

# HP 5920 & 5900 Switch Series

## IRF

### Configuration Guide

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# IRF overview

HP Intelligent Resilient Framework (IRF) technology creates a large IRF fabric from multiple devices to provide data center class availability and scalability. IRF virtualization technology offers processing power, interaction, unified management, and uninterrupted maintenance of multiple devices.

This book describes IRF concepts and guides you through the IRF setup procedure.

## Hardware compatibility

You can establish an IRF fabric that only comprises 5900 switches or 5920 switches, or establish a heterogeneous IRF fabric that comprises both 5900 and 5920 switches.

## IRF benefits

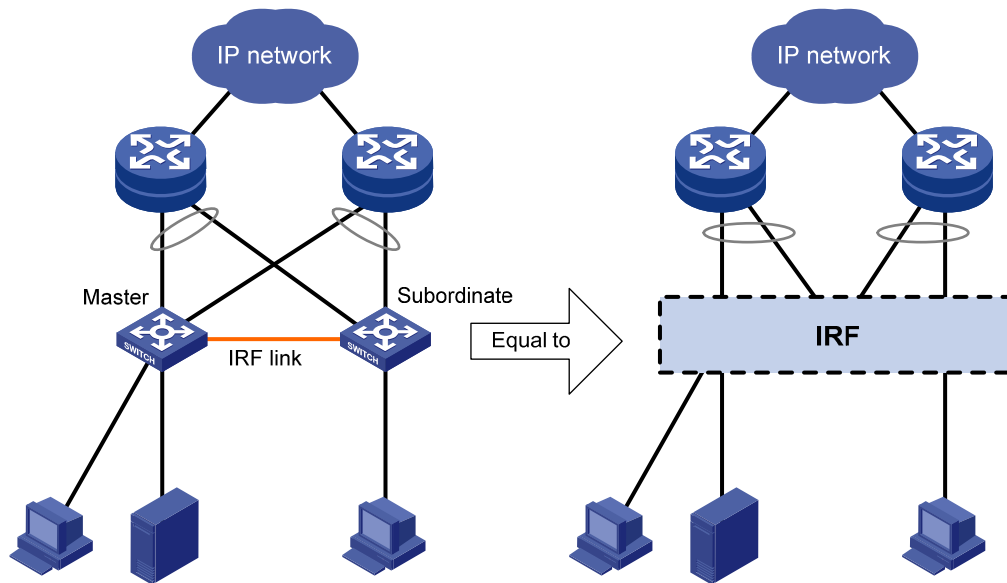
IRF delivers the following benefits:

- **Simplified topology and easy management**—An IRF fabric appears as one node and is accessible at a single IP address on the network. You can use this IP address to log in at any member device to manage all the members of the IRF fabric. In addition, you do not need to run the spanning tree feature among the IRF members.
- **1:N redundancy**—In an IRF fabric, one member works as the master to manage and control the entire IRF fabric, and all the other members process services while backing up the master. When the master fails, all the other member devices elect a new master from among them to take over without interrupting services.
- **IRF link aggregation**—You can assign several physical links between neighboring members to their IRF ports to create a load-balanced aggregate IRF connection with redundancy.
- **Multichassis link aggregation**—You can use the Ethernet link aggregation feature to aggregate the physical links between the IRF fabric and its upstream or downstream devices across the IRF members.
- **Network scalability and resiliency**—Processing capacity of an IRF fabric equals the total processing capacities of all the members. You can increase ports, network bandwidth, and processing capacity of an IRF fabric simply by adding member devices without changing the network topology.

## Application scenario

Figure 1 shows an IRF fabric that comprises two devices, which appear as a single node to the upper and lower layer devices.

Figure 1 IRF application scenario



## Network topologies

An IRF fabric can use a daisy chain topology or a ring topology. Full meshed topology is not supported. For information about connecting IRF member devices, see "[Connecting physical IRF ports.](#)"

## Basic concepts

This section describes the basic concepts you might encounter when working with IRF.

### IRF member roles

IRF uses two member roles: master and standby (called "subordinate" throughout the documentation).

When devices form an IRF fabric, they elect a master to manage and control the IRF fabric, and all the other devices back up the master. When the master device fails, the other devices automatically elect a new master from among them to take over. For more information about master election, see "[Master election.](#)"

While backing up the master, all subordinate devices process and forward traffic independently.

### IRF member ID

An IRF fabric uses member IDs to uniquely identify and manage its members. This member ID information is included as the first part of interface numbers and file paths to uniquely identify interfaces and files in an IRF fabric. For more information about interface and file path naming, see "[Interface naming conventions](#)" and "[File system naming conventions.](#)"

If two devices have the same IRF member ID, they cannot form an IRF fabric. If the IRF member ID of a device has been used in an IRF fabric, the device cannot join the fabric.

## IRF port

An IRF port is a logical interface for the connection between IRF member devices. Every IRF-capable device supports two IRF ports. The IRF ports are named IRF-port  $n/1$  and IRF-port  $n/2$ , where  $n$  is the member ID of the switch. The two IRF ports are referred to as "IRF-port 1" and "IRF-port 2" in this book for simplicity.

To use an IRF port, you must bind at least one physical port to it. The physical ports assigned to an IRF port automatically form an aggregate IRF link. An IRF port goes down only if all its physical IRF ports are down.

## Physical IRF port

Physical IRF ports connect IRF member devices and must be bound to an IRF port. They forward the IRF protocol packets between IRF member devices and the data packets that must travel across IRF member devices.

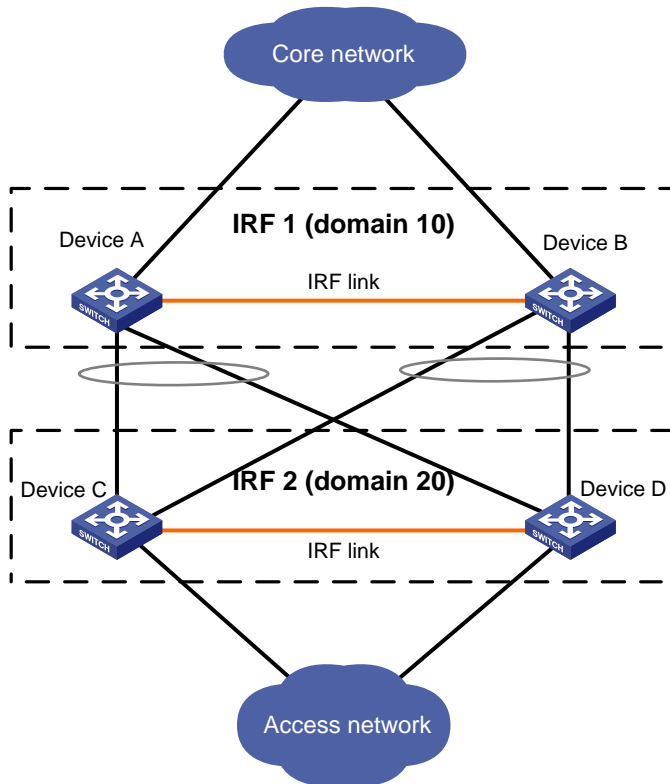
For more information about physical ports that can be used for IRF links, see "[IRF physical port restrictions and binding requirements](#)."

## IRF domain ID

One IRF fabric forms one IRF domain. IRF uses IRF domain IDs to uniquely identify IRF fabrics and prevent IRF fabrics from interfering with one another.

As shown in [Figure 2](#), Device A and Device B form IRF fabric 1, and Device C and Device D form IRF fabric 2. The fabrics have LACP MAD links between them. When a member device in one IRF fabric receives an extended LACP packet for MAD, it looks at the domain ID in the packet to see whether the packet is from the local IRF fabric or from a different IRF fabric. Then, the device can handle the packet correctly.

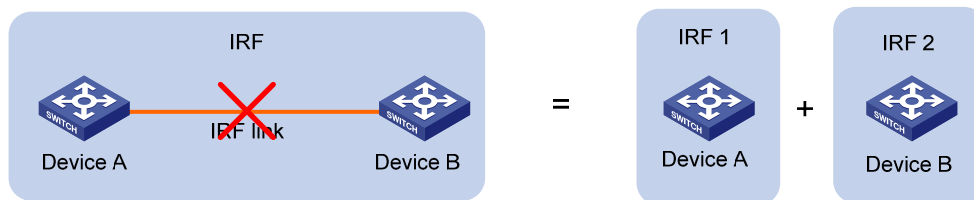
Figure 2 A network that comprises two IRF domains



## IRF split

IRF split occurs when an IRF fabric breaks up into two or more IRF fabrics because of IRF link failures, as shown in Figure 3. The split IRF fabrics operate with the same IP address and cause routing and forwarding problems on the network. To quickly detect a multi-active collision, configure at least one MAD mechanisms (see "IRF multi-active detection").

Figure 3 IRF split

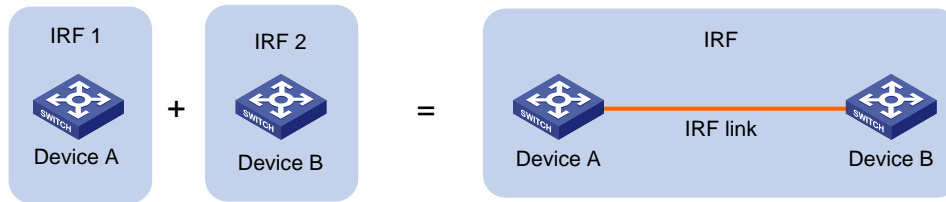


## IRF merge

IRF merge occurs when two split IRF fabrics re-unite or when you configure and connect two independent IRF fabrics to be one, as shown in Figure 4.



Figure 4 IRF merge



## Member priority

Member priority determines the possibility of a member device to be elected the master. A member with higher priority is more likely to be elected the master.

The default member priority is 1. You can change the member priority of a member device to affect the master election result.

## Interface naming conventions

An interface is named in the *chassis-id/slot-number/port-index* format, where:

- *chassis-id*—IRF member ID of the switch. This argument defaults to 1.
- *slot-number*—Represents the slot number of the interface card. This argument always takes 0 on the switch.
- *port-index*—Port index depends on the number of ports available on the device. To identify the index of a port, look at its port index mark on the chassis.

For one example, on the standalone switch Sysname, Ten-GigabitEthernet 1/0/1 represents the first port on the device. Set its link type to trunk, as follows:

```
<Sysname> system-view
[Sysname] interface ten-gigabitethernet 1/0/1
[Sysname-Ten-GigabitEthernet1/0/1] port link-type trunk
```

For another example, on the IRF fabric Master, Ten-GigabitEthernet 3/0/1 represents the first fixed port on member device 3. Set its link type to trunk, as follows:

```
<Master> system-view
[Master] interface ten-gigabitethernet 3/0/1
[Master-Ten-GigabitEthernet3/0/1] port link-type trunk
```

## File system naming conventions

On a standalone device, you can use its storage device name to access its file system. For more information about storage device naming conventions, see *Fundamentals Configuration Guide*.

On an IRF fabric, you can use the storage device name to access the file system of the master. To access the file system of any other member device, use the name in the **slotmember-ID#storage-device-name** format. For example:

To access the **test** folder under the root directory of the Flash on the master switch:

```
<Master> mkdir test
Creating directory flash:/test... Done.
<Master> dir
```

Directory of flash:

```
0 -rw- 43548660 Jan 01 2011 08:21:29 5900.ipe
1 drw- - Jan 01 2011 00:00:30 diagfile
2 -rw- 567 Jan 02 2011 01:41:54 dsakey
3 -rw- 735 Jan 02 2011 01:42:03 hostkey
4 -rw- 36 Jan 01 2011 00:07:52 ifindex.dat
5 -rw- 0 Jan 01 2011 00:53:09 lauth.dat
6 drw- - Jan 01 2011 06:33:55 license
7 drw- - Jan 02 2000 00:00:07 logfile
8 -rw- 23724032 Jan 01 2011 00:49:47 5900-r2108p03.bin
9 drw- - Jan 01 2000 00:00:07 seclog
10 -rw- 591 Jan 02 2011 01:42:03 serverkey
11 -rw- 4609 Jan 01 2011 00:07:53 startup.cfg
12 -rw- 3626 Jan 01 2011 01:51:56 startup.cfg_bak
13 -rw- 78833 Jan 01 2011 00:07:53 startup.mdb
14 drw- - Jan 01 2011 00:15:48 test
25 drw- - Jan 01 2011 04:16:53 versionInfo
```

524288 KB total (365292 KB free)

To create and access the test folder under the root directory of the Flash on member device 3:

```
<Master> mkdir slot3#flash:/test
Creating directory slot3#flash:/test... Done.
<Master> cd slot3#flash:/test
<Master> pwd
slot3#flash:/test
```

Or:

```
<Master> cd slot3#flash:/
<Master> mkdir test
Creating directory slot3#flash:/test... Done.
```

To copy the file **test.ipe** on the master to the root directory of the Flash on member device 3:

# Display the current working path. In this example, the current working path is the root directory of the Flash on member device 3.

```
<Master> pwd
slot3#flash:
```

# Change the current working path to the root directory of the Flash on the master device.

```
<Master> cd flash:/
<Master> pwd
flash:
```

# Copy the file to member device 3.

```
<Master> copy test.ipe slot3#flash:/
Copy flash:/test.ipe to slot3#flash:/test.ipe?[Y/N]:y
Copying file flash:/test.ipe to slot3#flash:/test.ipe... Done.
```

# Configuration synchronization mechanism

IRF uses a strict running-configuration synchronization mechanism so all chassis in an IRF fabric can work as a single node, and after the master fails, other members can operate normally.

In an IRF fabric, all chassis get and run the running configuration of the master. Any configuration you have made is propagated to all members.

For more information about configuration management, see *Fundamentals Configuration Guide*.

## Master election

Master election is held each time the IRF fabric topology changes, for example, when the IRF fabric is established, the master device fails or is removed, the IRF fabric splits, or IRF fabrics merge. Adding new member devices or the merge of an Active IRF fabric and a Recovery IRF fabric does not trigger master election.

Master election uses the following rules in descending order:

1. Current master, even if a new member has higher priority.  
When an IRF fabric is being formed, all members consider themselves as the master, and this rule is skipped.
2. Member with higher priority.
3. Member with the longest system uptime.  
Two members are considered starting up at the same time if the difference between their startup times is equal to or less than 10 minutes. For these members, the next tiebreaker applies.
4. Member with the lowest bridge MAC address.

The IRF fabric is formed on election of the master.

During an IRF merge, the members of the IRF fabric that fail the master election will automatically reboot to rejoin the IRF fabric that wins the election.

After a master election, all subordinate members reboot with the configuration on the master, and their original configuration, even if it has been saved, is removed.

## IRF multi-active detection

An IRF link failure causes an IRF fabric to split in two IRF fabrics operating with the same Layer 3 configurations, including the same IP address. To avoid IP address collision and network problems, IRF uses multi-active detection (MAD) mechanisms to detect the presence of multiple identical IRF fabrics, handle collisions, and recover from faults.

## Multi-active handling procedure

The multi-active handling procedure includes detection, collision handling, and failure recovery.

### Detection

The device's MAD implementation detects active IRF fabrics with the same Layer 3 global configuration by extending the LACP, BFD, ARP, or IPv6 ND protocol.

These MAD mechanisms identify each IRF fabric with a domain ID and an active ID (the member ID of the master). If multiple active IDs are detected in a domain, MAD determines that an IRF collision or split has occurred.

You can use at least one of these mechanisms in an IRF fabric, depending on your network topology.

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ⓘ **IMPORTANT:**

LACP MAD handles collisions in a different way than BFD MAD, ARP MAD, and ND MAD. To avoid conflicts, do not enable LACP MAD together with any of those mechanisms in an IRF fabric. However, you can use BFD MAD, ARP MAD, and ND MAD together.

