CCIE Data Center v3

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CCDE # 20110020

Comprehensive coverage of the CCIE Data Center (DC) v3 Exam



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CCIE Data Center v3 – Configuring Nexus NX-OS

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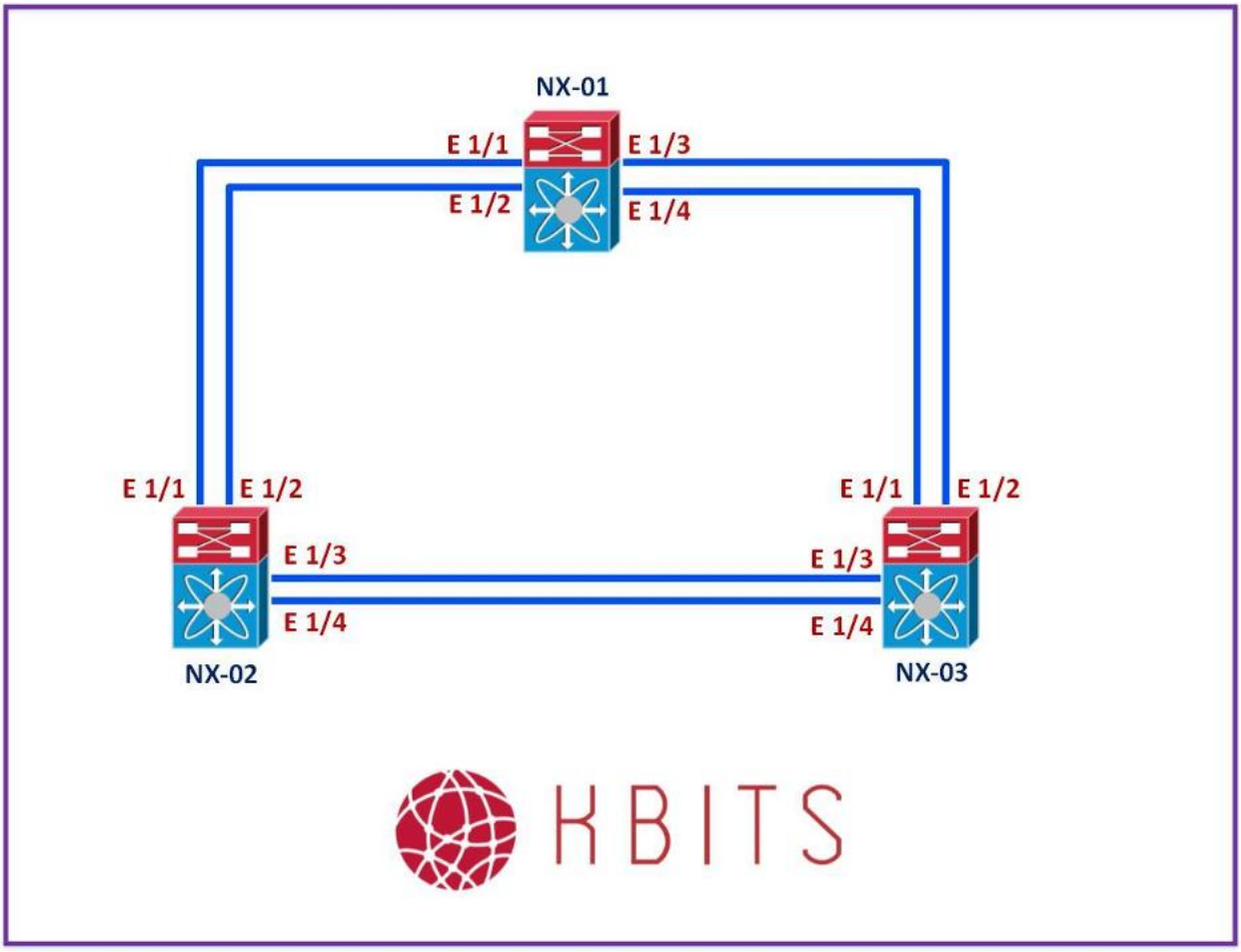
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Module 1 – Configuring Nexus Switches



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Lab 1- Introduction to the Nexus Operating System (NX-OS)



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Task 1
Initiliaze all 3 switches with a password of **Cisco123** for the default admin account.

Task 2
Configure the Switches with Hostnames of the switches based on the following:

- Nexus NX-01: **NX-01**
- Nexus NX-02: **NX-02**
- Nexus NX-03: **NX-03**

NX-01 Hostname NX-01 OR Switchname NX-01	**NX-02** Hostname NX-02 OR Switchname NX-02
NX-03 Hostname NX-03 OR Switchname NX-03	

Task 3
Find out the operating system that is running on the Nexus devices.

NX-01 Show version	**NX-02** Show version
NX-03 Show version	

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Task 4

Figure out the modules installed in your Nexus devices.

NX-01 Show module	**NX-02** Show module
NX-03 Show module	

Task 5

Find out the features available on your Nexus devices.

NX-01 Show feature	**NX-02** Show feature
NX-03 Show feature	

Task 6

Find out the features that are enabled by default.

NX-01 Show feature | include enabled	**NX-02** Show feature | include enabled
NX-03 Show feature | include enabled	

Task 7

Find the status of the interface and its characteristics. What type of Ethernet Interface is it (Gigabit, Ten G or 100G)?

NX-01 Show interface ethernet 1/1	**NX-02** Show interface ethernet 1/1
NX-03 Show interface ethernet 1/1	

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Task 8

Configure a checkpoint of your config file

NX-01 Checkpoint CK1	**NX-02** Checkpoint CK1
NX-03 Checkpoint CK1	

Task 9

Change the Hostname of the devices to the following:

- Nexus NX-01: **Dubai**
- Nexus NX-02: **LosAngeles**
- Nexus NX-03: **London**

NX-01 Switchname Dubai	**NX-02** Switchname LosAngeles
NX-03 Switchname London	

Task 10

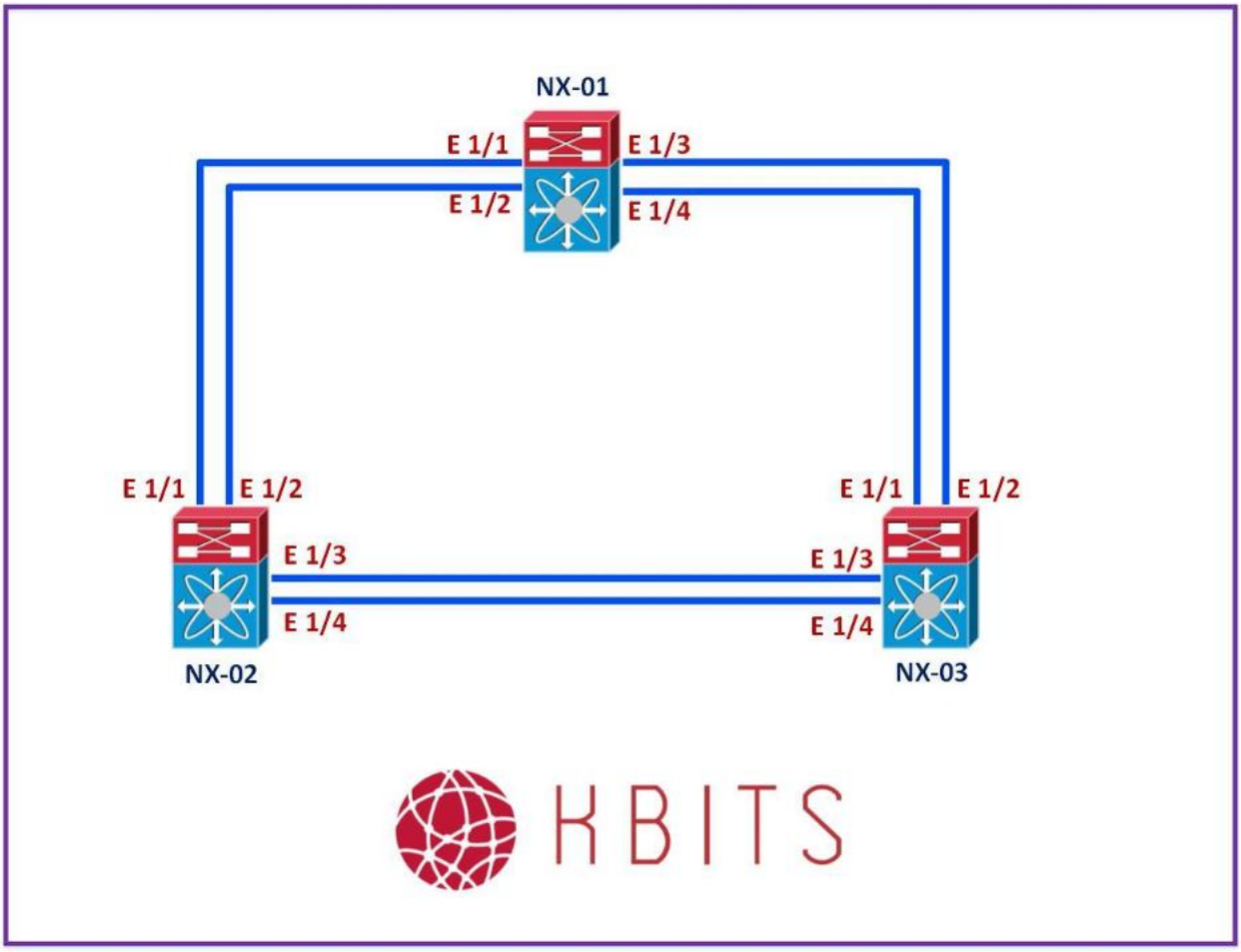
Revert the Switch back the running-config to the checkpoint created.

NX-01 Rollback running-config checkpoint CK1
NX-02 Rollback running-config checkpoint CK1
NX-03 Rollback running-config checkpoint CK1

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Lab 2 – Configuring Trunking & VLANs

(Builds on Lab 1)



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Task 1

Configure the interfaces that connect NX-01 to NX-02 and NX-03 as Trunk ports. Only use the ports shown in the Diagram (Lab1).

NX-01	**NX-02**
Interface E1/1-4 Switchport Switchport mode trunk No shutdown	Interface E1/1-4 Switchport Switchport mode trunk No shutdown
NX-03	
Interface E1/1-4 Switchport Switchport mode trunk No shutdown	

Task 2

Configure VLANs and assign ports to these vlans based on the following table:

- VLAN 10
  - Nexus NX-01: **E1/5 & E 1/6**
  - Nexus NX-02: **E1/5 & E 1/6**
  - Nexus NX-03: **E1/5 & E 1/6**

- VLAN 20
  - Nexus NX-01: **E1/7 & E 1/8**
  - Nexus NX-02: **E1/7 & E 1/8**
  - Nexus NX-03: **E1/7 & E 1/8**

NX-01	**NX-02**
VLAN 10,20 ! interface E 1/5-6 switchport switchport mode access switchport access vlan 10 No shut ! interface E 1/7-8 switchport switchport mode access Switchport access vlan 20 No shut	VLAN 10,20 ! interface E 1/5-6 switchport switchport mode access switchport access vlan 10 No shut ! interface E 1/7-8 switchport switchport mode access Switchport access vlan 20 No shut

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NX-03

```
VLAN 10,20
!
interface E 1/5-6
 switchport
 switchport mode access
 switchport access vlan 10
 No shut
!
interface E 1/7-8
switchport
 switchport mode access
 Switchport access vlan 20
 No shut
```

Task 3

Only VLANs 10 thru 20 should be allowed to cross the trunk links.

NX-01

```
Interface E 1/1-4
 Switchport trunk allowed vlan 10-20
```

NX-02

```
Interface E 1/1-4
 Switchport trunk allowed vlan 10-20
```

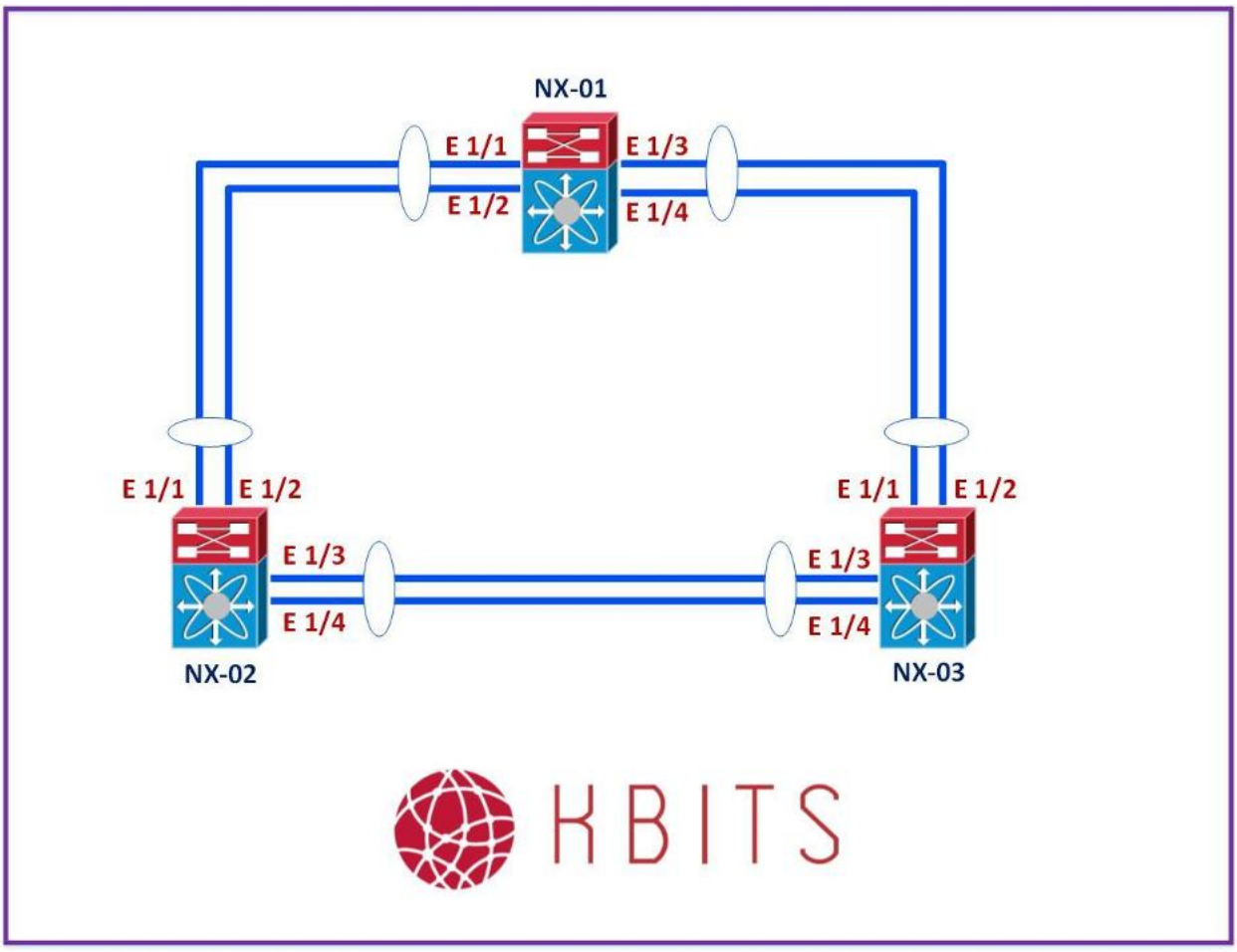
NX-03

```
Interface E 1/1-4
 Switchport trunk allowed vlan 10-20
```

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Lab 3 – Configuring Port Channels – Manual Mode

(Builds on Lab 2)



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Task 1

Default all the Trunking Interfaces on all 3 Switches.

NX-01 Default interface E 1/1-4
NX-02 Default interface E 1/1-4
NX-03 Default interface E 1/1-4

Task 2

Configure the Ports connecting NX-02 and NX03 to be part of a Port Channel. The Port Channel # should be set to 23 on both sides. The Port Channel should not use any negotiation protocol.

NX-02 Interface E 1/3 - 4 Channel-group 23 mode on No shut
NX-03 Interface E 1/3 - 4 Channel-group 23 mode on No shut

Task 3

Configure the Port-Channel to be a trunk.

NX-02 Interface Port-channel 23 Switchport Switchport mode trunk No shut
NX-03 Interface Port-channel 23 Switchport Switchport mode trunk No shut

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Task 4

Configure the Load Balancing mechanism method to be done based on a combination of the Source and Destination IP.

NX-02 port-channel load-balance src-dst ip
NX-03 port-channel load-balance src-dst ip

Task 5

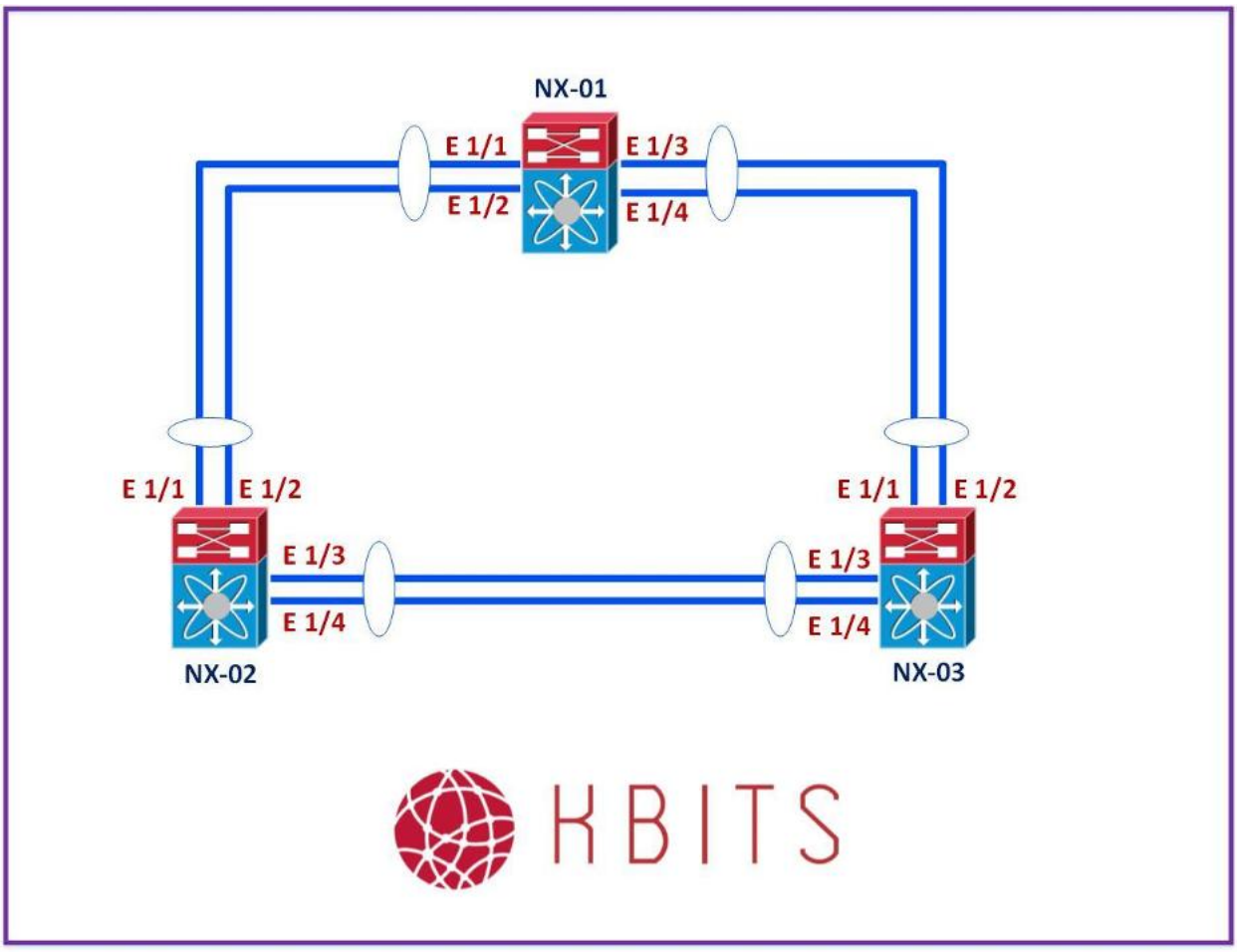
Verify the Port Channel status.

NX-02 Show port-channel summary
NX-03 Show port-channel summary

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Lab 4 – Configuring Port Channels – LACP

(Builds on Lab 3)



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Task 1

Configure the Ports connecting NX-01 and NX0S2 to be part of a Port Channel. The Port Channel # should be set to 12 on both sides. The Port Channel should LACP as the negotiation protocol.

NX-01
Feature lacp ! Interface E 1/1 - 2 Channel-group 12 mode active No shut
NX-02
Feature lacp ! Interface E 1/1 - 2 Channel-group 12 mode active No shut

Task 2

Configure the Port-Channel to be a trunk.

NX-01
Interface Port-channel 12 Switchport Switchport mode trunk No shut
NX-02
Interface Port-channel 12 Switchport Switchport mode trunk No shut

Task 3

Verify the Port Channel status.

NX-01
Show port-channel summary
NX-02

Show port-channel summary

Task 4

Configure the Ports connecting NX-01 and NX0S3 to be part of a Port Channel. The Port Channel # should be set to 13 on both sides. The Port Channel should LACP as the negotiation protocol.

NX-01 Feature lacp ! Interface E 1/3 - 4 Channel-group 13 mode active No shut
NX-03 Feature lacp ! Interface E 1/1 - 2 Channel-group 12 mode active No shut

Task 2

Configure the Port-Channel to be a trunk.

NX-01 Interface Port-channel 13 Switchport Switchport mode trunk No shut
NX-03 Interface Port-channel 13 Switchport Switchport mode trunk No shut

Task 3

Verify the Port Channel status.

NX-01 Show port-channel summary

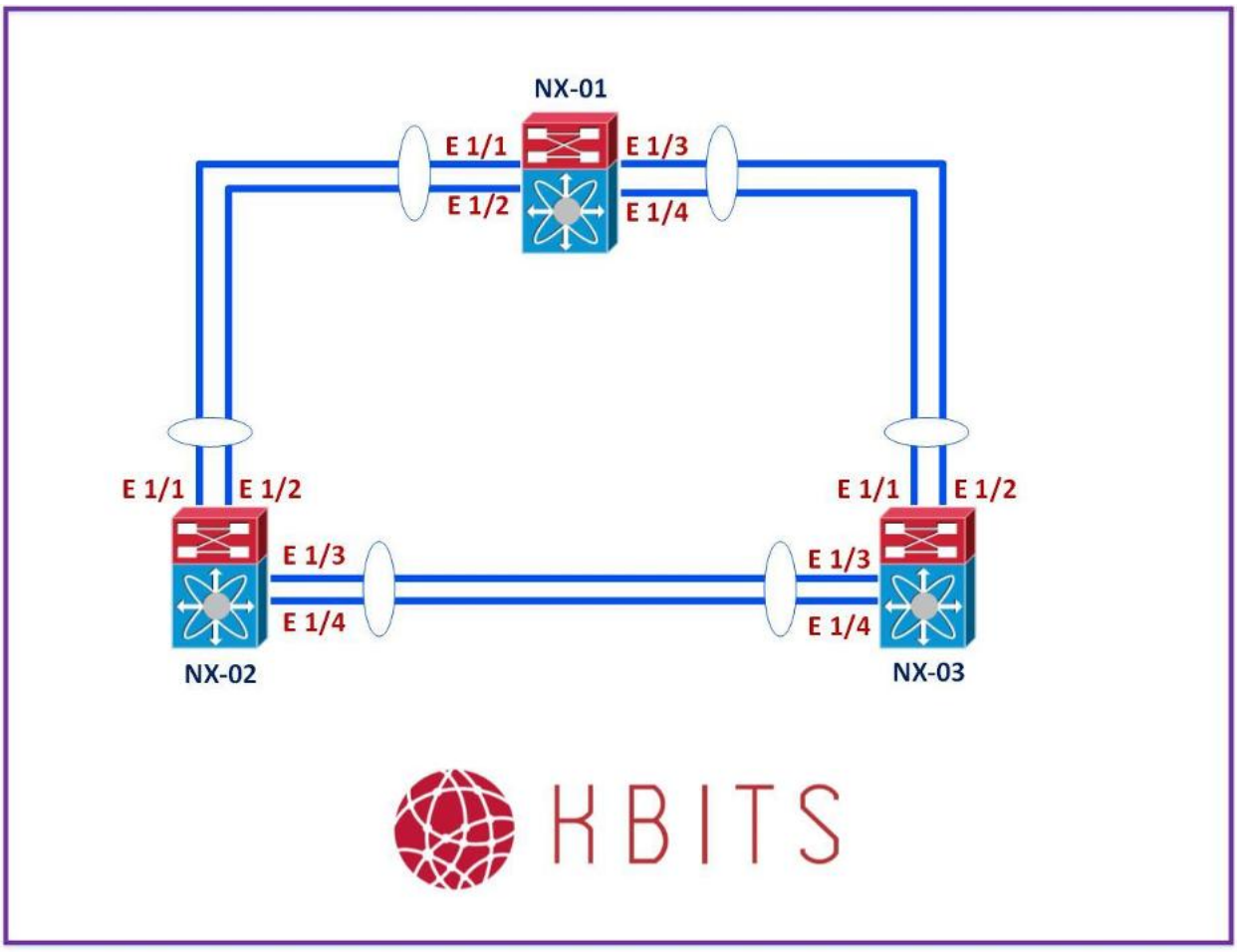
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NX-03

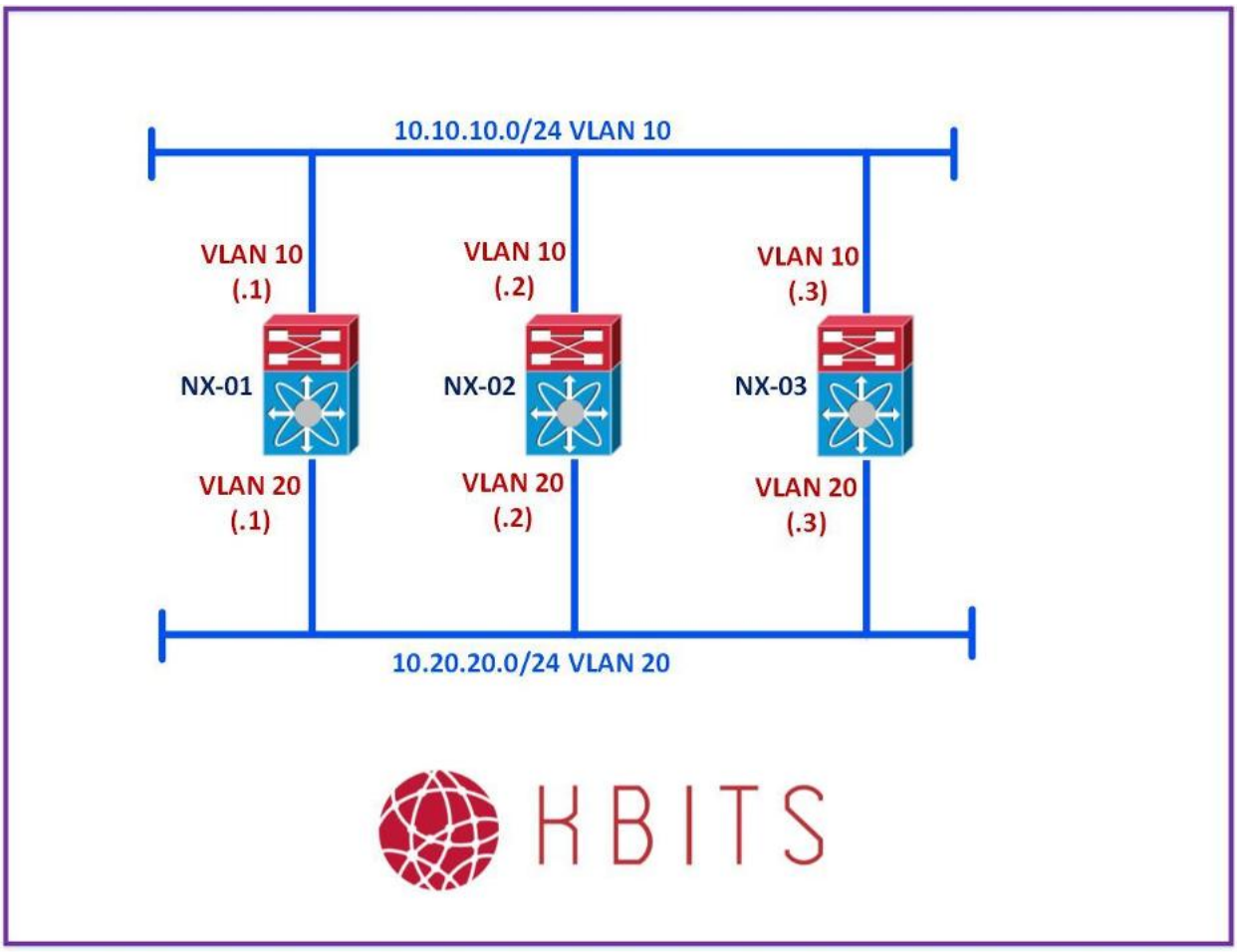
Show port-channel summary

Lab 5 – Configuring Switch Virtual Interfaces (SVI)

(Builds on Lab 4)



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Task 1

Enable the SVI feature on allthe Nexus Switches.

