deletes the startup-config file in flash so that the switch will reboot with its factory-default configuration.

The `erase startup-config` command does not clear passwords unless `include-credentials` has been set, at which time this command does erase username/password information and any other credentials stored in the config file. For more information, see the section on "Saving Security Credentials in a Config File" in the access security guide for your switch.

Using Clear/Reset

Procedure

1. Using pointed objects, simultaneously press both the `Reset` and `Clear` buttons on the front of the switch.
2. Continue to press the `Clear` button while releasing the `Reset` button.
3. When the Self Test LED begins to flash, release the `Clear` button.

   The switch then completes its self test and begins operating with the configuration restored to the factory default settings.

Restoring a flash image

The switch can lose its operating system if either the primary or secondary flash image location is empty or contains a corrupted OS file and an operator uses the `erase flash` command to erase a good OS image file from the opposite flash location.

Recovering from an empty or corrupted flash state

Use the switch's console serial port to connect to a workstation or laptop computer that has the following:

- A terminal emulator program with Xmodem capability, such as the HyperTerminal program included in Windows PC software.
- A copy of a good OS image file for the switch

The following procedure requires the use of Xmodem and copies an OS image into primary flash only.

This procedure assumes you are using HyperTerminal as your terminal emulator. If you use a different terminal emulator, you may need to adapt this procedure to the operation of your particular emulator.

1. Start the terminal emulator program.

   Ensure that the terminal program is configured as follows:

   - Baud rate: 9600
   - No parity
   - 8 Bits
   - 1 stop bit
   - No flow control
2. Use the `Reset` button to reset the switch.

   The following prompt should then appear in the terminal emulator:

   ```
   Enter h or ? for help.

   =>
   ```
3. Because the OS file is large, you can increase the speed of the download by changing the switch console and terminal emulator baud rates to a high speed. For Example:

   a. Change the switch baud rate to 115,200 Bps.

   ```
   => sp 115200
   ```

   b. Change the terminal emulator baud rate to match the switch speed:

      I. In HyperTerminal, select **Call|Disconnect**.
      II. Select **File|Properties**.
      III. Click on **Configure**.
      IV. Change the baud rate to **115200**.
      V. Click on **[OK]**, then in the next window, click on **[OK]** again.
      VI. Select **Call|Connect**.
      VII. Press **[Enter]** one or more times to display the => prompt.
4. Start the Console Download utility by entering `do` at the =prompt and pressing **[Enter]**:

   ```
   => do
   ```
5. You then see this prompt:

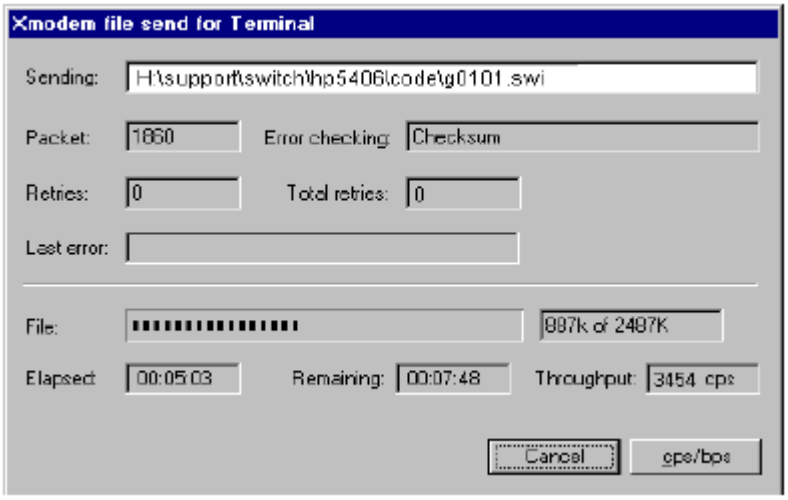
   ```
   You have invoked the console download utility.
   Do you wish to continue? (Y/N)>_
   ```
6. At the above prompt:

   a. Enter **y** (for Yes)
   b. Select **Transfer|File** in HyperTerminal.

c. Enter the appropriate filename and path for the OS image.
d. Select the **Xmodem** protocol (and not the 1k Xmodem protocol).
e. Click on **[Send]**.

If you are using HyperTerminal, you will see a screen similar to the following to indicate that the download is in progress:

Figure 117: *Example: of Xmodem download in progress*



When the download completes, the switch reboots from primary flash using the OS image you downloaded in the preceding steps, plus the most recent startup-config file.

DNS resolver

The domain name system (DNS) resolver is designed for use in local network domains, where it enables the use of a host name or fully qualified domain name with DNS-compatible switch CLI commands.

DNS operation supports both IPv4 and IPv6 DNS resolution and multiple, prioritized DNS servers. (For information on IPv6 DNS resolution, see the latest IPv6 configuration guide for your switch.)

Basic operation

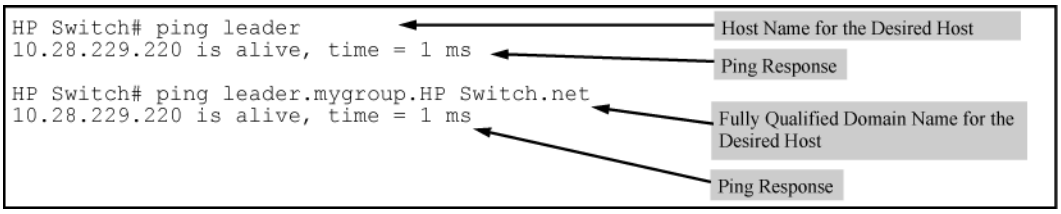
- When the switch is configured with only the IP address of a DNS server available to the switch, a DNS-compatible command, executed with a fully qualified domain name, can reach a device found in any domain accessible through the configured DNS server.
- When the switch is configured with both of the following:
  - The IP address of a DNS server available to the switch
  - The domain suffix of a domain available to the configured DNS serverthen:
  - A DNS-compatible command that includes the host name of a device in the same domain as the configured domain suffix can reach that device.
  - A DNS-compatible command that includes a fully qualified domain name can reach a device in any domain that is available to the configured DNS server.

Example:

Suppose the switch is configured with the domain suffix `mygroup.HP Switch.net` and the IP address for an accessible DNS server. If an operator wants to use the switch to ping a target host in this domain by using the

DNS name "leader" (assigned by a DNS server to an IP address used in that domain), the operator can use either of the following commands:

Figure 118: *Example: of using either a host name or a fully qualified domain name*



In the proceeding Example:, if the DNS server's IP address is configured on the switch, but a domain suffix is either not configured or is configured for a different domain than the target host, the fully qualified domain name **must** be used.

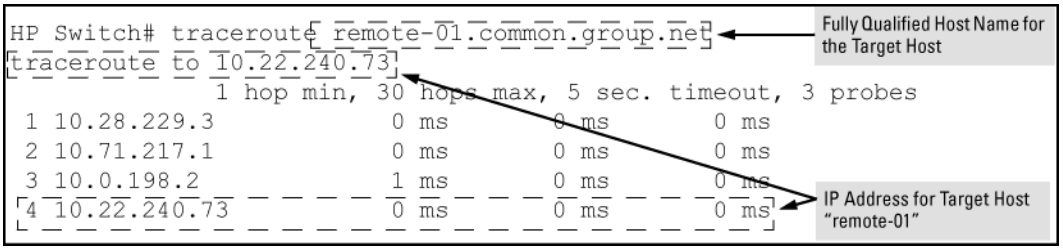
Note that if the target host is in a domain **other than** the domain configured on the switch:

- The host's domain must be reachable from the switch. This requires that the DNS server for the switch must be able to communicate with the DNS servers in the path to the domain in which the target host operates.
- The fully qualified domain name must be used, and the domain suffix must correspond to the domain in which the target host operates, regardless of the domain suffix configured in the switch.

Example:

Suppose the switch is configured with the domain suffix `mygroup.HP Switch.net` and the IP address for an accessible DNS server in this same domain. This time, the operator wants to use the switch to trace the route to a host named "remote-01" in a different domain named `common.group.net`. Assuming this second domain is accessible to the DNS server already configured on the switch, a `traceroute` command using the target's fully qualified DNS name should succeed.

Figure 119: *Example: using the fully qualified domain name for an accessible target in another domain*



Configuring and using DNS resolution with DNS-compatible commands

The DNS-compatible commands include `ping` and `traceroute`.)

Procedure

1. Determine the following:
   a. The IP address for a DNS server operating in a domain in your network.
   b. The priority (1 to 3) of the selected server, relative to other DNS servers in the domain.
   c. The domain name for an accessible domain in which there are hosts you want to reach with a DNS-compatible command. (This is the domain suffix in the fully qualified domain name for a given host operating in the selected domain. See **Basic operation** on page 484.) Note that if a domain suffix is not configured, fully qualified domain names can be used to resolve DNS-compatible commands.
   d. The host names assigned to target IP addresses in the DNS server for the specified domain.
2. Use the data from the first three bullets in step1 to configure the DNS entry on the switch.
3. Use a DNS-compatible command with the host name to reach the target devices.

Configuring a DNS entry

The switch allows up to two DNS server entries (IP addresses for DNS servers). One domain suffix can also be configured to support resolution of DNS names in that domain by using a host name only. Including the domain suffix enables the use of DNS-compatible commands with a target's host name instead of the target's fully qualified domain name.

Syntax:

[no] ip dns server-address priority <1-3> <*ip-addr*>

Configures the access priority and IP address of a DNS server accessible to the switch. These settings specify:

- The relative priority of the DNS server when multiple servers are configured
- The IP address of the DNS server

These settings must be configured before a DNS-compatible command can be executed with host name criteria.

The switch supports two prioritized DNS server entries. Configuring another IP address for a priority that has already been assigned to an IP address is not allowed.

To replace one IP address at a given priority level with another address having the same priority, you must first use the `no` form of the command to remove the unwanted address. Also, only one instance of a given server address is allowed in the server list. Attempting to enter a duplicate of an existing entry at a different priority level is not allowed .

To change the priority of an existing server address, use the `no` form of the command to remove the entry, then re-enter the address with the new priority.

The `no` form of the command replaces the configured IP address with the null setting. (Default: null)

Syntax:

[no] ip dns domain-name <*domain-name-suffix*>

This optional DNS command configures the domain suffix that is automatically appended to the host name entered with a DNS-compatible command. When the domain suffix and the IP address for a DNS server that can access that domain are both configured on the switch, you can execute a DNS-compatible command using only the host name of the desired target. (For an Example:, see **Example: of using either a host name or a fully qualified domain name**.) In either of the following two instances, you must manually provide the domain identification by using a fully qualified DNS name with a DNS-compatible command:

- If the DNS server IP address is configured on the switch, but the domain suffix is not configured (null).
- The domain suffix configured on the switch is not the domain in which the target host exists.

The switch supports one domain suffix entry and three DNS server IP address entries. (See the preceding command description.)

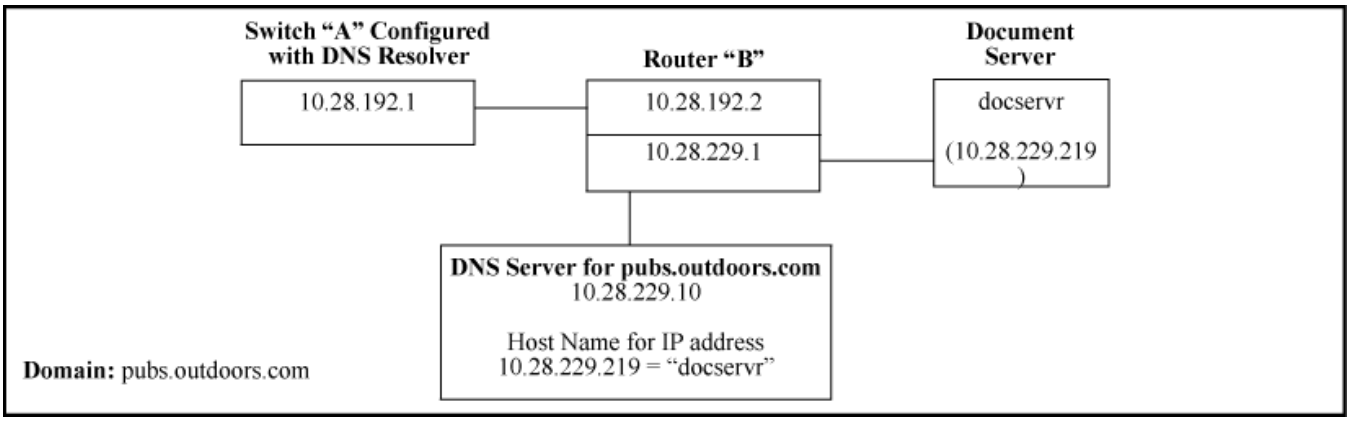
The `no` form of the command replaces the configured domain suffix with the null setting. (Default: null)

Using DNS names with ping and traceroute: Example:

In the network illustrated in **Figure 120: Example: network domain** on page 487, the switch at 10.28.192.1 is configured to use DNS names for DNS-compatible commands in the **pubs.outdoors.com** domain. The DNS

server has been configured to assign the host name **docservr** to the IP address used by the document server (10.28.229.219).

Figure 120: *Example: network domain*



Configuring switch "A" with the domain name and the IP address of a DNS server for the domain enables the switch to use host names assigned to IP addresses in the domain to perform `ping` and `traceroute` actions on the devices in the domain. To summarize:

Entity	Identity
DNS server IP address	10.28.229.10
Domain name (and domain suffix for hosts in the domain)	pubs.outdoors.com
Host name assigned to 10.28.229.219 by the DNS server	docservr
Fully qualified domain name for the IP address used by the document server (10.28.229.219)	docservr.pubs.outdoors.com
Switch IP address	10.28.192.1
Document server IP address	10.28.229.219

With the above already configured, the following commands enable a DNS-compatible command with the host name `docserver` to reach the document server at 10.28.229.219.

Configuring switch "A" in Example: network domain to support DNS resolution

```
switch(config)# ip dns server-address 10.28.229.10
switch(config)# ip dns domain-name pbs.outdoors.com
```

`Ping` and `traceroute` execution for the network in Example: network domain

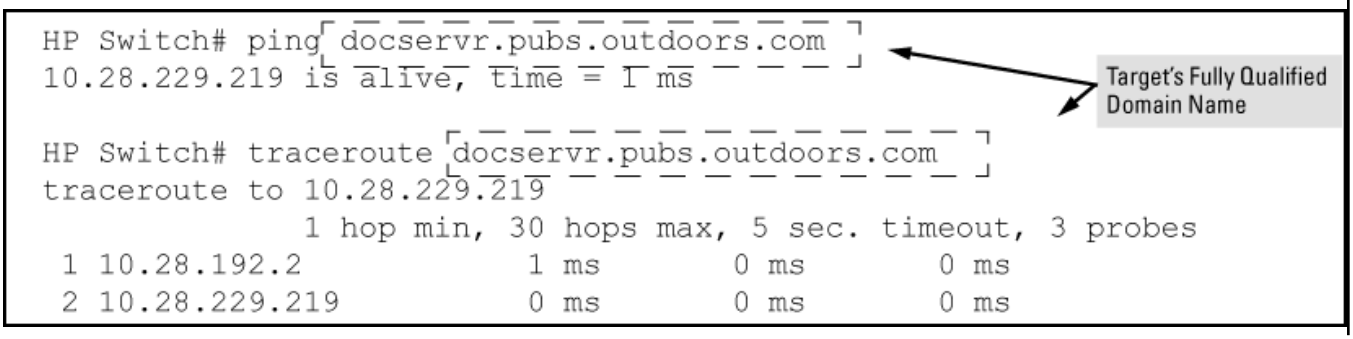
```
switch(config)# ping docservr
10.28.229.219 is alive, time = 1 ms

switch# traceroute docservr
traceroute to 10.28.229.219
              1 hop min, 30 hops max, 5 sec. timeout, 3 probes
```

```
 1 10.28.192.2 [1]            1 ms        0 ms        0 ms
 2 10.28.229.219 [2]          0 ms        0 ms        0 ms
```

- [1]First-Hop Router (“B”)
- [2]Traceroute Target

As mentioned under the following example, if the DNS entry configured in the switch does not include the domain suffix for the desired target, you must use the target host's fully qualified domain name with DNS-compatible commands. For example, using the document server in **Figure 120: Example: network domain** on page 487 as a target:

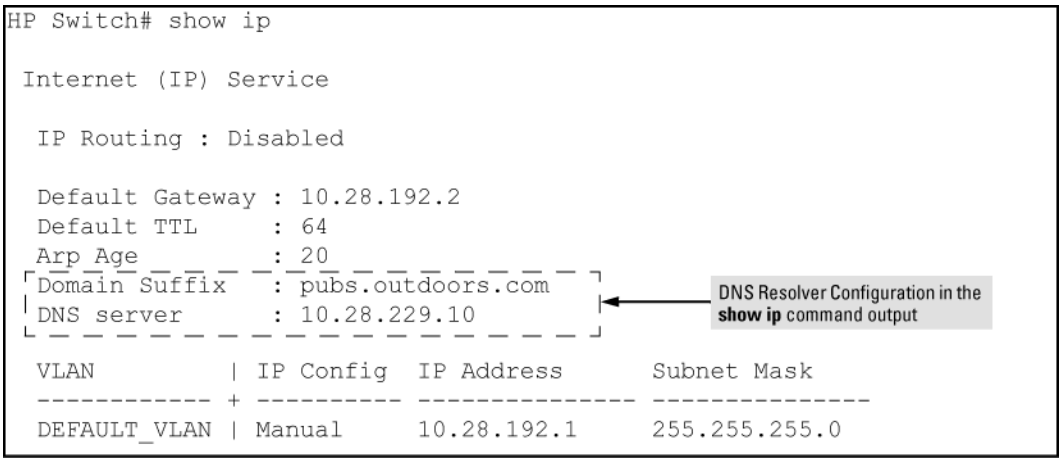
Figure 121: *Example: of `ping` and `traceroute` execution when only the DNS server IP address is configured*



Viewing the current DNS configuration

The `show ip` command displays the current domain suffix and the IP address of the highest priority DNS server configured on the switch, along with other IP configuration information. If the switch configuration currently includes a non-default (non-null) DNS entry, it will also appear in the `show run` command output.

Figure 122: *Example: of viewing the current DNS configuration*



Operating notes

- Configuring another IP address for a priority that has already been assigned to an IP address is not allowed. To replace one IP address at a given priority level with another address having the same priority, you must first use the no form of the command to remove the unwanted address. Also, only one instance of a given server address is allowed in the server list. Attempting to enter a duplicate of an existing entry at a different priority level is not allowed. To change the priority of an existing server address, use the no form of the command to remove the entry, then re-enter the address with the new priority.
- To change the position of an address already configured with priority **x**, you must first use `no ip dns server-address priority x <ip-addr>` to remove the address from the configuration, then use `ip dns server-address priority <ip-addr>` to reconfigure the address with the new priority. Also, if the

priority to which you want to move an address is already used in the configuration for another address, you must first use the `no` form of the command to remove the current address from the target priority.

- The DNS servers and domain configured on the switch must be accessible to the switch, but it is not necessary for any intermediate devices between the switch and the DNS server to be configured to support DNS operation.
- When multiple DNS servers are configured on the switch, they can reside in the same domain or different domains.
- A DNS configuration must include the IP address for a DNS server that is able to resolve host names for the desired domain. If a DNS server has limited knowledge of other domains, its ability to resolve DNS-compatible command requests is also limited.
- If the DNS configuration includes a DNS server IP address but does not also include a domain suffix, then any DNS-compatible commands should include the target host's fully qualified domain name.
- Switch-Initiated DNS packets go out through theVLAN having the best route to the DNS server, even if aManagement VLAN has been configured.
- The DNS server address must be manually input. It is not automatically determined viaDHCP.

Event Log messages

Please see the *Event Log Message Reference Guide* for information about Event Log messages.

Locating a switch (Locator LED)

To locate where a particular switch is physically installed, use the `chassislocate` command to activate the blue Locator LED on the switch's front panel.

Syntax:

chassislocate [blink | on | off]

Locates a switch by using the blue Locate LED on the front panel.

`blink <1-1440>`	Blinks the chassis Locate LED for a specified number of minutes (Default: 30 minutes).
`on <1-1440>`	Turns the chassis Locate LED on for a specified number of minutes (Default: 30 minutes).
`off`	Turns the chassis Locate LED off.

Locating a switch with the `chassislocate` command

```
switch(config)# chassislocate
 blink <1-1440>       Blink the chassis locate led (default 30 minutes).
 off                  Turn the chassis locate led off.
 on <1-1440>          Turn the chassis locate led on (default 30 minutes).
switch(config)# chassislocate
```

For redundant management systems, if the active management module failsover, the Locator LED does not remain lit.

Overview

The switch assigns MAC addresses in these areas:

- For management functions, one Base MAC address is assigned to the default VLAN (VID = 1). (All VLANs on the switches covered in this guide use the same MAC address.)
- For internal switch operations: One MAC address per port (see **Viewing the port and VLAN MAC addresses** on page 492.

MAC addresses are assigned at the factory. The switch automatically implements these addresses for VLANs and ports as they are added to the switch.

The switch's base MAC address is also printed on a label affixed to the switch.

Determining MAC addresses

Use the CLI to view the switch's port MAC addresses in hexadecimal format.

Use the menu interface to view the switch's base MAC address and the MAC address assigned to any VLAN you have configured on the switch. (The same MAC address is assigned to VLAN1 and all other VLANs configured on the switch.)

The switch's base MAC address is used for the default VLAN (VID =1) that is always available on the switch. This is true for dynamic VLANs as well; the base MAC address is the same across all VLANs.

Viewing the MAC addresses of connected devices

Syntax:

show mac-address [*port-list* | *mac-addr* | vlan < *vid*>]

Lists the MAC addresses of the devices the switch has detected, along with the number of the specific port on which each MAC address was detected.

[*port-list*]	Lists the MAC addresses of the devices the switch has detected, on the specified ports.
[*mac-addr*]	Lists the port on which the switch detects the specified MAC address.Returns the following message if the specified MAC address is not detected on any port in the switch: `MAC address <mac-addr> not found.`
[vlan <*vid*>]	Lists the MAC addresses of the devices the switch has detected on ports belonging to the specified VLAN, along with the number of the specific port on which each MAC address was detected.

Viewing the switch's MAC address assignments for VLANs configured on the switch

The Management Address Information screen lists the MAC addresses for:

- Base switch (default VLAN; VID=1)
- Any additional VLANs configured on the switch.

Also, the Base MAC address appears on a label on the back of the switch.

The Base MAC address is used by the first (default) VLAN in the switch. This is usually the VLAN named "DEFAULT_VLAN" unless the name has been changed (by using the VLAN Names screen). On the switches covered in this guide, the VID (VLAN identification number) for the default VLAN is always "1," **and cannot be changed**.

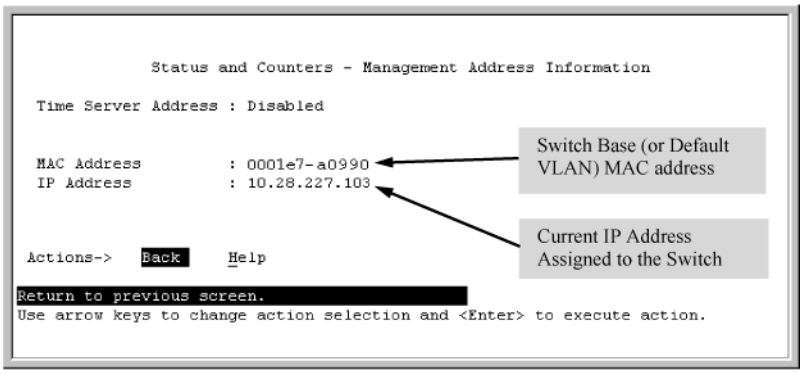
- From the Main Menu, select

  1. Status and Counters

  2. Switch Management Address Information

If the switch has only the default VLAN, the following screen appears. If the switch has multiple static VLANs, each is listed with its address data.