---

For a comparison of these MAD mechanisms, see "[Configuring MAD](#)."

## Collision handling

MAD mechanisms remove multi-active collisions by setting one IRF fabric to the Active state and other IRF fabrics to the Recovery state. Only members in the Active-state fabric can continue to forward traffic.

LACP MAD handles a multi-active collision in the following procedure:

1. Compares the number of members in each fabric.
2. Sets the fabric that has the most members to the Active state and all other fabrics to the Recovery state.
3. If all IRF fabrics have the same number of members, compares the member IDs of their masters.
4. Sets the IRF fabric that has the lowest numbered master to the Active state and all other fabrics to the Recovery (disabled) state.
5. Shuts down all physical network ports in the Recovery-state fabrics but their physical IRF ports and any ports you have specified with the **mad exclude interface** command.

In contrast, BFD MAD, ARP MAD, and ND MAD do not compare the number of members in fabrics. They directly set the IRF fabric that has the lowest numbered master to the Active state, set all other fabrics to the Recovery state, and take the same action on the network ports in Recovery-state fabrics as LACP MAD does.

## Failure recovery

To merge two split IRF fabrics, first repair the failed IRF link and remove the IRF link failure.

If the IRF fabric in Recovery state fails before the failure is recovered, repair the failed IRF fabric and the failed IRF link.

If the IRF fabric in Active state fails before the failure is recovered, first enable the IRF fabric in Recovery state to take over the active IRF fabric and protect services from being affected. After that, recover the MAD failure.

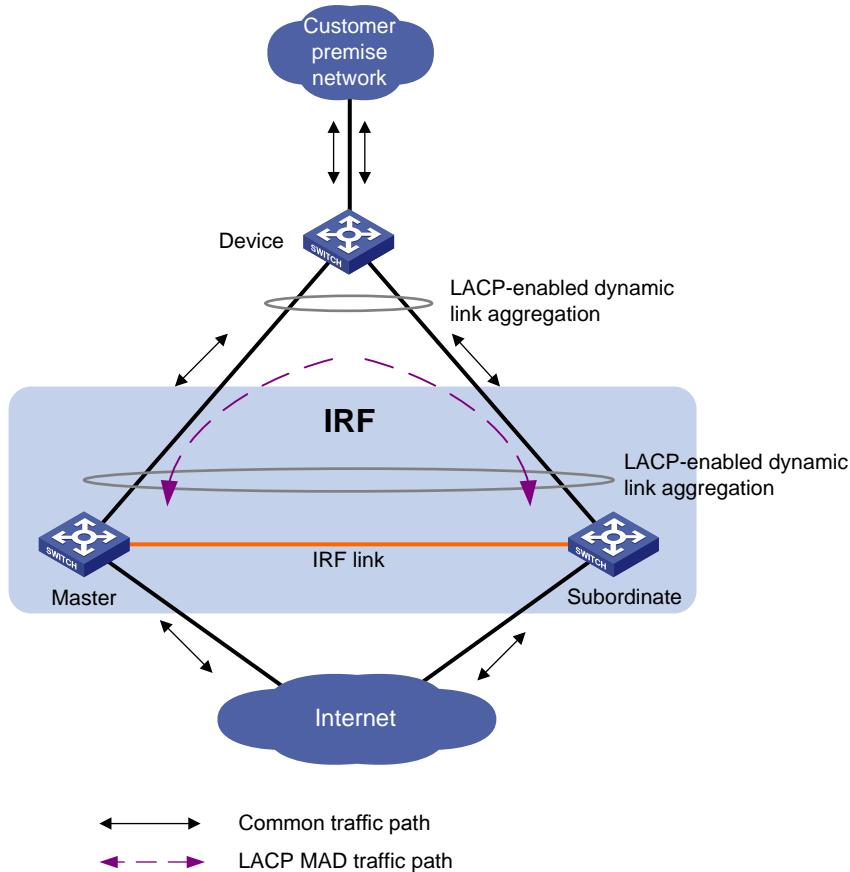
## LACP MAD

LACP MAD requires that every IRF member have a link with an intermediate device, and all these links form a dynamic link aggregation group, as shown in [Figure 5](#). The intermediate device must be a device that supports extended LACP for MAD.

The IRF member devices send extended LACPDU with TLVs that convey the domain ID and the active ID of the IRF fabric. The intermediate device transparently forwards the extended LACPDUs received from one member device to all the other member switches:

- If the domain IDs and the active IDs in the extended LACPDU sent by all the member devices are the same, the IRF fabric is integrated.
- If the extended LACPDUs convey the same domain ID but different active IDs, a split has occurred. To handle this situation, LACP MAD sets the IRF fabric with higher active ID in Recovery state, and shuts down all its physical ports but the console ports, IRF ports, and any ports you have specified with the **mad exclude interface** command. The IRF fabric with lower active ID is still in Active state and forwards traffic.

**Figure 5 LACP MAD application scenario**



## BFD MAD

BFD MAD can work with or without intermediate devices. [Figure 6](#) shows a typical BFD MAD application scenario.

To use BFD MAD:

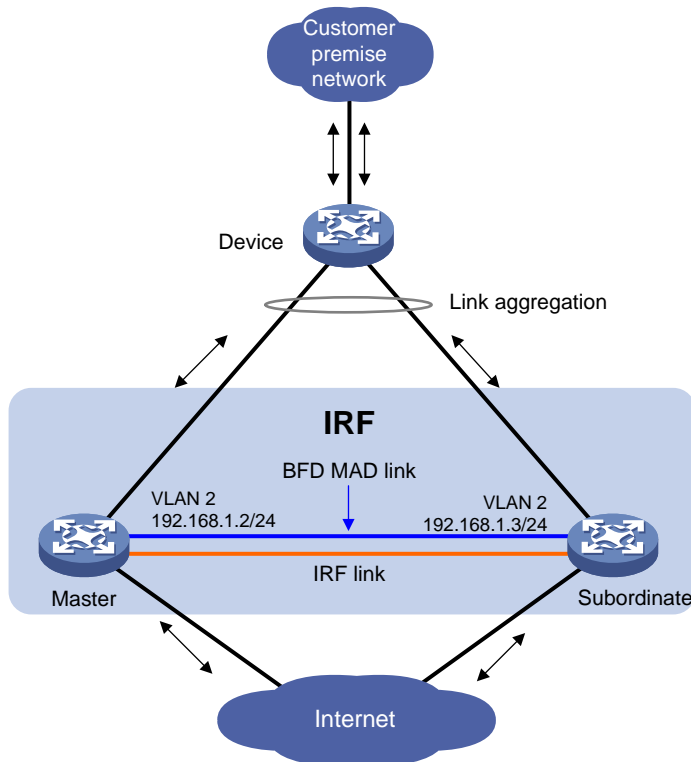
- Set up dedicated BFD MAD link between each pair of IRF members or between each IRF member and the intermediate device. Do not use the BFD MAD links for any other purpose.
- Assign the ports connected by BFD MAD links to the same VLAN, create a VLAN interface for the VLAN, and assign a MAD IP address to each member on the VLAN interface.

The MAD addresses identify the member devices and must belong to the same subnet.

With BFD MAD, the master tries to establish BFD sessions with other member devices by using its MAD IP address as the source IP address:

- If the IRF fabric is integrated, only the MAD IP address of the master is effective, and the master cannot establish a BFD session with any other member. If you execute the **display bfd session** command, the state of the BFD sessions is **Down**.
- When the IRF fabric splits, the IP addresses of the masters in the split IRF fabrics take effect, and the two masters can establish a BFD session. If you execute the **display bfd session** command, the state of the BFD session between the two devices is **Up**.

**Figure 6 BFD MAD application scenario**

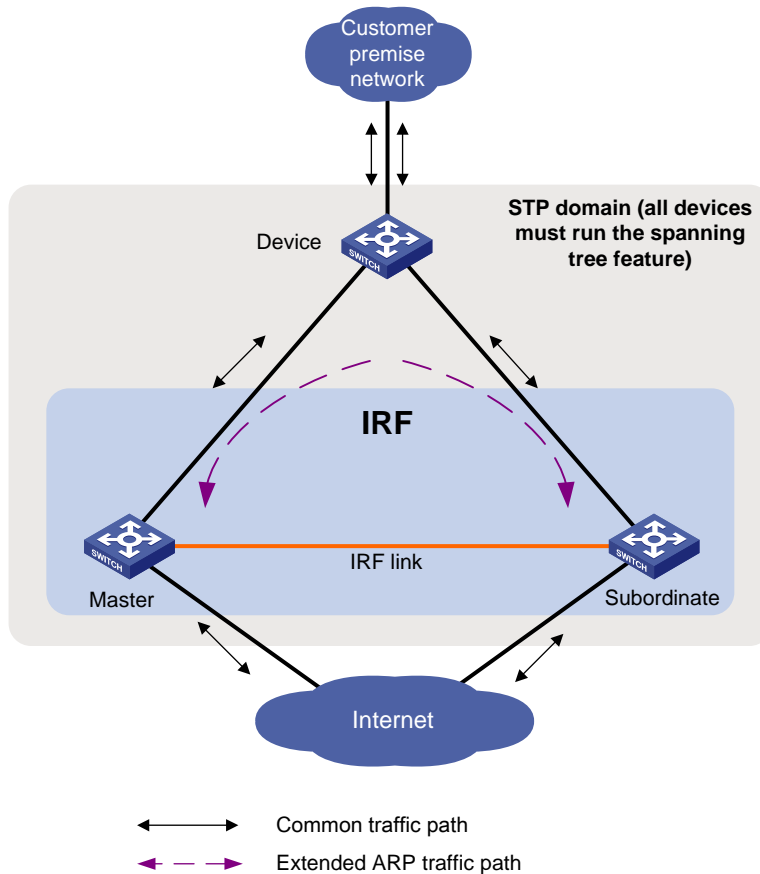


## ARP MAD

ARP MAD detects multi-active collisions by using extended ARP packets that convey the IRF domain ID and the active ID.

You can set up ARP MAD links between neighbor IRF member devices, or more commonly, between each IRF member device and an intermediate device (see [Figure 7](#)). If an intermediate device is used, you must also run the spanning tree feature between the IRF fabric and the intermediate device.

Figure 7 ARP MAD application scenario



Each IRF member compares the domain ID and the active ID in incoming extended ARP packets with its domain ID and active ID:

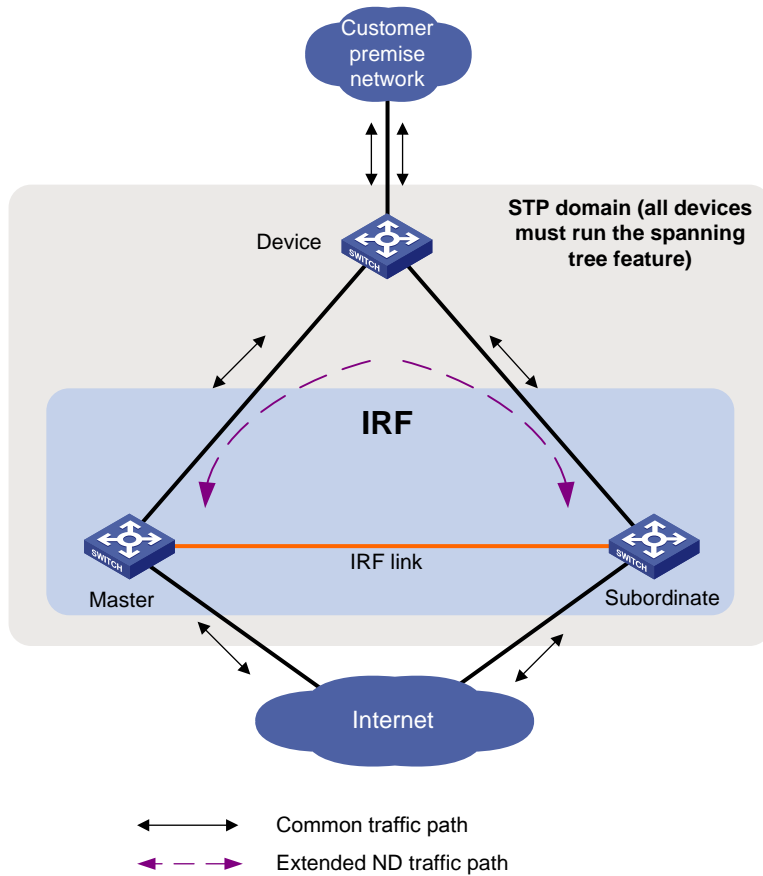
- If the domain IDs are different, the extended ARP packet is from a different IRF fabric, and the device does not continue to process the packet with the MAD mechanism.
- If the domain IDs are the same, the device compares the active IDs:
  - If the active IDs are different, the IRF fabric has split.
  - If the active IDs are the same, the IRF fabric is integrated.

## ND MAD

ND MAD detects multi-active collisions by using the ND protocol's NS packets that convey the IRF domain ID and the active ID.

You can set up ND MAD links between neighbor IRF member devices or more commonly, between each IRF member device and an intermediate device (see Figure 8). If an intermediate device is used, you must also run the spanning tree protocol between the IRF fabric and the intermediate device.

Figure 8 ND MAD application scenario



Each IRF member device compares the domain ID and the active ID in incoming NS packets with its domain ID and active ID:

- If the domain IDs are different, the NS packet is from a different IRF fabric, and the device does not continue to process the packet with the MAD mechanism.
- If the domain IDs are the same, the device compares the active IDs:
  - If the active IDs are different, the IRF fabric has split.
  - If the active IDs are the same, the IRF fabric is integrated.



---

# Configuring IRF

Read the configuration restrictions and guidelines carefully when you connect and set up an IRF fabric.

## General restrictions and configuration guidelines

### Software requirements

All IRF member switches must run the same software image version.

### IRF physical port restrictions and binding requirements

All SFP+ and QSFP+ ports on the 5900 switch and all SFP+ ports on the 5920 switch can be used as IRF physical ports.

When selecting transceiver modules and cables, follow these guidelines:

- Use SFP+/QSFP+ transceiver modules and fibers for long-distance connection, or use SFP+/QSFP+ cables to connect SFP+/QSFP+ ports for short-distance connection.
- QSFP+ transceiver modules are available only for the 5900 switches. For more information about transceiver modules, see the switch installation guide.
- The transceiver modules at the two ends of an IRF link must be the same type.

SFP+ ports on the HP 5900AF-48XG-4QSFP+ Switch, HP 5900AF-48XG-4QSFP+ TAA Switch, HP 5920AF-24XG Switch, and HP 5920AF-24XG TAA Switch are grouped by port number in order, starting from the one numbered 1. Each group contains four ports. Ports in the same group must be used for the same purpose. If you use one port in a group as an IRF physical port, the other ports in the group cannot be used for any other purposes.

When binding an SFP+ port in an SFP+ port group to an IRF port or removing it from the IRF port, shut down all the other SFP+ ports in the same group.

When connecting two neighboring IRF members, connect IRF-port 1 on one member to IRF-port 2 on the other.

On a physical port bound to an IRF port, you can execute only the **shutdown**, **description**, **priority-flow-control**, and **flow-interval** commands. For more information about these commands, see *Layer 2—LAN Switching Command Reference*.

### IRF link redundancy

You can bind up to four physical ports to an IRF port for link redundancy.

### MAD

- LACP MAD handles collisions in a different way than BFD MAD, ARP MAD, and ND MAD. To avoid conflicts, do not enable LACP MAD together with any of those mechanisms in an IRF fabric. However, you can configure BFD MAD, ARP MAD, and ND MAD together in an IRF fabric for prompt IRF split detection.

