

# Multicast PIM Sparse Mode

**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.**

<https://www.eve-ng.net/index.php/documentation/howtos/howto-add-aruba-cx-switch/>

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## Lab Objective

This guide will enable the reader to gain hands on experience with multicast Protocol Independent Multicast (PIM) sparse mode (SM). It explicitly builds unidirectional shared trees rooted at a rendezvous point (RP) per group, and optionally creates shortest-path trees per source.

PIM-SM generally scales fairly well for wide-area usage

## Lab Overview

This lab as shown in Figure 1 will allow you to generate multicast traffic from a multicast source over a L3 routed Protocol Independent Multicast (PIM) sparse mode multicast network with redundant Candidate-Rendezvous Point(C-RP)/Boot Strap Router (BSR) and Multicast Source Discovery Protocol(MSDP). FHR refers to First Hop Router and LHR refers to Last Hop Router

Simulating a multicast source on a AOS-CX VM doesn't work at this time, that's why a source VPCS (Virtual PC Simulator) is used.

In addition, no configuration is required on the receiver VPCS, you just need to power it up to simulate a receiver on LHR.

## Lab Network Layout

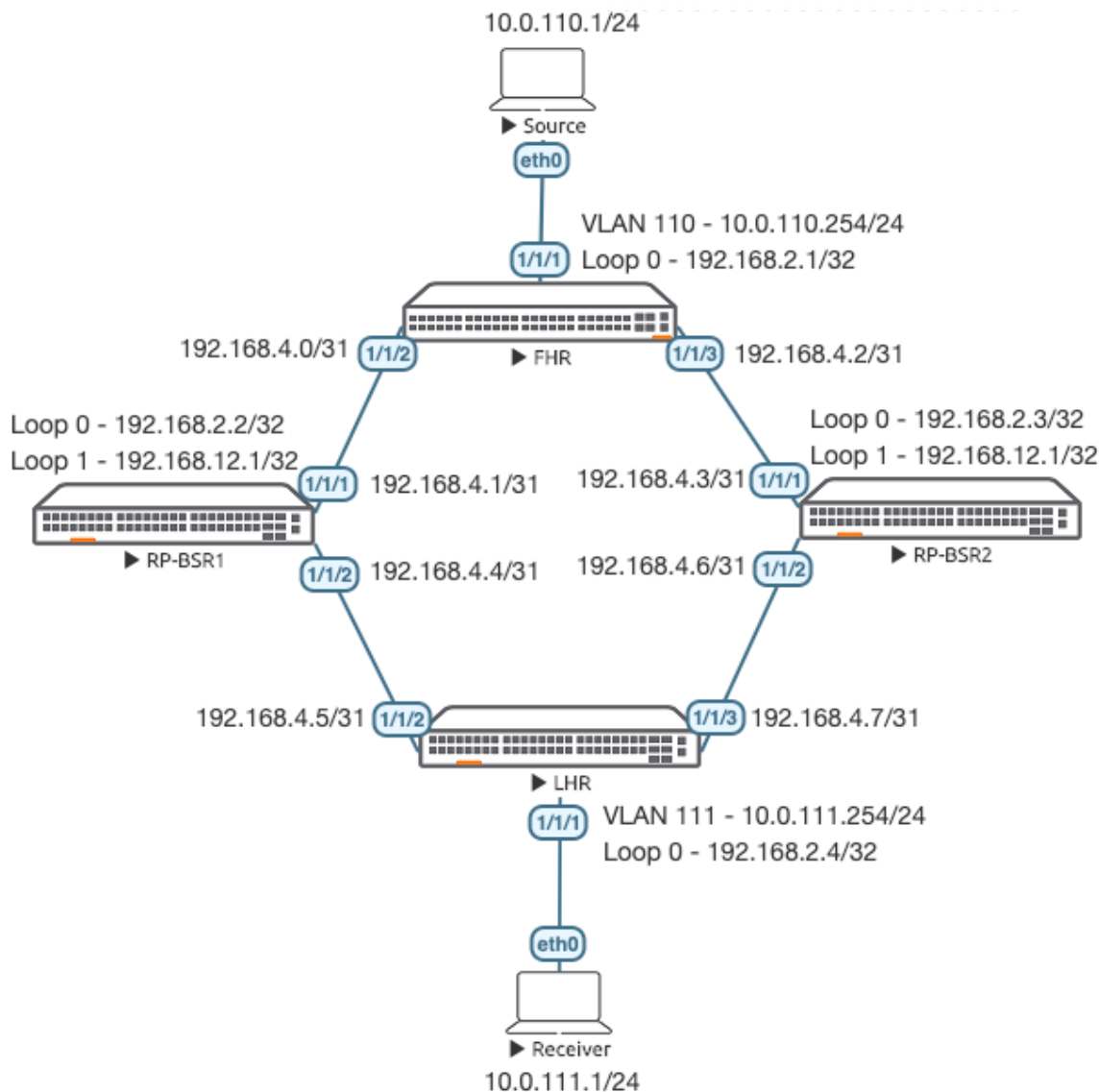


Figure 1. Lab topology and addresses

## Lab Tasks

### Task 1 – Lab setup

For this lab refer to Figure 1 for topology and IP address details.

- Start all the devices, including source and receiver
- Open each switch console and log in with user “admin” and hit enter, so that no password is applied
- Change all hostnames as shown in the topology:  