Figure 123: *Example: of the Management Address Information screen*



Viewing the port and VLAN MAC addresses

The MAC address assigned to each switch port is used internally by such features as Flow Control and the spanning-tree protocol. Using the `walkmib` command to determine the MAC address assignments for individual ports can sometimes be useful when diagnosing switch operation.

This procedure displays the MAC addresses for all ports and existing VLANs in the switch, regardless of which VLAN you select.

Procedure

1. If the switch is at the CLI Operator level, use the `enable` command to enter the Manager level of the CLI.
2. Enter the following command to display the MAC address for each port on the switch:

```
switch# walkmib ifPhysAddress
```

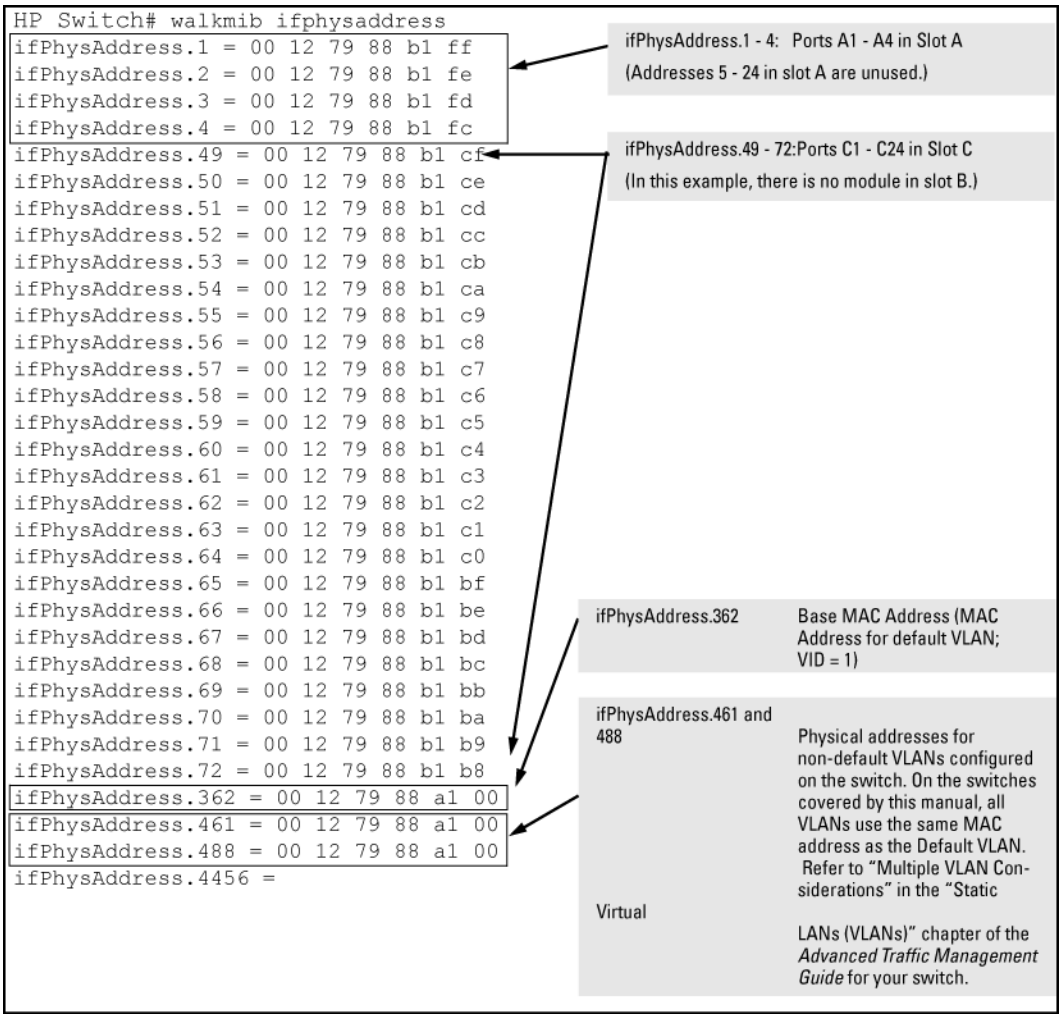
(The above command is not case-sensitive.)

Example:

A switch with the following module configuration shows MAC address assignments similar to those shown in the example below:

- A 4-port module in slot A, a 24-port module in slot C, and no modules in slots B and D
- Two non-default VLANs configured

Figure 124: *Example: of Port MAC address assignments on a switch*



Job Scheduler

The Job Scheduler feature enables the user to schedule commands or jobs on the switch for one time or multiple times. This is similar in concept to the UNIX ‘cron’ utility. The user can schedule any CLI command that the user would otherwise enter interactively. This includes commands to enable or disable ports, LEDs, and Power-Over-Ethernet. Jobs can also be scheduled to be triggered by certain pre-defined events such as switch reboot. The only major restriction on commands scheduled is that, it should not prompt/ask for any user inputs.

Commands

Job at | delay | enable | disable

Set schedule jobs using the options and set the count for the number of times the job is repeated.

Syntax

job *JOB NAME* at | delay | enable | disable

Description

Schedule a command to run automatically. Jobs can be scheduled to run once, multiple times on a recurring basis, or after certain events such as reboots. All commands run with manager privilege in configuration context.

The [no] form of the command deletes a scheduled job.

By default, jobs will be repeated an infinite number of times.

Restrictions

Jobs scheduled at any event will not be counted.

Jobs that are scheduled at the event “reboot” will not work in some multi management switches.

Range

- <1-1000>: is the value range for the `count` option.
- ([[DD:]HH:]MM): is the format used for the specific delay.

Options

count	Specify the number of times the job should run.
delay	Specify the delay before running the job.
enable	Enable a job that is disabled or expired.
disable	Disable a job. By default, a job is enabled.

Usage

job <*JOB NAME*> at <*([DD:]HH:]MM on <WEEKDAY-LIST>)*> config-save <*COMMAND*> count <*1-1000*>

job <*JOB NAME*> at <*[HH:]MM on [MM/]DD*> config-save <*COMMAND*> count <*1-1000*>

job <*JOB NAME*> at <*EVENT*> config-save <*COMMAND*>

job <*JOB NAME*> delay <*([DD:]HH:]MM*> config-save <*COMMAND*> count <*1-1000*>

job <*JOB NAME*> enable | disable

[no] job <*JOB NAME*>

Show job

Syntax

show job

Description

Show the jobs scheduled.

Show job

```
switch# show job

 Job Scheduler Status and Configuration

  Scheduler Status : Waiting for the system time to be set

                     Event or            Repeat  Save
  Name               Time                Count   Cfg  Command
  ------------------ ------------------- ------- ---- ------------
  Burrrrrrrrrrr...   reboot              --    Yes chassislocate blink
  baz                reboot              --     No  show time
  foo                17:00 SxTWTxS       --     No  savepower led
  a1                 12:00               2      Yes sh time
  a2                 Every 2:14:30 days  75     Yes vlan 3
  a3                 Every 00:00:25 days 1      No  vlan 4
```

Caution

The scheduler does not run until the system time is set.

Show job <Name>

Syntax

show job *JOB NAME*

Description

Show the job by name.

Show job <JOB NAME>

```
switch# show job a1

Job Information

Job Name    : a1
Runs At     : 01:24
Config Save : No
Repeat Count: --
Job Status  : Enabled
Run Count   : 1
Error Count : 0
Command     : show time
Job Status  : Enabled

 Output from Last Run
 --------------------
 Tue Dec 15 01:24:00 2015


switch# show job a2

Job Information

Job Name    : a2
Runs At     : Every 2:14:30 days
Config Save : Yes
Repeat Count: 75
Run Count   : 0
Error Count : 0
Command     : vlan 3
Job Status  : Disabled

switch# show job foo


Job Information

Job Name    : foo
Runs At     : 17:00 SxTWTxS
Config Save : Yes
Repeat Count: --
Run Count   : 0
Error Count : 0
Command     : savepower led
Job Status  : Enabled
```

HPE's Virtual Technician is a set of tools aimed at aiding network switch administrators in diagnosing and caring for their networks. VT provides tools for switch diagnoses when faced with unforeseen issues.

To improve the Virtual Technician features of our devices, HPE has added the following tools:

- Cisco Discovery Protocol
- Enabling Debug tracing for MOCANA code
- User diagnostic crash via front panel security button
- User diagnostic crash via the serial console

Cisco Discovery Protocol (CDP)

Show cdp traffic

Syntax

show cdp traffic

Description

Displays the number of Cisco Discovery Protocol (CDP) packets transmitted, received and dropped.

CDP frame Statistics

```
Port No|Transmitted Frames|Received Frames|Discarded Frames|Error Frames
-------  ----------------  --------------   ---------------  ---------
A1               46                  26             6           7
A2               30                  35             7           9
A3              120                 420             670       670
```

Clear cdp counters

Syntax

clear cdp counters

Description

Allows a user to clear CDP statistics.

Clear cdp counters

```
Port No|Transmitted Frames|Received Frames|Discarded Frames|Error Frames
-------  ----------------  --------------   ---------------  ---------
A1           46                  26               6             7
A2           30                  35               7             9
A3          120                 420              670           670
```

Enable/Disable debug tracing for MOCANA code

Debug security

Syntax

debug security ssl

Description

Enables the debug tracing for MOCANA code.

Use the [no] parameter to disable debug tracing.

ssl Display all SSL messages.

User diagnostic crash via Front Panel Security (FPS) button

Allows the switch's front panel **Clear** button to manually initiate a diagnostic reset. In the case of an application hang, this feature allows you to perform reliable diagnostics by debugging via the front panel **Clear** button. Diagnostic reset is controlled via Front Panel Security (FPS) options.

Front panel security password-clear

From the configure context:

Syntax

[no] front-panel-security password-clear *<RESET-ON-CLEAR>* | factory-reset | password-recovery | diagnostic-reset *<CLEAR-BUTTON | SERIAL-CONSOLE>*

Description

Enable the ability to clear the password(s) and/or configuration via the front panel buttons.

[no] disables the password clear option.

Parameters

- If `password-clear` is disabled, the password(s) cannot be reset using the clear button on the front panel of the device.
- If `factory-reset` is disabled, the configuration/password(s) can not be reset using the clear and reset button combination at boot time.
- When `password-recovery` is enabled (and the front panel buttons disabled), a lost password can be recovered by contacting HPE customer support.
- When `password-recovery` is disabled, there is no way to access a device after losing a password with the front panel buttons disabled.
- If `diagnostic-reset` is disabled, the user cannot perform a diagnostic switch reset on those rare events where the switch becomes unresponsive to user input because of unknown reason(s).
- If `diagnostic-reset` is enabled, the user can perform a diagnostic hard reset which will capture valuable diagnostic data and reset the switch.

Options

factory-reset	Enable/Disable factory-reset ability.
password-clear	Enable/Disable password clear.
password-recovery	Enable/Disable password recovery.
diagnostic-reset	Enable/Disable diagnostic reset.

Front-panel-security diagnostic-reset

From the configure context:

Syntax

front-panel-security diagnostic-reset <*CLEAR-BUTTON* | *SERIAL-CONSOLE*>

Description

Enables the diagnostic reset so that the switch can capture diagnostic data.

- To initiate diagnostic reset via the clear button, press the clear button for at least 30 seconds but not more than 40 seconds.
- To initiate diagnostic switch reset via the serial console, enter the diagnostic reset sequence on the serial console.

Options

Clear button	Enables the diagnostics by choosing the clear button option.
Serial console	Enables the diagnostics by choosing the serial console option.

[no] front-panel-security diagnostic-reset

From the configure context:

Syntax

[no] front-panel-security diagnostic-reset

Description

Disables the diagnostic reset feature so that the user is prevented from capturing diagnostic data and performing a diagnostic reset on the switch. Both the sub-options `reset-via-serial-console` and `reset-via-clear-button` will be disabled. This is necessary if the switch becomes unresponsive (hangs) for unknown reasons.

No front-panel-security diagnostic-reset

```
no front-panel-security diagnostic-reset

Clear Password       - Enabled
Reset-on-clear     - Disabled
Factory Reset        - Enabled
Password Recovery    - Enabled
Diagnostic Reset     - Disabled
```

CAUTION

Disabling the diagnostic reset prevents the switch from capturing diagnostic data on those rare events where the switch becomes unresponsive to user input because of unknown reasons. Ensure that you are familiar with the front panel security options before proceeding.

Front-panel-security diagnostic-reset clear-button

From the configure context:

Syntax

front-panel-security diagnostic-reset clear-button

Description

This command will enable diagnostic-reset via clear button. The user will be allowed to perform diagnostic reset by depressing the clear button for 30 seconds and not more than 40 seconds.

Front-panel-security diagnostic-rest clear-button

```
front-panel-security diagnostic-rest clear-button

Diagnostic Reset     - Enabled
clear-button         - Enabled
serial-console       -Disabled
```

CAUTION

Disabling the diagnostic reset prevents the switch from capturing diagnostic data on those rare events where the switch becomes unresponsive to user input because of unknown reasons. Ensure that you are familiar with the front panel security options before proceeding.

[No] front-panel-security diagnostic-reset clear-button

From the configure context:

Syntax

[no] front-panel-security diagnostic-reset clear-button

Description

Disables the diagnostic-reset via clear button.

CAUTION

Disabling the diagnostic reset prevents the switch from capturing diagnostic data on those rare events where the switch becomes unresponsive to user input because of unknown reasons. Ensure that you are familiar with the front panel security options before proceeding.

Show front-panel-security

Syntax

show front-panel-security

Options

Show front-panel-security

```
Clear Password    - Enabled
Reset -on-clear   - Disabled
Factory Reset     - Enabled
Password Recovery - Enabled
Diagnostic Reset  - Enabled
```

By default, user initiated diagnostic reset is enabled.

Diagnostic table

To accomplish this	Do this	Result
Soft Reset (Standalone switch)	Press and release the Reset button	The switch operating system is cleared gracefully (such as data transfer completion, temporary error conditions are cleared), then reboots and runs self tests.
Hard Reset (Standalone switch)	Press and hold the Reset button for more than 5 seconds (until all LEDs turn on), then release.	The switch reboots, similar to a power cycle. A hard reset is used, for example, when the switch CPU is in an unknown state or not responding.
Delete console and management access passwords	Press Clear for at least one second, but not longer than 5 seconds.	The switch deletes all access password.
Restore the factory default configuration	**1.** Press Clear and Reset simultaneously. **2.** While continuing to press Clear, release Reset. **3.** When the Test LED begins blinking (after approximately 25 seconds), release Clear.	The switch removes all configuration changes, restores the factory default configuration, and runs self test.

Table Continued

To accomplish this	Do this	Result
Diagnostic reset	1. Press Clear to 30–40 seconds. 2. When the test LED begins blinking (approximately after 30 seconds), release Clear. NOTE: Releasing the Clear button when TEST LED is not blinking (approximately after 40 seconds) will not honor the diagnostic reset request.	This initiates diagnostic reset, collects diagnostic information, and reboots the switch.

NOTE: These buttons are provided for the user's convenience. If switch security is a concern, ensure that the switch is installed in a secure location, such as a locked writing closet. To disable the buttons, use the `front-panel-security` command.

Validation rules

Validation	Error
Extra 'token' passed after diagnostic-reset.	Invalid input: <token>.

FPS Error Log

Event	Message
RMON_BOOT_CRASH_RECORD1	Diagnostic reset sequence detected on serial console; user has initiated diagnostic reset. On detection on local serial
RMON_BOOT_CRASH_RECORD1	SMM: Diagnostic reset sequence detected on serial console; user has initiated diagnostic reset. On detection on SMM serial console and signaled to AMM
RMON_BOOT_CRASH_RECORD1	STKM: Diagnostic reset sequence detected on serial console; user has initiated diagnostic reset. On detection on non-commander serial console and signaled to commander
RMON_BOOT_CRASH_RECORD1	User has initiated diagnostic reset via the serial console. Sw_panic() message

Table Continued

Event	Message
RMON_BOOT_CRASH_RECORD1	SMM: User has initiated diagnostic reset via the serial console. Sw_panic() message when triggered via SMM
RMON_BOOT_CRASH_RECORD1	STKM: User has initiated diagnostic reset via the serial console. Sw_panic() message when triggered via non-commander
Console print	STKM: HA Sync in progress; user initiated diagnostic request via the serial console rejected. Retry after sometime. Printed on the device console. When standby is in sync state, we don't want to crash the commander. So we report to the user to retry later
Console print	STKM: Member is booting; user initiated diagnostic request via the serial console rejected. Retry after sometime. Printed on the device console. When the member is till booting, it doesn't have the commander member number, thus we can't issue UIDC on the commander. So we report to the user to retry later.

User initiated diagnostic crash via the serial console

Remotely triggers a diagnostic reset of the switch via a serial console. This reset reboots the switch and collects diagnostic data for debugging an application hang, a system hang or any other rare occurrence. Diagnostic reset is controlled via FPS options.

The serial sequence to initiate the User Initiated Diagnostic Reset via Serial console is Ctrl+S, Ctrl+T, Ctrl+Q, Ctrl +T, Ctrl+S.

Front-panel-security diagnostic-reset serial-console

In the configure context:

Syntax

front-panel-security diagnostic-reset serial-console

Enables the diagnostic-reset via serial console. Allows the user to perform diagnostic reset by keying-in diagnostic reset sequence.

Front-panel-security diagnostic-reset serial-console

```
front-panel-security diagnostic-reset serial-console
```

```
Diagnostic Reset     - Enabled
clear-button       - Disabled
serial-console     - Enabled
```

[No] front-panel-security diagnostic-reset serial-console

In the configure context:

Syntax

[no] front-panel-security diagnostic-reset serial-console

Description

Disables the diagnostic-reset via serial console.

No front-panel-security diagnostic-reset serial-console

```
no front-panel-security diagnostic-reset serial-console

Diagnostic Reset     - Disabled
```

Disabling the diagnostic reset prevents the switch from capturing diagnostic data on those rare events where the switch becomes unresponsive to user input because of unknown reasons. Ensure that you are familiar with the front panel security options before proceeding.

Serial console error messages

Error	Message
RMON_BOOT_CRASH_RECORD1	Diagnostic reset sequence detected on serial console; user has initiated diagnostic reset.
RMON_BOOT_CRASH_RECORD1	SMM: Diagnostic reset sequence detected on serial console; user has initiated diagnostic reset.
RMON_BOOT_CRASH_RECORD1	STKM: Diagnostic reset sequence detected on serial console; user has initiated diagnostic reset.
RMON_BOOT_CRASH_RECORD1	User has initiated diagnostic reset via the serial console.
RMON_BOOT_CRASH_RECORD1	SMM: User has initiated diagnostic reset via the serial console.
RMON_BOOT_CRASH_RECORD1	STKM: User has initiated diagnostic reset via the serial console.

Table Continued

Error	Message
Console print	STKM: HA Sync in progress; user initiated diagnostic request via the serial console rejected. Retry after sometime.
Console print	STKM: Member is booting; user initiated diagnostic request via the serial console rejected. Retry after sometime.

IP Service Level Agreement (IP SLA) is a feature that helps administrators collect information about network performance in real time. With increasing pressure on maintaining agreed-upon Service Level Agreements on Enterprises and ISPs alike, the IP SLA serves as a useful tool.

Any IP SLA test involves a source node and a destination node. For all discussions in this document, the source will always be an HP switch with IP SLA support. A destination can, in most cases, be any IP-enabled device. For some SLA types that expect a nonstandard response to a test packet, an “SLA responder” must be configured. An “SLA responder” is nothing but an HP switch with IP SLA configurations on it that enable it to respond to the test packet.

The IP SLA feature provides:

- Application-aware monitoring that simulates actual protocol packets.
- Predictable measures that aid in ease of deployment and help with assessment of existing network performance.
- Accurate measures of delay and packet loss for time-sensitive applications.
- End-to-end measurements to represent actual user experience.

We support the following SLA types:

- UDP Echo, including connectivity testing of transport layer (UDP) services, Round-Trip-Time (RTT) measurement, one-way delay, and packet loss details.
- ICMP Echo, including connectivity testing, RTT measurement, and packet loss details.
- TCP Connect, including connectivity testing of transport layer (TCP) services, and handshake time measurement.

The IP SLA feature is implemented in a platform-independent manner. The following generic limitations are imposed, but are not platform-specific.

- IP SLA is not enabled for IPv6.
- IP SLA tests cannot be initiated over OOBM interfaces.
- History results for the configured IP SLAs will not be available after a switchover or a reboot.
- Maximum number of IP SLAs that can be configured.
- When there are multiple IP SLAs configured with destination as hostname, the DNS resolution happens serially. There can be a delay in sending the test probe (which will be sent only after successful DNS resolution).
- For TCP Connect SLA type, the four tuple (source IP/port, destination IP/port) must be unique.
- System clocks between the source and the responder must be synchronized with NTP if One Way Delay parameters have to be calculated for UDP Echo tests.
- Timeout for probes is 3 seconds for all SLA types and is not configurable.
- Transient spikes in RTT occur during the tests (in the source and the responder) if processor usage is high. Consider average result values over a period of time rather than point-in-time results.

Entity	Limit
Maximum number of SLAs enabled.	50
Maximum history bucket size per SLA.	50
Number of responders that can be configured.	10

Testing your IP SLA

An SLA test generally involves the following steps:

1. The source originates a test packet to the destination.
2. The destination responds to the test packet, at times embedding the needed information in the response packet.
3. Upon receiving the response, the source calculates the test results based on the timestamp, other packet parameters, and so on.
4. The source stores the results and updates the history records for the SLA.
5. The source reschedules the SLA for the next run.

For one-way delay calculations, the IP SLA sender and IP SLA responder must be NTP Time Synchronized.

Configuration commands

[no] ip-sla <ID>

Syntax

[no] ip-sla <ID>

Description

Configure the IP Service Level Agreement (SLA) parameters. The value of ID can range from 1-255.

Options

clear	Clear history records, message statistics, and threshold counters of particular SLA entry.
dhcp	Configure DHCP as the IP SLA test mechanism.
disable	Disable the IP SLA.
dns	Configure DNS as the IP SLA test mechanism.
enable	Enable the IP SLA.
history-size	Configure the number of history records to be stored for the IP SLA.
icmp-echo	Configure ICMP echo as the IP SLA test mechanism.
monitor	Configure monitoring parameters and respective threshold-action values.
schedule	Configure the start time, stop time, lifetime, and frequency of run for the IP SLA.
tcp-connect	Configure TCP connect as the IP SLA test mechanism.
tos	Configure the Type of Service value to be set in the test packet for the IP SLA.
udp-echo	Configure UDP echo as the IP SLA test mechanism.

On platforms that support Jitter and VOIP, the following options are also provided:

udp-jitter Configure UDP jitter as the IP SLA test mechanism.

udp-jitter-voip Configure UDP jitter for VoIP as the IP SLA test mechanism.

ip-sla <ID> clear

Syntax

ip-sla <ID> clear

Description

Clear history records, message statistics, and threshold counters of a particular SLA entry.

Options

records Clear history records, message statistics, and threshold counters of particular SLA entry.

[no] ip-sla <ID> history-size

Syntax

[no] ip-sla <ID> history-size

Description

Configure the number of history records to be stored for the IP SLA. The maximum supported size is 50 and the default value for history-size is 25.

[no] ip-sla <ID> icmp-echo

Syntax

[no] ip-sla <ID> icmp-echo [<IP-ADDR> | <HOST-NAME>] [source <IP-ADDR> | source-interface vlan <VLAN-ID>] [payload-size <SIZE>]

Description

Configure ICMP echo as the IP SLA test mechanism. Requires destination address/hostname and source address/vlan id for the IP SLA of ICMP-Echo SLA type.

- **payload-size**

  : Value can range from 1-1440. By default, payload-size is not set.