- If LACP MAD, ARP MAD, or ND MAD runs between two IRF fabrics, assign each fabric a unique IRF domain ID. For BFD MAD, this task is optional.
- To exclude a port from the shutdown action that is executed when an IRF fabric transits to the Recovery state, use the **mad exclude interface** command. To bring up a port after the IRF fabric transits to the Recovery state, you must use the **mad restore** command to activate the entire IRF fabric, rather than using the **undo shutdown** command.

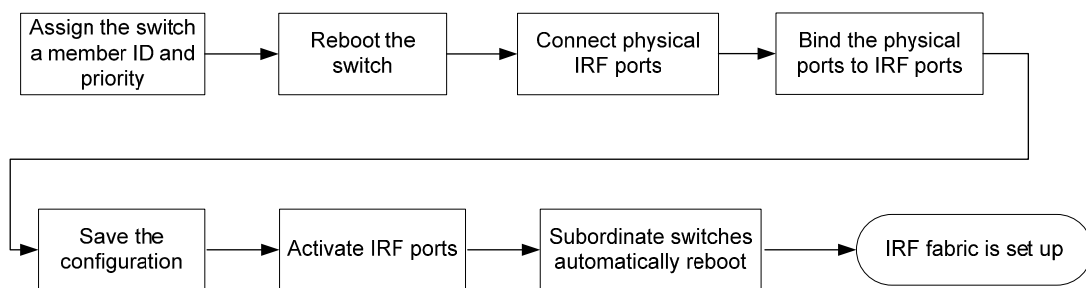
## Other configuration guidelines

- If a subordinate device uses the same next-startup configuration file name as the master device, the file might be overwritten depending on your configuration file management settings. To continue to use the configuration file after removing the switch from the IRF fabric, back up the file before setting up the IRF fabric.
- If two IRF fabrics have the same bridge MAC address, they cannot merge.
- Assign each member a unique IRF member ID to make sure that they can merge. You must reboot the members to validate the IRF member ID settings.
- Assign the highest member priority to the device you want to use as the master.
- Assign the IRF fabric a unique IRF domain ID in a multi-IRF network.
- Save any configuration you have made to the startup configuration file before you reboot the IRF member devices.

## Setup and configuration task list

HP recommends the basic IRF setup procedure in [Figure 9](#). Perform the tasks in this figure on each member device. After the IRF fabric is set up, you can access the IRF fabric to manage its member devices as if they were one device.

**Figure 9 Basic IRF setup flow chart**



HP recommends the following IRF fabric setup and configuration procedure:

Setup and configuration procedure	Remarks
1. (Required.) <a href="#">Planning the IRF fabric setup</a>	N/A
2. (Required.) <a href="#">Assigning a member ID to each IRF member device</a>	Perform this task on each member device.
3. (Required.) <a href="#">Specifying a priority for each member device</a>	Perform this task on each member device.
4. (Required.) <a href="#">Connecting physical IRF ports</a>	N/A

Setup and configuration procedure	Remarks
5. (Required.) <a href="#">Binding physical ports to IRF ports</a>	Perform this task on each member switch. When you complete IRF port binding and activation on all IRF member devices, the IRF fabric is formed.
6. (Required.) <a href="#">Accessing the IRF fabric</a>	When you log in to the IRF fabric, you are placed at the master's CLI, where you complete subsequent IRF settings and configure other features for the member devices as if they were one device.
7. (Optional.) <a href="#">Configuring a member device description</a>	This task is required for ARP MAD and LACP MAD.
8. (Optional.) <a href="#">Configuring IRF link load sharing mode:</a> <ul style="list-style-type: none"> <li>o <a href="#">Configuring the global load sharing mode</a></li> <li>o <a href="#">Configuring a port-specific load sharing mode</a></li> </ul>	N/A
9. (Optional.) <a href="#">Configuring IRF bridge MAC persistence</a>	N/A
10. (Optional.) <a href="#">Enabling software auto-update for software image synchronization</a>	HP recommends enabling software auto-update to make sure system software image synchronization.
11. (Optional.) <a href="#">Setting the IRF link down report delay</a>	N/A
12. (Required.) <a href="#">Configuring MAD:</a> <ul style="list-style-type: none"> <li>o <a href="#">Configuring LACP MAD</a></li> <li>o <a href="#">Configuring BFD MAD</a></li> <li>o <a href="#">Configuring ARP MAD</a></li> <li>o <a href="#">Configuring ND MAD</a></li> <li>o <a href="#">Excluding a port from the shutdown action upon detection of multi-active collision</a></li> </ul>	MAD mechanisms are independent of one another. You can configure at least one MAD mechanism for an IRF fabric.
13. (Optional.) <a href="#">Recovering an IRF fabric</a>	N/A

## Planning the IRF fabric setup

Consider the following items when you plan an IRF fabric:

- Hardware compatibility and restrictions
- IRF fabric size
- Master switch
- IRF physical ports
- Member ID and priority assignment scheme
- Fabric topology and cabling scheme

For more information about hardware and cabling, see the switch installation guide.

# Assigning a member ID to each IRF member device

## CAUTION:

In an IRF fabric, changing IRF member IDs might cause undesirable configuration changes and even data loss. Before you do that, back up the configuration and make sure you fully understand the impact on your network. For example, all member switches in an IRF fabric are the same model. If you swapped the IDs of any two members, their interface settings would also be swapped.

By default, the member IDs of all switches are 1. To create an IRF fabric, you must assign a unique IRF member ID to each member device.

Perform this task before the IRF fabric is formed. To prevent any undesirable configuration change or data loss, avoid changing member IDs after the IRF fabric is formed.

The new member ID takes effect at a reboot. After the switch reboots, the settings on all member ID-related physical resources (including physical network ports) are removed and require reconfiguration, regardless of whether you have saved the configuration.

To assign a member ID to a device:

Step	Command	Remarks
1. Enter system view.	<b>system-view</b>	N/A
2. Assign a member ID to a member device.	<b>irf member</b> <i>member-id</i> <b>renumber</b> <i>new-member-id</i>	The default IRF member ID is 1.
3. (Optional.) Save the configuration.	<b>save</b>	If you have bound physical ports to IRF ports or assigned member priority, save the configuration before rebooting the device so these settings can continue to take effect after the reboot.
4. Reboot the device.	<b>reboot</b> [ <i>slot slot-number</i> ] [ <b>force</b> ]	N/A

# Specifying a priority for each member device

IRF member priority represents the possibility for a device to be elected the master in an IRF fabric. The higher the priority, the higher the possibility.

A member priority change affects the election result at the next master election, but does not cause immediate master re-election.

To specify a priority for a member device:

Step	Command	Remarks
1. Enter system view.	<b>system-view</b>	N/A
2. Specify a priority for the device.	<b>irf member</b> <i>member-id</i> <b>priority</b> <i>priority</i>	The default IRF member priority is 1.

# Connecting physical IRF ports

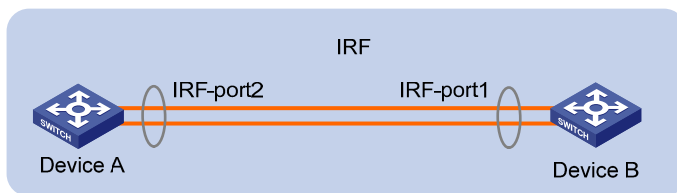
When you connect two neighboring IRF members, connect the physical ports of IRF-port 1 on one member to the physical ports of IRF-port 2 on the other, as shown in [Figure 10](#).

Suppose you have four chassis: A, B, C, and D. IRF-port 1 and IRF-port 2 are represented by A1 and A2 on chassis A, represented by B1 and B2 on chassis B, and so on. To connect the four chassis into a ring: A-B-C-D(A), the IRF links must be A1-B2, B1-C2, C1-D2, and D1-A2; or A2-B1, B2-C1, C2-D1, and D2-A1.

**!** **IMPORTANT:**

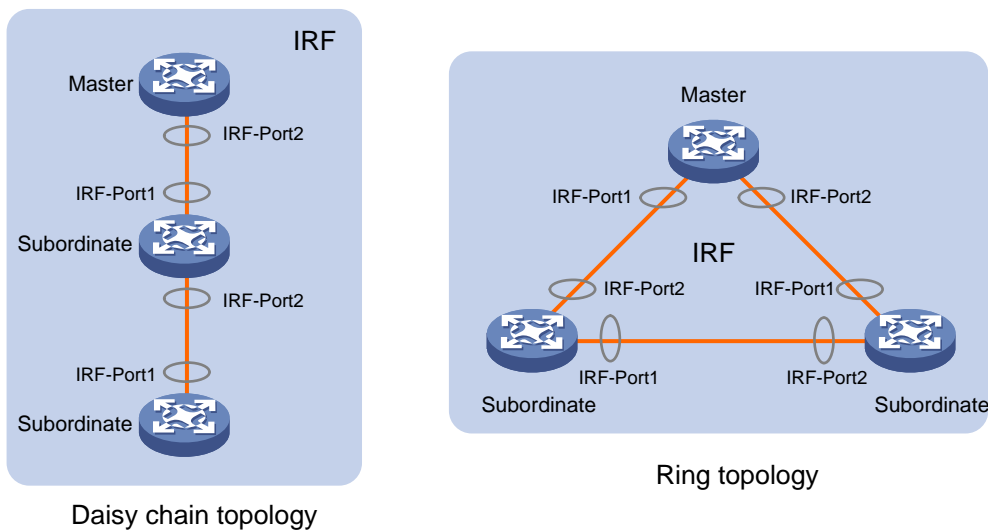
No intermediate devices are allowed between neighboring members.

**Figure 10 Connecting IRF physical ports**



Connect the devices into a daisy chain topology or more reliably, a ring topology (see [Figure 11](#)). In ring topology, the failure of one IRF link does not cause the IRF fabric to split as in daisy chain topology. Rather, the IRF fabric changes to a daisy chain topology without interrupting network services.

**Figure 11 Daisy chain topology vs. ring topology**



# Binding physical ports to IRF ports

When you bind physical ports to IRF ports, follow these guidelines:

- Follow the restrictions in "[IRF physical port restrictions and binding requirements.](#)"
- Always shut down a physical port before binding it to an IRF port or removing the binding.
- Start the shutdown operation on the master and then the member device that has the fewest number of hops from the master.

To bind physical ports to IRF ports:

Step	Command	Remarks
1. Enter system view.	<b>system-view</b>	N/A
2. Enter interface view or interface range view.	<ul style="list-style-type: none"> <li>• Enter interface range view:               <ul style="list-style-type: none"> <li>○ Approach 1:  <b>interface range</b> { <i>interface-type</i> <i>interface-number</i> [ <b>to</b> <i>interface-type</i> <i>interface-number</i> ] } &amp;&lt;1-5&gt;</li> <li>○ Approach 2:  <b>interface range name</b> <i>name</i> [ <b>interface</b> { <i>interface-type</i> <i>interface-number</i> [ <b>to</b> <i>interface-type</i> <i>interface-number</i> ] } &amp;&lt;1-5&gt; ]</li> </ul> </li> <li>• Enter interface view:  <b>interface</b> <i>interface-type</i> <i>interface-number</i></li> </ul>	<p>To shut down a range of SFP+ ports, enter interface range view. For more information about bulk configuring interfaces, see <i>Layer 2-LAN Switching Configuration Guide</i>.</p> <p>To shut down one SFP+/QSFP+ port, enter its interface view.</p> <p>If one SFP+ port in an SFP+ port group is used, shut down all the other SFP+ ports in the same group.</p>
3. Shut down the port or the range of ports.	<b>shutdown</b>	By default, all ports are up.
4. Return to system view.	<b>quit</b>	N/A
5. Enter IRF port view.	<b>irf-port</b> <i>member-id/port-number</i>	N/A
6. Bind each physical port to the IRF port.	<b>port group interface</b> <i>interface-type</i> <i>interface-number</i>	<p>By default, no physical ports are bound to any IRF port.</p> <p>Repeat this step to assign multiple physical ports to the IRF port for link redundancy.</p> <p>You can bind up to four physical ports to an IRF port.</p> <p>The binding attempt will fail if you have bound four physical ports to the IRF port.</p> <p>If you use one port in an SFP+ port group as an IRF physical port, the other ports in the group cannot be used for any other purposes.</p>
7. Return to system view.	<b>quit</b>	N/A

Step	Command	Remarks
8. Enter interface view or interface range view.	<ul style="list-style-type: none"> <li>• Enter interface range view:               <ul style="list-style-type: none"> <li>◦ Approach 1:  <code>interface range { interface-type interface-number [ to interface-type interface-number ] } &lt;1-5&gt;</code></li> <li>◦ Approach 2:  <code>interface range name name [ interface { interface-type interface-number [ to interface-type interface-number ] } &lt;1-5&gt; ]</code></li> </ul> </li> <li>• Enter interface view:  <code>interface interface-type interface-number</code></li> </ul>	N/A
9. Bring up the port or the range of ports.	<b>undo shutdown</b>	N/A
10. Return to system view.	<b>quit</b>	N/A
11. Save the configuration.	<b>save</b>	Activating IRF port configurations can cause IRF merge and reboot. To avoid data loss, save the running configuration to the startup configuration file before you perform the operation.
12. Activate the configuration.	<b>irf-port-configuration active</b>	<p>After this step is performed, the state of the IRF port changes to UP, the member devices automatically elect a master, and the subordinate device automatically reboots.</p> <p>After the IRF fabric is formed, you can add more physical ports to an IRF port (in UP state) without performing this step.</p>

## Accessing the IRF fabric

The IRF fabric appears as one device after it is formed. You configure and manage all IRF members at the CLI of the master. All settings you have made are automatically propagated to the IRF members.

You can access an IRF fabric's CLI in one of the following ways:

- **Local login**—Log in through the console port of any member device.
- **Remote login**—Log in at a Layer 3 interface on any member device by using methods including Telnet, Web, and SNMP.

When you log in to an IRF fabric, you are placed at the CLI of the master, regardless of at which member device you are logged in. After that, you can access the CLI of a subordinate device to execute a limited set of maintenance commands.

For more information, see the chapter on login in *Fundamentals Configuration Guide*.

## Configuring a member device description

You can configure a description for a member device to identify its physical location or for any other management purpose.

To configure a description for a member device:

Step	Command	Remarks
1. Enter system view.	<b>system-view</b>	N/A
2. Configure a description for a member device.	<b>irf member member-id description text</b>	By default, no member device description is configured.

## Configuring IRF link load sharing mode

On an IRF port with multiple links, traffic is balanced across its physical links. You can configure the IRF port to distribute traffic based on certain criteria, including IP addresses, MAC addresses and any combination of them. The criteria can also be packet types, such as Layer 2, IPv4, and IPv6.

Configure the IRF link load sharing mode for IRF links in system view or IRF port view:

- In system view, the configuration is global and takes effect on all IRF ports.
- In IRF port view, the configuration is port specific and takes effect only on the specific IRF port.

An IRF port preferentially uses the port-specific load sharing mode. If no port-specific load sharing mode is available, it uses the global load sharing mode.

The IRF link load sharing mode takes effect on all types of packets, including unicast, multicast, and broadcast.

## Configuring the global load sharing mode

Step	Command	Remarks
1. Enter system view.	<b>system-view</b>	N/A
2. Configure the global IRF link load sharing mode.	<b>irf-port global load-sharing mode</b> { <b>destination-ip</b>   <b>destination-mac</b>   <b>source-ip</b>   <b>source-mac</b> } *	By default, packets are automatically distributed across IRF member links based on packet types. If you execute this command multiple times, the most recent configuration takes effect.

