LAB GUIDE

Configuring OSPF on Aruba CX Switches

a Hewlett Packard Enterprise company

IMPORTANT! THIS GUIDE ASSUMES THAT THE AOS-CX OVA HAS BEEN INSTALLED AND WORKS IN GNS3 OR EVE-NG. PLEASE REFER TO GNS3/EVE-NG INITIAL SETUP LABS IF REQUIRED.

WRITE MEM SAVED CONFIGS DON'T IMPORT CORRECTLY, READER SHOULD COPY/PASTE LAB CONFIGS FROM APPENDIX INTO LAB IF REQUIRED.

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Lab Objective

At the end of this workshop, you will be able to implement the fundamentals of deploying an OSPFv2 network based on Aruba CX Switches. A successful deployment will show IPv4 HostA and IPv4 HostB have connectivity over the OSPF fabric.

Lab Overview

OSPFv2 is the IPv4 implementation of Open Shortest Path First protocol (OSPFv3 is the IPv6 implementation of this protocol). It is a link-state based IGP (Interior Gateway Protocol) routing protocol. It is widely used with medium to large sized enterprise networks.

The characteristics of OSPFv2 are:

- Provides a loop-free topology using SPF algorithm.
- Allows hierarchical routing using area 0 (backbone area) as the top of the hierarchy.
- Supports load balancing with equal cost routes for the same destination.
- OSPFv2 is a classless protocol and allows for a hierarchical design with VLSM (Variable Length Subnet
- Masking) and route summarization.
- Provides authentication of routing messages.
- Scales easily using the concept of OSPF areas.

- Provides fast convergence with triggered, incremental updates via LSAs.

Some OSPFv2 configuration is done in the global configuration context, others in the router ospf context, or in the interface configuration context, or in the vlink context. OSPFv2 can be configured on L3 ports, VLAN interfaces, LAG interfaces, and loopback interfaces. All such configurations work in the mentioned interfaces context. OSPFv2 mandates the associated interface to be a routed interface.

The protocol uses Link State Advertisements (LSAs) transmitted by each router to update neighboring routers regarding its interfaces and the routes available through those interfaces. Each routing switch in an area also maintains a link-state database (LSDB) that describes the area topology. (All routers in a given OSPF area have identical LSDBs.) The routing switches used to connect areas to each other flood summary link LSAs and external link LSAs to neighboring OSPF areas to update them regarding available routes. Through this means, each OSPF router determines the shortest path between itself and a desired destination router in the same OSPF domain (Autonomous System (AS)).

