

Part I Campus 2 Tier. Layer 3 Access with OSPF

**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/>

TABLE OF CONTENTS

Lab Objective.....	1
Lab Overview.....	1
Lab Network Layout.....	2
Lab Tasks.....	2
Task 1 - Lab setup.....	2
Task 2 - Configure links between Campus Core	3
Task 3 – Configure OSPF on Campus Core	4
Task 4 – Configure links and OSPF on Access Switch C.....	5
Task 5 – Configure VPC and test reachability.....	7
Appendix – Complete Configurations.....	8

Lab Objective

The lab will enable the user to gain hands on knowledge and experience in setup basic Campus 2 Tier Network with L3 Access using OSPF.

Aruba CX 6200 and 6300 typically can be used for L3 access in the campus.

For further details on Aruba CX switches and other features please refer to the latest Aruba documentation located on <https://asp.arubanetworks.com/>

Lab Overview

This lab set up is as shown in Figure 1. This set up is of a Two tier Aruba CX collapsed Core, with switches such as 6400 in the Core with a single access switch at the edge such as the 6200 or 6300.

At the end of the lab you will be able to observe a typical Two Tier Campus with the layer 3 at the access. All the layer 3 functions will begin at the Campus access layer all the way to the core. This helps to remove dependency on such things like spanning tree for loop prevention, and end points use their local switch as their default gateway.