## Configuring a port-specific load sharing mode

Before you configure a port-specific load sharing mode, make sure you have bound at least two physical ports to the IRF port.

To configure a port-specific load sharing mode for an IRF port:



Step	Command	Remarks
1. Enter system view.	<b>system-view</b>	N/A
2. Enter IRF port view.	<b>irf-port</b> <i>member-id/port-number</i>	N/A
3. Configure the port-specific load sharing mode.	<b>irf-port load-sharing mode</b> { <b>destination-ip</b>   <b>destination-mac</b>   <b>source-ip</b>   <b>source-mac</b> } *	By default, packets are automatically distributed across IRF member links based on packet types. If you execute this command multiple times, the most recent configuration takes effect.

## Configuring IRF bridge MAC persistence

An IRF fabric by default uses the bridge MAC address of the master device as its bridge MAC address. This bridge MAC address is used by Layer 2 protocols, for example, LACP, to identify the IRF fabric, and must be unique on a switched LAN for proper communication.

To avoid duplicate bridge MAC addresses, an IRF fabric can automatically change its bridge MAC address after its master leaves, but the change can cause temporary service interruption.

Depending on your network condition, enable the IRF fabric to preserve or change its bridge MAC address after the master leaves. Available options include:

- **irf mac-address persistent timer**—Bridge MAC address of the IRF fabric persists for 6 minutes after the master leaves. If the master does not come back before the timer expires, the IRF fabric uses the bridge MAC address of the new master as its bridge MAC address. This option avoids unnecessary bridge MAC address changes due to a device reboot, transient link failure, or purposeful link disconnection.
- **irf mac-address persistent always**—Bridge MAC address of the IRF fabric does not change after the master leaves.
- **undo irf mac-address persistent**—Bridge MAC address of the new master replaces the original one as soon as the old master leaves.

### ⓘ IMPORTANT:

- If ARP MAD or ND MAD is used, configure the **undo irf mac-address persistent** command to enable immediate bridge MAC address change after a master leaves.
- If a daisy chained IRF fabric has aggregate links with upstream or downstream devices, configure the **irf mac-address persistent always** command to avoid a bridge MAC change causing transmission delay or packet loss at a master/subordinate switchover.

If two IRF fabrics have the same bridge MAC address, they cannot merge.

To configure the IRF bridge MAC persistence setting:

Step	Command	Remarks
1. Enter system view.	<b>system-view</b>	N/A

Step	Command	Remarks
2. Configure IRF bridge MAC persistence.	<ul style="list-style-type: none"> <li>Keep the bridge MAC address unchanged even if the master has changed: <b>irf mac-address persistent always</b></li> <li>Preserve the bridge MAC address for 6 minutes after the master leaves: <b>irf mac-address persistent timer</b></li> <li>Change the bridge MAC address as soon as the master leaves: <b>undo irf mac-address persistent</b></li> </ul>	By default, the IRF fabric preserves its bridge MAC address for 6 minutes after the master leaves.

## Enabling software auto-update for software image synchronization

The software auto-update function automatically synchronizes the current software images of the master in an IRF fabric to all its members.

To join an IRF fabric, a device must use the same set of software images as the master in the fabric.

When you add a device to the IRF fabric, the software auto-update function compares the startup software images of the joining device with the current software images of the IRF master. If the two sets of images are different, the device automatically downloads the current software images of the master, sets the downloaded images as its main startup software images, and automatically reboots with the new software images to rejoin the IRF fabric.

If software auto-update is disabled, you must manually update the device with the software images of the master before adding it to the IRF fabric.

### Configuration prerequisites

Make sure the device you are adding to the IRF fabric has sufficient storage space for the new software images.

If no sufficient storage space is available, the device automatically deletes the current software images. If the reclaimed space is still insufficient, the device cannot complete the auto-update, and you must reboot the device and access the Boot menu to delete some files.

### Configuration procedure

To enable an IRF fabric to automatically synchronize software images of the master to the devices you are adding to the IRF fabric:

Step	Command	Remarks
1. Enter system view.	<b>system-view</b>	N/A
2. Enable software auto-update.	<b>irf auto-update enable</b>	By default, software auto-update is enabled.

# Setting the IRF link down report delay

You can avoid IRF link flapping causing frequent IRF splits and merges during a short time by configuring the IRF ports to delay reporting link down events. An IRF port works as follows:

- When the IRF link changes from up to down, the port does not immediately report the change to the IRF fabric. If the IRF link state is still down when the delay time is reached, the port reports the change to the IRF fabric.
- When the IRF link changes from down to up, the link layer immediately reports the event to the IRF fabric.

To set the IRF link down report delay:

Step	Command	Remarks
1. Enter system view.	<b>system-view</b>	N/A
2. Set the IRF link down report delay.	<b>irf link-delay interval</b>	<p>The default IRF link down report delay is 4 seconds.</p> <p>The greater the interval, the slower the service recovery.</p> <p>If your IRF fabric requires a fast master/subordinate or IRF link switchover or has deployed the BFD or GR feature, HP recommends setting the delay to 0 seconds.</p> <p>If CFD is enabled in the IRF fabric, the IRF link down report delay must not exceed the timeout time of the remote MEP. For more information about CFD, see <i>High Availability Configuration Guide</i>.</p>

# Configuring MAD

You have the following MAD mechanisms for detecting multi-active collisions in different network scenarios:

- LACP MAD
- BFD MAD
- ARP MAD
- ND MAD

LACP MAD handles collisions in a different way than BFD MAD, ARP MAD, and ND MAD. To avoid conflicts, do not enable LACP MAD together with any of those mechanisms in an IRF fabric. However, you can use BFD MAD, ARP MAD, and ND MAD together.

Table 1 provides a reference for you to make a MAD mechanism selection decision.

**Table 1 A comparison of the MAD mechanisms**

MAD mechanism	Advantages	Disadvantages	Application scenario
LACP MAD	<ul style="list-style-type: none"> <li>Detection speed is fast.</li> <li>Requires no MAD-dedicated physical ports or interfaces.</li> </ul>	Requires an intermediate device that supports extended LACP for MAD.	<p>Link aggregation is used between the IRF fabric and its upstream or downstream device.</p> <p>For information about LACP, see <i>Layer 2—LAN Switching Configuration Guide</i>.</p>
BFD MAD	<ul style="list-style-type: none"> <li>Detection speed is fast.</li> <li>No intermediate device is required.</li> <li>Intermediate device, if used, can come from any vendor.</li> </ul>	<ul style="list-style-type: none"> <li>Requires MAD dedicated physical ports and Layer 3 interfaces, which cannot be used for transmitting user traffic.</li> <li>If no intermediate device is used, the IRF members must be fully meshed.</li> <li>If an intermediate device is used, every IRF member must connect to the intermediate device.</li> </ul>	<ul style="list-style-type: none"> <li>Suitable for various network scenarios.</li> <li>If no intermediate device is used, this mechanism is only suitable for IRF fabrics that have a small number of members that are geographically close to one another.</li> </ul> <p>For information about BFD, see <i>High Availability Configuration Guide</i>.</p>
ARP MAD	<ul style="list-style-type: none"> <li>No intermediate device is required.</li> <li>Intermediate device, if used, can come from any vendor.</li> <li>Requires no MAD dedicated ports.</li> </ul>	<ul style="list-style-type: none"> <li>Detection speed is slower than BFD MAD and LACP MAD.</li> <li>The spanning tree feature must be enabled.</li> </ul>	<p>Spanning tree-enabled non-link aggregation IPv4 network scenario.</p> <p>For information about ARP, see <i>Layer 3—IP Services Configuration Guide</i>.</p>
ND MAD	<ul style="list-style-type: none"> <li>No intermediate device is required.</li> <li>Intermediate device, if used, can come from any vendor.</li> <li>Requires no MAD dedicated ports.</li> </ul>	<ul style="list-style-type: none"> <li>Detection speed is slower than BFD MAD and LACP MAD.</li> <li>The spanning tree feature must be enabled.</li> </ul>	<p>Spanning tree-enabled non-link aggregation IPv6 network scenario.</p> <p>For information about ND, see <i>Layer 3—IP Services Configuration Guide</i>.</p>

## Configuring LACP MAD

When you use LACP MAD, follow these guidelines:

- The intermediate device must be a device that supports extended LACP for MAD.
- If the intermediate device is in an IRF fabric, assign this fabric a different domain ID than the LACP MAD-enabled fabric to avoid false detection of IRF split.

- Use dynamic link aggregation mode. MAD is LACP dependent. Even though LACP MAD can be configured on both static and dynamic aggregate interfaces, it takes effect only on dynamic aggregate interfaces.
- Configure link aggregation settings on the intermediate device.

To configure LACP MAD:

Step	Command	Remarks
1. Enter system view.	<b>system-view</b>	N/A
2. Assign a domain ID to the IRF fabric.	<b>irf domain</b> <i>domain-id</i>	The default IRF domain ID is 0.
3. Create an aggregate interface and enter aggregate interface view.	<b>interface bridge-aggregation</b> <i>interface-number</i>	Perform this step also on the intermediate device.
4. Configure the aggregation group to operate in dynamic aggregation mode.	<b>link-aggregation mode dynamic</b>	By default, an aggregation group operates in static aggregation mode. Perform this step also on the intermediate device.
5. Enable LACP MAD.	<b>mad enable</b>	By default, LACP MAD is disabled.
6. Return to system view.	<b>quit</b>	N/A
7. Enter Ethernet interface view or interface range view.	<ul style="list-style-type: none"> <li>• Enter interface range view: <ul style="list-style-type: none"> <li>◦ Approach 1: <b>interface range</b> { <i>interface-type</i> <i>interface-number</i> [ <b>to</b> <i>interface-type</i> <i>interface-number</i> ] } &amp;&lt;1-5&gt;</li> <li>◦ Approach 2: <b>interface range name</b> <i>name</i> [ <b>interface</b> { <i>interface-type</i> <i>interface-number</i> [ <b>to</b> <i>interface-type</i> <i>interface-number</i> ] } &amp;&lt;1-5&gt; ]</li> </ul> </li> <li>• Enter Ethernet interface view: <b>interface</b> <i>interface-type</i> <i>interface-number</i></li> </ul>	To assign a range of ports to the aggregation group, enter interface range view. To assign one port to the aggregation group, enter Ethernet interface view.
8. Assign the Ethernet port or the range of Ethernet ports to the specified aggregation group.	<b>port link-aggregation group</b> <i>number</i>	Multichassis link aggregation is allowed. Perform this step also on the intermediate device.

## Configuring BFD MAD

When you use BFD MAD, follow these guidelines:

- You cannot enable BFD MAD on VLAN-interface 1.
- Do not use the BFD MAD VLAN for any other purpose. No Layer 2 or Layer 3 features, including ARP and LACP, can work on the BFD MAD-enabled VLAN interface or any port in the VLAN. If you

configure any other feature on the VLAN, neither the configured feature nor the BFD MAD function can work correctly.

- Do not enable the spanning tree feature on any port in the BFD MAD VLAN. The MAD function is mutually exclusive with the spanning tree feature.
- Do not bind a BFD MAD-enabled VLAN interface to any VPN. The MAD function is mutually exclusive with VPN.
- To avoid anomalies, make sure a BFD MAD-enabled VLAN interface has only IP addresses assigned with the **mad ip address** command. Do not use any other command, including the **ip address** command, to assign an IP address to the interface.
- All MAD IP addresses on the BFD MAD-enabled VLAN interface must be on the same subnet.
- If an intermediate device is used, assign the ports of the BFD MAD links to the BFD MAD VLAN on the device.

Step	Command	Remarks
1. Enter system view.	<b>system-view</b>	N/A
2. Assign a domain ID to the IRF fabric.	<b>irf domain</b> <i>domain-id</i>	By default, the domain ID of an IRF fabric is 0.
3. Create a VLAN dedicated to BFD MAD.	<b>vlan</b> <i>vlan-id</i>	The default VLAN on the device is VLAN 1.
4. Return to system view.	<b>quit</b>	N/A
5. Enter interface view or interface range view.	<ul style="list-style-type: none"> <li>• Enter interface range view: <ul style="list-style-type: none"> <li>◦ Approach 1: <b>interface range</b> { <i>interface-type</i> <i>interface-number</i> [ <b>to</b> <i>interface-type</i> <i>interface-number</i> ] } &amp;&lt;1-5&gt;</li> <li>◦ Approach 2: <b>interface range name</b> <i>name</i> [ <b>interface</b> { <i>interface-type</i> <i>interface-number</i> [ <b>to</b> <i>interface-type</i> <i>interface-number</i> ] } &amp;&lt;1-5&gt; ]</li> </ul> </li> <li>• Enter interface view: <b>interface</b> <i>interface-type</i> <i>interface-number</i></li> </ul>	<p>To assign a range of ports to the BFD MAD VLAN, enter interface range view.</p> <p>To assign one port to the BFD MAD VLAN, enter Ethernet interface view.</p>
6. Assign the port or the range of ports to the BFD MAD VLAN.	<ul style="list-style-type: none"> <li>• Assign the port to the VLAN as an access port: <b>port access vlan</b> <i>vlan-id</i></li> <li>• Assign the port to the VLAN as a trunk port: <b>port trunk permit vlan</b> <i>vlan-id</i></li> <li>• Assign the port to the VLAN as a hybrid port: <b>port hybrid vlan</b> <i>vlan-id</i> { <b>tagged</b>   <b>untagged</b> }</li> </ul>	<p>Choose one command depending on the port type.</p> <p>BFD MAD has no requirement for the link type of the detection port.</p> <p>The default link type of a port is access.</p>
7. Return to system view.	<b>quit</b>	N/A
8. Enter VLAN interface view.	<b>interface vlan-interface</b> <i>vlan-interface-id</i>	N/A

Step	Command	Remarks
9. Enable BFD MAD.	<b>mad bfd enable</b>	By default, BFD MAD is disabled.
10. Configure a MAD IP address for a member device on the VLAN interface.	<b>mad ip address</b> <i>ip-address</i> { <i>mask</i>   <i>mask-length</i> } <b>member</b> <i>member-id</i>	By default, no MAD IP address is configured on any VLAN interface.  Repeat this step to assign a MAD IP address to each member device on the VLAN interface.  The MAD IP addresses must not be on the same subnet as any IP address configured on any member device.

## Configuring ARP MAD

When you use ARP MAD, follow these guidelines:

- If an intermediate device is used, you can use common data links as ARP MAD links. If no intermediate device is used, set up dedicated ARP MAD links between IRF member devices.
- Use a VLAN dedicated to ARP MAD.
- If an intermediate device is used, do the following:
  - Run the spanning tree feature between the IRF fabric and the intermediate device.
  - Enable the IRF fabric to change its bridge MAC address as soon as the master leaves.
  - Create an ARP MAD VLAN and assign the ports on the ARP MAD links to the VLAN.
  - If the intermediate device is in an IRF fabric, you must assign this fabric a different domain ID than the ARP MAD-enabled fabric to avoid false detection of IRF splits.