[no] ip-sla <ID> udp-echo

Syntax

[no] ip-sla <ID> udp-echo [destination [<IP-ADDR> | <HOST-NAME>] <PORT-NUM>] [source <IP-ADDR> | <VLAN-ID>] [payload-size <SIZE>]

Description

Configure UDP echo as the IP SLA test mechanism. Requires destination address/hostname and source address/VLAN ID for the IP SLA of UDP-Echo SLA type.

- **PORT-NUM**: Value can range from 1024–65535.
- **payload-size**: Value can range from 1-1440. By default, payload-size is not set.

[no] ip-sla <ID> tcp-connect

Syntax

[no] ip-sla <ID> tcp-connect [destination [<IP-ADDR> | <HOST-NAME>] <PORT-NUM>] [source [<IP-ADDR> | <VLAN-ID>] <PORT-NUM>]

Description

Configure TCP connect as the IP SLA test mechanism. Requires destination address/hostname and source address/VLAN ID for the IP SLA of TCP connect SLA type. The value of PORT-NUM can range from 1024-65535.

[no] ip-sla <ID> monitor threshold-config

Syntax

[no] ip-sla <ID> monitor threshold-config [rtt | srcTodstTime | dstToSrcTime] threshold-type [immediate | consecutive <COUNT>] threshold-value <UPPER-LIMIT> <LOWER-LIMIT> action-type [trap | log | trap-log | none]

Description

Set upper and lower threshold parameters.

- **threshold-type immediate**: Take action immediately when the monitored parameters cross the threshold upper limit (subsequent notifications for upper thresholds are not generated until the parameter values go lower than the configured lower threshold value).
- **threshold-type consecutive**: Take action after threshold is hit consecutively for number of times.
- **action-type**: Describes action to be taken when the upper threshold is crossed.
- **trap**: Send snmp-trap when configured threshold is hit.
- **log**: Only log the event when configured threshold is hit.
- **trap-log**: Send snmp-trap and log the event when configured threshold is hit.
- **none**: Take no action.

The command option threshold-config can be individually set for rtt, srcTodstTime, and dstToSrcTime.

[no] ip-sla <ID> monitor packet-loss

Syntax

[no] ip-sla <ID> monitor packet-loss threshold-type [immediate | consecutive <COUNT>] action-type [trap | log | trap-log | none]

Description

Configure threshold-action values when packet loss happens.

- **threshold-type immediate**: Take action immediately when the monitored parameters cross the threshold upper limit (subsequent notifications for upper thresholds are not generated until the parameter values go lower than the configured lower threshold value).
- **threshold-type consecutive**: Take action after threshold is hit consecutively for number of times.
- **action-type**: Describes action to be taken when the upper threshold is crossed.
- **trap**: Send snmp-trap when configured threshold is hit.
- **log**: Only log the event when configured threshold is hit.
- **trap-log**: Send snmp-trap and log the event when configured threshold is hit.
- **none**: Take no action.

[no] ip-sla <ID> monitor test-completion

Syntax

[no] ip-sla <ID> monitor test-completion action-type [trap | log | trap-log | none]

Description

Configure action to be taken when test gets completed.

- **trap**: Send snmp-trap when configured threshold is hit.
- **log**: Only log the event when configured threshold is hit.
- **trap-log**: Send snmp-trap and log the event when configured threshold is hit.
- **none**: Take no action.

[no] ip-sla <ID> schedule

Syntax

[no] ip-sla <ID> schedule [[now | startTime <START-TIME>] [forever | stopTime <STOP-TIME> | repetitions <NUM>] [frequency <FREQUENCY>

Description

Configure the start time, stop time, lifetime, and frequency of run for the IP SLA. The default value for the frequency of operation is 60 seconds.

[no] ip-sla <ID> tos

Syntax

[no] ip-sla <ID> tos <VALUE>

Description

Configure the Type of Service value to be set in the test packet for the IP SLA.

- **Valid values**: 0–255

[no] ip-sla responder

Syntax

[no] ip-sla responder

Description

Configure SLA responder to respond to probe packets.

- **IP address**: local interface IP address
- **port**: takes L4 port numbers.
- **SLA types supported**: udp-echo and tcp-connect.

Show commands

show ip-sla <ID>

Syntax

```
show ip-sla <ID> <TAB>
```

Description

Show IP SLA configurations.

Options

history	Show the IP SLA results history.
message-statistics	Show the IP SLA message statistics.
results	Show the IP SLA results for UDP Jitter and UDP Jitter VoIP.
aggregated-results	Show the IP SLA aggregated results for UDP Jitter and UDP Jitter VOIP.

show ip-sla <ID>

```
SLA ID: 1
Status: [Enabled | Admin-disabled | Scheduled | Expired | Running]

SLA Type: [ICMP-echo | tcp-connect | UDP-echo | DHCP | DNS | udp-jitter | voip]

Destination Hostname: www.hp.com
Destination Address : 20.0.0.2
Source Address      : 20.0.0.1
History Bucket Size : 5
TOS: 32
Schedule:
      Frequency (seconds)       : 60
      Life                      : [Forever | 144 seconds]
      Start Time                : Tue Oct 27 22:12:16 2015
      Next Scheduled Run Time   : Tue Oct 27 22:43:16 2015

Threshold-Monitor is    : Enabled
      Threshold Config: RTT
      Threshold Type  : immediate
      Upper Threshold : 500 ms
     Lower Threshold : 100 ms
     Action Type     : Trap and Log

     Threshold Config: packet-loss
     Threshold Type  : consecutive (5)
     Action Type     : Trap

     Threshold Config: test-completion
     Action Type: None
```

show ip-sla <ID> history

Syntax

show ip-sla <ID> history

Description

Show the IP SLA results history.

show ip-sla <ID> history

```
SLA ID : 1

SLA Type : UDP-Echo

Minimum RTT (ms)         : 1
Maximum RTT (ms)         : 4294967282
Average RTT (ms)         : 3
Total RTT (ms)           : 315
RTT2 (sum of RTT squared): 63681

Start Time                Status  RTT      Description
------------------------ -------- ----      ------------
Mon Jan 1 00:51:28 1990 Failed  -        DMA tail drop detected.
Mon Jan 1 00:51:30 1990 Failed  -        SLA disabled before probe response
arrived.
```

show ip-sla <ID> message-statistics

Syntax

show ip-sla <ID> message-statistics

Description

Show the IP SLA message statistics.

show ip-sla <ID> message-statistics

```
SLA ID : 1
Status : Running
SLA Type : UDP-Echo
Destination Address : 10.0.0.2
Source Address : 10.0.0.1
Destination Port : 2000
History Bucket Size : 25
Payload Size : 500
TOS : 0
Messages:
Destination Address Unreachable : 0
Probes Skipped Awaiting DNS Resolution : 0
DNS Resolution Failed : 0
No Route to Target : 0
Internal Error : 0
Local Interface is Down : 0
No Response from Target : 0
Successful Probes Sent : 3
Probe Response received : 3
Possibly Tail Dropped : 0
```

show ip-sla responder

Syntax

show ip-sla responder

Description

Show the IP SLA responder details.

show ip-sla responder

```
SLA type         : UDP-echo
Listening Address: 1.1.1.1
Listening Port   : 5555
```

show ip-sla responder statistics

Syntax

`show ip-sla responder statistics <TAB>`

Description

Show the IP SLA responder statistics details.

Options

udp-jitter	Show the IP SLA responder statistics for UDP Jitter SLA type.
udp-jitter-voip	Show the IP SLA responder statistics for UDP Jitter VoIP SLA type.

show ip-sla responder statistics

```
IP SLA Responder  : Active
Number of packets received       : 31
Number of error packets received : 0
Number of packets sent           : 0

Recent Sources :
 10.12.80.100 [07:23:49.085 UTC Sun Oct 25 2015] UDP
 10.12.80.100 [07:22:49.003 UTC Sun Oct 25 2015] TCP
 10.12.80.100 [07:20:48.717 UTC Sun Oct 25 2015] TCP
 10.12.80.100 [07:18:48.787 UTC Sun Oct 25 2015] TCP
 10.12.80.100 [07:17:48.871 UTC Sun Oct 25 2015] TCP
```

show tech ip-sla

Syntax

show tech ip-sla

Description

Display output of a predefined command sequence used by technical support.

show tech ip-sla

```
switch# sh tech ip-sla

ipslaShowTech

 ======== IP SLA show tech BEGIN ============

 GLOBALS:
 Hash Handle:                        1e7bab20
 Struct Mem Handle for hash:         1e7ba2a8
 Struct Mem Handle for SLA ID LL:    1e7c9430
 Struct Mem Handle for FD List:      1e7bd690
 FastLog Handle:                     dfabf5c
 IPSLACtrl task ID:                  1068091456
 IPSLA Sender ID:                    1068092544
 IPSLA Listener ID:                  1068091840
 Number of enabled SLA's:            1
 SLA ID List Handle:                 1ec1ffd4
 FD ID List Handle:                  0
 Ring Full Counter:                  0

 Details for SLA ID: 1


SLA ID: 1
Status: Running

SLA mechanism: ICMP-Echo

Destination address: 192.168.1.2
Source address: 192.168.1.1
History bucket size: 25
Payload size: 0
TOS: 0
Schedule:
      Frequency (seconds)       : 60
      Life                      : Forever
      Start Time                : Mon Jun 13 10:42:52 2016
      Next Scheduled Run Time   : Mon Jun 13 10:46:52 2016


Threshold-Monitor is  : Enabled
        Threshold Config     : RTT
        Threshold Type       : Immediate
        Upper Threshold      : 10
        Lower Threshold      : 2
        Action Type          : Log



SLA ID: 1
Status: Running

SLA mechanism: ICMP-Echo

Destination address: 192.168.1.2
Source address: 192.168.1.1
History bucket size: 25
Payload size: 0
TOS: 0
Messages:
```

```
       Destination address unreachable        : 0
       Probes skipped awaiting DNS resolution : 0
       DNS resolution failed                  : 0
       No route to target                     : 0
       Internal error                         : 0
       Local interface is down                : 0
       No response from target                : 0
       Successful probes sent                 : 9
       Probe response received                : 9
       Possibly tail dropped                  : 0

Count of Threshold hits:
               RTT             : 0
               packetLoss      : 0


SLA ID: 1

Minimum RTT (ms)          : 1
Maximum RTT (ms)          : 1
Average RTT (ms)          : 1
Total RTT (ms)            : 9
RTT2 (sum of RTT squared): 9

     Start Time                 Status       RTT               Description
     ----------                 ------       ---               -----------
Tue Jun 14 10:43:12 2016       Passed          1
Mon Jun 13 10:39:05 2016       Passed          1
Mon Jun 13 10:40:05 2016       Passed          1
Mon Jun 13 10:41:05 2016       Passed          1
Mon Jun 13 10:42:05 2016       Passed          1
Mon Jun 13 10:42:52 2016       Passed          1
Mon Jun 13 10:43:52 2016       Passed          1
Mon Jun 13 10:44:52 2016       Passed          1
Mon Jun 13 10:45:52 2016       Passed          1

 ICMP ID hash walk:


 ========== IP SLA show tech END ==============

 ======== IP SLA Server show tech BEGIN ============
Responder not active
IP SLA Responder: Inactive

 ======== IP SLA Server show tech END ============


=== The command has completed successfully. ===
```

Validation rules

Validation	Error/Warning/Prompt
Enabling SLA without configuring SLA type.	Cannot enable IP SLA, no valid source/destination configured.
IP address given for source or destination is multicast or broadcast.	Invalid IP address.

Table Continued

Validation	Error/Warning/Prompt
Configure the SLA type with a source IP which is configured in the same switch.	Destination IP cannot be configured as the same as one of the local interface IP addresses.
Configure threshold with invalid value.	Invalid threshold count value. For threshold type 'Immediate', count must be 1 and for 'Consecutive', count must be greater than or equals to 2.
Configure threshold value for 'PacketLoss' or 'TestCompletion'	Configuration is not applicable when threshold is configured for 'PacketLoss' or 'TestCompletion'.
Configure threshold type for TestCompletion.	Configuration is not applicable when threshold is configured for 'TestCompletion'.
Configure schedule with proper end time with a frequency which is out of end time.	Invalid endtime. Endtime is not enough to run the tests for configured frequency and repetitions.
Configuring ‘srcTodstTime’ or ‘dstTosrcTime’ threshold configuration for ‘icmp-echo’ or ‘tcp-connect’.	Invalid threshold configuration for configured SLA type.
Enabling the IP SLA which is already in enabled state.	IP SLA is already enabled.
Disabling the IP SLA which is already in disabled state.	IP SLA is already disabled.
Show IP SLA history of un-configured SLA.	IP SLA is not configured for this ID.
Enable more number (currently decided 50 as limit) of IP SLA.	Maximum number of enabled IP SLAs at a time is limited to 50.
Removing IP SLA type/tos/history size/ schedule/ threshold configuration with un-configured value.	IP SLA configuration does not exist.
Configuring scheduler with a frequency value which is not satisfying the condition frequency > number of packets per probe * packet interval.	Frequency value is insufficient to configure the scheduler.
Scheduler already configured and try to configure SLA type with a value of ‘number of packets per probe’ and ‘packet interval’ which is not satisfying the condition frequency > number of packets per probe * packet interval.	Number of packets/packet interval is insufficient to configure IP SLA type.
Configuring IP SLA with invalid values.	Invalid configuration for IP SLA.
Change the IP SLA configuration when the SLA is enabled.	Configuration changes not allowed when IP SLA is enabled.

Table Continued

Validation	Error/Warning/Prompt
When IP address vs port number configured for an SLA is already in use	Error: Socket for configured address, port is already in use, choose different port number
When Source IP address given in SLA configuration is not configured in the switch	Error: Source IP address is not configured in switch
Invalid SLA ID given in show command	Error: Invalid IP SLA ID
Configure SLA more than allowed limit	Warning: The maximum number of IP SLAs allowed is 50.
Configure Responder more than allowed limit	Error: IP SLA Responder configurations reached max limit. No more configurations accepted.
Configure inter-packet interval when number of packets to be sent out is one.	Error Not applicable as Number of packets to be sent out is 1.
Upper threshold value is less than lower threshold value.	Error: Upper threshold value X is less than lower threshold value Y.
Configure schedule with start time greater than stop time.	Error: Stop time must be greater than start time.
Configure schedule with past stop time.	Error: Stop time must be greater than current time.
Configure schedule with invalid frequency value.	Error: Schedule frequency is out of range. Valid range is 5 to 604800.
Configuring history size with invalid value.	Error: IP SLA History size is out of range. Valid range is 1–50.
Configuring SLA type with invalid payload value.	IP SLA Payload value is out of range. Valid range is 1–1440.
Configuring SLA type with invalid port number.	Invalid port number. Valid range is 1024 to 65535.
Configure the IPSLA parameters without configuring SLA type.	No valid IP SLA type configuration found.
Configuring the responder with existing details.	IP SLA Responder with same configuration exist.
Configure management VLAN as source VLAN.	Error: Not allowed to configure management VLAN as source interface.
Enabling IP SLA without required configuration parameters.	Configuration is incomplete to enable the entry.

Event log messages

Cause

Event	Message
User adds IP SLA endpoint configuration.	I 10/28/15 02:47:12 05020 ipsla: The IP SLA 1 of SLA Type: UDP-Echo, Source IPv4 Address: 10.0.0.1, Destination IPv4 Address: 10.0.0.5, Destination Port: 54563 added.
User removes the endpoint configuration.	I 10/28/15 02:47:12 05021 ipsla: The IP SLA 1 of SLA Type: UDP-Echo, Source IPv4 Address: 10.0.0.1, Destination IPv4 Address: 10.0.0.5, Destination Port: 54563 removed.
When the SLA state changes (can be either system initiated or done by the user)	I 10/28/15 01:42:22 05027 ipsla: IP SLA 1 state changed to Expired.I 10/28/15 01:42:22 05021 ipsla: IP SLA 1 state changed to Enabled.I 10/28/15 01:42:22 05021 ipsla: IP SLA 1 state changed to Scheduled.I 10/28/15 01:42:22 05021 ipsla: IP SLA 1 state changed to Admin-disabled.
User configures a responder	I 10/28/15 01:42:22 05025 ipsla: IP SLA responder configured for SLA Type: TCP-Connect, Listen Address: 10.0.0.7, Listen Port: 38425
User removes a responder	I 10/28/15 01:42:22 05026 ipsla: IP SLA responder removed for SLA Type: TCP-Connect, Listen Address: 10.0.0.7, Listen Port: 38425
SLA test results cross configured threshold	I 10/28/15 01:42:22 05022 ipsla: IP SLA 1, threshold is crossed. Monitored Param: RTT, Threshold Type: immediate, Upper threshold: 500, Lower threshold: 100, Action Type: Trap and Log. Actual Threshold: 600
User adds DNS IP-SLA configuration	I 08/09/16 02:47:12 05029 ipsla: The IP SLA 1 of SLA Type: DNS, Name server IPv4 Address: 10.0.0.1, Target Hostname: a.hp.com added
User removes DNS IP-SLA configuration	I 08/09/16 02:47:12 05030 ipsla: The IP SLA 1 of SLA Type: DNS, Name server IPv4 Address: 10.0.0.1, Target Hostname: a.hp.com removed.
The packet loss threshold for the SLA has reached	I 08/09/16 02:47:12 05023 ipsla: The IP SLA 1 of SLA Type: DNS, Packet loss is observed. Threshold type: immediate, Action type: Trap and Log
The SLA test has completed and the threshold config for test completion is present	I 08/09/16 02:47:12 05024 ipsla: The IP SLA 1, Probe for SLA Type: UDP-Echo, Source IPv4 Address:1.1.1.2, Destination IPv4 Address:1.1.1.3, Destination Port:3000 Completed

Table Continued

Event	Message
TCP-Connect Duplicate configuration is present	W 08/09/16 02:47:12 05028 ipsla: Duplicate configuration detected; the IP SLA 10 configuration is the same as the IP SLA 1. For TCP, 4-tuple combination has to be unique.
User adds DHCP SLA configuration	I 08/09/16 02:47:12 05031 ipsla: The IP SLA 1 of SLA Type: DHCP, Vlan: 1 added.
User removes DHCP SLA configuration	I 08/09/16 02:47:12 05032 ipsla: The IP SLA 1 of SLA Type: DHCP, Vlan: 1 removed.
DHCP SLA test has completed and the threshold config for test completion is present	I 08/09/16 02:47:12 05033 ipsla: The IP SLA 1, Probe for SLA Type: DHCP, Source Vlan : 1 Completed

Aruba Central Network Management Solution Overview

The Aruba Central network management solution, a software-as-a-service subscription in the cloud, provides streamlined management of multiple network devices. Aruba switches are able to talk to Aruba Central and utilize cloud-based management functionality. Cloud-based management functionality allows for the deployment of network devices at sites with no IT personnel (branch offices, retail stores, and so forth). The communication channel used to connect the devices with the cloud portal is outside the control of end users. It adheres to corporate standards like the use of firewalls.

This feature provides:

- Zero-touch provisioning
- Network Management/Remote monitoring
- Events/alerts notification
- Configuration
- Firmware management

Table 33: *Features supported by Aruba Central*

Configuration	
VLANS	Create VLANs
	IP address assignment
	Tag/Untag
Ports	Admin status [Up/Down]
	PoE [Enable/Disable for an interface]
User Management	Create/delete Operator User
	Create Manager user
	IP address assignment to Uplink Vlan [Static to DHCP and vice versa]
	Name server configuration

RCD	
	Establish a remote console session to Switch

Monitoring	
	Events
	Statistics

Firmware Management	
	Update the switch firmware

Troubleshooting	
	Execute troubleshooting commands from central

Restricted commands in switch when connected to Central

boot
recopy
erase
reload
startup-default
upgrade-software
setup
delete
reboot
restore
menu
write memory
aruba-vpn
amp-server

Limited Management Interface on switch

WebUI
REST
SNMP
TR-69
Menu

You can provision the switch in Aruba Activate. For more information about provisioning, See *Aruba Networks and AirWave Switch Configuration Guide*.

LED Blink feature

Central connectivity loss is indicated by LEDs. If connectivity is broken and Aruba-Central is enabled, the USR/FDX and Locator LEDs will blink. The LEDs will stop blinking once the switch is connected back to Central.

Configuration commands

aruba-central

Syntax

Switch (config) # aruba-central [disable | enable | support-mode]

Description

Configure Aruba Central server support. When enabled, and when a server web address has been obtained using Aruba Activate, the system will connect to an Aruba Central server. The system will obtain configuration updates and most local configuration commands will be disabled. This mode is enabled by default.

Options

disable	Disable Aruba Central server support.
enable	Enable Aruba Central server support.
support-mode	Enter the support mode to enable all configuration commands.

Restrictions

- Switch communication to Aruba Central is not supported via OOBM.
- Aruba-central is not supported in FIPS switches and it will be disabled by default.
- Aruba-central is not supported in Stack switches and it will be disabled by default.

To avoid broadcast storm or loops in your network while configuring ZTP, do not have redundant links after you complete ZTP and Airwave registration. Authorize the new switch and then push the Golden Configuration template from Airwave.

Show commands

show aruba-central

Syntax

show aruba-central

Description

Show Aruba Central server information.

show aruba-central

```
switch# sh aruba-central

 Configuration and Status - Aruba Central
  Server URL           : https://hpsw-jenkins-soa-qa-
build-1404-250.test.pdt1.arubathena.com/ws
  Connected            : Yes
  Mode                 : Managed
  Last Disconnect Time : Tue Jun 14 16:01:15 2016
```

Overview

Auto device detection

The command `device-profile` enables the user to define profiles and configure the associations of profiles to each device type. By creating a device profile, parameters will be defined for a connection interface by device type. To configure each parameter under a profile name, a context level is provided.

The command `device-profile name <PROFILE NAME>` configures for the default values. The default value is permissible when no user-defined profile is created.

To associate each device type with a device profile, a context level is created which authorizes the user to enable or disable the profile by device-type. Only the device type `aruba-ap` is supported.

Rogue AP isolation

The command `rogue-ap-isolation` configures each device and blocks, logs, or allows a rogue AP when detected. The command enables or disables rogue AP isolation.

The command `clear rogue-ap-isolation` is provided to clear the detected rogue AP device MAC address.

Show commands are provided to display the configuration and status of the profiles. Another show command will display the list of rogue APs detected.

Jumbo frames on a device port

Configure jumbo frame support for the device port. Jumbo frames are not permissible by default.

Enabling jumbo frame support in a profile might affect other ports with different profiles. When a profile has jumbo frame enabled and is applied to any port, all other ports that are members of any VLAN listed in the profile will also have jumbo frame support.

Configuration commands

allow-jumbo-frames

Syntax

allow-jumbo-frames

Description

Configure jumbo frame support for the device port. Jumbo frames are not enabled by default.

Enabling jumbo frame support in a profile affects other ports with different profiles. When a profile has jumbo frames enabled and is applied to any port, all other ports that are members of any VLAN listed in the profile will also have jumbo frame support.

Validation rules

Validation	Error/Warning/Prompt
Invalid jumbo command.	Invalid input.
If jumbo frame support is configured on a VLAN for which the device profile had overridden the configuration, display the existing warning.	This configuration change will be delayed because a device profile that enables jumbo frame support is applied to a port in this VLAN.

Default AP Profile

Creates a user-defined profile.

The profile name is a valid character string with the maximum permissible length of 32. The default profile is named `default-ap-profile` and cannot be modified.

The default configuration parameters may be modified using the command `device-<PROFILE NAME> default-ap-profile` . Up to four different profiles may be configured.

The `[no]` command removes the user-defined profiles.

device-profile

From within the configure context:

Syntax

device-profile *<PROFILE-NAME>* *<DEVICE-TYPE>*

Description

Create port configuration profiles and associate them with devices. When a configured device type is connected on a port, the system will automatically apply the corresponding port profile. When the device is disconnected, the profile is removed after a 2 minute delay. Connected devices are identified using LLDP.

Options

<PROFILE-NAME>	Specify the name of the profile to be configured.
<DEVICE-TYPE>	Specify an approved device-type to configure and attach a profile to.