Lab Network Layout

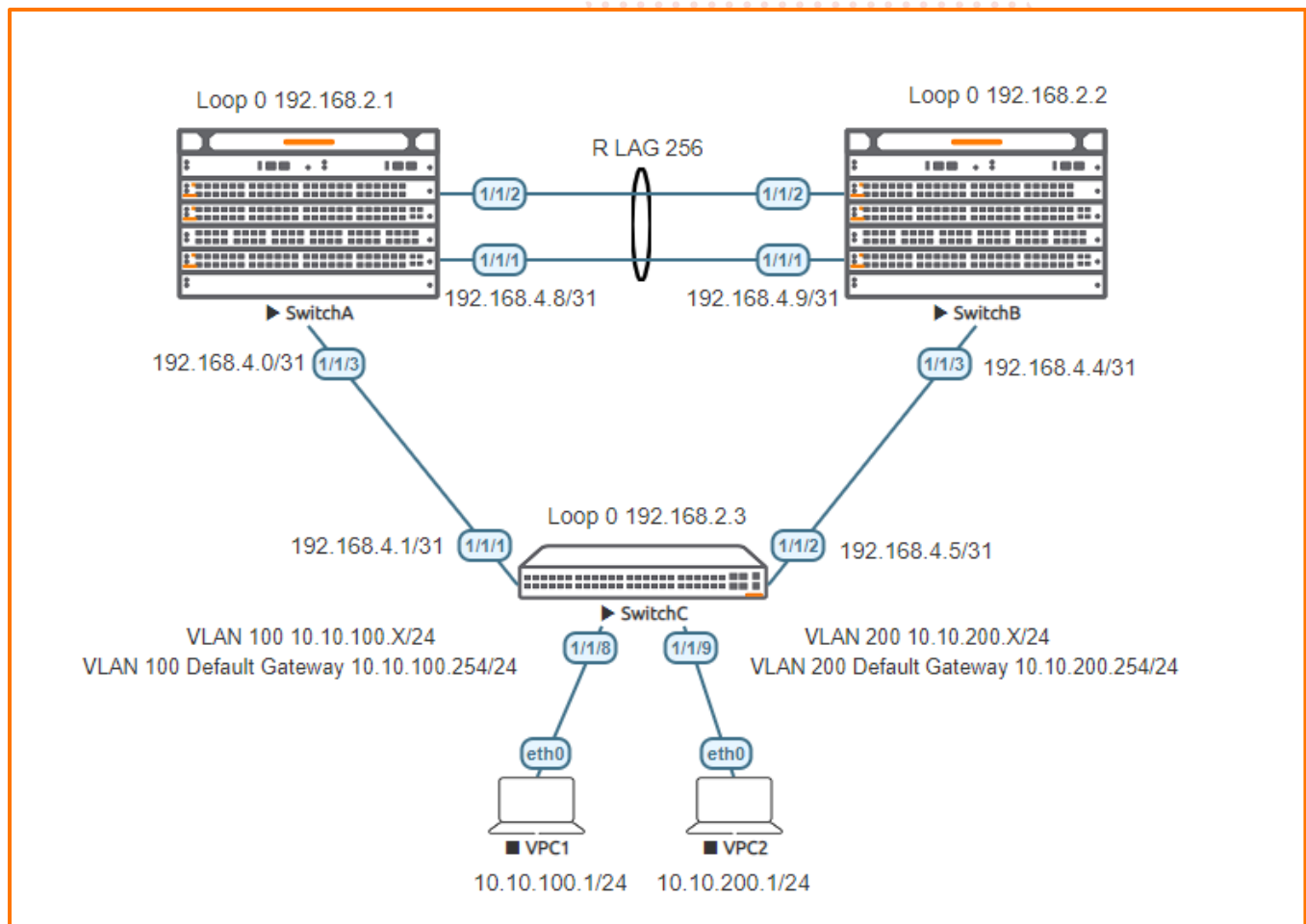


Figure 1. Lab topology

Lab Tasks

Task 1 - Lab setup

For this lab refer to Figure 1 for topology setup. Open switch A, B and C consoles and log in with user "admin" and no password.

```
configure
```

```
hostname <device host name>
```

On Switch A and B bring up on 1/1/1-1/1/3:

```
interface 1/1/1-1/1/3
no shutdown
```

use "exit" to go back a level

On Switch C bring up on 1/1/1-1/1/2

```
interface 1/1/1-1/1/2
no shutdown
```

- Validate LLDP neighbors appear as expected on each switch. Here we show Switch C output only.

```
SwitchC 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 TTL	CHASSIS-ID SYS-NAME	PORT-ID	PORT-DESC
1/1/1	08:00:09:b7:09:95	1/1/3	1/1/3 120 SwitchA
1/1/2	08:00:09:e4:3c:7a	1/1/3	1/1/3 120 SwitchB

Task 2 - Configure links between Campus Core

On Switch A and B Core configure:

- LAG on the collapsed Core

SwitchA#	SwitchB#
interface lag 256	interface lag 256
ip address 192.168.4.8/31	ip address 192.168.4.9/31
no shutdown	no shutdown
description Routed LAG	description Routed LAG
lACP mode active	lACP mode active
int 1/1/1-1/1/2	int 1/1/1-1/1/2
mtu 9198	mtu 9198
description core link	description core link
lag 256	lag 256

- Ensure the LAG is operational, Switch A is shown here, the reader can also check Switch B.

```
SwitchA# show interface lag
```

```
Aggregate lag256 is up
Admin state is up
Description : Routed LAG
MAC Address      : 08:00:09:b7:09:95
Aggregated-interfaces : 1/1/1 1/1/2
Aggregation-key   : 256
Aggregate mode    : active
Speed             : 2000 Mb/s
L3 Counters: Rx Disabled, Tx Disabled
qos trust none
```

Statistic	RX	TX	Total
Packets	84	107	0
Unicast	0	0	0
Multicast	0	0	0
Broadcast	0	0	0
Bytes	11244	14032	0
Jumbos	0	0	0
Dropped	0	0	0
Pause Frames	0	0	0
L3 Packets	0	0	0
L3 Bytes	0	0	0
Errors	0	0	0
CRC/FCS	0	n/a	0
Collision	n/a	0	0
Runts	0	n/a	0
Giants	0	n/a	0

```
SwitchA(config)# show lacp interfaces
```

State abbreviations :
A - Active P - Passive F - Aggregable I - Individual
S - Short-timeout L - Long-timeout N - InSync O - OutofSync
C - Collecting D - Distributing
X - State m/c expired E - Default neighbor state

Actor details of all interfaces:

Intf	Aggr Name	Port Id	Port Pri	State	System-ID	System Pri	Aggr Key	Forwarding State
1/1/1	lag256	2	1	ALFNCD	08:00:09:b7:09:95	65534	256	up
1/1/2	lag256	3	1	ALFNCD	08:00:09:b7:09:95	65534	256	up

Partner details of all interfaces:

Intf	Aggr Name	Port Id	Port Pri	State	System-ID	System Pri	Aggr Key
1/1/1	lag256	2	1	ALFNCD	08:00:09:e4:3c:7a	65534	256
1/1/2	lag256	3	1	ALFNCD	08:00:09:e4:3c:7a	65534	256

- Check connectivity between core switches. Here we ping between Switch A and B

