

# Static VXLAN

**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 lab will enable the reader to gain hands on experience with L2 static Virtual Extensible LAN (VXLAN).

### Lab Overview

This lab as shown in Figure 1 will allow you to provide end hosts (Virtual PC Simulator - VPCS) on the same subnet with L2 overlay network connectivity across the VXLAN data plane tunnel created manually.

OSPF is used as the IP underlay Interior Gateway Protocol (IGP) to provide loopback connectivity for VXLAN tunnel establishment.

Static VXLAN uses flood and learn to advertise MAC addresses.

Take note that L3 VXLAN does not currently work with AOS-CX VMs.

VLAN 110 will be mapped to VXLAN Network Identifier (VNI) 110 to provide L2 overlay connectivity across the leaf switches.

## Lab Network Layout

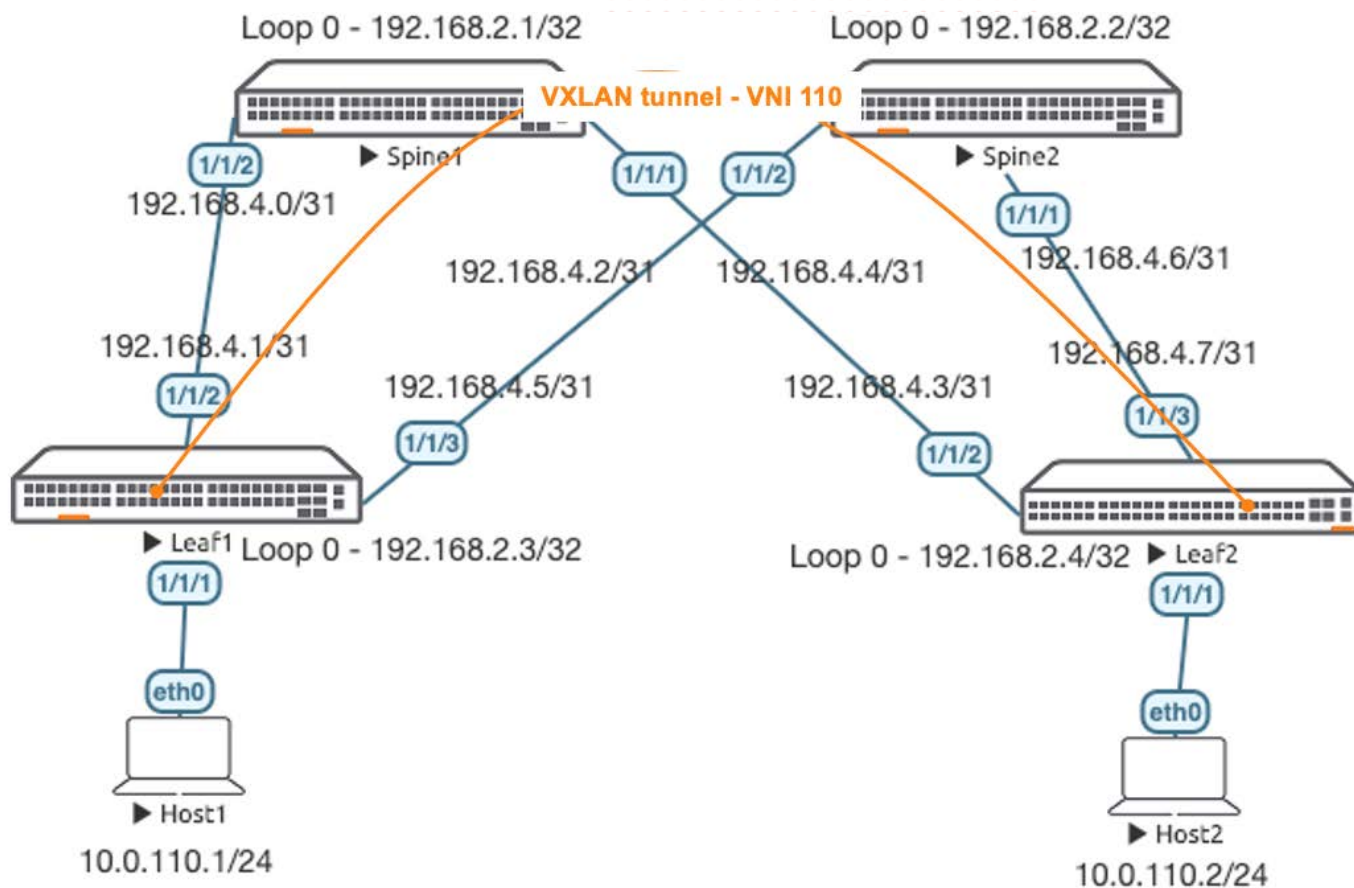


Figure 1. Lab topology and addresses

## Lab Tasks

### Task 1 – Lab setup

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

- Start all the devices, including VPCS hosts
- 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
```

### Leaf1

