LAB GUIDE

Campus Series Part I
2 Tier L2 Access & VSX

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

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 VSX switch such as 6400 in the Core with a single access switch at the edge such as the 6100

At the end of the lab you will be able to observe a typical Two Tier Campus with the Layer 2 at the access. All the layer 3 functions will be at the VSX Core with all VLANS trunked to the core, taking advantage of Multi Chassis LAG

Lab Network Layout

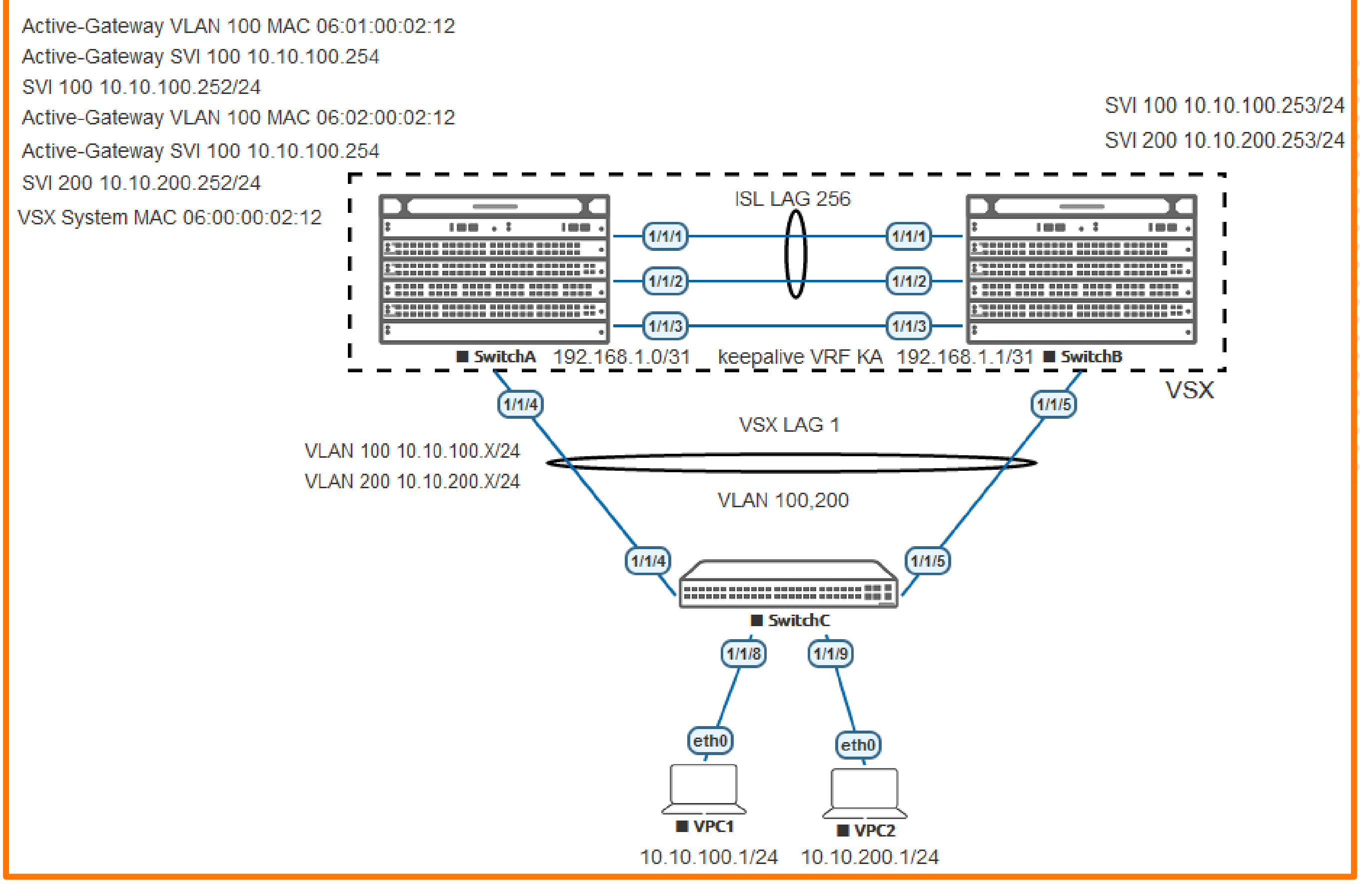

Figure 1. Lab topology

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. **Note**: Switch A is not used in this lab