To configure ARP MAD:

Step	Command	Remarks
1. Enter system view.	<b>system-view</b>	N/A
2. Assign a domain ID to the IRF fabric.	<b>irf domain</b> <i>domain-id</i>	The default IRF domain ID is 0.
3. Create a VLAN dedicated to ARP MAD.	<b>vlan</b> <i>vlan-id</i>	The default VLAN on the device is VLAN 1.
4. Return to system view.	<b>quit</b>	N/A
5. Enter Ethernet interface view.	<b>interface</b> <i>interface-type</i> <i>interface-number</i>	N/A

Step	Command	Remarks
6. Assign the port to the ARP MAD VLAN.	<ul style="list-style-type: none"> <li>Assign the port to the VLAN as an access port: <b>port access vlan</b> <i>vlan-id</i></li> <li>Assign the port to the VLAN as a trunk port: <b>port trunk permit vlan</b> <i>vlan-id</i></li> <li>Assign the port to the VLAN as a hybrid port: <b>port hybrid vlan</b> <i>vlan-id</i> { <b>tagged</b>   <b>untagged</b> }</li> </ul>	<p>Choose one command depending on the port type.</p> <p>ARP MAD detection has no requirement for the link type of the detection port.</p> <p>The default link type of a port is access.</p>
7. Return to system view.	<b>quit</b>	N/A
8. Enter VLAN interface view.	<b>interface</b> <i>vlan-interface</i> <i>vlan-interface-id</i>	N/A
9. Assign the interface an IP address.	<b>ip address</b> <i>ip-address</i> { <i>mask</i>   <i>mask-length</i> }	By default, no IP address is assigned to any VLAN interface.
10. Enable ARP MAD.	<b>mad arp enable</b>	By default, ARP MAD is disabled.

## Configuring ND MAD

When you use ND MAD, follow these guidelines:

- Enable the IRF fabric to change its bridge MAC address as soon as the master leaves.
- If the intermediate device is in an IRF fabric, assign this fabric a different domain ID than the ND MAD-enabled fabric to avoid false detection of IRF split.
- If an intermediate device is used, you can use common data links as ND MAD links. If no intermediate device is used, set up dedicated ND MAD links between IRF member devices.
- Use a VLAN dedicated to ND MAD.
- On the intermediate device, create the ND MAD VLAN and assign the ports on the ND MAD links to the VLAN.

To configure ND MAD:

Step	Command	Remarks
1. Enter system view.	<b>system-view</b>	N/A
2. Assign a domain ID to the IRF fabric.	<b>irf domain</b> <i>domain-id</i>	The default IRF domain ID is 0.
3. Create a VLAN dedicated to ND MAD.	<b>vlan</b> <i>vlan-id</i>	The default VLAN on the device is VLAN 1.
4. Return to system view.	<b>quit</b>	N/A
5. Enter Ethernet interface view.	<b>interface</b> <i>interface-type</i> <i>interface-number</i>	N/A



Step	Command	Remarks
6. Assign the port to the ND MAD VLAN.	<ul style="list-style-type: none"> <li>Assign the port to the VLAN as an access port: <b>port access vlan</b> <i>vlan-id</i></li> <li>Assign the port to the VLAN as a trunk port: <b>port trunk permit vlan</b> <i>vlan-id</i></li> <li>Assign the port to the VLAN as a hybrid port: <b>port hybrid vlan</b> <i>vlan-id</i> { <b>tagged</b>   <b>untagged</b> }</li> </ul>	<p>Choose one command depending on the port type.</p> <p>ND MAD detection has no requirement for the link type of the detection port.</p> <p>The default link type of a port is access.</p>
7. Return to system view.	<b>quit</b>	N/A
8. Enter VLAN interface view.	<b>interface</b> <i>vlan-interface</i> <i>vlan-interface-id</i>	N/A
9. Assign the interface an IP address.	<b>ipv6 address</b> { <i>ipv6-address/pre-length</i>   <i>ipv6 address pre-length</i> }	By default, no IPv6 address is assigned to any VLAN interface.
10. Enable ND MAD.	<b>mad nd enable</b>	By default, ND MAD is disabled.

## Excluding a port from the shutdown action upon detection of multi-active collision

When the IRF fabric moves to the Recovery state, all its network ports but the console and physical IRF ports by default automatically shut down.

You can exclude a network port from the shutdown action for management or other special purposes. For example:

- Exclude a port from the shutdown action so you can Telnet to the port for managing the device.
- Exclude a VLAN interface and its Layer 2 ports from the shutdown action so you can log in through the VLAN interface.

### CAUTION:

Excluding a VLAN interface and its Layer 2 ports from the shutdown action introduces IP collision risks because the VLAN interface might be active on both the IRF fabric in Active state and the IRF fabric in Recovery state.

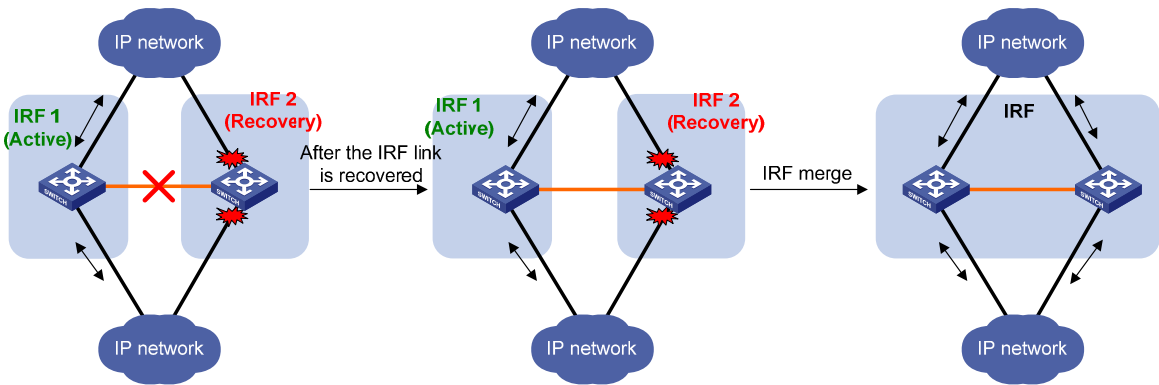
To configure a port to not shut down when the IRF fabric transits to the Recovery state:

Step	Command	Remarks
1. Enter system view.	<b>system-view</b>	N/A
2. Configure a network port to not shut down when the IRF fabric transits to the Recovery state.	<b>mad exclude interface</b> <i>interface-type</i> <i>interface-number</i>	By default, when an IRF fabric transits to the Recovery state, all its network ports but the IRF physical ports and console port are shut down.

# Recovering an IRF fabric

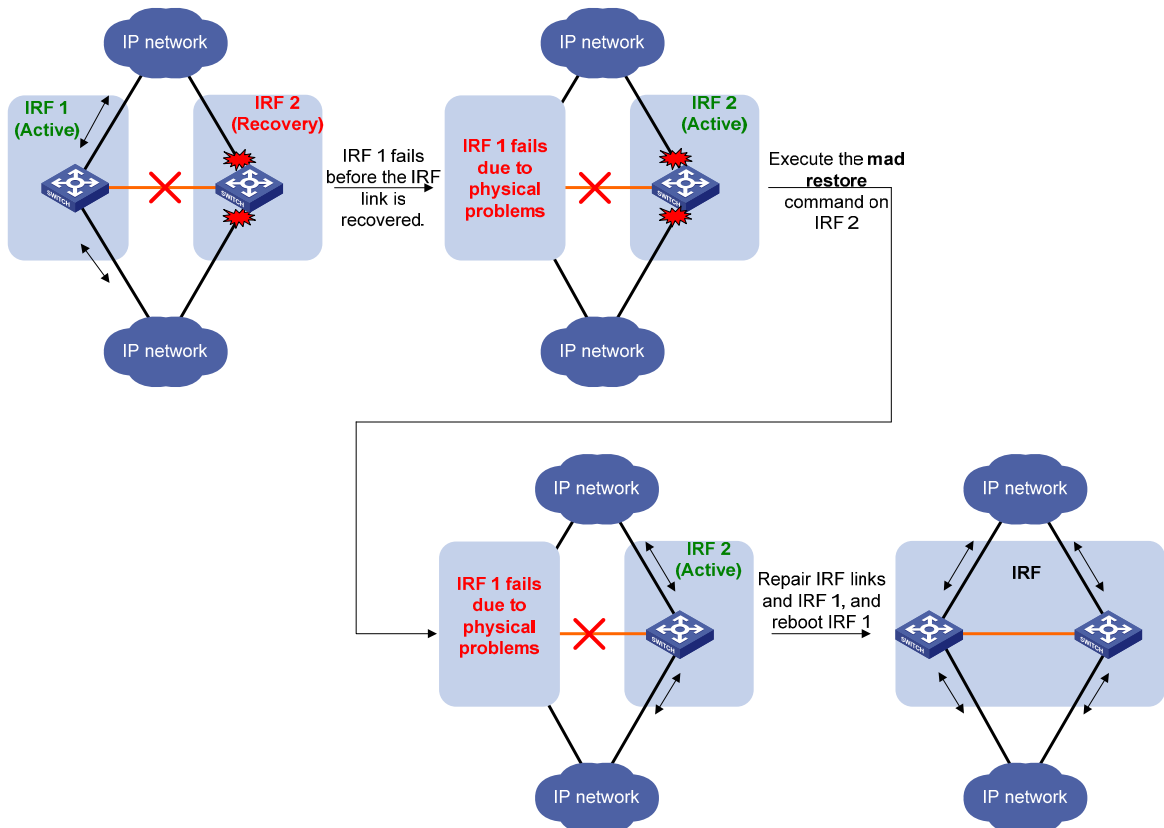
When the failed IRF link between two split IRF fabrics is recovered, all member devices in the Recovery-state fabric automatically join the Active-state fabric as subordinate members, and the network ports that have been shut down by MAD automatically restore their original physical state, as shown in Figure 12.

Figure 12 Recovering the IRF fabric



If the Active-state fabric has failed, for example, because of device or link failures, before the IRF link is recovered (see Figure 13), use the **mad restore** command on the Recovery-state fabric to change its state to Active to take over. After you repair the IRF link, the two parts merge into a unified IRF fabric.

Figure 13 Active-state IRF fabric fails before the IRF link is recovered



To manually recover the IRF fabric in Recovery state:

Step	Command
1. Enter system view.	<b>system-view</b>
2. Change the state of the IRF fabric from Recovery to Active.	<b>mad restore</b>

After the IRF fabric is recovered, all ports that have been shut down by MAD automatically come up.

## Displaying and maintaining an IRF fabric

Execute **display** commands in any view.

Task	Command
Display information about all IRF members.	<b>display irf</b>
Display the IRF fabric topology.	<b>display irf topology</b>
Display IRF link information.	<b>display irf link</b>
Display IRF configuration.	<b>display irf configuration</b>
Display the load sharing mode for IRF links.	<b>display irf-port load-sharing mode [ irf-port [ member-id/port-number ] ]</b>
Display MAD configuration.	<b>display mad [ verbose ]</b>

## Configuration examples

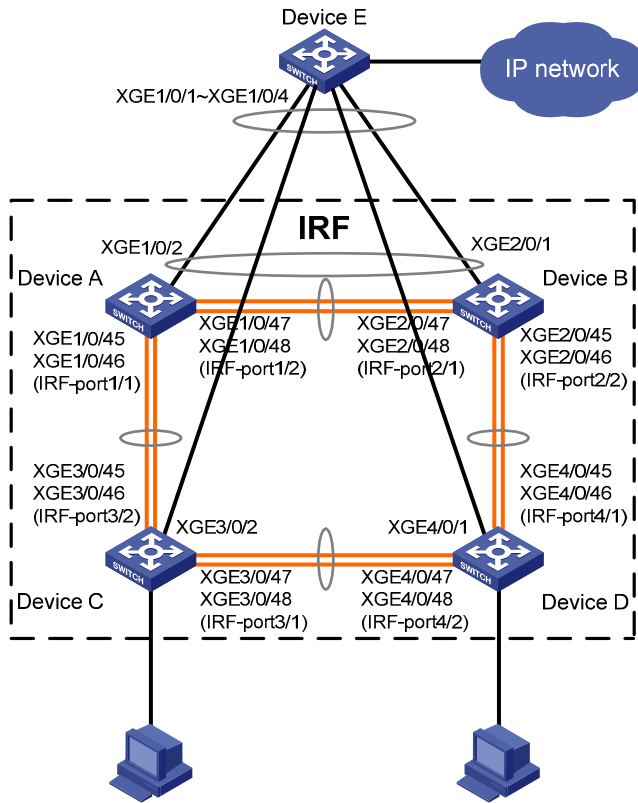
This section provides IRF configuration examples for IRF fabrics that use different MAD mechanisms.

### LACP MAD-enabled IRF configuration example

#### Network requirements

Set up a four-chassis IRF fabric at the access layer of the enterprise network in [Figure 14](#). Configure LACP MAD in the IRF fabric, because the IRF fabric has a multichassis aggregate link to Device E, an HP device that supports extended LACP.

Figure 14 Network diagram



## Configuration procedure

### 1. Configure Device A:

# Shut down the physical ports used for IRF connection. This example uses the SFP+ port group that contains Ten-GigabitEthernet 1/0/45 to Ten-GigabitEthernet 1/0/48 for IRF connection.

```
<Sysname> system-view
[Sysname] interface range name irf interface ten-gigabitethernet 1/0/45 to
ten-gigabitethernet 1/0/48
[Sysname-if-range-irf] shutdown
[Sysname-if-range-irf] quit
```

# Bind Ten-GigabitEthernet 1/0/45 and Ten-GigabitEthernet 1/0/46 to IRF-port 1/1.

```
[Sysname] irf-port 1/1
[Sysname-irf-port1/1] port group interface ten-gigabitethernet 1/0/45
[Sysname-irf-port1/1] port group interface ten-gigabitethernet 1/0/46
[Sysname-irf-port1/1] quit
```

# Bind Ten-GigabitEthernet 1/0/47 and Ten-GigabitEthernet 1/0/48 to IRF-port 1/2.

```
[Sysname] irf-port 1/2
[Sysname-irf-port1/2] port group interface ten-gigabitethernet 1/0/47
[Sysname-irf-port1/2] port group interface ten-gigabitethernet 1/0/48
[Sysname-irf-port1/2] quit
```

# Bring up the SFP+ ports and save the configuration.

```
[Sysname] interface range name irf
[Sysname-if-range-irf] undo shutdown
[Sysname-if-range-irf] quit
```

```
[Sysname] save
# Activate the IRF port configuration.
[Sysname] irf-port-configuration active
```

## 2. Configure Device B:

# Change the member ID of Device B to 2 and reboot the device to validate the change.

```
<Sysname> system-view
[Sysname] irf member 1 renumber 2
Renumbering the member ID may result in configuration change or loss. Continue? [Y/N]:y
[Sysname] quit
<Sysname> reboot
```

# Connect Device B to Device A as shown in [Figure 14](#), and log in to Device B. This example uses the SFP+ group that contains Ten-GigabitEthernet 2/0/45 to Ten-GigabitEthernet 2/0/48 for IRF connection.

# Shut down the physical ports.

```
<Sysname> system-view
[Sysname] interface range name irf interface ten-gigabitethernet 2/0/45 to
ten-gigabitethernet 2/0/48
[Sysname-if-range-irf] shutdown
[Sysname-if-range-irf] quit
```

# Bind Ten-GigabitEthernet 2/0/47 and Ten-GigabitEthernet 2/0/48 to IRF-port 2/1.

```
[Sysname] irf-port 2/1
[Sysname-irf-port2/1] port group interface ten-gigabitethernet 2/0/47
[Sysname-irf-port2/1] port group interface ten-gigabitethernet 2/0/48
[Sysname-irf-port2/1] quit
```

# Bind Ten-GigabitEthernet 2/0/45 and Ten-GigabitEthernet 2/0/46 to IRF-port 2/2.

```
[Sysname] irf-port 2/2
[Sysname-irf-port2/2] port group interface ten-gigabitethernet 2/0/45
[Sysname-irf-port2/2] port group interface ten-gigabitethernet 2/0/46
[Sysname-irf-port2/2] quit
```

# Bring up the SFP+ ports and save the configuration.

```
[Sysname] interface range name irf
[Sysname-if-range-irf] undo shutdown
[Sysname-if-range-irf] quit
[Sysname] save
```

# Activate the IRF port configuration.

```
[Sysname] irf-port-configuration active
```

The two devices perform master election, and the one that has lost the election reboots to form an IRF fabric with the master.