```
SwitchA# ping 192.168.4.9
PING 192.168.4.9 (192.168.4.9) 100(128) bytes of data.
108 bytes from 192.168.4.9: icmp_seq=1 ttl=64 time=1.91 ms
108 bytes from 192.168.4.9: icmp_seq=2 ttl=64 time=2.27 ms
108 bytes from 192.168.4.9: icmp_seq=3 ttl=64 time=2.19 ms
108 bytes from 192.168.4.9: icmp_seq=4 ttl=64 time=2.10 ms
108 bytes from 192.168.4.9: icmp_seq=5 ttl=64 time=2.01 ms
```

Task 3 – Configure OSPF on Campus Core

SwitchA#	SwitchB#
<pre>! router ospf 1 router-id 192.168.2.1 max-metric router-lsa on-startup passive-interface default graceful-restart restart-interval 300 trap-enable area 0.0.0.0 ! interface loopback 0 ip address 192.168.2.1/32 ip ospf 1 area 0.0.0.0 ! interface lag 256 mtu 9198 description to SwitchB ip ospf 1 area 0.0.0.0 no ip ospf passive ip ospf network point-to-point ! interface 1/1/3 mtu 9198 description to SwitchC ip address 192.168.4.0/31 ip ospf 1 area 0.0.0.0 no ip ospf passive ip ospf network point-to-point</pre>	<pre>router ospf 1 router-id 192.168.2.2 max-metric router-lsa on-startup passive-interface default graceful-restart restart-interval 300 trap-enable area 0.0.0.0 ! interface loopback 0 ip address 192.168.2.2/32 ip ospf 1 area 0.0.0.0 ! interface lag 256 mtu 9198 description to SwitchA ip ospf 1 area 0.0.0.0 no ip ospf passive ip ospf network point-to-point ! interface 1/1/3 mtu 9198 description to SwitchC ip address 192.168.4.4/31 ip ospf 1 area 0.0.0.0 no ip ospf passive ip ospf network point-to-point</pre>

- Check OSPF Neighbors on the Core. Here we check from Switch A

```
SwitchA# show ip ospf neighbors
VRF : default                                Process : 1
=====
```

Total Number of Neighbors : 1

Neighbor ID	Priority	State	Nbr Address	Interface
192.168.2.2	n/a	FULL	192.168.4.9	lag256

SwitchA#

Task 4 – Configure links and OSPF on Access Switch C

On **Switch C** L3 Access configure :

- OSPF to Core

```
SwitchC#
configure
!
router ospf 1
  router-id 192.168.2.3
  max-metric router-lsa on-startup
  passive-interface default
  graceful-restart restart-interval 300
  trap-enable
  area 0.0.0.0
!
interface loopback 0
  ip address 192.168.2.3/32
  ip ospf 1 area 0.0.0.0
!
interface 1/1/1
  mtu 9198
  description to SwitchA
  ip address 192.168.4.1/31
  ip ospf 1 area 0.0.0.0
  no ip ospf passive
  ip ospf network point-to-point
  ip ospf 1 area 0.0.0.0
!
interface 1/1/2
  mtu 9198
  description to SwitchB
  ip address 192.168.4.5/31
  ip ospf 1 area 0.0.0.0
  no ip ospf passive
  ip ospf network point-to-point
```

- Check OSPF to Core switches. You should see two FULL neighbors

```
show ip ospf neighbors
VRF : default                                Process : 1
=====
```

Total Number of Neighbors : 2

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

- Check OSPF Routes. You should see routes as shown below

```
show ip ospf route
Codes: i - Intra-area route, I - Inter-area route
       E1 - External type-1, E2 - External type-2
```

```
OSPF Process ID 1 VRF default, Routing Table
-----
```

Total Number of Routes : 6

