CUMULUS LINUX BOOTCAMP: LAB GUIDE

Scope

This workbook covers configuration of network protocols on Cumulus Linux Network Operating System.

Audience

This workbook is intended for Technical Training students.

Objectives

By the end of this workbook, students will be able to:

- Configure basic switch functions with Cumulus Linux
- Configure layer 2 and layer 3 protocols with Cumulus Linux
- Verify configuration and connectivity
- Monitor and troubleshoot networking related connectivity issues

Overview

Each student will be using the Cumulus Air © platform, exercises in this workbook on a group of devices (servers and switches).

Notice

Please follow the instructions below carefully to successfully complete the practice.
If you encounter technical issues, please contact the Nvidia Networking Academy team: nbu-academy-support@nvidia.com

Release Date

Revision 2.2 – November 2020

Good Luck,

Nvidia Networking Academy team

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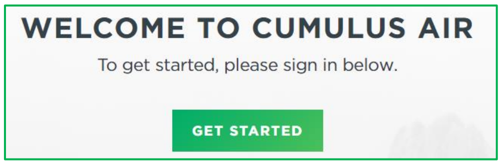
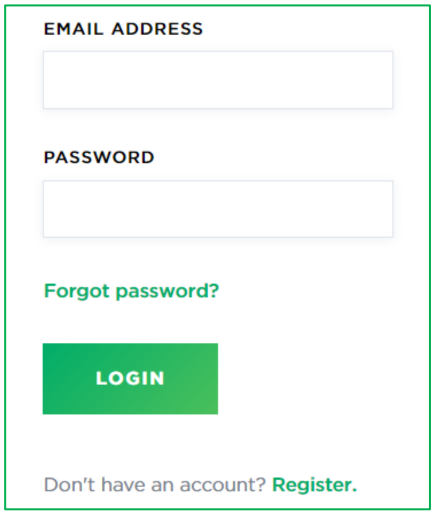
PREREQUISITES AND GUIDELINES

Please perform and review the following steps before you start:

1. Enter the Cumulus Air web page : https://air.cumulusnetworks.com/Login
   Click "GET STARTED" button.

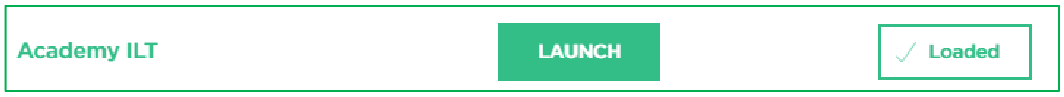


- If you have already created an account, use your credentials to Login.
- To sign up for the first time, click "Register" and fill in your details.
  Once completed, a confirmation email will be sent, open it to activate your new account.



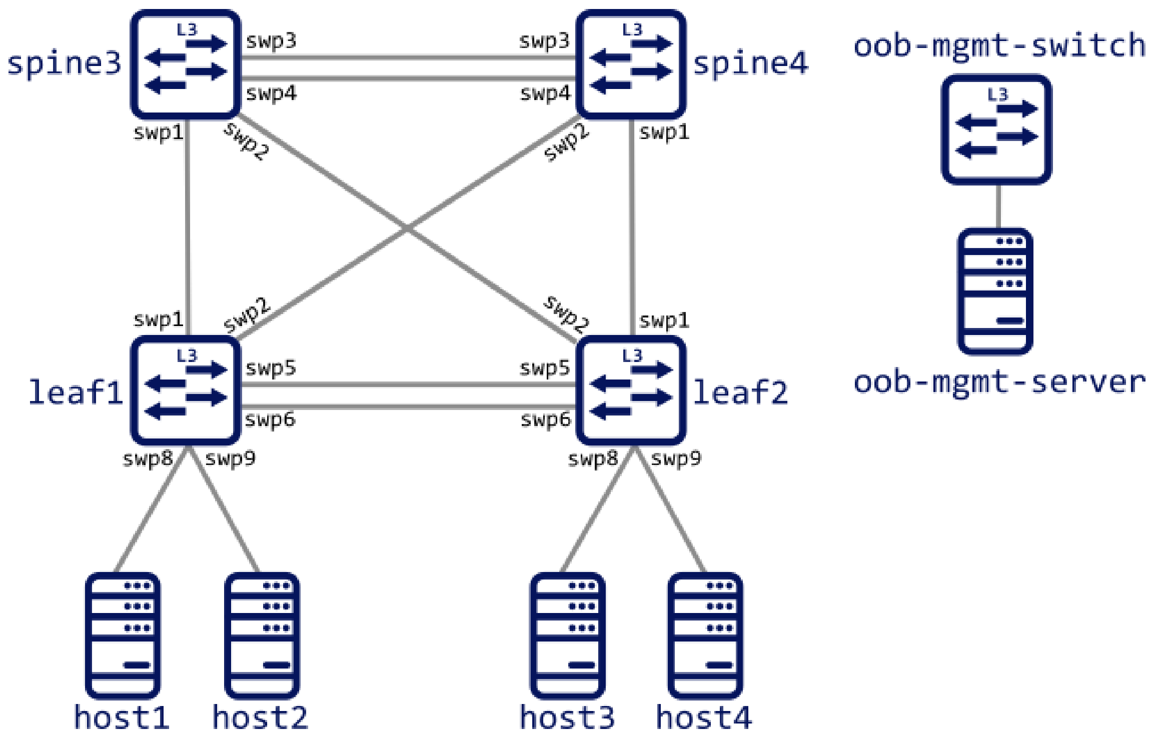
2. Once you are logged in, you will reach the **"Cumulus in The Cloud"** dashboard.
   Wait for the lab to be Loaded.

3. Click on the "Academy ILT" label.



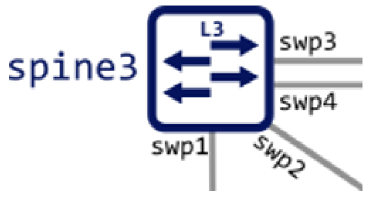
ACADEMY LAB TOPOLOGY

The training lab is organized in the following topology:

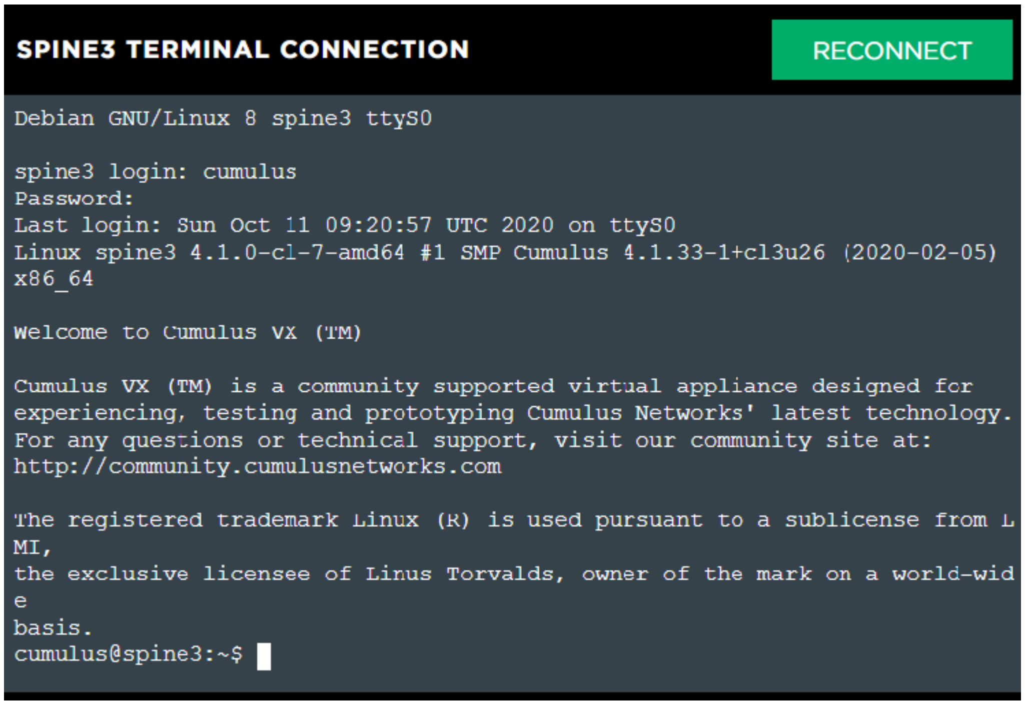


ACADEMY LAB ACCESS

Click on a NODE to open its console



1. When the login prompt appears, enter the username – "**`cumulus`**"
2. When the password prompt appears, enter the password – "Academy123" and press Enter.
3. You should now be prompted with the node's name. This indicates that you have successfully accessed the node.



```
Debian GNU/Linux 8 spine3 ttyS0

spine3 login: cumulus
Password:
Last login: Sun Oct 11 09:20:57 UTC 2020 on ttyS0
Linux spine3 4.1.0-cl-7-amd64 #1 SMP Cumulus 4.1.33-1+cl3u26 (2020-02-05)
x86_64

Welcome to Cumulus VX (TM)

Cumulus VX (TM) is a community supported virtual appliance designed for
experiencing, testing and prototyping Cumulus Networks' latest technology.
For any questions or technical support, visit our community site at:
http://community.cumulusnetworks.com

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MI,
the exclusive licensee of Linus Torvalds, owner of the mark on a world-wid
e
basis.
cumulus@spine3:~$
```

PRACTICE 1: USING THE NCLU

Practice Objectives:

In this practice session you will become familiar with the Cumulus Linux NCLU:

- You will use '**net add**' and '**net del**' commands to change the configuration
- You will use '**net commit**' command to apply configuration changes
- You will use '**net show**' commands to validate the configuration
- Last, you will use '**net rollback**' command to roll back to a previous configuration

Task 1: Retrieve system information

a. Identify the switch image version:
# net show system

```
cumulus@spine3:mgmt:~$ net show system
Hostname......... spine3
Build............ Cumulus Linux 4.2.0
Uptime........... 1:18:20.020000
Model............ Cumulus VX
Memory........... 922MB
Vendor Name...... Cumulus Networks
Part Number...... 4.2.0
Base MAC Address. 44:38:39:00:00:20
Serial Number.... 44:38:39:00:00:20
Product Name..... VX
```

Task 2: Configure the switch with NCLU

b. Display the switch ports:

# net show interface

```
cumulus@spine3:mgmt:~$ net show interface
State  Name   Spd  MTU    Mode      LLDP                    Summary
-----  ----   ---  -----  --------  ----------------------  --------------------------
UP     lo     N/A  65536  Loopback                          IP: 127.0.0.1/8
       lo                                                   IP: ::1/128
UP     eth0   1G   1500   Mgmt      oob-mgmt-switch (swp4)  Master: mgmt(UP)
       eth0                                                 IP: 192.168.200.5/24(DHCP)
UP     mgmt   N/A  65536  VRF                               IP: 127.0.0.1/8
```

c. Bring up the switch ports:
  - On the spine switches bring up **swp1-4**.

```
# net add interface swp1-4
# net commit
```

```
cumulus@spine3:mgmt:~$ net add interface swp1-4
cumulus@spine3:mgmt:~$ net commit

cumulus@spine3:mgmt:~$ net show interface
State  Name  Spd  MTU    Mode      LLDP                    Summary
-----  ----  ---  -----  --------  ----------------------  --------------------------
UP     lo    N/A  65536  Loopback                          IP: 127.0.0.1/8
       lo                                                  IP: ::1/128
UP     eth0  1G   1500   Mgmt      oob-mgmt-switch (swp4)  Master: mgmt(UP)
       eth0                                                IP: 192.168.200.5/24(DHCP)
UP     swp1  1G   9216   Default
UP     swp2  1G   9216   Default
UP     swp3  1G   9216   Default
UP     swp4  1G   9216   Default
UP     mgmt  N/A  65536  VRF                               IP: 127.0.0.1/8
```

  - On the leaf switches bring up ports **swp1-2,5-6,8-9**

```
# net add interface swp1-2,5-6,8-9
# net commit
```

```
cumulus@leaf2:mgmt:~$ net add int swp1-2,5-6,8-9
cumulus@leaf2:mgmt:~$ net commit

cumulus@leaf2:mgmt:~$ net show interface
State  Name  Spd  MTU    Mode      LLDP                    Summary
-----  ----  ---  -----  --------  ----------------------  --------------------------
UP     lo    N/A  65536  Loopback                          IP: 127.0.0.1/8
       lo                                                  IP: ::1/128
UP     eth0  1G   1500   Mgmt      oob-mgmt-switch (swp3)  Master: mgmt(UP)
       eth0                                                IP: 192.168.200.4/24(DHCP)
UP     swp1  1G   9216   Default   spine4 (swp1)
UP     swp2  1G   9216   Default   spine3 (swp2)
UP     swp5  1G   9216   Default   leaf1 (swp5)
UP     swp6  1G   9216   Default   leaf1 (swp6)
UP     swp8  1G   9216   Default
UP     swp9  1G   9216   Default
UP     mgmt  N/A  65536  VRF                               IP: 127.0.0.1/8
```

d. On switch **leaf1** add an alias to each of the interfaces which are part of the lab topology. The alias should describe the device which is connected to the interface. For example:

- Interface **swp8** is connected to server **host1**
- Interface **swp1** is connected to switch **spine3**

# net add interface *<INTERFACE>* alias *<TEXT>*

```
cumulus@leaf1:mgmt:~$ net add interface swp8 alias Connected to host1:Eth2
cumulus@leaf1:mgmt:~$ net add interface swp1 alias Connected to spine3:swp1
```

e. View the changes in the commit buffer:

# net pending

```
cumulus@leaf1:mgmt:~$ net pending

 auto swp1
 iface swp1
+    alias Connected to spine3:swp1

 auto swp8
 iface swp8
+    alias Connected to host1:Eth2
```

f. Commit the changes with a custom description:

# net commit description *<TEXT>*

```
cumulus@leaf1:mgmt:~$ net commit description Practice-1

 auto swp1
 iface swp1
+    alias Connected to spine3:swp1


 auto swp8
 iface swp8
+    alias Connected to host1:Eth2


net add/del commands since the last "net commit"
================================================

User     Timestamp                   Command
-------  --------------------------  -------------------------------------------------
cumulus  2020-10-11 09:52:20.747134  net add interface swp8 alias Connected to host1:Eth2
cumulus  2020-10-11 09:52:30.206711  net add interface swp1 alias Connected to spine3:swp1
```

g. View the NCLU commit history:
# net show commit history

```
cumulus@leaf1:mgmt:~$ net show commit history
#  Date                 Description
-  -------------------  --------------------------------
3  2020-10-11 09:43:46  nclu "net commit" (user cumulus)
5  2020-10-11 09:57:55  nclu Practice-1
```

Task 3: Rollback the Configuration

a. Rollback to the last commit:
# net rollback last

```
cumulus@leaf1:mgmt:~$ net rollback last
```

b. Verify rollback was applied successfully:
# net show configuration

```
cumulus@leaf1:mgmt:~$ net show configuration
<output omitted>
interface swp1
interface swp8
```

Please note:

- At this point all configuration is deleted because the configuration has been reverted to a point before any configuration existed.
- Alternatively, you can roll back to any commit by referencing the unique commit number or description.