NX-01 Feature interface-vlan	**NX-02** Feature interface-vlan
NX-03 Feature interface-vlan	

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Task 2

Configure the SVI's on the Nexus switches based on the following table:

- NX-01
  - VLAN 10: **10.10.10.1/24**
  - VLAN 20: **10.20.20.1/24**
- NX-02
  - VLAN 10: **10.10.10.2/24**
  - VLAN 20: **10.20.20.2/24**
- NX-03
  - VLAN 10: **10.10.10.3/24**
  - VLAN 20: **10.20.20.3/24**

NX-01	**NX-02**
Interface VLAN 10 Ip address 10.10.10.1/24 No shut ! Interface VLAN 20 Ip address 10.20.20.1/24 No shut	Interface VLAN 10 Ip address 10.10.10.2/24 No shut ! Interface VLAN 20 Ip address 10.20.20.2/24 No shut
NX-03 Interface VLAN 10 Ip address 10.10.10.3/24 No shut ! Interface VLAN 20 Ip address 10.20.20.3/24 No shut	

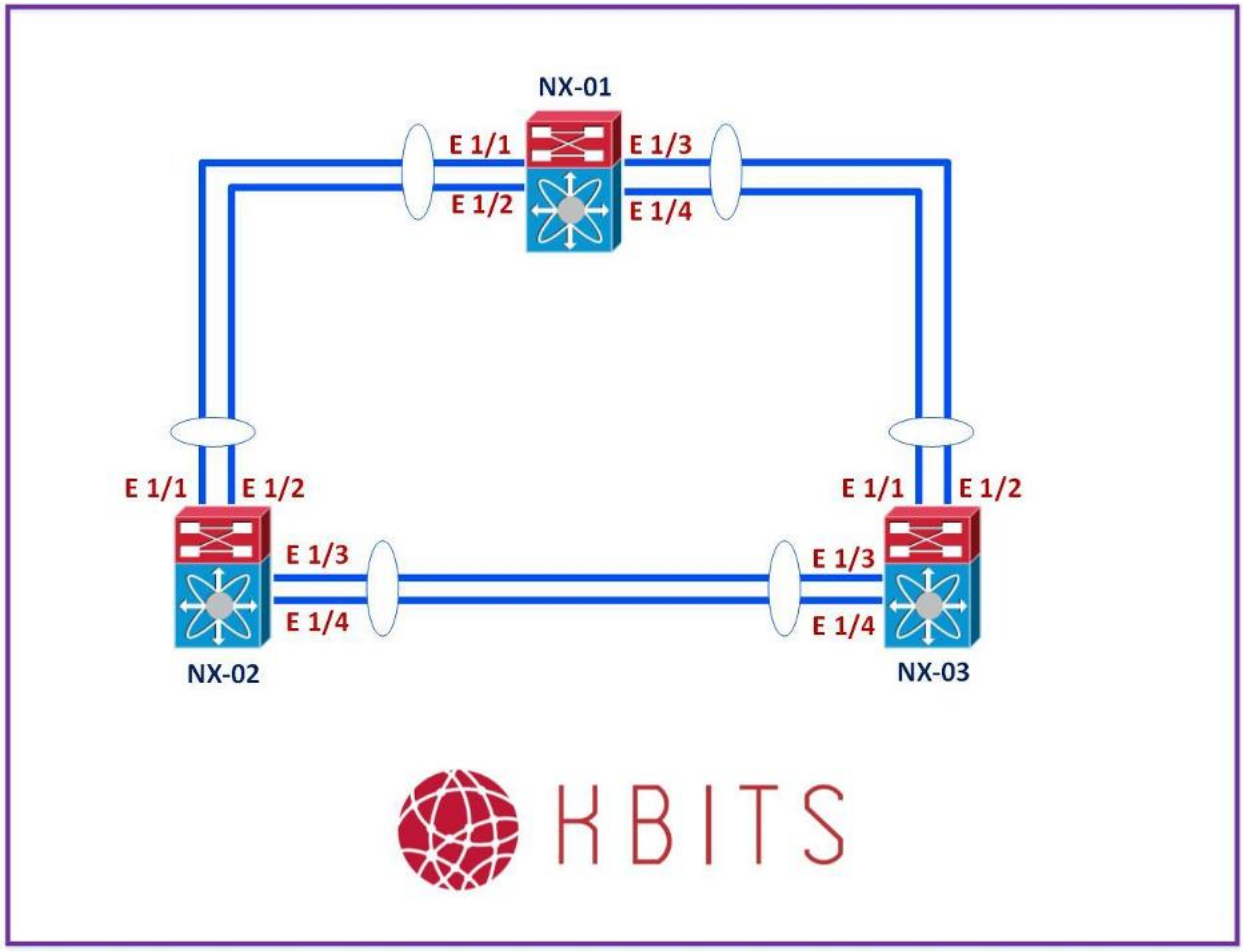
Task 3

Make sure the devices are pingable within the same VLANs.

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Lab 6 – Configuring Port Security

(Builds on Lab 5)



Task 1

Enable the Port-Security Feature on all 3 switches.

NX-01 Feature port-security	**NX-02** Feature port-security
NX-03 Feature port-security	

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Task 2

Configure NX-01 such that only MAC 0010.1111.2222 can connect to Port E 1/5. If another port tries to connect to this port, it should be shudown.

NX-01

```
Interface E 1/5
 Switchport port-security
 Switchport port-security mac 0010.1111.2222
```

Task 3

Configure NX-02 such that only MAC 0010.2222.4444 can connect to Port E 1/5. If another port tries to connect to this port, it should be shudown.

NX-02

```
Interface E 1/5
 Switchport port-security
 Switchport port-security mac 0010.2222.4444
```

Task 4

Configure Port security on NX-03 ports E 1/5 & E 1/6. You would like to learn the MAC address dynamically and copy it to the running-configuration file.

NX-03

```
Interface E 1/5-6
 Switchport port-security
 Switchport port-security mac sticky
```

Task 5

Enable Port security for E 1/6 port on NX-01such that 5 MAC address can be connected to it. Configure 2 MAC Address (0001-1010-AB12 and 0001-1010-AB13) statically. The rest of the MAC addresses can be learned dynamically.

NX-01

```
Interface E 1/6
 Switchport port-security
 Switchport port-security max 5
 Switchport port-security mac 0001.1010.AB12
 Switchport port-security mac 0001.1010.AB13
 Switchport port-security mac sticky
```

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Task 6

Configure the NX-01 such that it tries to bring up the Port-security error disabled port automatically after 4 minutes.

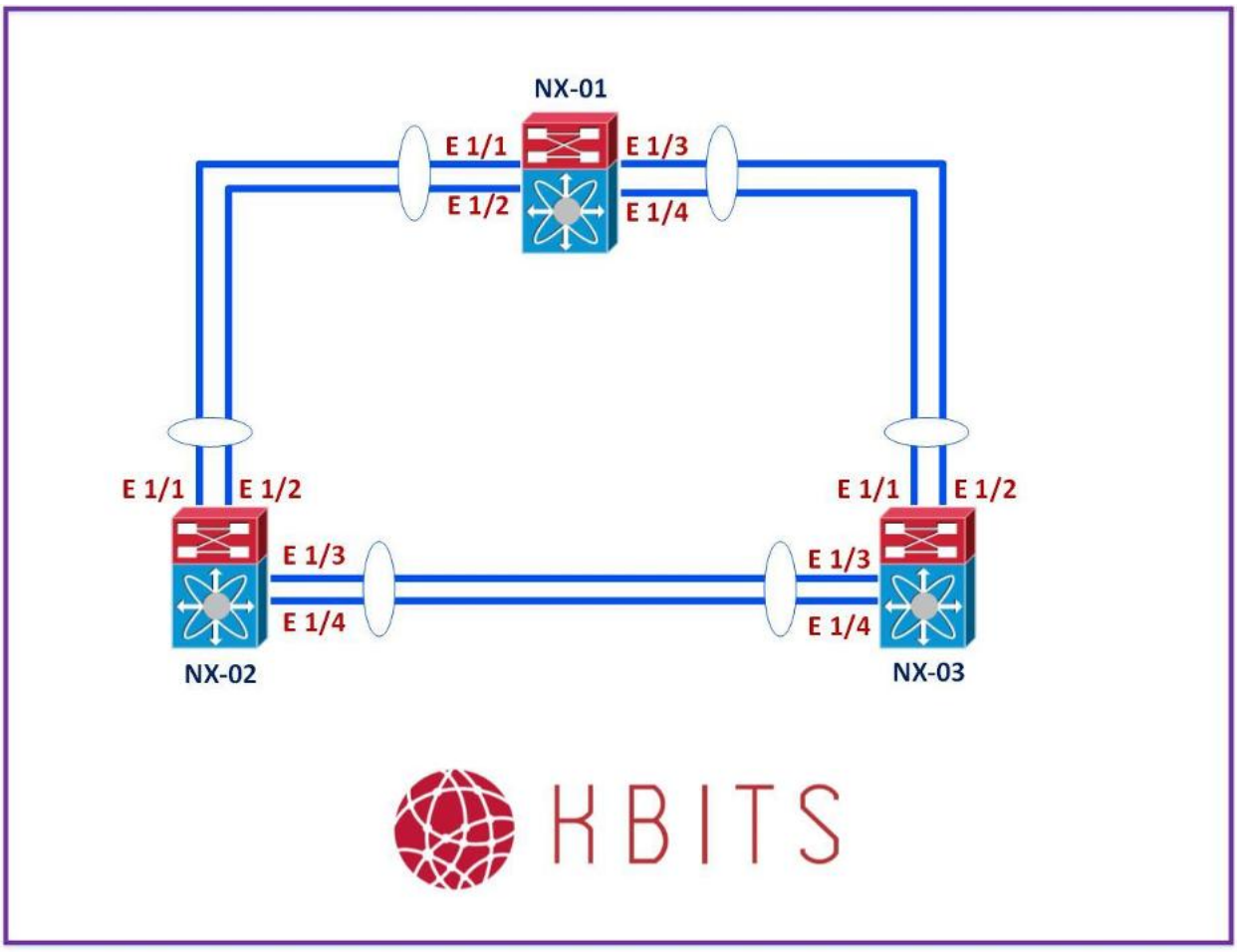
NX-01

```
errdisable recovery cause psecure-violation
errdisable recovery interval 240
```

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Lab 7 – Preventing the Rogue DHCP Server Attack using the DHCP Snooping

(Builds on Lab 6)



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Task 1

Enable the DHCP Snooping Feature on the Nexus NX-01.

NX-01

```
Feature dhcp
```

Task 2

The DHCP server resides on the E 1/5 on NX-01. Make sure the switch only allows DHCP replies from this port on NX-01 for VLAN 10 and VLAN 20.

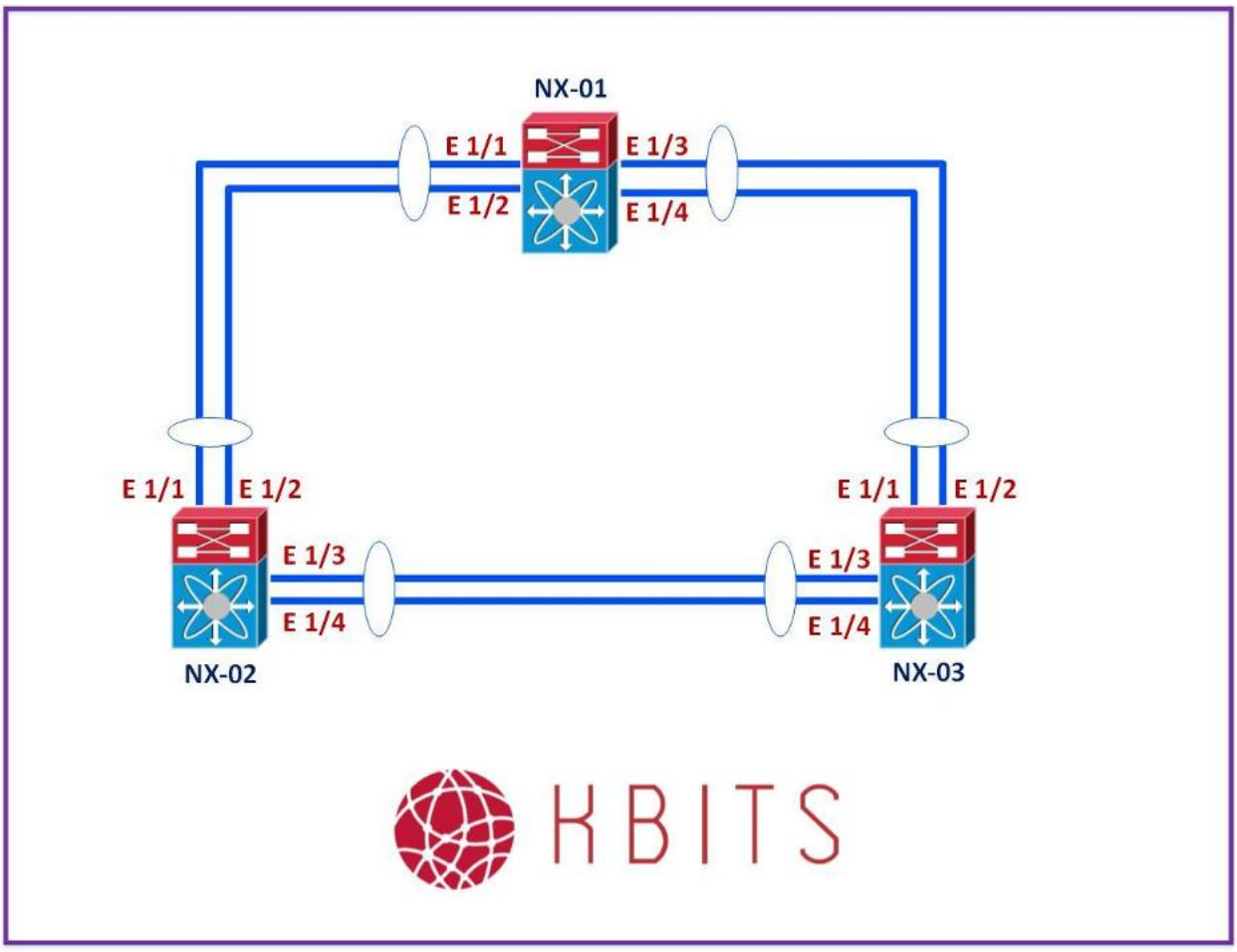
NX-01

```
Ip dhcp snooping
Ip dhcp snooping vlan 10
Ip dhcp snooping vlan 20
!
Interface E 1/5
 Ip dhcp snooping trust
```

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Lab 8 – Configuring Storm Control

(Builds on Lab 7)



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Task 1

Configure NXSO2 ports E 1/7 & E 1/8 such that broadcast and multicast traffic do not use more than 50% of the Interface bandwidth.

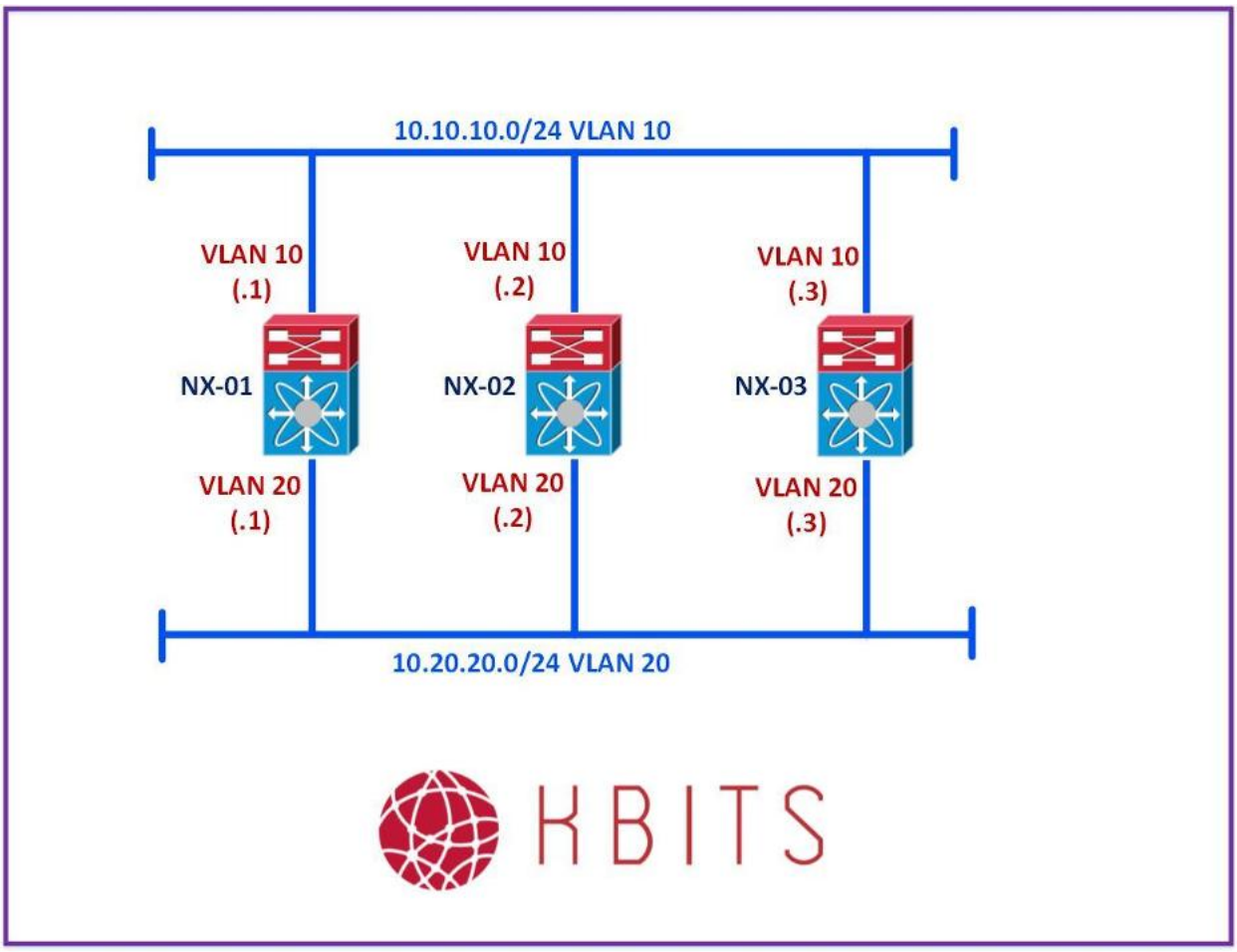
NX-02

```
Interface E 1/7-8
Storm-control broadcast level 50.00
Storm-control multicast level 50.00
```

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Lab 9 – Configuring IP ACLs

(Builds on Lab 8)



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Task 1

Configure an ACL to only allow Telnet & SSH traffic coming into the SVI 10 Interface on NX-03.

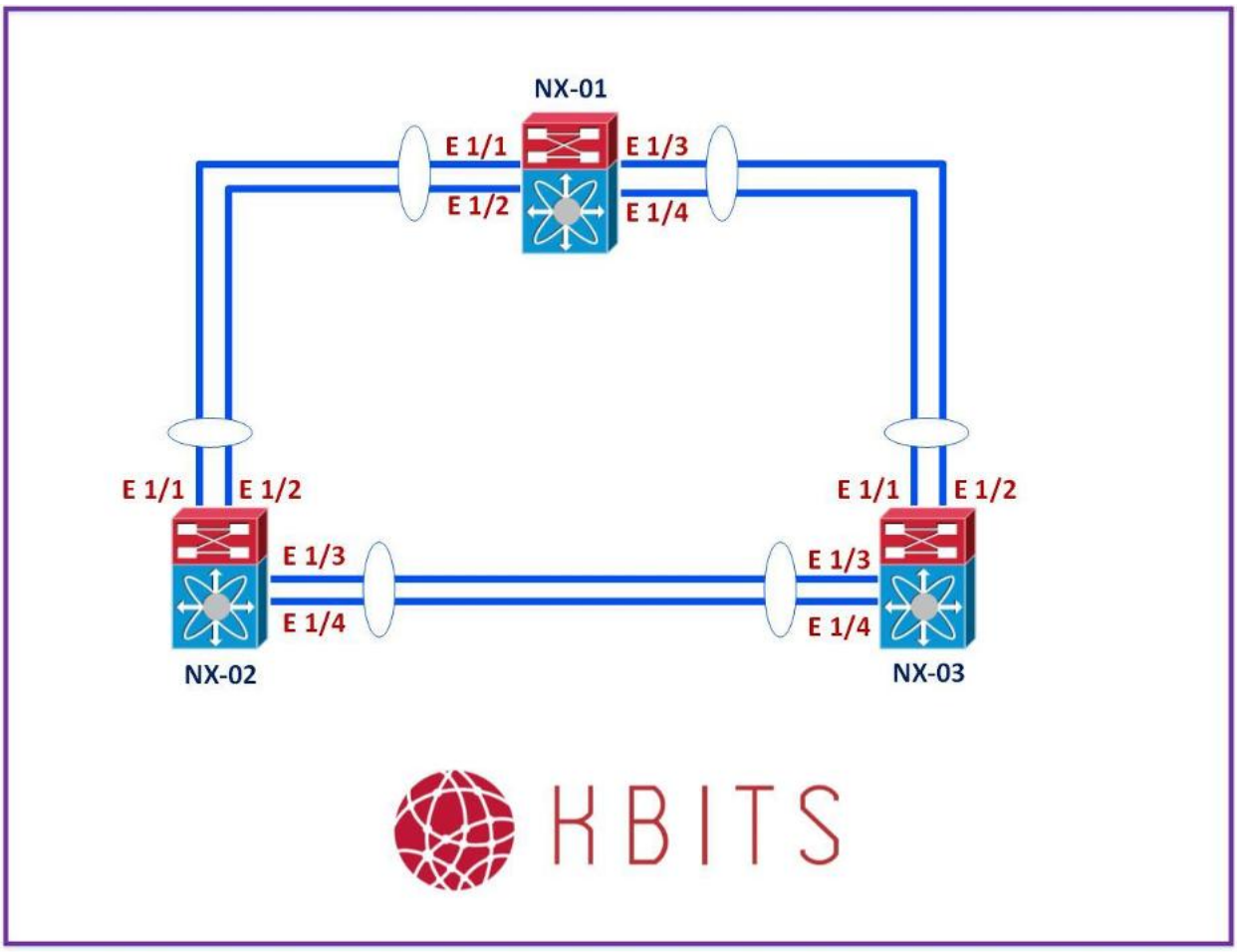
NX-03

```
Ip access-list CONTROL
 Permit tcp any any eq 23
 Permit tcp any any eq 22
!
Interface VLAN 10
 Ip access-group CONROL in
```

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Lab 10 – Configuring MAC ACLs

(Builds on Lab 9)



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Task 1

There is a MAC Address 0001.0012.2222 trying to attack VLAN 10 by sending a broadcast storm. You have traced this packet to port E 1/6 on NX-03. Block this MAC address on E 1/6 on NS-03. Do not use Storm control or VACL to accomplish this task.

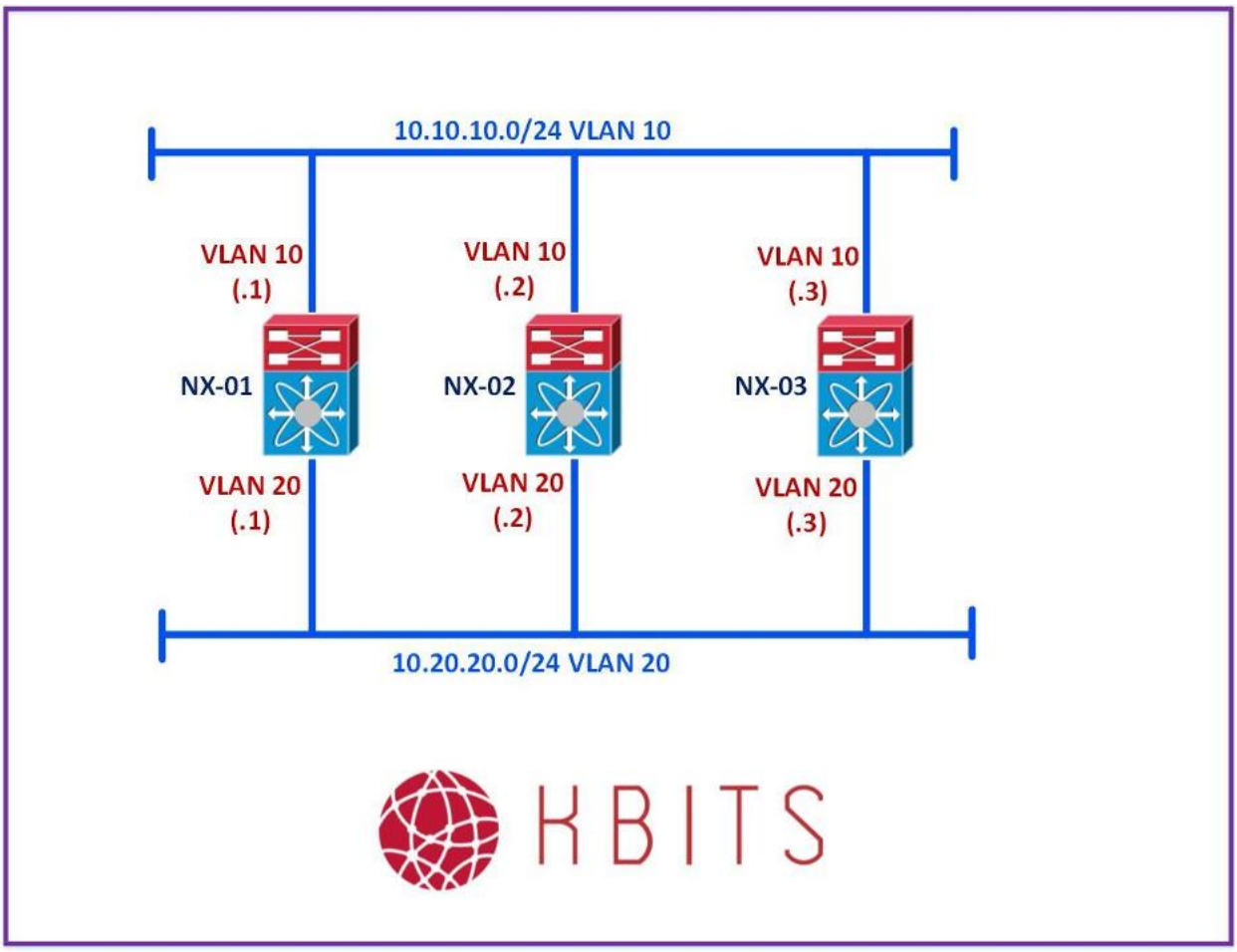
NX-03

```
mac access-list MAC-BLOCK-STORM
 deny 0001.0012.2222 0.0.0 any
 permit any any
!
Interface E 1/6
 Mac access-group MAC-BLOCK-STORM in
```

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Lab 11 – Configuring VLAN ACLs (VACL)

(Builds on Lab 10)



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Task 1

You have been requested to implement the following policy on NX-01:

- Deny IGMP in VLAN 10
- Deny TFTP in VLAN 20
- There is a MAC address 0001.0012.2222 trying to attack VLAN 10. Block this MAC address from accessing any device in VLAN 10.