## 3. Configure Device C:

# Change the member ID of Device C to 3 and reboot the device to validate the change.

```
<Sysname> system-view
[Sysname] irf member 1 renumber 3
Renumbering the member ID may result in configuration change or loss. Continue? [Y/N]:y
[Sysname] quit
<Sysname> reboot
```

# Connect Device C to Device A as shown in [Figure 14](#), and log in to Device C. This example uses the SFP+ port group that contains Ten-GigabitEthernet 3/0/45 to Ten-GigabitEthernet 3/0/48 for IRF connection.

# Shut down the physical ports.

```
<Sysname> system-view
[Sysname] interface range name irf interface ten-gigabitethernet 3/0/45 to
ten-gigabitethernet 3/0/48
[Sysname-if-range-irf] shutdown
[Sysname-if-range-irf] quit
```

# Bind Ten-GigabitEthernet 3/0/47 and Ten-GigabitEthernet 3/0/48 to IRF-port 3/1.

```
[Sysname] irf-port 3/1
[Sysname-irf-port3/1] port group interface ten-gigabitethernet 3/0/47
[Sysname-irf-port3/1] port group interface ten-gigabitethernet 3/0/48
[Sysname-irf-port3/1] quit
```

# Bind Ten-GigabitEthernet 3/0/45 and Ten-GigabitEthernet 3/0/46 to IRF-port 3/2.

```
[Sysname] irf-port 3/2
[Sysname-irf-port3/2] port group interface ten-gigabitethernet 3/0/45
[Sysname-irf-port3/2] port group interface ten-gigabitethernet 3/0/46
[Sysname-irf-port3/2] quit
```

# Bring up the SFP+ ports and save the configuration.

```
[Sysname] interface range name irf
[Sysname-if-range-irf] undo shutdown
[Sysname-if-range-irf] quit
[Sysname] save
```

# Activate the IRF port configuration.

```
[Sysname] irf-port-configuration active
```

Device C reboots to join the IRF fabric.

#### 4. Configure Device D:

# Change the member ID of Device D to 4 and reboot the device to validate the change.

```
<Sysname> system-view
[Sysname] irf member 1 renumber 4
Renumbering the member ID may result in configuration change or loss. Continue? [Y/N]:y
[Sysname] quit
<Sysname> reboot
```

# Connect Device D to Device B and Device C as shown in [Figure 14](#), and log in to Device D. This example uses the SFP+ port group that contains Ten-GigabitEthernet 4/0/45 to Ten-GigabitEthernet 4/0/48 for IRF connection.

# Shut down the physical ports.

```
<Sysname> system-view
[Sysname] interface range name irf interface ten-gigabitethernet 4/0/45 to
ten-gigabitethernet 4/0/48
[Sysname-if-range-irf] shutdown
[Sysname-if-range-irf] quit
```

# Bind Ten-GigabitEthernet 4/0/45 and Ten-GigabitEthernet 4/0/46 to IRF-port 4/1.

```
[Sysname] irf-port 4/1
[Sysname-irf-port4/1] port group interface ten-gigabitethernet 4/0/45
```

```
[Sysname-irf-port4/1] port group interface ten-gigabitethernet 4/0/46
[Sysname-irf-port4/1] quit
# Bind Ten-GigabitEthernet 4/0/47 and Ten-GigabitEthernet 4/0/48 to IRF-port 4/2.
[Sysname] irf-port 4/2
[Sysname-irf-port4/2] port group interface ten-gigabitethernet 4/0/47
[Sysname-irf-port4/2] port group interface ten-gigabitethernet 4/0/48
[Sysname-irf-port4/2] quit
```

# Bring up the SFP+ ports and save the configuration.

```
[Sysname] interface range name irf
[Sysname-if-range-irf] undo shutdown
[Sysname-if-range-irf] quit
[Sysname] save
```

# Activate the IRF port configuration.

```
[Sysname] irf-port-configuration active
```

Device D reboots to join the IRF fabric. A four-chassis IRF fabric is formed.

## 5. Configure LACP MAD on the IRF fabric:

# Set the domain ID of the IRF fabric to 1.

```
<Sysname> system-view
[Sysname] irf domain 1
```

# Create a dynamic aggregate interface and enable LACP MAD.

```
[Sysname] interface bridge-aggregation 2
[Sysname-Bridge-Aggregation2] link-aggregation mode dynamic
[Sysname-Bridge-Aggregation2] mad enable
```

You need to assign a domain ID (range: 0-4294967295)

```
[Current domain is: 1]:
```

```
The assigned domain ID is: 1
```

```
Info: MAD LACP only enable on dynamic aggregation interface.
```

```
[Sysname-Bridge-Aggregation2] quit
```

# Assign Ten-GigabitEthernet 1/0/2, Ten-GigabitEthernet 2/0/1, Ten-GigabitEthernet 3/0/2, and Ten-GigabitEthernet 4/0/1 to the aggregate interface.

```
[Sysname] interface ten-gigabitethernet 1/0/2
[Sysname-Ten-GigabitEthernet1/0/2] port link-aggregation group 2
[Sysname-Ten-GigabitEthernet1/0/2] quit
[Sysname] interface ten-gigabitethernet 2/0/1
[Sysname-Ten-GigabitEthernet2/0/1] port link-aggregation group 2
[Sysname-Ten-GigabitEthernet2/0/1] quit
[Sysname] interface ten-gigabitethernet 3/0/2
[Sysname-Ten-GigabitEthernet3/0/2] port link-aggregation group 2
[Sysname-Ten-GigabitEthernet3/0/2] quit
[Sysname] interface ten-gigabitethernet 4/0/1
[Sysname-Ten-GigabitEthernet4/0/1] port link-aggregation group 2
[Sysname-Ten-GigabitEthernet4/0/1] quit
```

## 6. Configure Device E as the intermediate device:

---

**△ CAUTION:**

If the intermediate device is in an IRF fabric, assign this fabric a different domain ID than the LACP MAD-enabled fabric.

---

```
# Create a dynamic aggregate interface.
<Sysname> system-view
[Sysname] interface bridge-aggregation 2
[Sysname-Bridge-Aggregation2] link-aggregation mode dynamic
[Sysname-Bridge-Aggregation2] quit
# Assign Ten-GigabitEthernet 1/0/1, Ten-GigabitEthernet 1/0/2, Ten-GigabitEthernet 1/0/3,
and Ten-GigabitEthernet 1/0/4 to the aggregate interface.
[Sysname] interface ten-gigabitethernet 1/0/1
[Sysname-Ten-GigabitEthernet1/0/1] port link-aggregation group 2
[Sysname-Ten-GigabitEthernet1/0/1] quit
[Sysname] interface ten-gigabitethernet 1/0/2
[Sysname-Ten-GigabitEthernet1/0/2] port link-aggregation group 2
[Sysname-Ten-GigabitEthernet1/0/2] quit
[Sysname] interface ten-gigabitethernet 1/0/3
[Sysname-Ten-GigabitEthernet1/0/3] port link-aggregation group 2
[Sysname-Ten-GigabitEthernet1/0/3] quit
[Sysname] interface ten-gigabitethernet 1/0/4
[Sysname-Ten-GigabitEthernet1/0/4] port link-aggregation group 2
```

## BFD MAD-enabled IRF configuration example

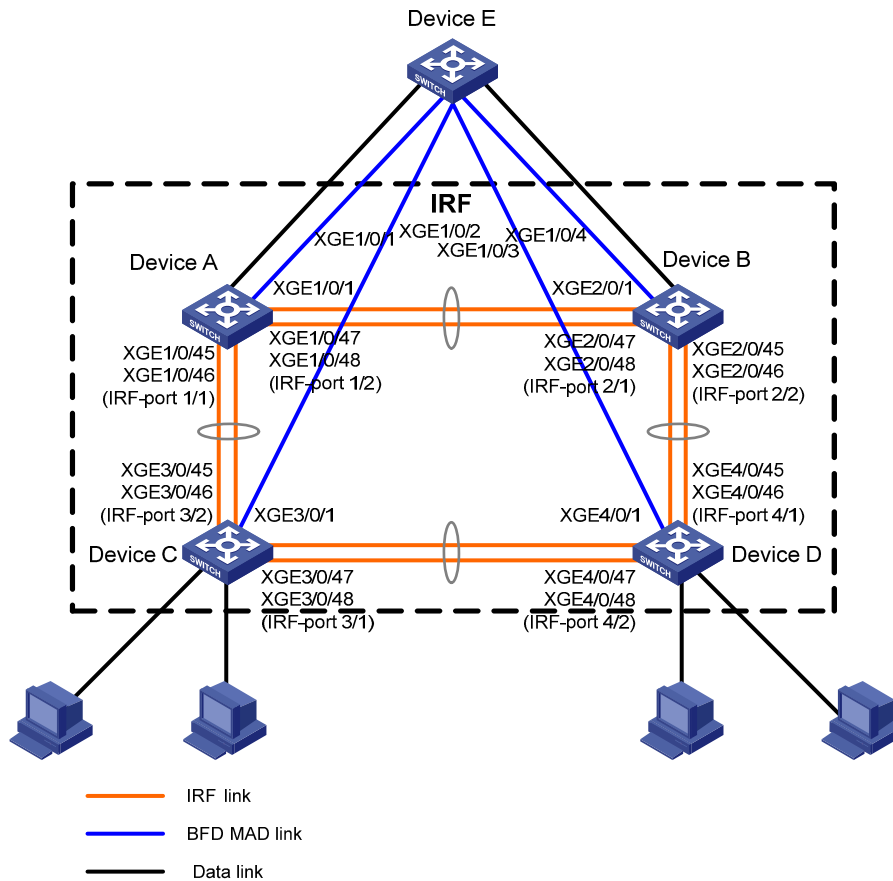
### Network requirements

Set up a four-chassis IRF fabric at the distribution layer of the enterprise network in [Figure 15](#). Configure BFD MAD in the IRF fabric and set up BFD MAD links between each member device and the intermediate device. Disable the spanning tree feature on the ports used for BFD MAD, because the two features conflict with each other.

Assign the highest member priority to Device A so it can be elected as the master.



Figure 15 Network diagram



## Configuration procedure

### 1. Configure Device A:

# Shut down the physical ports used for IRF connection. This example uses the SFP+ port group that contains Ten-GigabitEthernet 1/0/45 to Ten-GigabitEthernet 1/0/48 for IRF connection.

```
<Sysname> system-view
[Sysname] interface range name irf interface ten-gigabitethernet 1/0/45 to
ten-gigabitethernet 1/0/48
[Sysname-if-range-irf] shutdown
[Sysname-if-range-irf] quit
```

# Bind Ten-GigabitEthernet 1/0/45 and Ten-GigabitEthernet 1/0/46 to IRF-port 1/1.

```
[Sysname] irf-port 1/1
[Sysname-irf-port1/1] port group interface ten-gigabitethernet 1/0/45
[Sysname-irf-port1/1] port group interface ten-gigabitethernet 1/0/46
[Sysname-irf-port1/1] quit
```

# Bind Ten-GigabitEthernet 1/0/47 and Ten-GigabitEthernet 1/0/48 to IRF-port 1/2.

```
[Sysname] irf-port 1/2
[Sysname-irf-port1/2] port group interface ten-gigabitethernet 1/0/47
[Sysname-irf-port1/2] port group interface ten-gigabitethernet 1/0/48
[Sysname-irf-port1/2] quit
```

# Bring up the SFP+ ports and save the configuration.

```
[Sysname] interface range name irf
```

```
[Sysname-if-range-irf] undo shutdown
[Sysname-if-range-irf] quit
[Sysname] save
# Activate the IRF port configuration.
[Sysname] irf-port-configuration active
```

## 2. Configure Device B:

# Change the member ID of Device B to 2 and reboot the device to validate the change.

```
<Sysname> system-view
[Sysname] irf member 1 renumber 2
Renumbering the member ID may result in configuration change or loss. Continue? [Y/N]:y
[Sysname] quit
<Sysname> reboot
```

# Connect Device B to Device A as shown in [Figure 15](#), and log in to Device B. This example uses the SFP+ group that contains Ten-GigabitEthernet 2/0/45 to Ten-GigabitEthernet 2/0/48 for IRF connection.

# Shut down the physical ports.

```
<Sysname> system-view
[Sysname] interface range name irf interface ten-gigabitethernet 2/0/45 to
ten-gigabitethernet 2/0/48
[Sysname-if-range-irf] shutdown
[Sysname-if-range-irf] quit
```

# Bind Ten-GigabitEthernet 2/0/47 and Ten-GigabitEthernet 2/0/48 to IRF-port 2/1.

```
[Sysname] irf-port 2/1
[Sysname-irf-port2/1] port group interface ten-gigabitethernet 2/0/47
[Sysname-irf-port2/1] port group interface ten-gigabitethernet 2/0/48
[Sysname-irf-port2/1] quit
```

# Bind Ten-GigabitEthernet 2/0/45 and Ten-GigabitEthernet 2/0/46 to IRF-port 2/2.

```
[Sysname] irf-port 2/2
[Sysname-irf-port2/2] port group interface ten-gigabitethernet 2/0/45
[Sysname-irf-port2/2] port group interface ten-gigabitethernet 2/0/46
[Sysname-irf-port2/2] quit
```

# Bring up the SFP+ ports and save the configuration.

```
[Sysname] interface range name irf
[Sysname-if-range-irf] undo shutdown
[Sysname-if-range-irf] quit
[Sysname] save
```

# Activate the IRF port configuration.

```
[Sysname] irf-port-configuration active
```

The two devices perform master election, and the one that has lost the election reboots to form an IRF fabric with the master.

## 3. Configure Device C:

# Change the member ID of Device C to 3 and reboot the device to validate the change.

```
<Sysname> system-view
[Sysname] irf member 1 renumber 3
Renumbering the member ID may result in configuration change or loss. Continue? [Y/N]:y
[Sysname] quit
```

```
<Sysname> reboot
```

# Connect Device C to Device A as shown in [Figure 15](#), and log in to Device C. This example uses the SFP+ port group that contains Ten-GigabitEthernet 3/0/45 to Ten-GigabitEthernet 3/0/48 for IRF connection.

# Shut down the physical ports.

```
<Sysname> system-view
```

```
[Sysname] interface range name irf interface ten-gigabitethernet 3/0/45 to  
ten-gigabitethernet 3/0/48
```

```
[Sysname-if-range-irf] shutdown
```

```
[Sysname-if-range-irf] quit
```

# Bind Ten-GigabitEthernet 3/0/47 and Ten-GigabitEthernet 3/0/48 to IRF-port 3/1.

```
[Sysname] irf-port 3/1
```

```
[Sysname-irf-port3/1] port group interface ten-gigabitethernet 3/0/47
```

```
[Sysname-irf-port3/1] port group interface ten-gigabitethernet 3/0/48
```

```
[Sysname-irf-port3/1] quit
```

# Bind Ten-GigabitEthernet 3/0/45 and Ten-GigabitEthernet 3/0/46 to IRF-port 3/2.

```
[Sysname] irf-port 3/2
```

```
[Sysname-irf-port3/2] port group interface ten-gigabitethernet 3/0/45
```

```
[Sysname-irf-port3/2] port group interface ten-gigabitethernet 3/0/46
```

```
[Sysname-irf-port3/2] quit
```

# Bring up the SFP+ ports and save the configuration.

```
[Sysname] interface range name irf
```

```
[Sysname-if-range-irf] undo shutdown
```

```
[Sysname-if-range-irf] quit
```

```
[Sysname] save
```

# Activate the IRF port configuration.

```
[Sysname] irf-port-configuration active
```

Device C reboots to join the IRF fabric.