configure  
hostname ...
- On all devices, bring up required ports:  
int 1/1/1-1/1/6  
no shutdown  
use “exit” to go back a level

- Validate LLDP neighbors appear as expected on each switch

```
show lldp neighbor
```

#### FHR

```
FHR(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
1/1/2	08:00:09:8a:14:fa	1/1/1	1/1/1	120	RP-BSR1
1/1/3	08:00:09:12:8e:9e	1/1/1	1/1/1	120	RP-BSR2

## Task 2 – Configure FHR, RP-BSR1, RP-BSR2, LHR Interfaces

- Configure interfaces, IPs and required VLANs on these 4 switches

#### FHR

```
FHR(config)# int 1/1/2
FHR(config-if)# ip add 192.168.4.0/31
FHR(config-if)# int 1/1/3
FHR(config-if)# ip add 192.168.4.2/31
FHR(config-if)# int lo 0
FHR(config-loopback-if)# ip add 192.168.2.1/32
FHR(config-loopback-if)# vlan 110
FHR(config-vlan-110)# int vlan 110
FHR(config-if-vlan)# ip add 10.0.110.254/24
FHR(config-if-vlan)# int 1/1/1
FHR(config-if)# no routing
FHR(config-if)# vlan access 110
```

#### RP-BSR1

```
RP-BSR1(config)# int 1/1/1
RP-BSR1(config-if)# ip add 192.168.4.1/31
RP-BSR1(config-if)# int 1/1/2
RP-BSR1(config-if)# ip add 192.168.4.4/31
RP-BSR1(config-if)# int lo 0
RP-BSR1(config-loopback-if)# ip add 192.168.2.2/32
RP-BSR1(config-loopback-if)# int lo 1
RP-BSR1(config-loopback-if)# ip add 192.168.12.1/32
```

#### RP-BSR2

```
RP-BSR2(config)# int 1/1/1
RP-BSR2(config-if)# ip add 192.168.4.3/31
RP-BSR2(config-if)# int 1/1/2
```

```
RP-BSR2(config-if)# ip add 192.168.4.6/31
RP-BSR2(config-if)# int lo 0
RP-BSR2(config-loopback-if)# ip add 192.168.2.3/32
RP-BSR2(config-loopback-if)# int lo 1
RP-BSR2(config-loopback-if)# ip add 192.168.12.1/32
```

### LHR