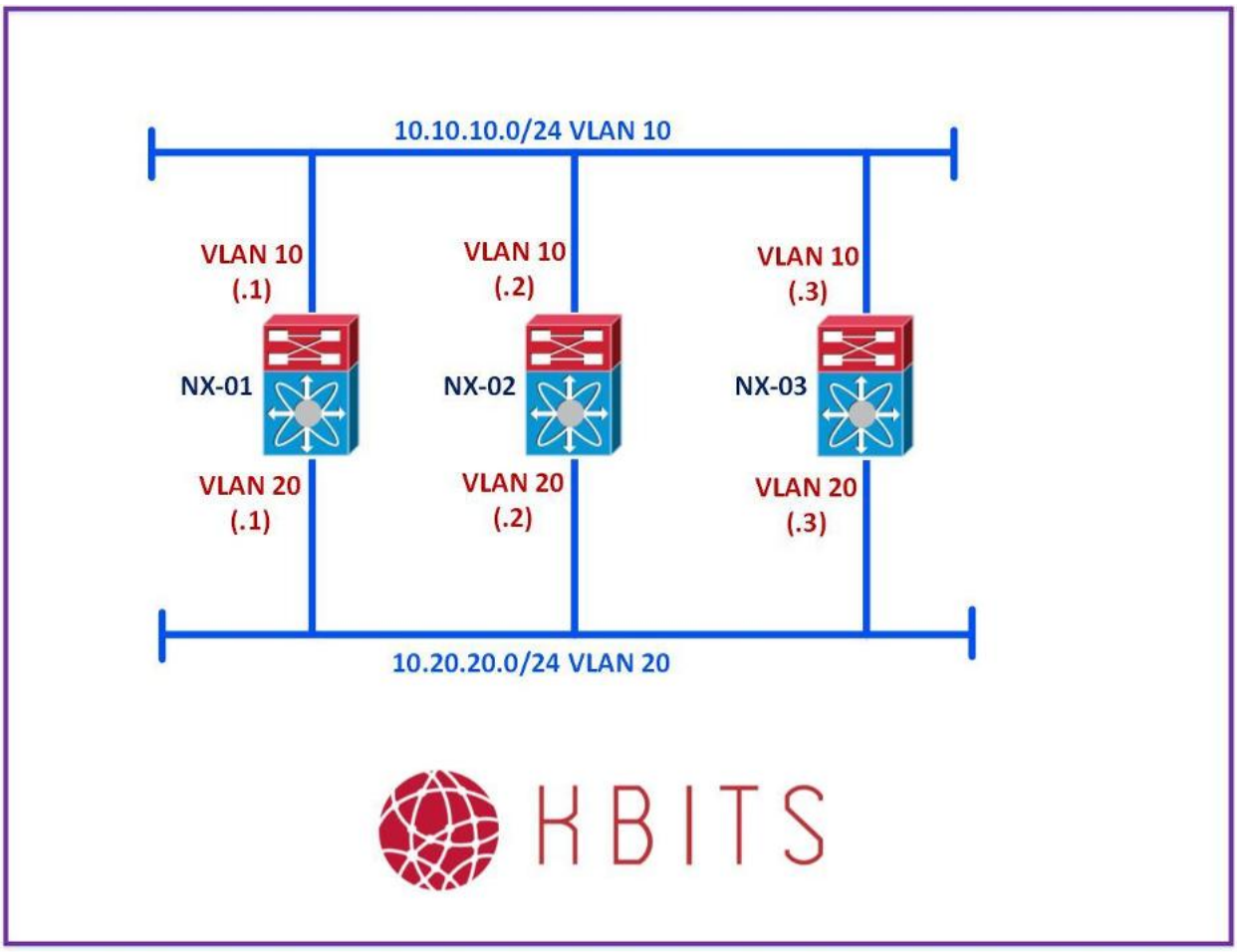
NX-01

```
Ip Access-list VACL-10
 permit igmp any any
!
Ip Access-list VACL-20
 permit udp any any eq 69
!
Mac access-list MAC-VACL-10
 Permit 0001.0012.2222 0.0.0 any
!
Ip access-list IP-PERMIT
 Permit ip any any
!
Vlan access-map VLAN10 10
 Match ip addr VACL-10
 Action drop
Vlan access-map VLAN10 20
 Match mac addr MAC-VACL-10
 Action drop
Vlan access-map VLAN10 100
 Match ip address IP-PERMIT
 Action forward
!
Vlan access-map VLAN20 10
 Match ip addr VACL-20
 Action drop
Vlan access-map VLAN20 100
 Match ip address IP-PERMIT
 Action forward
!
Vlan filter VLAN10 vlan-list 10
Vlan filter VLAN20 vlan-list 20
```

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Lab 12 – Remote Management

(Builds on Lab 10)



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Task 1

Configure all 3 switches for Remote Management using Telnet in addition to the SSH, which is enabled by Default.

NX-01 Feature telnet
NX-02 Feature telnet
NX-03 Feature telnet

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CCIE Data Center v3 – Configuring Nexus NX-OS

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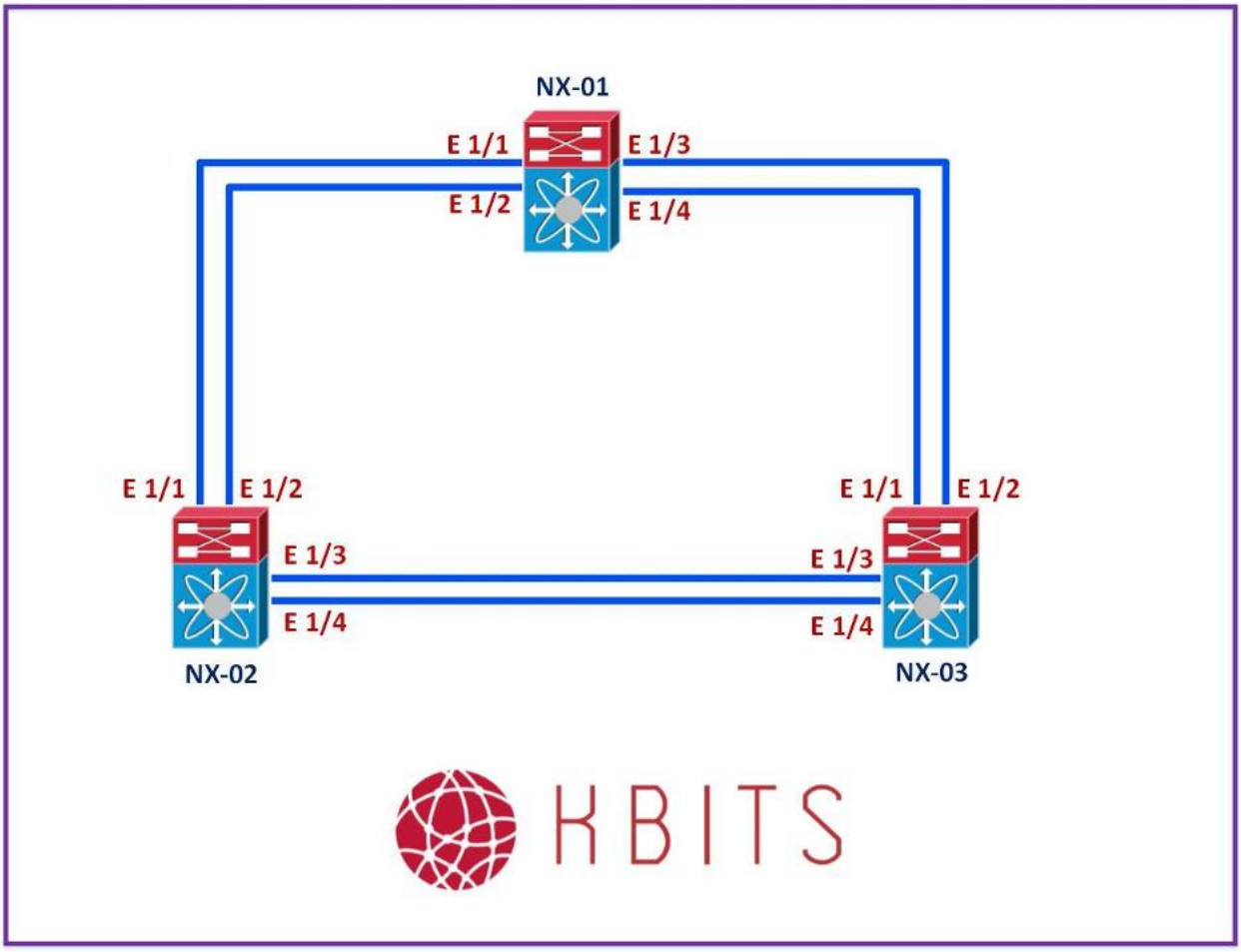
Module 2 - Configuring Spanning Tree Protocol (STP)



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Lab 1- Configuring Root Bridges in a Rapid PVST Network

(Builds on Previous Module)



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Task 1

Although the default STP mode is Rapid PVST, make sure you set all 3 switches to Rapid PVST manually.

NX-01 Spanning-tree mode rapid-pvst
NX-02 Spanning-tree mode rapid-pvst
NX-03 Spanning-tree mode rapid-pvst

Task 2

Configure **NX-01** as the root bridge for VLANs **1 - 20**. Configure **NX-02** as the secondary for VLANs **1-10** and **NX-03** as the secondary for VLANs **11-20**.

NX-01 Spanning-tree vlan 1-20 root primary Or Spanning-tree vlan 1-20 priority 0
NX-02 Spanning-tree vlan 1-10 root secondary Or Spanning-tree vlan 1-10 priority 4096
NX-03 Spanning-tree vlan 11-20 root secondary Or Spanning-tree vlan 11-20 priority 4096

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Task 3

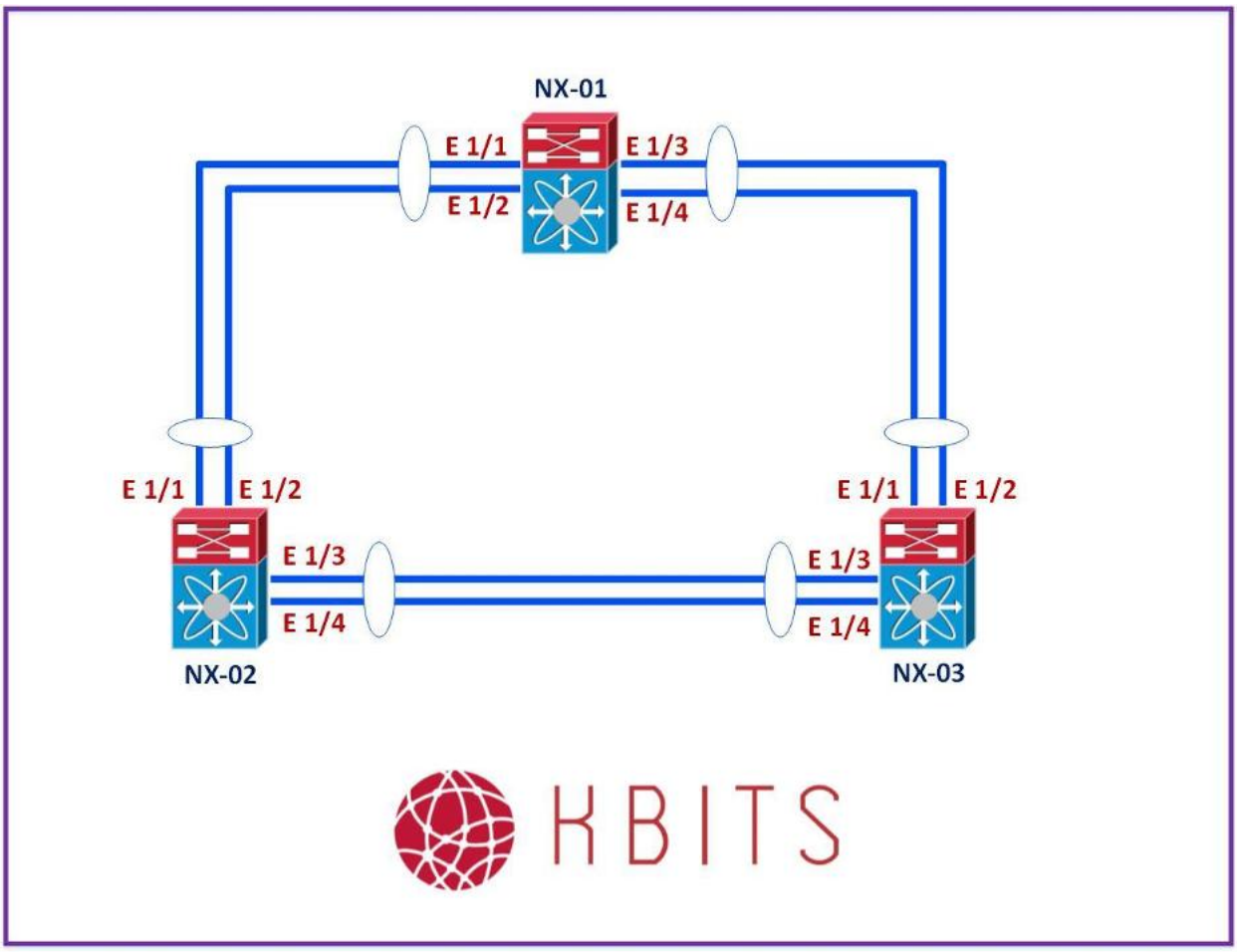
Verify STP information for VLAN 10 & 20 by using the **show spanning-tree vlan XX** commands on all 3 switches.

NX-01 **Show spanning-tree vlan 10** **Note:** Check the Root ID and make sure **NX-01** is the root bridge for all VLAN. **Show spanning-tree vlan 20** **Note:** Check the Root ID and make sure **NX-01** is the root bridge for all VLAN.
NX-02 **Show spanning-tree vlan 10** **Note:** Check the Root ID and make sure **NX-01** is the root bridge for all VLAN. **Show spanning-tree vlan 20** **Note:** Check the Root ID and make sure **NX-01** is the root bridge for all VLAN.
NX-03 **Show spanning-tree vlan 10** **Note:** Check the Root ID and make sure **NX-01** is the root bridge for all VLAN. **Show spanning-tree vlan 20** **Note:** Check the Root ID and make sure **NX-01** is the root bridge for all VLAN.

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Lab 2 – Tuning STP Startup Times

(Builds on Lab 1)



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Task 1

Users in VLAN 10 are complaining about the time it usually takes for an interface to come up after they have plugged in the network cable. Configure the TOTAL link startup delay until the port becomes forwarding to 16 seconds. Configure N7K-1 to accomplish this without jumping any state.

NX-01 Spanning-tree vlan 10 forward-time 8
NX-02 Spanning-tree vlan 10 forward-time 8
NX-03 Spanning-tree vlan 10 forward-time 8

Task 2

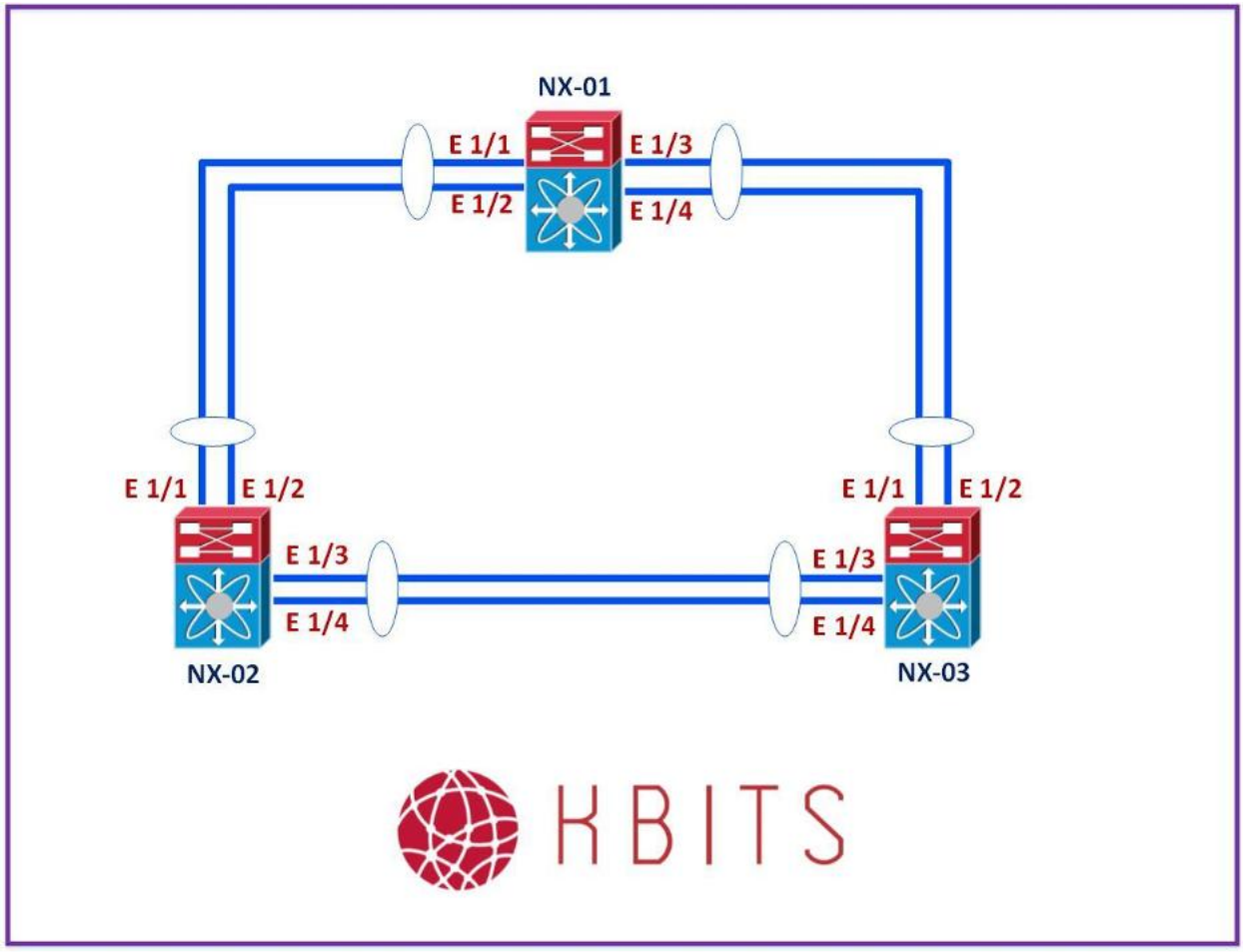
Verify that the Timers have changed for VLAN 10 by using the **show spanning-tree vlan 10** command on all switches.

NX-01 show spanning-tree vlan 10
NX-02 show spanning-tree vlan 10
NX-03 show spanning-tree vlan 10

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Lab 3 – Configuring Edge Ports

(Builds on Lab 2)



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Task 1

Configure all ports in VLAN 20 in a way that, the link will come up as soon as someone plugs in a network cable into these ports bypassing STP learning/listening states.

NX-01 Interface E 1/7-8 Spanning-tree port type edge
NX-02 Interface E 1/7-8 Spanning-tree port type edge
NX-03 Interface E 1/7-8 Spanning-tree port type edge

Task 2

Verifying the setting by using the **show spanning-tree interface E 1/XX**

NX-01 show spanning-tree interface E 1/7
NX-02 show spanning-tree interface E 1/7
NX-03 show spanning-tree interface E 1/8

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Lab 4 - Configuring BPDU Guard & BPDU Filter

(Builds on Lab 3)

Task 1

The IT departament just found out that someone in the lobby area just plugged in a switch into port E 1/7 on NX-01. Configure a command on the appropriate ports on all 3 switches such that if someone connects a hub or a switch to any of the 2 edge ports configured in the previous lab, the port will be disabled. Also make sure that after 4 minutes the disabled port comes up automatically.

NX-01 Interface E 1/7-8 Spanning-tree bpduguard enable ! Errdisable recovery cause bpduguard Errdisable recovery interval 240
NX-02 Interface E 1/7-8 Spanning-tree bpduguard enable ! Errdisable recovery cause bpduguard Errdisable recovery interval 240
NX-03 Interface E 1/7-8 Spanning-tree bpduguard enable ! Errdisable recovery cause bpduguard Errdisable recovery interval 240

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Task 2

Verify the errdisable recovery feature by using the **show errdisable revovery** command.

NX-01 show errdisable recovery
NX-02 show errdisable recovery
NX-03 show errdisable recovery

Task 3

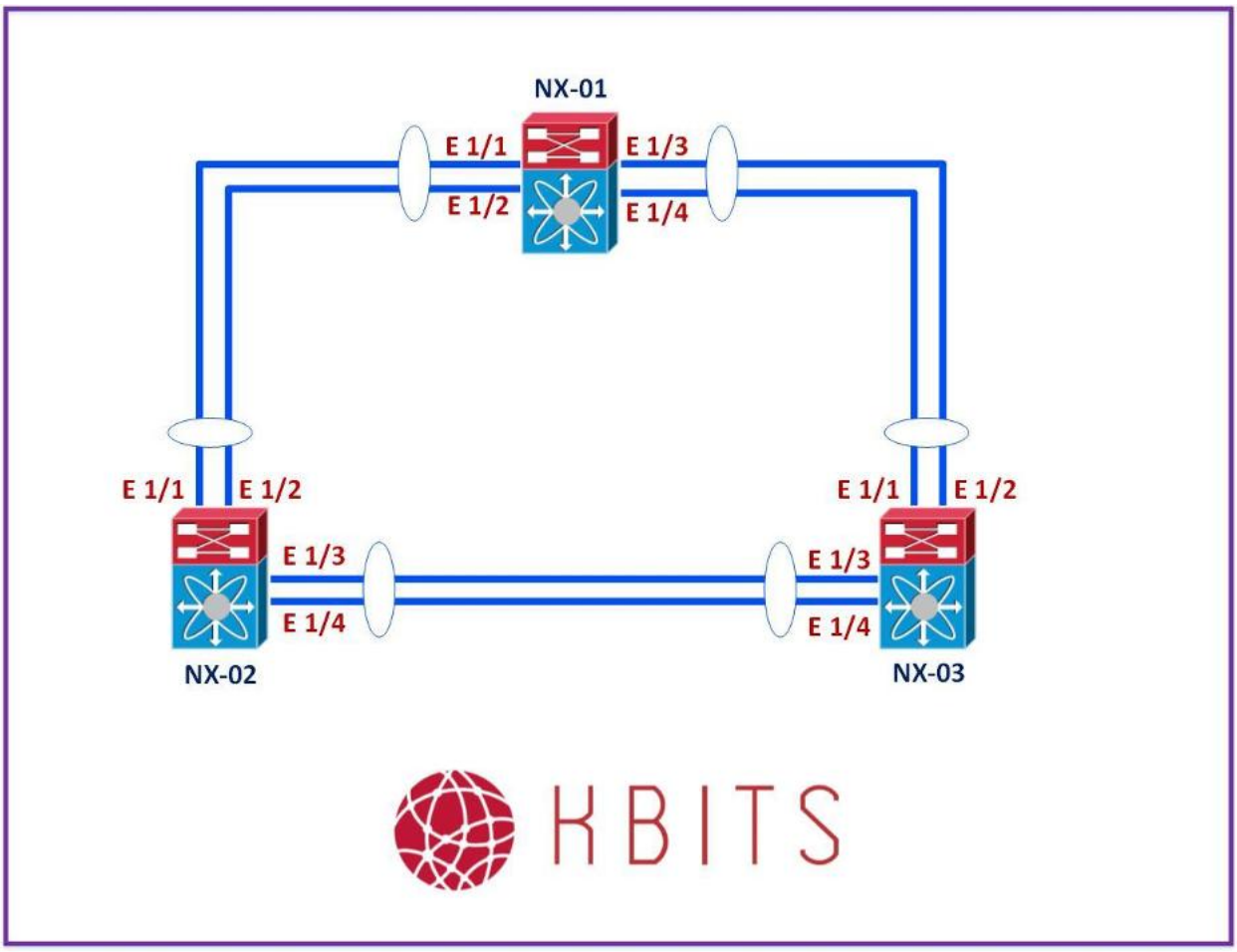
Configure NX-3 port E1/8 such that this port won't send or receive any BDPU packets.

NX-03 Interface E 1/8 Spanning-tree bpdufilter enable

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Lab 5 – Configuring Root Guard

(Builds on Lab 4)



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Task 1

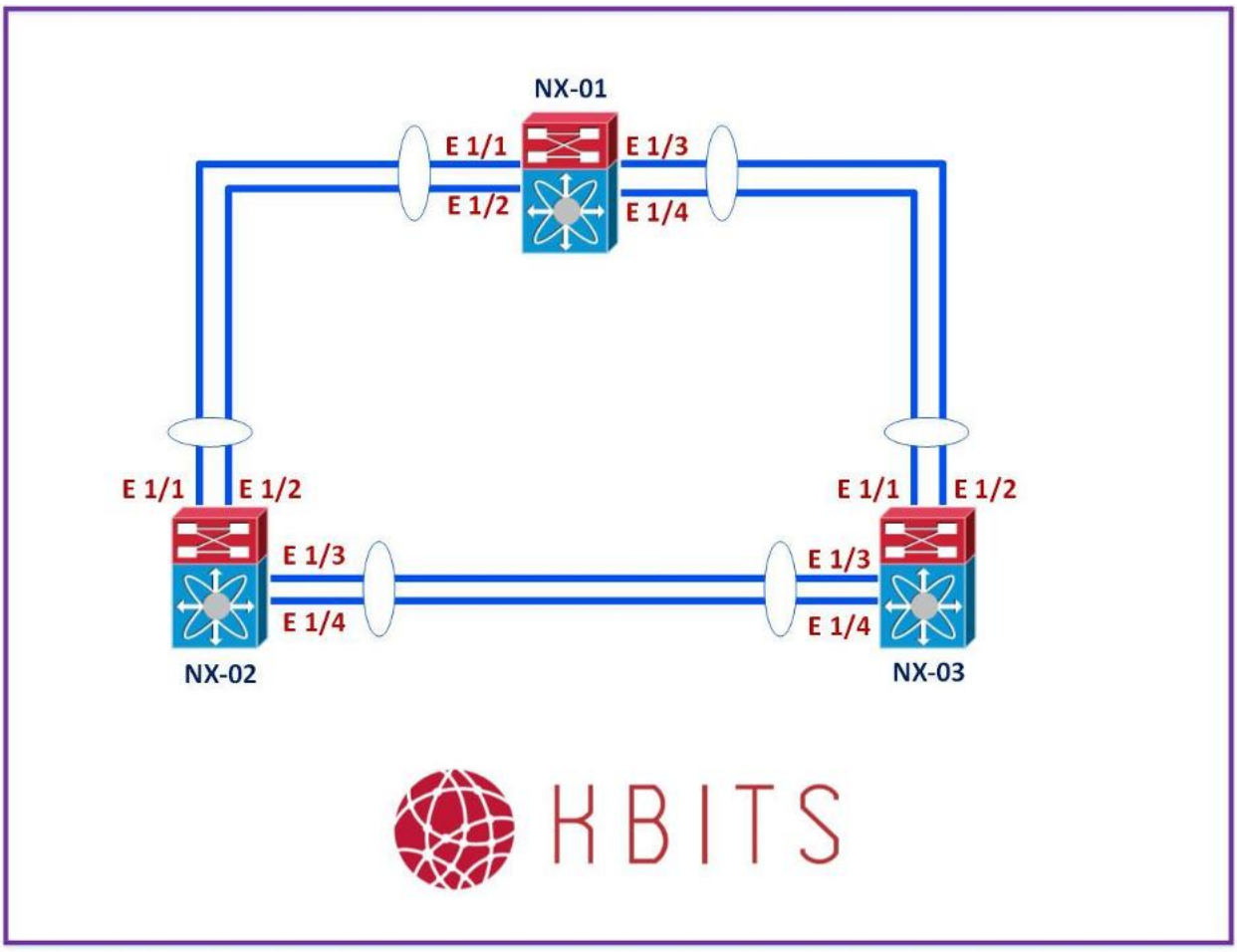
NX-02 & NX-03 will be connected to Access Layer switches in the future on Ports E 1/9 & 10. Make sure that you prevent a superior BPDU from being processed on these ports.

NX-02 Interface E 1/9-10 Spanning-tree guard root
NX-03 Interface E 1/9-10 Spanning-tree guard root

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Lab 6 – Configuring Bridge Assurance on Network Port Types

(Builds on Lab 5)



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Task 1

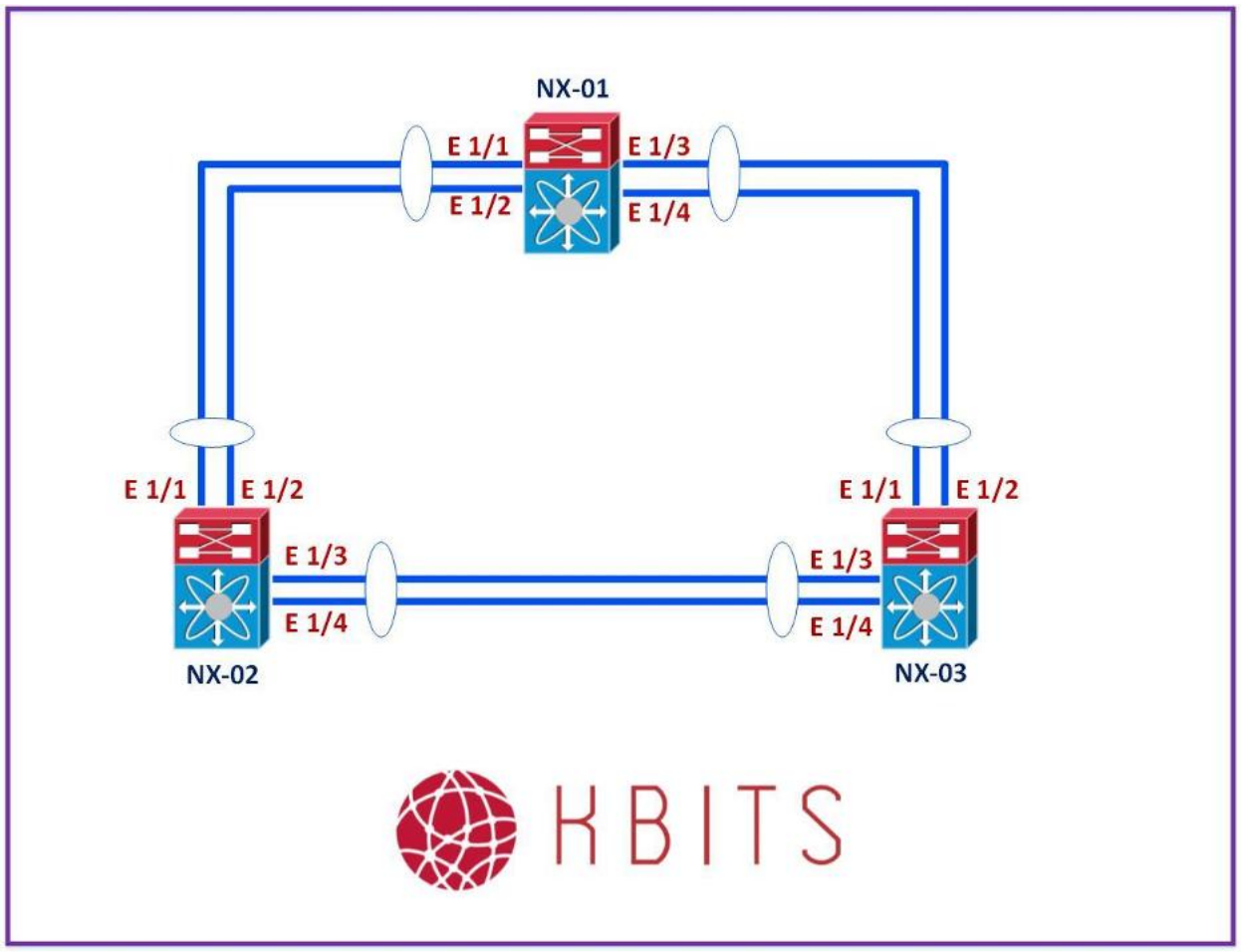
Configure the Trunk links between the switches such that they maintain a bidirectional Keepalive using BPDU.