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

- On **Switch A** bring up on 1/1/1-1/1/4:

```
int 1/1/1-1/1/4
    no shutdown
```

use `"exit"` to go back a level

- On **Switch B** bring up on 1/1/1-1/1/3 as well as 1/1/5

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

int 1/1/5
```

```
    no shutdown
```

- On **Switch C** bring up interface 1/1/4-1/1/5 and 1/1/8-1/1/9

```
int 1/1/4-1/1/5
    no shutdown
    exit

int 1/1/9-1/1/10
    no shutdown
    exit
```

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

```
SwitchA# show lldp neighbor-info

LLDP Neighbor Information
=========================

Total Neighbor Entries          : 4
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       08:00:09:6c:5c:9c  1/1/1                           1/1/1                         120      SwitchB
1/1/2       08:00:09:6c:5c:9c  1/1/2                           1/1/2                         120      SwitchB
1/1/3       08:00:09:6c:5c:9c  1/1/3                           1/1/3                         120      SwitchB
1/1/4       08:00:09:6e:7c:45  1/1/4                           1/1/4                         120      SwitchC
```

Task 2 - Configure VSX

On **Switch A and B** Core configure:

- ISL LAG on the collapsed Core

SwitchA#	**SwitchB#**
interface lag 256 no shutdown description ISL no routing vlan trunk allowed all lacp mode active int 1/1/1-1/1/2 mtu 9198 description ISL link lag 256	interface lag 256 no shutdown description ISL no routing vlan trunk allowed all lacp mode active int 1/1/1-1/1/2 mtu 9198 description ISL link lag 256

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

```
SwitchA#
show int lag 256

Aggregate lag256 is up
 Admin state is up
 Description : ISL
 MAC Address                 : 08:00:09:9a:af:68
 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
 VLAN Mode: native-untagged
 Native VLAN: 1
 Allowed VLAN List: all

 Statistic                           RX                  TX               Total
 ---------------- -------------------- -------------------- --------------------
 Packets                            174                 270                   0
   Unicast                            0                   0                   0
   Multicast                          0                   0                   0
   Broadcast                          0                   0                   0
 Bytes                            23210               35368                   0
 Jumbos                               0                   0                   0
 Dropped                              0                   0                   0
 Pause Frames                         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
```

```
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       Port  Port  State   System-ID         System Aggr Forwarding
           Name       Id    Pri                             Pri    Key  State
---------------------------------------------------------------------------------
1/1/1      lag256     2     1     ALFNCD  08:00:09:9a:af:68 65534  256  up
1/1/2      lag256     3     1     ALFNCD  08:00:09:9a:af:68 65534  256  up


Partner details of all interfaces:
---------------------------------------------------------------------------------
Intf       Aggr       Port  Port  State   System-ID         System Aggr
           Name       Id    Pri                             Pri    Key
---------------------------------------------------------------------------------
1/1/1      lag256     2     1     ALFNCD  08:00:09:6c:5c:9c 65534  256
1/1/2      lag256     3     1     ALFNCD  08:00:09:6c:5c:9c 65534  256
```

- Setup of VSX keep alive VRF named “KA”.

SwitchA#	**SwitchB#**
vrf KA exit int 1/1/3 vrf attach KA ip address 192.168.1.0/31 description VSX keepalive link	vrf KA exit int 1/1/3 vrf attach KA ip address 192.168.1.1/31 description VSX keepalive link

- Use VRF ping to check connectivity from Switch A i.e. `ping 192.168.1.1 vrf KA`
- Create the VSX configuration

SwitchA#	**SwitchB#**
vsx system-mac 06:00:00:00:02:12 inter-switch-link lag 256 role primary vsx-sync vsx-global	vsx inter-switch-link lag 256 role secondary

- Check VSX state, only Switch A is shown, the reader can also check Switch B