```
192.168.2.1/32      (i) area: 0.0.0.0
    via 192.168.4.0 interface 1/1/1, cost 65535 distance 110
192.168.2.2/32      (i) area: 0.0.0.0
    via 192.168.4.4 interface 1/1/2, cost 65535 distance 110
192.168.4.0/31      (i) area: 0.0.0.0
    directly attached to interface 1/1/1, cost 100 distance 110
192.168.4.4/31      (i) area: 0.0.0.0
    directly attached to interface 1/1/2, cost 100 distance 110
192.168.4.8/31      (i) area: 0.0.0.0
    via 192.168.4.0 interface 1/1/1, cost 65585 distance 110
192.168.4.8/31      (i) area: 0.0.0.0
    via 192.168.4.4 interface 1/1/2, cost 65585 distance 110
```

- Validate connectivity to loopback on core. Here we show connectivity to Switch A

```
SwitchC#ping 192.168.2.1
PING 192.168.2.1 (192.168.2.1) 100(128) bytes of data.
108 bytes from 192.168.2.1: icmp_seq=1 ttl=64 time=2.15 ms
108 bytes from 192.168.2.1: icmp_seq=2 ttl=64 time=2.07 ms
108 bytes from 192.168.2.1: icmp_seq=3 ttl=64 time=3.70 ms
108 bytes from 192.168.2.1: icmp_seq=4 ttl=64 time=2.29 ms
108 bytes from 192.168.2.1: icmp_seq=5 ttl=64 time=1.70 ms
```

- Create VLANs with OSPF advertisements

```
SwitchC#
configure

vlan 100,200
interface vlan 100
ip address 10.10.100.254/24
no ip ospf passive
ip ospf 1 area 0
interface vlan 200
ip address 10.10.200.254/24
no ip ospf passive
ip ospf 1 area 0
interface 1/1/8
no shutdown
no routing
vlan access 100
interface 1/1/9
no shutdown
no routing
vlan access 200
```

- Check that the VLAN routes from Switch C are advertised onto the Core Switches A and B. Here we check on Switch A only. The reader can check both.

```
SwitchA# show ip route
```

Displaying ipv4 routes selected for forwarding

```
Origin Codes: C - connected, S - static, L - local
               R - RIP, B - BGP, O - OSPF
Type Codes:   E - External BGP, I - Internal BGP, V - VPN, EV - EVPN
               IA - OSPF internal area, E1 - OSPF external type 1
               E2 - OSPF external type 2
```

VRF: default

Prefix	Nexthop	Interface	VRF(egress)	Origin/ Type	Distance/ Metric	Age
10.10.100.0/24	192.168.4.1	1/1/3	-	O	[110/200]	00h:06m:10s
10.10.200.0/24	192.168.4.1	1/1/3	-	O	[110/200]	00h:03m:57s


```

192.168.2.1/32      -      loopback0      -      L      [0/0]      -
192.168.2.2/32      192.168.4.9      lag256      -      O      [110/50]      00h:55m:24s
192.168.2.3/32      192.168.4.1      1/1/3      -      O      [110/100]      00h:31m:03s
192.168.4.0/31      -      1/1/3      -      C      [0/0]      -
192.168.4.0/32      -      1/1/3      -      L      [0/0]      -
192.168.4.4/31      192.168.4.9      lag256      -      O      [110/150]      00h:55m:24s
192.168.4.8/31      -      lag256      -      C      [0/0]      -
192.168.4.8/32      -      lag256      -      L      [0/0]      -

```

Total Route Count : 10

```

SwitchA(config-if)# show ip ospf routes
Codes: i - Intra-area route, I - Inter-area route
       E1 - External type-1, E2 - External type-2

```

OSPF Process ID 1 VRF default, Routing Table

Total Number of Routes : 7

```

10.10.100.0/24      (i) area: 0.0.0.0
                    via 192.168.4.1 interface 1/1/3, cost 200 distance 110
10.10.200.0/24      (i) area: 0.0.0.0
                    via 192.168.4.1 interface 1/1/3, cost 200 distance 110
192.168.2.2/32      (i) area: 0.0.0.0
                    via 192.168.4.9 interface lag256, cost 50 distance 110
192.168.2.3/32      (i) area: 0.0.0.0
                    via 192.168.4.1 interface 1/1/3, cost 100 distance 110
192.168.4.0/31      (i) area: 0.0.0.0
                    directly attached to interface 1/1/3, cost 100 distance 110
192.168.4.4/31      (i) area: 0.0.0.0
                    via 192.168.4.9 interface lag256, cost 150 distance 110
192.168.4.8/31      (i) area: 0.0.0.0
                    directly attached to interface lag256, cost 50 distance 110

```

SwitchA#

Task 5 – Configure VPC and test reachability

- Configure VPC1