Parameters

allow-jumbo-frames	Configure jumbo frame support for the device port.
untagged-vlan *<VLAN-ID>*	Configure this port as an untagged member of specified VLAN.
tagged-vlan *<VLAN-LIST>*	Configure this port as a tagged member of the specified VLANs.
cos *<COS-VALUE>*	Configure the Class of Service (CoS) priority for traffic from the device.
ingress-bandwidth *<PERCENTAGE>*	Configure ingress maximum bandwidth for the device port.
egress-bandwidth *<PERCENTAGE>*	Configure egress maximum bandwidth for the device port.
poe-max-power *<WATTS>*	Configure the maximum PoE power for the device port (in watts).

poe-priority	Configure the PoE priority for the device port.

Usage

[no] device-profile name <*PROFILE-NAME*>

[no] device-profile type <*DEVICE*>

Associating a device with a profile

To associate an Aruba access point (AP) device-type to a user-defined profile, use the context `HPE Switch(device-aruba-ap)#`. All Aruba access points use the identifier **aruba-ap**.

The `[no]` form of the command removes the device type association and disables the feature for the device type.

The feature is disabled by default.

device-profile type

From within the configure context:

Syntax

device-profile type

Description

Configure an approved device-type and attach the profile. The profile configuration is applied to any port where this device type is connected.

Approved device types

aruba-ap	Aruba access point device.
aruba-switch-router	Aruba switch or router device.
cisco-phone	Cisco phone device.
cisco-switch-router	Cisco switch or router device.
hpe-switch-router	HPE switch or router device.

Options

From within the **device-aruba-ap** context

associate <*PROFILE-NAME*>	Associated the specified device type by profile name.
enable	Enables the automatic profile association.
disable	Disables the automatic profile association.

Usage

[no] device-profile type <*DEVICE*> [associate <*PROFILE-NAME*> |enable | disable]

Configuring the rogue-ap-isolation command

Used to configure the `rogue-ap-isolation` command. A block/log option may be configured for when a rogue AP is identified by the switch. The block/log option may be enabled or disabled. The default action is to block a rogue AP.

The `whitelist` command is used to configure any specific MAC addresses excluded from the rogue AP list. The whitelist configuration is saved in the configuration. The whitelist supports 128 MACs.

The `[no]` form the command is used to remove the MAC address individually by specifying the MAC.

rogue-ap-isolation

Within the configure context:

Syntax

rogue-ap-isolation

Description

Configure rogue AP isolation and rogue AP Whitelist MAC addresses for the switch. When enabled, the system detects the MAC address of rogue access points and takes the specified action for traffic or from that address. The whitelist is used to add MAC addresses of approved access points to the whitelist.

Options

action	Configure the action to take for rogue AP packets. Actions available are enable, disable, block, log, and whitelist.
	block Block and logs traffic to or from any rogue access points.
	log Log traffic to or from any rogue access points.
enable	Enable the rogue AP Isolation.
disable	Disable the rogue AP Isolation.
whitelist <*MAC-ADDRESS*>	Configures rogue AP Whitelist MAC addresses for the switch. This option is used to add MAC addresses of approved access points to the whitelist.
<*MAC-ADDR*>	Specify the MAC address of the device to be moved from the Rogue AP list to the whitelist.

Usage

rogue-ap-isolation [enable | disable]

rogue-ap-isolation action [log | block]

[no] rogue-ap-isolation whitelist <*MAC-ADDRESS*>

Show commands

show device-profile

Syntax

Within the configure context:

show device-profile

Description

Show device profile configuration and status.

config Show the device profile configuration details for a single, or all, profiles.

status Show currently applied device profiles.

Usage

show device-profile config *<PROFILE-NAME>*

show device-profile status

show device-profile config

```
Switch# Show device-profile config
 Device Profile Configuration
  Configuration for device profile : default-ap-profile
   untagged-vlan    : 1
   tagged-vlan      : None
   ingress-bandwith : 100%
   egress-bandwith  : 100%
   cos       : 0
   speed-duplex     : auto
   poe-max-power    : 33W
   poe-priority     : High
   allow-jumbo-frames: Enabled

  Configuration for device profile : profile1
   untagged-vlan    : 10
   tagged-vlan      : 40,50,60
   ingress-bandwith : 10%
   egress-bandwith  : 95%
   cos       : 4
   speed-duplex     : auto-10
   poe-max-power    : 20W
   poe-priority     : Low
```

show device-profile config profile1

```
Switch# Show device-profile config profile1
 Device Profile Configuration
  Configuration for device profile : profile1
   untagged-vlan    : 10
   tagged-vlan      : 40,50,60
   ingress-bandwith : 10%
   egress-bandwith  : 95%
   cos       : 4
```

```
   speed-duplex     : auto-10
   poe-max-power    : 20W
   poe-priority     : Low
```

show command device-profile status

Syntax

show device-profile [config | status]

Description

Displays the device-profile configuration or device-profile status.

Options

config Show device profile configuration details for a single profile or all profiles.

status Show currently applied device profiles status.

show device-profile status

```
Switch# show device-profile status

 Device Profile Status
  Port           Device Type      Applied Device Profile
  ----           -----------      ----------------------
  5              aruba-ap         profile1
  10             aruba-ap         profile1
```

Show rogue-ap-isolation

Syntax

show rogue-ap-isolation

Description

Show rogue access point information.

Options

whitelist Show rogue access point whitelist information.

Usage

show rogue-ap-isolation whitelist

show rogue-ap-isolation

```
Switch# show rogue-ap-isolation

 Rogue AP Isolation
  Rogue AP Status : Enable
  Rogue AP Action : Block
   Rogue AP MAC                    Neighbor Device
   ----------------                ----------------
```

```
   11:22:33:44:55:66                00:12:34:56:67:89
   aa:bb:cc:dd:ee:ff                00:98:45:56:67:89
```

show rogue-ap-isolation whitelist

```
Switch# show rogue-ap-isolation whitelist

 Rogue AP Whitelist Configuration
  Rogue AP MAC
  -----------------
  11:22:33:44:55:66
  aa:bb:cc:dd:ee:ff
```

Overview

This feature supports secure communication between ArubaOS-Switches and the Aruba mobility controller (VPN concentrator) for Network Management Server (AirWave) traffic. The switch also provides the necessary support for Zero Touch Provisioning (ZTP) by establishing a secure tunnel between an ArubaOS-Switch and the Network Management Server (AirWave) which are provided for by a DHCP Server or Activate.

IPsec ensures that communication between ArubaOS-Switch-based switches and AirWave Server (management traffic) is protected by establishing a secure channel between the switches and the Aruba VPN Controller (connected to AirWave server).

AirWave details

ZTP discovers switches in their respective management stations (AirWave) during initial boot up which enables the automatic configuration and management of the switches.

- ZTP checks if AirWave details are provided along with IP via DHCP.
  - If AirWave details are missing from DHCP, ZTP will try to connect to Activate to receive AirWave details.

IPsec Tunnel Establishment

- IPsec tunnel for AirWave is auto-configured. The switch decides to create IPSec tunnel only when an Aruba controller IP is present in the device before establishing the connection to AirWave.
- If the controller IP is not provided, the switch will try to establish a direct connection to AirWave.
- If the controller IP is present, the ArubaOS-Switch auto configures and initiates an IPsec tunnel interface. Once the tunnel is established, the Aurba controller provides an inner IP which the switch will then use as source IP to send any AirWave bound traffic. The switch then creates a static route to AirWave with the IPsec tunnel interface as the gateway.

IPSec Tunnel Failures

The following behaviors can cause an IPSec tunnel creation failure:

- Time

  The time in the switch has to be valid and correct. Time issues have been observed on the Aruba 2930F and Aruba 2920 24G Switches.
- Authentication

  The switch MAC addresses for both members must be added to the Aruba controller whitelist.
- Controller IP

  The controller IP must be reachable from the switch.
- Static Route

  There must not be any conflicting static route in the system for the AirWave IP configured.

AirWave IP after discovery

Airwave IP and Aruba Controller IP (either from the Activate Server or from a DHCP server) are established and auto configured in an IPSEC-IPv4 Tunnel. Once received, the IPsec tunnel is auto configured and established to

send Airwave traffic securely. The Aruba Controller provides an inner-ip to the switch which then can communicate with Airwave.

Configuring the Aruba controller

On the Aruba Controller, configure via CLI:

Procedure

1. Disable control-plane-security (CPSEC).

   ```
   control-plane-security
   ```

   ```
   no cpsec-enable
   ```

2. Add the switch MAC address to whitelist and for authentication.

   ```
   whitelist-db rap add mac-address <Switch Mac add> ap-group default [remote-ip <ip address for Switch>]
   ```

   ```
   local-userdb add username <Switch Mac Add> password <switch mac add>
   ```

3. Add an IP address pool that can be assigned to switch after tunnel creation. IP range must be in the same subnet through which AirWave is reachable from Controller.

   ```
   ip local pool "ipsec" 2.0.0.100 2.0.0.255
   ```

4. Create access lists that permit AirWave traffic and assign them to ap-roles.

   ```
   ip access-list session hpe-acl
   ```

   ```
   any any tcp 22 permit
   ```

   ```
   any any tcp 443 permit !
   ```

   ```
   user-role ap-role
   ```

   ```
   access-list session hpe-acl !
   ```

5. View the whitelist.
   show whitelist-db cpsec

   ```
   (host) #show whitelist-db cpsec
            ap-group <ap_group>
            ap-name <ap_name>
            cert-type {factory-cert|switch-cert}
            mac-address <name>
            page <num>
            start &lt;offset>
            state {approved-ready-for-cert|certified-factory-cert|
              unapproved-factory-cert|unapproved-no-cert}
   ```

   show whitelist-db cpsec-status

   ```
   (host) #show whitelist-db cpsec-status
   (host) #show whitelist-db rap
            apgroup <rap-group>
            apname <rap-name>
            fullname <rap-fullname>
            long
            mac-address <mac-address>
            page <page-number>
            start &lt;offset>
   ```

   show whitelist-db rap-status

```
(host) #show whitelist-db rap-status
```

show ip interface brief

```
(Aruba7210) #show ip interface brief

Interface    IP Address / IP Netmask       Admin   Protocol   VRRP-IP   (VRRP-Id)
vlan 1     172.16.0.254 / 255.255.255.0      up      up         none      (none)
vlan 30      30.30.30.2 / 255.255.255.0      up      up         none      (none)
vlan 17        17.0.0.5 / 255.255.255.0      up      up         none      (none)
loopback     unassigned / unassigned         up      up
```

show vlan

```
(Aruba7210) #show vlan

VLAN CONFIGURATION
------------------
VLAN  Description  Ports               AAA Profile
----  -----------  -----               -----------
1     Default      GE0/0/2-0/5 Pc0-7   N/A
17    VLAN0017     GE0/0/1             N/A
30    VLAN0030     GE0/0/0             N/A
amp ip is : 30.30.30.1
```

show running-config | begin "0/0/0"

```
#show running-config | begin "0/0/0"
(Aruba7210) #show running-config | begin "0/0/0"
interface gigabitethernet 0/0/0
        description "GE0/0/0"
        trusted
        trusted vlan 1-4094
        switchport access vlan 30

interface gigabitethernet 0/0/1
        description "GE0/0/1"
        trusted
        trusted vlan 1-4094
        switchport access vlan 17

interface gigabitethernet 0/0/2
        description "GE0/0/2"
        trusted
        trusted vlan 1-4094

interface gigabitethernet 0/0/3
        description "GE0/0/3"
        trusted
        trusted vlan 1-4094

interface gigabitethernet 0/0/4
        description "GE0/0/4"
        trusted
        trusted vlan 1-4094

interface gigabitethernet 0/0/5
        description "GE0/0/5"
        trusted
        trusted vlan 1-4094
```

```
interface vlan 1
        ip address 172.16.0.254 255.255.255.0
        ipv6 address 2001::1/64

interface vlan 30
        ip address 30.30.30.2 255.255.255.0

interface vlan 17
        ip address 17.0.0.5 255.255.255.0

no uplink wired vlan 1
uplink disable
ip nexthop-list pan-gp-ipsec-map-list

crypto isakmp policy 20
  encryption aes256

crypto isakmp policy 10001

crypto isakmp policy 10002
  encryption aes256
  authentication rsa-sig


crypto isakmp policy 10003
  encryption aes256

crypto isakmp policy 10004
  version v2
  encryption aes256
  authentication rsa-sig

crypto isakmp policy 10005
  encryption aes256

crypto isakmp policy 10006
  version v2
  encryption aes128
  authentication rsa-sig

crypto isakmp policy 10007
  version v2
  encryption aes128

crypto isakmp policy 10008
  version v2
  encryption aes128
  hash sha2-256-128
  group 19
  authentication ecdsa-256
  prf prf-hmac-sha256

crypto isakmp policy 10009
  version v2
  encryption aes256
  hash sha2-384-192
  group 20
  authentication ecdsa-384
  prf prf-hmac-sha384

crypto isakmp policy 10012
  version v2
  encryption aes256
```

```
  authentication rsa-sig

crypto isakmp policy 10013
  encryption aes256

crypto ipsec transform-set default-ha-transform esp-3des esp-sha-hmac
crypto ipsec transform-set default-boc-bm-transform esp-aes256 esp-sha-hmac
crypto ipsec transform-set default-1st-ikev2-transform esp-aes256 esp-sha-hmac
crypto ipsec transform-set default-3rd-ikev2-transform esp-aes128 esp-sha-hmac
crypto ipsec transform-set default-rap-transform esp-aes256 esp-sha-hmac
crypto ipsec transform-set default-aes esp-aes256 esp-sha-hmac
crypto dynamic-map default-rap-ipsecmap 10001

  version v2
  set transform-set "default-gcm256" "default-gcm128" "default-rap-transform"

crypto dynamic-map default-dynamicmap 10000
  set transform-set "default-transform" "default-aes"

crypto map GLOBAL-IKEV2-MAP 10000 ipsec-isakmp dynamic default-rap-ipsecmap
crypto map GLOBAL-MAP 10000 ipsec-isakmp dynamic default-dynamicmap
crypto isakmp eap-passthrough eap-tls
crypto isakmp eap-passthrough eap-peap
crypto isakmp eap-passthrough eap-mschapv2

ip local pool "ipsec" 30.30.30.100
```

AirWave Controller IP configuration commands

aruba-vpn type

From within the configure context:

Syntax

[no] aruba-vpn type amp peer-ip <*IP*> [tos <*0–63*>| ttl<*1-255*>]

Description

Configure the Aruba VPN type, peer IP address, and ToS or TTL value. The default value for ToS is -1 and for TTL is 64.

Options

<AMP>	Configure the AirWave Management Platform (AMP) server.
<TYPE>	Configure the controller IP.
<IP-ADDR>	IP address of the VPN.
ttl	Configure the Aruba VPN ttl value — <*1-255*>
tos	Configure the Aruba VPN tos value. — <*0–63*>

Usage

[no] aruba-vpn type <*VPN-TYPE*>

switch(config)# aruba-vpn type

switch(config)# aruba-vpn type amp

switch(config)# aruba-vpn type amp peer-ip

switch(config)# aruba-vpn type amp peer-ip 17.0.0.5 tos

switch(config)#aruba-vpn type amp peer-ip 17.0.0.5 tos 2 ttl

The use of the argument [no] removes the `aruba-vpn type` statement from the configuration.

Show commands

show aruba-vpn

Syntax

show aruba-vpn type <*VPN-TYPE*>

Description

Show Aruba-VPN configuration information.

Switch(config)# show aruba-vpn

```
show aruba-vpn
 Aruba VPN details
  Aruba VPN Type           : amp
  Aruba VPN Peer IP        : 171.0.0.3
  Aruba VPN Config Status  : Configured
  Aruba VPN tos            : Value from IPv4 header
  Aruba VPN ttl            : 64
```

show aruba-vpn type amp

```
show aruba-vpn type amp

Aruba VPN details
  Aruba VPN Type           : amp
  Aruba VPN Peer IP        : 2.2.2.2
  Aruba VPN Config Status  : Configured
  Aruba VPN tos            :   32
  Aruba VPN ttl            :   54
```

show ip route

Syntax

show ip route

Description

Show the IP route.

show ip route

```
                                IP Route Entries
 Destination        Gateway         VLAN Type       Sub-Type   Metric     Dist.
 ------------------ --------------- ---- ---------- ---------- ---------- -----
 0.0.0.0/0          192.168.20.31   1    static                250        1
 2.0.0.25/32*        aruba-vpn             connected             1          0
 2.0.0.199/32**       aruba-vpn              static               1          1
 127.0.0.0/8        reject                  static               0          0
 127.0.0.1/32       lo0                     connected            1          0
 192.168.20.0/24    DEFAULT_VLAN    1    connected             1          0
```

*The inner IP received from the Aruba Controller.

**Static Route for Airwave IP. Added automatically by the switch after tunnel establishment.

show interfaces tunnel aruba-vpn

Syntax

show interfaces tunnel aruba-vpn

Description

Auto-configured tunnel interface before creating IPSec. The tunnel ID is auto generated and to avoid conflict with user generated tunnel interface, the tunnel id is always the max tunnel supported by the switch + 1.

aruba-vpn	Display the configuration and status details of aruba-vpn tunnel.
brief	Display brief configuration and status for all tunnels.

Usage

show interfaces tunnel aruba-vpn

show interfaces tunnel brief

show interfaces [tunnel] [<*TUNNEL-LIST*> | <*TUNNEL-NAME*> | brief | type]

show interfaces tunnel aruba-vpn

```
Aruba-3810M-24G-PoEP-1-slot(config)# show interfaces tunnel aruba-vpn
 Tunnel Configuration :
  Tunnel               : tunnel-129
  Tunnel Name          : aruba-vpn-tunnel
```

```
 Tunnel Status         : Enabled
 Source Address        : 17.0.0.30
 Destination Address   : 17.0.0.5
 Mode                  : IPsec IPv4
 TOS                   : Value from IPv4 header
 TTL                   : 64
 IPv6                  : Disabled
 MTU                   : 1280

Current Tunnel Status :
 Tunnel State                : Up
 Destination Address Route   : 17.0.0.0/24
 Next Hop IP                 : 17.0.0.5
 Next Hop Interface          : vlan-1
 Next Hop IP Link Status     : Up
 Source Address              : Configured on vlan-1
 IP Datagrams Received       : 9732
 IP Datagrams Transmitted    : 13129
```

show interfaces tunnel brief

```
Aruba-3810M-24G-PoEP-1-slot(config)#  show interfaces tunnel brief
 Status - Tunnel Information Brief
 Tunnel                    : tunnel-129
 Mode                      : IPsec IPv4
 Source Address            : 17.0.0.30
 Destination Address       : 17.0.0.5
 Configured Tunnel Status  : Enabled
 Current Tunnel State      : Up
```

show ip counters tunnel aruba-vpn

Syntax

show ip counters tunnel aruba-vpn

Description

Show IP counters for a tunnel.

Options

aruba-vpn	Show counters for aruba-vpn tunnel.
ipv4	Show IPv4 only.
ipv6	Show IPv6 only.
<TUNNEL-ID>	Show specified tunnel only.

Usage

show ip counters tunnel ipv4

show ip counters tunnel ipv6

show ip counters tunnel <*TUNNEL-ID*>

show ip counters tunnel aruba-vpn

```
sh ip counters tunnel
Address Family :    IPv4
Interface      :    Tunnel 129
 IP In Datagrams Received                              : 2439
 IP In Octets Received                                 : 362736
 IP In Datagrams Broadcast Received                    : 0
 IP In Octets Broadcast Received                       : 0
 IP In Datagrams Multicast Received                    : 0
 IP In Octets Multicast Received                       : 0
 IP In Datagrams Discarded Datagram Header Error       : 0
 IP In Datagrams Discarded No Route                    : 0
 IP In Datagrams Discarded Invalid Address             : 0
 IP In Datagrams Discarded Unknown Protocol            : 0
 IP In Datagrams Discarded Truncation                  : 0
 IP In Datagrams Discarded Processing Error            : 0
 IP In Datagrams Forwarding Required                   : 0
 IP In Datagrams Delivery to Protocols Successful      : 2439
 IP Datagrams Reassembly Required                      : 0
 IP Datagrams Reassembly Successful                    : 0
 IP Datagrams Reassembly Failed                        : 0
 IP Out Datagrams Transmitted                          : 2514
 IP Out Octets Transmitted                             : 1197348
 IP Out Datagrams Broadcast Transmitted                : 0
 IP Out Octets Broadcast Transmitted                   : 0
 IP Out Datagrams Multicast Transmitted                : 0
 IP Out Octets Multicast Transmitted                   : 0
 IP Out Datagrams Discarded Processing Error           : 0
 IP Out Datagrams Forwarded                            : 0
 IP Out Datagrams Transmit Requests from Protocols     : 2509
 IP Out Datagrams Fragmentation Required               : 0
 IP Out Datagrams Fragmentation Successful             : 5
 IP Out Datagrams Fragmentation Failed                 : 0
 IP Out Datagrams Fragments Created                    : 0

Address Family :    IPv6
Interface      :    Tunnel 129
 IP In Datagrams Received                              : 0
 IP In Octets Received                                 : 0
 IP In Datagrams Broadcast Received                    : 0
 IP In Octets Broadcast Received                       : 0
 IP In Datagrams Multicast Received                    : 0
 IP In Octets Multicast Received                       : 0
 IP In Datagrams Discarded Datagram Header Error       : 0
 IP In Datagrams Discarded No Route                    : 0
 IP In Datagrams Discarded Invalid Address             : 0
 IP In Datagrams Discarded Unknown Protocol            : 0
 IP In Datagrams Discarded Truncation                  : 0
 IP In Datagrams Discarded Processing Error            : 0
 IP In Datagrams Forwarding Required                   : 0
```

```
IP In Datagrams Delivery to Protocols Successful     : 0
IP Datagrams Reassembly Required                     : 0
IP Datagrams Reassembly Successful                   : 0
IP Datagrams Reassembly Failed                       : 0
IP Out Datagrams Transmitted                         : 0
IP Out Octets Transmitted                            : 0
IP Out Datagrams Broadcast Transmitted               : 0
IP Out Octets Broadcast Transmitted                  : 0
IP Out Datagrams Multicast Transmitted               : 0
IP Out Octets Multicast Transmitted                  : 0
IP Out Datagrams Discarded Processing Error          : 0
IP Out Datagrams Forwarded                           : 0
IP Out Datagrams Transmit Requests from Protocols    : 0
IP Out Datagrams Fragmentation Required              : 0
IP Out Datagrams Fragmentation Successful            : 0
IP Out Datagrams Fragmentation Failed                : 0
IP Out Datagrams Fragments Created                   : 0
```

show crypto-ipsec sa

Syntax

show crypto ipsec sa

Description

Show crypto-IPsec statistics.

Switch(config)# show crypto-ipsec sa

```
Aruba-2930F-48G-4SFPP# show crypto ipsec sa

  Crypto IPSec Status
  Interface               : 1
  Source Address          : 192.168.20.14
  Destination Address     : 171.0.0.3
  Source Port             : 0               Destination Port    : 0
  SPI                     : 3767553536
  Encapsulation Protocol  : ESP
  Encryption              : AES             Hash                : SHA1
  PFS                     : 0               PFS Group           :
  Mode                    : tunnel
  Key Life                : 3600            Remaining key Life  : 3303
  Key Size                : 0               Remaining key Size  : 0
  Interface               : 2
  Source Address          : 171.0.0.3
  Destination Address     : 192.168.20.14
  Source Port             : 0               Destination Port    : 0
  SPI                     : 4173307552
  Encapsulation Protocol  : ESP
  Encryption              : AES             Hash                : SHA1
  PFS                     : 0               PFS Group           :
  Mode                    : tunnel
  Key Life                : 3600            Remaining key Life  : 3301
  Key Size                : 0               Remaining key Size  : 0
```

Usage

show crypto ipsec statistics

show running-configuration

Syntax

show running-configuration

IP route or tunnel interface will not be displayed in show run as they are auto created.

show running-configuration

```
show running-configuration

; JL254A Configuration Editor; Created on release #WC.16.02.0000x
; Ver #0e:01.b3.ef.7c.5f.fc.6b.fb.9f.fc.f3.ff.37.ef:ab

hostname "Aruba-2930F-48G-4SFPP"
module 1 type jl254a
snmp-server community "public" unrestricted

vlan 1
   name "DEFAULT_VLAN"
   untagged 1-52
   ip address dhcp-bootp
   exit

amp-server ip 2.0.0.199 group "aw_group" folder "fold" secret "secr"
aruba-vpn type amp peer-ip 171.0.0.3
```

Overview

Every client is associated with a user role. User roles associate a set of attributes for authenticated clients (clients with authentication configuration) and unauthenticated clients, applied to each user session. User roles must be enabled globally.