```
Leaf1(config)# sh lld 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	1/1/2	1/1/2	120	Spine1
1/1/3	08:00:09:12:8e:9e	1/1/2	1/1/2	120	Spine2

## Task 2 – Configure IP Underlay Interfaces

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

### Leaf1

```
Leaf1(config)# int lo 0
Leaf1(config-loopback-if)# ip add 192.168.2.3/32
Leaf1(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
```

```
Leaf1(config-loopback-if)# router ospf 1
Leaf1(config-ospf-1)# router-id 192.168.2.3
Leaf1(config-ospf-1)# int 1/1/2
Leaf1(config-if)# ip add 192.168.4.1/31
Leaf1(config-if)# ip ospf 1 area 0
Leaf1(config-if)# ip ospf network point-to-point
Leaf1(config-if)# int 1/1/3
Leaf1(config-if)# ip add 192.168.4.5/31
Leaf1(config-if)# ip ospf 1 area 0
Leaf1(config-if)# ip ospf network point-to-point
```

### Leaf2

```
Leaf2(config)# int lo 0
Leaf2(config-loopback-if)# ip add 192.168.2.4/32
Leaf2(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
```

```
Leaf2(config-loopback-if)# router ospf 1
Leaf2(config-ospf-1)# router-id 192.168.2.4
Leaf2(config-ospf-1)# int 1/1/2
Leaf2(config-if)# ip add 192.168.4.3/31
Leaf2(config-if)# ip ospf 1 area 0
Leaf2(config-if)# ip ospf network point-to-point
Leaf2(config-if)# int 1/1/3
Leaf2(config-if)# ip add 192.168.4.7/31
```

```
Leaf2(config-if)# ip ospf 1 area 0
Leaf2(config-if)# ip ospf network point-to-point
```

### Spine1

```
Spine1(config)# int lo 0
Spine1(config-loopback-if)# ip add 192.168.2.1/32
Spine1(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

Spine1(config-loopback-if)# router ospf 1
Spine1(config-ospf-1)# router-id 192.168.2.1
Spine1(config-ospf-1)# int 1/1/2
Spine1(config-if)# ip add 192.168.4.0/31
Spine1(config-if)# ip ospf 1 area 0
Spine1(config-if)# ip ospf network point-to-point
Spine1(config-if)# int 1/1/1
Spine1(config-if)# ip add 192.168.4.2/31
Spine1(config-if)# ip ospf 1 area 0
Spine1(config-if)# ip ospf network point-to-point
```

### Spine2

```
Spine2(config)# int lo 0
Spine2(config-loopback-if)# ip add 192.168.2.2/32
Spine2(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

Spine2(config-loopback-if)# router ospf 1
Spine2(config-ospf-1)# router-id 192.168.2.2
Spine2(config-ospf-1)# int 1/1/2
Spine2(config-if)# ip add 192.168.4.4/31
Spine2(config-if)# ip ospf 1 area 0
Spine2(config-if)# ip ospf network point-to-point
Spine2(config-if)# int 1/1/1
Spine2(config-if)# ip add 192.168.4.6/31
Spine2(config-if)# ip ospf 1 area 0
Spine2(config-if)# ip ospf network point-to-point
```

- Verify OSPF neighbors appear as expected between the switches

```
Leaf1(config)# sh ip os neighbors
OSPF Process ID 1 VRF default
=====
```

Total Number of Neighbors: 2

Neighbor ID	Priority	State	Nbr Address	Interface
192.168.2.1	n/a	FULL	192.168.4.0	1/1/2
192.168.2.2	n/a	FULL	192.168.4.4	1/1/3

- Verify OSPF routes are learnt as expected, you should see ECMP routes towards Lo0 of the other leaf, this is supposed to allow VXLAN traffic to be load shared across the ECMP routes (this works with real hardware, however AOS-CX VMs do not currently support ECMP)

```
Leaf1(config)# sh ip ro ospf
```

```
Displaying ipv4 routes selected for forwarding
```