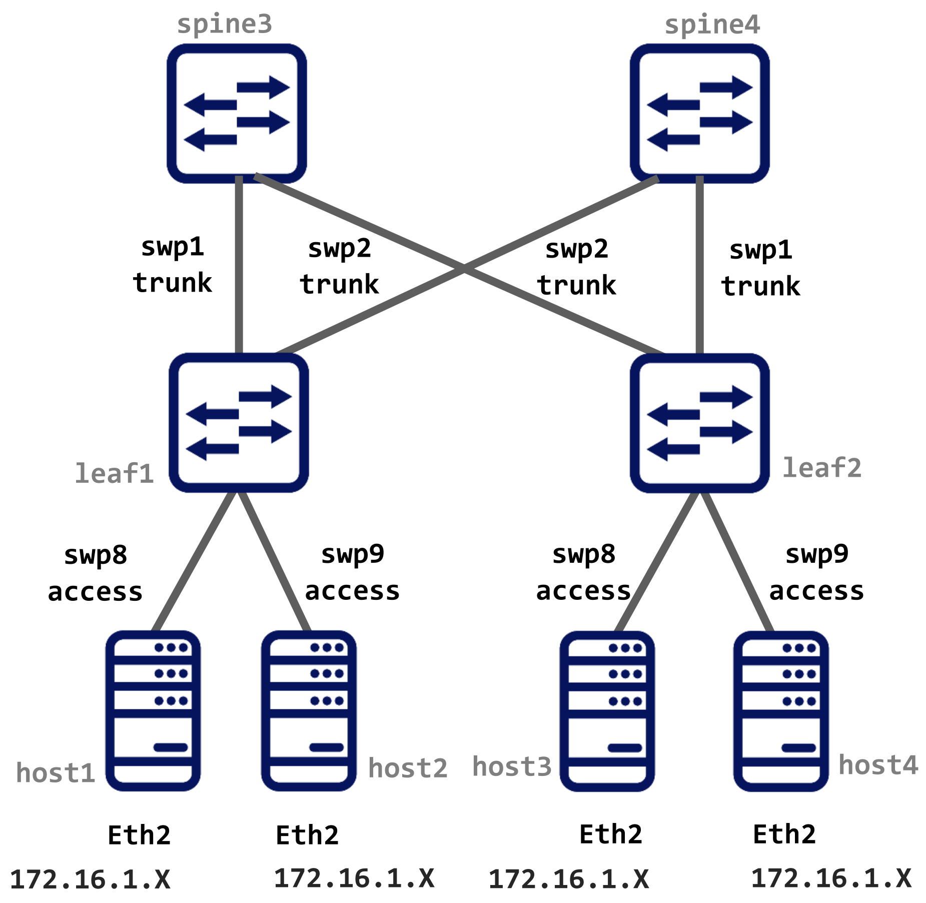
PRACTICE 2: BASIC SWITCH FUNCTIONS

Practice Objectives:

In this practice session you will verify IP connectivity between servers in the lab.

- You will configure the servers IP settings – an IP address, a subnet mask and a default gateway.
- You will configure a bridge on each of the Cumulus Linux switches and add switch ports to the bridge.
- You will use **'ping'** utility to verify communication between servers in your group.
- Last, you will observe how the switch forwarding database – the MAC address table – is built and maintained.

Topology Used in this Practice:



Task 1: Configure Servers IP Settings

a. Access the servers and check interface **’eth2’** IP settings:
# ifconfig *<DEV>*

```
cumulus@host1:~$ ifconfig eth2
eth2: flags=4098<BROADCAST,MULTICAST>  mtu 1500
        ether 44:38:39:00:00:11  txqueuelen 1000  (Ethernet)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

b. Configure an IP address and a subnet mask for interface **’eth2’**.
Use the following table for IP address assignment.
Use **/24** as the subnet mask.

Practice Lab Servers Properties

Server	‘eth2’ IP Address
host1	172.16.1.1
host2	172.16.1.2
host3	172.16.1.3
host4	172.16.1.4

# ifconfig *<DEV> <IP/MASK>*

```
cumulus@host1:~$ sudo ifconfig eth2 0.0.0.0
cumulus@host1:~$ sudo ifconfig eth2 172.16.1.1/24
cumulus@host1:~$ ifconfig eth2
eth2: flags=4098<BROADCAST,MULTICAST>  mtu 1500
        ether 44:38:39:00:00:11  txqueuelen 1000  (Ethernet)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
```

c. Verify a static route entry to **172.16.0.0/16** via interface **'eth2'**:

# route

```
cumulus@host1:~$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         _gateway        0.0.0.0         UG    0      0        0 eth0
172.16.1.0      0.0.0.0         255.255.255.0   U     0      0        0 eth2
192.168.200.0   0.0.0.0         255.255.255.0   U     0      0        0 eth0
```

- If the static route is missing, add it:

# ip route add *<ADDRESS/MASK>* dev *<DEV>*

```
cumulus@host1:~$ sudo ip route add 172.16.0.0/16 dev eth2
```

```
cumulus@host1:~$ sudo ip route add 172.16.0.0/16 dev eth2
cumulus@host1:~$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         _gateway        0.0.0.0         UG    0      0        0 eth0
172.16.0.0      0.0.0.0         255.255.0.0     U     0      0        0 eth2
172.16.1.0      0.0.0.0         255.255.255.0   U     0      0        0 eth2
192.168.200.0   0.0.0.0         255.255.255.0   U     0      0        0 eth0
```

Task 2: Configure a Bridge

a. Access the switches and reset configuration:

# net del all
# net commit

```
cumulus@leaf1:mgmt:~$ net del all
cumulus@leaf1:mgmt:~$ net commit
```

b. On all four switches – leaves and spines - create a bridge and set the inter switch links (**swp1** and **swp2**) as trunk ports:

# net add bridge bridge ports *<PORTS>*

```
cumulus@leaf1:mgmt:~$ net add bridge bridge ports swp1-2
```

c. On the leaf switches only – leaf1 and leaf2 - set the host-facing ports, swp8 and swp9, as access ports in VLAN 1:

# net add interface *<PORTS>* bridge access *<VLAN-ID>*

```
cumulus@leaf1:mgmt:~$ net add bridge bridge ports swp8-9
cumulus@leaf1:mgmt:~$ net add interface swp8-9 bridge access 1
```

d. Commit changes:
# net commit

```
cumulus@leaf1:mgmt:~$ net commit
```

e. Verify configuration:
# net show configuration

```
cumulus@leaf1:mgmt:~$  net show configuration

interface swp8
  bridge-access 1

interface swp9
  bridge-access 1

interface bridge
  bridge-ports swp1 swp2 swp8 swp9
  bridge-vids 1
  bridge-vlan-aware yes
```

f. Verify interfaces status:
# net show interface

```
cumulus@leaf1:mgmt:~$ net show interface
State  Name    Spd  MTU    Mode       LLDP                        Summary
-----  ------  ---  -----  ---------  --------------------------  --------------------------
UP     lo      N/A  65536  Loopback                               IP: 127.0.0.1/8
       lo                                                         IP: ::1/128
UP     eth0    1G   1500   Mgmt       oob-mgmt-switch (swp2)      Master: mgmt(UP)
       eth0                                                       IP: 192.168.200.3/24(DHCP)
UP     swp1    1G   9216   Access/L2  spine3 (swp1)               Master: bridge(UP)
UP     swp2    1G   9216   Access/L2  spine4 (swp2)               Master: bridge(UP)
UP     swp8    1G   9216   Access/L2  host1 (44:38:39:00:00:11)   Master: bridge(UP)
UP     swp9    1G   9216   Access/L2                              Master: bridge(UP)
UP     bridge  N/A  9216   Bridge/L2
UP     mgmt    N/A  65536  VRF                                    IP: 127.0.0.1/8
```

Please note:

Even though **swp1-2** were configured in 'trunk' mode, they are displayed in the output in 'Access' mode. The reason is that currently only VLAN1 is configured and no frames are sent tagged over those ports.
Once you configure additional VLANs, those ports will be displayed in 'trunk' mode indicating they are tagging frames.

Task 3: Observe a Switch's Forwarding Database

a. Identify the MAC addresses of all four servers in your group.

```
cumulus@host1:~$ ifconfig eth2
eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.16.1.1  netmask 255.255.255.0  broadcast 172.16.1.255
        inet6 fe80::4638:39ff:fe00:11  prefixlen 64  scopeid 0x20<link>
        ether 44:38:39:00:00:11  txqueuelen 1000  (Ethernet)
        RX packets 1159  bytes 79499 (79.4 KB)
        RX errors 0  dropped 182  overruns 0  frame 0
        TX packets 71  bytes 13388 (13.3 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

Fill in the table with the MAC addresses of 'eth2' interfaces of the servers:

Server	MAC address of interface 'eth2'

b. Use '**ping**' from one server to another server in the lab.
For example, ping from server **host1** to server **host3**.

```
cumulus@host1:~$ ping 172.16.1.3
PING 172.16.1.3 (172.16.1.3) 56(84) bytes of data.
64 bytes from 172.16.1.3: icmp_seq=1 ttl=64 time=2.99 ms
64 bytes from 172.16.1.3: icmp_seq=2 ttl=64 time=2.28 ms
```

c. Display the switch's MAC address table. Identify on which switch ports the servers' MAC addresses were learned?
# net show bridge macs

```
cumulus@leaf2:mgmt:~$ net show bridge macs

VLAN      Master  Interface  MAC                TunnelDest  State      Flags  LastSeen
--------  ------  ---------  -----------------  ----------  ---------  -----  --------
1         bridge  swp1       44:38:39:00:00:09                                00:00:15
1         bridge  swp2       44:38:39:00:00:07                                00:00:01
1         bridge  swp2       44:38:39:00:00:11                                00:01:29
1         bridge  swp8       44:38:39:00:00:15                                00:00:23
```

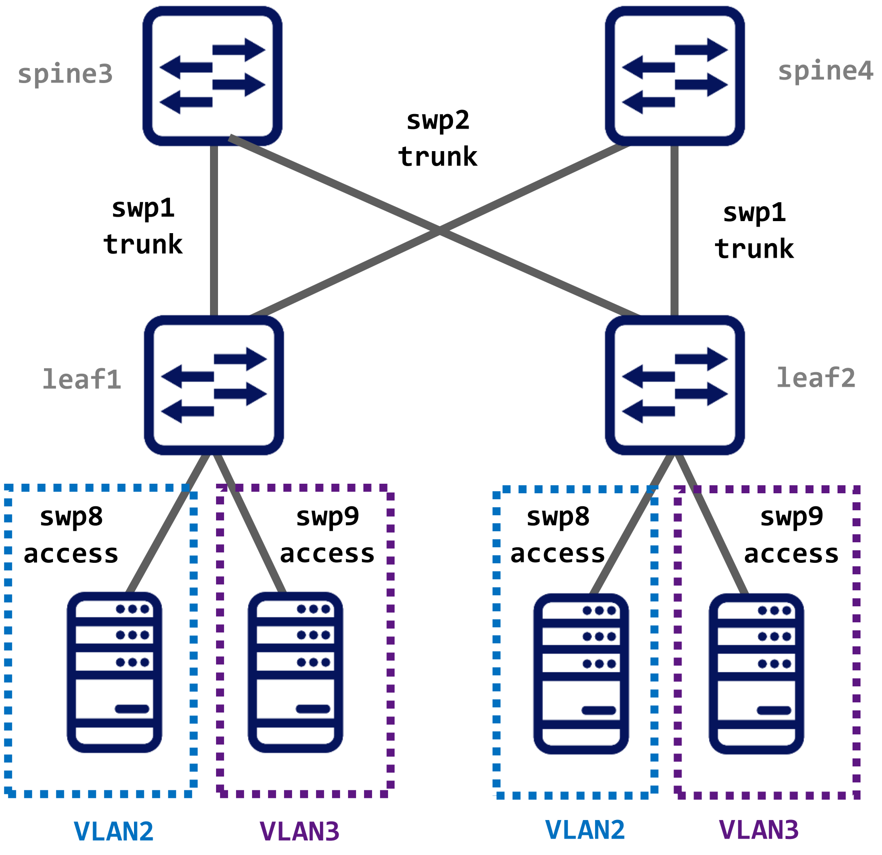
PRACTICE 3: VLANs AND TRUNKING

Practice Objectives:

In this practice session you will configure and verify VLANs and trunking:

- You will configure two new VLANs and assign switch ports connected to servers to the configured VLANs.
- You will configure SVIs to allow inter-VLAN communication.