```
LHR(config)# int 1/1/2
LHR(config-if)# ip add 192.168.4.5/31
LHR(config-if)# int 1/1/3
LHR(config-if)# ip add 192.168.4.7/31
LHR(config-if)# int lo 0
LHR(config-loopback-if)# ip add 192.168.2.4/32
LHR(config-loopback-if)# vlan 111
LHR(config-vlan-111)# int vlan 111
LHR(config-if-vlan)# ip add 10.0.111.254/24
LHR(config-loopback-if)# int 1/1/1
LHR(config-if)# no routing
LHR(config-if)# vlan access 111
```

## Task 3 – Configure FHR, RP-BSR1, RP-BSR2, LHR with Unicast Routing

- Multicast depends heavily on unicast, you need to ensure unicast connectivity works as expected before moving onto multicast

### FHR

```
FHR(config-if)# int lo 0
FHR(config-loopback-if)# ip ospf 1 area 0
OSPF process does not exist.
Do you want to create (y/n)? y
OSPF Area is not configured.
Do you want to create (y/n)? y

FHR(config-loopback-if)# router ospf 1
FHR(config-ospf-1)# router-id 192.168.2.1
FHR(config-ospf-1)# int 1/1/2
FHR(config-if)# ip ospf 1 area 0
FHR(config-if)# ip ospf network point-to-point
FHR(config-if)# int 1/1/3
FHR(config-if)# ip ospf 1 area 0
FHR(config-if)# ip ospf network point-to-point
FHR(config-if)# int vlan 110
FHR(config-if-vlan)# ip ospf 1 area 0
```

### RP-BSR1

```
RP-BSR1(config-loopback-if)# int lo 0
RP-BSR1(config-loopback-if)# ip ospf 1 area 0
OSPF process does not exist.
Do you want to create (y/n)? y
OSPF Area is not configured.
Do you want to create (y/n)? y

RP-BSR1(config-if)# router ospf 1
RP-BSR1(config-ospf-1)# router-id 192.168.2.2
RP-BSR1(config-loopback-if)# int lo 1
RP-BSR1(config-loopback-if)# ip ospf 1 area 0
! Lo1 used for anycast RP
```

```
RP-BSR1(config-loopback-if)# int 1/1/1
RP-BSR1(config-if)# ip ospf 1 area 0
RP-BSR1(config-if)# ip ospf network point-to-point
RP-BSR1(config-if)# int 1/1/2
RP-BSR1(config-if)# ip ospf 1 area 0
RP-BSR1(config-if)# ip ospf network point-to-point
```

### **RP-BSR2**

```
RP-BSR2(config-loopback-if)# int lo 0
RP-BSR2(config-loopback-if)# ip ospf 1 area 0
OSPF process does not exist.
Do you want to create (y/n)? y
OSPF Area is not configured.
Do you want to create (y/n)? y
```

```
RP-BSR2(config-loopback-if)# router ospf 1
RP-BSR2(config-ospf-1)# router-id 192.168.2.3
RP-BSR2(config-ospf-1)# int lo 1
RP-BSR2(config-loopback-if)# ip ospf 1 area 0
! Lo1 used for anycast RP
```

```
RP-BSR2(config-loopback-if)# int 1/1/1
RP-BSR2(config-if)# ip ospf 1 area 0
RP-BSR2(config-if)# ip ospf network point-to-point
RP-BSR2(config-if)# int 1/1/2
RP-BSR2(config-if)# ip ospf 1 area 0
RP-BSR2(config-if)# ip ospf network point-to-point
```

### **LHR**

```
LHR(config-if)# int lo 0
LHR(config-loopback-if)# ip ospf 1 area 0
OSPF process does not exist.
Do you want to create (y/n)? y
OSPF Area is not configured.
Do you want to create (y/n)? y
```

```
LHR(config-loopback-if)# router ospf 1
LHR(config-ospf-1)# router-id 192.168.2.4
LHR(config-ospf-1)# int 1/1/2
LHR(config-if)# ip ospf 1 area 0
LHR(config-if)# ip ospf network point-to-point
LHR(config-if)# int 1/1/3
LHR(config-if)# ip ospf 1 area 0
LHR(config-if)# ip ospf network point-to-point
LHR(config-if)# int vlan 111
LHR(config-if-vlan)# ip ospf 1 area 0
```

- Verify OSPF neighbors appear as expected between the switches