Lab Network Layout

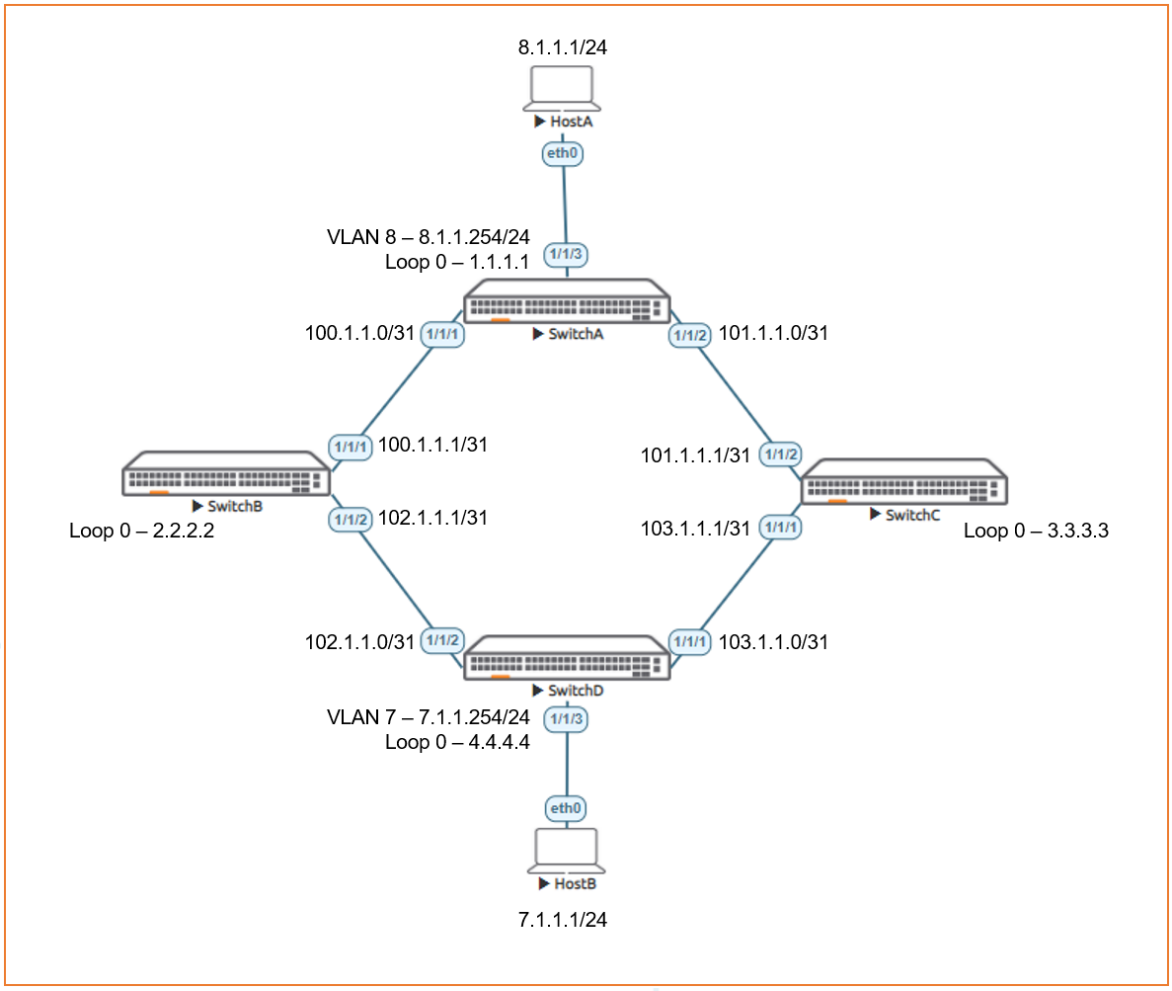

Figure 1. Lab topology and addresses

Lab Tasks

To complete the lab, you should follow the following steps:

1. Lab set-up
2. Configure HostA and HostB
3. Configure switch to switch interfaces, loopbacks, and VLANs
4. Configure OSPFv2
5. Verify OSPF peering is up
6. Verify HostA to HostB connectivity

Notes:

- Accessing the lab tasks panel are not available when using the community edition. The Lab Guide is fully available use.
- Many commands, except 'show' & 'ping', are configuration commands and need to be entered in the proper switch configuration mode. If a command does not work make sure you are in the right configuration context.

Task 1 – Lab Setup

- Start all the devices, including host and client
- Open each switch console and log in with user "admin" and no password
- Change all hostnames as shown in the topology:

```
hostname …
```

- On all devices, bring up required ports:

```
int 1/1/1-1/1/3
  no shutdown
```

- Validate LLDP neighbors appear as expected

```
show lldp neighbor
```

SwitchB

```
SwitchB(config)# show lldp neighbor-info
LLDP Neighbor Information
=========================
Total Neighbor Entries          : 2
Total Neighbor Entries Deleted  : 0
Total Neighbor Entries Dropped  : 0
Total Neighbor Entries Aged-Out : 0

LOCAL-PORT  CHASSIS-ID         PORT-ID          PORT-DESC               TTL      SYS-NAME
-------------------------------------------------------------------------------------------
1/1/1       08:00:09:1d:a2:66  1/1/1            1/1/1                   120      SwitchA
1/1/2       08:00:09:23:64:e7  1/1/2            1/1/2                   120      SwitchD
```

Task 2 - Configure Host_A and Host_B

- Apply the proper IP address and gateway to both Host_A and Host_B

HostA

```
ip 8.1.1.1/24 8.1.1.254
```

HostB

```
ip 7.1.1.1/24 7.1.1.254
```

- Verify with show ip

```
show ip
```

HostA

```
VPCS> sho ip
NAME        : VPCS[1]
IP/MASK     : 8.1.1.1/24
GATEWAY     : 8.1.1.254
DNS         :
```

```
MAC          : 00:50:79:66:68:05
LPORT        : 20000
RHOST:PORT   : 127.0.0.1:30000
MTU          : 1500
```