Topology Used in this Lab:



Task 1: Configuring VLANs and Trunking

a. Access the switch that was assigned to you and reset configuration:

# net del all
# net commit

```
cumulus@leaf1:mgmt:~$ net del all
cumulus@leaf1:mgmt:~$ net commit
```

b. On all four switches – spines and leaves - create a bridge and set the inter switch links, **swp1** and **swp2**, as trunk ports:
# net add bridge bridge ports *<PORTS>*

```
cumulus@leaf1:mgmt:~$ net add bridge bridge ports swp1-2
```

c. On all four switches – spines and leaves - add VLANs 2-3 to the bridge:

```
cumulus@leaf1:mgmt:~$ net add bridge bridge vids 2,3
```

d. On leaf switches only **leaf1** and **leaf2** set the host-facing ports, swp8 and swp9, as access ports and associate them to the appropriate VLAN:
interface **swp8** in **VLAN2** and interface **swp9** in **VLAN3**
# net add interface *<PORTS>* bridge access *<VLAN-ID>*

```
cumulus@leaf1:mgmt:~$ net add bridge bridge ports swp8-9
cumulus@leaf1:mgmt:~$ net add interface swp8 bridge access 2
cumulus@leaf1:mgmt:~$ net add interface swp9 bridge access 3
```

e. Commit changes:

```
cumulus@leaf1:mgmt:~$ net commit
```

f. Verify configuration:

```
cumulus@leaf1:mgmt:~$ net show configuration

interface swp8
  bridge-access 2

interface swp9
  bridge-access 3

interface bridge
  bridge-ports swp1 swp2 swp8 swp9
  bridge-vids 1-3
  bridge-vlan-aware yes
```

g. Verify VLANs configuration:

`# net show bridge vlan`

```
cumulus@leaf1:mgmt:~$ net show bridge vlan

Interface  VLAN  Flags
---------  ----  ---------------------
swp1       1     PVID, Egress Untagged
           2-3   []
swp2       1     PVID, Egress Untagged
           2-3   []
swp8       2     PVID, Egress Untagged
swp9       3     PVID, Egress Untagged
```

Please note:

- Access ports are shown with a single line representing the VLAN associated to the port.
- Trunk ports are shown with multiple lines representing the VLANs associated with the trunk port.

Task 2: Servers' IP settings

Access the servers and configure an IP address for interface **'eth2'** according to the table below.

Servers in the same VLAN will be configured with IP addresses in the same subnet, hence they will be able to communicate over the layer 2 network.

VLAN ID	Server	'eth2' IP Address
VLAN 2	host1	172.16.2.18/24
VLAN 3	host2	172.16.3.19/24
VLAN 2	host3	172.16.2.28/24
VLAN 3	host4	172.16.3.29/24

a. Configure the server's IP address and subnet mask:

- Clear existing IP configuration:

  # ifconfig eth2 0.0.0.0

- Configure an IP address and a subnet mask:

  # ifconfig eth2 *<IP/MASK>*

- Verify IP configuration:

  # ifconfig eth2

```
cumulus@host1:~$ sudo ifconfig eth2 0.0.0.0
cumulus@host1:~$ sudo ifconfig eth2 172.16.2.18/24
cumulus@host1:~$ ifconfig eth2
eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.16.2.18  netmask 255.255.255.0  broadcast 172.16.2.255
        inet6 fe80::4638:39ff:fe00:11  prefixlen 64  scopeid 0x20<link>
        ether 44:38:39:00:00:11  txqueuelen 1000  (Ethernet)
        RX packets 2946  bytes 202184 (202.1 KB)
        RX errors 0  dropped 182  overruns 0  frame 0
        TX packets 190  bytes 38098 (38.0 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

b. Verify a static route entry to network **172.16.0.0/16** via the default gateway's address. Use the default gateway address in the following table:

VLAN ID	Default gateway address
VLAN 2	172.16.2.254/24
VLAN 3	172.16.3.254/24

# ip route add *<NET_ADDRESS/MASK>* dev *<DEV>* via *<IP>*

```
cumulus@host1:~$ sudo ip route add 172.16.0.0/16 dev eth2 via 172.16.2.254
cumulus@host1:~$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         _gateway        0.0.0.0         UG    0      0        0 eth0
172.16.0.0      172.16.2.254    255.255.0.0     UG    0      0        0 eth2
172.16.2.0      0.0.0.0         255.255.255.0   U     0      0        0 eth2
192.168.200.0   0.0.0.0         255.255.255.0   U     0      0        0 eth0
```

c. Use '**ping**' to check communication between servers in the same VLAN.
For example servers **host1** and **host3**.

```
[cumulus@host1 ~]# ping 172.16.2.28
PING 172.16.2.28 (172.16.2.28) 56(84) bytes of data.
64 bytes from 172.16.2.28: icmp_seq=1 ttl=64 time=4.11 ms
64 bytes from 172.16.2.28: icmp_seq=2 ttl=64 time=2.58 ms
```

Task 3: Configuring SVIs for inter-VLAN routing

a. On switch **spine3** configure two SVIs (Switch VLAN Interfaces) that will be used for routing between VLAN2 and VLAN3:
- Interface **vlan2** will serve as the default gateway for **VLAN2**
- Interface **vlan3** will serve as the default gateway for **VLAN3**

Use the following table for IP address assignment:

Interface vlan 2	172.16.2.254/24
Interface vlan 3	172.16.3.254/24

# net add vlan *<VID>* ip address *<IP/MASK>*

```
cumulus@spine3:mgmt:~$  net add vlan 2 ip address 172.16.2.254/24
cumulus@spine3:mgmt:~$ net add vlan 3 ip address 172.16.3.254/24
cumulus@spine3:mgmt:~$ net commit
```

b. Use '**ping**' and '**traceroute**' utilities to verify communication between hosts in different VLANs. For example, ping from server '**host1**' in **VLAN2** to server '**host2**' in **VLAN3**.

```
[cumulus@host1 ~]# ping 172.16.3.19
PING 172.16.3.19 (172.16.3.19) 56(84) bytes of data.
64 bytes from 172.16.3.19: icmp_seq=1 ttl=63 time=0.155 ms
```

```
[cumulus@host1 ~]#  traceroute 172.16.3.19
traceroute to 172.16.3.19 (172.16.3.19), 30 hops max, 60 byte packets
 1  172.16.2.254 (172.16.2.254)  1.340 ms  1.633 ms  1.607 ms
 2  172.16.3.19 (172.16.3.19)  4.043 ms  4.023 ms  3.999 ms 2
```

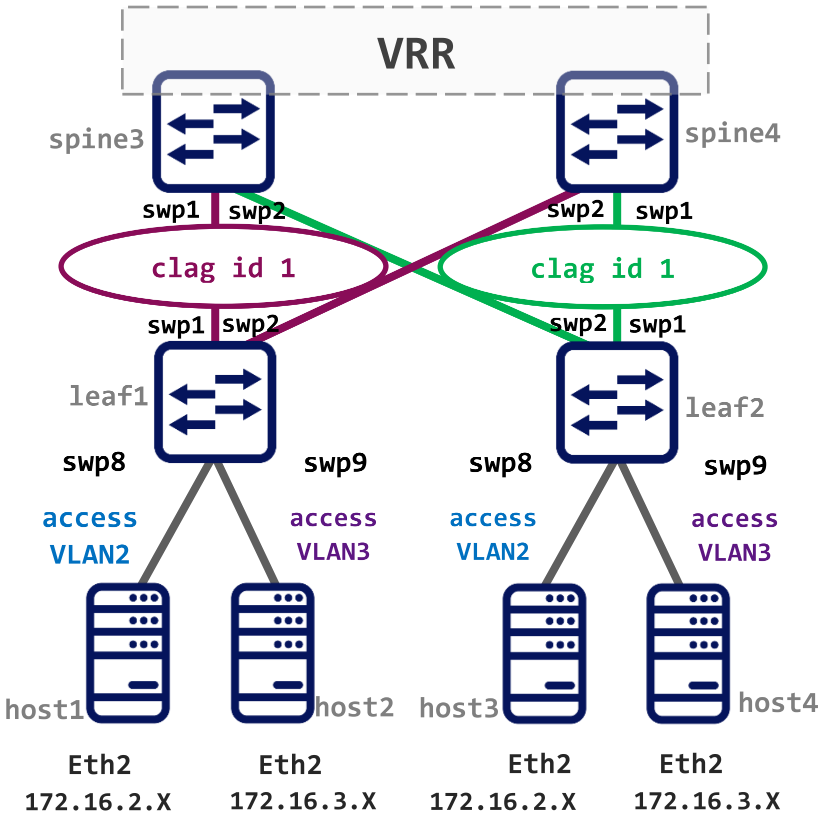
PRACTICE 4: CONFIGURING MLAG and VRR

Practice Objectives:

In this practice session you will configure the spine switches, **spine3** and **spine4**, with MLAG and VRR towards the leaf switches.

- MLAG will make the spine switches to look and behave like a single Layer 2 switch towards the Layer 2 network.
- VRR will make the spine switches to look and behave like a single router providing **default gateway redundancy.**
- Interface '**clag 1**' will aggregate **swp1** on **spine3** and **swp2** on **spine4** connected to switch **leaf1**.
  Switch **leaf1** will be configured with a regular LAG.
- Interface '**clag 2**' will aggregate **swp2** on **spine3** and **swp1** on **spine4** connected to switch **leaf2**.
  Switch **leaf2** will be configured with a regular LAG.

Topology used in this lab:



Task 1: LAG Configuration – Leaf Switches

a. Access the leaf switches **leaf1** and **leaf2** and reset configuration:

# net del all
# net commit

```
cumulus@leaf1:mgmt:~$ net del all
cumulus@leaf1:mgmt:~$ net commit
```

b. Create a bond named **'BOND-TO-SPINES'**, where bonds slaves are interfaces **swp1** and **swp2**.

# net add bond *<BOND-NAME>* bond slaves *<PORTS>*

```
cumulus@leaf1:mgmt:~$ net add bond BOND-TO-SPINES bond slaves swp1-2
cumulus@leaf1:mgmt:~$ net commit
```

c. Verify bonds configuration:

```
cumulus@leaf1:mgmt:~$ net show interface bonds
    Name            Speed   MTU   Mode      Summary
--  --------------  -----  ----  -------   --------------------------------
DN  BOND-TO-SPINES  N/A    9216  802.3ad   Bond Members: swp1(UP), swp2(UP)
```

Please note:

The bond interface is down because its peer (the MLAG peer) was not configured yet.

d. Create a bridge and add the bond interface, **BOND-TO-SPINES**, and the host facing interfaces, **swp8** and **swp9**, to the bridge:

```
cumulus@leaf1:mgmt:~$ net add bridge bridge ports swp8-9,BOND-TO-
```

e. Configure VLANs 2-3 and associate **swp8** to **VLAN2** and **swp9** to **VLAN3**:

```
cumulus@leaf1:mgmt:~$ net add interface swp8 bridge access 2
cumulus@leaf1:mgmt:~$ net add interface swp9 bridge access 3
cumulus@leaf1:mgmt:~$ net commit
```

Please note:

Commands are demonstrated on switch **leaf1**.
Switch **leaf2** should be configured similarly.

Task 2: Configuring MLAG – spine switches

a. Access the switches and reset the configuration:

# net del all
# net commit

```
cumulus@spine3:mgmt:~$ net del all
cumulus@spine3:mgmt:~$ net commit
```

- Write down, on a side note, the IP addresses of the management ports, **eth0**. Those IP addresses will be configured as the MLAG backup-IPs.

```
cumulus@spine3:mgmt:~$ net show interface eth0
    Name  MAC                Speed  MTU   Mode
--  ----  -----------------  -----  ----  ----
UP  eth0  44:38:39:00:00:20  1G     1500  Mgmt

IP Details
-------------------------  ----------------
IP:                        192.168.200.5/24
```

```
cumulus@spine4:mgmt:~$ net show interface eth0
    Name  MAC                Speed  MTU   Mode
--  ----  -----------------  -----  ----  ----
UP  eth0  44:38:39:00:00:22  1G     1500  Mgmt

IP Details
-------------------------  ----------------
IP:                        192.168.200.6/24
```

b. Configure the spine switches, **spine3** and **spine4**, as MLAG peers.

# net add clag peer sys-mac *<MAC>* interface *<PEERLINK-INTERFACES>* *<ROLE>* backup-ip *<IP>*

Please note:

- Interfaces **swp3** and **swp4** will be configured as the MLAG **peerlink**.
- Switch **spine3** is configured as the MLAG **primary** and **spine4** as the **secondary.**
- On switch **spine3** use **spine4's** IP as the backup-IP and vice-versa.