```
FHR# sh ip ospf nei
OSPF Process ID 1 VRF default
=====
```

Total Number of Neighbors: 2

Neighbor ID	Priority	State	Nbr Address	Interface
192.168.2.2	n/a	FULL	192.168.4.1	1/1/2
192.168.2.3	n/a	FULL	192.168.4.3	1/1/3

- Verify OSPF routes are learnt as expected on LHR/FHR, you should see routes for C-RP/BSR Lo0/Lo1, and source/receiver subnets, check your configs if routes are missing
- Equal Cost Multi Pathing (ECMP) does not currently work in AOS-CX VMs, it may show up in the routing table but does not forward across equal paths

```
FHR# sh ip ro ospf
```

Displaying ipv4 routes selected for forwarding

'[x/y]' denotes [distance/metric]

```
10.0.111.0/24, vrf default
  via 192.168.4.1, [110/300], ospf
  via 192.168.4.3, [110/300], ospf
192.168.2.2/32, vrf default
  via 192.168.4.1, [110/100], ospf
192.168.2.3/32, vrf default
  via 192.168.4.3, [110/100], ospf
192.168.2.4/32, vrf default
  via 192.168.4.1, [110/200], ospf
  via 192.168.4.3, [110/200], ospf
192.168.4.4/31, vrf default
  via 192.168.4.1, [110/200], ospf
192.168.4.6/31, vrf default
  via 192.168.4.3, [110/200], ospf
192.168.12.1/32, vrf default
  via 192.168.4.1, [110/100], ospf
  via 192.168.4.3, [110/100], ospf
```

## Task 4 – Configure FHR, RP-BSR1, RP-BSR2, LHR with PIM SM

- On LHR/FHR, configure static RP to 192.168.12.1 since BSR doesn't work in AOS-CX VMs at this time. Also configure PIM-SM and IGMP on the SVIs (VLAN 110 exists on FHR, VLAN 111 exists on LHR).
- On C-RP/BSR switches, configure MSDP between them (for RP load sharing), enable BSRs to advertise C-RP information and C-RP that uses Lo1, this will ensure 192.168.12.1 RP is available even if 1 RP-BSR switch fails (PIM BSRs don't work with AOS-CX VMs at this time, you will just gain the experience of CLI configuration).

### FHR

```
FHR(config)# router pim
FHR(config-pim)# enable
FHR(config-pim)# rp-address 192.168.12.1
```



```
FHR(config-pim)# int 1/1/2
FHR(config-if)# ip pim-sparse enable
FHR(config-if)# int 1/1/3
FHR(config-if)# ip pim-sparse enable
FHR(config-if)# int vlan 110
FHR(config-if-vlan)# ip pim-sparse enable
FHR(config-if-vlan)# ip igmp enable
```

#### **RP-BSR1**

```
RP-BSR1(config)# int lo 0
RP-BSR1(config-loopback-if)# ip pim-sparse enable
RP-BSR1(config-loopback-if)# int lo 1
RP-BSR1(config-loopback-if)# ip pim-sparse enable
RP-BSR1(config-loopback-if)# int 1/1/1
RP-BSR1(config-if)# ip pim-sparse enable
RP-BSR1(config-if)# int 1/1/2
RP-BSR1(config-if)# ip pim-sparse enable
RP-BSR1(config-if)# router pim
RP-BSR1(config-pim)# enable
RP-BSR1(config-pim)# rp-candidate source-ip-interface loopback1
RP-BSR1(config-pim)# rp-candidate group-prefix 224.0.0.0/4
RP-BSR1(config-pim)# bsr-candidate source-ip-interface loopback0
RP-BSR1(config-pim)# router msdp
RP-BSR1(config-msdp)# enable
RP-BSR1(config-msdp)# ip msdp peer 192.168.2.3
! RP-BSR1 should peer using Lo0 to RP-BSR2 Lo0
RP-BSR1(config-msdp-peer)# connect-source loopback0
RP-BSR1(config-msdp-peer)# enable
RP-BSR1(config-msdp-peer)# mesh-group 1
```

#### **RP-BSR2**