NX-01 Spanning-tree bridge assurance ! Interface port-channel 12 Spanning-tree port type network ! Interface port-channel 13 Spanning-tree port type network
NX-02 Spanning-tree bridge assurance ! Interface port-channel 12 Spanning-tree port type network ! Interface port-channel 23 Spanning-tree port type network
NX-03 Spanning-tree bridge assurance ! Interface port-channel 13 Spanning-tree port type network ! Interface port-channel 23 Spanning-tree port type network

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Lab 7 – Configuring Port Profiles

(Builds on Lab 6)



Task 1

Ports E 1/11-12 need to be assigned to VLAN 15 on NX-02. The Ports need to have BPDUGuard & BPDUFilter features enabled. Make sure they skip the STP Listening & Learning States. Use Port Profiles to accomplish this task.

NX-02

```
VLAN 15
!
Port-profile VLAN15
 Switchport
 Switchport mode access
 Switchport access vlan 15
```

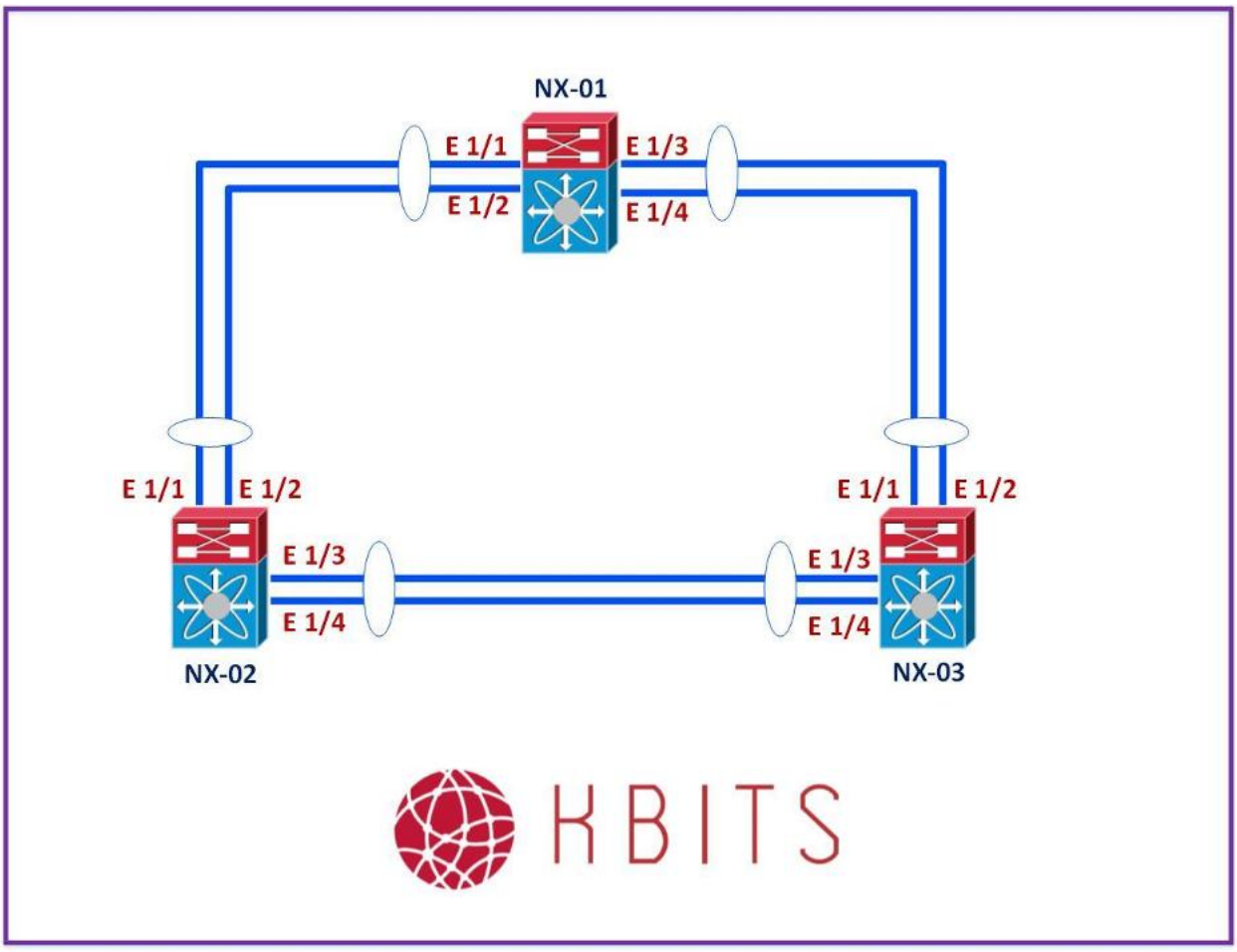
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```
 Spanning-tree port type edge
 Spanning-tree bpdufilter enable
 Spanning-tree bpduguard enable
 No shutdown
 State enabled
!
Interface E 1/11-12
 Inherit port-profile VLAN15
 Exit
```

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Lab 8 – Configuring MSTP

(Builds on Lab 7)



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Task 1

Re-Configure all three Nexus switches to run STP in MST Mode.

NX-01 Spanning-tree mode mst	**NX-02** Spanning-tree mode mst
NX-03 Spanning-tree mode mst	

Task 2

Configure MST based on the following requirements:

- There should be two instances of STP, instance 1 and 2
- Instance 1 should handle VLANs 1 thru 10
- Instance 2 should handle VLAN 11 thru 20
- NX-01 should be the root bridge for both instances.
- NX-02 should be the secondary root bridge Instance 1.
- NX-02 should be the secondary root bridge Instance 2.
- MST configuration should use the following:
    - Name: KB-NEXUS
    - Revision: 10

NX-01	**NX-02**

Spanning-tree mode mst
!
Spanning-tree mst configuration
  Revision 10
  Name KB-NEXUS
  Instance 1 vlan 1-10
  Instance 2 vlan 11-20
!
Spanning-tree mst 1 priority 0
Spanning-tree mst 2 priority 0
	Spanning-tree mode mst
	!
	Spanning-tree mst configuration
	  Revision 10
	  Name KB-NEXUS
	  Instance 1 vlan 1-10
	  Instance 2 vlan 11-20
	!
	Spanning-tree mst 1 priority 4096

NX-03
 	
Spanning-tree mode mst
!
Spanning-tree mst configuration
  Revision 10
  Name KB-NEXUS
  Instance 1 vlan 1-10
  Instance 2 vlan 11-20
!
Spanning-tree mst 2 priority 4096	

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CCIE Data Center v3 – Configuring Nexus NX-OS

Authored By:

Khawar Butt

Hepta CCIE # 12353
(R/S, Security, SP, Voice, Storage, Data Center, Wireless)

CCDE # 20110020

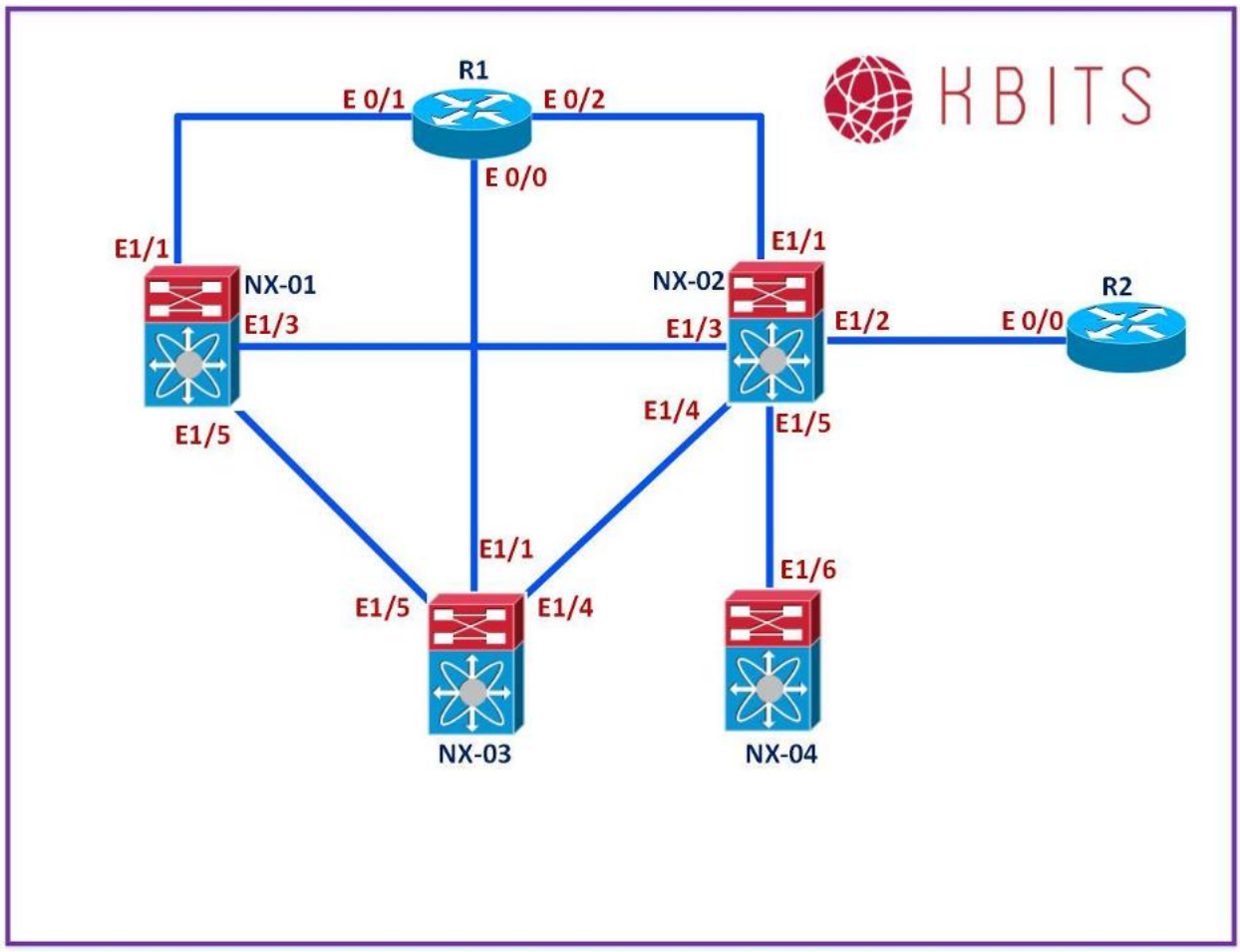
Module 3 – Configuring Routing



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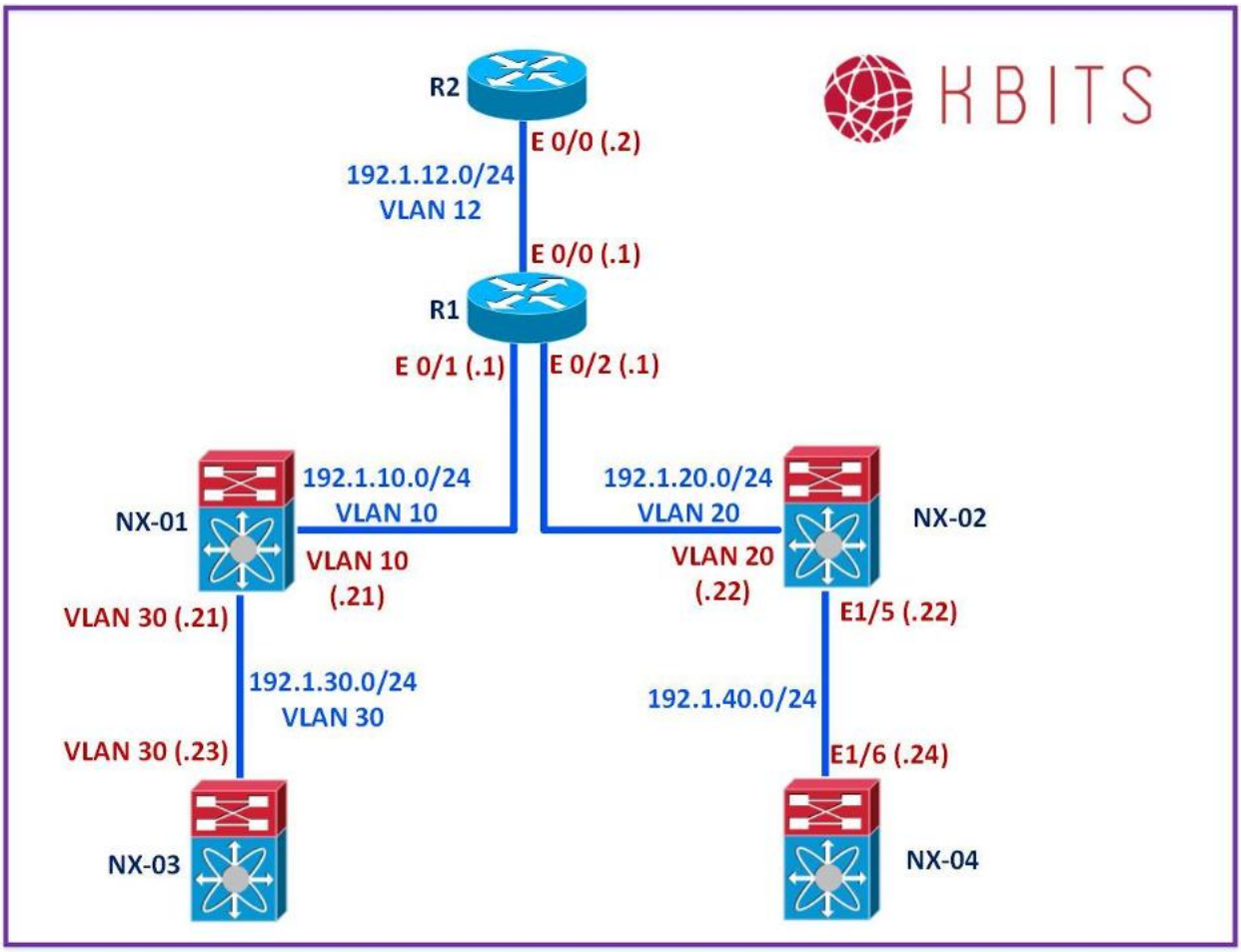
Lab 1 – Configure the Base Topology for Routing Protocols

Physical /L2 Topology



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Logical /L3 Topology



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Task 1
Initiliaze all 3 switches with a password of **Cisco123** for the default admin account.

Task 2
Configure the Switches with Hostnames of the switches based on the following:

- Nexus NX-01: **NX-01**
- Nexus NX-02: **NX-02**
- Nexus NX-03: **NX-03**
- Nexus NX-04: **NX-04**

NX-01 Switchname NX-01	**NX-02** Switchname NX-02
NX-03 Switchname NX-03	**NX-04** Switchname NX-04

Task 3
Configure Trunking between the NX-01, NX-02 & NX-03. The Link between NX-03 & NX-04 will be a L3 Link.

NX-01 Interface E 1/3, E 1/5 Switchport Switchport mode trunk No shut	**NX-02** Interface E 1/3-4 Switchport Switchport mode trunk No shut
NX-03 Interface E 1/4 - 5 Switchport Switchport mode trunk No shut	

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Task 4

Configure VLANs and assign ports to them to create the L3 topology by taking both the diagrams into consideration. IP Addresses will be configured in the next task.

NX-01

```
Vlan 10,12,20,30
!
Interface E 1/1
 Switchport mode access
 Switchport access vlan 10
```

NX-02

```
Vlan 10,12,20,30
!
Interface E 1/1
 Switchport mode access
 Switchport access vlan 20
!
Interface E 1/2
 Switchport mode access
 Switchport access vlan 12
```

NX-03

```
Vlan 10,12,20,30
!
Interface E 1/1
 Switchport mode access
 Switchport access vlan 12
```

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Task 5

Configure IP Addressing between R1 & R2 on the 192.1.12.0/24 network based on the L3 Diagram. Ping to verify communication.

R1
Interface E 0/0 Ip address 192.1.12.1 255.255.255.0 No shut
R2
Interface E 0/0 Ip address 192.1.12.2 255.255.255.0 No shut

Task 6

Configure IP Addressing between R1 & NX-01 on the 192.1.10.0/24 network based on the L3 Diagram. Ping to verify communication.

R1
Interface E 0/1 Ip address 192.1.10.1 255.255.255.0 No shut
NX-01
Feature Interface-vlan ! Interface VLAN10 Ip address 192.1.10.21 255.255.255.0 No shut

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Task 7

Configure IP Addressing between R1 & NX-02 on the 192.1.20.0/24 network based on the L3 Diagram. Ping to verify communication.

R1

```
Interface E 0/2
 Ip address 192.1.20.1 255.255.255.0
 No shut
```

NX-02

```
Feature Interface-vlan
1
Interface VLAN20
 Ip address 192.1.20.22 255.255.255.0
 No shut
```

Task 8

Configure IP Addressing between NX01 & NX-03 on the 192.1.30.0/24 network based on the L3 Diagram. Ping to verify communication.

NX-01

```
Interface VLAN 30
 Ip address 192.1.30.21 255.255.255.0
 No shut
```

NX-03

```
Feature Interface-vlan
1
Interface VLAN30
 Ip address 192.1.30.23 255.255.255.0
 No shut
```

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Task 9

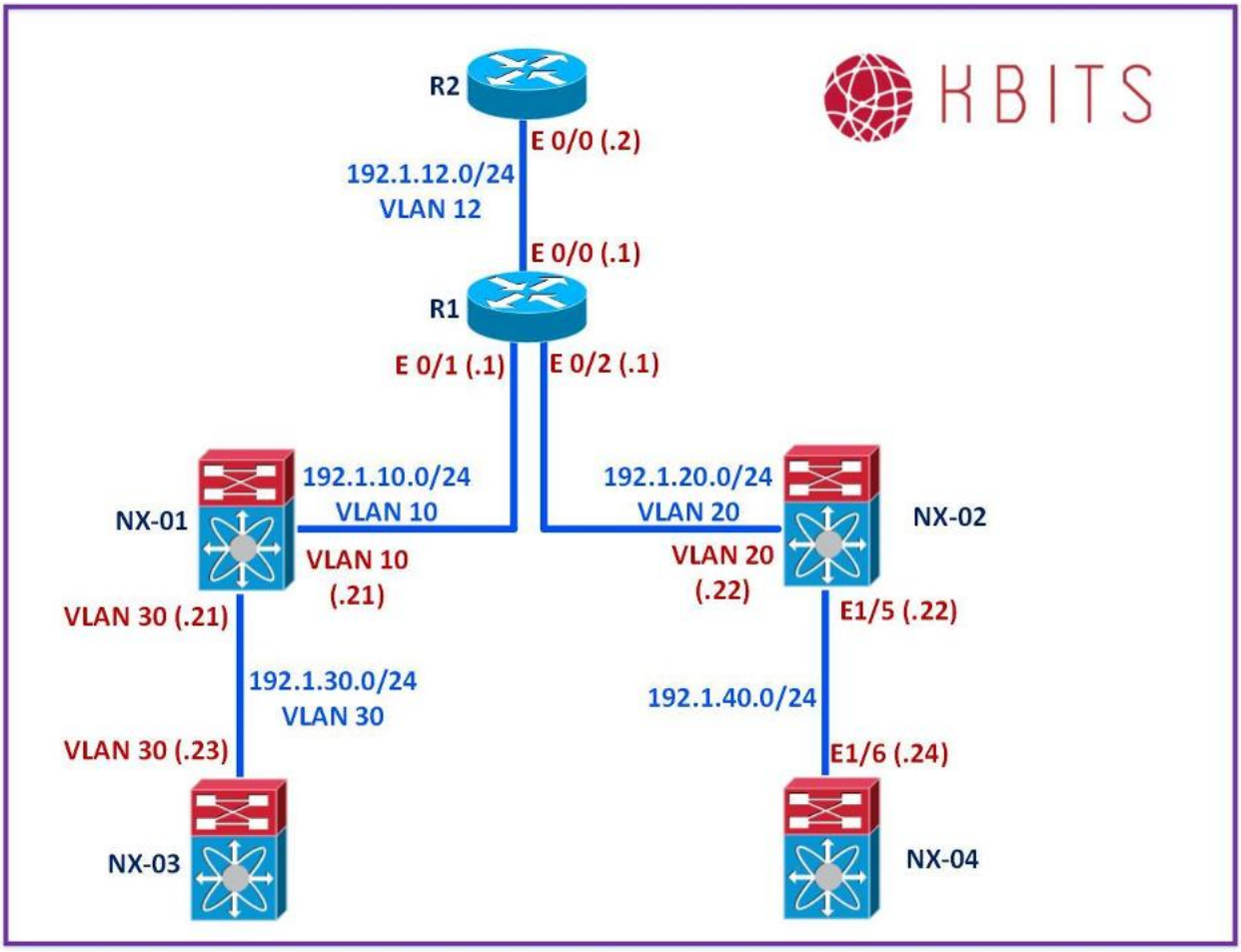
Configure IP Addressing between NX02 & NX-04 on the 192.1.40.0/24 network based on the L3 Diagram. Configure L3 Ports between NX-03 & NX-04. Ping to verify communication.

NX-02 Interface E 1/5 No switchport Ip address 192.1.40.22 255.255.255.0 No shut
NX-04 Interface E 1/6 No switchport Ip address 192.1.40.24 255.255.255.0 No shut

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Lab 2 – Configuring Static Routing

(Builds on Lab 1)



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Task 1

Configure the following Loopbacks on all the Devices:

- **R1**
  - Loopback0: 1.1.1.1/8
  - Loobkack1: 100.1.1.1/24
  - Loopback10: 10.1.1.1/32
- **R2**
  - Loopback0: 2.2.2.2/8
  - Loobkack1: 100.1.2.2/24
  - Loopback10: 10.1.1.2/32
- **NX-01**
  - Loopback0: 121.121.121.121/8
  - Loobkack1: 100.1.21.21/24
  - Loopback10: 10.1.1.21/32
- **NX-02**
  - Loopback0: 122.122.122.122/8
  - Loobkack1: 100.1.22.22/24
  - Loopback10: 10.1.1.22/32
- **NX-03**
  - Loopback0: 123.123.123.123/8
  - Loobkack1: 100.1.23.23/24
  - Loopback10: 10.1.1.23/32
- **NX-04**
  - Loopback0: 124.124.124.124/8
  - Loobkack1: 100.1.24.24/24
  - Loopback10: 10.1.1.24/32

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R1

```
Interface Loopback0
 Ip address 1.1.1.1 255.0.0.0
!
Interface Loopback1
 Ip address 100.1.1.1 255.255.255.0
!
Interface Loopback10
 Ip address 10.1.1.1 255.255.255.255
```

R2

```
Interface Loopback0
 Ip address 2.2.2.2 255.0.0.0
!
Interface Loopback1
 Ip address 100.1.2.2 255.255.255.0
!
Interface Loopback10
 Ip address 10.1.1.2 255.255.255.255
```

NX-01

```
Interface Loopback0
 Ip address 121.121.121.121 255.0.0.0
!
Interface Loopback1
 Ip address 100.1.21.21 255.255.255.0
!
Interface Loopback10
 Ip address 10.1.1.21 255.255.255.255
```

NX-02

```
Interface Loopback0
 Ip address 122.122.122.122 255.0.0.0
!
Interface Loopback1
 Ip address 100.1.22.22 255.255.255.0
!
Interface Loopback10
 Ip address 10.1.1.22 255.255.255.255
```

NX-03

```
Interface Loopback0
 Ip address 123.123.123.123 255.0.0.0
```

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! Interface Loopback1 Ip address 100.1.23.23 255.255.255.0 ! Interface Loopback10 Ip address 10.1.1.23 255.255.255.255
NX-04 Interface Loopback0 Ip address 124.124.124.124 255.0.0.0 ! Interface Loopback1 Ip address 100.1.24.24 255.255.255.0 ! Interface Loopback10 Ip address 10.1.1.24 255.255.255.255

Task 2

Configure Default Routes on NX-03, NX-04 & R2 towards their directly connected neighbors. Configure Default routes on NX-01 & NX-02 towards R1.

NX-01 Ip route 0.0.0.0/0 192.1.10.1
NX-02 Ip route 0.0.0.0/0 192.1.20.1
NX-03 Ip route 0.0.0.0/0 192.1.30.21
NX-04 Ip route 0.0.0.0/0 192.1.40.22
R2 Ip route 0.0.0.0 0.0.0.0 192.1.12.1

Task 3

Configure Static Routes on NX-01 towards the Loopback of NX-03. You should have complete connectivity of routes between NX-01 & NX-03 at the completion of the task. Do not configure a Default route on NX-01.

NX-01

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```
Ip route 10.1.1.23/32 192.1.30.23
Ip route 100.1.23.0/24 192.1.30.23
Ip route 123.0.0.0/8 192.1.30.23
```

Task 4

Configure Static Routes on NX-02 towards the Loopback of NX-04. You should have complete connectivity of routes between NX-02 & NX-04 at the completion of the task. Do not configure a Default route on NX-02.

NX-02

```
Ip route 10.1.1.24/32 192.1.40.24
Ip route 100.1.24.0/24 192.1.40.24
Ip route 124.0.0.0/8 192.1.40.24
```

Task 5

Configure Static Routes on R1 towards the Loopback of R2. You should have complete connectivity of routes between R1 & R2 at the completion of the task. Do not configure a Default route on NX-02.

R1

```
Ip route 10.1.1.2 255.255.255.255 192.1.12.2
Ip route 100.1.2.0 255.255.255.0 192.1.12.2
Ip route 2.0.0.0 255.0.0.0 192.1.12.2
```

Task 6

Configure Static Routes on R1 towards the Loopbacks of Nexus Switches (NX-01, NX-02, NX-03 & NX-04) based on the L3 toplogy to provide End-to-End Routing.