```
cumulus@spine3:mgmt:~$ net add clag peer  sys-mac 44:38:39:FF:00:01 interface swp3-4
                             primary backup-ip 192.168.200.6 vrf mgmt
```

```
cumulus@spine4:mgmt:~$ net add clag peer  sys-mac 44:38:39:FF:00:01 interface swp3-4
                             secondary backup-ip 192.168.200.5 vrf mgmt
```

c. Configure bridge settings – VLANs and STP priority:

```
cumulus@spine3:mgmt:~$ net add vlan 2-3
cumulus@spine3:mgmt:~$ net add bridge stp treeprio 4096
```

```
cumulus@spine4:mgmt:~$ net add vlan 2-3
cumulus@spine4:mgmt:~$ net add bridge stp treeprio 4096
```

d. Commit the changes:

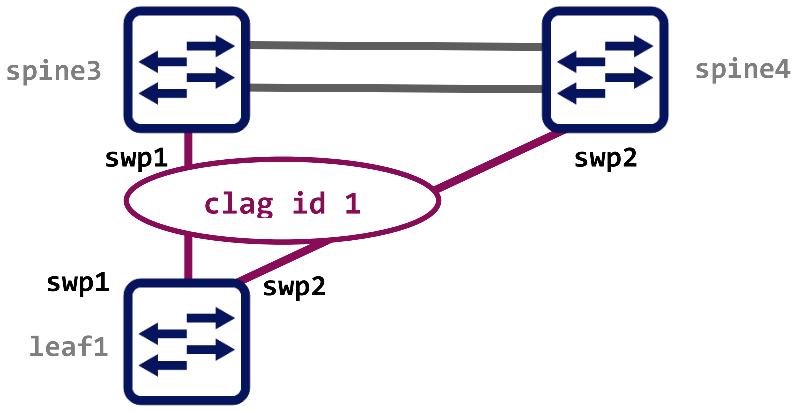
```
cumulus@spine3:mgmt:~$ net commit
```

```
cumulus@spine4:mgmt:~$ net commit
```

Task 3: Configuring CLAG interfaces - spine switches

a. Configure two `CLAG` interfaces on each of the spine switches.

- Interface **‘clag 1’** will aggregate **swp1** on **spine3** and **swp2** on **spine4** which are connected to switch **leaf1**

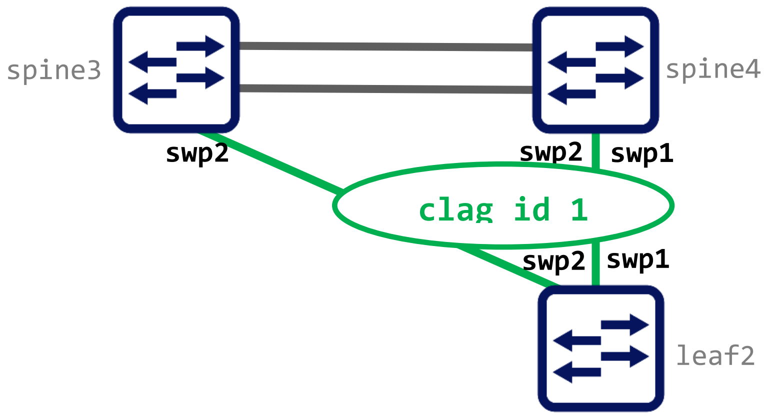


```
# net add clag port bond <BONDNAME> interface <PORTS> clag-id <ID>
```

```
cumulus@spine3:mgmt:~$ net add clag port bond LEAF1 interface swp1 clag-id 1
```

```
cumulus@spine4:mgmt:~$ net add clag port bond LEAF1 interface swp2 clag-id 1
```

- Interface **'clag 2'** will aggregate **swp2** on **spine3** and **swp1** on **spine4** which are connected to switch **leaf2**.



```
cumulus@spine3:mgmt:~$ net add clag port bond LEAF2 interface swp2 clag-id 2
```

```
cumulus@spine4:mgmt:~$ net add clag port bond LEAF2 interface swp1 clag-id 2
```

b. Commit the changes:

```
cumulus@spine3:mgmt:~$ net commit
```

```
cumulus@spine4:mgmt:~$ net commit
```

c. View MLAG resulting configuration:

```
cumulus@spine3:mgmt:~$ net show configuration

interface LEAF1
  bond-slaves swp1
  clag-id 1

interface LEAF2
  bond-slaves swp2
  clag-id 2

interface bridge
  bridge-ports peerlink LEAF1 LEAF2
  bridge-vids 2-3
  bridge-vlan-aware yes
  mstpctl-treeprio 4096

interface peerlink
  bond-slaves swp3 swp4

interface peerlink.4094
  clagd-backup-ip 192.168.200.6 vrf mgmt
  clagd-peer-ip linklocal
  clagd-priority 1000
  clagd-sys-mac 44:38:39:FF:00:01
```

c. Verify that MLAG protocol is up:
   # net show clag

```
cumulus@spine3:mgmt:~$ net show clag
The peer is alive
     Our Priority, ID, and Role: 1000 24:8a:07:cf:6a:50 primary
    Peer Priority, ID, and Role: 2000 24:8a:07:cf:6d:d0 secondary
          Peer Interface and IP: peerlink.4094 169.254.1.2
                      Backup IP: 10.143.33.188 (active)
                     System MAC: 44:38:39:ff:00:01

CLAG Interfaces
Our Interface      Peer Interface     CLAG Id   Conflicts              Proto-Down Reason
----------------   ----------------   -------   --------------------   -----------------
           LEAF1   LEAF1              1         -                      -
           LEAF2   LEAF2              2         -                      -
```

Task 4: Servers' IP settings

a. Access the servers and configure an IP address for interface **'eth2'** (see tables below).

VLAN ID	Server	'eth2' IP Address
VLAN 2	host1	172.16.2.18/24
VLAN 3	host2	172.16.3.19/24
VLAN 2	host3	172.16.2.28/24
VLAN 3	host4	172.16.3.29/24

Configure the server's IP address and subnet mask:

- Clear existing IP configuration:

  # ifconfig eth2 0.0.0.0

- Configure an IP address and a subnet mask:

  # ifconfig eth2 *<IP/MASK>*

- Verify IP configuration:

  # ifconfig eth2

```
cumulus@host1:~$ sudo ifconfig eth2 0.0.0.0
cumulus@host1:~$ sudo ifconfig eth2 172.16.2.18/24
cumulus@host1:~$ ifconfig eth2
eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.16.2.18  netmask 255.255.255.0  broadcast 172.16.2.255
        inet6 fe80::4638:39ff:fe00:11  prefixlen 64  scopeid 0x20<link>
        ether 44:38:39:00:00:11  txqueuelen 1000  (Ethernet)
        RX packets 3  bytes 180 (180.0 B)
```

b. Verify a static route entry to network 172.16.0.0/16 via the default gateway's address. Use the following table for default gateway assignment.

VLAN ID	Default gateway address
vlan 2	172.16.2.254/24
vlan 3	172.16.3.254/24

`# ip route add <NET_ADDRESS/MASK> dev <DEV> via <IP>`

```
cumulus@host1:~$ sudo ip route add 172.16.0.0/16 dev eth2 via 172.16.2.254
cumulus@host1:~$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         _gateway        0.0.0.0         UG    0      0        0 eth0
172.16.0.0      172.16.2.254    255.255.0.0     UG    0      0        0 eth2
172.16.2.0      0.0.0.0         255.255.255.0   U     0      0        0 eth2
192.168.200.0   0.0.0.0         255.255.255.0   U     0      0        0 eth0
```

c. Use **‘ping’** to check communication between servers in the same VLAN.
For example, server **host1** and **host3** in VLAN2.

```
[cumulus@host1 ~]# ping 172.16.2.28
PING 172.16.2.28 (172.16.2.28) 56(84) bytes of data.
64 bytes from 172.16.2.28: icmp_seq=1 ttl=64 time=2.60 ms
64 bytes from 172.16.2.28: icmp_seq=2 ttl=64 time=1.83 ms
```

d. Verify that the MLAG switches have their MAC address tables synchronized.

```
cumulus@spine3:mgmt:~$ net show bridge macs

VLAN      Master  Interface  MAC                TunnelDest  State      Flags  LastSeen
--------  ------  ---------  -----------------  ----------  ---------  -----  --------
2         bridge  LEAF1      44:38:39:00:00:11                                00:00:49
2         bridge  LEAF2      44:38:39:00:00:15                                00:00:52
3         bridge  LEAF1      44:38:39:00:00:13                                00:02:05
3         bridge  LEAF2      44:38:39:00:00:17                                00:02:05
```

```
cumulus@spine4:mgmt:~$ net show bridge macs

VLAN      Master  Interface  MAC                TunnelDest  State      Flags  LastSeen
--------  ------  ---------  -----------------  ----------  ---------  -----  --------
2         bridge  LEAF1      44:38:39:00:00:11                                00:00:49
2         bridge  LEAF2      44:38:39:00:00:15                                00:00:52
3         bridge  LEAF1      44:38:39:00:00:13                                00:02:05
3         bridge  LEAF2      44:38:39:00:00:17                                00:02:05
```

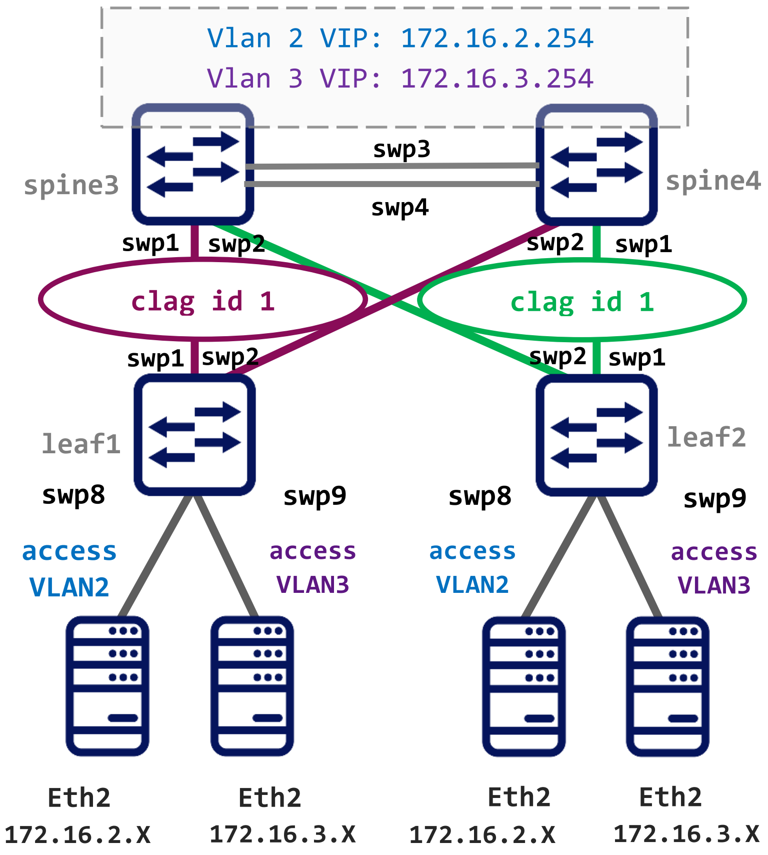
Please note:

- Once the MLAG configuration is completed, the spine switches appear as a single Layer 2 switch towards to Layer 2 network. Hence, they are capable to provide an efficient load balancing and better network utilization for the layer 2 network.

- In the following task additionally, the spine switches will be configured as VRR routers. Thus, they will provide default gateway redundancy and efficient load balancing towards the layer 3 network.

Task 5: Configuring VRR

Topology used in this task:



a. Configure two SVIs (Switch Virtual Interfaces) on each of the spine switches, `interface vlan 2` and `interface vlan 3`.
   - Configure an IP for each of the vlan interfaces.
   - Configure a VIP (Virtual IP) and a VMAC (Virtual MAC).
   - Use the following table for address assignment. Use /24 as the subnet mask.

SWITCH SPINE3

VLAN	SVI	VIP	VMAC
vlan 2	172.16.2.252/24	172.16.2.254/24	00:00:5e:00:01:02
vlan 3	172.16.3.252/24	172.16.3.254/24	00:00:5e:00:01:03

SWITCH SPINE4

VLAN	SVI	VIP	VMAC
vlan 2	172.16.2.253/24	172.16.2.254/24	00:00:5e:00:01:02
vlan 3	172.16.3.253/24	172.16.3.254/24	00:00:5e:00:01:03

# net add vlan *<VLAN_ID>* ip address *<IP/MASK>*

# net add vlan *<VLAN_ID>* ip address-virtual *<VMAC>* *<VIP/MASK>*

```
cumulus@spine3:mgmt:~$ net add vlan 2 ip address 172.16.2.252/24
cumulus@spine3:mgmt:~$ net add vlan 2 ip address-virtual 00:00:5e:00:01:02 172.16.2.254/24
cumulus@spine3:mgmt:~$ net add vlan 3 ip address 172.16.3.252/24
cumulus@spine3:mgmt:~$ add vlan 3 ip address-virtual 00:00:5e:00:01:03 172.16.3.254/24
cumulus@spine3:mgmt:~$ commit
```

```
cumulus@spine4:mgmt:~$ net add vlan 2 ip address 172.16.2.253/24
cumulus@spine4:mgmt net add vlan 2 ip address-virtual 00:00:5e:00:01:02 172.16.2.254/24
cumulus@spine4:mgmt net add vlan 3 ip address 172.16.3.253/24
cumulus@spine4:mgmt net add vlan 3 ip address-virtual 00:00:5e:00:01:03 172.16.3.254/24
cumulus@spine4:~$ net commit
```

b. Verify VRR configuration:

```
cumulus@spine3:mgmt:~$ net show interface
State  Name           Spd   MTU    Mode          LLDP         Summary
-----  -------------  ----  -----  ------------  -----------  -------------------
UP     vlan2          N/A  9216   Interface/L3               IP: 172.16.2.252/24
UP     vlan2-v0       N/A  9216   Interface/L3               IP: 172.16.2.254/24
UP     vlan3          N/A  9216   Interface/L3               IP: 172.16.3.252/24
UP     vlan3-v0       N/A  9216   Interface/L3               IP: 172.16.3.254/24
```

```
cumulus@spine3:mgmt:~$ net show interface vlan2-v0
    Name      MAC                Speed  MTU   Mode
--  --------  -----------------  -----  ----  ------------
UP  vlan2-v0  00:00:5e:00:01:02  N/A    9216  Interface/L3

IP Details
-------------------------  ---------------
IP:                        172.16.2.254/24
```

c. Verify VRR operation.
Use **'ping'** and **'traceroute'** utilities to verify communication between hosts in different VLANs.
For example, from **'host1'** in VLAN 2 to **'host2'** in VLAN 3.