```
SwitchA#
show vsx status
VSX Operational State
---------------------
  ISL channel              : In-Sync
  ISL mgmt channel         : operational
  Config Sync Status       : In-Sync
  NAE                      : peer_reachable
  HTTPS Server             : peer_reachable

Attribute            Local                Peer
------------         --------             --------
ISL link             lag256               lag256
ISL version          2                    2
System MAC           06:00:00:00:02:12    06:00:00:00:02:12
Platform             X86-64               X86-64
```

```
Software Version    Virtual.10.07.0010  Virtual.10.07.0010
Device Role         primary             secondary
```

NOTE: Depending on the Aruba CX Simulator resources that have been allocated it can take a few seconds to be fully synced

- Setup of VSX keep alive for “split brain” protection.

SwitchA#	**SwitchB#**
vsx keepalive peer 192.168.1.1 source 192.168.1.0 vrf KA	vsx keepalive peer 192.168.1.0 source 192.168.1.1 vrf KA

- Check VSX Peer from both Switch A and B, only Switch A is shown, the reader can also check Switch B

```
SwitchA#
show vsx brief
ISL State                              : In-Sync
Device State                           : Peer-Established
Keepalive State                        : Keepalive-Established
Device Role                            : Primary
Number of Multi-chassis LAG interfaces : 0
```

- Sync the VSX parameters of your choice. Here we will do all possible on the Primary Switch A. Switch B should sync automatically.

  Note these protocols and services are not used and may not be supported in the AOS-CX simulator in this lab but can be used for the future and are configured for completeness

```
SwitchA#
vsx-sync aaa acl-log-timer arp-security bfd-global bgp control-plane-acls copp-policy dhcp-relay
dhcp-server dhcp-snooping dns evpn gbp hardware-high-capacity-tcam icmp-tcp keychain lldp loop-protect-
global  mac-lockout macsec mclag-interfaces mgmd-global nd-snooping ospf qos-global rip route-map
sflow-global snmp ssh static-routes stp-global time udp-forwarder vrrp
```

- Check the configuration on Switch B should have synced

```
SwitchB#

show run | begin vsx
vsx
    system-mac 06:00:00:00:02:12
    inter-switch-link lag 256
    role secondary
    keepalive peer 192.168.1.0 source 192.168.1.1 vrf KA
           vsx-sync aaa acl-log-timer arp-security bfd-global bgp control-plane-acls copp-policy dhcp-
       relay dhcp-server dhcp-snooping dns evpn gbp hardware-high-capacity-tcam icmp-tcp keychain lldp
       loop-protect-global mac-lockout macsec mclag-interfaces mgmd-global nd-snooping neighbor ospf
       qos-global rip route-map sflow-global snmp ssh static-routes stp-global time udp-forwarder vrrp
       vsx-global
```

- Add Vlans 100 and 200 as per Figure 1 on the Primary Switch A

```
SwitchA#
vlan 100,200
vsx-sync
```

- Check switch B that they have synced

```
SwitchB#
show vlan

--------------------------------------------------------------------------------------------------
VLAN  Name                          Status  Reason                  Type     Interfaces
--------------------------------------------------------------------------------------------------
1     DEFAULT_VLAN_1                up      ok                      default  lag256
100   VLAN100                       up      ok                      static   lag256
200   VLAN200                       up      ok                      static   lag256
```

- Setup of MCLAG on the VSX Switches

SwitchA#	SwitchB#
interface lag 1 multi-chassis description SwitchC VSX-MCLAG no shutdown vlan trunk allowed 100,200 lacp mode active int 1/1/4 no routing description to SwitchC lag 1	interface lag 1 multi-chassis no shutdown int 1/1/5 no routing description to SwitchC lag 1

NOTE: For best practice it is recommended to enable spanning tree for rouge protection. However, due to a limitation in the AOS-CX simulator this will not be configured in this lab. Please refer to VSX best practice guide https://support.hpe.com/hpesc/public/docDisplay?docId=a00094242en_us for inclusion of spanning tree in a VSX configuration

Task 3 – Access Switch LAG

On **Switch C** L2 Access configure :

- Vlan 100,200
- LAG to Switch A and B