```

VPCS> ip 10.10.100.1/24 10.10.100.254
Checking for duplicate address...
PC1 : 10.10.100.1 255.255.255.0 gateway 10.10.100.254

```

- Check various Reachability .Here we check to Core Switch A

```

VPCS> ping 192.168.2.1

84 bytes from 192.168.2.1 icmp_seq=1 ttl=63 time=2.546 ms
84 bytes from 192.168.2.1 icmp_seq=2 ttl=63 time=5.527 ms
84 bytes from 192.168.2.1 icmp_seq=3 ttl=63 time=5.554 ms
84 bytes from 192.168.2.1 icmp_seq=4 ttl=63 time=5.539 ms
84 bytes from 192.168.2.1 icmp_seq=5 ttl=63 time=2.815 ms

```

- The reader can check further reachability as well as configure VPC2 to explore further.

End of lab

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.

Switch A

```
SwitchA#
!
!Version ArubaOS-CX Virtual.10.07.0010
!export-password: default
hostname SwitchA
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 lag 256
    no shutdown
    description to SwitchB
    ip address 192.168.4.8/31
    lacp mode active
    ip ospf 1 area 0.0.0.0
    no ip ospf passive
    ip ospf network point-to-point
interface 1/1/1
    no shutdown
    mtu 9198
    description core link
    lag 256
interface 1/1/2
    no shutdown
    mtu 9198
    description core link
    lag 256
interface 1/1/3
    no shutdown
    mtu 9198
    description to SwitchC
    ip address 192.168.4.0/31
    ip ospf 1 area 0.0.0.0
    no ip ospf passive
    ip ospf network point-to-point
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
    max-metric router-lsa on-startup
    passive-interface default
    graceful-restart restart-interval 300
    trap-enable
    area 0.0.0.0
https-server vrf mgmt
```

Switch B

```
SwitchB#
!Version ArubaOS-CX Virtual.10.07.0010
!export-password: default
hostname SwitchB
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 lag 256
    no shutdown
    description to SwitchA
    ip address 192.168.4.9/31
    lacp mode active
    ip ospf 1 area 0.0.0.0
    no ip ospf passive
    ip ospf network point-to-point
interface 1/1/1
    no shutdown
    mtu 9198
    description core link
    lag 256
interface 1/1/2
    no shutdown
    mtu 9198
    description core link
    lag 256
interface 1/1/3
    no shutdown
    mtu 9198
    description to SwitchC
    ip address 192.168.4.4/31
    ip ospf 1 area 0.0.0.0
    no ip ospf passive
    ip ospf network point-to-point
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
    max-metric router-lsa on-startup
    passive-interface default
    graceful-restart restart-interval 300
    trap-enable
    area 0.0.0.0
```

Switch C

```
SwitchC#
!
!Version ArubaOS-CX Virtual.10.07.0010
!export-password: default
hostname SwitchC
led locator on
ntp server pool.ntp.org minpoll 4 maxpoll 4 iburst
ntp enable
!
!
ssh server vrf mgmt
vlan 1,100,200
interface mgmt
    no shutdown
    ip dhcp
interface 1/1/1
    no shutdown
    mtu 9198
    description to SwitchA
    ip address 192.168.4.1/31
    ip ospf 1 area 0.0.0.0
    no ip ospf passive
    ip ospf network point-to-point
interface 1/1/2
    no shutdown
    mtu 9198
    description to SwitchB
```

```
ip address 192.168.4.5/31
ip ospf 1 area 0.0.0.0
no ip ospf passive
ip ospf network point-to-point
interface 1/1/8
no shutdown
no routing
vlan access 100
interface 1/1/9
no shutdown
no routing
vlan access 200
interface loopback 0
ip address 192.168.2.3/32
ip ospf 1 area 0.0.0.0
interface vlan 100
ip address 10.10.100.254/24
ip ospf 1 area 0.0.0.0
no ip ospf passive
interface vlan 200
ip address 10.10.200.254/24
ip ospf 1 area 0.0.0.0
no ip ospf passive
!
!
router ospf 1
router-id 192.168.2.3
max-metric router-lsa on-startup
passive-interface default
graceful-restart restart-interval 300
trap-enable
area 0.0.0.0
https-server vrf mgmt
```



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