R1

```
Ip route 10.1.1.1 255.255.255.255 192.1.10.21
Ip route 100.1.21.0 255.255.255.0 192.1.10.21
Ip route 121.0.0.0 255.0.0.0 192.1.10.21
!
Ip route 10.1.1.23 255.255.255.255 192.1.10.21
Ip route 100.1.23.0 255.255.255.0 192.1.10.21
Ip route 123.0.0.0 255.0.0.0 192.1.10.21
!
Ip route 10.1.1.22 255.255.255.255 192.1.20.22
Ip route 100.1.22.0 255.255.255.0 192.1.20.22
Ip route 122.0.0.0 255.0.0.0 192.1.20.22
```

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```
!
Ip route 10.1.1.24 255.255.255.255 192.1.20.22
Ip route 100.1.24.0 255.255.255.0 192.1.20.22
Ip route 124.0.0.0 255.0.0.0 192.1.20.22
```

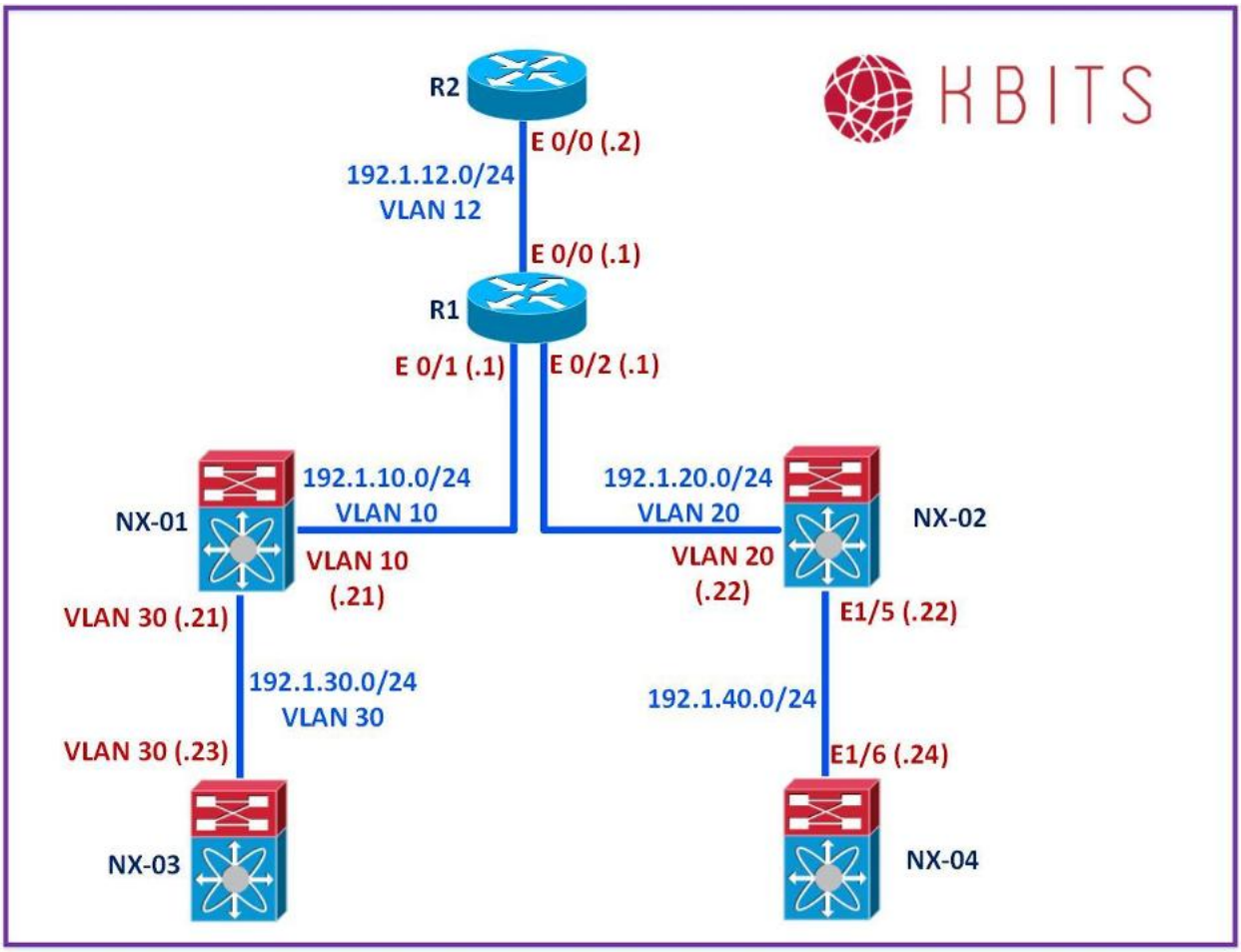
Task 7

Verify reachability of the Loopback networks based on the static routing configured above by using Ping.

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Lab 3 – Configuring EIGRP – Initial Configuration & Redistribution

(Builds on Lab 2)



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Task 0 – Pre-requisite

Remove ALL Static Routes from the Previous Lab

Task 1

Configure EIGRP on R1 & R2 in AS 12. Enable the Loopbacks and the E 0/0 interface in EIGRP on R2. Enable EIGRP only on E0/0 on R1 in this task. Use NX-12 as the Instance Name on both devices. Set the EIGRP Router ID based on Loopback10 Interfaces of the Routers.

R1

```
Router EIGRP NX-12
  address-family ipv4 unicast autonomous-system 12
   eigrp router-id 10.1.1.1
   network 192.1.12.0
```

R2

```
Router EIGRP NX-12
  address-family ipv4 unicast autonomous-system 12
   eigrp router-id 10.1.1.2
   network 192.1.12.0
   network 2.0.0.0
   network 10.1.1.2 0.0.0.0
   network 100.1.2.0 0.0.0.255
```

Task 2

Configure EIGRP on R1, NX-01 & NX-02 in AS 100. Enable the Loopbacks, VLAN 10 & VLAN 20 Interfaces under EIGRP. Use NEXUS as the Instance Name on all 3 devices. Set the EIGRP Router ID based on Loopback10 Interfaces of the Routers.

R1

```
Router EIGRP NEXUS
  address-family ipv4 unicast autonomous-system 100
   eigrp router-id 10.1.1.1
   network 192.1.10.0
   network 192.1.20.0
   network 1.0.0.0
   network 10.1.1.1 0.0.0.0
   network 100.1.1.0 0.0.0.255
```

NX-01

```
Feature eigrp
```

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```
!
Router EIGRP NEXUS
  address-family ipv4 unicast
    autonomous-system 100
    router-id 10.1.1.21
!
Interface Loopback 0
 Ip router eigrp NEXUS
!
Interface Loopback 1
 Ip router eigrp NEXUS
!
Interface Loopback 10
 Ip router eigrp NEXUS
!
Interface VLAN 10
 Ip router eigrp NEXUS
```

NX-02

```
Feature eigrp
!
Router EIGRP NEXUS
  address-family ipv4 unicast
    autonomous-system 100
    router-id 10.1.1.22
!
Interface Loopback 0
 Ip router eigrp NEXUS
!
Interface Loopback 1
 Ip router eigrp NEXUS
!
Interface Loopback 10
 Ip router eigrp NEXUS
!
Interface VLAN 20
 Ip router eigrp NEXUS
```

Task 3

Configure EIGRP between NX-01 & NX-03 in EIGRP 13. Enable the Loopbacks under EIGRP on NX-03. Use NX-13 as the Instance Name on both the devices. Set the EIGRP Router ID based on Loopback10 Interfaces of both the Routers.

NX-01

```
Router EIGRP NX-13
  address-family ipv4 unicast
    autonomous-system 13
    router-id 10.1.1.21
!
Interface VLAN 30
 Ip router eigrp NX-13
```

NX-03

```
Feature eigrp
!
Router EIGRP NX-13
  address-family ipv4 unicast
    autonomous-system 13
    router-id 10.1.1.23
!
Interface Loopback 0
 Ip router eigrp NX-13
!
Interface Loopback 1
 Ip router eigrp NX-13
!
Interface Loopback 10
 Ip router eigrp NX-13
!
Interface VLAN 30
 Ip router eigrp NX-13
```

Task 4

Configure EIGRP between NX-02 & NX-04 in EIGRP 24. Enable the Loopbacks under EIGRP on NX-04. Use NX-24 as the Instance Name on both the devices. Set the EIGRP Router ID based on Loopback10 Interfaces of both the Routers.

NX-02

```
Router EIGRP NX-24
  address-family ipv4 unicast
    autonomous-system 24
    router-id 10.1.1.22
!
Interface E 1/5
 Ip router eigrp NX-24
```

NX-04

```
Feature eigrp
```

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```
!
Router EIGRP NX-24
  address-family ipv4 unicast
    autonomous-system 24
    router-id 10.1.1.24
!
Interface Loopback 0
 Ip router eigrp NX-24
!
Interface Loopback 1
 Ip router eigrp NX-24
!
Interface Loopback 10
 Ip router eigrp NX-24
!
Interface E 1/6
 Ip router eigrp NX-24
```

Task 5

Configure redistribution on R1 to mutually redistribute between the NEXUS & the NX-12 instances.

R1

```
router eigrp NEXUS
 address-family ipv4 unicast autonomous-system 100
  topology base
    redistribute eigrp 12
!
router eigrp NX-12
 address-family ipv4 unicast autonomous-system 12
  topology base
    redistribute eigrp 100
```

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Task 6

Configure redistribution on NX-01 to mutually redistribute between the NEXUS & the NX-13 instances.

NX-01

```
ip access-list ALL
  10 permit ip any any
!
Route-map ALL-NETS
 Match ip address ALL
!
router eigrp NX-13
  address-family ipv4 unicast
    redistribute eigrp NEXUS route-map ALL-NETS
!
router eigrp NEXUS
  address-family ipv4 unicast
    redistribute eigrp NX-13 route-map ALL-NETS
```

Task 7

Configure redistribution on NX-02 to mutually redistribute between the NEXUS & the NX-24 instances.

NX-02

```
ip access-list ALL
  10 permit ip any any
!
Route-map ALL-NETS
 Match ip address ALL
!
router eigrp NX-24
  address-family ipv4 unicast
    redistribute eigrp NEXUS route-map ALL-NETS
!
router eigrp NEXUS
  address-family ipv4 unicast
    redistribute eigrp NX-24 route-map ALL-NETS
```

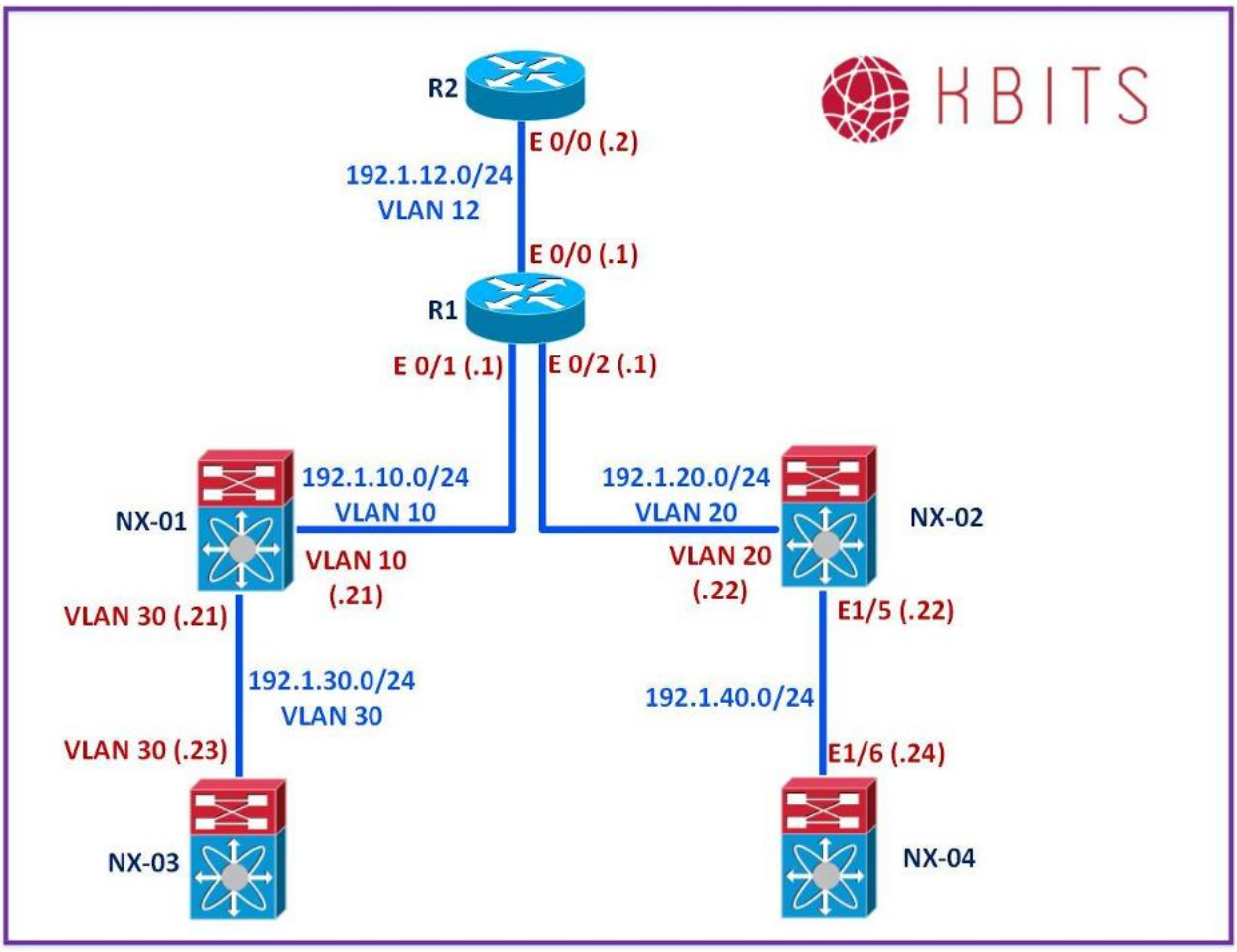
Task 8

Verify End-To-End Connnectivity between the loopbacks connected to all the devices.

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Lab 4 – Configuring EIGRP – Authentication & Summarization

(Builds on Lab 3)



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Task 1

Configure EIGRP Authentication between R1, NX-01 & NX-02. They should use a Key of Cisco@123 with a Key ID of 12353. Use MD5 has the password hash mechanism.

R1

```
Key Chain KC-1
 Key 12353
   Key-string Cisco@123
!
Router EIGRP NEXUS
  address-family ipv4 unicast autonomous-system 100
  af-interface E 0/1
   authentication mode md5
   authentication key-chain KC-1
  af-interface E 0/2
   authentication mode md5
   authentication key-chain KC-1
```

NX-01

```
Key Chain KC-1
 Key 12353
   Key-string Cisco@123
!
Interface VLAN 10
 Ip authentication mode eigrp NEXUS md5
 Ip authentication key-chain eigrp NEXUS KC-1
```

NX-02

```
Key Chain KC-1
 Key 12353
   Key-string Cisco@123
!
Interface VLAN 20
 Ip authentication mode eigrp NEXUS md5
 Ip authentication key-chain eigrp NEXUS KC-1
```

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Task 2

Configure the following loopbacks on NX-03 and Enable them in EIGRP NX-13.

- Loopback 201: 201.1.20.1/24
- Loopback 202: 201.1.21.1/24
- Loopback 203: 201.1.22.1/24
- Loopback 204: 201.1.23.1/24

NX-03

```
Interface Loopback201
 Ip address 201.1.20.1/24
 Ip router eigrp NX-13
!
Interface Loopback202
 Ip address 201.1.21.1/24
 Ip router eigrp NX-13
!
Interface Loopback203
 Ip address 201.1.22.1/24
 Ip router eigrp NX-13
!
Interface Loopback204
 Ip address 201.1.23.1/24
 Ip router eigrp NX-13
```

Task 3

Summarize these networks towards NX-01.

NX-03

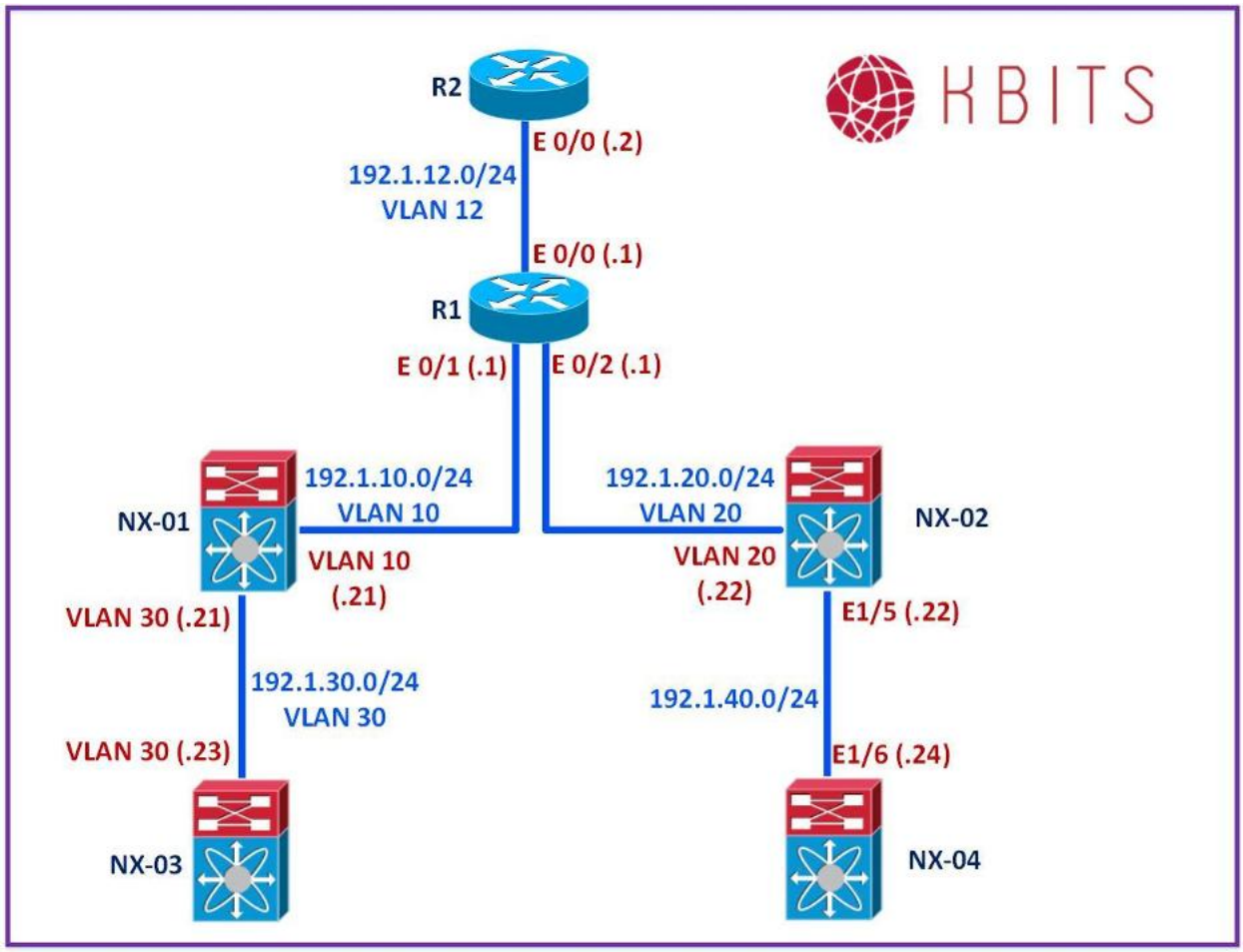
```
Interface VLAN 30
 Ip summary-address eigrp NX-13 201.1.20.0 255.255.252.0
```

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Lab 5 – Configuring OSPF – Initial Configuration & Redistribution

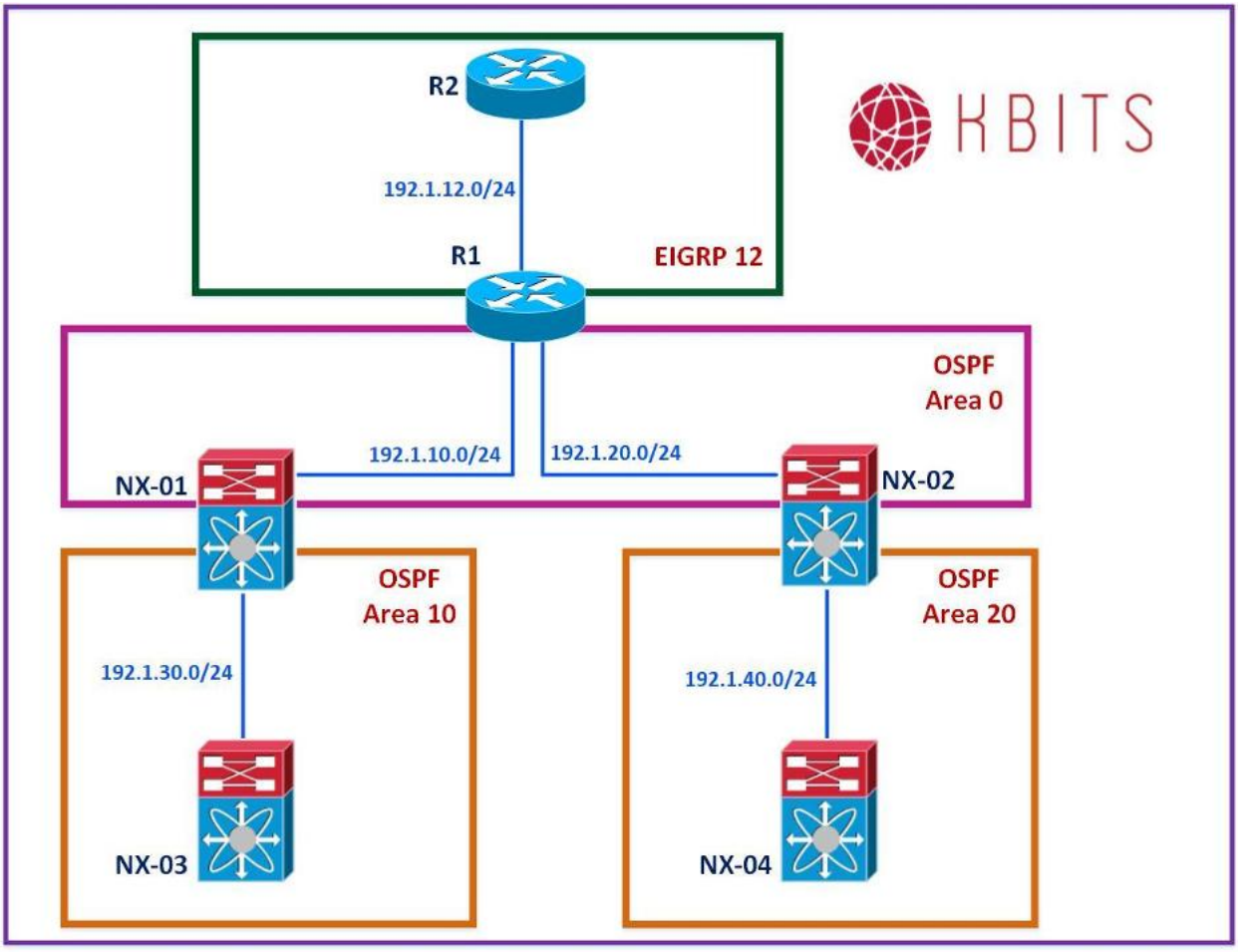
(Builds on Lab 4)

L3 Topology Diagram



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OSPF Area Diagram



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Task 0 – Pre-requisite

De-Configure EIGRP from ALL Devices

Task 1

Configure EIGRP on R1 & R2 in AS 12. Enable the Loopbacks and the E 0/0 interface in EIGRP on R2. Enable EIGRP only on E0/0 on R1 in this task. Use NX-12 as the Instance Name on both devices. Set the EIGRP Router ID based on Loopback10 Interfaces of the Routers.

R1

```
Router EIGRP NX-12
  address-family ipv4 unicast autonomous-system 12
   eigrp router-id 10.1.1.1
   network 192.1.12.0
```

R2

```
Router EIGRP NX-12
  address-family ipv4 unicast autonomous-system 12
   eigrp router-id 10.1.1.2
   network 192.1.12.0
   network 2.0.0.0
   network 10.1.1.2 0.0.0.0
   network 100.1.2.0 0.0.0.255
```

Task 2

Configure R1, NX-01 & NX-02 in Area 0. Configure the Router-ID as **0.0.0.1** on R1, **0.0.0.21** on NX-01 & **0.0.0.22** on NX-02. Loopback Interfaces should be advertised with the Interface mask. Enable the following interfaces in Area 0:

- **R1** – All Loopbacks, E 0/1 & E 0/2 interfaces.
- **NX-01** – Loopback 0 & VLAN 10 Interfaces.
- **NX-02** – Loopback 0 & VLAN 20 Interfaces.

R1

```
Router ospf 1
 Router-id 0.0.0.1
 Network 192.1.10.0 0.0.0.255 area 0
 Network 192.1.20.0 0.0.0.255 area 0
 Network 1.0.0.0 0.255.255.255 area 0
 Network 10.1.1.1 0.0.0.0 area 0
 Network 100.1.1.0 0.0.0.255 area 0
!
Interface Loopback 0
```

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Ip ospf network point-to-point ! Interface Loopback1 Ip ospf network point-to-point ! Interface Loopback10 Ip ospf network point-to-point
NX-01 Feature ospf ! Router ospf 1 router-id 0.0.0.21 ! Interface Loopback 0 Ip router ospf 1 area 0 Ip ospf network point-to-point ! Interface VLAN 10 Ip router ospf 1 area 0
NX-02 Feature ospf ! Router ospf 1 router-id 0.0.0.22 ! Interface Loopback 0 Ip router ospf 1 area 0 Ip ospf network point-to-point ! Interface VLAN 20 Ip router ospf 1 area 0

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Task 3

Configure NX-01 & NX-03 in Area 10. Configure the Router-ID as **0.0.0.23** on NX-03. Loopback Interfaces should be advertised with the Interface mask. Enable the following interfaces in Area 10:

- **NX-01** – Loopback 1, Loopback10 & VLAN 30 Interfaces.
- **NX-03** – All Loopback Interfaces & VLAN 30 Interfaces.

NX-01

```
Interface Loopback 1
 Ip router ospf 1 area 10
 Ip ospf network point-to-point
!
Interface Loopback 10
 Ip router ospf 1 area 10
 Ip ospf network point-to-point
!
Interface VLAN 30
 Ip router ospf 1 area 10
```

NX-03

```
Feature ospf
!
Router ospf 1
 router-id 0.0.0.23
!
Interface Loopback 0
 Ip router ospf 1 area 10
 Ip ospf network point-to-point
!
Interface Loopback 1
 Ip router ospf 1 area 10
 Ip ospf network point-to-point
!
Interface Loopback 10
 Ip router ospf 1 area 10
 Ip ospf network point-to-point

Interface VLAN 30
 Ip router ospf 1 area  10
```

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Task 4

Configure NX-02 & NX-04 in Area 20. Configure the Router-ID as **0.0.0.24** on NX-04. Loopback Interfaces should be advertised with the Interface mask. Enable the following interfaces in Area 20:

- **NX-02** – Loopback 1, Loopback10 & E 1/5 Interfaces.
- **NX-04** – All Loopback Interfaces & E 1/6 Interfaces.

NX-02

```
Interface Loopback 1
 Ip router ospf 1 area 20
 Ip ospf network point-to-point
!
Interface Loopback 10
 Ip router ospf 1 area 20
 Ip ospf network point-to-point
!
Interface E 1/5
 Ip router ospf 1 area 20
```

NX-04

```
Feature ospf
!
Router ospf 1
 router-id 0.0.0.24
!
Interface Loopback 0
 Ip router ospf 1 area 20
 Ip ospf network point-to-point
!
Interface Loopback 1
 Ip router ospf 1 area 20
 Ip ospf network point-to-point
!
Interface Loopback 10
 Ip router ospf 1 area 20
 Ip ospf network point-to-point

Interface E 1/6
 Ip router ospf 1 area  20
```

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Task 5

Configure redistribution on R1 to mutually redistribute between EIGRP & OSPF.

R1

```
Router EIGRP NX-12
  address-family ipv4 unicast autonomous-system 12
  topology base
   redistribute ospf 1 metric 10 10 10 10 10
!
router ospf 1
 redistribute eigrp 12
```

Task 6

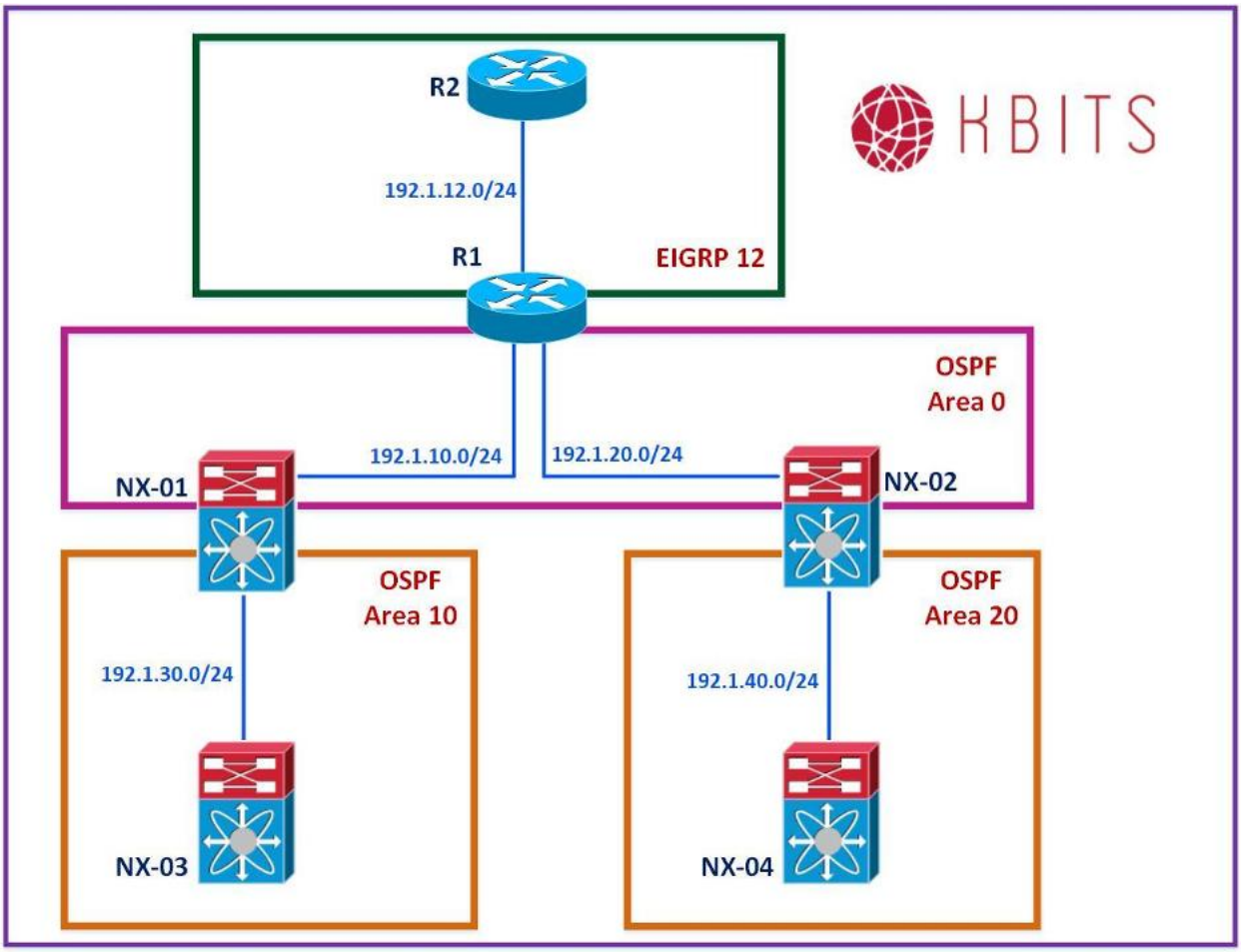
Verify End-To-End Connnectivity between the loopbacks connected to all the devices.

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Lab 6 – Configuring OSPF – Authentication & Summarization

(Builds on Lab 5)

OSPF Area Diagram



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Task 1

Configure OSPF Authentication between R1, NX-01 & NX-02 using MD5. They should use a Key of Cisco@123 with a Key ID of 123.

R1 Interface E 0/1 Ip ospf authentication message-digest Ip ospf message-digest-key 123 md5 Cisco@123 ! Interface E 0/2 Ip ospf authentication message-digest Ip ospf message-digest-key 123 md5 Cisco@123
NX-01 Interface VLAN 10 Ip ospf authentication message-digest Ip ospf message-digest-key 123 md5 Cisco@123
NX-02 Interface VLAN 20 Ip ospf authentication message-digest Ip ospf message-digest-key 123 md5 Cisco@123

Task 2

Configure OSPF Authentication between NX-01 & NX-03 using Clear Text Authentication. They should use a Key of Cisco123.

NX-01 Interface VLAN 30 Ip ospf authentication Ip ospf authentication-key Cicso123
NX-03 Interface VLAN 30 Ip ospf authentication Ip ospf authentication-key Cicso123

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Task 3

Configure the following loopbacks on NX-04 and Enable them in OSPF in Area 20.

- Loopback 201: 202.1.20.1/24
- Loopback 202: 202.1.21.1/24
- Loopback 203: 202.1.22.1/24
- Loopback 204: 202.1.23.1/24

NX-04