```
SwitchC#
vlan 100,200
exit
int lag 1
no shut
no routing
vlan trunk allowed 100,200
lacp mode active
int 1/1/4-1/1/5
lag 1
int 1/1/4
description to SwitchA
int 1/1/5
description to SwitchB
```

- Validate LAG. Switch C is shown here, the reader can also check Switch A and B

```
SwitchC

show interface lag 1

Aggregate lag1 is up
 Admin state is up
 Description :
 MAC Address                  : 08:00:09:6e:7c:45
 Aggregated-interfaces        : 1/1/4 1/1/5
 Aggregation-key              : 1
 Aggregate mode               : active
 Speed                        : 2000 Mb/s
 L3 Counters: Rx Disabled, Tx Disabled
 qos trust none
 VLAN Mode: native-untagged
 Native VLAN: 1
 Allowed VLAN List: 100,200

 Statistic                        RX                   TX                Total
 ---------------- -------------------- -------------------- --------------------
 Packets                         547                  517                    0
   Unicast                         0                    0                    0
```

```
   Multicast                    0                 0                 0
   Broadcast                    0                 0                 0
 Bytes                      74043             70099                 0
 Jumbos                         0                 0                 0
 Dropped                        0                 0                 0
 Pause Frames                   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
```

```
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       Port  Port  State   System-ID         System Aggr Forwarding
           Name       Id    Pri                             Pri    Key  State
----------------------------------------------------------------------------------
1/1/4      lag1       5     1     ALFNCD  08:00:09:6e:7c:45 65534  1    up
1/1/5      lag1       6     1     ALFNCD  08:00:09:6e:7c:45 65534  1    up


Partner details of all interfaces:
----------------------------------------------------------------------------------
Intf       Aggr       Port  Port  State   System-ID         System Aggr
           Name       Id    Pri                             Pri    Key
----------------------------------------------------------------------------------
1/1/4      lag1       4     1     ALFNCD  06:00:00:00:02:12 65534  1
1/1/5      lag1       1005  1     ALFNCD  06:00:00:00:02:12 65534  1
```

- A multi chassis lag check can also be carried out from the VSX core too, as a useful view from the Core perspective

```
SwitchA#
show lacp interfaces multi-chassis

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       Aggregate  Port    Port     State   System-ID         System   Aggr
           name       id      Priority                           Priority Key
----------------------------------------------------------------------------------
1/1/4      lag1(mc)   4       1        ALFNCD  06:00:00:00:02:12 65534    1


Partner details of all interfaces:
----------------------------------------------------------------------------------
```

```
Intf      Aggregate  Partner Port     State   System-ID         System   Aggr
          name       Port-id Priority                           Priority Key
--------------------------------------------------------------------------------
1/1/4     lag1(mc)   5       1        ALFNCD  08:00:09:6e:7c:45 65534    1


Remote Actor details of all interfaces:
--------------------------------------------------------------------------------
Intf      Aggregate  Port    Port     State   System-ID         System   Aggr
          name       id      Priority                           Priority Key
--------------------------------------------------------------------------------
1/1/5     lag1(mc)   1005    1        ALFNCD  06:00:00:00:02:12 65534    1


Remote Partner details of all interfaces:
--------------------------------------------------------------------------------
Intf      Aggregate  Partner Port     State   System-ID         System   Aggr
          name       Port-id Priority                           Priority Key
--------------------------------------------------------------------------------
1/1/5     lag1(mc)   6       1        ALFNCD  08:00:09:6e:7c:45 65534    1
```

Task 4 – Access Switch port VLANs

On **Switch C** L2 Access configure :

- Access port VLANs
- Port 1/1/8 in VLAN 100 and Port 1/1/9 VLAN 200

```
SwitchC# configure
int 1/1/8-1/1/9
no shutdown
no routing
int 1/1/8
vlan access  100
int 1/1/9
vlan access 200
```

Task 5 – VPC set up

Set up VPCs as in Figure 1 : power up and configure:

- On 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
```

- On VPC2

```
VPCS> ip 10.10.200.1/24 10.10.200.254
Checking for duplicate address...
PC1 : 10.10.200.1 255.255.255.0 gateway 10.10.200.254
```

Task 6 – VSX Active Gateway

At this stage the Access and Core switches have Layer 2 connectivity. However, hosts only have a Layer 2 ethernet connection and Layer 3 default gateway for hosts to communicate at Layer 3 is not available right now. As we are using VSX we can deploy a single Next Hop across the fabric. Eliminating the requirement of Next Hop protocols such as VRRP. **Note:** VRRP can still be deployed in VSX fabric depending of the network requirements not covered in this lab.