#### 4. Configure Device D:

# Change the member ID of Device D to 4 and reboot the device to validate the change.

```
<Sysname> system-view
```

```
[Sysname] irf member 1 renumber 4
```

```
Renumbering the member ID may result in configuration change or loss. Continue? [Y/N]:y
```

```
[Sysname] quit
```

```
<Sysname> reboot
```

# Connect Device D to Device B and Device C as shown in [Figure 15](#), and log in to Device D. This example uses the SFP+ port group that contains Ten-GigabitEthernet 4/0/45 to Ten-GigabitEthernet 4/0/48 for IRF connection.

# Shut down the physical ports.

```
<Sysname> system-view
```

```
[Sysname] interface range name irf interface ten-gigabitethernet 4/0/45 to  
ten-gigabitethernet 4/0/48
```

```
[Sysname-if-range-irf] shutdown
```

```
[Sysname-if-range-irf] quit
```

# Bind Ten-GigabitEthernet 4/0/45 and Ten-GigabitEthernet 4/0/46 to IRF-port 4/1.

```
[Sysname] irf-port 4/1
```

```
[Sysname-irf-port4/1] port group interface ten-gigabitethernet 4/0/45
[Sysname-irf-port4/1] port group interface ten-gigabitethernet 4/0/46
[Sysname-irf-port4/1] quit
```

# Bind Ten-GigabitEthernet 4/0/47 and Ten-GigabitEthernet 4/0/48 to IRF-port 4/2.

```
[Sysname] irf-port 4/2
[Sysname-irf-port4/2] port group interface ten-gigabitethernet 4/0/47
[Sysname-irf-port4/2] port group interface ten-gigabitethernet 4/0/48
[Sysname-irf-port4/2] quit
```

# Bring up the SFP+ ports and save the configuration.

```
[Sysname] interface range name irf
[Sysname-if-range-irf] undo shutdown
[Sysname-if-range-irf] quit
[Sysname] save
```

# Activate the IRF port configuration.

```
[Sysname] irf-port-configuration active
```

Device D reboots to join the IRF fabric. A four-chassis IRF fabric is formed.

#### 5. Configure BFD MAD on the IRF fabric:

# Create VLAN 3, and add Ten-GigabitEthernet 1/0/1, Ten-GigabitEthernet 2/0/1, Ten-GigabitEthernet 3/0/1, and Ten-GigabitEthernet 4/0/1 to VLAN 3.

```
[Sysname] vlan 3
[Sysname-vlan3] port ten-gigabitethernet 1/0/1 ten-gigabitethernet 2/0/1
ten-gigabitethernet 3/0/1 ten-gigabitethernet 4/0/1
[Sysname-vlan3] quit
```

# Create VLAN-interface 3 and configure a MAD IP address for each member device on the VLAN interface.

```
[Sysname] interface vlan-interface 3
[Sysname-Vlan-interface3] mad bfd enable
[Sysname-Vlan-interface3] mad ip address 192.168.2.1 24 member 1
[Sysname-Vlan-interface3] mad ip address 192.168.2.2 24 member 2
[Sysname-Vlan-interface3] mad ip address 192.168.2.3 24 member 3
[Sysname-Vlan-interface3] mad ip address 192.168.2.4 24 member 4
[Sysname-Vlan-interface3] quit
```

# Disable the spanning tree feature on Ten-GigabitEthernet 1/0/1, Ten-GigabitEthernet 2/0/1, Ten-GigabitEthernet 3/0/1, and Ten-GigabitEthernet 4/0/1.

```
[Sysname] interface ten-gigabitethernet 1/0/1
[Sysname-Ten-GigabitEthernet1/0/1] undo stp enable
[Sysname-Ten-GigabitEthernet1/0/1] quit
[Sysname] interface ten-gigabitethernet 2/0/1
[Sysname-Ten-GigabitEthernet2/0/1] undo stp enable
[Sysname-Ten-GigabitEthernet2/0/1] quit
[Sysname] interface ten-gigabitethernet 3/0/1
[Sysname-Ten-GigabitEthernet3/0/1] undo stp enable
[Sysname-Ten-GigabitEthernet3/0/1] quit
[Sysname] interface ten-gigabitethernet 4/0/1
[Sysname-Ten-GigabitEthernet4/0/1] undo stp enable
```

#### 6. Configure Device E as the intermediate device:

**CAUTION:**

If the intermediate device is in an IRF fabric, assign this fabric a different domain ID than the BFD MAD-enabled fabric.

```
# Create VLAN 3, and assign Ten-GigabitEthernet 1/0/1, Ten-GigabitEthernet 1/0/2,
Ten-GigabitEthernet 1/0/3, and Ten-GigabitEthernet 1/0/4 to VLAN 3 for forwarding BFD MAD
packets.
```

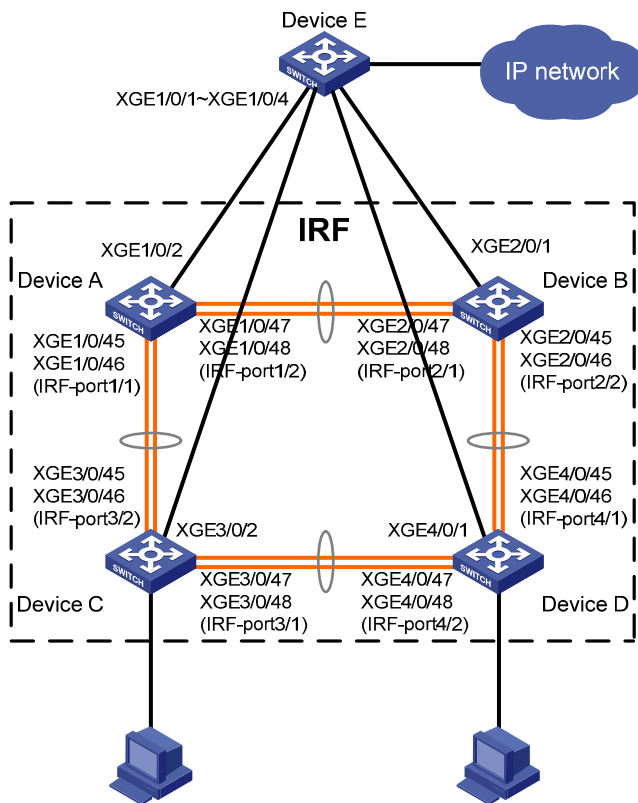
```
<DeviceE> system-view
[DeviceE] vlan 3
[DeviceE-vlan3] port ten-gigabitethernet 1/0/1 to ten-gigabitethernet 1/0/4
[DeviceE-vlan3] quit
```

## ARP MAD-enabled IRF configuration example

### Network requirements

Set up a four-chassis IRF fabric in the enterprise network in Figure 16. Configure ARP MAD in the IRF fabric and use the links connected to Device E for transmitting ARP MAD packets. To prevent loops, run the spanning tree feature between Device E and the IRF fabric.

Figure 16 Network diagram



### Configuration procedure

1. Configure Device A:

```
# Shut down the physical ports used for IRF connection. This example uses the SFP+ port group that
contains Ten-GigabitEthernet 1/0/45 to Ten-GigabitEthernet 1/0/48 for IRF connection.
```

```
<Sysname> system-view
```

```

[Sysname] interface range name irf interface ten-gigabitethernet 1/0/45 to
ten-gigabitethernet 1/0/48
[Sysname-if-range-irf] shutdown
[Sysname-if-range-irf] quit
# Bind Ten-GigabitEthernet 1/0/45 and Ten-GigabitEthernet 1/0/46 to IRF-port 1/1.
[Sysname] irf-port 1/1
[Sysname-irf-port1/1] port group interface ten-gigabitethernet 1/0/45
[Sysname-irf-port1/1] port group interface ten-gigabitethernet 1/0/46
[Sysname-irf-port1/1] quit
# Bind Ten-GigabitEthernet 1/0/47 and Ten-GigabitEthernet 1/0/48 to IRF-port 1/2.
[Sysname] irf-port 1/2
[Sysname-irf-port1/2] port group interface ten-gigabitethernet 1/0/47
[Sysname-irf-port1/2] port group interface ten-gigabitethernet 1/0/48
[Sysname-irf-port1/2] quit
# Bring up the SFP+ ports and save the configuration.
[Sysname] interface range name irf
[Sysname-if-range-irf] undo shutdown
[Sysname-if-range-irf] quit
[Sysname] save
# Activate the IRF port configuration.
[Sysname] irf-port-configuration active

```

## 2. Configure Device B:

# Change the member ID of Device B to 2 and reboot the device to validate the change.

```

<Sysname> system-view
[Sysname] irf member 1 renumber 2
Renumbering the member ID may result in configuration change or loss. Continue? [Y/N]:y
[Sysname] quit
<Sysname> reboot

```

# Connect Device B to Device A as shown in [Figure 16](#), and log in to Device B. This example uses the SFP+ group that contains Ten-GigabitEthernet 2/0/45 to Ten-GigabitEthernet 2/0/48 for IRF connection.

# Shut down the physical ports.

```

<Sysname> system-view
[Sysname] interface range name irf interface ten-gigabitethernet 2/0/45 to
ten-gigabitethernet 2/0/48
[Sysname-if-range-irf] shutdown
[Sysname-if-range-irf] quit

```

# Bind Ten-GigabitEthernet 2/0/47 and Ten-GigabitEthernet 2/0/48 to IRF-port 2/1.

```

[Sysname] irf-port 2/1
[Sysname-irf-port2/1] port group interface ten-gigabitethernet 2/0/47
[Sysname-irf-port2/1] port group interface ten-gigabitethernet 2/0/48
[Sysname-irf-port2/1] quit

```

# Bind Ten-GigabitEthernet 2/0/45 and Ten-GigabitEthernet 2/0/46 to IRF-port 2/2.

```

[Sysname] irf-port 2/2
[Sysname-irf-port2/2] port group interface ten-gigabitethernet 2/0/45
[Sysname-irf-port2/2] port group interface ten-gigabitethernet 2/0/46
[Sysname-irf-port2/2] quit

```

# Bring up the SFP+ ports and save the configuration.

```
[Sysname] interface range name irf
[Sysname-if-range-irf] undo shutdown
[Sysname-if-range-irf] quit
[Sysname] save
```

# Activate the IRF port configuration.

```
[Sysname] irf-port-configuration active
```

The two devices perform master election, and the one that has lost the election reboots to form an IRF fabric with the master.

### 3. Configure Device C:

# Change the member ID of Device C to 3 and reboot the device to validate the change.

```
<Sysname> system-view
```

```
[Sysname] irf member 1 renumber 3
```

Renumbering the member ID may result in configuration change or loss. Continue? [Y/N]:y

```
[Sysname] quit
```

```
<Sysname> reboot
```

# Connect Device C to Device A as shown in [Figure 16](#), and log in to Device C. This example uses the SFP+ port group that contains Ten-GigabitEthernet 3/0/45 to Ten-GigabitEthernet 3/0/48 for IRF connection.

# Shut down the physical ports.

```
<Sysname> system-view
```

```
[Sysname] interface range name irf interface ten-gigabitethernet 3/0/45 to
ten-gigabitethernet 3/0/48
```

```
[Sysname-if-range-irf] shutdown
```

```
[Sysname-if-range-irf] quit
```

# Bind Ten-GigabitEthernet 3/0/47 and Ten-GigabitEthernet 3/0/48 to IRF-port 3/1.

```
[Sysname] irf-port 3/1
```

```
[Sysname-irf-port3/1] port group interface ten-gigabitethernet 3/0/47
```

```
[Sysname-irf-port3/1] port group interface ten-gigabitethernet 3/0/48
```

```
[Sysname-irf-port3/1] quit
```

# Bind Ten-GigabitEthernet 3/0/45 and Ten-GigabitEthernet 3/0/46 to IRF-port 3/2.

```
[Sysname] irf-port 3/2
```

```
[Sysname-irf-port3/2] port group interface ten-gigabitethernet 3/0/45
```

```
[Sysname-irf-port3/2] port group interface ten-gigabitethernet 3/0/46
```

```
[Sysname-irf-port3/2] quit
```

# Bring up the SFP+ ports and save the configuration.

```
[Sysname] interface range name irf
```

```
[Sysname-if-range-irf] undo shutdown
```

```
[Sysname-if-range-irf] quit
```

```
[Sysname] save
```

# Activate the IRF port configuration.

```
[Sysname] irf-port-configuration active
```

Device C reboots to join the IRF fabric.

### 4. Configure Device D:

# Change the member ID of Device D to 4 and reboot the device to validate the change.

```
<Sysname> system-view
```

```
[Sysname] irf member 1 renumber 4
Renumbering the member ID may result in configuration change or loss. Continue? [Y/N]:y
[Sysname] quit
<Sysname> reboot
```

# Connect Device D to Device B and Device C as shown in [Figure 16](#), and log in to Device D. This example uses the SFP+ port group that contains Ten-GigabitEthernet 4/0/45 to Ten-GigabitEthernet 4/0/48 for IRF connection.

# Shut down the physical ports.

```
<Sysname> system-view
[Sysname] interface range name irf interface ten-gigabitethernet 4/0/45 to
ten-gigabitethernet 4/0/48
[Sysname-if-range-irf] shutdown
[Sysname-if-range-irf] quit
```

# Bind Ten-GigabitEthernet 4/0/45 and Ten-GigabitEthernet 4/0/46 to IRF-port 4/1.

```
[Sysname] irf-port 4/1
[Sysname-irf-port4/1] port group interface ten-gigabitethernet 4/0/45
[Sysname-irf-port4/1] port group interface ten-gigabitethernet 4/0/46
[Sysname-irf-port4/1] quit
```

# Bind Ten-GigabitEthernet 4/0/47 and Ten-GigabitEthernet 4/0/48 to IRF-port 4/2.

```
[Sysname] irf-port 4/2
[Sysname-irf-port4/2] port group interface ten-gigabitethernet 4/0/47
[Sysname-irf-port4/2] port group interface ten-gigabitethernet 4/0/48
[Sysname-irf-port4/2] quit
```

# Bring up the SFP+ ports and save the configuration.

```
[Sysname] interface range name irf
[Sysname-if-range-irf] undo shutdown
[Sysname-if-range-irf] quit
[Sysname] save
```

# Activate the IRF port configuration.

```
[Sysname] irf-port-configuration active
```

Device D reboots to join the IRF fabric. A four-chassis IRF fabric is formed.

## 5. Configure ARP MAD on the IRF fabric:

# Enable the spanning tree feature globally on the IRF fabric to prevent loops.

```
<Sysname> system-view
[Sysname] stp global enable
```

# Configure the IRF fabric to change its bridge MAC address as soon as the master leaves.

```
[Sysname] undo irf mac-address persistent
```

# Set the domain ID of the IRF fabric to 1.

```
[Sysname] irf domain 1
```

# Create VLAN 3, and assign Ten-GigabitEthernet 1/0/2, Ten-GigabitEthernet 2/0/1, Ten-GigabitEthernet 3/0/2, and Ten-GigabitEthernet 4/0/1 to VLAN 3.

```
[Sysname] vlan 3
[Sysname-vlan3] port ten-gigabitethernet 1/0/2 ten-gigabitethernet 2/0/1
ten-gigabitethernet 3/0/2 ten-gigabitethernet 4/0/1
[Sysname-vlan3] quit
```

# Create VLAN-interface 3, assign it an IP address, and enable ARP MAD on the interface.



```
[Sysname] interface vlan-interface 3
[Sysname-Vlan-interface3] ip address 192.168.2.1 24
[Sysname-Vlan-interface3] mad arp enable
You need to assign a domain ID (range: 0-4294967295)
[Current domain is: 1]:
The assigned domain ID is: 1
```

6. Configure Device E as the intermediate device:

---

**△ CAUTION:**

If the intermediate device is in an IRF fabric, you must assign this fabric a different domain ID than the ARP MAD-enabled fabric.