```
[cumulus@host1 ~]# ping 172.16.3.19
PING 172.16.3.19 (172.16.3.19) 56(84) bytes of data.
64 bytes from 172.16.3.19: icmp_seq=1 ttl=63 time=3.83 ms
64 bytes from 172.16.3.19: icmp_seq=2 ttl=63 time=1.90 ms

[cumulus@host1 ~]# traceroute 172.16.3.19
traceroute to 172.16.3.19 (172.16.3.19), 30 hops max, 60 byte packets
 1  172.16.2.254 (172.16.2.254)  1.511 ms  1.423 ms  1.435 ms
 2  172.16.3.19 (172.16.3.19)  2.182 ms  1.994 ms *
```

d. Verify MLAG/VRR failover.
Use continuous **'ping'** between hosts in different VLANs.
For example, from server **'host1'** in VLAN 2 to server **'host2'** in VLAN 3.

While **'ping'** is running, reboot switch **spine3**. Was the traffic disrupted?

____

After switch **spine3** reboots, reboot switch **spine4**. Was the traffic disputed now?

____

What are your conclusions regarding MLAG/VRR failover?

____

PRACTICE 5: CONFIGURING BGP UNNUMBERED

Practice Objectives:

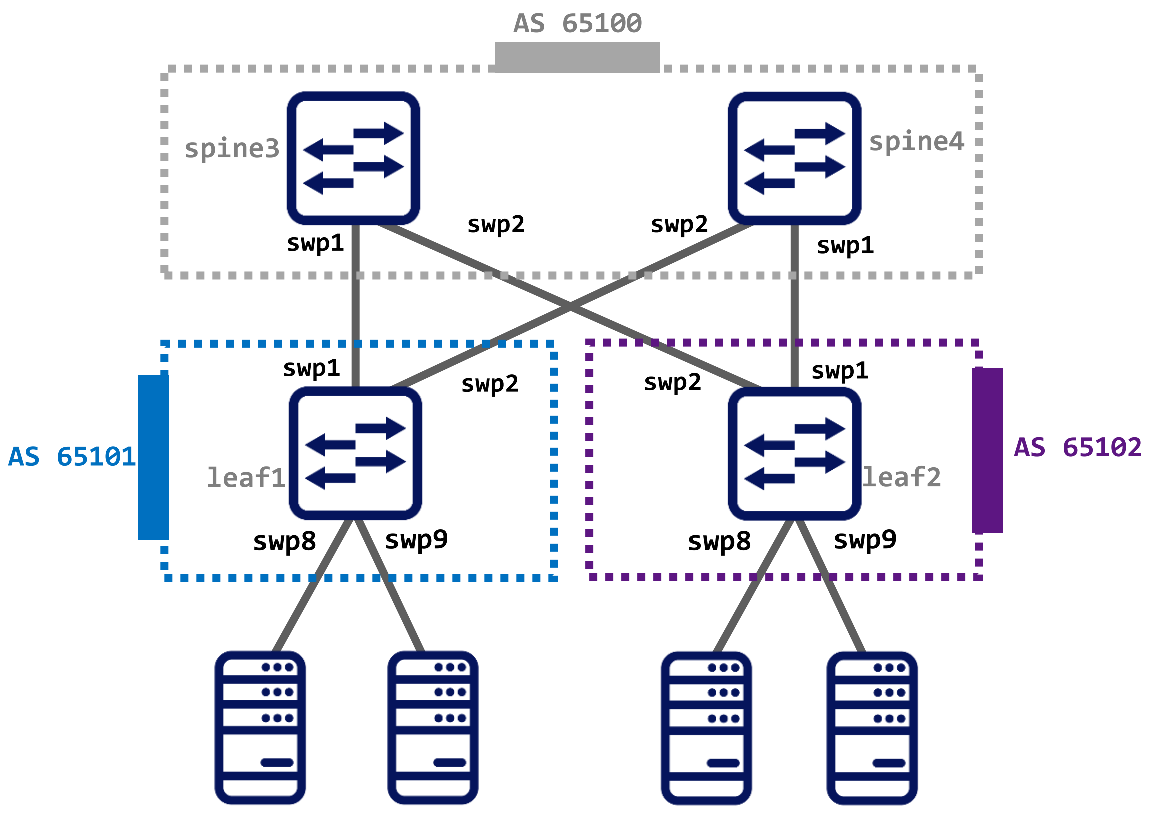
In this practice session you will configure BGP Unnumbered:

- Spine switches will be configured in the same AS and each of the leaf switches will be configured in its own AS.
- BGP unnumbered will be configured on all four switches.
- eBGP sessions will be established between the spine and leaf switches.
- Leaf switches will advertise their local IP prefixes.
- By the end of this practice session you will achieve end-to-end connectivity between all servers in your group, over the BGP Autonomous Systems.

Please note:

- Commands are demonstrated on switches **`leaf1`** and **`spine3`**. You should apply similar commands on the other two switches in your group.

Topology used in this practice session:



Task 1: Starting FRR

a. Access the switches and reset the configuration:

```
# net del all
# net commit
```

```
cumulus@leaf1:mgmt:~$ net del all
cumulus@leaf1:mgmt:~$ net commit
```

b. Start FRR routing daemons.
Edit the **/etc/frr/daemons** file. Set to **'yes'** both **zebra** and **bgpd**.
Save and exit.

```
cumulus@leaf1:mgmt:~$ sudo vi /etc/frr/daemons
zebra=yes
bgpd=yes
```

c. Restart FRR Service.

```
cumulus@leaf1:mgmt:~$ sudo systemctl restart frr
```

Task 2: Configuring loopback interfaces

a. On each of the switches configure a loopback interface.

Use the following table for IP address assignment:

Switch	Loopback IP address
leaf1	172.16.100.1/32
leaf2	172.16.100.2/32
spine3	172.16.100.3/32
spine4	172.16.100.4/32

```
# net add loopback lo ip address <IP/MASK>
```

```
cumulus@leaf1:mgmt:~$ net add loopback lo ip address 172.16.100.1/32
```

```
cumulus@spine3:mgmt:~$ net add loopback lo ip address 172.16.100.3/32
```

Task 3: Configuring BGP Unnumbered

a. Configure BGP unnumbered:

# net add bgp autonomous-system *<LOCAL-AS>*
# net add bgp neighbor *<INTERFACE>* interface remote-as external

```
cumulus@leaf1:mgmt:~$ net add bgp autonomous-system 65101
cumulus@leaf1:mgmt:~$ net add bgp neighbor swp1-2 interface remote-as external
```

```
cumulus@spine3:mgmt:~$ net add bgp autonomous-system 65100
cumulus@spine3:mgmt:~$ net add bgp neighbor swp1-2 interface remote-as external
```

b. Advertise the loopback addresses and commit the changes.

# net add bgp network *<IP/MASK>*

```
cumulus@leaf1:mgmt:~$ net add bgp network 172.16.100.1/24
cumulus@leaf1:mgmt:~$ net commit
```

```
cumulus@spine3:mgmt:~$ net add bgp network 172.16.100.3/24
cumulus@spine3:mgmt:~$ net commit
```

Please note:
Commands are demonstrated on switches **leaf1** and **spine3**. You should apply similar commands on the other two switches in your group.

c. Verify configuration:

```
cumulus@leaf1:mgmt:~$ net show configuration
router bgp 65101
  bgp router-id 172.16.100.1
  neighbor swp1 interface remote-as external
  neighbor swp2 interface remote-as external

  address-family ipv4 unicast
    network 172.16.100.1/32


interface lo
  address 172.13.100.1/32
```

d. Verify eBGP sessions were established:
Each switch should be able to see two eBGP neighbors, via interfaces **swp1** and **wp2**.

# net show bgp summary

```
cumulus@leaf1:mgmt:~$ net show bgp summary

show bgp ipv4 unicast summary
=============================
BGP router identifier 172.16.100.1, local AS number 65101 vrf-id 0
BGP table version 3
RIB entries 7, using 1344 bytes of memory
Peers 2, using 43 KiB of memory

Neighbor        V         AS   MsgRcvd   MsgSent   TblVer  InQ OutQ  Up/Down State/PfxRcd
spine3(swp1)    4      65100      1295      1294        0    0    0 00:58:16            2
spine4(swp2)    4      65100       349       420        0    0    0 00:15:22            2

Total number of neighbors 2
```

b. Verify loopback prefixes are reachable:
- Each switch should have in its routing table the prefixes of the other switch's loopback interfaces.

# net show route bgp

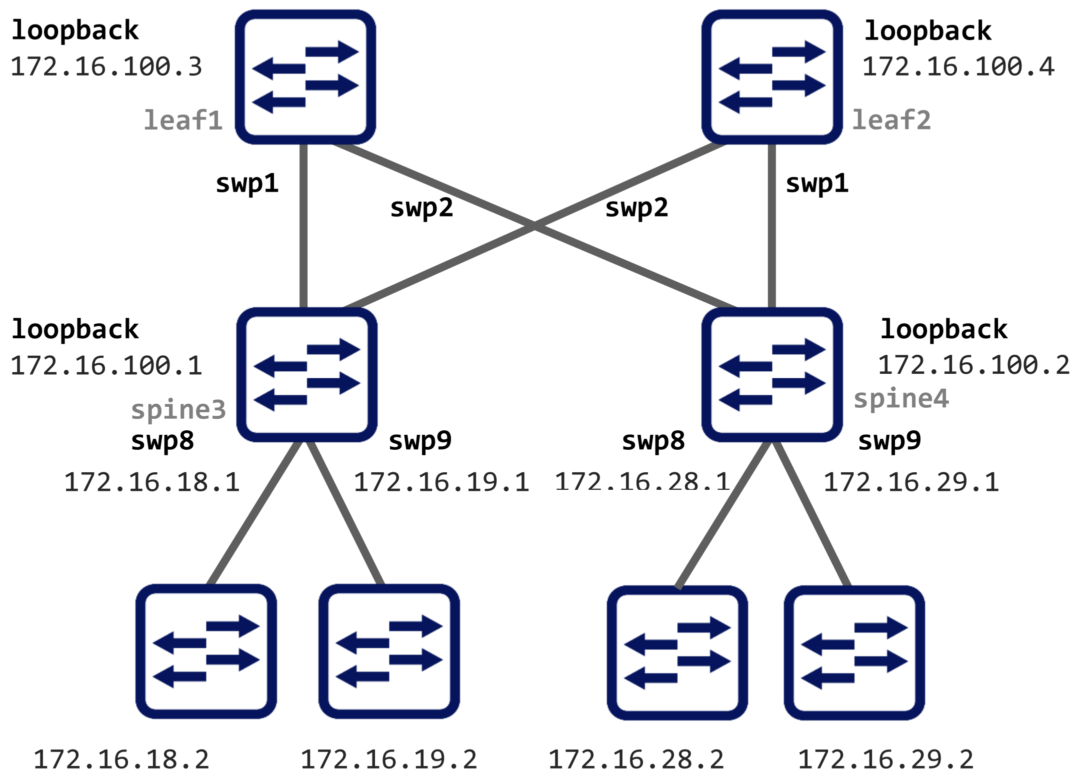
```
cumulus@leaf1:mgmt:~$ net show route bgp
RIB entry for bgp
=================
Codes: K - kernel route, C - connected, S - static, R - RIP,
       O - OSPF, I - IS-IS, B - BGP, E - EIGRP, N - NHRP,
       T - Table, v - VNC, V - VNC-Direct, A - Babel, D - SHARP,
       F - PBR, f - OpenFabric,
       > - selected route, * - FIB route, q - queued route, r - rejected route

B>* 172.16.100.2/32 [20/0] via fe80::4638:39ff:fe00:5, swp1, weight 1, 00:06:41
  *                        via fe80::4638:39ff:fe00:b, swp2, weight 1, 00:06:41
B>* 172.16.100.3/32 [20/0] via fe80::4638:39ff:fe00:5, swp1, weight 1, 00:05:52
B>* 172.16.100.4/32 [20/0] via fe80::4638:39ff:fe00:b, swp2, weight 1, 00:05:34
```

Please note:
- NEXT-HOP is the neighbor's IPv6 Link Local Address
- BGP multipath is enabled

Task 4: Advertise local IP prefixes

a. On the leaf switches, assign IP addresses to the host-facing interfaces, **swp8** and **swp9**.
spine3 spine4
Advertise the IP prefixes in the BGP process.
Use the IP addresses listed in the below topology. Use /24 for the subnet mask.



# net add interface *<INTERFACE>* ip add *<IP/MASK>*

# net add bgp network *<IP/MASK>*