Task 3 - Configure interfaces and verify direct connectivity

- Configure switch interfaces and ensure direct connectivity works
- Apply proper IPv4 Addresses to all interfaces, including loopback
- On Switch A and C:
    - Create Host facing VLAN/Interface
    - Apply proper VLAN to host facing access interface
- Ensure direct connectivity works between each link

SwitchA

```
vlan 8
    description HostA VLAN
interface 1/1/1
    no shutdown
    description To SwitchB
    ip address 100.1.1.0/31
interface 1/1/2
    no shutdown
    description To SwitchC
    ip address 101.1.1.0/31
interface 1/1/3
    no shutdown
    description Host Segment
    no routing
    vlan access 8
interface loopback 0
    ip address 1.1.1.1/32
interface vlan 8
    description To Host VLAN
    ip address 8.1.1.254/24
```

SwitchB

```
interface 1/1/1
    no shutdown
    description To SwitchA
    ip address 100.1.1.1/31
interface 1/1/2
    no shutdown
    description To SwitchD
    ip address 102.1.1.1/31
interface loopback 0
    ip address 2.2.2.2/32
```

SwitchC

```
interface 1/1/1
    no shutdown
    description To SwitchD
    ip address 103.1.1.1/31
interface 1/1/2
    no shutdown
    description To SwitchA
    ip address 101.1.1.1/31
interface loopback 0
    ip address 3.3.3.3/32
```

SwitchD

```
vlan 7
```

```
    description HostB VLAN
interface 1/1/1
    no shutdown
    description To SwitchC
    ip address 103.1.1.0/31
interface 1/1/2
    no shutdown
    description To SwitchB
    ip address 102.1.1.0/31
interface 1/1/3
    no shutdown
    description HostB Segment
    no routing
    vlan access 7
interface loopback 0
    ip address 4.4.4.4/32
interface vlan 7
    description To Host segment
    ip address 7.1.1.254/24
```

SwitchA

```
SwitchA(config)# ping 2.2.2.2
connect: Network is unreachable

SwitchA(config)# ping 102.1.1.0
connect: Network is unreachable

SwitchA(config)# ping 100.1.1.1
PING 100.1.1.1 (100.1.1.1) 100(128) bytes of data.
108 bytes from 100.1.1.1: icmp_seq=1 ttl=64 time=5.80 ms
108 bytes from 100.1.1.1: icmp_seq=2 ttl=64 time=1.87 ms
108 bytes from 100.1.1.1: icmp_seq=3 ttl=64 time=1.90 ms
108 bytes from 100.1.1.1: icmp_seq=4 ttl=64 time=1.92 ms
108 bytes from 100.1.1.1: icmp_seq=5 ttl=64 time=1.78 ms

--- 100.1.1.1 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4004ms
rtt min/avg/max/mdev = 1.781/2.658/5.809/1.577 ms

SwitchA(config)# ping 101.1.1.1
PING 101.1.1.1 (101.1.1.1) 100(128) bytes of data.
108 bytes from 101.1.1.1: icmp_seq=1 ttl=64 time=2.21 ms
108 bytes from 101.1.1.1: icmp_seq=2 ttl=64 time=2.24 ms
108 bytes from 101.1.1.1: icmp_seq=3 ttl=64 time=1.63 ms
108 bytes from 101.1.1.1: icmp_seq=4 ttl=64 time=1.87 ms
108 bytes from 101.1.1.1: icmp_seq=5 ttl=64 time=2.14 ms

--- 101.1.1.1 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4004ms
rtt min/avg/max/mdev = 1.631/2.022/2.249/0.241 ms
```

Task 4 - Configure OSPF

- Create OSPF process 1 and area 0
- Create an OSPF IPv4 Router-ID (same as Loopback)
- Use OSPF point to point
- Ensure Loopback 0 and switch to switch interfaces are advertised into OSPF
- Ensure VLAN 7 interface on Switch D is advertised into OSPF
- Ensure VLAN 8 interface on Switch A is advertised into OSPF