---

```
# Enable the spanning tree feature globally on Device E to prevent loops.
<DeviceE> system-view
[DeviceE] stp global enable

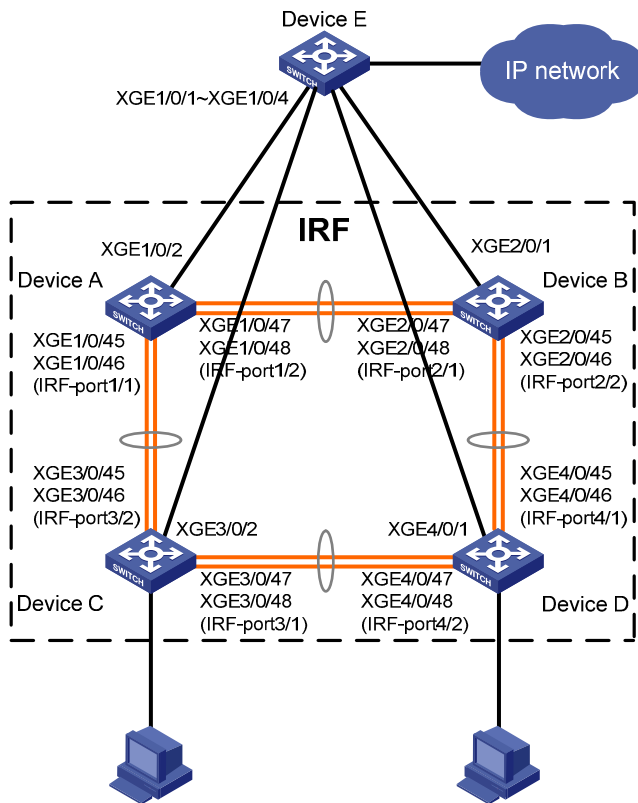
# Create VLAN 3, and assign ports Ten-GigabitEthernet 1/0/1, Ten-GigabitEthernet 1/0/2,
Ten-GigabitEthernet 1/0/3, and Ten-GigabitEthernet 1/0/4 to VLAN 3 for forwarding ARP MAD
packets.
[DeviceE] vlan 3
[DeviceE-vlan3] port ten-gigabitethernet 1/0/1 to ten-gigabitethernet 1/0/4
[DeviceE-vlan3] quit
```

## ND MAD-enabled IRF configuration example

### Network requirements

Set up a four-chassis IRF fabric in the IPv6 enterprise network in [Figure 17](#). Configure ND MAD in the IRF fabric and use the links connected to Device E for transmitting ND MAD packets. To prevent loops, run the spanning tree feature between Device E and the IRF fabric.

Figure 17 Network diagram



## Configuration procedure

### 1. Configure Device A:

# Shut down the physical ports used for IRF connection. This example uses the SFP+ port group that contains Ten-GigabitEthernet 1/0/45 to Ten-GigabitEthernet 1/0/48 for IRF connection.

```
<Sysname> system-view
[Sysname] interface range name irf interface ten-gigabitethernet 1/0/45 to
ten-gigabitethernet 1/0/48
[Sysname-if-range-irf] shutdown
[Sysname-if-range-irf] quit
```

# Bind Ten-GigabitEthernet 1/0/45 and Ten-GigabitEthernet 1/0/46 to IRF-port 1/1.

```
[Sysname] irf-port 1/1
[Sysname-irf-port1/1] port group interface ten-gigabitethernet 1/0/45
[Sysname-irf-port1/1] port group interface ten-gigabitethernet 1/0/46
[Sysname-irf-port1/1] quit
```

# Bind Ten-GigabitEthernet 1/0/47 and Ten-GigabitEthernet 1/0/48 to IRF-port 1/2.

```
[Sysname] irf-port 1/2
[Sysname-irf-port1/2] port group interface ten-gigabitethernet 1/0/47
[Sysname-irf-port1/2] port group interface ten-gigabitethernet 1/0/48
[Sysname-irf-port1/2] quit
```

# Bring up the SFP+ ports and save the configuration.

```
[Sysname] interface range name irf
[Sysname-if-range-irf] undo shutdown
[Sysname-if-range-irf] quit
```

```
[Sysname] save
# Activate the IRF port configuration.
[Sysname] irf-port-configuration active
```

## 2. Configure Device B:

# Change the member ID of Device B to 2 and reboot the device to validate the change.

```
<Sysname> system-view
[Sysname] irf member 1 renumber 2
Renumbering the member ID may result in configuration change or loss. Continue? [Y/N]:y
[Sysname] quit
<Sysname> reboot
```

# Connect Device B to Device A as shown in [Figure 17](#), and log in to Device B. This example uses the SFP+ group that contains Ten-GigabitEthernet 2/0/45 to Ten-GigabitEthernet 2/0/48 for IRF connection.

# Shut down the physical ports.

```
<Sysname> system-view
[Sysname] interface range name irf interface ten-gigabitethernet 2/0/45 to
ten-gigabitethernet 2/0/48
[Sysname-if-range-irf] shutdown
[Sysname-if-range-irf] quit
```

# Bind Ten-GigabitEthernet 2/0/47 and Ten-GigabitEthernet 2/0/48 to IRF-port 2/1.

```
[Sysname] irf-port 2/1
[Sysname-irf-port2/1] port group interface ten-gigabitethernet 2/0/47
[Sysname-irf-port2/1] port group interface ten-gigabitethernet 2/0/48
[Sysname-irf-port2/1] quit
```

# Bind Ten-GigabitEthernet 2/0/45 and Ten-GigabitEthernet 2/0/46 to IRF-port 2/2.

```
[Sysname] irf-port 2/2
[Sysname-irf-port2/2] port group interface ten-gigabitethernet 2/0/45
[Sysname-irf-port2/2] port group interface ten-gigabitethernet 2/0/46
[Sysname-irf-port2/2] quit
```

# Bring up the SFP+ ports and save the configuration.

```
[Sysname] interface range name irf
[Sysname-if-range-irf] undo shutdown
[Sysname-if-range-irf] quit
[Sysname] save
```

# Activate the IRF port configuration.

```
[Sysname] irf-port-configuration active
```

The two devices perform master election, and the one that has lost the election reboots to form an IRF fabric with the master.

## 3. Configure Device C:

# Change the member ID of Device C to 3 and reboot the device to validate the change.

```
<Sysname> system-view
[Sysname] irf member 1 renumber 3
Renumbering the member ID may result in configuration change or loss. Continue? [Y/N]:y
[Sysname] quit
<Sysname> reboot
```

# Connect Device C to Device A as shown in [Figure 17](#), and log in to Device C. This example uses the SFP+ port group that contains Ten-GigabitEthernet 3/0/45 to Ten-GigabitEthernet 3/0/48 for IRF connection.

# Shut down the physical ports.

```
<Sysname> system-view
[Sysname] interface range name irf interface ten-gigabitethernet 3/0/45 to
ten-gigabitethernet 3/0/48
[Sysname-if-range-irf] shutdown
[Sysname-if-range-irf] quit
```

# Bind Ten-GigabitEthernet 3/0/47 and Ten-GigabitEthernet 3/0/48 to IRF-port 3/1.

```
[Sysname] irf-port 3/1
[Sysname-irf-port3/1] port group interface ten-gigabitethernet 3/0/47
[Sysname-irf-port3/1] port group interface ten-gigabitethernet 3/0/48
[Sysname-irf-port3/1] quit
```

# Bind Ten-GigabitEthernet 3/0/45 and Ten-GigabitEthernet 3/0/46 to IRF-port 3/2.

```
[Sysname] irf-port 3/2
[Sysname-irf-port3/2] port group interface ten-gigabitethernet 3/0/45
[Sysname-irf-port3/2] port group interface ten-gigabitethernet 3/0/46
[Sysname-irf-port3/2] quit
```

# Bring up the SFP+ ports and save the configuration.

```
[Sysname] interface range name irf
[Sysname-if-range-irf] undo shutdown
[Sysname-if-range-irf] quit
[Sysname] save
```

# Activate the IRF port configuration.

```
[Sysname] irf-port-configuration active
```

Device C reboots to join the IRF fabric.

#### 4. Configure Device D:

# Change the member ID of Device D to 4 and reboot the device to validate the change.

```
<Sysname> system-view
[Sysname] irf member 1 renumber 4
Renumbering the member ID may result in configuration change or loss. Continue? [Y/N]:y
[Sysname] quit
<Sysname> reboot
```

# Connect Device D to Device B and Device C as shown in [Figure 17](#), and log in to Device D. This example uses the SFP+ port group that contains Ten-GigabitEthernet 4/0/45 to Ten-GigabitEthernet 4/0/48 for IRF connection.

# Shut down the physical ports.

```
<Sysname> system-view
[Sysname] interface range name irf interface ten-gigabitethernet 4/0/45 to
ten-gigabitethernet 4/0/48
[Sysname-if-range-irf] shutdown
[Sysname-if-range-irf] quit
```

# Bind Ten-GigabitEthernet 4/0/45 and Ten-GigabitEthernet 4/0/46 to IRF-port 4/1.

```
[Sysname] irf-port 4/1
[Sysname-irf-port4/1] port group interface ten-gigabitethernet 4/0/45
```

```
[Sysname-irf-port4/1] port group interface ten-gigabitethernet 4/0/46
[Sysname-irf-port4/1] quit
# Bind Ten-GigabitEthernet 4/0/47 and Ten-GigabitEthernet 4/0/48 to IRF-port 4/2.
[Sysname] irf-port 4/2
[Sysname-irf-port4/2] port group interface ten-gigabitethernet 4/0/47
[Sysname-irf-port4/2] port group interface ten-gigabitethernet 4/0/48
[Sysname-irf-port4/2] quit
# Bring up the SFP+ ports and save the configuration.
[Sysname] interface range name irf
[Sysname-if-range-irf] undo shutdown
[Sysname-if-range-irf] quit
[Sysname] save
# Activate the IRF port configuration.
[Sysname] irf-port-configuration active
Device D reboots to join the IRF fabric. A four-chassis IRF fabric is formed.
```

#### 5. Configure ND MAD on the IRF fabric:

```
# Enable the spanning tree feature globally on the IRF fabric to prevent loops.
<Sysname> system-view
[Sysname] stp global enable
# Configure the IRF fabric to change its bridge MAC address as soon as the master leaves.
[Sysname] undo irf mac-address persistent
# Set the domain ID of the IRF fabric to 1.
[Sysname] irf domain 1
# Create VLAN 3, and add Ten-GigabitEthernet 1/0/2, Ten-GigabitEthernet 2/0/1,
Ten-GigabitEthernet 3/0/2, and Ten-GigabitEthernet 4/0/1 to VLAN 3.
[Sysname] vlan 3
[Sysname-vlan3] port ten-gigabitethernet 1/0/2 ten-gigabitethernet 2/0/1
ten-gigabitethernet 3/0/2 ten-gigabitethernet 4/0/1
[Sysname-vlan3] quit
# Create VLAN-interface 3, assign it an IPv6 address, and enable ND MAD on the interface.
[Sysname] interface vlan-interface 3
[Sysname-Vlan-interface3] ipv6 address 2001::1 64
[Sysname-Vlan-interface3] mad nd enable
You need to assign a domain ID (range: 0-4294967295)
[Current domain is: 1]:
The assigned domain ID is: 1
```

#### 6. Configure Device E as the intermediate device:

#### CAUTION:

If the intermediate device is in an IRF fabric, you must assign this fabric a different domain ID than the ND MAD-enabled fabric.

```
# Enable the spanning tree feature globally on Device E to prevent loops.
<DeviceE> system-view
[DeviceE] stp global enable
```

# Create VLAN 3, and add ports Ten-GigabitEthernet 1/0/1, Ten-GigabitEthernet 1/0/2, Ten-GigabitEthernet 1/0/3, and Ten-GigabitEthernet 1/0/4 to VLAN 3 for forwarding ND MAD packets.

```
[DeviceE] vlan 3
```

```
[DeviceE-vlan3] port ten-gigabitethernet 1/0/1 to ten-gigabitethernet 1/0/4
```

```
[DeviceE-vlan3] quit
```

---

# Support and other resources

## Contacting HP

For worldwide technical support information, see the HP support website:

<http://www.hp.com/support>

Before contacting HP, collect the following information:

- Product model names and numbers
- Technical support registration number (if applicable)
- Product serial numbers
- Error messages
- Operating system type and revision level
- Detailed questions

## Subscription service

HP recommends that you register your product at the Subscriber's Choice for Business website:

<http://www.hp.com/go/wwalerts>

After registering, you will receive email notification of product enhancements, new driver versions, firmware updates, and other product resources.

## Related information

### Documents

To find related documents, browse to the Manuals page of the HP Business Support Center website:

<http://www.hp.com/support/manuals>

- For related documentation, navigate to the Networking section, and select a networking category.
- For a complete list of acronyms and their definitions, see *HP FlexNetwork Technology Acronyms*.

### Websites

- HP.com <http://www.hp.com>
- HP Networking <http://www.hp.com/go/networking>
- HP manuals <http://www.hp.com/support/manuals>
- HP download drivers and software <http://www.hp.com/support/downloads>
- HP software depot <http://www.software.hp.com>
- HP Education <http://www.hp.com/learn>

# Conventions

This section describes the conventions used in this documentation set.





## Command conventions

Convention	Description
<b>Boldface</b>	<b>Bold</b> text represents commands and keywords that you enter literally as shown.
<i>Italic</i>	<i>Italic</i> text represents arguments that you replace with actual values.
[ ]	Square brackets enclose syntax choices (keywords or arguments) that are optional.
{ x   y   ... }	Braces enclose a set of required syntax choices separated by vertical bars, from which you select one.
[ x   y   ... ]	Square brackets enclose a set of optional syntax choices separated by vertical bars, from which you select one or none.
{ x   y   ... } *	Asterisk-marked braces enclose a set of required syntax choices separated by vertical bars, from which you select at least one.
[ x   y   ... ] *	Asterisk-marked square brackets enclose optional syntax choices separated by vertical bars, from which you select one choice, multiple choices, or none.
&<1-n>	The argument or keyword and argument combination before the ampersand (&) sign can be entered 1 to n times.
#	A line that starts with a pound (#) sign is comments.

## GUI conventions

Convention	Description
<b>Boldface</b>	Window names, button names, field names, and menu items are in bold text. For example, the <b>New User</b> window appears; click <b>OK</b> .
>	Multi-level menus are separated by angle brackets. For example, <b>File &gt; Create &gt; Folder</b> .

## Symbols

Convention	Description
 <b>WARNING</b>	An alert that calls attention to important information that if not understood or followed can result in personal injury.
 <b>CAUTION</b>	An alert that calls attention to important information that if not understood or followed can result in data loss, data corruption, or damage to hardware or software.
 <b>IMPORTANT</b>	An alert that calls attention to essential information.
<b>NOTE</b>	An alert that contains additional or supplementary information.
 <b>TIP</b>	An alert that provides helpful information.



## Network topology icons

---



Represents a generic network device, such as a router, switch, or firewall.

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Represents a routing-capable device, such as a router or Layer 3 switch.

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Represents a generic switch, such as a Layer 2 or Layer 3 switch, or a router that supports Layer 2 forwarding and other Layer 2 features.

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## Port numbering in examples

The port numbers in this document are for illustration only and might be unavailable on your device.

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