```
cumulus@leaf1:mgmt:~$ net add interface swp8 ip add 172.16.18.1/24
cumulus@leaf1:mgmt:~$ net add interface swp9 ip add 172.16.19.1/24
cumulus@leaf1:mgmt:~$ net add bgp network 172.16.18.0/24
cumulus@leaf1:mgmt:~$ net add bgp network 172.16.19.0/24
cumulus@leaf1:mgmt:~$ net commit
```

```
cumulus@leaf2:mgmt:~$ net add interface swp8 ip add 172.16.28.1/24
cumulus@leaf2:mgmt:~$ net add interface swp9 ip add 172.16.29.1/24
cumulus@leaf2:mgmt:~$ net add bgp network 172.16.28.0/24
cumulus@leaf2:mgmt:~$ net add bgp network 172.16.29.0/24
cumulus@leaf2:mgmt:~$ net commit
```

b. Verify that the remote leaf switch has learned the IP prefixes:
- Switch **`leaf1`** should have in its routing table the IP prefixes advertise by switch **`leaf2`**:
  - `172.16.28.1/24`
  - `172.16.29.0/24`
- Switch **`leaf2`** should have in its routing table the IP prefixes advertise by switch **`leaf1`**:
  - `172.16.18.1/24`
  - `172.16.19.0/24`

`# net show route bgp`

```
cumulus@leaf1:mgmt:~$ net show route bgp
RIB entry for bgp
=================
Codes: K - kernel route, C - connected, S - static, R - RIP,
       O - OSPF, I - IS-IS, B - BGP, E - EIGRP, N - NHRP,
       T - Table, v - VNC, V - VNC-Direct, A - Babel, D - SHARP,
       F - PBR, f - OpenFabric,
       > - selected route, * - FIB route, q - queued route, r - rejected route

B>* 172.16.28.0/24 [20/0] via fe80::4638:39ff:fe00:5, swp1, weight 1, 00:00:08
  *                       via fe80::4638:39ff:fe00:b, swp2, weight 1, 00:00:08
B>* 172.16.29.0/24 [20/0] via fe80::4638:39ff:fe00:5, swp1, weight 1, 00:00:08
  *                       via fe80::4638:39ff:fe00:b, swp2, weight 1, 00:00:08
B>* 172.16.100.2/32 [20/0] via fe80::4638:39ff:fe00:5, swp1, weight 1, 00:21:36
  *                        via fe80::4638:39ff:fe00:b, swp2, weight 1, 00:21:36
B>* 172.16.100.3/32 [20/0] via fe80::4638:39ff:fe00:5, swp1, weight 1, 00:20:47
B>* 172.16.100.4/32 [20/0] via fe80::4638:39ff:fe00:b, swp2, weight 1, 00:20:29
```

Task 5: Verify end-to-end connectivity

a. Configure the servers IP settings. Configure an IP address and a subnet mask for interface **’eth2’**. Use the following tables for IP address assignment.
Use /24 as the subnet mask.

Server	'eth2' IP Address	Next Hop to 172.16.0.0/16
host1	172.16.18.2	172.16.18.1
host2	172.16.19.2	172.16.19.1
host3	172.16.28.2	172.16.28.1
host4	172.16.29.2	172.16.29.1

- Clear existing IP configuration:

  # ifconfig *<DEV>* 0.0.0.0

- Configure an IP address and a subnet mask:

  # ifconfig *<DEV>* *<IP/MASK>*

```
cumulus@host1:~$ sudo ifconfig eth2 0.0.0.0
cumulus@host1:~$ sudo ifconfig eth2 172.16.18.2/24
cumulus@host1:~$ ifconfig eth2
eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.16.18.2  netmask 255.255.255.0  broadcast 172.16.18.255
        inet6 fe80::4638:39ff:fe00:11  prefixlen 64  scopeid 0x20<link>
        ether 44:38:39:00:00:11  txqueuelen 1000  (Ethernet)
        RX packets 3  bytes 180 (180.0 B)
```

b. Add a route entry to 172.16.0.0/16 via interface **'eth2'**:

# ip route add <ADDRESS/MASK> dev <DEV> via <IP_ADDRESS>

```
cumulus@host1:~$ sudo ip route add 172.16.0.0/16 dev eth2 via 172.16.18.1
```

```
cumulus@host1:~$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         _gateway        0.0.0.0         UG    0      0        0 eth0
172.16.0.0      172.16.18.1     255.255.0.0     UG    0      0        0 eth2
172.16.2.0      0.0.0.0         255.255.255.0   U     0      0        0 eth2
192.168.200.0   0.0.0.0         255.255.255.0   U     0      0        0 eth0
```

c. Use **'ping'** and **'traceroute'** utilities to verify communication between servers in different Autonomous Systems.

For example, ping from server **'host1'** (AS 65101) to server **'host3'** (in AS 65102).

```
[cumulus@host1 ~]# ping 172.16.28.2
PING 172.16.28.2 (172.16.28.2) 56(84) bytes of data.
64 bytes from 172.16.28.2: icmp_seq=1 ttl=61 time=4.04 ms
64 bytes from 172.16.28.2: icmp_seq=2 ttl=61 time=2.56 ms
```

```
[cumulus@host1 ~]# traceroute  172.16.28.2
traceroute to 172.16.28.2 (172.16.28.2), 30 hops max, 60 byte packets
 1  172.16.18.1  (172.16.18.1)  0.761 ms  0.927 ms  0.899 ms
 2  172.16.100.3 (172.16.100.3) 1.433 ms  1.354 ms  1.372 ms
 3  172.16.100.2 (172.16.100.2) 2.449 ms  2.058 ms  2.493 ms
 4  172.16.28.2  (172.16.28.2)  3.215 ms  3.244 ms  3.348 ms
```

Please note:
The next practice relies on BGP Unnumbered configuration. Please make sure to save the configuration before exiting.

PRACTICE 6: CONFIGURING VXLAN WITH EVPN

Practice Objectives:

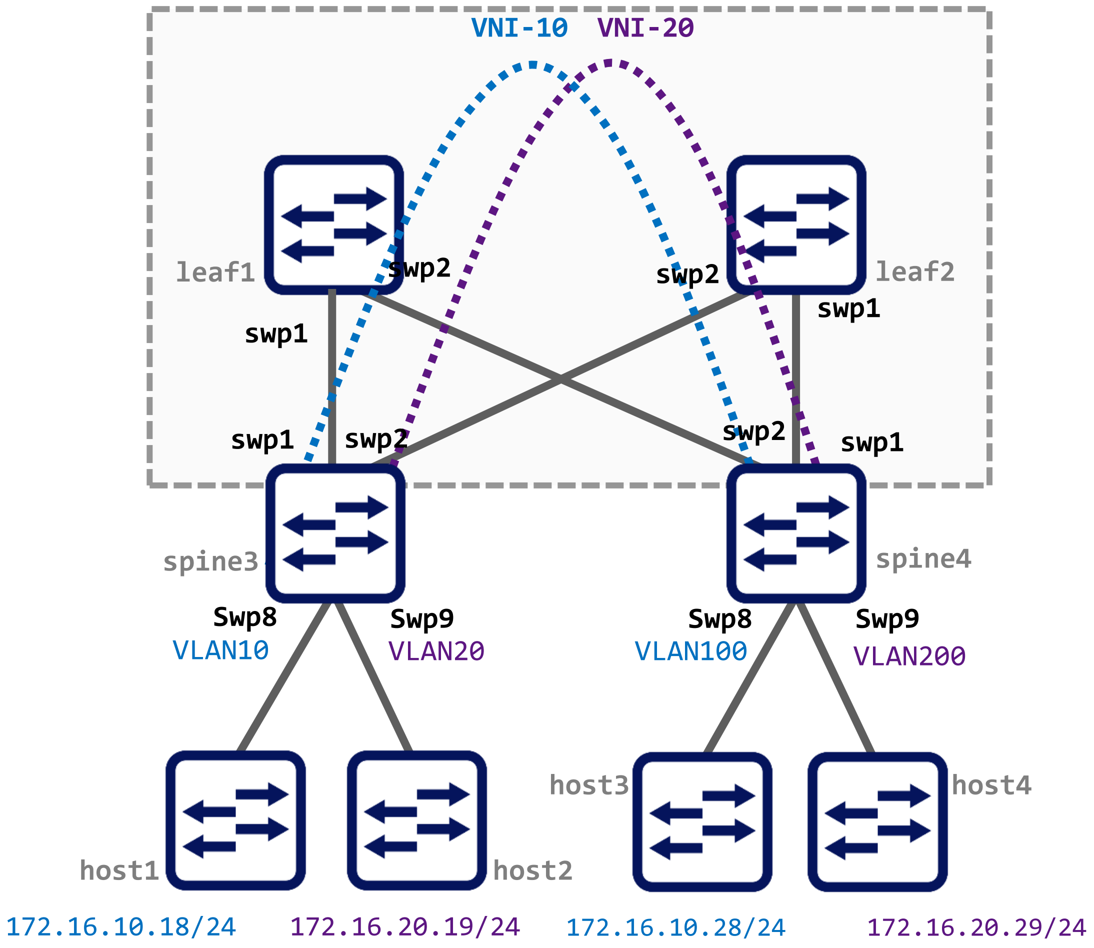
In this practice session you will configure VXLAN with EVPN:

- The leaf switches will be configured as the VTEPs
- EVPN will be configured as the VXLAN control plane
- Two VXLAN Network IDs (VNIs) will be configured:
  - **`VNI-10`** will connect **`VLAN 10`** on switch **`leaf1`** and **`VLAN 100`** on switch **`leaf2`**.
  - **`VNI-20`** will connect **`VLAN 20`** on switch **`leaf1`** and **`VLAN 200`** on switch **`leaf2`**.

- Hosts in each VNI will be able to communicate in layer 2 over the underlay layer 3 network.

Please note:
The configuration in this practice session relies on the previous practice.
Make sure that BGP Unnumbered is properly configured and fully operational.

Topology used in this practice session:



Task 1: Configuring servers IP settings

a. Configure an IP address and a subnet mask for interface **’eth2’**.
Use the following tables for IP address assignment. Use /24 as the subnet mask.

Server	ETH2 IP Address
host1	172.16.10.18
host2	172.16.20.19
host3	172.16.10.28
host4	172.16.20.29

- Clear existing IP configuration:

  # ifconfig *<DEV>* 0.0.0.0

- Configure an IP address and a subnet mask:

  # ifconfig *<DEV>* *<IP/MASK>*

Task 2: Configuring VLANs

a. Access the leaf switches and configure the host-facing ports **swp8** and **swp9**.
First clear any existing configuration, then assign the ports to the appropriate VLAN:
   - Switch **leaf1** - assign swp8 to VLAN 10 and swp9 to VLAN 20
   - Switch **leaf2** - assign swp8 to VLAN 100 and swp9 to VLAN 200

# net add interface *<INTERFACE>* bridge access *<VLAN>*

```
cumulus@leaf1:mgmt:~$ net del interface swp8-9
cumulus@leaf1:mgmt:~$ net add interface swp8 bridge access 10
cumulus@leaf1:mgmt:~$ net add interface swp9 bridge access 20
cumulus@leaf1:mgmt:~$ net commit
```

```
cumulus@leaf1:mgmt:~$ net del interface swp8-9
cumulus@leaf2:mgmt:~$ net add interface swp8 bridge access 100
cumulus@leaf2:mgmt:~$ net add interface swp9 bridge access 200
cumulus@leaf2:mgmt:~$ net commit
```

Task 3: Configuring VNIs

a. Access the leaf switches and configure the VNIs:
   - Create a VXLAN interface with a unique ID
   - Map the VXLAN to a VLAN

- Configure the VXLAN's local tunnel IP (use the VTEPs loopback)

```
# net add vxlan <VXLAN-NAME> vxlan id <VXLAN-ID>
# net add vxlan <VXLAN-NAME> bridge access <VLAN-ID>
# net add vxlan <VXLAN-NAME> vxlan local-tunnelip <IP-ADRESS>
# net commit
```

- On switch **leaf1**:
  VNI-10 will be mapped to VLAN 10 and VNI-20 will be mapped to VLAN 20.
  VXLAN's local tunnel IP is 172.16.100.1
- On switch **leaf2**:
  VNI-10 will be mapped to VLAN 100 and VNI-20 will be mapped to VLAN 200.
  VXLAN's local tunnel IP is 172.16.100.2

```
cumulus@leaf1:mgmt:~$ net add vxlan VNI-10 vxlan id 10
cumulus@leaf1:mgmt:~$ net add vxlan VNI-10 bridge access 10
cumulus@leaf1:mgmt:~$ net add vxlan VNI-10 vxlan local-tunnelip 172.16.100.1
cumulus@leaf1:mgmt:~$ net add vxlan VNI-20 vxlan id 20
cumulus@leaf1:mgmt:~$ net add vxlan VNI-20 bridge access 20
cumulus@leaf1:mgmt:~$ net add vxlan VNI-20 vxlan local-tunnelip 172.16.100.1
cumulus@leaf1:mgmt:~$ net commit
```

```
cumulus@leaf2:mgmt:~$ net add vxlan VNI-10 vxlan id 10
cumulus@leaf2:mgmt:~$ net add vxlan VNI-10 bridge access 100
cumulus@leaf2:mgmt:~$ net add vxlan VNI-10 vxlan local-tunnelip 172.16.100.2
cumulus@leaf2:mgmt:~$ net add vxlan VNI-20 vxlan id 20
cumulus@leaf2:mgmt:~$ net add vxlan VNI-20 bridge access 200
cumulus@leaf2:mgmt:~$ net add vxlan VNI-20 vxlan local-tunnelip 172.16.100.2
cumulus@leaf2:mgmt:~$ net commit
```

Task 4: Configuring EVPN

a. Access the spine switches and configure EVPN.
   Switch **spine4** should be configured similarly.