- Setup of Active Gateway for both VLAN 100 and 200 on VSX Core

SwitchA#	SwitchB#
interface vlan 100 vsx-sync active-gateways ip mtu 9100 ip address 10.10.100.252/24 active-gateway ip mac 06:01:00:00:02:12 active-gateway ip 10.10.100.254 interface vlan 200 vsx-sync active-gateways ip mtu 9100 ip address 10.10.200.252/24 active-gateway ip mac 06:02:00:00:02:12 active-gateway ip 10.10.200.254	interface vlan 100 ip mtu 9100 ip address 10.10.100.253/24 interface vlan 200 ip mtu 9100 ip address 10.10.200.253/24

NOTE: The best practice for active-gateway VMAC is to use the same VMAC for all IPv4 SVI active-gateways. The scope of this VMAC is purely link-local. However, due to a limitation in the AOS-CX simulator with the Virtual PCs (VPC) each VMAC will be configured differently. For further information on VSX and VMAC for active gateway please refer to the best practice guide at https://support.hpe.com/hpesc/public/docDisplay?docId=a00094242en_us

Task 7 – Test User Connectivity from Virtual PC (VPC)

- From VPC1 ping the local default gateway (the active gateway for the subnet)

```
VPCS> ping 10.10.100.254

84 bytes from 10.10.100.254 icmp_seq=1 ttl=64 time=8.555 ms
84 bytes from 10.10.100.254 icmp_seq=2 ttl=64 time=8.991 ms
84 bytes from 10.10.100.254 icmp_seq=3 ttl=64 time=10.830 ms
84 bytes from 10.10.100.254 icmp_seq=4 ttl=64 time=41.927 ms
84 bytes from 10.10.100.254 icmp_seq=5 ttl=64 time=3.985 ms

VPCS>
```

- From VPC1 ping the other VPC2

```
VPCS> ping 10.10.200.1

84 bytes from 10.10.200.1 icmp_seq=1 ttl=63 time=24.791 ms
84 bytes from 10.10.200.1 icmp_seq=2 ttl=63 time=7.151 ms
84 bytes from 10.10.200.1 icmp_seq=3 ttl=63 time=8.739 ms
84 bytes from 10.10.200.1 icmp_seq=4 ttl=63 time=6.554 ms
84 bytes from 10.10.200.1 icmp_seq=5 ttl=63 time=6.310 ms
```

- The above connectivity is possible as both subnets are directly connected to the VSX Fabric
- The reader can test from VPC2 as required.

The basic 2 tier campus from a reachability perspective is now complete

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#
Current configuration:
!
!Version ArubaOS-CX Virtual.10.07.0010
!export-password: default
hostname SwitchA
vrf KA
ntp server pool.ntp.org minpoll 4 maxpoll 4 iburst
ntp enable
!
!
!
ssh server vrf mgmt
vlan 1
vlan 100
    vsx-sync
vlan 200
    vsx-sync
interface mgmt
    no shutdown
    ip dhcp
interface lag 1 multi-chassis
    no shutdown
    description SwitchC VSX-MCLAG
    no routing
    vlan trunk native 1
    vlan trunk allowed 100,200
    lacp mode active
interface lag 256
    no shutdown
    description ISL
    no routing
    vlan trunk native 1
    vlan trunk allowed all
    lacp mode active
interface 1/1/1
    no shutdown
    mtu 9198
    description ISL link
    lag 256
interface 1/1/2
    no shutdown
    mtu 9198
    description ISL link
    lag 256
interface 1/1/3
    no shutdown
    vrf attach KA
    description VSX keepalive link
    ip address 192.168.1.0/31
interface 1/1/4
    no shutdown
    description to SwitchC
    lag 1
interface vlan 100
    vsx-sync active-gateways
    ip mtu 9100
    ip address 10.10.100.252/24
    active-gateway ip mac 06:01:00:00:02:12
    active-gateway ip 10.10.100.254
interface vlan 200
    vsx-sync active-gateways
    ip mtu 9100
    ip address 10.10.200.252/24
    active-gateway ip mac 06:02:00:00:02:12
    active-gateway ip 10.10.200.254
vsx
```