Examples of user roles are:

- Employee = All access
- Contractor = Limited access to resources
- Guest = Browse Internet

Each user role determines the client network privileges, frequency of reauthentication, applicable bandwidth contracts, and other permissions. There are a maximum of 32 administratively configurable user roles available with one predefined and read-only user role called **denyall**.

A user role consists of optional parameters such as:

- Captive portal profileSpecifies the URL via:
  - **captive-portal profile**

    or
  - Vendor Specific Attribute (VSA). RADIUS: HP **HP-Captive-Portal-URL** = <http://...>
- Ingress user policy

  L3 (IPv4 and/or IPv6) ordered list of Classes with actions, with an implicit deny all for IPv4 and IPv6.
- Reauthentication period

  The time that the session is valid for. The default is 0 unless the user role is overridden. The default means that the reauthentication is disabled.

  Reauthentication period is required to override the default of 0.
- Untagged VLAN (either VLAN ID or VLAN-name)

  VLAN precedence order behavior:
  - If configured, untagged VLAN specified in the user role (VSA Derived Role, UDR, or Initial Role).
  - Statically configured untagged and/or tagged VLANs of the port the user is on.

Operational notes

- When user roles are enabled, all users that are connecting on ports where authentication is configured will have a user role applied. User role application happens even if the user fails to authenticate. If the user cannot be authenticated, the “Initial Role” will be applied to that user.
- The user role may be applied in one of two ways:
  - Vendor Specific Attribute (VSA)

    Type: RADIUS: Hewlett-Packard-Enterprise

    Name: HPE-User-Role

    ID: 25

Value: <myUserRole>

The RADIUS server (ClearPass Policy Manager) determines application of the VSA Derived Role. The role is sent to the switch via a RADIUS VSA. The VSA Derived Role will have the same precedence order as the authentication type (802.1x, WMA).

- User Derived Role (UDR

)The User Derived Role is part of Local MAC authentication (LMA) and is applied when user roles are enabled and LMA is configured.

  UDR will have the same precedence as LMA. Precedence behavior of the authentication types will be maintained, (802.1x -> LMA -> WMA (highest to lowest)).

Restrictions

- User roles cannot be enabled when BYOD redirect, MAC authentication failure redirect, or enhanced web-based authentication are enabled.
- Web-based authentication is not supported on the same port with other authentication methods when user roles are enabled.
- `show port-access <AUTH-TYPE>` commands are not supported when user-roles are enabled. The command `show port-access clients [detail]` is the only way to see authenticated clients with their associated roles.
- `aaa port-access auth <port> control` commands are not supported when user roles are enabled.
- `unauth-vid` commands are not supported when user roles are enabled.
- `auth-vid` commands are not supported when user roles are enabled.

Limitations for web-based authentication

Cannot be combined with other authentication types on same port.

Limitations for LMA

Reauthentication period and captive portal profile are not supported.

Error messages

Action	Error message
Attempting to enable BYOD Redirect when user roles are enabled.	BYOD redirect cannot be enabled when user roles are enabled.
Attempting to enable MAFR when user roles are enabled.	MAC authentication failure redirect cannot be enabled when user roles are enabled.
Attempting to enable enhanced web-based authentication when user roles are enabled.	Enhanced web-based authentication cannot be enabled when user roles are enabled.
Attempting to enable web-based authentication when other authentication types are enabled for the same port, and user roles are enabled.	Web-based authentication cannot be enabled with other authentication types on this port when user roles are enabled.
`switch (config)# show port-access mac-based clients`	User roles are enabled. Use `show port-access clients` to view client information.

Table Continued

Action	Error message
`switch (config)# aaa port-access authenticator e8 control autho`	802.1x control mode, **Force Authorized/ Unauthorized**, cannot be set when user roles are enabled.
`Attempting to enable local user role when MAFR, BYOD, or EWA are enabled.`	User roles cannot be enabled when BYOD redirect, MAC authentication failure redirect, or enhanced web-based authentication are enabled.

Captive-portal commands

Overview

The Captive Portal profile defines the web address that a user is redirected to for Captive Portal authentication. If the url is blank, a RADIUS VSA will be used.

There is a predefined profile called **use-radius-vsa** that is already configured to use the RADIUS VSA.

Two captive portal profiles are supported:

- Predefined and read-only
  - Predefined and read-only profile name is `use-radius-vsa`.
- Customized

[no] aaa authentication captive-portal profile

Syntax

[no] aaa authentication captive-portal profile *<PROFILE-STR>* [url *<URL-STR>*]

Description

Create a captive-portal profile. Profiles are used in user roles to direct the user to a designated captive portal server. When the profile includes a web address, that web address is always used to contact the server. When no web address is specified, it is obtained from the RADIUS VSA.

A profile does not have to be pre-existing in the switch for it to be configured to a user role.

Options

profile	Configure a captive portal profile.
<PROFILE-STR>	Configure a captive portal profile string 64 characters long.
url	Configure the captive portal server web address.
<URL-STR>	Configure the captive portal server web address string.

Usage

Switch# aaa authentication captive-portal profile <*NAME*>

Switch# aaa authentication captive-portal profile <*NAME*> url <*URL*>

Validation rules

Validation	Error/Message/Prompt
Attempts made to remove a nonexisting profile will return an error: `switch# no aaa authentication captive-portal profile NON_EXISTING_PROFILE`	`Captive portal profile NON_EXISTING_PROFILE not found.`
When including the configured web address after the web address parameter: `[no] aaa authentication captive-portal profile myCaptivePortalProfile url http://myCPPM.local/guest/captive_portal_login.php`	`Invalid input: http://blablabla.com`
A profile name with invalid syntax produces an error: `Switch# aaa authentication captive-portal-profile "this is an invalid name"`	`#aaa authentication captive-portal-profile "this is an invalid name" Invalid character ' ' in name.`
When trying to modify a profile that is predefined, `switch# aaa authentication captive-portal-profile name use-radius-vsa`	Captive portal profile `use-radius-vsa` is read only and cannot be modified
A profile name that is too long produces an error: `switch# aaa authentication captive-portal-profiletest342...;ldklsdjflkdsjflk`	The name must be fewer than 64 characters.
When attempting to configure more than the number of admin configured profiles,`switch# aaa authentication captive-portal-profile profileNumber2`	No more captive portal profiles may be created.

Policy commands

Overview

These commands create a context that may be used to classify the policy. From the existing `policy` command, a new policy type called **user** was added. The new actions are specific to **policy user**:

- redirect
- permit
- deny

NOTE

Only L3 classes (IPv4 and IPv6) are currently supported.

The user policy includes “implicit deny all rules” for both IPv4 and IPv6 traffic.

policy user

Syntax

policy user *<POLICY-NAME>*

Description

Create and enter newly created user policy context.

Usage

Switch (config)# policy user employee

[no] policy user

Syntax

[no] policy user *<POLICYNAME>*

Description

Delete and remove specified user policy from switch configuration.

Operating notes

- The user policy will include implicit “deny all” rules for both IPv4 and IPv6 traffic.
- ipv4 or ipv6 classes must specify source address as *any*. Specifying host addresses or subnets will result in the following error message:

  Switch (policy-user)# class ipv4 class25 action priority 0
  User policies cannot use classes that have a source IP address specified.
- *permit* and *deny* are mutually exclusive.
- *ip-precedence* and *dscp* are mutually exclusive.

Usage

switch (config)# no policy user employee

policy resequence

Syntax

policy resequence *<POLICYNAME>* *<START><INCREMENT>*

Description

Resequence classes and remarks configured within specified user policy. The usage shows resequencing classes and remarks within user policy “employee” starting at 200 and incrementing by 2.

Usage

Switch (config)# policy user employee 200 2

Commands in the policy-user context

Create classes inside of the **policy** context before you apply actions to them.

(policy-user)# class

Within the **policy-user** context:

Syntax

(policy-user)# [no] [<*SEQUENCE-NUMBER*>] class ipv4 | ipv6 <*CLASS-NAME*> [action permit | deny | redirect captive portal] | [action dscp | ip—precedence <*CODEPOINT* | *PRECEDENCE*>] [action priority <*PRIORITY*>] | [action rate-limit kbps <*RATE*>]

Description

Associate a class with ACL or QoS actions for this policy.

Options

Options

deny	Deny all traffic.
DSCP	Specify an IP DSCP.
IP-precedence	Specify the IP precedence.
permit	Permit all traffic.
priority	Specify the priority.
rate-limit	Configure rate limiting for all traffic.
redirect	Specify a redirect destination.

Usage

Switch(policy-user)# class ipv6 employeeIpv6Http action deny

Switch(policy-user)# class ipv4 http action redirect captive-portal

Switch(policy-user)# class ipv4 dnsDhcp action permit

User role configuration

aaa authorization user-role

Syntax

aaa authorization user-role [enable | disable| [initial-role <*ROLE-STR*>] |[name <*ROLE*>]]

Description

Configure user roles. A user role determines the client network privileges, the frequency of reauthentication, applicable bandwidth contracts, along with other permissions. Every client is associated with a user role or the client is blocked from access to the network.

Options

enable Enable authorization using user roles.

disable Disable authorization using user roles.

initial-role The default initial role “denyall” is used when no other role applies. If a client connects to the switch and does not have a user role associated, then the initial role is used. Any role can be configured as initial role using this option.

The initial role may be assigned if:

- captive-portal profile is configured with a web address, but the Captive Portal VSA is sent from RADIUS
- captive-portal profile is configured to use the RADIUS VSA but no Captive Portal VSA is sent.
- captive-portal feature is disabled when the captive-portal profile is referenced in the applied user role to the client.
- The user role feature is enabled with RADIUS authentication, but no user role VSA is returned.
- User role does not exist.
- Not enough TCAM resource available.
- Access-Reject from RADIUS.
- User role VSA is sent along with invalid attributes.
- RADIUS not reachable.
- VLAN configured on the user role does not exist.
- Captive Portal profile does not exist.
- User policy configured on the user role does not exist.
- Reauthentication period is enabled (nonzero) in the user role for LMA.
- Captive Portal profile is included in the user role for LMA.

name *<NAME-STR>* Create or modify a user-role. Role name identifies a user-role. When adding a user-role, a new context will be created. The context prompt will be named “user-role” (user-role)#.

Usage

Switch# aaa authorization user-role enable

Switch# aaa authorization user-role disable

Switch# aaa authorization user-role name <*ROLE1*>

Switch# [no] aaa authorization user-role enable

Switch# [no] aaa authorization user-role name <*ROLE1*>

Switch# aaa authorization user-role initial-role <*ROLE1*>

Switch# aaa authorization user-role name <*MYUSERROLE*> policy <*MYUSERPOLICY*>

Switch# aaa authorization user-role name <*MYUSERROLE*> captive-portal-profile <*MYCAPTPORTPROFILE*>

Switch# aaa authorization user-role name <*MYUSERROLE*> vlan-id <*VID*>

Switch# aaa authorization user-role name <*MYUSERROLE*> reauth-period <*0-999999999*>

Error log

Scenario	Error Message
If the user tries to delete a user-role configured as the initial role	User role <*INITIAL_ROLE_NAME*> is configured as the initial role and cannot be deleted.
If the user attempts to configure more than the number of administrator configured roles	`#aaa authorization user-role name roleNumber33`. No more user roles can be created.
If the user enters a role name that is too long	`switch# aaa authorization user-role test342....jflkdsjflk`. The name must be fewer than 64 characters long.
If the user enters a role name with invalid syntax	`switch# aaa authorization user-role name "this is an invalid name"`. Invalid character ' ' in name.
If the user tries to delete a nonexisting user-role	User role *<NON_EXISTING_ROLE_NAME>* not found.
`Switch# aaa authorization user-role name <DENYALL>`	User role *<DENYALL>* is read only and cannot be modified.

captive-portal-profile

From within the **user-role** context:

Syntax

captive-portal-profile <*PROFILE_NAME*>

Description

Assigns a captive portal profile to the user role. The predefined captive portal profile, `use-radius-vsa`, indicates that the redirect web address must be sent via RADIUS.

To clear a captive portal profile from the user role, use the [no] version of the command.

policy

From within the **user-role** context:

Syntax

policy <*POLICY_NAME*>

Description

Assigns a user policy to the user role. To clear a policy from the user role, use the [no] version of the command.

Modification of the user policy, or class contained in a user policy, will force users consuming that user policy via a user role to be deauthenticated.

reauth-period

From within the user-role context:

Syntax

reauth-period <*VALUE*>

Description

Set the reauthentication period for the user role. Use [0] to disable reauthentication. For RADIUS-based authentication methods, it will override the RADIUS session timeout. It also overrides any port-based reauth-period configuration with the exception that LMA does not support a reauth-period.

Options

<VALUE> Valid values are 0 – 999,999,999; a required configuration in user roles and it defaults to 0.

(user-role)# reauth-period 100

Set the reauthentication value for the current user role:

(user-role)# reauth-period 100

(user-role)# reauth-period 0

0 is used to disable reauthentication, and it is the default value.

```
(user-role)# reauth-period 0
```

Validation rules

Validation	Error/Warning/Prompt
(user-role)# reauth-period 10000000	`Invalid input: 100000000000000000`

VLAN commands

The VLAN must be configured on the switch at the time the user role is applied. Only one of VLAN-name or VLAN-ID is allowed for any user role.

Modification of the VLAN will force users assigned to that VLAN via a user role to be deauthenticated.

vlan-id

From within the user-role context:

Subcommand syntax

vlan-id <*VLAN-ID*>

Description

Create a VLAN with id VLAN-ID.

Use the `[no]` version of the command when clearing the VLAN-ID from the user role:

Usage

```
(user-role)# no vlan-id
```

vlan-name

From within the **user-role** context:

Subcommand syntax

vlan-name <*VLAN-NAME*>

Description

Create a VLAN with the name VLAN-NAME. Only one of VLAN-NAME or VLAN-ID is allowed for any user role.

Use the `[no]` version of the command when clearing the VLAN from the user role, by name:

Usage

```
(user-role)# no vlan-name
```

vlan-id 100

```
(user-role)# vlan-id 100
```

vlan-name vlan100

```
(user-role)#vlan-name VLAN100
```

VLAN range commands

This command is executed from a global configuration context.

VLANs specified by VLAN-ID-LIST

Syntax

```
[no] vlan <VLAN-ID-LIST>
```

Description

Creates VLANs specified by the VLAN-ID-LIST and returns to the global configuration context. Use the [no] version of the command to delete the VLANs specified by the VLAN-ID-LIST.

Examples

```
config# vlan 2-15
config# vlan 5,10,13-20,25
config# no vlan 2-10
config# no vlan 2,5,15-18,25
```

VLANs specified by VLAN-ID-LIST and tag specified ports specified by PORT-LIST

Syntax

```
[no] vlan <VLAN-ID-LIST> tagged <PORT-LIST>
```

Description

Creates VLANs specified by the VLAN-ID-LIST and tags the ports specified by the PORT-LIST to the VLAN-ID-LIST. If VLANs already exist, the tagging of ports specified by the PORT-LIST is performed.

Use the [no] version of the command to remove the tagged PORT-LIST from a range of VLANs specified by the VLAN-ID-LIST. After command execution, CLI returns to the global configuration context.

Examples

```
config# vlan 2-15 tagged A1-A20
config# vlan 5,10,13-20,25 tagged A1-A5,L2,L5-L10
config# vlan 2-20 tagged all
config# no vlan 2-15 tagged A1-A5
config# no vlan 5,10,13-20 tagged A1-A5,L6
```

Applying a UDR

UDR can be used to assign user roles locally (that is, without RADIUS). LMA has been extended to allow applying a user role to a MAC address, MAC group, MAC mask, or MAC OUI.

aaa port-access local-mac apply user-role

Syntax

[no] aaa port-access local-mac apply user-role <Role-Name> [mac-oui <MAC-OUI> | mac-mask <MAC-MASK> |mac-addr <MAC-ADDR> | mac-group <MAC-GROUP-NAME>]

Description

Apply user roles.

Options

mac-addr	To apply user role with MAC address.
mac-group	To apply user role with MAC group.
mac-mask	To apply user role with MAC Mask.
mac-oui	To apply user role with MAC OUI.

Usage

[no] aaa port-access local-mac apply user-role <*MYUSERROLE*> [mac-oui <*MAC-OUI*>]

[no] aaa port-access local-mac apply user-role <*MYUSERROLE*> [mac-mask <*MAC-MASK*>]

[no] aaa port-access local-mac apply user-role <*MYUSERROLE*> [mac-addr <*MAC-ADDR*>]

[no] aaa port-access local-mac apply user-role <*MYUSERROLE*> [mac-group <*MAC-GROUP-NAME*>]

Show commands

show captive-portal profile

Syntax

show captive-portal profile

Description

Show Captive Portal profile configuration.

show captive-portal profile

```
(config)# show captive-portal profile
```

```
Captive Portal Profile Configuration
 Name : use-radius-vsa
 Type : predefined
 URL  :

 Name : myCaptivePortalProfile
 Type : custom
 URL  : http://mycppm.local/guest/captive_portal_login.php
```

show user-role

Syntax

show user-role [<*ROLE-NAME*>] [detailed]

Description

Show users role configuration.

Options

<ROLE-NAME>	Show user roles by role-name.
***<ROLE-NAME>* detailed**	Show user roles in detail by role-name.

show user-role

```
Switch# show user-role

 User Roles

  Enabled      : <Yes/No>
  Initial Role : denyall

  Type          Name
  ----------    ------------
  local         Employee
  local         Guest
  predefined    denyall
```

show user-role <ROLE-NAME>

```
Switch# show user-role captivePortalwithVSA

User Role Information

Name                              : captivePortalwithVSA
  Type                              : local
  Reauthentication Period (seconds) : 0
  Untagged VLAN                     : 610
  Captive Portal Profile            : use-radius-vsa
  Policy                            : cppolicy
```

show user-role detailed

The example shows how to configure user roles to use Clearpass as a Captive Portal. The Captive Portal URL is specified in a RADIUS VSA.

```
Switch# show user-role captivePortalwithVSA detailed

User Role Information
   Name                              : captivePortalwithVSA
   Type                              : local
   Reauthentication Period (seconds) : 0
   VLAN                              : 610
   Captive Portal Profile            : use-radius-vsa
     URL                             : (use RADIUS VSA)
   Policy                            : cppolicy

Statements for policy "cppolicy"
policy user "cppolicy"
     10 class ipv4 "cppm" action permit
     20 class ipv4 "steal" action redirect captive-portal
     30 class ipv4 "other" action permit
   exit

Statements for class IPv4 "cppm"
class ipv4 "cppm"
     10 match tcp 0.0.0.0 255.255.255.255 1.0.9.15 0.0.0.0 eq 80
     20 match tcp 0.0.0.0 255.255.255.255 1.0.9.15 0.0.0.0 eq 443
   exit

Statements for class IPv4 "steal"
class ipv4 "steal"
     10 match tcp 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255 eq 80
     20 match tcp 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255 eq 443
   exit

Statements for class IPv4 "other"
class ipv4 "other"
     10 match udp 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255 eq 53
     20 match udp 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255 eq 67
     30 match icmp 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
   exit
```

show port-access clients

Syntax

show port-access clients [detailed]

Description

Use this command to display the status of active authentication sessions.

show port-access clients

```
Port Access Client Status

Port  Client Name   MAC Address    IP Address      User Role        Type VLAN
----- ------------- -------------- --------------- ---------------------- ------
1/A18 001517581ec4  001517-581ec4 10.108.1.201    ixia1            MAC   108
```

```
A7                  000c29-5121fc n/a             denyall         LOCAL
A8                  000c29-d12996 n/a             myrole          LOCAL 42
```

show port-access clients detailed

```
Switch (config)# show port-access clients detailed

 Port Access Client Status Detail
  Client Base Details :
    Port            : 1/A18                Authentication Type : mac-based
    Client Status   : authenticated        Session Time        : 11 seconds
    Client Name     : 001517581ec4         Session Timeout     : 60 seconds
    MAC Address     : 001517-581ec4
    IP              : 10.108.1.201

 User Role Information
    Name                              : ixia1
    Type                              : local
    Reauthentication Period (seconds) : 60
    Untagged VLAN                     : 108
    Tagged VLANs                      :
    Captive Portal Profile            :
    Policy                            : policyIxia1

Statements for policy "policyIxia1"
policy user "policyIxia1"
     10 class ipv4 "classIxia1" action rate-limit kbps 11000
   exit

Statements for class IPv4 "classIxia1"
class ipv4 "classIxia1"
     10 match ip 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
   exit
```

Overview

The Port QoS Trust feature restricts which packet QoS information may be used to determine inbound queue servicing and any priority information to be permitted into the local hop.

Port QoS Trust Mode configuration allows preservation or removal of the inbound QoS priorities carried in Layer 2 (the VLAN cos or Priority CodePoint (PCP) value, known as the 802.1p priority tag) and/or in Layer 3 (the IP-ToS byte, in IP-Precedence or IP-Diffserv mode). The different modes let the customer trust all, some, or no packet priority fields.

The per-port configuration enables the customer to trust some sources or devices and not others. This feature is mutually exclusive with any active port-priority configuration.

Configuration commands

qos trust

Syntax

qos trust [default|dot1p|dscp|ip-prec|none|device [none|<*DEVICE-TYPE*>]]

Description

Set the QoS Trust Mode configuration for the port.

Options

default	Trust 802.1p priority and preserve DSCP or IP-ToS.
device <*DEVICE-TYPE*>	On approved devices, trust IP-ToS Differentiated-Services in IP packets, and use the DSCP-MAP to remark the 802.1p priority. If the DSCP codepoint does not have an associated priority, the priority will be remarked to 0. On unapproved devices, trust 802.1p priority and preserve any IP- ToS values.
dot1p	Trust 802.1p priority and preserve DSCP or IP-ToS.
dscp	Trust IP-ToS Differentiated-Services in IP packets, and use the DSCP-MAP to remark the 802.1p priority. If the DSCP codepoint does not have an associated 802.1p priority, the priority will be remarked to 0.
ip-precedence	Trust IP-ToS IP-Precedence mode in IP packets and remark the 802.1p priority.
none	Do not trust either the 802.1p priority or the IP-ToS values.

QoS trust devices

aruba-ap	Aruba Access point device.
none	Clear all trusted devices from port.

NOTE

Both SNMP and the CLI will verify that the current QoS Port Priority and desired QoS Trust Mode configuration are not mutually exclusive (and conversely).

qos dscp-map

Syntax

qos dscp-map <*CODEPOINT*> priority <*PRIORITY*> [name <*NAME*> | default | legacy]

Description

Modifies DSCP mapping.

Options

default	Returns switch to the fully mapped factory-default configuration.
legacy	Restore the legacy default behavior (partial mapping) used in earlier code releases.

Show commands

show qos trust

Syntax

show qos trust [device] <*PORT*>

Description

Shows port-based QoS trust configuration

Options

device	Show list of trusted devices per-port.
<port>	Show trusted devices on a single port.