```
# net add bgp evpn neighbor <INTERFACE> activate
```

```
cumulus@spine3:mgmt:~$ net add bgp evpn neighbor swp1-2 activate
cumulus@spine3:mgmt:~$ net commit
```

b. Access the leaf switches and configure EVPN to advertise all VNIs (EVPN allows VTEPs to exchange VNI membership information).
Switch **leaf2** should be configured similarly.

# net add bgp evpn neighbor *<INTERFACE>* activate
# net add bgp evpn advertise-all-vni

```
cumulus@leaf1:mgmt:~$ net add bgp evpn neighbor swp1-2 activate
cumulus@leaf1:mgmt:~$ net add bgp evpn advertise-all-vni
cumulus@leaf1:mgmt:~$ net commit
```

c. Verify VXLAN Information.

# net show evpn vni *<VNI>*

```
cumulus@leaf1:mgmt:~$ net show evpn vni 10

VNI: 10
 Type: L2
 Tenant VRF: default
 VxLAN interface: VNI-10
 VxLAN ifIndex: 12
 Local VTEP IP: 172.16.100.1
 Mcast group: 0.0.0.0
 Remote VTEPs for this VNI:
  172.16.100.2 flood: HER
 Number of MACs (local and remote) known for this VNI: 2
```

Task 5: Verify end-to-end communication

- Each VNI is a logical layer 2 network over the underlay layer 3 network. Logically there are no layer 3 hops between hosts in the same VNI.
- Use **'ping'** and **'traceroute'** utilities to verify end-to-end communication between hosts in a VNI. For example, from host **'host1'** to **'host3'** that are configured in `VNI-10`.

```
[cumulus@host1 ~]# ping 172.16.10.28
PING 172.16.10.28 (172.16.10.28) 56(84) bytes of data.
64 bytes from 172.16.10.28: icmp_seq=1 ttl=64 time=7.19 ms
```

```
[cumulus@host1 ~]# traceroute 172.16.10.28
traceroute to 172.16.10.28 (172.16.10.28), 30 hops max, 60 byte packets
 1  172.16.10.28 (172.16.10.28)  4.887 ms  4.817 ms  4.788 ms
```

Please note:
The next practice relies on VXLAN with EVPN configuration. Please make sure to save the configuration before exiting.

PRACTICE 7: DISTRIBUTED ASYMMETRIC VXLAN ROUTING

Practice Objectives:

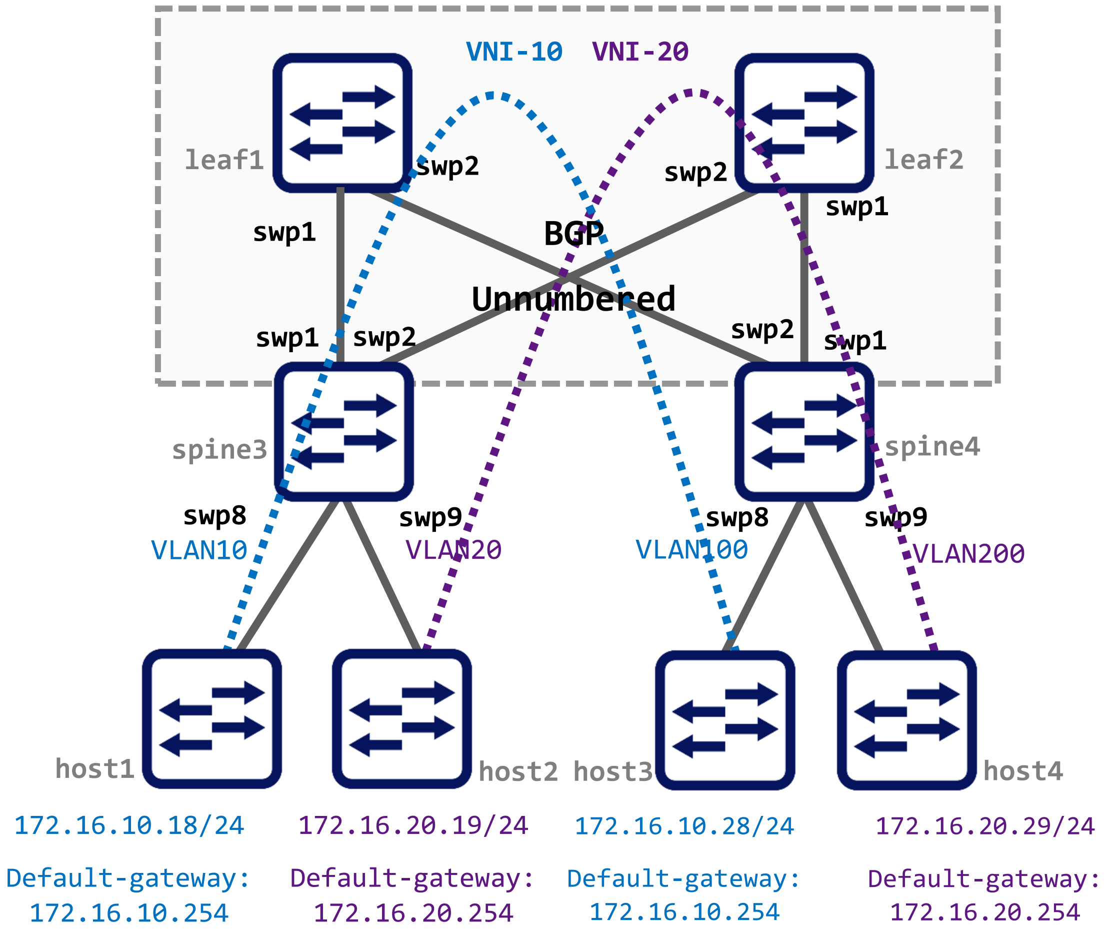
In this practice session you will configure distributed asymmetric VXLAN routing.

- VTEPs (leaf switches) will be configured as the distributed anycast default gateway, i.e., each VTEP will be configured with a VIP and VMAC for each of the subnets. Each VTEP will serve as the default gateway for its locally connected hosts.
- In asymmetric VXLAN routing only the ingress VTEP perform the routing, while the egress VTEP perform VXLAN bridging only.

Please note:

The configuration in this practice session relies on the previous practice. Make sure that BGP Unnumbered and VXLAN with EVPN are properly configured and fully operational.

Topology used in this practice session:



Task 1: Configuring servers IP settings

a. Add a static route entry to network `172.16.0.0/16` via the default gateway's IP:
   - Servers `'host1'` and `'host3'` are in `VNI-10`, their default gateway is `172.16.10.254`
   - Servers `'host2'` and `'host4'` are in `VNI-20,` their default gateway is `172.16.20.254`

Server	Default gateway
host1	172.16.10.254
host2	172.16.20.254
host3	172.16.10.254
host4	172.16.20.254

```
# ip route add <NET_ADD/MASK> dev <DEV> via <IP>
```

```
[cumulus@host1 ~]# sudo ip route add 172.16.0.0/16 dev eth2 via 172.16.10.254
```

Task 2: Configuring SVIs on the VTEPs

a. Access the leaf switch and configure the SVIs and the anycast default gateway's VMAC and VIP.
   Assign IP addresses according the following tables. Use /24 as the subnet mask.

Switch leaf1:

SVI	IP	Default gateway's VIP	Default gateway's VMAC
VLAN 10	172.16.10.252	172.16.10.254	00:00:5e:00:01:01
VLAN 20	172.16.20.252	172.16.20.254	00:00:5e:00:01:02

Switch leaf2:

SVI	IP	Default gateway's VIP	Default gateway's VMAC
VLAN 100	172.16.10.253	172.16.10.254	00:00:5e:00:01:01
VLAN 200	172.16.20.253	172.16.20.254	00:00:5e:00:01:02

# net add vlan *<VLAN>* ip address *<IP>*
# net add vlan *<VLAN>* ip address-virtual *<VMAC>* *<VIP/MASK>*

```
cumulus@leaf1:mgmt:~$ net add vlan 10 ip address 172.16.10.252/24
cumulus@leaf1:mgmt:~$ net add vlan 10 ip address-virtual
00:00:5e:00:01:01 172.16.10.254/24

cumulus@leaf1:mgmt:~$ net add vlan 20 ip address 172.16.20.252/24
cumulus@leaf1:mgmt:~$ net add vlan 20 ip address-virtual
00:00:5e:00:01:02 172.16.20.254/24

cumulus@leaf1:mgmt:~$ net commit
```

```
cumulus@leaf2:mgmt:~$ net add vlan 100 ip address 172.16.10.253/24
cumulus@leaf2:mgmt:~$ net add vlan 100 ip address-virtual
00:00:5e:00:01:01 172.16.10.254/24

cumulus@leaf2:mgmt:~$ net add vlan 200 ip address 172.16.20.253/24
cumulus@leaf2:mgmt:~$ net add vlan 200 ip address-virtual
00:00:5e:00:01:02 172.16.20.254/24

cumulus@leaf2:mgmt:~$ net commit
```

Please note:

The VMAC and VIP must be identical on both VTEPs in order to implement anycast default gateway and to allow proper inter-VXLAN routing.

Task 3: Test inter-VXLAN communication

a. Use ‘**ping**’ and ‘**traceroute**’ utilities to verify end-to-end communication between hosts in different VNIs.
For example, ping from host ‘host1’ in VNI-10 to ‘host2’ in VNI-20.
In this case the egress switch **leaf1** will perform VXLAN routing between the source and destination VNIs, while the egress switch **leaf2** will bridge between destination VNI and the destination VLAN.

```
[cumulus@host1 ~]# ping 172.16.20.19
PING 172.16.20.19 (172.16.20.19) 56(84) bytes of data.
64 bytes from 172.16.20.19: icmp_seq=1 ttl=63 time=3.48 ms
64 bytes from 172.16.20.19: icmp_seq=2 ttl=63 time=1.15 ms
```

```
[cumulus@host1 ~]# traceroute 172.16.20.19
traceroute to 172.16.20.19 (172.16.20.19), 30 hops max, 60 byte packets
 1  172.16.10.254 (172.16.10.254)  1.271 ms  1.431 ms  1.412 ms
 2  172.16.20.19 (172.16.20.19)  1.564 ms  1.593 ms  1.595 ms
```

PRACTICE 8: EDITING ANSIBLE INVENTORY FILE

Practice objectives:

In this practice session you perform the initial configurations required for Ansible to start working with the group servers and switches.

- You will configure **hosts** and **groups** in your Ansible hosts file.
- You will use **Ansible ping module** to validate the configuration.
- Last, you will use **Ansible Variables** to refine the hosts configuration.

Task 1: Editing the Ansible Inventory (hosts) file

a. Connect to the 'oob-mgmt-server' and Use VIM, or another text editor to edit the **/etc/ansible/hosts** file:

# vi /etc/ansible/hosts

```
# Default ansible hosts file
# comments begin with the '#' character
#   - Blank lines are ignored
#   - Groups of hosts are delimited by [header] elements
#   - hostnames or ip addresses are accepted
#   - A hostname/ip can be a member of multiple groups



~
~
~
```

⚠ to exit VIM:

1. Press ESC
2. Type ':'
3. Type "q!" to exit **without saving** or "wq" to **save and exit**

```
~
~
:wq
```

To edit the file using VIM go to insert mode by typing 'a'
(make sure the word "—INSERT --" appears at the end of the page).

```
~
~
~
~
~
-- INSERT --
```

Task 2: Adding servers to the Inventory (hosts) file

a. While in “INSERT” mode, add the servers host name to the hosts file.

```
# Default ansible hosts file
# comments begin with the '#' character
#   - Blank lines are ignored
#   - Groups of hosts are delimited by [header] elements
#   - hostnames or ip addresses are accepted
#   - A hostname/ip can be a member of multiple groups

host1
host2
host3
host4
~
~
~
```

Please note:

- Every line that starts with ‘#’ is considered a comment and can be deleted.
- Instead of configuring each server in a different line, you can use a REGEX expression to capture all group servers in one line ***# host[1:4]***

Task 3: Testing Ansible connectivity using the "ping" module

a. Save and Exit the hosts file (type ESC, ':', 'wq' and <enter>)

```
# Default ansible hosts file
# comments begin with the '#' character
#   - Blank lines are ignored
#   - Groups of hosts are delimited by [header] elements
#   - hostnames or ip addresses are accepted
#   - A hostname/ip can be a member of multiple groups

host1
host2
host3
host4
~
~
~
:wq
```

b. Validate the configuration by using the ping module

```
cumulus@oob-mgmt-server:~$ ansible host3 -m ping
host3 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/bin/python"
    },
    "changed": false,
    "ping": "pong"
}
cumulus@oob-mgmt-server:~$
```

```
cumulus@oob-mgmt-server:~$ ansible host4 -m ping
host4 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/bin/python"
    },
    "changed": false,
    "ping": "pong"
}
cumulus@oob-mgmt-server:~$
```

Task 4: Add servers to a host group

a. Use VIM to edit the /etc/ansible/hosts file, and enter INSERT mode by typing ‘a’

# vi /etc/ansible/hosts

b. Add all servers to a group called “servers”

```
# Default ansible hosts file
# comments begin with the '#' character
#   - Blank lines are ignored
#   - Groups of hosts are delimited by [header] elements
#   - hostnames or ip addresses are accepted
#   - A hostname/ip can be a member of multiple groups

[servers]
host1
host2
host3
host4
~
~
~
```

c. Exit VIM and use the Ansible “ping” module to test the new group configuration.