```
RP-BSR2(config)# int lo 0
RP-BSR2(config-loopback-if)# ip pim-sparse enable
RP-BSR2(config-loopback-if)# int lo 1
RP-BSR2(config-loopback-if)# ip pim-sparse enable
RP-BSR2(config-loopback-if)# int 1/1/1
RP-BSR2(config-if)# ip pim-sparse enable
RP-BSR2(config-if)# int 1/1/2
RP-BSR2(config-if)# ip pim-sparse enable
RP-BSR2(config-if)# router pim
RP-BSR2(config-pim)# enable
RP-BSR2(config-pim)# rp-candidate source-ip-interface loopback1
RP-BSR2(config-pim)# rp-candidate group-prefix 224.0.0.0/4
RP-BSR2(config-pim)# bsr-candidate source-ip-interface loopback0
RP-BSR2(config-pim)# router msdp
RP-BSR2(config-msdp)# enable
RP-BSR2(config-msdp)# ip msdp peer 192.168.2.2
! RP-BSR2 should peer using Lo0 to RP-BSR1 Lo0
RP-BSR2(config-msdp-peer)# connect-source loopback0
RP-BSR2(config-msdp-peer)# enable
RP-BSR2(config-msdp-peer)# mesh-group 1
```

#### **LHR**

```
LHR(config)# router pim
LHR(config-pim)# enable
LHR(config-pim)# rp-address 192.168.12.1
LHR(config-pim)# int 1/1/2
LHR(config-if)# ip pim-sparse enable
LHR(config-if)# int 1/1/3
```

```
LHR(config-if)# ip pim-sparse enable
LHR(config-if)# int vlan 111
LHR(config-if-vlan)# ip pim-sparse enable
LHR(config-if-vlan)# ip igmp enable
```

- Validate MSDP peer comes up on RP-BSR

```
RP-BSR1# sh ip msdp summary
```

```
VRF: default
```

```
MSDP Peer Status Summary
```

Peer address	State	Uptime(Downtime)	Reset Count	SA Count
192.168.2.3	up	1m 18s	0	0

- Validate RPs are set correctly on LHR/FHR.

```
FHR# sh ip pim rp-set
```

```
VRF: default
```

```
Status and Counters - PIM-SM Static RP-Set Information
```

Group Address	Group Mask	RP Address	Override
224.0.0.0	240.0.0.0	192.168.12.1	No

## Task 5 – Configure Multicast Source

- Configure the Source VPCS with your desired IP and default gateway

```
VPCS> ip 10.0.110.1/24 10.0.110.254
Checking for duplicate address...
PC1 : 10.0.110.1 255.255.255.0 gateway 10.0.110.254
```

- Ensure unicast connectivity works

```
VPCS> ping 10.0.110.254
```

```
84 bytes from 10.0.110.254 icmp_seq=1 ttl=64 time=1.363 ms
84 bytes from 10.0.110.254 icmp_seq=2 ttl=64 time=1.281 ms
84 bytes from 10.0.110.254 icmp_seq=3 ttl=64 time=1.032 ms
84 bytes from 10.0.110.254 icmp_seq=4 ttl=64 time=0.848 ms
84 bytes from 10.0.110.254 icmp_seq=5 ttl=64 time=1.045 ms
^C
```

```
VPCS> ping 10.0.111.254
```

```
84 bytes from 10.0.111.254 icmp_seq=1 ttl=62 time=3.560 ms
84 bytes from 10.0.111.254 icmp_seq=2 ttl=62 time=2.848 ms
84 bytes from 10.0.111.254 icmp_seq=3 ttl=62 time=2.656 ms
84 bytes from 10.0.111.254 icmp_seq=4 ttl=62 time=2.868 ms
^C
```



## Task 6 – Final Validation

- Generate multicast traffic on the source VPCS and leave it running (it has to be running to validate mroute later on)