Usage

show qos trust [device | [ethernet <*PORT-LIST*>]

show qos trust

```
switch# show qos trust

Port-based qos Trust Configuration

  Port    Trust Mode    | Device Trust State ---- --- ----
  A1      Default       |
  A2      Default       |
  A3      Device**      | Trusted
  A4      IP-Prec       |
```

```
  A5       Dot1p          |
  A5       None           |
  A5       DSCP           |
  A5       Device**       |
  A5       Dot1p          |

** For a list of trusted devices per-port, use the command show qos trust device.
To show trusted devices on a single port, use the command show qos trust device
<PORT>.
```

show qos trust device

```
switch# show qos trust device

Port-Based QoS Trust Configuration

  Port     Trusted Devices
  -------  ---------------
  A1       aruba-ap
  A2       aruba-ap
  A4       aruba-ap
```

show qos trust device <PORT>

```
switch# show qos trust device <PORT>

Port A4 QoS Trust Configuration
   Current state: Trusted

   Trusted Devices: aruba-ap
```

Validation rules

Validation	Error/Warning/Prompt
qos trust *<UNSUPPORTEDDEVICETYPE>*	Invalid input: %s
no qos trust *<ANYVALUE>*	Invalid command. To disable trust for a port, use `qos trust none`. To return to the default configuration and leave priority information unchanged, use `qos trust default`.
QoS priority when trust mode is anything other than *<NONE>* or *<DEFAULT>*.	The port QoS trust mode must be *<DEFAULT>* or *<NONE>* to configure the QoS port priority feature.
QoS DSCP when trust mode is anything other than *<NONE>* or *<DEFAULT>*.	The port QoS trust mode must be *<DEFAULT>* or *<NONE>* to configure the QoS port priority feature.

Table Continued

Validation	Error/Warning/Prompt
`QoS trust dot1.p` when any port QoS priority is enabled.	The port QoS priority feature must be disabled before configuring this port QoS trust mode.
QoS trust ip-prec when any port QoS priority is enabled.	The port QoS priority feature must be disabled before configuring this port QoS trust mode.
QoS trust DSCP when any port QoS priority is enabled.	The port QoS priority feature must be disabled before configuring this port QoS trust mode.
QoS trust device when any port QoS priority is enabled.	The port QoS priority feature must be disabled before configuring this port QoS trust mode.

Overview

The tunneled node feature encapsulates incoming packets from end-hosts in Generic Routing Encapsulation (GRE) and forwards them to a Mobility Controller for additional processing. The Mobility Controller strips the GRE header and processes the packet for authentication and stateful firewall, which enables centralized security policy, authentication, and access control.

The tunneled node feature is enabled on a per-port basis. Any traffic coming from nontunneled node interfaces is forwarded without being tunneled to a Mobility Controller.

Operating notes

- Tunneled node profile may be created using CLI and SNMP.
- The tunneled node profile supports configuring of:
  - Primary controller (IPv4 only).
  - Backup controller (IPv4 only).
  - Heartbeat keepalive timeout – range 1-8 seconds.
- Only one tunneled node profile may be created.
- The tunneled-node profile may be applied to a physical port only via CLI and SNMP.
- The maximum number of physical ports to which the profile may be applied is:
  - Aruba 5400R Switch Series (non-VSF): 256 physical ports.
  - Aruba 5400R Switch Series (VSF): 512 physical ports.
- The configuration related to the tunneled node profile will be stored in the flash and restored after a boot.
- High availability (HA) will be supported for the tunneled-node related configuration.
- A tunnel, associated with a port, is “up” when both conditions are met. A tunnel is “down” when either of the conditions are not met.
  - Either the primary or backup controller is reachable.
  - A boot strap message response is received from the controller.
- Heartbeat between the switch and controller has failed when the controller does not respond after five attempts. All tunnels are brought down with a heartbeat failure.
- A tunnel “up or down” status will be logged for each tunnel node port in the event log.
- The `show tech` command dumps all user-mode and test-mode command outputs.
- To reach the Aruba controller, the VLAN must have a manual IP configured.
- With the exception of the 802.1x BPDU, the switch consumes all other BPDUs.

Protocol Application Programming Interface (PAPI)

The PAPI Enhanced Security configuration provides protection to Aruba devices, AirWave, and ALE against malicious users sending fake messages that results in security challenges.

Starting from ArubaOS-Switch version 16.02, a minor security enhancement has been made to Protocol Application Programming Interface (PAPI) messages. Protocol Application Programming Interface endpoint authenticates the sender by performing a check of the incoming messages using MD5 (hash). All PAPI endpoints — APs, Controllers, Mobility Access Switches, Airwave, and ALE — must use the same secret key. The switch software currently uses a fixed key to calculate the MD5 digest and cooperate with the controller for PAPI enhanced security.

NOTE

To use this functionality, the PAPI security profile must be configured on the controller. For more information on the Aruba controller, see the **Aruba Networks Controller Configuration Manual**.

Configuration commands

tunneled-node-server

From within the **configure** context:

Syntax

[no] tunneled-node-server

Description

Configure a tunneled node profile. The profile name may be up to 32 characters long. Only one profile may be configured in the switch.

Options

tunneled-node-server	Configure a tunneled node server.

Usage

(config)# [no] tunneled-node-server

[no] tunneled-node-server

Validation rules

Validation	Error/Warning/Prompt
Trying to create more than one profile.	Cannot configure more than one tunneled node profile.
Trying to delete the nonexisting profile.	Record not found.
Trying to delete the existing profile which is applied on ports.	Cannot delete the tunneled node profile as one or more ports are using it.

tunneled-node-server

From within the **interface** context:

Syntax

[no] tunneled-node-server

Description

Apply the tunneled node server on the port.

Options

tunneled-node-server	Apply the tunneled node server on the port.

Usage

[no] tunneled-node-server

Validation rules

Validation	Error/Warning/Prompt
If meshing is configured, tunneled node profile is not allow applied on a port. It is mutually exclusive.	Cannot apply tunneled node profile on a port because meshing is enabled on the device.
If tunneled node profile is applied on a port, configuring meshing is not allowed. It is mutually exclusive.	Cannot enable meshing because tunneled node profile is applied on one or more ports.
If tunneled node profile is applied on a port, configuring Q-in-Q is not allowed. It is mutually exclusive.	Cannot enable Q-in-Q because tunneled node profile is applied on one or more ports.
If Q-in-Q is configured, tunneled node profiling applied on a port is not allowed. It is mutually exclusive.	Cannot apply tunneled node profile on a port because Q-in-Q is enabled on the device.
Trying to enable the distribute trunk on the switch when tunneled node profile is applied on a port.	Cannot enable distributed trunking because tunneled node profile is applied on one or more ports.
If distribute trunk is enabled on the switch, applying tunneled node profile to a port is not allowed. It is mutually exclusive.	Cannot apply tunneled node profile on a port because distributed trunking is enabled on the device.
Trying to enable IPv4 multicast routing on the switch when tunneled node profile is applied on a port. It is mutually exclusive.	Cannot enable IPv4 multicast routing because tunneled node profile is applied on one or more ports.
If IPv4 multicast routing is configured on the switch, tunneled node profile applied on a port is not allowed. It is mutually exclusive.	Cannot apply tunneled node profile on a port because IPv4 multicast routing is configured on the device.
Trying to enable OpenFlow on the switch when tunneled node profile is applied on a port. It is mutually exclusive.	Cannot enable OpenFlow because tunneled node profile is applied on one or more ports.
If OpenFlow is configured on the switch, tunneled node profile applied on a port is not allowed. It is mutually exclusive.	Cannot apply tunneled node profile on a port because OpenFlow is configured on the device.
Trying to enable VxLAN on the switch when tunneled node profile is applied on a port. It is mutually exclusive.	Cannot enable VxLAN because tunneled node profile is applied on one or more ports.

Table Continued

Validation	Error/Warning/Prompt
If VxLAN is configured on the switch, tunneled node profile applied on a port is not allowed. It is mutually exclusive.	Cannot apply tunneled node profile on a port because VxLAN is configured on the device.
If DIPLD is enabled on a port, tunneled node profile applied on a port is not allowed. It is mutually exclusive.	Cannot apply tunneled node profile on the port because DIPLD is applied on this port.
If tunneled node profile is applied on a port, DIPLD applied on that port is not allowed. It is mutually exclusive.	Cannot apply DIPLD on the port because tunneled node profile is applied on this port.
If DIPLDv6 is enabled on a port, tunneled node profile applied on a port is not allowed. It is mutually exclusive.	Cannot apply tunneled node profile on the port because DIPLDv6 is applied on this port.
If tunneled node profile is applied on a port, DIPLDv6 applied on that port is not allowed. It is mutually exclusive.	Cannot apply DIPLDv6 on the port because tunneled node profile is applied on this port.
If tunneled node profile is applied on a port, the port that is part of IPv6 ND Snooping enabled VLAN is not allowed. It is mutually exclusive.	Cannot configure IPv6 ND Snooping on the VLAN because tunneled node profile is applied on one or more ports on that VLAN.
If Virus Throttling is enabled on a port, tunneled node profile applied on a port is not allowed. It is mutually exclusive.	Cannot apply tunneled node profile on the port because Virus Throttling is applied on this port.
If tunneled node profile is applied on a port, Virus Throttling applied on a port is not allowed. It is mutually exclusive.	Cannot configure Virus Throttling on the port because tunneled node profile is applied on this port.
Tunneled node profile cannot be applied on the trunks.	Cannot apply tunneled node profile on the Trunks.
If DHCP Client is enabled on a VLAN, tunneled node profile applied on the ports part of a VLAN is not allowed. It is mutually exclusive.	Cannot apply tunneled node profile on the port because the port is part of the DHCP client enabled VLAN.
If tunneled node profile is applied on a port, a port to which is part of a DHCP client enabled VLAN is not allowed. It is mutually exclusive.	Cannot configure DHCP client on the VLAN because tunneled node profile is applied on one or more ports on that VLAN.

tunneled-node-server

Syntax

tunneled-node-server [controller-ip <*IP-ADDR*> | backup-controller-ip <*IP-ADDR*> | [keepalive <*TIMEOUT*>] | enable | fallback-local-switching]

Description

Configure tunneled node server information.

Options

controller-IP	Configure the controller IP address for the tunneled node.
backup-controller-IP	Configure the backup controller IP address for the tunneled node.
keepalive	Configure the keepalive timeout for the tunneled node in seconds [1-40]. The default is 8 seconds.
enable	Enter the manager command context.
fallback-local-switching	Apply fallback option when communication with the controller fails. When the tunneled node is applied to a port and the tunnel cannot be established with the controller, the fallback-local-switching option allows port traffic to be switched locally. When the option fallback-local-switching is not specified, the port traffic is dropped when the tunnel reestablishment fails.

Usage

switch(config)# tunneled-node-server controller-ip 15.255.133.148

switch(config)# tunneled-node-server backup-controller-ip 15.255.133.148

switch(config)# tunneled-node-server keepalive 40

switch(config)# tunneled-node-server fallback-local-switching

interface tunneled-node-server

Syntax

interface <*PORT*> tunneled-node-server

Description

Enable tunneled node on a port.

controller-ip

From within the **tunneled-node-profile** context:

Syntax

[no] controller-ip <*IP-ADDR*>

Description

Configure the Controller IP address for the tunneled node.

Usage

[no] controller-ip <*IP-ADDR*>

controller-ip	Configure the Controller IP address for the tunneled node.

keepalive

From within the **tunneled-node** context:

Syntax

[no] keepalive <*TIMEOUT*>

Description

Configure the keepalive timeout for the tunneled node in seconds.

Keepalive timeout seconds [1-40].

Default: 8 seconds.

Options

keepalive	Configure the keepalive timeout for the tunneled node in seconds.

backup-controller-ip

From within the **tunneled-node-profile** context:

Syntax

[no] backup-controller-ip <*IP-ADDR*>

Description

Configure the backup controller IP address for the tunneled node.

Options

backup-controller-ip	Configure the backup controller IP address for the tunneled node.

Usage

[no] backup-controller-ip <*IP-ADDR*>

fallback-local-switching

From within the **interface** context:

Syntax

fallback-local-switching

Description

To switch traffic locally upon losing connectivity to the controller, you must configure the fallback option before connectivity fails. When the tunneled node is applied to a port and the tunnel cannot be established with the controller, the fallback-local-switching option allows port traffic to be switched locally. When the option fallback-local-switching is not specified, the port traffic is dropped when the tunnel reestablishment fails.

Show commands

show tunneled-node-server

From within the **configure** context:

Syntax

show tunneled-node-server

Description

Display the tunneled node profile configured.

Options

tunneled-node-server	Display the tunneled node server configured.

show tunneled-node-server

```
(config) # show tunneled-node-server
 Tunneled Node Server Information
  State                          : Enabled
  Primary Controller             : 10.34.125.73
  Backup Controller              : 10.34.125.72
  Keepalive Interval (seconds) : 8
```

Validation rules

Validation	Error/Warning/Prompt
If profile is not present	Tunneled node profile is not configured.

show tunneled-node-server state

From within the **configure** context:

Syntax

show tunneled-node-server state

Description

Display the tunneled node server state.

show tunneled-node-server state

```
(config) #show tunneled-node-server state
 Tunneled Node Port State
 Active Controller IP Address  : 10.34.125.73
```

```
Port   State
------ -------------------------
1      Complete
3      Complete
4      Complete
A3     Complete
```

show tunneled-node-server

Syntax

show tunneled-node-server [state | statistics]

Description

Display switch operation information.

Options

state	Display the tunneled node port state.
statistics	Display the tunneled node statistics.

show tunneled-node-server state

```
Tunneled node Port State
Active Controller IP Address  :
Port   State
------ -------------------------
2      Port down
```

show tunneled-node-server statistics

```
Tunneled node Statistics

 Port : 2

  Control Plane Statistics
   Bootstrap packets sent      : 0
   Bootstrap packets received  : 0
   Bootstrap packets invalid   : 0

  Tunnel Statistics
   Rx Packets                                  : 0
   Tx Packets                                  : 0
   Rx 5 Minute Weighted Average Rate (Pkts/sec)  : 0
   Tx 5 Minute Weighted Average Rate (Pkts/sec)  : 0

Aggregate Statistics
 Heartbeat packets sent           : 0
 Heartbeat packets received       : 0
 Heartbeat packets invalid        : 0
 Fragmented Packets Dropped (Rx)  : 0
 Packets to Non-Existent Tunnel   : 0
 MTU Violation Drop               : 0
```

clear statistics tunneled-node-server

Syntax

clear statistics tunneled-node-server

Description

Clear statistics from the tunneled node server.

Interaction table

Features enabled with tunneled node:

Feature
Mirrors (MAC, VLAN, port)
PVST/RPVST/STP
DLDP
UDLD
LLDP/CDP
GVRP/MVRP
LACP
UFD
Sflow
Loop protect
Smartlink
Global QoS (VLAN, port, rate limit)
Mac lockout/lockdown
ACL/Classifiers (ingress/egress)
IGMP/MLD
GMB
Broadcast-limit
energy-efficient-Ethernet
flow-control

Table Continued

Feature
power-over-ethernet • poe-allocate-by • poe-lldp-detect Rogue Mac detection LLDP auto-provisioning

Restrictions

- Once a tunneled-node profile is applied to a port, the controller IP (primary and backup) cannot be changed.
- IP address cannot be assigned to VLANs that the tunnel-node port belongs to.
- No support for fragmentation and reassembly for encapsulated frames that result in an MTU violation. Such frames will be dropped. HPE recommends configuring the switch-controller path for Jumbo MTU. No support for PMTU detection for tunnel traffic.
- The packets from nontunneled node ports (in the same VLAN as tunnel-node port) will not be bridged to the tunneled-node ports and conversely.

Features not allowed on a tunneled node port/VLAN with tunneled node ports/globally:

Feature	Blocked globally/per port/ VLAN with tunneled-node-ports
IP multicast routing	Global
Openflow	Global
Q-in-Q	Global
Distributed Trunking	Global
Mesh	Global
VXLAN	Global
IP address: manual and dhcp	VLAN
802.1x, mac auth, webauth, LMA, port security	port
DIPLD (IPv4/IPv6)	port
DSNOOP (IPv4/IPv6)	VLAN
ARP protect	VLAN
RA guard	port
Virus throttling	port
BYOD	VLAN

Table Continued

Feature	Blocked globally/per port/ VLAN with tunneled-node-ports
Trunk	Profile cannot be applied to a trunk
PBR policies	VLAN
IRF on a tunneled-node port	port
Src port/Mcast filters	port
DHCP client/Server/Relay	VLAN

PAPI security

Protocol Application Programming Interface (PAPI)

The PAPI Enhanced Security configuration provides protection to Aruba devices, AirWave, and ALE against malicious users sending fake messages that results in security challenges.

Starting from ArubaOS-Switch version 16.02, a minor security enhancement has been made to Protocol Application Programming Interface (PAPI) messages. Protocol Application Programming Interface endpoint authenticates the sender by performing a check of the incoming messages using MD5 (hash). All PAPI endpoints — APs, Controllers, Mobility Access Switches, AirWave, and ALE — must use the same secret key. The switch software currently uses a fixed key to calculate the MD5 digest and cooperate with the controller for PAPI enhanced security.

To use this functionality, the PAPI security profile must be configured on the controller. For more information on the Aruba controller, see the **Aruba Networks Controller Configuration Manual**.

PAPI configurable secret key

To support enhanced PAPI security, a command is available to configure a MD5 secret key.

papi-security

Syntax

```
switch# (config) papi-security
```

Description

Configure MD5 key for enhanced PAPI security.

Parameters

enhanced-security	The enhanced-security CLI must be enabled in Aruba controller for the connection to be truly secured.
<KEY-STR>	Configure MD5 key for enhanced PAPI security using a key-string parameter.
<KEY-VALUE>	Configure MD5 key for enhanced papi security using a key-value parameter.

Restrictions

- To view the status of the PAPI security, using the `show run` command with the option `include credentials` enabled, the PAPI security key will show in the output as an encrypted form.
- Key length has to be between 10-64.
- By default the enhanced-security is disabled.
- When enhanced-security mode is disabled, any AP can obtain the current shared secret key.
- When enhanced-security mode is enabled, an AP is not updated with the new shared secret key unless the AP knows the previous key and the AP is updated with the new key within one hour of the key creation.
- Key length has to be between 10-64 or the following message will appear:

  Minimum key-value length allowed is 10 characters and maximum allowed is 64 characters.

Usage

```
Switch(config)# papi-security key-value <KEY-VALUE>
Switch(config)# [no] papi-security <KEY-VALUE>
```

papi-security key-value

```
HP-2920-24G(config)# papi-security key-value TestKey12345678
HP-2920-24G(config)# no papi-security key-value

HP-2920-24G(config)# papi-security key-value Test
Minimum key-value length allowed is 10 characters and maximum allowed is 64
characters.
```

show run with encrypted key

```
 Switch(config)# sh run
Running configuration:
;J9576A Configuration Editor
;Created on release #KA.16.02.0000x
;Ver #0e:01.f0.92.34.5f.3c.6b.fb.ff.fd.ff.ff.3f.ef:78
;encrypt-cred +NXT3w7ky2IXNXadlJblS/1ZRi/o73Qq28XXcLkSCZq9PU30Kl+KMLMva8rQri5g

 hostname "HP-3800-48G-4SFPP"
 module 1 type j9576y
 module 2 type j9576x
 encrypt-credentials
 papi-security encrypted-key <"encrypted-key">
 snmp-server community "public" unrestricted
 snmpv3 engineid "00:00:00:0b:00:00:50:65:f3:b4:a6:c0"
 oobm
 ip address dhcp-bootp
 exit

 vlan 1
 name "DEFAULT_VLAN"
 untagged 1-52
 ip address dhcp-bootp
 exit

 activate provision disable
```

show run with include key

```
show run
Running configuration:
; J9576A Configuration Editor
; Created on release #KA.16.02.0000x
; Ver#0e:01.f0.92.34.5f.3c.6b.fb.ff.fd.ff.ff.3f.ef:78

 hostname "HP-3800-48G-4SFPP"
 module 1 type j9576y
 module 2 type j9576x
 include-credentials
 papi-security key-value <"key">
 snmp-server community "public" unrestricted
 snmpv3 engineid "00:00:00:0b:00:00:50:65:f3:b4:a6:c0"
 oobm
 ip address dhcp-bootp
 exit

 vlan 1
 name "DEFAULT_VLAN"
 untagged 1-52
 ip address dhcp-bootp
 exit

 activate provision disable
```

The Time Domain Reflectometry (TDR) is a new port feature supported on some switches running ArubaOS-Switch software. TDR is introduced to detect cable faults on 100BASE-TX and 1000BASE-T ports.

Virtual cable testing

The Virtual Cable Test (VCT) uses the same command as TDR. It is applicable only for GigT transceivers like copper transceiver (J8177C–ProCurve Gigabit 1000Base-T Mini-GBIC). The VCT test results include distance to the fault, but not the cable length.

Test cable-diagnostics

Syntax

test cable-diagnostics <*PORT-LIST*>

Description

Use the command to test for cable faults.

Option

PORT-LIST

Specify copper port as a input port number.

Test cable-diagnostics C21

```
test cable-diagnostics C21

The 'test cable-diagnostics' command will cause a loss of link and will take a few
seconds per interface to complete.
Continue [Y/N]? y

MDI         Cable    Distance    Pair   Pair        MDI
Port Pair   Status   to Fault    Skew   Polarity    Mode
---------   ------   --------    -----   ------   ------
C21 1-2       Open       0 m      0 ns
    3-6       Open       0 m      0 ns
    4-5       Open       0 m      0 ns
    7-8       Open       1 m      0 ns
```

Test cable-diagnostics 1/1-1/10

```
switch# test cable-diagnostics 1/1-1/10

This command will cause a loss of link on all tested ports and will take
several seconds per port to complete.  Use the 'show cable-diagnostics' command to
view
 the results.
```

```
Continue (y/n)? Y

switch# show cable-diagnostics 1/1-1/10

Cable Diagnostic Status - Copper Ports

      MDI    Cable       Cable Length or
 Port Pair   Status      Distance to Fault
 ---- ------ ----------- ---------------------
 1/1  1-2    OK          5m
      3-6    OK          5m
      4-5    OK          7m
      7-8    OK          7m
 1/2  1-2    OK          7m
      3-6    OK          7m
      4-5    OK          7m
      7-8    OK          7m
 1/3  1-2    OK          5m
      3-6    OK          7m
      4-5    OK          5m
      7-8    OK          7m
 1/4  1-2    OK          7m
      3-6    OK          7m
      4-5    OK          7m
      7-8    OK          5m
 1/5  1-2    OK          4m
      3-6    OK          5m
      4-5    OK          5m
      7-8    OK          4m
 1/6  1-2    OK          4m
      3-6    OK          4m
      4-5    OK          4m
      7-8    OK          4m
 1/7  1-2    OK          5m
      3-6    OK          4m
      4-5    OK          5m
      7-8    OK          4m
 1/8  1-2    OK          4m
      3-6    OK          5m
      4-5    OK          4m
      7-8    OK          4m
 1/9  1-2    OK          5m
      3-6    OK          5m
      4-5    OK          5m
      7-8    OK          5m
 1/10 1-2    OK          7m
      3-6    OK          5m
      4-5    OK          5m
      7-8    OK          5m
```

Good cable tests

```
switch# test cable-diagnostics 51

This command will cause a loss of link on all tested ports and will take
several seconds per port to complete.  Use the 'show cable-diagnostics'
command to view the results.

Continue (y/n)? Y
```

```
switch# show cable-diagnostics 51

Cable Diagnostic Status - Transceiver Ports

        MDI    Cable       Distance   Pair    Pair       MDI
  Port  Pair   Status      to Fault   Skew    Polarity   Mode
  ---- ------  ---------   --------   -----   -------   -----
  51     1-2     OK           0 m      8 ns   Normal     MDI
         3-6     OK           0 m      8 ns   Normal
         4-5     OK           0 m      8 ns   Normal     MDIX
         7-8     OK           0 m      0 ns   Normal


switch# test cable-diagnostics 52

This command will cause a loss of link on all tested ports and will take
several seconds per port to complete.  Use the 'show cable-diagnostics'
command to view the results.

Continue (y/n)?  Y

switch# show cable-diagnostics 52

Cable Diagnostic Status - Transceiver Ports

        MDI    Cable       Distance   Pair    Pair       MDI
  Port  Pair   Status      to Fault   Skew    Polarity   Mode
  ---- ------  ---------   --------   -----   -------   -----
  52    1-2     OK           0 m      0 ns   Normal     MDI
        3-6     OK           0 m      0 ns   Normal
        4-5     OK           0 m      0 ns   Normal     MDIX
        7-8     OK           0 m      0 ns   Normal
```

Faulty cable test

```
switch# test cable-diagnostics 51
This command will cause a loss of link on all tested ports and will take
several seconds per port to complete.  Use the 'show cable-diagnostics'
command to view the results.

Continue (y/n)?  y
switch# show cable-diagnostics 51

Cable Diagnostic Status - Transceiver Ports

      MDI    Cable       Distance   Pair   Pair       MDI
  Port Pair   Status      to Fault   Skew   Polarity   Mode
  ---- ------ ----------- ---------- ------ ---------- ------
  51    1-2    OK          0 m        0 ns
        3-6    Short       1 m        0 ns
        4-5    Short       1 m        0 ns
        7-8    OK          0 m        0 ns


switch# test cable-diagnostics 52

This command will cause a loss of link on all tested ports and will take
several seconds per port to complete.  Use the 'show cable-diagnostics'
command to view the results.

Continue (y/n)?  Y
```

```
switch# show cable-diagnostics 52

Cable Diagnostic Status - Transceiver Ports

      MDI    Cable       Distance   Pair   Pair       MDI
 Port Pair   Status      to Fault   Skew   Polarity   Mode
 ---- ------ ----------- ---------- ------ ---------- ------
 52   1-2     Open        0 m        0 ns
      3-6     Open        0 m        0 ns
      4-5     Open        1 m        0 ns
      7-8     Open        0 m        0 ns
```

Error message

Error Message	Cause
The transceiver on port 1/A1 does not support cable diagnostics.	• usage of invalid(fiber-SFP+) port • The selected range includes an entry for an invalid port.

show cable-diagnostics

Syntax

`show cable-diagnostics <PORT-LIST>`

Description

Use the command to generate results of completed tests on single or multiple ports. For incomplete tests, a warning is displayed.