```
cumulus@oob-mgmt-server:~$ ansible switches -m ping
leaf2 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/bin/python"
    },
    "changed": false,
    "ping": "pong"
}
leaf1 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/bin/python"
    },
    "changed": false,
    "ping": "pong"
}
spine3 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/bin/python"
    },
    "changed": false,
    "ping": "pong"
}
spine4 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/bin/python"
    },
    "changed": false,
    "ping": "pong"
}
```

Task 5: Add Cumulus Linux switches to the inventory

a. Use VIM to edit the /etc/ansible/hosts file, and enter INSERT mode by typing 'a'
# vi /etc/ansible/hosts

b. Add the leaf switches ('leaf1' and 'leaf2') to the inventory file, also add the necessary credentials (user and password)
# leaf1 ansible_user=cumulus ansible_ssh_pass=Academy123

```
# Default ansible hosts file
# comments begin with the '#' character
#   - Blank lines are ignored
#   - Groups of hosts are delimited by [header] elements
#   - hostnames or ip addresses are accepted
#   - A hostname/ip can be a member of multiple groups

[servers]
host[1:4] ansible_user=cumulus ansible_ssh_pass=Academy123

leaf1 ansible_user=cumulus ansible_ssh_pass=Academy123
leaf2 ansible_user=cumulus ansible_ssh_pass=Academy123

~
~
```

c. Exit VIM and use the Ansible "ping" module to test Ansible connectivity to the switches.

```
cumulus@oob-mgmt-server:~$ ansible leaf1 -m ping
leaf1 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/bin/python"
    },
    "changed": false,
    "ping": "pong"
}
```

Please note:

- You might encounter a warning regarding the Python interpreter on the switches, it can be ignored.
- If the ansible user or password are incorrect, you will get the following error:

```
leaf2 | UNREACHABLE! => {
    "changed": false,
    "msg": "Failed to connect to the host via ssh: Permission denied
(publickey,password).",
    "unreachable": true}
```

Task 6: Add Cumulus Linux switches to a host group

a. Use VIM to edit the /etc/ansible/hosts file, and enter INSERT mode by typing 'a'

```
# vi /etc/ansible/hosts
```

b. Add the **leaf** switches to a group called "leaves"

```
.
.
.

[servers]
host[1:4] ansible_user=cumulus ansible_ssh_pass=Academy123


[leaves]
leaf1 ansible_user=cumulus ansible_ssh_pass=Academy123
leaf2 ansible_user=cumulus ansible_ssh_pass=Academy123
~
~
~
```

c. Add the **spine** switches, same way the leaves were added.

```
.
.
.

[servers]
host[1:4] ansible_user=cumulus ansible_ssh_pass=Academy123

[leaves]
leaf1 ansible_user=cumulus ansible_ssh_pass=Academy123
leaf2 ansible_user=cumulus ansible_ssh_pass=Academy123

[spines]
spine3 ansible_user=cumulus ansible_ssh_pass=Academy123
spine4 ansible_user=cumulus ansible_ssh_pass=Academy123

~
~
~
```

d. Add the leaves and spines to a group called “switches”.

```
.
.
.

[servers]
host[1:4] ansible_user=cumulus ansible_ssh_pass=Academy123

[leaves]
leaf1 ansible_user=cumulus ansible_ssh_pass=Academy123
leaf2 ansible_user=cumulus ansible_ssh_pass=Academy123

[spines]
spine3 ansible_user=cumulus ansible_ssh_pass=Academy123
spine4 ansible_user=cumulus ansible_ssh_pass=Academy123

[switches:children]
spines
leaves

~
~
~
```

e. Exit VIM and use the Ansible “ping” module to test Ansible connectivity to the switches

```
cumulus@oob-mgmt-server:~$ ansible switches -m ping
leaf2 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/bin/python"
    },
    "changed": false,
    "ping": "pong"
}
leaf1 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/bin/python"
    },
    "changed": false,
    "ping": "pong"
}
spine3 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/bin/python"
    },
    "changed": false,
    "ping": "pong"
}
spine4 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/bin/python"
    },
    "changed": false,
    "ping": "pong"
}
```

Task 7: Add variables to be shared by the groups

a. Add the username and password as variables, to be shared among all 'switches' group members, then delete the definitions on each switch.

```
.
.
.

[group_b_servers]
host[1:4] ~~ansible_user=cumulus ansible_ssh_pass=Academy123~~

[leaves]
leaf1 ~~ansible_user=cumulus ansible_ssh_pass=Academy123~~
leaf2 ~~ansible_user=cumulus ansible_ssh_pass=Academy123~~

[spines]
spine3 ~~ansible_user=cumulus ansible_ssh_pass=Academy123~~
spine4 ~~ansible_user=cumulus ansible_ssh_pass=Academy123~~

[switches:children]
spines
leaves

[switches:vars]
ansible_user=cumulus
ansible_ssh_pass=Academy123

~
~
~
```

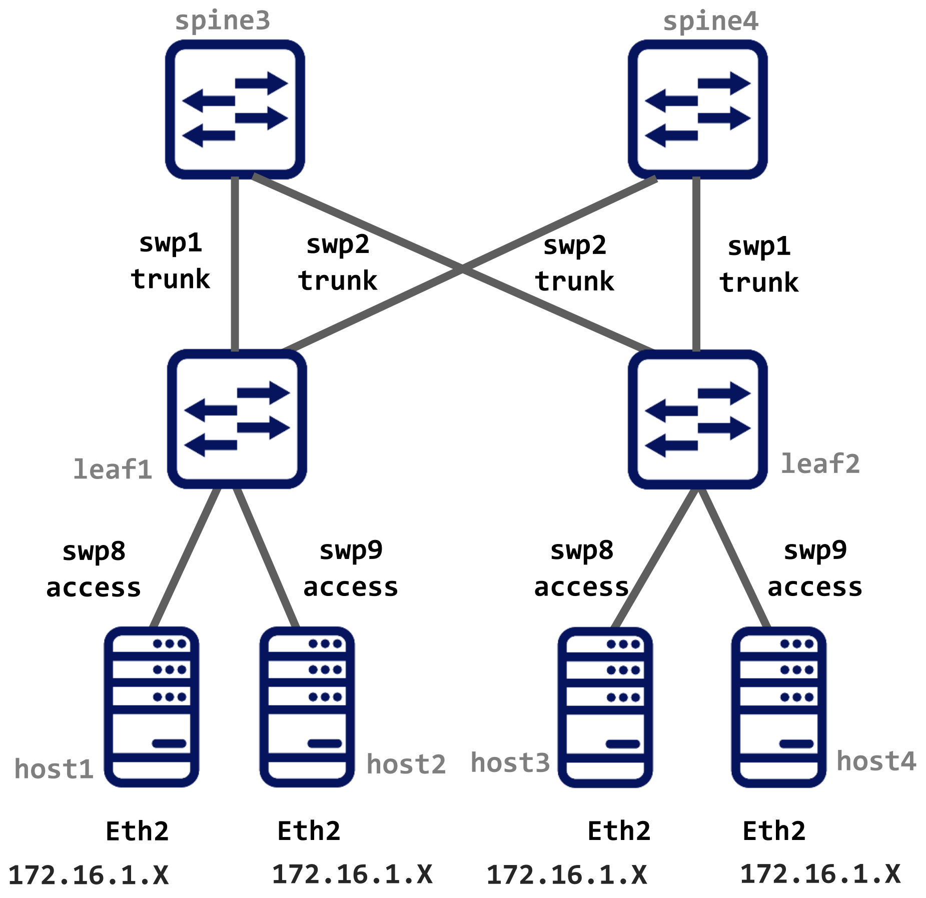
PRACTICE 9: ANSIBLE PLAYBOOK

Practice objectives:

In this practice session you configure an Ansible playbook based on a familiar practice exercise

- You will configure the servers IP settings – an IP address, a subnet mask and a default gateway.
- You will configure a bridge on each of the Cumulus Linux switches in your group and add switch ports to the bridge.
- You will execute the playbook you wrote
- Last, you will use '**ping**' utility to verify communication between servers in your group.

Topology used in this practice:



Task 1: Create a new Ansible playbook

a. Access the Ansible controller server that was assigned to you, and create a new yaml file under the /etc/ansible/ directory

```
# touch /etc/ansible/labPlaybook.yaml
```

b. Use VIM or another text editor to edit the **/etc/ansible/labPlaybook.yaml** file:

```
# vi /etc/ansible/labPlaybook.yaml
```

(the file should be empty)

- You should apply similar commands to devices in the group that was assigned to you.
- Every line that starts with '#' is considered a comment and can be deleted.

Please note:

The tasks and commands that you will configure in the playbook are based on **Practice3** in this lab guide.

Task 2: Resetting old configurations

a. Add a new task to the playbook, the task purpose is to clear the old configurations before we apply our own. This task should be applied on the servers group.
b. Add two additional sub-tasks under the task you configured:
    1. Clear the current eth2 interfaces IP addresses in each server
    2. Clear static routes in each server

```
# /etc/ansible/labPlaybook.yaml

- name: Clear server’s old configurations
  hosts: servers
  tasks:
    - name: Clear eth2 interface existing IP
      command: ifconfig eth2 0.0.0.0

    - name: Clear static routes for network 172.30.0.0/16
      command: ip route del 172.30.0.0/16
      ignore_errors: yes
```

Please note:
Clearing an empty routing table might cause errors, and those errors are not relevant to the playbook execution, therefore should be ignored.
Please make sure that the “**ignore_errors**” value is set to “**yes**”.

c. Add a new task to the playbook, the task purpose is to clear the old switch configurations before we apply our own. This task should be applied on the ‘**switches**’ **group**.
d. Add one sub-task under the task you configured:
    1. Use the **NCLU** module to clear all switch configurations with the **`net del all`** command.

```
# /etc/ansible/labPlaybook.yaml

.
.
.

- hosts: switches
  tasks:

   - name: Clear old switch configurations
     nclu:
       commands:
         - del all
       commit: true
```

Task 3: Configure switches according to the practice exercise

a. Add a new task to the playbook, the task purpose is to apply configuration that all the switches share. This task should be applied on the **switch group**.
b. add two sub-task under the task you configured, use **NCLU** module to apply:
1. configure **trunks** between the switches
2. create the **VLANs** 2,3.

```
# /etc/ansible/labPlaybook.yaml

.
.
.

- hosts: switches
  tasks:

- name: Create a bridge and set inter switch links as trunk ports
      nclu:
        commands:
          - add bridge bridge ports swp1-2
        commit: false

    - name: Create VLANs
      nclu:
        commands:
          - add bridge bridge vids 2,3
        commit: true
```

c. Add a new task to the playbook, the task purpose is to apply configuration that all **leaf** switches share. This task should be applied on the **leaves group**.
d. add one sub-task under the task you configured, use **NCLU** module to apply:
1. set the host-facing ports as access ports, and associate each interface to it's designated VLAN.

```
# /etc/ansible/labPlaybook.yaml

.
.
.

- hosts: leaves
  tasks:

    - name: Set the host-facing ports as access ports in VLAN 1 and COMMIT
changes
      nclu:
        commands:
          - add bridge bridge ports swp8-9
          - add interface swp8 bridge access 2
          - add interface swp9 bridge access 3
        commit: true
```

Task 4: Configure servers according to the practice exercise

a. Add 4 new tasks to the playbook, the tasks purpose is to configure the IP address on each server. Each task should be applied on **each server**.

```
# /etc/ansible/labPlaybook.yaml

.
.
.

- name: Configure host1
  hosts: host1
  tasks:
    - name: Configure IP address
      command: ifconfig eth2 172.30.12.18/24

- name: Configure host2
  hosts: host2
  tasks:
    - name: Configure IP address
      command: ifconfig eth2 172.30.13.19/24

- name: Configure host3
  hosts: host3
  tasks:
    - name: Configure IP address
      command: ifconfig eth2 172.30.12.28/24

- name: Configure host4
  hosts: host4
  tasks:
    - name: Configure IP address
      command: ifconfig eth2 172.30.13.29/24
```

b. Add 2 new tasks to the playbook, the tasks purpose is to configure static routes for each VLAN subnet. Each task should be applied on the servers associated with the VLAN.

```
# /etc/ansible/labPlaybook.yaml

.
.
.

- name: Add static route entry for VLAN 2
  hosts: host1, host3
  tasks:
    - name: Add default gateway for 172.30.0.0/16
      command: ip route add 172.30.0.0/16 dev eth2 via 172.30.12.254

- name: Add static route entry for VLAN 3
  hosts: host2, host4
  tasks:
    - name: Add default gateway for 172.30.0.0/16
      command: ip route add 172.30.0.0/16 dev eth2 via 172.30.13.254
```

Task 4: Executing the playbook

a. Access the Ansible controller server that was assigned to you, and make sure that the host file is configured as follows
# cat /etc/ansible/hosts

```
.
.
.

[servers]
host[1:4]

[leaves]
leaf1
leaf2

[spines]
spine3
spine4

[switches:children]
spines
leaves

[switches:vars]
ansible_user=cumulus
ansible_ssh_pass=Academy123

~
~
~
```

Please note:

- Configurations are demonstrated on group B servers and switches.
  You should apply similar commands to devices in the group that was assigned to you.
- Every line that starts with '#' is considered a comment and can be deleted.

b. Execute the playbook you wrote
# ansible-playbook /etc/ansible/labPlaybook.yaml

c. Verify configuration on the servers and switches