- Verify OSPF peering is up
- Verify that HostA can reach HostB

SwitchA

```
router ospf 1
    router-id 1.1.1.1
    area 0.0.0.0
interface 1/1/1
    ip ospf 1 area 0.0.0.0
    ip ospf network point-to-point
interface 1/1/2
    ip ospf 1 area 0.0.0.0
    ip ospf network point-to-point
interface loopback 0
    ip ospf 1 area 0.0.0.0
interface vlan 8
    ip ospf 1 area 0.0.0.0
    ip ospf network point-to-point
```

SwitchB

```
router ospf 1
    router-id 2.2.2.2
    area 0.0.0.0
interface 1/1/1
    ip ospf 1 area 0.0.0.0
    ip ospf network point-to-point
interface 1/1/2
    ip ospf 1 area 0.0.0.0
    ip ospf network point-to-point
interface loopback 0
    ip ospf 1 area 0.0.0.0
```

SwitchC

```
router ospf 1
    router-id 3.3.3.3
    area 0.0.0.0
interface 1/1/1
    ip ospf 1 area 0.0.0.0
    ip ospf network point-to-point
interface 1/1/2
    ip ospf 1 area 0.0.0.0
    ip ospf network point-to-point
interface loopback 0
    ip ospf 1 area 0.0.0.0
```

SwitchD

```
router ospf 1
    router-id 4.4.4.4
    area 0.0.0.0
interface 1/1/1
    ip ospf 1 area 0.0.0.0
    ip ospf network point-to-point
interface 1/1/2
    ip ospf 1 area 0.0.0.0
    ip ospf network point-to-point
interface loopback 0
    ip ospf 1 area 0.0.0.0
interface vlan 7
    ip ospf 1 area 0.0.0.0
```

```
    ip ospf network point-to-point
```

SwitchA

```
SwitchA(config)# show ip ospf neighbors

OSPF Process ID 1 VRF default
==============================
Total Number of Neighbors: 2

Neighbor ID      Priority  State             Nbr Address       Interface
-------------------------------------------------------------------------
2.2.2.2          n/a       FULL              100.1.1.1          1/1/1
3.3.3.3          n/a       FULL              101.1.1.1          1/1/2
```

SwitchB

```
SwitchB(config)# show ip ospf neighbors

OSPF Process ID 1 VRF default
==============================
Total Number of Neighbors: 2

Neighbor ID      Priority  State             Nbr Address       Interface
-------------------------------------------------------------------------
1.1.1.1          n/a       FULL              100.1.1.0          1/1/1
4.4.4.4          n/a       FULL              102.1.1.0          1/1/2
```

SwitchC

```
SwitchC(config)# show ip ospf neighbors

OSPF Process ID 1 VRF default
==============================
Total Number of Neighbors: 2

Neighbor ID      Priority  State             Nbr Address       Interface
-------------------------------------------------------------------------
4.4.4.4          n/a       FULL              103.1.1.0          1/1/1
1.1.1.1          n/a       FULL              101.1.1.0          1/1/2
```

SwitchD

```
SwitchD(config)# show ip ospf neighbors

OSPF Process ID 1 VRF default
==============================
Total Number of Neighbors: 2

Neighbor ID      Priority  State             Nbr Address       Interface
-------------------------------------------------------------------------
3.3.3.3          n/a       FULL              103.1.1.1          1/1/1
2.2.2.2          n/a       FULL              102.1.1.1          1/1/2
```

HostA

```
VPCS> show ip

NAME        : VPCS[1]
IP/MASK     : 8.1.1.1/24
GATEWAY     : 8.1.1.254
DNS         :
MAC         : 00:50:79:66:68:05
LPORT       : 20000
```

```
RHOST:PORT  : 127.0.0.1:30000
MTU         : 1500

VPCS> ping 7.1.1.1
84 bytes from 7.1.1.1 icmp_seq=1 ttl=61 time=9.914 ms
84 bytes from 7.1.1.1 icmp_seq=2 ttl=61 time=4.092 ms
84 bytes from 7.1.1.1 icmp_seq=3 ttl=61 time=3.314 ms
84 bytes from 7.1.1.1 icmp_seq=4 ttl=61 time=3.207 ms
84 bytes from 7.1.1.1 icmp_seq=5 ttl=61 time=4.284 ms
```