```
    system-mac 06:00:00:00:02:12
    inter-switch-link lag 256
    role primary
    keepalive peer 192.168.1.1 source 192.168.1.0 vrf KA
    vsx-sync aaa acl-log-timer arp-security bfd-global bgp control-plane-acls copp-policy dhcp-relay dhcp-server dhcp-snooping dns evpn gbp hardware-high-capacity-tcam icmp-tcp keychain lldp loop-protect-global mac-lockout macsec mclag-interfaces mgmd-global nd-snooping neighbor ospf qos-global rip route-map sflow-global snmp ssh static-routes stp-global time udp-forwarder vrrp vsx-global
!
!
https-server vrf mgmt
SwitchA#
```

Switch B

```
SwitchB#
Current configuration:
!
!Version ArubaOS-CX Virtual.10.07.0010
!export-password: default
hostname SwitchB
vrf KA
ntp server pool.ntp.org minpoll 4 maxpoll 4 iburst
ntp enable
!
!
!
ssh server vrf mgmt
vlan 1
vlan 100
    vsx-sync
vlan 200
    vsx-sync
interface mgmt
    no shutdown
    ip dhcp
interface lag 1 multi-chassis
    no shutdown
    description SwitchC VSX-MCLAG
    no routing
    vlan trunk native 1
    vlan trunk allowed 100,200
    lacp mode active
interface lag 256
    no shutdown
    description ISL
    no routing
    vlan trunk native 1
    vlan trunk allowed all
    lacp mode active
interface 1/1/1
    no shutdown
    mtu 9198
    description ISL link
    lag 256
interface 1/1/2
    no shutdown
    mtu 9198
    description ISL link
    lag 256
interface 1/1/3
    no shutdown
    vrf attach KA
    description VSX keepalive link
    ip address 192.168.1.1/31
interface 1/1/5
    no shutdown
    description to SwitchC
    lag 1
interface vlan 100
    vsx-sync active-gateways
    ip mtu 9100
    ip address 10.10.100.253/24
    active-gateway ip mac 06:01:00:00:02:12
    active-gateway ip 10.10.100.254
interface vlan 200
    vsx-sync active-gateways
    ip mtu 9100
    ip address 10.10.200.253/24
```

```
    active-gateway ip mac 06:02:00:00:02:12
    active-gateway ip 10.10.200.254
vsx
    system-mac 06:00:00:00:02:12
    inter-switch-link lag 256
    role secondary
    keepalive peer 192.168.1.0 source 192.168.1.1 vrf KA
    vsx-sync aaa acl-log-timer arp-security bfd-global bgp control-plane-acls copp-policy dhcp-relay
dhcp-server dhcp-snooping dns evpn gbp hardware-high-capacity-tcam icmp-tcp keychain lldp loop-protect-
global mac-lockout macsec mclag-interfaces mgmd-global nd-snooping neighbor ospf qos-global rip route-
map sflow-global snmp ssh static-routes stp-global time udp-forwarder vrrp vsx-global
!
!
https-server vrf mgmt
SwitchB(config)#
```

Switch C

```
SwitchC#
Current configuration:
!
!Version ArubaOS-CX Virtual.10.07.0010
!export-password: default
hostname SwitchC
ntp server pool.ntp.org minpoll 4 maxpoll 4 iburst
ntp enable
!
!
!
ssh server vrf mgmt
vlan 1-2,100,200
interface mgmt
    no shutdown
    ip dhcp
interface lag 1
    no shutdown
    no routing
    vlan trunk native 1
    vlan trunk allowed 100,200
    lacp mode active
interface 1/1/4
    no shutdown
    description to SwitchA
    lag 1
interface 1/1/5
    no shutdown
    description to SwitchB
    lag 1
interface 1/1/8
    no shutdown
    no routing
    vlan access 100
interface 1/1/9
    no shutdown
    no routing
    vlan access 200
!
!
https-server vrf mgmt
SwitchC#
```

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