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

```
192.168.2.1/32, vrf default
  via 192.168.4.0, [110/100], ospf
192.168.2.2/32, vrf default
  via 192.168.4.4, [110/100], ospf
192.168.2.4/32, vrf default
  via 192.168.4.4, [110/200], ospf
  via 192.168.4.0, [110/200], ospf
192.168.4.2/31, vrf default
  via 192.168.4.0, [110/200], ospf
192.168.4.6/31, vrf default
  via 192.168.4.4, [110/200], ospf
```

←ECMP to Leaf2 Lo0

### Task 3 – Configure Leaf Switches with VXLAN

- On both leaf switches, configure the desired VLAN to be VXLAN encapsulated on the ports towards Host1, Host2

#### Leaf1

```
Leaf1(config)# vlan 110
Leaf1(config-vlan-110)# int 1/1/1
Leaf1(config-if)# no routing
Leaf1(config-if)# vlan access 110
```

#### Leaf2

```
Leaf2(config)# vlan 110
Leaf2(config-vlan-110)# int 1/1/1
Leaf2(config-if)# no routing
Leaf2(config-if)# vlan access 110
```

- Configure the VXLAN interface, the source IP based on Lo0 and the desired VLAN to VXLAN Network Identifier (VNI) mapping

#### Leaf1

```
Leaf1(config)# interface vxlan 1
Leaf1(config-vxlan-if)# source ip 192.168.2.3
Leaf1(config-vxlan-if)# no shutdown
Leaf1(config-vxlan-if)# vni 110
Leaf1(config-vni-110)# vlan 110
Leaf1(config-vni-110)# vtep-peer 192.168.2.4
```

#### Leaf2

```
Leaf2(config)# interface vxlan 1
Leaf2(config-vxlan-if)# source ip 192.168.2.4
Leaf2(config-vxlan-if)# no shutdown
Leaf2(config-vxlan-if)# vni 110
```

```
Leaf2(config-vni-110)# vlan 110
Leaf1(config-vni-110)# vtep-peer 192.168.2.3
```

- Validate the VXLAN interface is up with correct source, destination VTEP peer IPs and VNI/VLAN mapping.

```
Leaf1(config)# sh int vxlan
Interface vxlan1 is up
Admin state is up
Description:
Underlay VRF: default
Destination UDP port: 4789
VTEP source IPv4 address: 192.168.2.3
```

VNI	VLAN	VTEP Peers	Origin
110	110	192.168.2.4	static

- If wireshark is available <https://www.eve-ng.net/index.php/features-compare/>
- Setup and start wireshark packet captures
  - right click on a leaf switch -> Capture -> 1/1/2 -> Ethernet
  - also right click on the same switch, other uplink -> Capture -> 1/1/3 -> Ethernet
- Only 1 link might show the desired packet captures as ECMP is not supported on the AOS-CX VMs

## Task 4 – Configure Hosts (VPCS)

- Configure Host1, Host2 with the desired IP and default gateway (the default gateway doesn't exist on the network as L2 VXLAN is used but is a required config in VPCS, so we assume a .254 as the default gateway)

### Host1

```
ip 10.0.110.1/24 10.0.110.254
```

### Host2

```
ip 10.0.110.2/24 10.0.110.254
```

## Task 5 – Final Validation

- Ensure L2 connectivity works between hosts

```
VPCS> ping 10.0.110.2
```

```
84 bytes from 10.0.110.2 icmp_seq=1 ttl=64 time=1.787 ms
84 bytes from 10.0.110.2 icmp_seq=2 ttl=64 time=3.202 ms
84 bytes from 10.0.110.2 icmp_seq=3 ttl=64 time=3.999 ms
84 bytes from 10.0.110.2 icmp_seq=4 ttl=64 time=3.055 ms
84 bytes from 10.0.110.2 icmp_seq=5 ttl=64 time=3.375 ms
```



- Validate local and remote MACs are seen on the leaf switches as expected

```
Leaf1# sh mac-address-table
MAC age-time          : 300 seconds
Number of MAC addresses : 2
```

MAC Address	VLAN	Type	Port
00:50:79:66:68:05	110	dynamic	1/1/1
00:50:79:66:68:07	110	dynamic	vxlan1(192.168.2.4)