HostB

```
VPCS> show ip

NAME        : VPCS[1]
IP/MASK     : 7.1.1.1/24
GATEWAY     : 7.1.1.254
DNS         :
MAC         : 00:50:79:66:68:06
LPORT       : 20000
RHOST:PORT  : 127.0.0.1:30000
MTU         : 1500

VPCS> ping 8.1.1.1

84 bytes from 8.1.1.1 icmp_seq=1 ttl=61 time=10.707 ms
84 bytes from 8.1.1.1 icmp_seq=2 ttl=61 time=3.234 ms
84 bytes from 8.1.1.1 icmp_seq=3 ttl=61 time=3.055 ms
84 bytes from 8.1.1.1 icmp_seq=4 ttl=61 time=2.905 ms
84 bytes from 8.1.1.1 icmp_seq=5 ttl=61 time=3.291 ms
```

Appendix – Complete Configurations

SwitchA

```
SwitchA(config)# sho run
Current configuration:
!
!Version ArubaOS-CX Virtual.10.06.0001
!export-password: default
hostname SwitchA
user admin group administrators password ciphertext AQBapfUWJWpGRc6KYv1XkGlb9qmtmxEBa
F2JxMyUdVHscVFqYgAAACmt+0Ucn4xg/guGozwoWf8fiCTF69PAnBI0/XEMm51mvbQeFI2XjhkU/bLnmW2r0/
0ZYx2yipA2xqS9OgTUzwhy0ARo2CEM5Zkmb44KFBDnYR+RLeOZ3mWabZ1xx16KtYlt
led locator on
ntp server pool.ntp.org minpoll 4 maxpoll 4 iburst
ntp enable
!
!
!
!
ssh server vrf mgmt
vlan 1
vlan 8
    description HostA VLAN
interface mgmt
    no shutdown
    ip dhcp
interface 1/1/1
    no shutdown
    description To SwitchB
    ip address 100.1.1.0/31
    ip ospf 1 area 0.0.0.0
    ip ospf network point-to-point
```

```
interface 1/1/2
    no shutdown
    description To SwitchC
    ip address 101.1.1.0/31
    ip ospf 1 area 0.0.0.0
    ip ospf network point-to-point
interface 1/1/3
    no shutdown
    description Host Segment
    no routing
    vlan access 8
interface loopback 0
    ip address 1.1.1.1/32
    ip ospf 1 area 0.0.0.0
interface vlan 8
    description Host VLAN
    ip address 8.1.1.254/24
    ip ospf 1 area 0.0.0.0
    ip ospf network point-to-point
!
!
!
!
!
router ospf 1
    router-id 1.1.1.1
    area 0.0.0.0
https-server vrf mgmt
```

SwitchB

```
SwitchB(config)# sho run
Current configuration:
!
!Version ArubaOS-CX Virtual.10.06.0001
!export-password: default
hostname SwitchB
user admin group administrators password ciphertext AQBapR3yvjJYd/gE3fmoQ64ppIllk26co
oJCPeZoYpZHZdwfYgAAAFEYineyqPb/ZcZ82mdNpyj1rkxCb/Xz34/3/2mZ3r8j8NCKH85z1FzX2Wd9bpPWBO
afnRKq1pzWopGQbUtQteuY67+K4R/F4gCy4ZYO8bW8SJC79p1fKBvGLyVNZnhjSQJf
led locator on
ntp server pool.ntp.org minpoll 4 maxpoll 4 iburst
ntp enable
!
!
!
!
ssh server vrf mgmt
vlan 1
interface mgmt
    no shutdown
    ip dhcp
interface 1/1/1
    no shutdown
    description To SwitchA
    ip address 100.1.1.1/31
    ip ospf 1 area 0.0.0.0
    ip ospf network point-to-point
interface 1/1/2
    no shutdown
    description To SwitchD
    ip address 102.1.1.1/31
    ip ospf 1 area 0.0.0.0
    ip ospf network point-to-point
interface loopback 0
```

```
    ip address 2.2.2.2/32
    ip ospf 1 area 0.0.0.0
!
!
!
!
!
router ospf 1
    router-id 2.2.2.2
    area 0.0.0.0
https-server vrf mgmt
```