```
Interface Loopback201
 Ip address 202.1.20.1/24
 Ip router ospf 1 area 20
!
Interface Loopback202
 Ip address 202.1.21.1/24
 Ip router ospf 1 area 20
!
Interface Loopback203
 Ip address 202.1.22.1/24
 Ip router ospf 1 area 20
!
Interface Loopback204
 Ip address 202.1.23.1/24
 Ip router ospf 1 area 20
```

Task 4

Summarize these networks towards Area 0.

NX-02

```
Router ospf 1
 Area 20 range 202.1.20.0 255.255.252.0
```

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Task 5

Configure the following loopbacks on R2 and Enable them in EIGRP.

- Loopback 201: 222.1.4.1/24
- Loopback 202: 222.1.5.1/24
- Loopback 203: 222.1.6.1/24
- Loopback 204: 222.1.7.1/24

R2

```
Interface Loopback201
 Ip address 222.1.4.1 255.255.255.0
!
Interface Loopback202
 Ip address 222.1.5.1 255.255.255.0
!
Interface Loopback203
 Ip address 222.1.6.1 255.255.255.0
!
Interface Loopback204
 Ip address 222.1.7.1 255.255.255.0
!
router eigrp NX-12
 address-family ipv4 unicast autonomous-system 12
  network 222.1.4.0
  network 222.1.5.0
  network 222.1.6.0
  network 222.1.7.0
```

Task 6

Summarize these networks towards OSPF.

R1

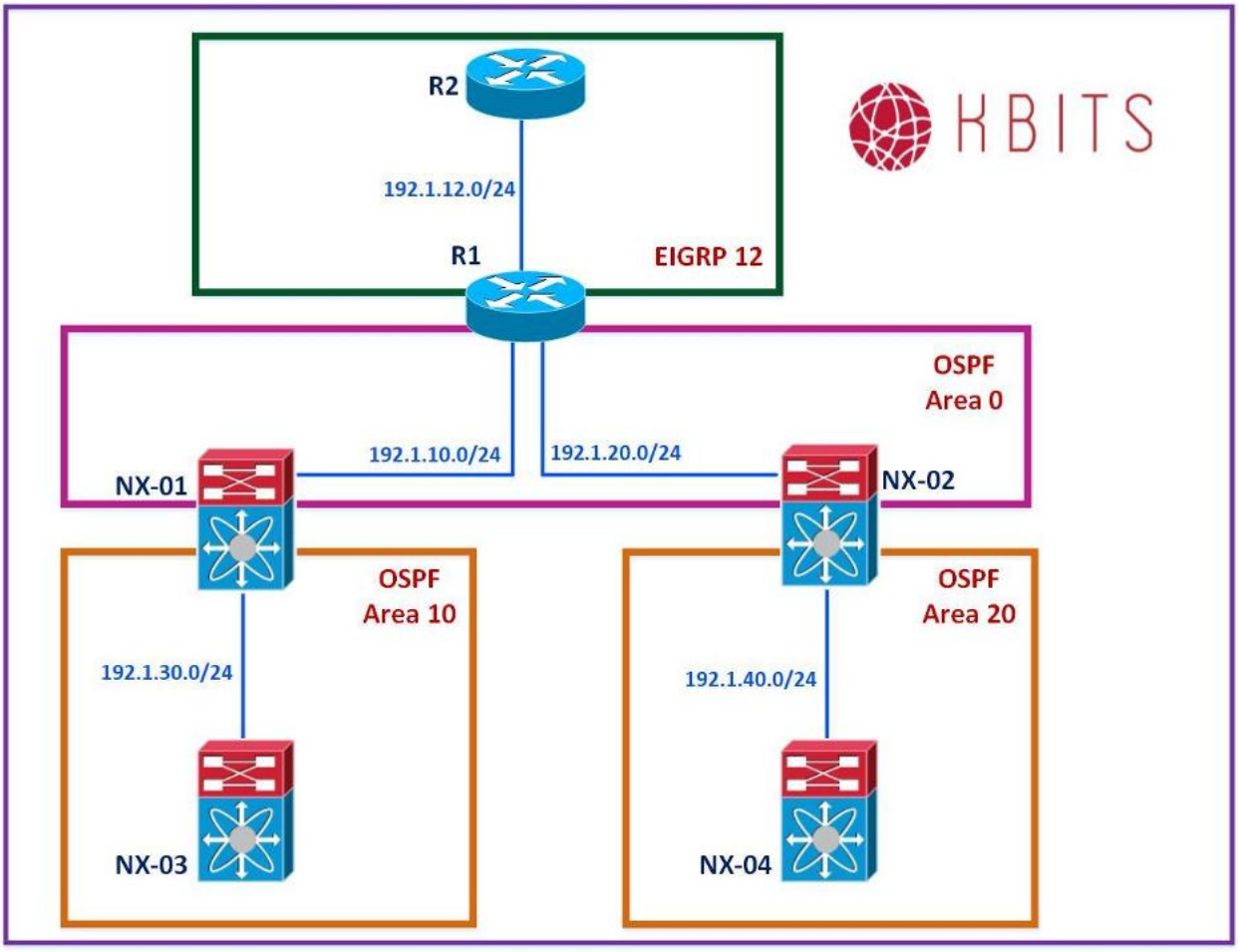
```
Router ospf 1
 Summary-address 222.1.4.0 255.255.252.0
```

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Lab 7 – Configuring OSPF – Area Types

(Builds on Lab 6)

OSPF Area Diagram



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Task 1

Configure Area 10 such that it blocks all external routes from propagating in. Area 10 should not connectivity towards the EIGRP Domain.

NX-01 Router ospf 1   Area 10 stub
NX-03 Router ospf 1   Area 10 stub

Task 2

Configure Area 20 such that it blocks all Inter-Area & external routes from propagating in. Area 20 should maintain full connectivity towards the entire network.

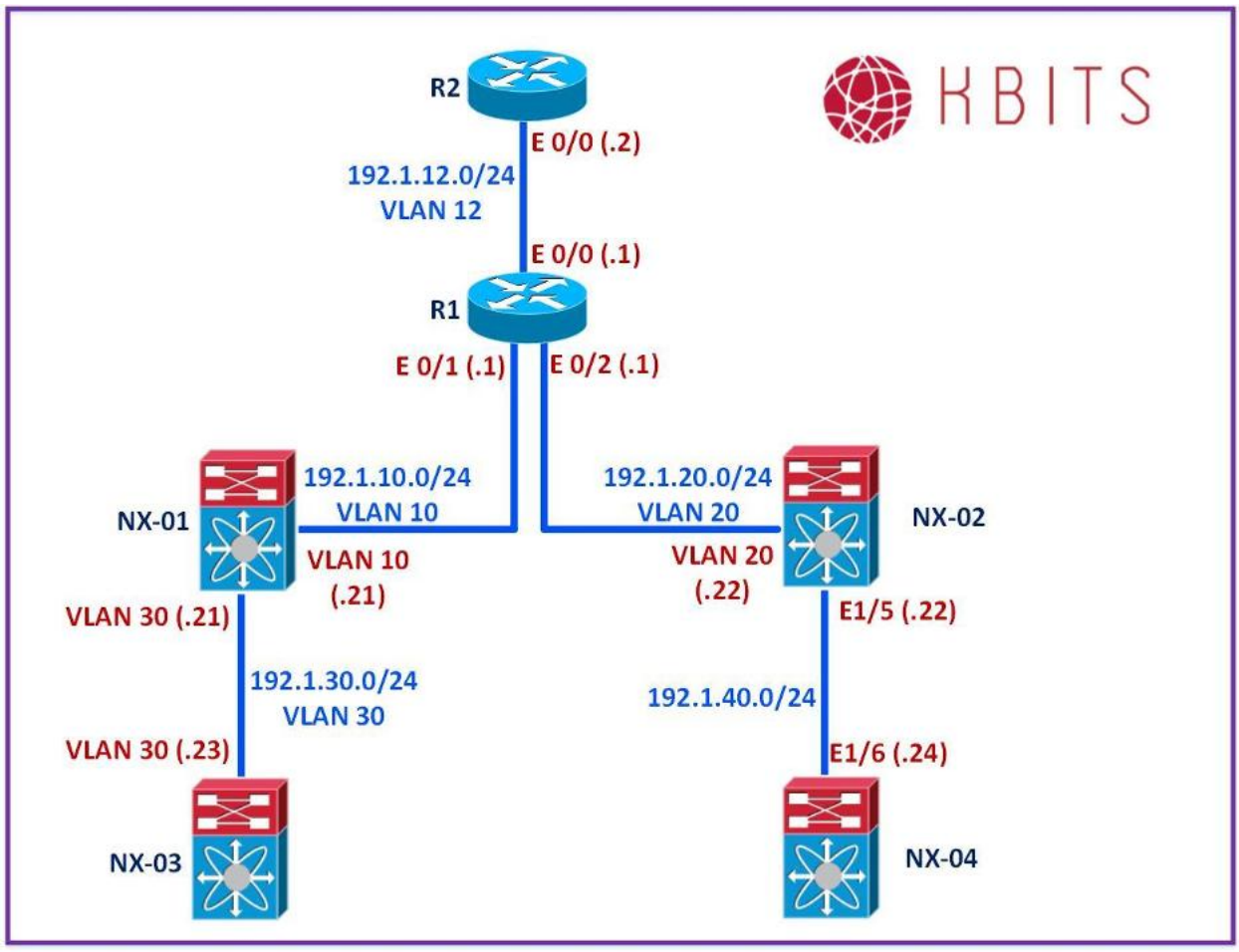
NX-02 Router ospf 1   Area 20 stub no-summary
NX-04 Router ospf 1   Area 20 stub

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Lab 8 – Configuring iBGP

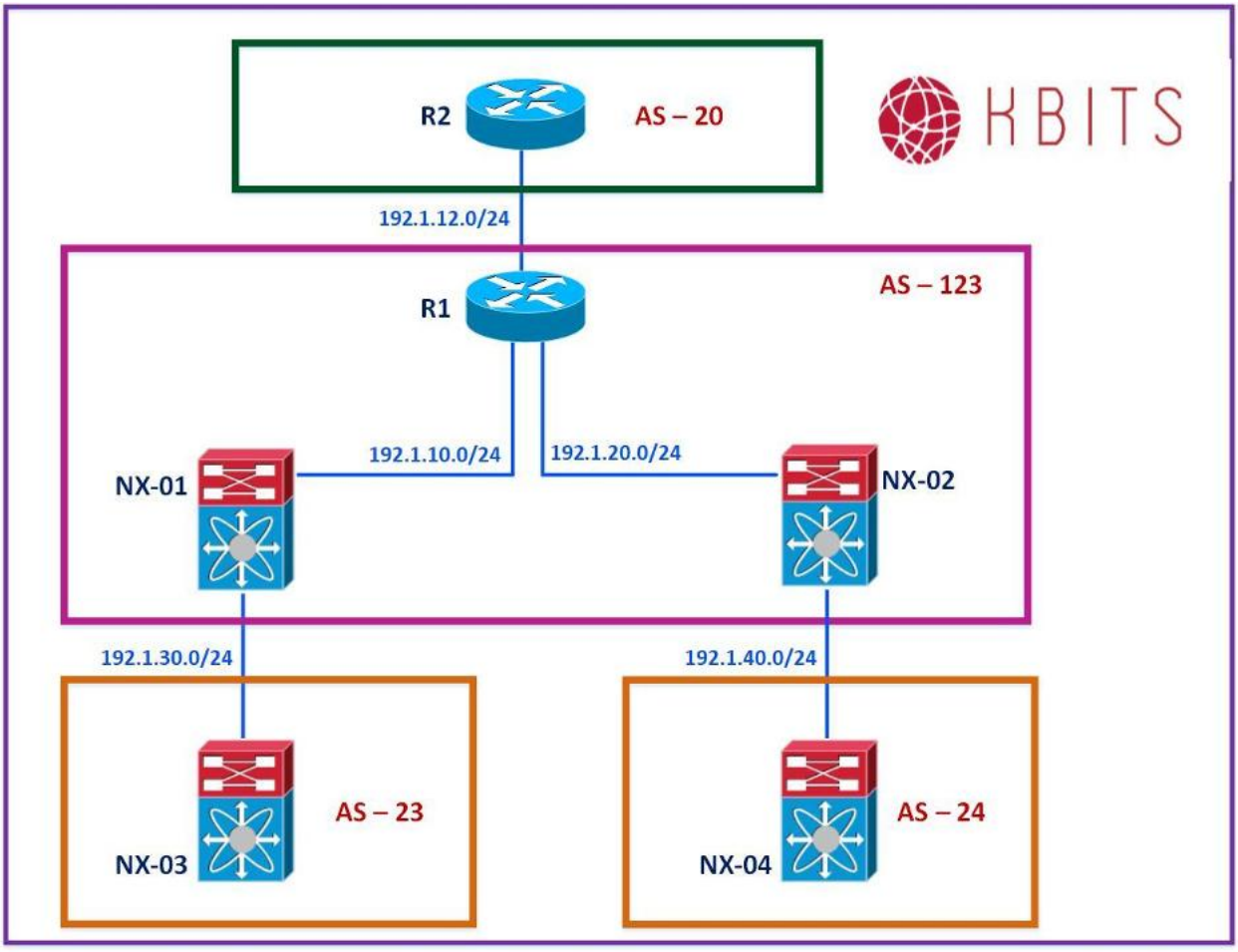
(Builds on Lab 7)

L3 Topology Diagram



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BGP AS Diagram



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Task 0 – Pre-requisite

De-Configure OSPF from ALL Devices. Make sure to clear the Authentication commands from the Interfaces.

Task 1

Configure OSPF in Area 0 as the Underlay IGP for AS 123. Enable the 192.1.10.0/24, 192.1.20.0/24 & the Loopback 10 Interfaces in OSPF. Configure the Router-ID as **0.0.0.1** on R1, **0.0.0.21** on NX-01 & **0.0.0.22** on NX-02

R1

```
Router ospf 1
  router-id 0.0.0.1
  network 192.1.10.0 0.0.0.255 area 0
  network 192.1.20.0 0.0.0.255 area 0
  network 10.1.1.1 0.0.0.0 area 0
```

NX-01

```
Feature ospf
!
Router ospf 1
 router-id 0.0.0.21
!
Interface VLAN 10
 Ip router ospf 1 area 0
!
Interface Loopback 10
 Ip router ospf 1 area 0
```

NX-02

```
Feature ospf
!
Router ospf 1
 router-id 0.0.0.22
!
Interface VLAN 20
 Ip router ospf 1 area 0
!
Interface Loopback 10
 Ip router ospf 1 area 0
```

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Task 2

Configure BGP in AS 123 between R1, NX-01 & NX-02. NX-01 & NX-02 will form a BGP relationship with the R1 only. They will not form a neighbor relationship between each other. Configure R1 to be a Route Reflector for NX-01 & NX-02. Advertise Looback0 & Loopback1 networks in BGP on all 3 routers. Configure the neighbor relationship with Redundancy in mind.

R1

```
Router bgp 123
 Network 1.0.0.0
 Network 100.1.1.0 mask 255.255.255.0
 Neighbor 10.1.1.21 remote-as 123
 Neighbor 10.1.1.21 update-source Loopback10
 Neighbor 10.1.1.21 next-hop-self
 Neighbor 10.1.1.21 route-reflector-client
 Neighbor 10.1.1.22 remote-as 123
 Neighbor 10.1.1.22 update-source Loopback10
 Neighbor 10.1.1.22 next-hop-self
 Neighbor 10.1.1.22 route-reflector-client
```

NX-01

```
Feature bgp
!
Router bgp 123
 address-family ipv4 unicast
   Network 121.0.0.0 mask 255.0.0.0
   Network 100.1.21.0 mask 255.255.255.0
 neighbor 10.1.1.1
   remote-as 123
   Update-source loopback 10
     address-family ipv4 unicast
       Next-hop-self
```

NX-02

```
Feature bgp
!
Router bgp 123
 address-family ipv4 unicast
   Network 122.0.0.0 mask 255.0.0.0
   Network 100.1.22.0 mask 255.255.255.0
 neighbor 10.1.1.1
   remote-as 123
   Update-source loopback 10
     address-family ipv4 unicast
```

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Next-hop-self

Task 3

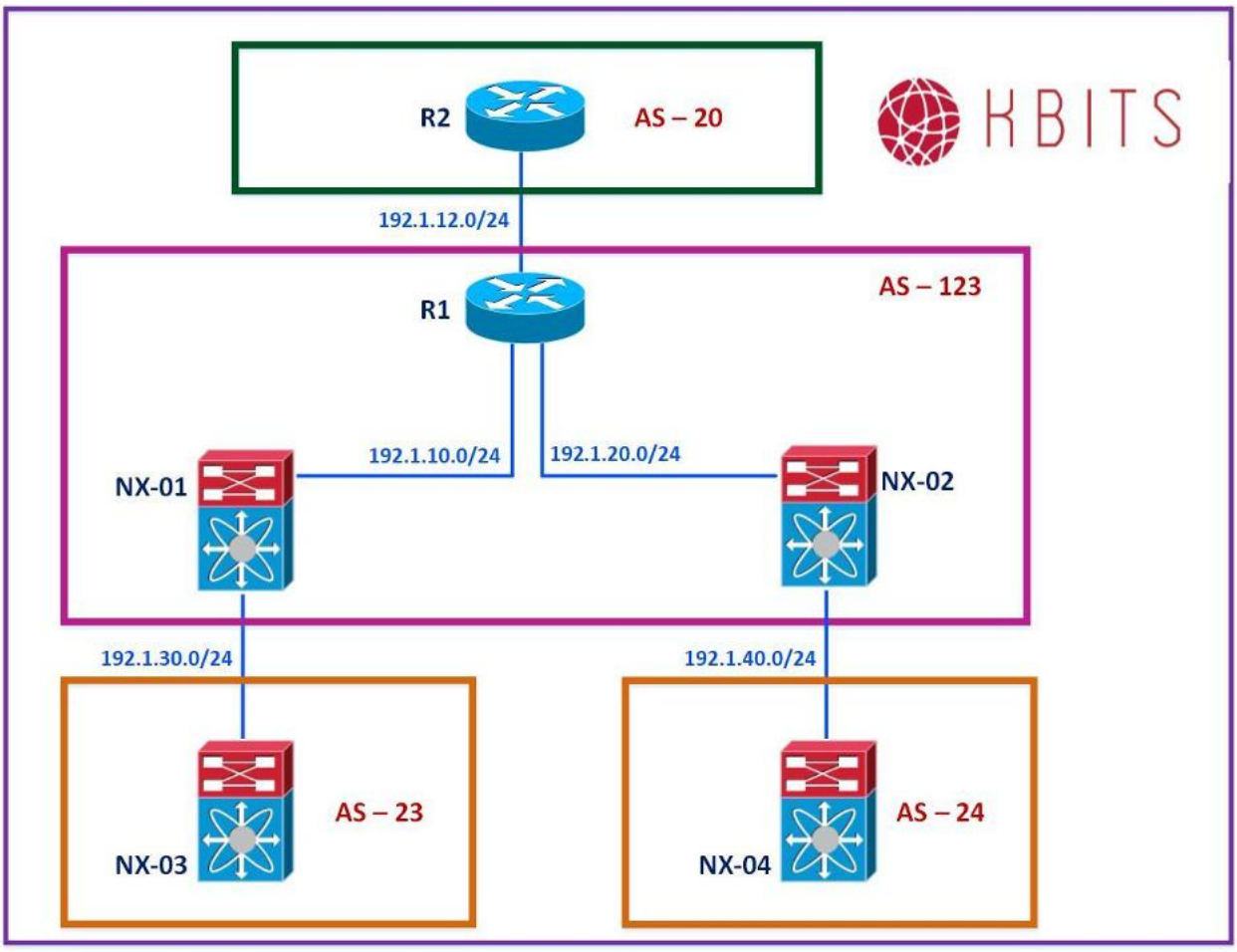
Verify that the Loopback 0 & Loopback 1 networks in AS 123 are learnt thru BGP and can communicate.

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Lab 9 – Configuring eBGP

(Builds on Lab 8)

BGP AS Diagram



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Task 1

Configure BGP between R1& R2 based on the BGP Topology Diagram.
Advertise Looback0 & Loopback1 networks in BGP on R2.

R1

```
Router bgp 123
 Neighbor 192.1.12.2 remote-as 20
```

R2

```
Router bgp 20
 Network 2.0.0.0
 Network 100.1.2.0 mask 255.255.255.0
 Neighbor 192.1.12.1 remote-as 123
```

Task 2

Configure BGP between NX-01 & NX-03 based on the BGP Topology Diagram.
Advertise Looback0 & Loopback1 networks in BGP on NX-03.

NX-01

```
Router bgp 123
 address-family ipv4 unicast
   neighbor 192.1.30.23
     remote-as 23
     address-family ipv4 unicast
```

NX-03

```
Feature bgp
!
Router bgp 23
 address-family ipv4 unicast
   Network 123.0.0.0 mask 255.0.0.0
   Network 100.1.23.0 mask 255.255.255.0
 neighbor 192.1.30.21
    remote-as 123
    address-family ipv4 unicast
```

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Task 3

Configure BGP between NX-02 & NX-04 based on the BGP Topology Diagram. Advertise Looback0 & Loopback1 networks in BGP on NX-04.

NX-02

```
Router bgp 123
 address-family ipv4 unicast
  neighbor 192.1.40.24
     remote-as 24
     address-family ipv4 unicast
```

NX-04

```
Feature bgp
!
Router bgp 24
  address-family ipv4 unicast
    Network 124.0.0.0 mask 255.0.0.0
    Network 100.1.24.0 mask 255.255.255.0
  neighbor 192.1.40.22
    remote-as 123
    address-family ipv4 unicast
```

Task 4

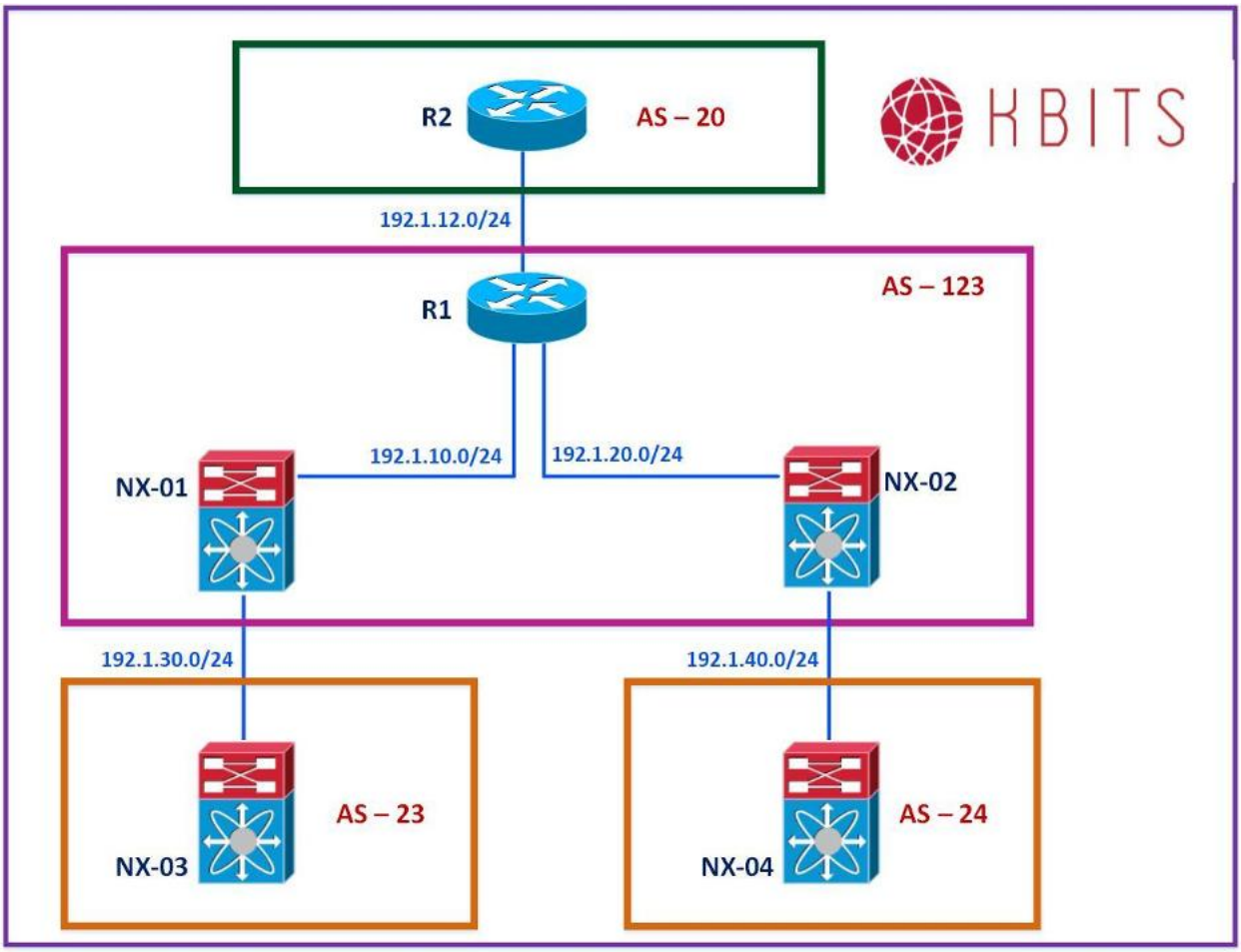
Verify that the Loopback 0 & Loopback 1 networks on all devices are learnt thru BGP and can communicate.

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Lab 10 – Configuring Authentication & Aggregation

(Builds on Lab 9)

BGP AS Diagram



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Task 1

Configure BGP to authenticate neighbors within AS 123 using MD5 authentication using a password of Cisco@123

R1 Router bgp 123 Neighbor 10.1.1.21 password Cisco@123 Neighbor 10.1.1.22 password Cisco@123
NX-01 Router bgp 123 neighbor 10.1.1.1 password Cisco@123
NX-02 Router bgp 123 neighbor 10.1.1.1 password Cisco@123

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Task 2

Configure BGP to authenticate all eBGP neighbors using a password of Ccie@123.

R1 Router bgp 123 Neighbor 192.1.12.2 password Ccie@123
R2 Router bgp 20 Neighbor 192.1.12.1 password Ccie@123
NX-01 Router bgp 123 neighbor 192.1.30.23 password Ccie@123
NX-03 Router bgp 23 neighbor 192.1.30.21 password Ccie@123
NX-02 Router bgp 123 neighbor 192.1.40.24 password Ccie@123
NX-04 Router bgp 24 neighbor 192.1.40.22 password Ccie@123

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Task 3

The following loopbacks have been created in the previous lab on NX-04. Advertise them in BGP.

- Loopback 201: 202.1.20.1/24
- Loopback 202: 202.1.21.1/24
- Loopback 203: 202.1.22.1/24
- Loopback 204: 202.1.23.1/24

NX-04