- Validate VXLAN traffic is seen in the wireshark capture

```
222 467.568626857 10.0.110.2 10.0.110.1 ICMP 148 Echo (ping) reply id=0x17bd, seq=2/512, ttl=64
223 468.573783975 10.0.110.2 10.0.110.1 ICMP 148 Echo (ping) reply id=0x18bd, seq=3/768, ttl=64
224 469.577206691 10.0.110.2 10.0.110.1 ICMP 148 Echo (ping) reply id=0x19bd, seq=4/1024, ttl=64
▶ Frame 222: 148 bytes on wire (1184 bits), 148 bytes captured (1184 bits) on interface 0
▶ Ethernet II, Src: HewlettP_8a:14:fa (08:00:09:8a:14:fa), Dst: HewlettP_16:7b:7e (08:00:09:16:7b:7e)
▶ Internet Protocol Version 4, Src: 192.168.2.4, Dst: 192.168.2.3
▶ User Datagram Protocol, Src Port: 25721, Dst Port: 4789
▼ Virtual eXtensible Local Area Network
  ▶ Flags: 0x0800, VXLAN Network ID (VNI)
    Group Policy ID: 0
    VXLAN Network Identifier (VNI): 110
    Reserved: 0
▶ Ethernet II, Src: Private_66:68:07 (00:50:79:66:68:07), Dst: Private_66:68:05 (00:50:79:66:68:05)
▶ Internet Protocol Version 4, Src: 10.0.110.2, Dst: 10.0.110.1
▶ Internet Control Message Protocol
```

## 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

### Host1

```
VPCS> show ip
```

```
NAME       : VPCS[1]
IP/MASK    : 10.0.110.1/24
GATEWAY    : 10.0.110.254
DNS        :
MAC        : 00:50:79:66:68:05
LPORT     : 20000
RHOST:PORT : 127.0.0.1:30000
MTU        : 1500
```

### Host2

```
VPCS> show ip
```

```
NAME       : VPCS[1]
IP/MASK    : 10.0.110.2/24
GATEWAY    : 10.0.110.254
DNS        :
MAC        : 00:50:79:66:68:07
LPORT     : 20000
RHOST:PORT : 127.0.0.1:30000
MTU        : 1500
```

### Leaf1

```
Leaf1# sh run
```

```
Current configuration:
```

```
!
!Version ArubaOS-CX Virtual.10.05.0001
!export-password: default
hostname Leaf1
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 192.168.4.1/31
    ip ospf 1 area 0.0.0.0
    ip ospf network point-to-point
```



```
interface 1/1/3
  no shutdown
  ip address 192.168.4.5/31
  ip ospf 1 area 0.0.0.0
  ip ospf network point-to-point
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
interface vxlan 1
  source ip 192.168.2.3
  no shutdown
  vni 110
    vlan 110
    vtep-peer 192.168.2.4
  !
!
!
!
router ospf 1
  router-id 192.168.2.3
  area 0.0.0.0
https-server vrf mgmt
```

### Leaf2

```
Leaf2# sh run
Current configuration:
!
!Version ArubaOS-CX Virtual.10.05.0001
!export-password: default
hostname Leaf2
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 192.168.4.3/31
  ip ospf 1 area 0.0.0.0
  ip ospf network point-to-point
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
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 vxlan 1
source ip 192.168.2.4
no shutdown
vni 110
vlan 110
vtep-peer 192.168.2.3
!
!
!
router ospf 1
router-id 192.168.2.4
area 0.0.0.0
https-server vrf mgmt
```

### Spine1

```
Spine1# sh run
Current configuration:
!
!Version ArubaOS-CX Virtual.10.05.0001
!export-password: default
hostname Spine1
led locator on
!
!
!
ssh server vrf mgmt
vlan 1
interface mgmt
no shutdown
ip dhcp
interface 1/1/1
no shutdown
ip address 192.168.4.2/31
ip ospf 1 area 0.0.0.0
ip ospf network point-to-point
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
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 192.168.2.1/32
ip ospf 1 area 0.0.0.0
!
!
```

```
!  
!  
!  
router ospf 1  
  router-id 192.168.2.1  
  area 0.0.0.0  
https-server vrf mgmt
```

### Spine2

```
Spine2# sh run  
Current configuration:  
!  
!Version ArubaOS-CX Virtual.10.05.0001  
!export-password: default  
hostname Spine2  
led locator on  
!  
!  
!  
ssh server vrf mgmt  
vlan 1  
interface mgmt  
  no shutdown  
  ip dhcp  
interface 1/1/1  
  no shutdown  
  ip address 192.168.4.6/31  
  ip ospf 1 area 0.0.0.0  
  ip ospf network point-to-point  
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  
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  
!  
!  
!  
!  
!  
router ospf 1  
  router-id 192.168.2.2  
  area 0.0.0.0  
https-server vrf mgmt
```



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