SwitchC

```
SwitchC(config)# show run
Current configuration:
!
!Version ArubaOS-CX Virtual.10.06.0001
!export-password: default
hostname SwitchC
user admin group administrators password ciphertext AQBape6pkO0nRbZ5UDg5A5s/bgrPHYZut
HbZns4wT4c00KY1YgAAAOvx74jAUbuCFtX/z2xt1zBhUDEJRNzucQPmxbbvDB2qLA5sA7FV0Vv2dAZS4mNtkZ
+LlYP6flAG2ejyHPRrcP6P+a/XkNMATU7LoG9rvPyq8dlXVLG/l4cuNq4Y4qvQ+2sE
led locator on
ntp server pool.ntp.org minpoll 4 maxpoll 4 iburst
ntp enable
!
!
!
!
ssh server vrf mgmt
vlan 1
interface mgmt
    no shutdown
    ip dhcp
interface 1/1/1
    no shutdown
    description To SwitchD
    ip address 103.1.1.1/31
    ip ospf 1 area 0.0.0.0
    ip ospf network point-to-point
interface 1/1/2
    no shutdown
    description To SwitchA
    ip address 101.1.1.1/31
    ip ospf 1 area 0.0.0.0
    ip ospf network point-to-point
interface loopback 0
    ip address 3.3.3.3/32
    ip ospf 1 area 0.0.0.0
!
!
!
!
!
router ospf 1
    router-id 3.3.3.3
    area 0.0.0.0
https-server vrf mgmt
```

SwitchD

```
SwitchD(config)# sho run
```

```
Current configuration:
!
!Version ArubaOS-CX Virtual.10.06.0001
!export-password: default
hostname SwitchD
user admin group administrators password ciphertext AQBapdBC+is0ah9uQyUARf8anyXBdKxIc
hK9i1wM+LjmwBDeYgAAAOs2w/nCnYS3rEiZlp8SM+aP0dcLSotqH4hcpNWclXDQnd+tmTJRnsWeOZTGJ2ukoi
w3YEOjkv/MprepWjcCBxTyLSoKxRib/Ya8L5kOsvIq6MoocLyBxz15yFZRG8du7PpY
led locator on
ntp server pool.ntp.org minpoll 4 maxpoll 4 iburst
ntp enable
!
!
!
!
ssh server vrf mgmt
vlan 1
vlan 7
    description HostB VLAN
interface mgmt
    no shutdown
    ip dhcp
interface 1/1/1
    no shutdown
    description To SwitchC
    ip address 103.1.1.0/31
    ip ospf 1 area 0.0.0.0
    ip ospf network point-to-point
interface 1/1/2
    no shutdown
    description To SwitchB
    ip address 102.1.1.0/31
    ip ospf 1 area 0.0.0.0
    ip ospf network point-to-point
interface 1/1/3
    no shutdown
    description HostB Segment
    no routing
    vlan access 7
interface loopback 0
    ip address 4.4.4.4/32
    ip ospf 1 area 0.0.0.0
interface vlan 7
    description To Host VLAN
    ip address 7.1.1.254/24
    ip ospf 1 area 0.0.0.0
    ip ospf network point-to-point
!
!
!
!
!
router ospf 1
    router-id 4.4.4.4
    area 0.0.0.0
https-server vrf mgmt
```

HostA

```
VPCS> show ip

NAME        : VPCS[1]
IP/MASK     : 8.1.1.1/24
GATEWAY     : 8.1.1.254
```

```
DNS          :
MAC          : 00:50:79:66:68:05
LPORT        : 20000
RHOST:PORT   : 127.0.0.1:30000
MTU          : 1500
```

HostB

```
VPCS> show ip

NAME         : VPCS[1]
IP/MASK      : 7.1.1.1/24
GATEWAY      : 7.1.1.254
DNS          :
MAC          : 00:50:79:66:68:06
LPORT        : 20000
RHOST:PORT   : 127.0.0.1:30000
MTU          : 1500
```

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