```
Router bgp 24
 Address-family ipv4 unicast
   Network 202.1.20.0 mask 255.255.255.0
   Network 202.1.21.0 mask 255.255.255.0
   Network 202.1.22.0 mask 255.255.255.0
   Network 202.1.23.0 mask 255.255.255.0
```

Task 4

Summarize these networks towards AS 123. Make sure that the specific routes are suppressed.

NX-04

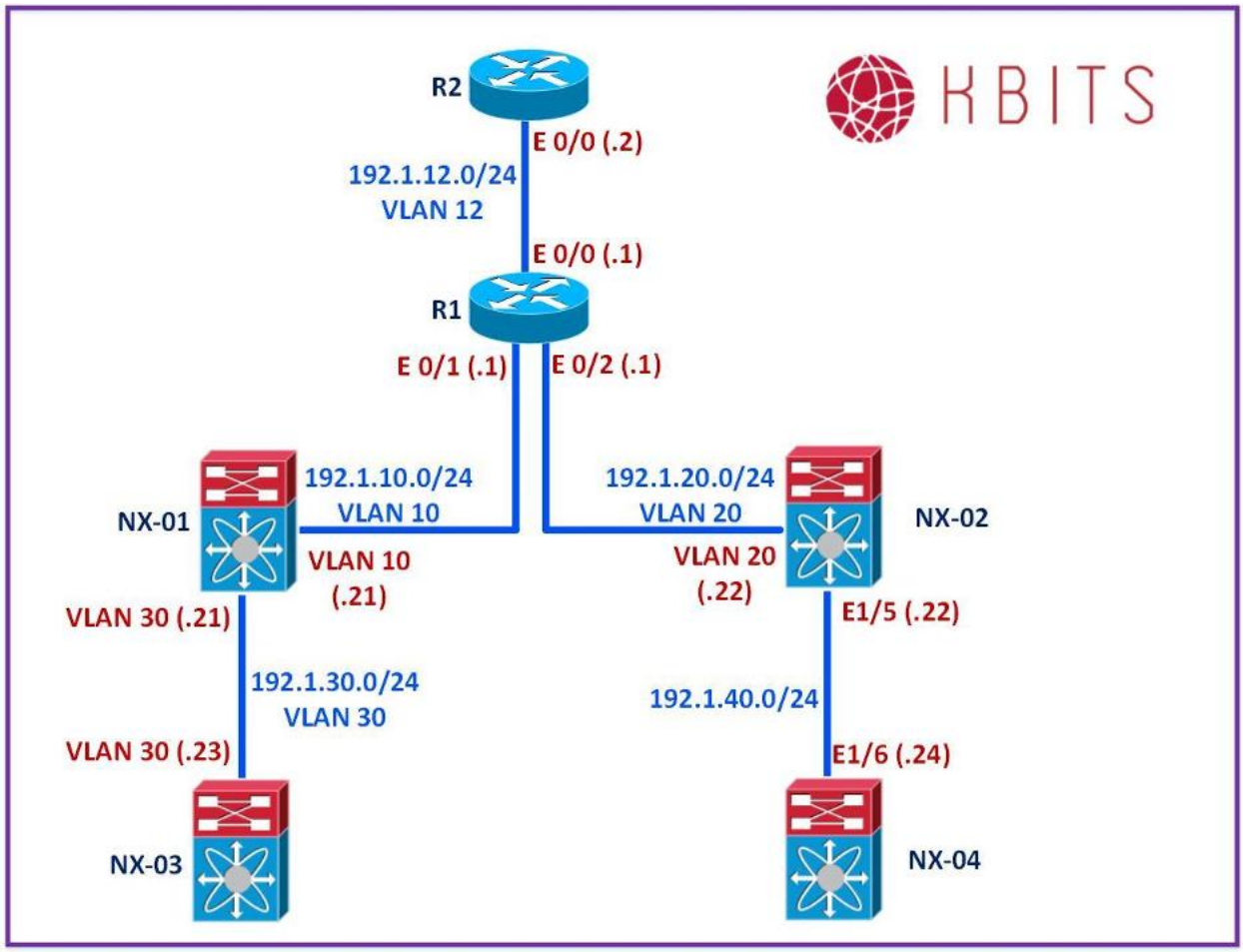
```
Router bgp 24
 Address-family ipv4 unicast
   Aggregate-address 202.1.20.0 255.255.252.0 summary-only
```

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Lab 11 – Configuring PIM Sparse Mode - Static RP

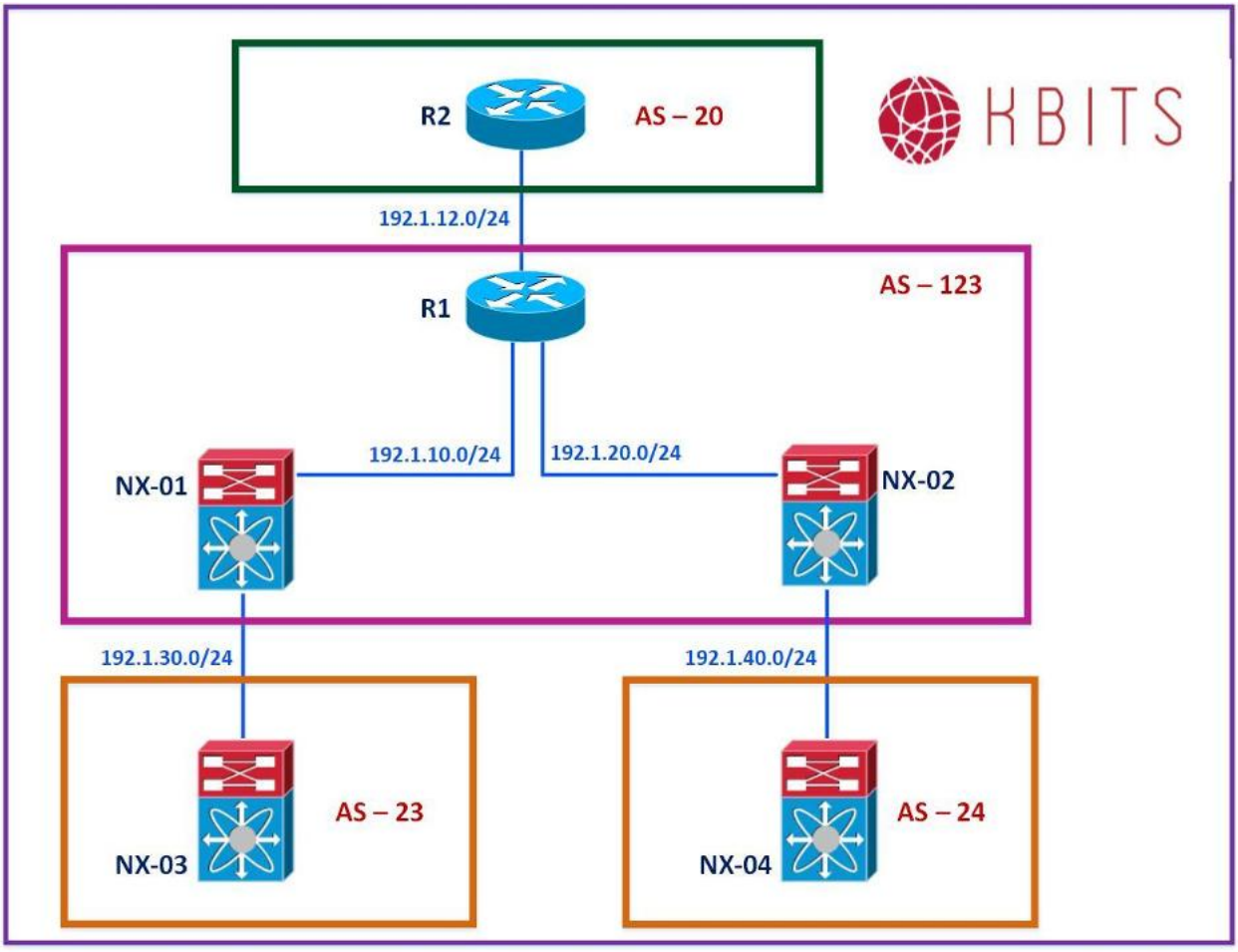
(Builds on Lab 10)

L3 Topology Diagram



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BGP AS Diagram



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Task 1

Configure AS 123 for PIM Sparse Mode. Configure **NX-01** to be the RP for Multicast groups 225.21.21.0/24, and **NX-02** to be the RP for the groups 225.22.22.0/24. These two RPs should use their Loopback 10 interface for this purpose.

R1

```
Ip multicast-routing
!
Access-list 21 permit 225.21.21.0 0.0.0.255
Access-list 22 permit 225.22.22.0 0.0.0.255
!
Ip pim rp-address 10.1.1.21 21
Ip pim rp-address 10.1.1.22 22
!
Interface E 0/1
 Ip pim sparse-mode
!
Interface E 0/2
 Ip pim sparse-mode
```

NX-01

```
Feature pim
!
Ip pim rp-address 10.1.1.21 group-list 225.21.21.0/24
Ip pim rp-address 10.1.1.22 group-list 225.22.22.0/24
!
Interface Loopback10
 Ip pim sparse-mode
!
Interface VLAN 10
 Ip pim sparse-mode
```

NX-02

```
Feature pim
!
Ip pim rp-address 10.1.1.21 group-list 225.21.21.0/24
Ip pim rp-address 10.1.1.22 group-list 225.22.22.0/24
!
Interface Loopback10
 Ip pim sparse-mode
!
Interface VLAN 20
 Ip pim sparse-mode
```

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Task 2

Configure the following Loopback 10 interfaces in AS 123 on R1, NX-01 & NX-02 to joing the **225.21.21.1** & **225.22.22.1** Multicast Groups.

R1 Interface Loopback10 ip igmp join-group 225.21.21.1 ip igmp join-group 225.22.22.1
NX-01 Interface Loopback10 ip igmp join-group 225.21.21.1 ip igmp join-group 225.22.22.1
NX-02 Interface Loopback10 ip igmp join-group 225.21.21.1 ip igmp join-group 225.22.22.1

Task 3

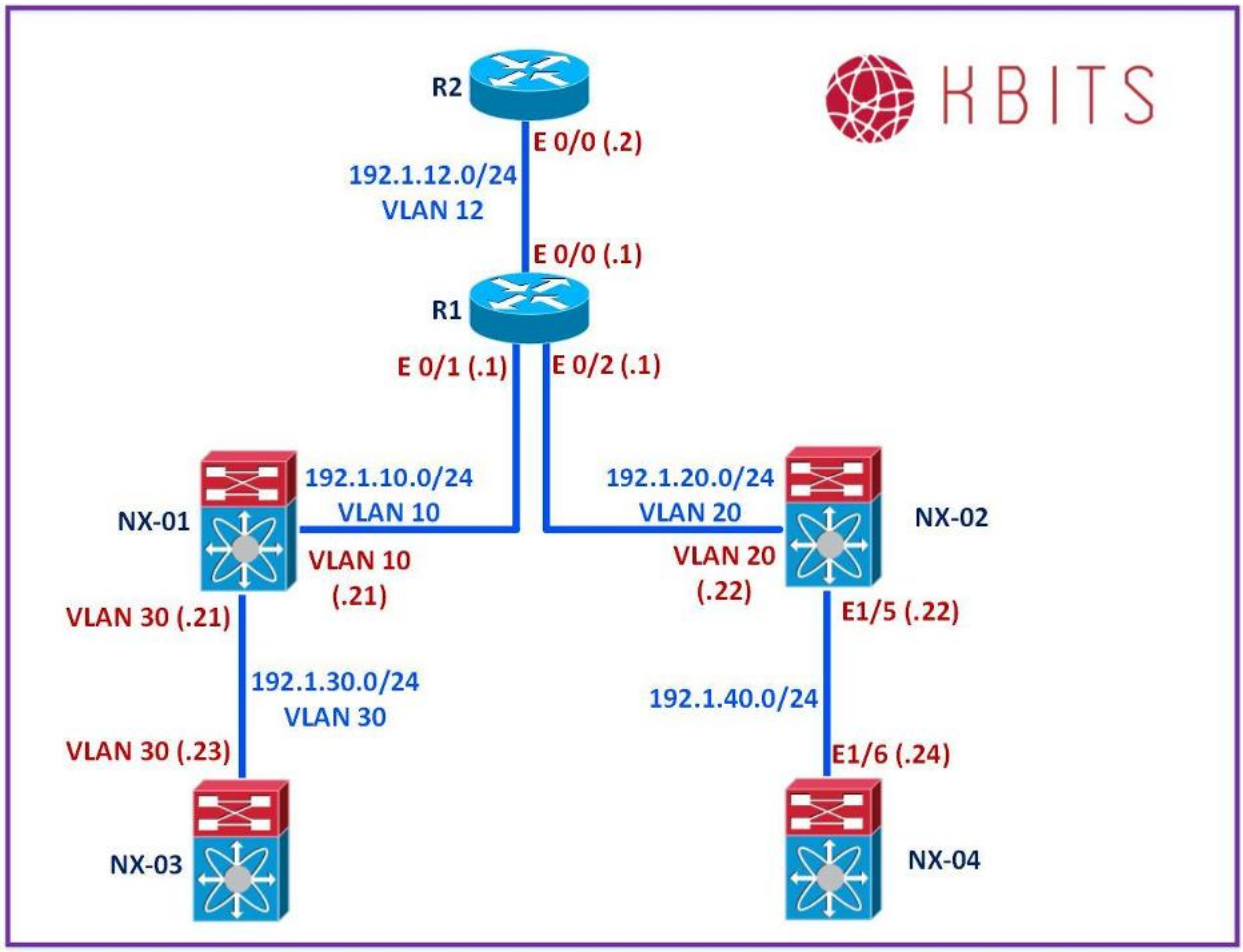
Verify the Multicast communication by both groups from R1. You should get a response from all 3 devices.

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Lab 12 – Configuring PIM Sparse Mode - Auto RP

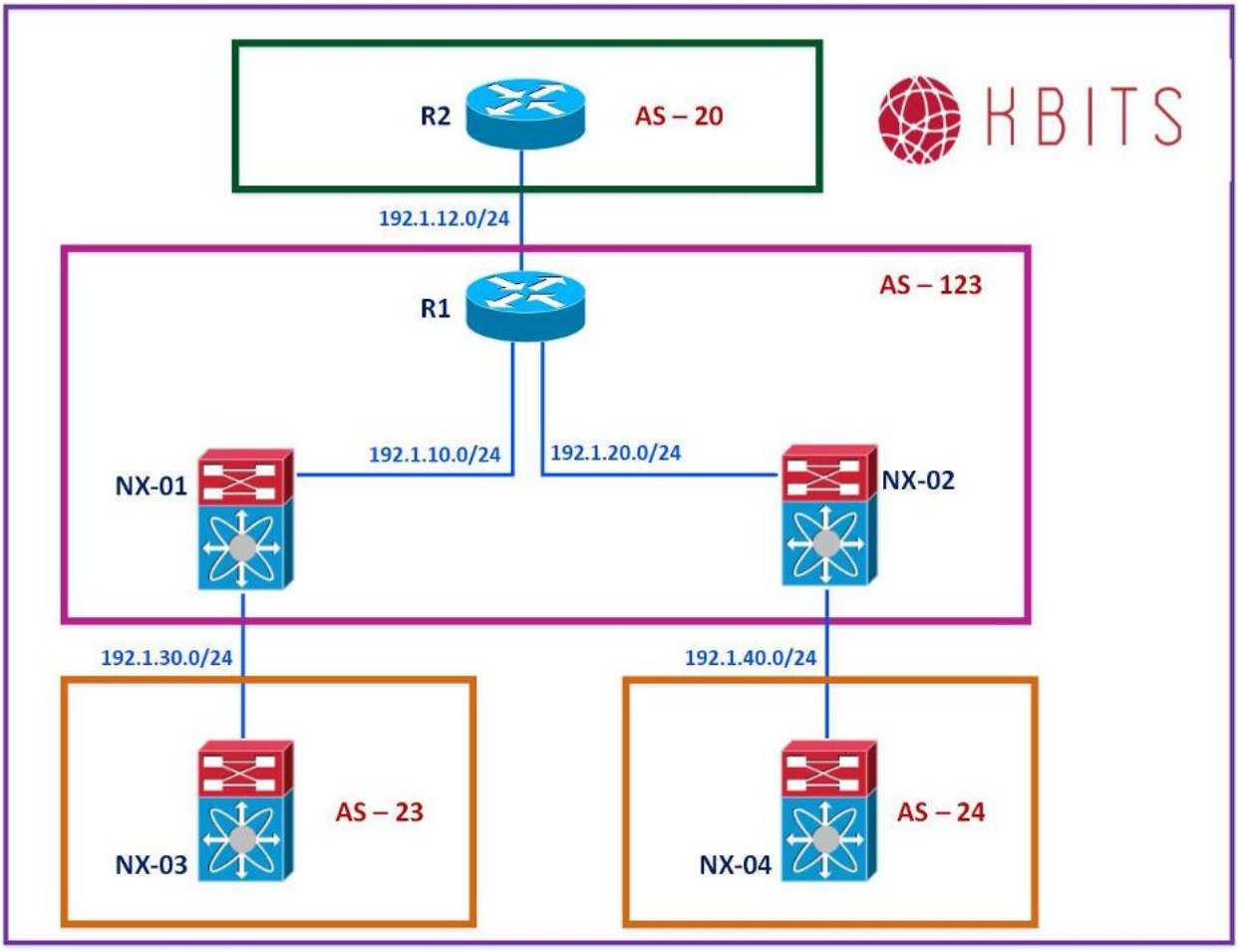
(Builds on Lab 11)

L3 Topology Diagram



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BGP AS Diagram



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Task 0

De-configure Static RP configurations on all the Devices.

R1 No Ip pim rp-address 10.1.1.21 21 No Ip pim rp-address 10.1.1.22 22
NX-01 No Ip pim rp-address 10.1.1.21 group-list 225.21.21.0/24 No Ip pim rp-address 10.1.1.22 group-list 225.22.22.0/24
NX-02 No Ip pim rp-address 10.1.1.21 group-list 225.21.21.0/24 No Ip pim rp-address 10.1.1.22 group-list 225.22.22.0/24

Task 1

Configure **NX-01** as an RP-Candidate as well as the Mapping Agent using Auto RP. **NX-02** should also be configured as a RP-Candidate. Use Loopback 10 as the RP-Address. **NX-01** & **NX-02** should be RP's for all Multicast Groups.

R1 ip pim autorp listener
NX-01 Ip pim auto-rp listen forward Ip pim auto-rp rp-candidate loopback10 group-list 224.0.0.0/4 Ip pim auto-rp mapping-agent loopback10
NX-02 Ip pim auto-rp listen forward Ip pim auto-rp rp-candidate loopback10 group-list 224.0.0.0/4

Task 2

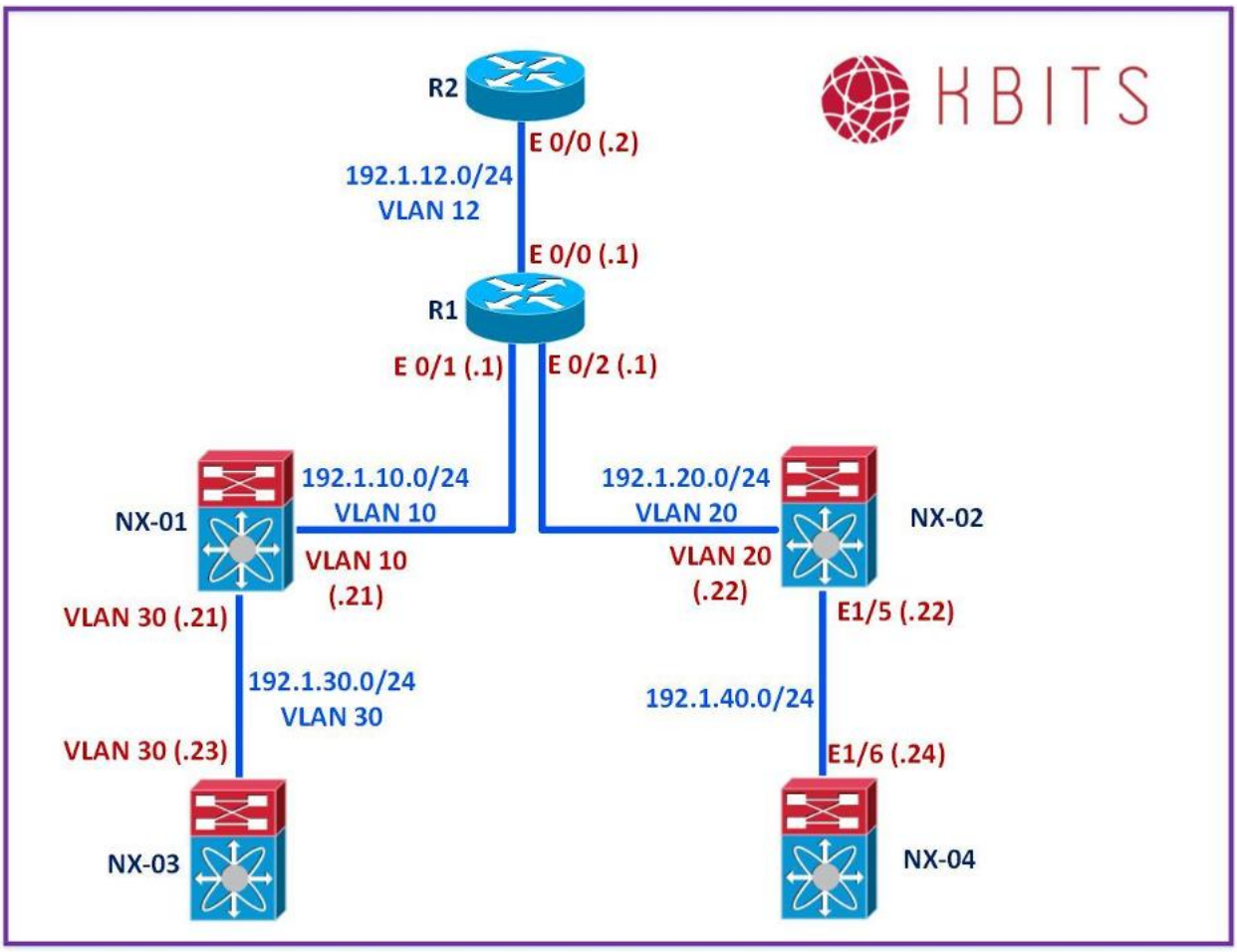
Verify that NX-02 is elected as the RP by using the "**Show ip pim rp mapping**" command on R1 or "**Show ip pim rp**" command on the NX-01 or NX-02 Switches.

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Lab 13 – Configuring PIM Sparse Mode - BSR

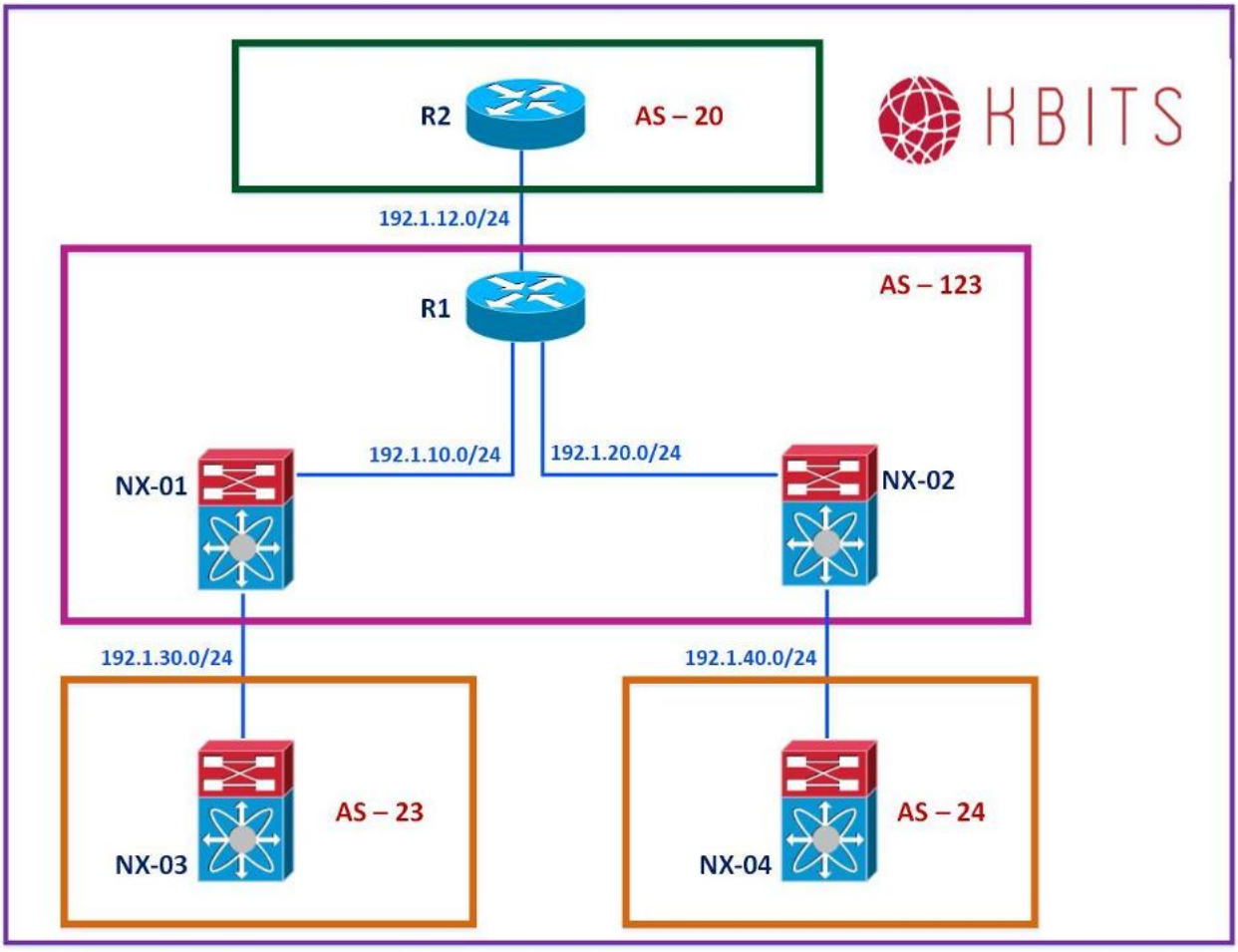
(Builds on Lab 12)

L3 Topology Diagram



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BGP AS Diagram



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Task 0

De-configure Auto RP configurations on all the Devices.

R1 No ip pim autorp listener
NX-01 No Ip pim auto-rp listen forward No Ip pim auto-rp rp-candidate loopback10 group-list 224.0.0.0/4 No Ip pim auto-rp mapping-agent loopback10
NX-02 No Ip pim auto-rp listen forward No Ip pim auto-rp rp-candidate loopback10 group-list 224.0.0.0/4

Task 1

Configure **NX-02** as an BSR-Candidate as well as the Mapping Agent. **NX-01** should also be configured as a BSR RP-Candidate. Use Loopback 10 as the RP-Address. **NX-01** & **NX-02** should be RPs for all Multicast Groups. **NX-01** should be selected as the preferred RP

NX-01 Ip pim bsr listen ip pim bsr rp-candidate loopback10 group-list 224.0.0.0/4 priority 1
NX-02 Ip pim bsr listen ip pim bsr bsr-candidate loopback10 ip pim bsr rp-candidate loopback10 group-list 224.0.0.0/4 priority 10

Task 2

Verify that NX-01 is elected as the RP by using the "**Show ip pim rp mapping**" command on R1 or "**Show ip pim rp**" command on the NX-01 or NX-02 Switches.

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CCIE Data Center v3 – Nexus NX-OS Switching

Authored By:

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Hepta CCIE # 12353
(R/S, Security, SP, Voice, Storage, Data Center, Wireless)

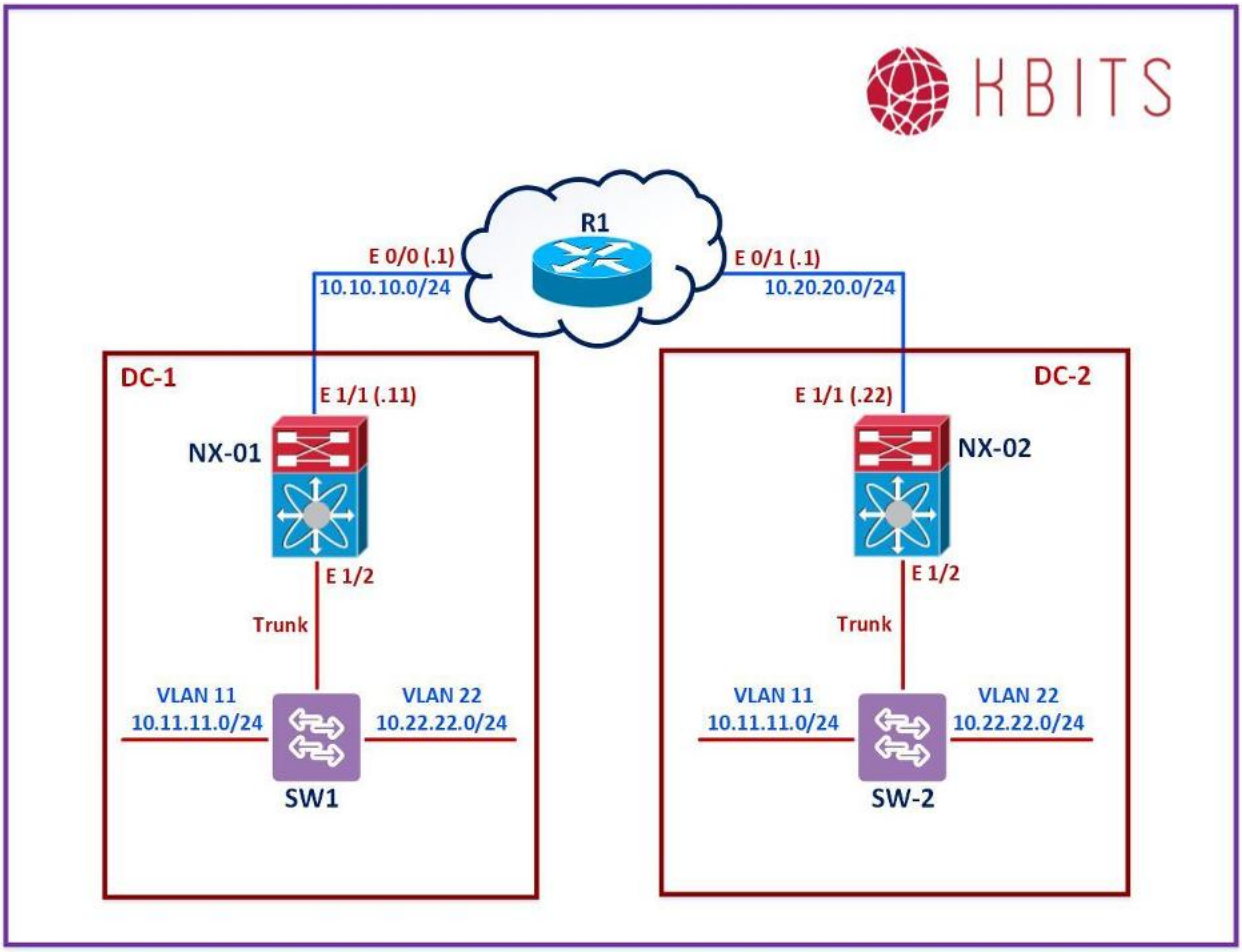
CCDE # 20110020

Module 4 – Configuring VXLAN



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Lab 1 – Configuring VXLAN – Using IGP & PIM



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Task 1
Initiliaze 2 Nexus switches with a password of **Cisco123** for the default admin account.

Task 2
Configure IP Addresses on R1, NX-01 & NX-02 based on the following:

- **R1**
  - Interface Loopback0: 1.1.1.1/32
  - Interface E 0/0: 10.10.10.1/24
  - Interface E 0/1: 10.20.20.1/24

- **NX-01**
  - Interface Loopback0: 192.168.1.1/32
  - Interface E 1/1: 10.10.10.11/24

- **NX-02**
  - Interface Loopback0: 192.168.1.2/32
  - Interface E 1/1: 10.20.20.22/24

R1 Hostname R1 ! Interface E 0/0 ip add 10.10.10.1 255.255.255.0 duplex full no shut ! Interface E 0/1 ip add 10.20.20.1 255.255.255.0 duplex full no shut ! Interface Loopback 0 ip address 1.1.1.1 255.255.255.255	**NX-01** Switchname NX-01 ! Interface Loopback0 ip address 192.168.1.1/32 ! Interface E 1/1 no switchport ip address 10.10.10.11/24 no shut
NX-02 Switchname NX-02 ! Interface Loopback0 ip address 192.168.1.2/32 ! Interface E 1/1	

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no switchport ip address 10.20.20.22/24 no shut	

Task 3

Configure OSPF to route the Loopback 0 networks between R1, NX-01 & NX-02. Configure the Router-IDs based on the following:

- **R1** – 1.1.1.1
- **NX-01** – 11.11.11.11
- **NX-02** – 22.22.22.22

R1