Option

`PORT`

Specify one copper port as an input port number.

clear cable-diagnostics

Syntax

`clear cable-diagnostics`

Description

Use the command to clear the result buffer.

Example

```
switch(config)# clear cable-diagnostics
```

Limitations

TDR has the following limitations:

- TDR length accuracy is ± 5 m
- Does not work on Smart Rate Interfaces with 10GBASE-T and NGBASE-T (2.5G, 5G copper) ports available on:

    - v3 blades
        - J9991A — Aruba 20-port 10/100/1000BASE-T PoE+ / 4-port 1/2.5/5/10GBASE-T PoE+ MACsec v3 zl2 Module
        - J9995A — Aruba 8-port 1/2.5/5/10GBASE-T PoE+ MACsec v3 zl2 Module
    - 3810M (JL076A — Aruba 3810M 40G 8 HPE Smart Rate PoE+ 1-slot Switch)
- Not supported on v2 zl modules
- Valid only on 100BASE-TX and 1000BASE-T ports

Overview

The Link Layer Discovery Protocol (LLDP) is a vendor-neutral link layer protocol in the Internet Protocol Suite used by Aruba network devices for advertising their identity, capabilities, and neighbors on an IEEE 802 local area network, principally wired ethernet. The LLDP-bypass authentication feature provides zero touch provisioning of Aruba 802.11ac wireless access points (APs).

In an LLDP module, the packet is parsed and inspected for the presence of an Aruba Organizational Unit Identifier (OUI) Type-Lenght-Value (TLV). The Aruba OUI TLV, once detected, will bypass the authentication and permit traffic to pass on the port. If the Aruba OUI TLV is absent, the packet will be dropped and processing of the packet or LLDP transmission for that device will not pass.

In ZTP environments, when an Aruba AP is plugged into the switch port, the device profiles will be applied on the AP without any user intervention. After discovery of an Aruba AP, the switch will dynamically provision the AP connected port without initiating any authentication needs. This feature is enabled at the port-level or on a range of ports.

Features not supported

- Authorization parameters configured in RADIUS and the switch are not supported by the LLDP-bypass authentication feature.

Configuration commands

aaa port-access lldp-bypass

From within the configure context:

Syntax

[no] aaa port-access lldp-bypass

Description

The command configures lldp-bypass authentication on the switch ports.

Configure lldp-bypass on the switch ports to bypass authentication for Aruba-APs which sends special LLDP TLVs.

When lldp-bypass is enabled on the switch ports, the Aruba-APs sending a special LLDP TLV will not undergo any authentication like 802.1x/WMA/LMA. By default, lldp-bypass is disabled on the switch ports.

Options

authenticator	Configure 802.1X (Port Based Network Access) authentication on the switch or the switch ports.
gvrp-vlans	Enable the use of RADIUS-assigned dynamic (GVRP) VLANs.
lldp-bypass	Configure lldp-bypass on the switch ports to bypass authentication for Aruba-APs

local-mac	Configure Local MAC address-based network authentication on the device or the device ports.
mac-based	Configure MAC address based network authentication on the switch or the switch ports.
mka	Configure the MACsec Key Agreement (MKA) protocol parameters.
ethernet <*PORT-LIST*>	Manage general port security features on the device ports. Use either a port number or <*ALL*>.
supplicant	Manage 802.1X (Port Based Network Access) supplicant on the switch ports.
web-based	Configure web-based network authentication.

Usage

[no] aaa port-access lldp-bypass <*PORT-LIST*>

Description

Validation rules

Validation	Error/Warning/Prompt

When the lldp-bypass is enabled on the port, different error messages are displayed.	If MAC lockdown is enabled on the port:
	`Error configuring port A1: lldp-bypass cannot be enabled on a port with MAC lock-enabled.`
	If learn-mode is configured on the port:
	`A1: lldp-bypass cannot be enabled on the port with learn-mode configured.`
	If MACsec is configured on the port:
	`Error configuring port A1: lldp-bypass cannot be enabled on the port with MACsec-enabled.`
	If trunk is configured on the port:
	`Error configuring port A1: lldp-bypass cannot be enabled on the port with mesh or manual trunks configured.`
	If mesh is configured on the port:
	`lldp-bypass cannot be enabled on the port with mesh or manual trunks configured.`
	If Distributed Trunking is configured on the port:
	`lldp-bypass cannot be enabled on the port with mesh or manual trunks configured.`

When MACsec is enabled on the port:	If lldp-bypass is enabled on the port: `Cannot apply MACsec on the port A1 when lldp-bypass is enabled on that port.`
When learn-mode is configured on the port:	If lldp-bypass is enabled on the port: `A1: Cannot apply learn-mode on the port A1 when lldp-bypass is enabled on that port.`

Table Continued

Validation	Error/Warning/Prompt
When trunk, distributed trunk or mesh is configured on the port:	If lldp-bypass is enabled on the port: `Cannot apply mesh or manual trunks on the port A1 when lldp-bypass is enabled on that port.`
When MAC-lockdown is enabled on the port:	If lldp-bypass is enabled on the port: `Cannot apply MAC lock-enable on the port A1 when lldp-bypass is enabled on that port.`
Security Warning when enabling lldp-bypass on the port.	`Enabling lldp-bypass on the port may give access to any Aruba-AP that sends a special LLDP TLV without undergoing any authentication. This configuration may allow network access to the rogue devices that are capable of sending the special LLDP TLV` `Do you want to continue? [y/n]:`

Show commands

show port-access lldp-bypass clients

Syntax

show port-access lldp-bypass clients

Description

Displays the clients which bypassed the authentication.

Options

<PORT-LIST> Show information for specified ports only.

Usage

show port-access lldp-bypass clients [*<PORT-LIST>*]

show port-access lldp-bypass clients

```
switch#show port-access lldp-bypass clients

Port Access lldp-bypass Client Status
Port     MAC Address
-------   ----------------
A1       000005-010203
A2       010203-040506
```

Stackable switch: show port-access lldp-bypass clients

```
switch(config)# show port-access lldp-bypass clients

Port Access lldp-bypass Client Status
Port     MAC Address
-------   ----------------
1/1       000005-010203
1/2       005056-bd7039
```

show port-access lldp-bypass clients A1

```
switch#show port-access lldp-bypass clients A1

Port Access lldp-bypass Client Status
Port     MAC Address
-------   ----------------
A1        000005-010203
```

Stackable switch: show port-access lldp-bypass clients 1/1

```
switch(config)# show port-access lldp-bypass clients 1/1

Port Access lldp-bypass Client Status
Port     MAC Address
-------   ----------------
1/1       000005-010203
```

show port-access lldp-bypass config

Syntax

show port-access lldp-bypass config

Description

Displays the lldp-bypass configuration applied on all switch ports.

show port-access lldp-bypass config

```
switch#show port-access lldp-bypass config

Port Access lldp-bypass Configuration
Port   Enabled
------  ----------
A1     Yes
A2     Yes
A3     No
A4     No
...
A24    No
F1     No
F2     No
```

```
F3      No

F24     No
```

Stackable switch: show port-access lldp-bypass config

```
switch(config)#show port-access lldp-bypass config

Port Access lldp-bypass Configuration
Port   Enabled
------  ----------
1/1    Yes
1/2    Yes
1/3    No
...
1/52   No
2/1    No

2/26   No
3/1    No

3/26   No
```

Error Log

Event	Message
CLIERR_CANNOT_ENABLE_LLDP_BYPASS_MAC_LOCKDOWN_ENABLED	lldp-bypass is not allowed on the port where MAC-lockdown is enabled. `lldp-bypass cannot be enabled on a port with MAC lock-enabled.`
CLIERR_MACLOCK_AND_LLDP_BYPASS	MAC-lockdown is not permitted on the port where is enabled lldp-bypass. `Cannot configure MAC lock-enable on the port A1 when lldp-bypass is enabled on that port.`
CLIERR_CANNOT_ENABLE_LLDP_BYPASS_MACSEC_ENABLED	lldp-bypass is not allowed on the port MACsec is configured. `lldp-bypass cannot be enabled on a port when MACsec is enabled.`
CLIERR_CANNOT_ENABLE_MACSEC_AS_LLDP_BYPASS_CONFIGURED	MACsec is not permitted on the port where is enabled lldp-bypass. `Cannot apply MACsec on the port A1 when lldp-bypass is enabled on that port.`

Table Continued

Event	Message
CLIERR_CANNOT_ENABLE_LEARN_MODE_CONFIGURED_LLDP_BYPASS	Port-security learn-mode configured is not permitted when lldp-bypass is enabled on the port. `A1: Cannot apply learn-mode on the port A1 when lldp-bypass is enabled on that port.`
CLIERR_LLDP_BYPASS_AND_LEARN_MODE_CONFIGURED	lldp-bypass is not permitted when port-security learn-mode is configured. `lldp-bypass cannot be enabled on a port when learn-mode is enabled.`
CLIERR_LLDP_BYPASS_AND_MESH_OR_MANUAL_TRUNK	Trunk/ mesh/Distributed Trunk is not permitted on the lldp-bypass enabled port. `Cannot apply mesh or manual trunks on the port A1 when lldp-bypass is enabled on that port.`
Existing Log:CLIERR_MESH_OR_MANUAL_TRUNK	lldp-bypass cannot be enabled for trunk/mesh/ Distributed Trunk ports. `lldp-bypass cannot be enabled on a port when mesh or manual trunks is enabled.`

Debug log

Comment	Message
Security warning to be displayed when lldp-bypass configuration is enabled on the port.	`Enabling lldp-bypass on the port may give access to any Aruba-AP that sends a special LLDP TLV without undergoing any authentication. This configuration may allow network access to the rogue devices that are capable of sending the special LLDP TLV` `Do you want to continue? [y/n]:`
When adding the Aruba-AP into the authorized client list.	`Will use the existing debug log:` `0000:00:24:25.07 PSEC mPORTSECMCtrl:added new SA 000005-000000 to authorized addr list of port A1 for vlan 1.`
When removing the Aruba-AP from the authorized client list.	`Will use the existing debug log:` `0000:00:01:47.07 PSEC mPORTSECMCtrl:removed 000006-000000 from authorized addr list of port A1 for vlan 1 due to delete.`

Table Continued

Comment	Message
When Aruba-AP is detected on lldp-bypass enabled port:	`0000:00:13:57.64 PSEC mPORTSECMCtrl: Received PROFMGR_DEVICE_CONNECTED event for 40e3d6-c6d492 on port A1.`
When already connected Aruba-AP is disconnected/removed on lldp-bypass enabled port.	`0000:00:13:07.96 PSEC mPORTSECMCtrl: Received PROFMGR_DEVICE_DISCONNECTED event for 40e3d6-c6d492 on port A1.`

Net-service Overview

Net-service names are used as alias in defining ACL rules for defined lists. An alias of net-service will configure a list of hosts, networks, or subnets.

Extended ACL can have both source IP, destination IP and port number along with protocol in its ACE. An alias-based ACE for an extended ACL therefore allows the use of an alias of net-service protocol and destination port.

Limitations

- Alias-based ACE will not support access-control based on source port which is a limitation of the net-service command. The use of net-service will also restrict operators specified for port number to `equals` and `range`.
  - Operators `lt`, `gt`, `equal`,`negative`, and `range` for the source port in the ACL rule are not specified using the options available in net-service.
  - Operators `lt`, `gt`, `negative` are not specified for destination port using the options available in net-service.
  - Only the ACL will be affected when changes are made to an existing net-service. Either the rule must be reapplied to the ACL or the switch must be rebooted to affect the service.

netservice [tcp | udp | port]

Syntax

[no] netservice *<NAME-STR>* [tcp | udp | *<PROTOCOL>*]
port *<PORT-LIST>*

Description

Configures net-service.

Parameters

protocol	IP protocol number. Range: 0-255
TCP	Configure an alias for a TCP protocol.
UDP	Configure an alias for a UDP protocol.
port	Specify a single port or a list of noncontiguous port numbers, by entering up to six port numbers, separated by commas or range of ports. Range: 0-65535

Example net-service tcp-service tcp 100

```
net-destination src-ip
 host 10.120.0.1
 host 10.91.1.1
 host 10.0.100.12
```

```
   net-destination destn-ip
      host 16.90.51.12
      host 10.93.24.1

   net-service tcp-service tcp 100
   ip access-list extended "acl1"
      permit alias src-ip alias destn-ip alias tcp-service
```

Net-destination overview

The use of net-destination and net-service helps reduce effort required to configure ACL rules.

Net-destination is a list of hosts, networks, or subnets that are used to configure an ACL rules.

There are two types of ACLs supported and configured on the switch:

- Standard
- Extended

Standard

The standard ACL can have an IP source or network in the ACE. Defining the alias-based ACE for standard ACL, only use an alias of net-destination for the source.

Example - standard

```
net-destination src-ip
      host 10.120.0.1
      host 10.91.1.1
      host 10.0.100.12

   net-destination destn-ip
      host 16.90.51.12
      host 10.93.24.1

   net-service tcp-service tcp 100
   ip access-list extended "acl1"
      permit alias src-ip alias destn-ip
         alias tcp-service
```

Extended

The extended ACL can have both source IP, destination IP and port number along with protocol in its ACE. Defining an alias-based ACE for an extended ACL can use an alias of net-destination for the source and destination and an alias of net-service for the protocol and destination port. Alias-based ACE will not support access-control based on source port which is a limitation of the net-service command. The use of net-service will also restrict the operators that can be specified for port number to `equals`and `range`.

Example - extended

```
HP-Switch-5406Rzl2(config)# ip access-list extended aext1
HP-Switch-5406Rzl2(config-ext-nacl)#
   permit tcp host 10.100.12.1 gt 23 16.90.0.0 /16 range 200 400
HP-Switch-5406Rzl2(config-ext-nacl)# exit
```

Limitations

- Limited to IPv4 addresses per syntax.
- Any changes made to an existing net-destination that is used by an ACL, will be applied on the ACL only when the rule is reapplied to it or when switch is rebooted.

- The number of entries for a single net-destination is limited. The number of net-destinations configurable on a switch is also limited.
- A considerable amount of memory (for global structures) will be allocated when alias-based ACEs are configured which may cause issues on a switch with low memory.
- The Host or Domain name cannot be specified as an entry in a net-destination.
- Application level gateway will not be supported as the existing ACL infra does not support ALG.
- SNMP support to configure and delete net-destination, net-service, and the alias-based rules will not be provided.
- The ‘invert’ and ‘range’ option have been deprecated as per ArubaOS-Switch 7.4 CLI Reference Guide and hence will not be supported. However, the functionality of ‘invert’ option can be achieved through the ‘deny’ rule.
- RADIUS server-based ACL application to interface/VLAN will not be supported for ACLs with alias-based rules.

net-destination host |position | network

Syntax

[no] netdestination <*NAME-STR*> [host <*IP-ADDR*>
[position <*NUM*>] network <*IP-ADDR/MASK-LENGTH*>
[position <*NUM*>]]

Description

Net-destination is a list of hosts, networks, or subnets that are used to configure an ACL rule.

Parameters

host Configures a single IPv4 host.

network An IPv4 subnet consisting of an IP address and netmask.

no Removes any configured item in list or an entire net-destination.

position Specifies the position of a host, network, or range in the net-destination. This optional parameter is specific to a net-destination and may only be used to sort entries in a list.

show net-destination

Syntax

show net-destination <*NAME-STR*>

Description

Show a host-specific net-destination.

Overview

Only IP addresses assigned by the DHCP server are visible in RADIUS accounting on an ArubaOS-Switch. Visibility of statically assigned IP addresses in RADIUS accounting is available with a CLI that enables and disables static IP visibility for authenticated clients.

IP client-tracker

Syntax

```
ip client-tracker
```

Description

Enables or disables the visibility of statically and dynamically assigned IPv4 and IPv6 addresses for authenticated clients.

Options

[no] Use of [no] disables the Static IP visibility feature.

Usage

- [no] ip client-tracker

Example show port-access clients

```
show port-access clients
Port Access Client Status

Port    Client Name    MAC Address          IP Address      User Role Type  VLAN
----   -------------- -------------- ---------------------- ---------- ----- ----
1      005056bd3ff7  005056-bd3ff7  3ffe:501:ffff:100::5e              MAC  1
```

Example output for an IPv4 client

```
Switch(config)# sh port-acc cli
 Port Access Client Status

Port    Client Name    MAC Address          IP Address      User Role Type  VLAN
----   -------------- -------------- ---------------------- ---------- ----- ----
  1/3   000002b85001  000002-b85001   10.1.1.30                         MAC   10
```

Networking Websites

Hewlett Packard Enterprise Networking Information Library	**www.hpe.com/networking/resourcefinder**
Hewlett Packard Enterprise Networking Software	**www.hpe.com/networking/software**
Hewlett Packard Enterprise Networking website	**www.hpe.com/info/networking**
Hewlett Packard Enterprise My Networking website	**www.hpe.com/networking/support**
Hewlett Packard Enterprise My Networking Portal	**www.hpe.com/networking/mynetworking**
Hewlett Packard Enterprise Networking Warranty	**www.hpe.com/networking/warranty**

General websites

Hewlett Packard Enterprise Information Library	**www.hpe.com/info/EIL**

For additional websites, see **Support and other resources**.

Accessing Hewlett Packard Enterprise Support

- For live assistance, go to the Contact Hewlett Packard Enterprise Worldwide website:

  http://www.hpe.com/assistance
- To access documentation and support services, go to the Hewlett Packard Enterprise Support Center website:

  http://www.hpe.com/support/hpesc

Information to collect

- Technical support registration number (if applicable)
- Product name, model or version, and serial number
- Operating system name and version
- Firmware version
- Error messages
- Product-specific reports and logs
- Add-on products or components
- Third-party products or components

Accessing updates

- Some software products provide a mechanism for accessing software updates through the product interface. Review your product documentation to identify the recommended software update method.
- To download product updates:

Hewlett Packard Enterprise Support Center	**www.hpe.com/support/hpesc**
Hewlett Packard Enterprise Support Center: Software downloads	**www.hpe.com/support/downloads**
Software Depot	**www.hpe.com/support/softwaredepot**

- To subscribe to eNewsletters and alerts:

  www.hpe.com/support/e-updates
- To view and update your entitlements, and to link your contracts and warranties with your profile, go to the Hewlett Packard Enterprise Support Center **More Information on Access to Support Materials** page:

  www.hpe.com/support/AccessToSupportMaterials

Access to some updates might require product entitlement when accessed through the Hewlett Packard Enterprise Support Center. You must have an HPE Passport set up with relevant entitlements.

Customer self repair

Hewlett Packard Enterprise customer self repair (CSR) programs allow you to repair your product. If a CSR part needs to be replaced, it will be shipped directly to you so that you can install it at your convenience. Some parts do not qualify for CSR. Your Hewlett Packard Enterprise authorized service provider will determine whether a repair can be accomplished by CSR.

For more information about CSR, contact your local service provider or go to the CSR website:

http://www.hpe.com/support/selfrepair

Remote support

Remote support is available with supported devices as part of your warranty or contractual support agreement. It provides intelligent event diagnosis, and automatic, secure submission of hardware event notifications to Hewlett Packard Enterprise, which will initiate a fast and accurate resolution based on your product's service level. Hewlett Packard Enterprise strongly recommends that you register your device for remote support.

If your product includes additional remote support details, use search to locate that information.

Remote support and Proactive Care information

HPE Get Connected	**www.hpe.com/services/getconnected**
HPE Proactive Care services	**www.hpe.com/services/proactivecare**
HPE Proactive Care service: Supported products list	**www.hpe.com/services/proactivecaresupportedproducts**
HPE Proactive Care advanced service: Supported products list	**www.hpe.com/services/proactivecareadvancedsupportedproducts**

Proactive Care customer information

Proactive Care central	**www.hpe.com/services/proactivecarecentral**
Proactive Care service activation	**www.hpe.com/services/proactivecarecentralgetstarted**

Warranty information

To view the warranty for your product, see the *Safety and Compliance Information for Server, Storage, Power, Networking, and Rack Products* document, available at the Hewlett Packard Enterprise Support Center:

www.hpe.com/support/Safety-Compliance-EnterpriseProducts

Additional warranty information

HPE ProLiant and x86 Servers and Options	**www.hpe.com/support/ProLiantServers-Warranties**
HPE Enterprise Servers	**www.hpe.com/support/EnterpriseServers-Warranties**
HPE Storage Products	**www.hpe.com/support/Storage-Warranties**
HPE Networking Products	**www.hpe.com/support/Networking-Warranties**

Regulatory information

To view the regulatory information for your product, view the *Safety and Compliance Information for Server, Storage, Power, Networking, and Rack Products*, available at the Hewlett Packard Enterprise Support Center:

www.hpe.com/support/Safety-Compliance-EnterpriseProducts

Additional regulatory information

Hewlett Packard Enterprise is committed to providing our customers with information about the chemical substances in our products as needed to comply with legal requirements such as REACH (Regulation EC No 1907/2006 of the European Parliament and the Council). A chemical information report for this product can be found at:

www.hpe.com/info/reach

For Hewlett Packard Enterprise product environmental and safety information and compliance data, including RoHS and REACH, see:

www.hpe.com/info/ecodata

For Hewlett Packard Enterprise environmental information, including company programs, product recycling, and energy efficiency, see:

www.hpe.com/info/environment

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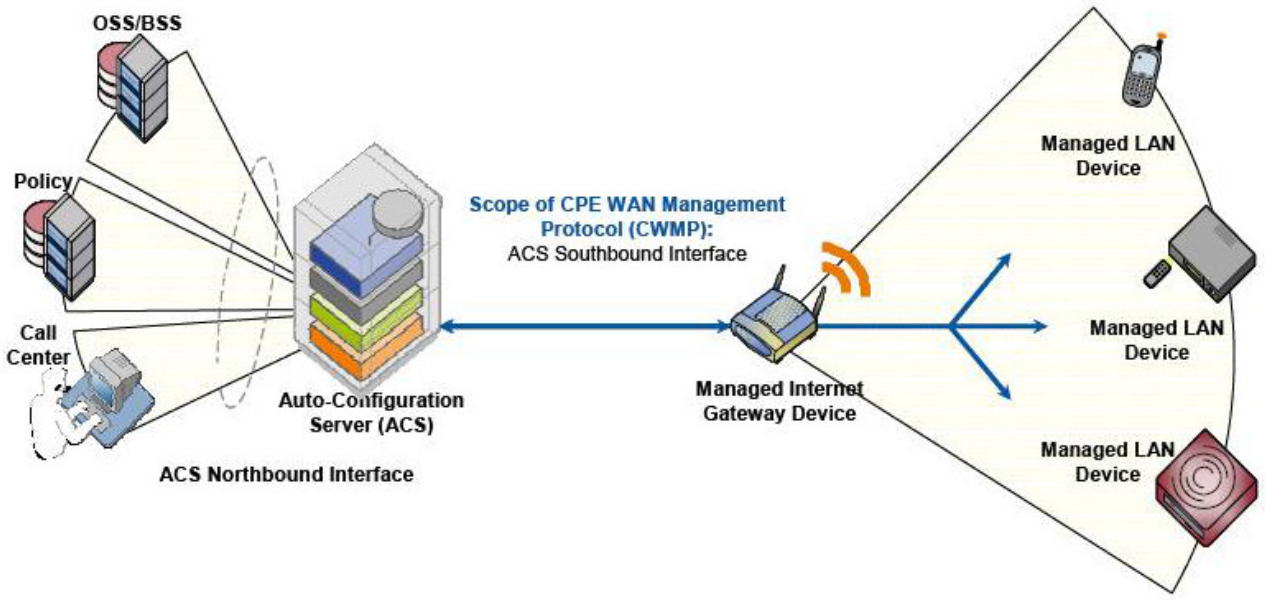
Introduction

TR-069 is a technical specification created by the **Broadband Forum**. The TR-069 protocol specifies client and server requirements to manage devices across the Internet by using a client server architecture to provide communication between the CPE (Customer Premises Equipment) and the ACS (Auto Configuration Server). A protocol helps to manage complex networks where many devices such as modems, routers, gateways, VoIP phones and mobile tablets compete for resources. TR-069 defines the CPE WAN Management Protocol (CWMP) protocol necessary to remotely manage end-user devices. ACS provides automatic configuration for these devices.