```
VPCS> ping 239.10.10.10 -c 10000
```

```
239.10.10.10 icmp_seq=1 timeout
239.10.10.10 icmp_seq=2 timeout
239.10.10.10 icmp_seq=3 timeout
239.10.10.10 icmp_seq=4 timeout
239.10.10.10 icmp_seq=5 timeout
239.10.10.10 icmp_seq=6 timeout
239.10.10.10 icmp_seq=7 timeout
239.10.10.10 icmp_seq=8 timeout
239.10.10.10 icmp_seq=9 timeout
```

- Take note, the receiver VPCS is not actually receiving multicast traffic, but you will be able to view the incoming interface and outgoing interface list of the multicast tree on the AOS-CX switches
- Since the receiver is not able to send a multicast join, you will need to force a static IGMP join from the LHR SVI

```
interface vlan111
 ip igmp static-group 239.10.10.10
```

- Validate mroute on FHR

```
FHR# show ip mroute
IP Multicast Route Entries
```

```
VRF : default
Total number of entries : 1
```

```
Group Address      : 239.10.10.10
Source Address     : 10.0.110.1
Incoming interface  : vlan110
Outgoing Interface List :
Interface          State
-----
1/1/2              forwarding
```

- Validate mroute on RP-BSR1

```
RP-BSR1# show ip mroute
IP Multicast Route Entries
```

```
VRF : default
Total number of entries : 1
```

```
Group Address      : 239.10.10.10
Source Address     : 10.0.110.1
Neighbor           : 192.168.4.0
Incoming interface  : 1/1/1
Outgoing Interface List :
Interface          State
-----
1/1/2              forwarding
```

- Validate mroute on RP-BSR2, this is expected as Reverse Path Forwarding (RPF) fails on this path, only 1 RP-BSR will forward multicast traffic.

```
RP-BSR2# sh ip mr
RP-BSR2#
```

- Validate mroute on LHR, only 1 incoming interface will be valid due to RPF checks.

```
LHR# sh ip mroute
IP Multicast Route Entries

VRF : default
Total number of entries : 2

Group Address      : 239.10.10.10
Source Address     : 10.0.110.1
Neighbor           : 192.168.4.6
Incoming interface : 1/1/3

Group Address      : 239.10.10.10
Source Address     : 10.0.110.1
Neighbor           : 192.168.4.4
Incoming interface : 1/1/2
Outgoing Interface List :
Interface          State
-----
vlan111            forwarding
```

- If you shut the uplink on RP-BSR1, you will notice that multicast traffic now fails over to the redundant RP-BSR.

```
RP-BSR1(config)# int 1/1/1
RP-BSR1(config-if)# shut
```

```
RP-BSR2# sh ip mroute
IP Multicast Route Entries

VRF : default
Total number of entries : 1

Group Address      : 239.10.10.10
Source Address     : 10.0.110.1
Neighbor           : 192.168.4.2
Incoming interface : 1/1/1
Outgoing Interface List :
Interface          State
-----
1/1/2              forwarding
```

- The change to the multicast tree will also be seen on LHR

```
LHR# sh ip mroute
IP Multicast Route Entries

VRF : default
Total number of entries : 1
```

```

Group Address       : 239.10.10.10
Source Address      : 10.0.110.1
Neighbor            : 192.168.4.6
Incoming interface  : 1/1/3
Outgoing Interface List :
Interface           State
-----
vlan111             forwarding

```

## Appendix – Complete Configurations

- If you face issues during your lab, you can verify your configs with the configs listed in this section
- If configs are the same, try powering off/powering on the switches to reboot them

### Source

VPCS> show ip

```

NAME       : VPCS[1]
IP/MASK     : 10.0.110.1/24
GATEWAY     : 10.0.110.254
DNS         :
MAC         : 00:50:79:66:68:07
LPORT      : 20000
RHOST:PORT  : 127.0.0.1:30000
MTU         : 1500

```

### FHR

FHR# sh run

Current configuration:

```

!
!Version ArubaOS-CX Virtual.10.05.0001
!export-password: default
hostname FHR
user admin group administrators password ciphertext
AQBapciYotudBbzD7MjzjciBYUTbCGPkwdonctLjMfT3xqV6YgAAANH83E950R2W3ICo/eu04oIF+7mmyZnnx7Lb3+iid3P
9lM2/KKISb2E8n1ZirzCfl3n23YxUVoBg4iTTPQyB
z3I0rcXzcfTGNBhN6WL0BZgcCouSiOjeBfrZABq49fMnkToQ
led locator on
!
!
!
!
ssh server vrf mgmt
vlan 1,110
interface mgmt
    no shutdown
    ip dhcp
interface 1/1/1
    no shutdown
    no routing
    vlan access 110
interface 1/1/2
    no shutdown
    ip address 192.168.4.0/31
    ip ospf 1 area 0.0.0.0
    ip ospf network point-to-point
    ip pim-sparse enable

```

```

interface 1/1/3
  no shutdown
  ip address 192.168.4.2/31
  ip ospf 1 area 0.0.0.0
  ip ospf network point-to-point
  ip pim-sparse enable
interface 1/1/4
  no shutdown
interface 1/1/5
  no shutdown
interface 1/1/6
  no shutdown
interface loopback 0
  ip address 192.168.2.1/32
  ip ospf 1 area 0.0.0.0
interface vlan 110
  ip address 10.0.110.254/24
  ip ospf 1 area 0.0.0.0
  ip igmp enable
  ip pim-sparse enable
!
!
!
!
router ospf 1
  router-id 192.168.2.1
  area 0.0.0.0
router pim
  enable
  rp-address 192.168.12.1
https-server vrf mgmt

```

#### **RP-BSR1**

```

RP-BSR1# sh run
Current configuration:
!
!Version ArubaOS-CX Virtual.10.05.0001
!export-password: default
hostname RP-BSR1
user admin group administrators password ciphertext
AQBapZhLwt8DJgKaOw9GxYqqfKO9Oniuah5+u397ZOdYDwqjYgAAAJy1AvfchHajw4hPi jeAlKD04p2ir8kDQ+bFd+5N6E6
dp0zZI9cG2fOkq9DF/okSrMAx8Yq2eewxyBWoleAC
sQsoJPlthFovZ55R3Z59so7BLA0wywzEVgv+FMvJP9clvM+S
led locator on
!
!
!
!
ssh server vrf mgmt
vlan 1
interface mgmt
  no shutdown
  ip dhcp
interface 1/1/1
  ip address 192.168.4.1/31
  ip ospf 1 area 0.0.0.0
  ip ospf network point-to-point
  ip pim-sparse enable
interface 1/1/2
  no shutdown
  ip address 192.168.4.4/31
  ip ospf 1 area 0.0.0.0
  ip ospf network point-to-point
  ip pim-sparse enable

```

```

interface 1/1/3
  no shutdown
interface 1/1/4
  no shutdown
interface 1/1/5
  no shutdown
interface 1/1/6
  no shutdown
interface loopback 0
  ip address 192.168.2.2/32
  ip ospf 1 area 0.0.0.0
  ip pim-sparse enable
interface loopback 1
  ip address 192.168.12.1/32
  ip ospf 1 area 0.0.0.0
  ip pim-sparse enable
!
!
!
!
!
router ospf 1
  router-id 192.168.2.2
  area 0.0.0.0
router pim
  enable
  rp-candidate source-ip-interface loopback1
  rp-candidate group-prefix 224.0.0.0/4
  bsr-candidate source-ip-interface loopback0
https-server vrf mgmt
router msdp
  enable
  ip msdp peer 192.168.2.3
  connect-source loopback0
  enable
  mesh-group 1

```

#### **RP-BSR2**

```

RP-BSR2# sh run
Current configuration:
!
!Version ArubaOS-CX Virtual.10.05.0001
!export-password: default
hostname RP-BSR2
user admin group administrators password ciphertext
AQBapYDL9lBBT0SbvCIV7F+vTIVaV5UBW5yXqKbysuvCbfofYgAAAOPDlCWX5wPjLQkg1KvUIeyclvQnCxdpWKxIXMVovtt
PZpvoLhp7tWpKT/+aZWPhw+E+qCI1L3AeFaYqUTlm
M4pT6jwn649rAniE7Qa8/AY4A5yI6B9vNag5JTEgrqT0kyki
led locator on
!
!
!
!
ssh server vrf mgmt
vlan 1
interface mgmt
  no shutdown
  ip dhcp
interface 1/1/1
  no shutdown
  ip address 192.168.4.3/31
  ip ospf 1 area 0.0.0.0
  ip ospf network point-to-point
  ip pim-sparse enable

```

```

interface 1/1/2
  no shutdown
  ip address 192.168.4.6/31
  ip ospf 1 area 0.0.0.0
  ip ospf network point-to-point
  ip pim-sparse enable
interface 1/1/3
  no shutdown
interface 1/1/4
  no shutdown
interface 1/1/5
  no shutdown
interface 1/1/6
  no shutdown
interface loopback 0
  ip address 192.168.2.3/32
  ip ospf 1 area 0.0.0.0
  ip pim-sparse enable
interface loopback 1
  ip address 192.168.12.1/32
  ip ospf 1 area 0.0.0.0
  ip pim-sparse enable
!
!
!
!
!
router ospf 1
  router-id 192.168.2.3
  area 0.0.0.0
router pim
  enable
  rp-candidate source-ip-interface loopback1
  rp-candidate group-prefix 224.0.0.0/4
  bsr-candidate source-ip-interface loopback0
https-server vrf mgmt
router msdp
  enable
  ip msdp peer 192.168.2.2
  connect-source loopback0
  enable
  mesh-group 1

```

```

LHR
LHR# sh run
Current configuration:
!
!Version ArubaOS-CX Virtual.10.05.0001
!export-password: default
hostname LHR
user admin group administrators password ciphertext
AQBapZMxhCoJj0f0GFCzG4zJw8j+c5DkLcMs8m+AJzaIEQzRYgAAANNkNWXieQw5mXMaguhMo+INS+mowbVwiCx8EuBSMky
8LltNdGLPTd6zrFpalv6fAfODpcvxJ8RnBU5a87Lh
pVNMydnYRZGjS8Mj4/A4v/DI4aVZzKEMV/1PzW07BxS37+Xi
led locator on
!
!
!
!
ssh server vrf mgmt
vlan 1,111
interface mgmt

```



```
no shutdown
ip dhcp
interface 1/1/1
no shutdown
no routing
vlan access 111
interface 1/1/2
no shutdown
ip address 192.168.4.5/31
ip ospf 1 area 0.0.0.0
ip ospf network point-to-point
ip pim-sparse enable
interface 1/1/3
no shutdown
ip address 192.168.4.7/31
ip ospf 1 area 0.0.0.0
ip ospf network point-to-point
ip pim-sparse enable
interface 1/1/4
no shutdown
interface 1/1/5
no shutdown
interface 1/1/6
no shutdown
interface loopback 0
ip address 192.168.2.4/32
ip ospf 1 area 0.0.0.0
interface vlan 111
ip address 10.0.111.254/24
ip ospf 1 area 0.0.0.0
ip igmp enable
ip igmp static-group 239.10.10.10
ip pim-sparse enable
!
!
!
!
!
router ospf 1
router-id 192.168.2.4
area 0.0.0.0
router pim
enable
rp-address 192.168.12.1
https-server vrf mgmt
```



[www.arubanetworks.com](http://www.arubanetworks.com)

3333 Scott Blvd. Santa Clara, CA 95054  
1.844.472.2782 | T: 1.408.227.4500 | FAX: 1.408.227.4550 | [info@arubanetworks.com](mailto:info@arubanetworks.com)