CWMP is automatically enabled. To conserve resources, reconfigure this setting using the `cwmp disable` command.

TR-069 defines an auto-configuration architecture which provides the following primary capabilities:

- Auto-configuration and dynamic service provisioning
- Software/firmware image management
- Status and performance monitoring
- Diagnostics
- Bidirectional SOAP/HTTP based protocol



Advantages of TR-069

- TR-069 can manage devices with dynamic IP addresses.
  - TR-069 use Organization Unique ID (OUI) and serial number rather than IP to identify a device.
- TR-069 can manage devices in a private network.
  - The HPE ACS BIMS (an iMC module) uses HTTP to communicate with the device, and the session is initiated by the device, so BIMS can pass through NAT to manage the device.
- TR-069 is secure.
  - TR-069 can use HTTPS to communicate with or transfer files to/from the device; it is more secure than TFTP, FTP or Telnet.
- TR-069 is suitable for WAN management across internet.
- TR-069 is suitable for zero-touch configuration.
  - The zero-configuration mechanism is defined in the TR-069 specification.
- TR-069 is suitable for large-scale device management.
  - TR-069 support distributed architecture. The ACS can be distributed to multiple servers, each ACS can manage part of devices.

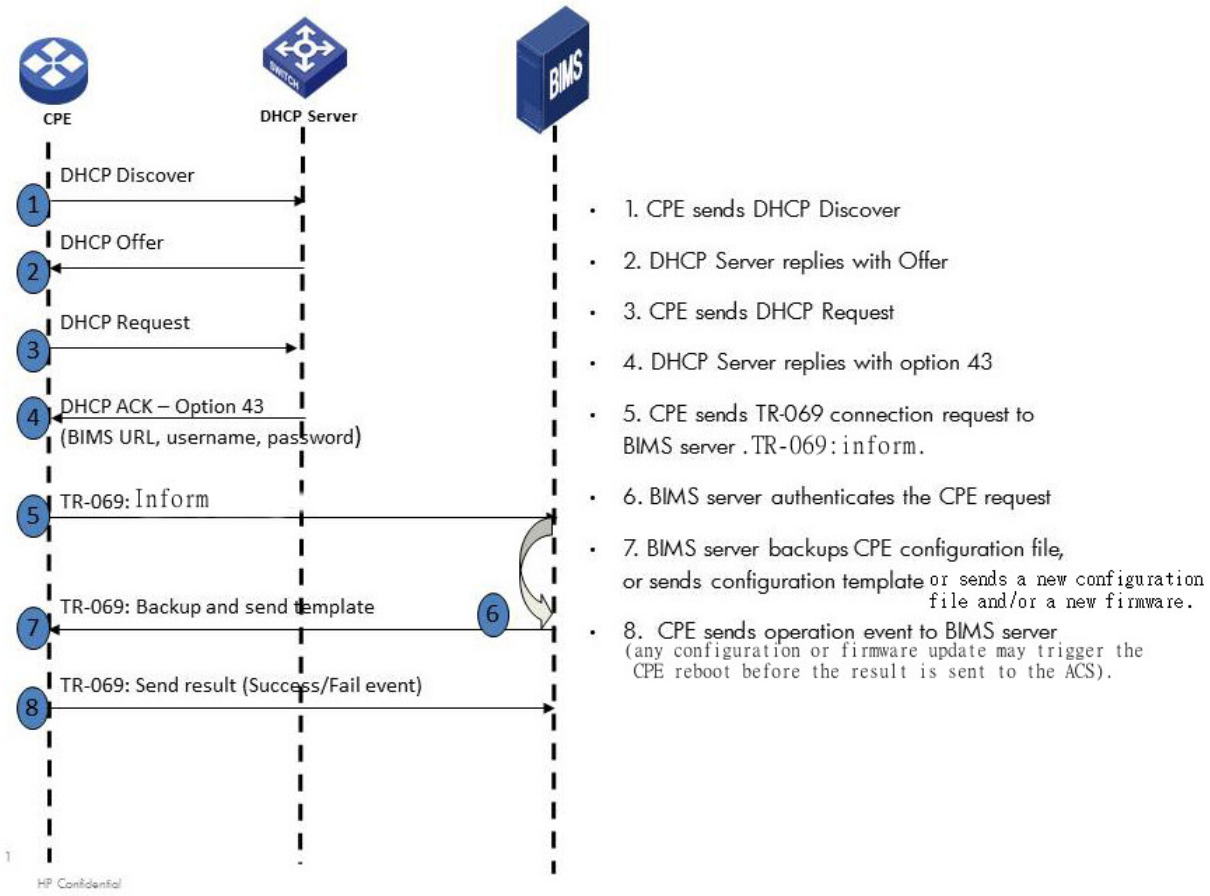
Zero-touch configuration process

Auto configuration or “zero-touch” deployment is a recurring customer requirement, especially for remote-office deployments. New devices introduced inside a private network require management tools be co-located to configure them or update firmware, or require manual intervention to do configuration. TR-069 allows managing devices that reside in a private network via HTTP(S), enabling a new set of deployment and management models today, not possible using SNMP.

The client side, when configured, will contact the server at a predefined URL, using HTTP or HTTPS as protocol. After authentication, the ACS is able to perform the following basic operations:

- Update CPE Configuration.
- Update CPE TR-069 parameters.
- Update CPE firmware.
- Reboot CPE (backup, startup, and running configurations)
- Run CPE ping diagnostics.
- Reset CPE to factory default.
- Get periodic Status (several parameters can be retrieved depending on what is supported).

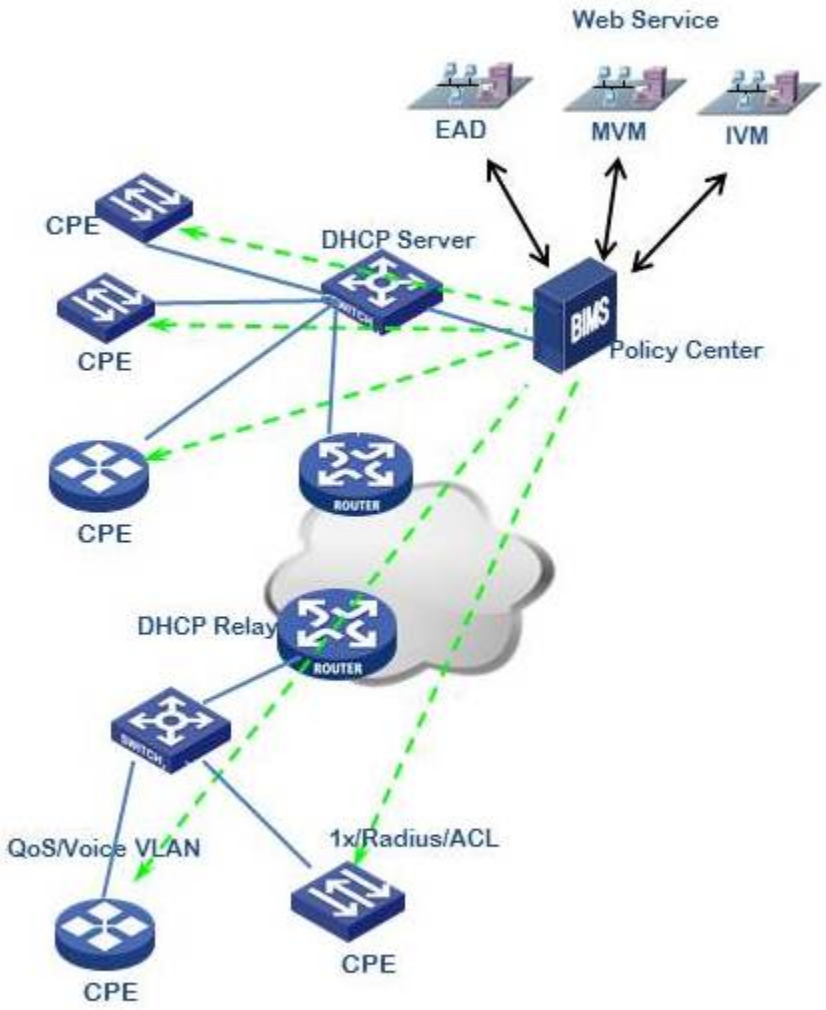
Since TR-069 uses HTTP, it can be used across a WAN. If the CPE can reach the URL, it can be managed. TR-069 is mostly a push protocol where the client periodically sends information without server requests. This allows for greater scalability over traditional SNMP based tools, which are also bounded to work within the LAN, while TR-069 can offer management to remote offices.



Zero-touch configuration for Campus networks

In this example, the following steps to configure CPEs for a Campus Network environment.

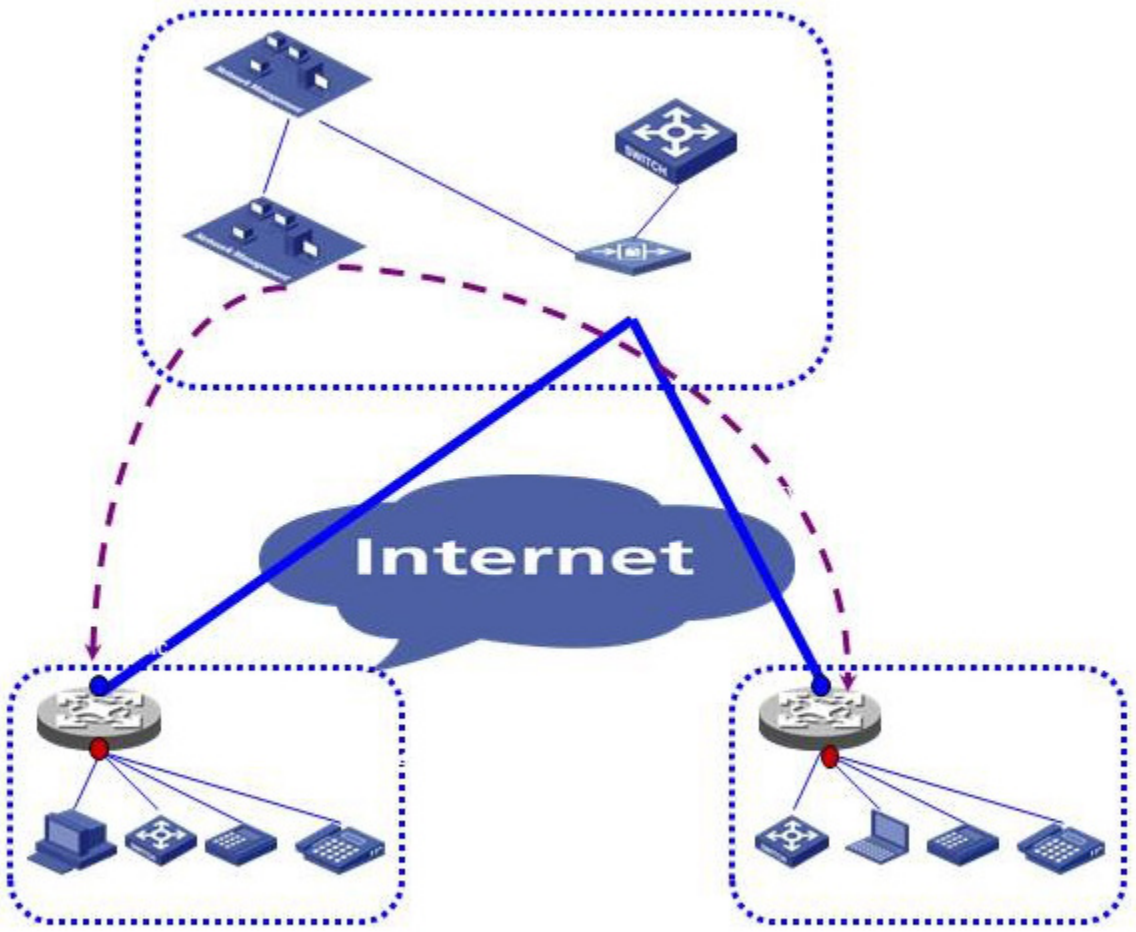
1. Pre-configuration for all CPEs in BIMS.
2. CPEs get BIMS parameters from DHCP server.
3. CPEs initiate a connection to BIMS, then BIMS deploys the pre-configuration to CPEs.



Zero-touch configuration for Branch networks

In this example, the following steps to configure CPEs for a Branch network environment.

1. Create the basic configuration for your spoke device manually, using the username/password from ISP and BIMS URL.
2. The IPSec VPN configuration is generated by IVM and deployed by BIMS.
3. The IPSec VPN tunnel is automatically created.
4. The device in the branch private network can DHCP relay to HQ to continue the zero touch configuration.



Zero-touch configuration setup and execution

1. DHCP configuration
2. BIMS configuration
3. Execution

CLI commands

Configuration setup

Within the configure mode:

Syntax:

cwmp

acs Configure Auto Configuration Server (ACS) access.

cpe Configure Customer Premises Equipment (CPE) access.

disable Disable the CPE WAN Management Protocol.

CWMP is automatically enabled. To conserve resources, reconfigure this setting using the `cwmp disable` command.

enable Enable the CPE WAN Management Protocol.

Syntax:

[no] cwmp

acs Configure Auto Configuration Server (ACS) access.

cpe Configure Customer Premises Equipment (CPE) access.

enable Enable the CPE WAN Management Protocol.

ACS password configuration

Syntax:

cwmp acs

password Configure the password used for authentication when the switch connects to the ACS.

url Configure the URL of the ACS.

username Configure the username used for authentication when the switch connects to the ACS.

When encrypt-credentials is off

Syntax:

cwmp acs password

plaintext Configure the password used for authentication when the switch connects to the ACS.

When encrypt-credentials is on

Syntax:

cwmp acs password

encrypted-key An encrypted password generated with the `encrypt-credentials` command.

plaintext Configure the password used for authentication when the switch connects to the ACS.

Encrypt-credential on

cwmp acs password encrypted-key

ASCII-STR Enter an ASCII string (maximum length: 384 characters).

Plaintext password

cwmp acs password plaintext

PASSWORD-STR A plaintext password used for ACS authentication (maximum length: 256 characters).

ACS URL configuration

Syntax:

cwmp acs url

URL-STR The URL of the ACS (maximum length: 256 characters).

ACS username configuration

Syntax:

cwmp acs username

USERNAME-STR A username for ACS authentication (maximum length: 256 characters).

CPE configuration

Syntax:

cwmp cpe

password Configure the password used for authentication when the ACS connects to the switch.

username Configure the username used for authentication when the ACS connects to the switch.

CPE password configuration

When encrypt-credentials is on

Syntax:

cwmp cpe password

encrypted-key An encrypted password generated with the 'encrypt-credentials' command.

plaintext Configure the password used for authentication when the ACS connects to the switch.

Syntax:

cwmp cpe password encrypted-key

ASCII-STR Enter an ASCII string (maximum length: 384 characters).

When encrypt-credentials is off

Syntax:

cwmp cpe [password]

plaintext Configure the password used for authentication when the ACS connects to the switch

Syntax:

cwmp cpe

PASSWORD-STR A plaintext password used for ACS authentication (maximum length: 256 characters).

CPE username configuration

Syntax:

cwmp cpe [username]

USERNAME-STR A username for ACS authentication (maximum length: 256 characters).

Enable/disable CWMP

Syntax:

cwmp [enable|disable]

Show commands

CWMP configuration and status query

Syntax:

show cwmp

configuration	Show current CWMP configuration.
status	Show current CWMP status.

When CWMP is enabled

Syntax:

show cwmp configuration

CWMP configuration

```
CWMP Configuration
CWMP Status          : Enabled
ACS URL              : http://16.93.62.32:9090
ACS Username         : bims
Inform Enable Status : Enabled
Inform Interval      : 60
Inform Time          : 2014-04-08T06:00:00
Reconnection Timeout : 30
```

CWMP status

```
CWMP Status
CWMP Status              : Enabled
ACS URL                  : http://16.93.62.32:9090
ACS URL Origin           : Config
ACS Username             : bims
Connection Status        : Disconnected
Data Transfer Status     : None
Last ACS Connection Time : Wed Apr  9 16:56:00 2014
Time to Next Connection  : 00:00:36
```

When CWMP is disabled

Syntax:

show cwmp status

CWMP status

```
CWMP Status
CWMP Status              : Disabled
```

CWMP configuration

```
show cwmp configuration
CWMP Configuration
CWMP Status          : Disabled
```

Event logging

The TR-069 client offers some tools to diagnose problems:

- System logging
- Status/control commands

System logging

The CPE implements the following system log notification codes and sample messages:

- **RMON_TR69_INFORM_COMPLETE**
  - INFORM to http://15.29.20.50:9090/ from (IP address not set yet) completed with error.
  - INFORM to http://15.29.20.50:9090/ from 10.0.10.212 completed with error.
  - INFORM to http://15.29.20.50:9090/ from 10.0.10.212 completed successfully.
- **RMON_TR69_AUTH_FAILED**
  - Authentication on ACS http://15.29.20.50:9090/ failed.
- **RMON_TR69_CONN_FAILED**
  - Connection attempts with ACS http://15.29.20.50:9090/ from 10.0.10.212 failed.

To avoid flooding the system log on frequent attempts to connect with the ACS, the following criteria are used with both successful and failed attempts:

1. The very first event is always logged.
2. Any change from success to failure or vice versa is always logged.
3. Repeat success or failure events are logged only once every five minutes.

The HTTP file transfer component supports these system log notification codes and sample messages:

- **RMON_HTTP_XFER_COMPLETE**
  - I 11/19/13 08:06:13 04185 http: Download of http://10.0.11.240:9876/path to DestinationFile completed successfully.
  - I 11/19/13 08:06:13 04185 http: Upload of SourceFile to http://10.0.11.240:9876/path completed successfully.
- **RMON_HTTP_CONN_FAILED**
  - W 11/19/13 08:06:13 04186 http: Connection to http://10.0.11.240:9876/path failed.
- **RMON_HTTP_TIMED_OUT**
  - W 11/19/13 08:06:13 04192 http: Download of http://10.0.11.240:9876/path to DestinationFile timed out.
  - W 02/20/14 00:32:17 04192 http: Upload of SourceFile to http://10.0.11.240:9876/path timed out.
- **RMON_HTTP_NO_SPACE**
  - W 11/19/13 08:06:13 04189 http: Upload of SourceFile to http://10.0.11.240:9876/path canceled because of insufficient memory.
- **RMON_HTTP_REQ_FAILED**
  - W 11/19/13 08:06:13 04190 http: Upload of SourceFile to http://10.0.11.240:9876/path failed (errno 13).
  - W 11/19/13 08:06:13 04190 http: Upload of SourceFile to http://10.0.11.240:9876/path failed (errno 1).

- W 11/19/13 08:06:13 04190 http: Download of http://10.0.11.240:9876/path to DestinationFile failed (errno 13).
- W 11/19/13 08:06:13 04190 http: Download of http://10.0.11.240:9876/path to DestinationFile failed (errno 1).
- W 11/19/13 08:06:13 04190 http: Download of http://10.0.11.240:9876/path to DestinationFile failed (errno 17).

- **RMON_HTTP_WRONG_FILE**
  - W 11/19/13 08:06:13 04191 http: Download canceled because file http://10.0.11.240:9876/path is malformed or incompatible.
  - W 11/19/13 08:06:13 04191 http: Download canceled because file http://10.0.11.240:9876/path is malformed or incompatible.
- **RMON_HTTP_FILE_NOT_FOUND**
  - W 11/19/13 08:06:13 04200 http: Upload of SourceFile to http://10.0.11.240:9876/path canceled because of inexistent file.

Status/control commands

The following commands help assess the general state of TR–069 and control the source of the ACS configuration record:

Table 34: *Status/control commands*

Command	Result

`show cwmp status`	`CWMP is Enabled  ACS URL : https://16.93.62.32:9443`
	`ACS URL is set by : Config`
	`ACS Username : bims`
	`Connection status : Disconnected`
	`Data transfer status : None`
	`Time of last successful connection : Thu Feb 20 01:16:59 2014`
	`Interval upon to next connection : Null`

`show cwmp configuration`	`CWMP is Enabled  ACS URL : https://16.93.62.32:9443`
	`ACS Username : bims`
	`Inform Enable Status : Disabled`
	`Inform Interval : 3559`
	`Inform Time :`
	`Reconnection times : 30`

`[no] dhcp tr69-acs-url`	Prevents using any ACS information from DHCP

Acronym	Definition
ACL	Access Control List
AMP	AirWave Management Platform
AP	Access Point
BYOD	Bring Your Own Device
CoA	Change of Authorization
CLI	Command Line Interface
CPPM	ClearPass Policy Manager
DHCP	Dynamic Host Configuration Protocol
DoS	Denial-of-Service
EWA	Enhanced Web Authentication
IP	Internet Protocol
HA	High Availability
HMAC-SHA1	Hash-based Message Authentication Code used with the SHA-1 cryptographic hash function.
HTTP	Hypertext Transfer Protocol
HTTPS	Secure Hypertext Transfer Protocol
ID	Identifier
IP	Internet Protocol
L3	The third, or routing, layer of the open systems interconnection (OSI) model. The network layer routes data to different LANs and Wide Area Networks (WANs) based on network addresses.

Table Continued

Acronym	Definition
LAN	Local Area Network
MAC	Media Access Control
MAFR	MAC Authentication Failure Redirect
MAS	Management Interface Specification
NMS	Network Management System
PVOS	ArubaOS-Switch Operating System
RADIUS	Remote Authentication Dial In User Service
SNMP	Simple Network Management Protocol
VLAN	Virtual Local Area Network
VSA	Vendor Specific Attribute
ZTP	Zero Touch Provisioning