```
router ospf 1
 router-id 1.1.1.1
 network 10.0.0.0 0.255.255.255 area 0
 network 1.0.0.0 0.255.255.255 area 0
```

NX-01

```
feature ospf
!
router ospf 1
 router-id 11.11.11.11
!
Interface Loopback 0
 ip router ospf 1 area 0
!
Interface E 1/1
 ip router ospf 1 area 0
```

NX-02

```
feature ospf
!
router ospf 1
 router-id 22.22.22.22
!
Interface Loopback 0
 ip router ospf 1 area 0
!
Interface E 1/1
 ip router ospf 1 area 0
```

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Task 4

Configure Multicast Routing on R1, NX-01 & NX-02 using PIM in Sparse Mode. Enable PIM on the Loopback 0 interfaces of all 3 devices and the Physical Links between them. Configure R1 Loopback 0 as the RP-Address.

R1

```
ip multicast-routing
!
Interface Loopback 0
 ip pim sparse-mode
!
Interface E 0/0
 ip pim sparse-mode
!
Interface E 0/1
 ip pim sparse-mode
!
ip pim rp-address 1.1.1.1
```

NX-01

```
feature pim
!
Interface Loopback 0
 ip pim sparse-mode
!
Interface E 1/1
 ip pim sparse-mode
!
ip pim rp-address 1.1.1.1
```

NX-02

```
feature pim
!
Interface Loopback 0
 ip pim sparse-mode
!
Interface E 1/1
 ip pim sparse-mode
!
ip pim rp-address 1.1.1.1
```

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Task 5

Enable the "vn-segment-vlan-based" Feature on NX-01 & NX-02. Associate **VLAN 11** with a VNI **10011** & **VLAN 22** with a VNI **10022.**

NX-01

```
feature vn-segment-vlan-based
!
vlan 11
 vn-segment 10011
!
vlan 22
 vn-segment 10022
```

NX-02

```
feature vn-segment-vlan-based
!
vlan 11
 vn-segment 10011
!
vlan 22
 vn-segment 10022
```

Task 6

Enable the "nv overlay" Feature on NX-01 & NX-02. Configure a NVE Interface with an ID of **1**. Configure it use the Source Interface as Loopback 0. Configure it use a Multicast group of **239.1.1.11** for **VNI 10011** & a Multicast group of **239.1.1.22** for **VNI 10022**.

NX-01

```
feature nv overlay
!
Interface nve 1
 source-interface loopback0
 member vni 10011 mcast-group 239.1.1.11
 member vni 10022 mcast-group 239.1.1.22
 no shut
```

NX-02

```
feature nv overlay
!
Interface nve 1
 source-interface loopback0
 member vni 10011 mcast-group 239.1.1.11
```

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```
member vni 10022 mcast-group 239.1.1.22
no shut
```

Task 7

Configure the E 1/2 port on NX-01 & NX-02 as a trunk towards the internal switches (SW1 & SW2). Only allow VLANs **11** & **22** on these trunk ports.

SW1

```
Interface E 1/2
 switchport
 switchport mode trunk
 switchport trunk allowed vlan 11,22
 no shut
```

SW2

```
Interface E 1/2
 switchport
 switchport mode trunk
 switchport trunk allowed vlan 11,22
 no shut
```

Task 8

Configure the Internals switches (SW1 & SW2) with VLANs **11** & **22**. Configure th uplink ports (E 0/0) on both switches as trunks and only the above VLANs on these trunk ports. Configure IP Routing on the switches and Configure SVI Interfaces based on the following:

- **SW1**
  - Interface VLAN 11: 10.11.11.1/32
  - Interface VLAN 22: 10.22.22.1/32
- **SW2**
  - Interface VLAN 11: 10.11.11.2/32
  - Interface VLAN 22: 10.22.22.2/32

SW1

```
vlan 11,22
!
Interface E 0/0
 switchport
 switchport trunk encapsulation dot1q
 switchport mode trunk
```

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```
 switchport trunk allowed vlan 11,22
 no shut
!
ip routing
!
interface vlan 11
 ip add 10.11.11.1 255.255.255.0
 no shut
!
interface vlan 22
 ip add 10.22.22.1 255.255.255.0
 no shut
```

SW2

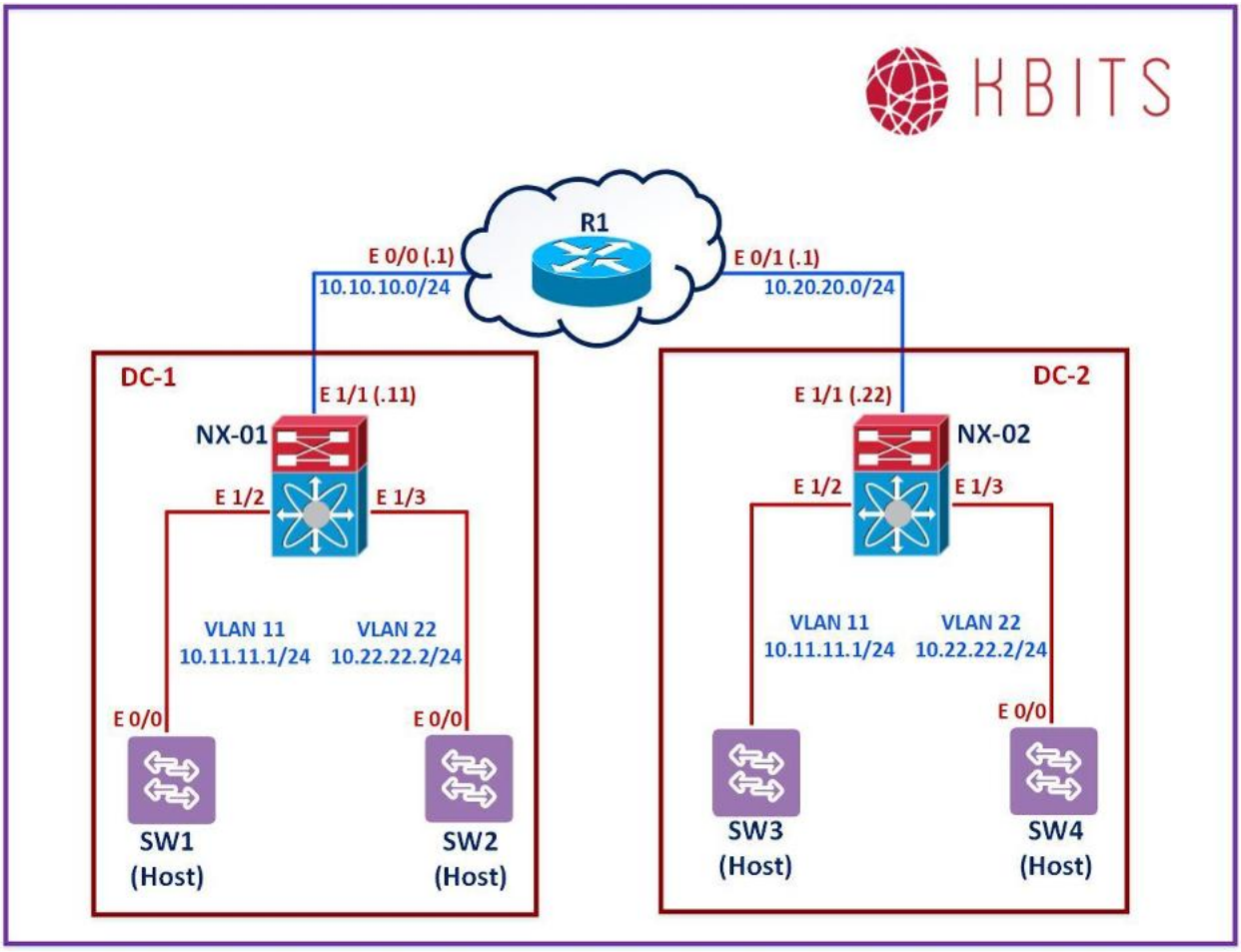
```
vlan 11,22
!
Interface E 0/0
 switchport
 switchport trunk encapsulation dot1q
 switchport mode trunk
 switchport trunk allowed vlan 11,22
 no shut
!
ip routing
!
interface vlan 11
 ip add 10.11.11.2 255.255.255.0
 no shut
!
interface vlan 22
 ip add 10.22.22.2 255.255.255.0
 no shut
```

Task 9

You should have reachability SW1 to SW2 within the same VLAN over the VXLAN Tunnel between NX-01 & NX-02. Ping 10.11.11.2 & 10.22.22.2 from SW1 to verify the communication.

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Lab 2 – Configuring VXLAN – Using BGP – EVPN



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Task 1
Initiliaze 2 Nexus switches with a password of **Cisco123** for the default admin account.

Task 2
Configure IP Addresses on R1, NX-01 & NX-02 based on the following:

- **R1**
  - Interface Loopback0: 1.1.1.1/32
  - Interface E 0/0: 10.10.10.1/24
  - Interface E 0/1: 10.20.20.1/24

- **NX-01**
  - Interface Loopback0: 192.168.1.1/32
  - Interface E 1/1: 10.10.10.11/24

- **NX-02**
  - Interface Loopback0: 192.168.1.2/32
  - Interface E 1/1: 10.20.20.22/24

R1	**NX-01**
Hostname R1 ! Interface E 0/0 ip add 10.10.10.1 255.255.255.0 duplex full no shut ! Interface E 0/1 ip add 10.20.20.1 255.255.255.0 duplex full no shut ! Interface Loopback 0 ip address 1.1.1.1 255.255.255.255	Switchname NX-01 ! Interface Loopback0 ip address 192.168.1.1/32 ! Interface E 1/1 no switchport ip address 10.10.10.11/24 no shut
NX-02 Switchname NX-02 ! Interface Loopback0 ip address 192.168.1.2/32 ! Interface E 1/1	

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no switchport ip address 10.20.20.22/24 no shut	

Task 3

Configure OSPF to route the Loopback 0 networks between R1, NX-01 & NX-02. Configure the Router-IDs based on the following:

- **R1** – 1.1.1.1
- **NX-01** – 11.11.11.11
- **NX-02** – 22.22.22.22

R1

```
router ospf 1
 router-id 1.1.1.1
 network 10.0.0.0 0.255.255.255 area 0
 network 1.0.0.0 0.255.255.255 area 0
```

NX-01

```
feature ospf
!
router ospf 1
 router-id 11.11.11.11
!
Interface Loopback 0
 ip router ospf 1 area 0
!
Interface E 1/1
 ip router ospf 1 area 0
```

NX-02

```
feature ospf
!
router ospf 1
 router-id 22.22.22.22
!
Interface Loopback 0
 ip router ospf 1 area 0
!
Interface E 1/1
 ip router ospf 1 area 0
```

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Task 4

Enable the following features on NX-01 & NX-02. They are required for the VXLAN using BGP – EVPN configuration:

- feature bgp
- feature interface-vlan
- feature vn-segment-vlan-based
- feature nv overlay
- nv overlay evpn

NX-01

```
feature bgp
feature interface-vlan
feature vn-segment-vlan-based
feature nv overlay
nv overlay evpn
```

NX-02

```
feature bgp
feature interface-vlan
feature vn-segment-vlan-based
feature nv overlay
nv overlay evpn
```

Task 5

Configure a VRF named KBITSs on NX-01 & NX-02. Create a **VLAN 101**. Link **VLAN 101** to **VNI 100101**.

NX-01

```
vrf context KBITS
!
vlan 101
 vn-segment 100101
```

NX-02

```
vrf context KBITS
!
vlan 101
 vn-segment 100101
```

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Task 6

Configure an SVI for **VLAN 101**. Link the SVI to the **KBITS** VRF. It will be used as L3VNI for Inter-vxlan Routing.

NX-01

```
Interface vlan 101
 vrf member KBITS
 ip forward
 no shut
```

NX-02

```
Interface vlan 101
 vrf member KBITS
 ip forward
 no shut
```

Task 7

Link the **KBITS** VRF to **VNI 100101**. Configure the VRF to Auto-generate the RD and RT values. Enable RT auto-generation for EVPN as well.

NX-01

```
vrf context KBITS
 vni 100101
 rd auto
 address-family ipv4 unicast
  route-target both auto
  route-target both auto evpn
```

NX-02

```
vrf context KBITS
 vni 100101
 rd auto
 address-family ipv4 unicast
  route-target both auto
  route-target both auto evpn
```

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Task 8

Configure BGP between NX-01 & NX-02 in AS 100. Configure the Neighbor relationship based on the Loopback 0 addresses. Set the Router-ID as **11.11.11.11** for NX-01 & **22.22.22.22** for NX-02. Enable the L2VPN EVPN address-family. It should be configured to exchange the Extended Community BGP Attribute. Enable the **KBITS** VRF for the IPv4 address family.

NX-01

```
router bgp 100
 router-id 11.11.11.11
 neighbor 192.168.1.2
  remote-as 100
  update-source Loopback0
  address-family l2vpn evpn
   send-community extended
 !
 vrf KBITS
  address-family ipv4 unicast
```

NX-02

```
router bgp 100
 router-id 22.22.22.22
 neighbor 192.168.1.1
  remote-as 100
  update-source Loopback0
  address-family l2vpn evpn
   send-community extended
 !
 vrf KBITS
  address-family ipv4 unicast
```

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Task 9

Configure an NVE Interface on both devices. It should use the Loopback 0 interface as the Source. Configure BGP as the host-reachability protocol on the interface. Associate **VNI 100101** with the NVE Interface.

NX-01

```
Interface nve 1
 no shut
 source-interface Loopback0
 host-reachability protocol bgp
 member vni 100101 associate-vrf
```

NX-02

```
Interface nve 1
 no shut
 source-interface Loopback0
 host-reachability protocol bgp
 member vni 100101 associate-vrf
```

Task 10

Configure **VLANs 11** & **VLANs 22** on NX-01 & NX-02. These are the Internal VLANs. Assign **VLAN 11** a VNI of **10011** & assign **VLAN 22** a VNI of **10022.**

NX-01

```
vlan 11
 vn-segment 10011
!
vlan 22
 vn-segment 10022
```

NX-02

```
vlan 11
 vn-segment 10011
!
vlan 22
 vn-segment 10022
```

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Task 11

Configure both switches with a common anycast gateway MAC address of **0001.1111.1111**. Configure 2 SVI's each on both the switches based on the information below. Enable them to be used as Anycast Gateways.

- **NX-01**
  - VRF: KBITS
  - Interface VLAN 11: 10.11.11.254/24
  - Interface VLAN 22: 10.22.22.254/24

- **NX-02**
  - VRF: KBITS
  - Interface VLAN 11: 10.11.11.254/24
  - Interface VLAN 22: 10.22.22.254/24

NX-01

```
fabric forwarding anycast-gateway-mac 0001.1111.1111
!
Interface vlan 11
 vrf member KBITS
  ip address 10.11.11.254/24
  no shut
  fabric forwarding mode anycast-gateway
!
Interface vlan 22
 vrf member KBITS
  ip address 10.22.22.254/24
  no shut
  fabric forwarding mode anycast-gateway
```

NX-02

```
fabric forwarding anycast-gateway-mac 0001.1111.1111
!
Interface vlan 11
 vrf member KBITS
  ip address 10.11.11.254/24
  no shut
  fabric forwarding mode anycast-gateway
!
Interface vlan 22
 vrf member KBITS
  ip address 10.22.22.254/24
  no shut
  fabric forwarding mode anycast-gateway
```

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Task 12

Configure the VNIs **10011** & **10022** to use BGP as the ingress replication protocol under the NVE Interface.

NX-01

```
Interface nve 1
 member vni 10011
  ingress-replication protocol bgp
 member vni 10022
  ingress-replication protocol bgp
```

NX-02

```
Interface nve 1
 member vni 10011
  ingress-replication protocol bgp
 member vni 10022
  ingress-replication protocol bgp
```

Task 13

Configure EVPN for the 2 L2 VNIs to generate the RD & RT values automatically.

NX-01

```
evpn
 vni 10011 L2
   rd auto
   route-target both auto
 vni 10022 L2
   rd auto
   route-target both auto
```

NX-02

```
evpn
 vni 10011 L2
   rd auto
   route-target both auto
 vni 10022 L2
   rd auto
   route-target both auto
```

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Task 14

Configure NX-01 & NX-02 ports connected towards the Internal Switches as Access Ports. The Internal Switches are acting as L3 Hosts. Assign **E1/2** to **VLAN 11** and **E1/3** to **VLAN 22** on both switches.

NX-01

```
Interface E 1/2
 switchport mode access
 switchport access vlan 11
!
Interface E 1/3
 switchport mode access
 switchport access vlan 22
```

NX-02

```
Interface E 1/2
 switchport mode access
 switchport access vlan 11
!
Interface E 1/3
 switchport mode access
 switchport access vlan 22
```

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Task 15

Configure SW1 – SW4 based on the information below:

- **SW1**
  - IP routing: Enabled
  - Interface VLAN 11: 10.11.11.1/24
  - Default Gateway: 10.11.11.254
- **SW2**
  - IP routing: Enabled
  - Interface VLAN 11: 10.22.22.2/24
  - Default Gateway: 10.22.22.254
- **SW3**
  - IP routing: Enabled
  - Interface VLAN 11: 10.11.11.3/24
  - Default Gateway: 10.11.11.254
- **SW4**
  - IP routing: Enabled
  - Interface VLAN 11: 10.22.22.4/24
  - Default Gateway: 10.22.22.254

SW1

```
ip routing
!
Interface E 0/0
 no switchport
 ip address 10.11.11.1 255.255.255.0
 no shut
!
ip route 0.0.0.0 0.0.0.0 10.11.11.254
```

SW2

```
ip routing
!
Interface E 0/0
 no switchport
 ip address 10.22.22.2 255.255.255.0
 no shut
!
ip route 0.0.0.0 0.0.0.0 10.22.22.254
```

SW3

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```
ip routing
!
Interface E 0/0
 no switchport
 ip address 10.11.11.3 255.255.255.0
 no shut
!
ip route 0.0.0.0 0.0.0.0 10.11.11.254
```

SW4

```
ip routing
!
Interface E 0/0
 no switchport
 ip address 10.22.22.4 255.255.255.0
 no shut
!
ip route 0.0.0.0 0.0.0.0 10.22.22.254
```

Task 16

You should have reachability between SW1 – SW4. Ping 10.11.11.3, 10.22.22.2 & 10.22.22.4 from SW1 to verify the communication. Verify the MAC Addresses and associated IP Address using the following commands:

- Show l2route evpn mac all
- Show l2route evpn mac-ip all

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CCIE Data Center v3 – Nexus NX-OS Switching

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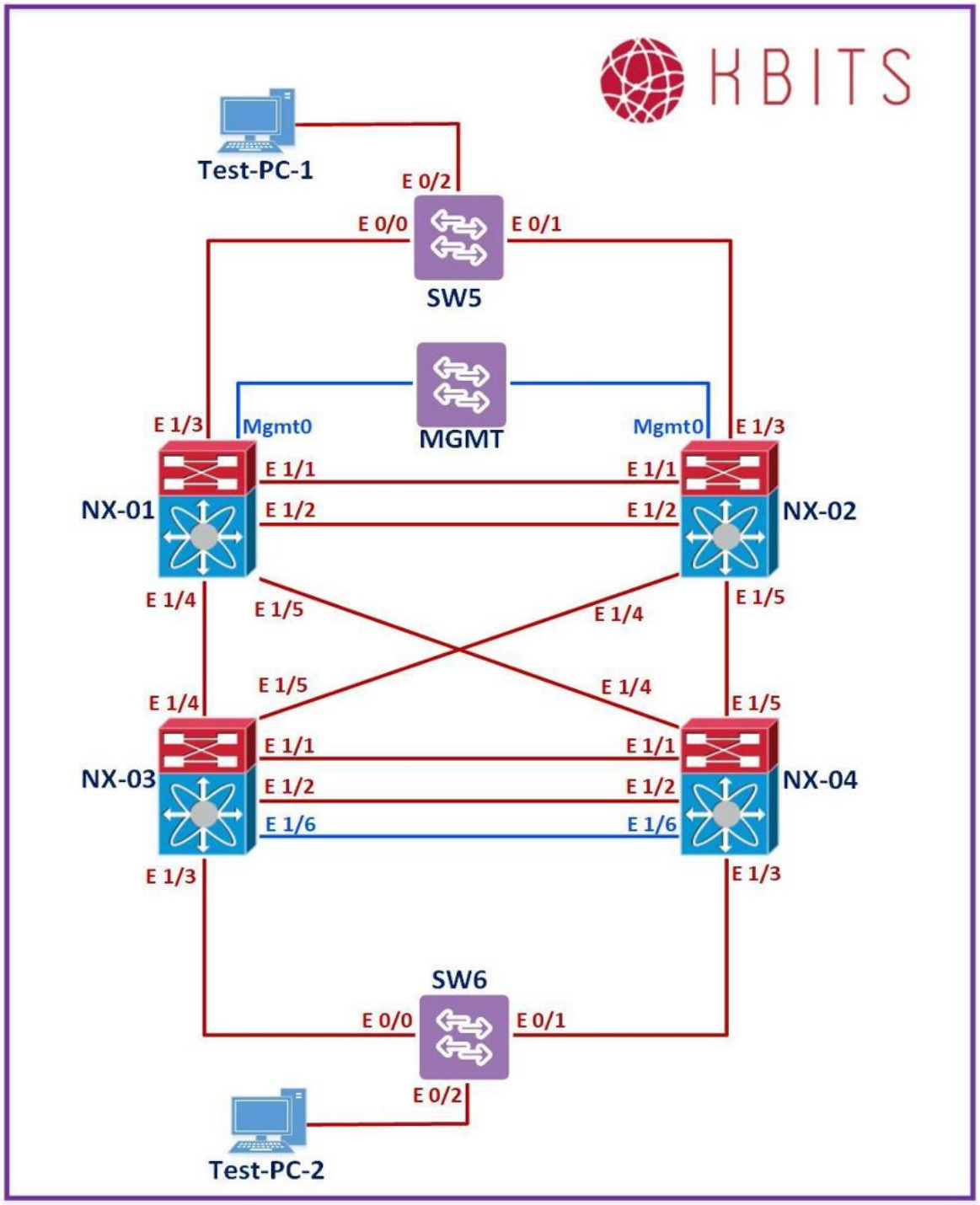
Module 5 – Advanced Configurations



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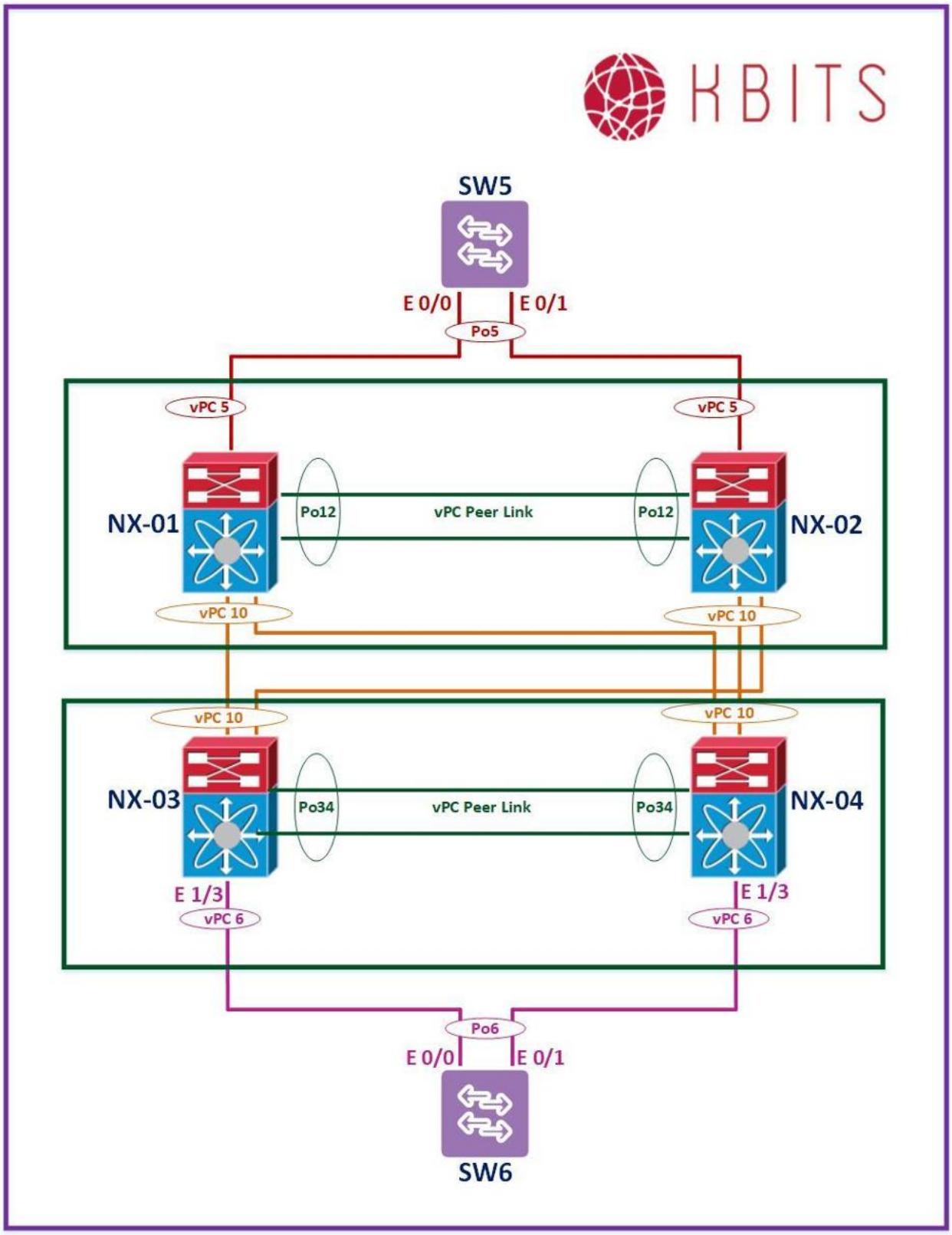
Lab 1 – Configuring Virtual Port Channels (VPC)

Physical Diagram



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Logical Diagram



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Task 1

Initiliaze 4 Nexus switches with a password of **Cisco123** for the default admin account.

Task 2

Configure a LACP port-channel between NX-01 & NX-02 based to bundle ports E 1/1 & E/2. Configure the Port Channel ID as **12**. Configure the Port-Channel as a Trunk Port. This port-channel will be used as the peer-link for a vPC between NX-01 & NX-02 in a later task.

NX-01	**NX-02**
Switchname NX-01 ! Feature LACP ! Interface E 1/1-2 Channel-group 12 mode active No shut ! Interface Port-channel 12 Switchport Switchport mode trunk No shut	Switchname NX-02 ! Feature LACP ! Interface E 1/1-2 Channel-group 12 mode active No shut ! Interface Port-channel 12 Switchport Switchport mode trunk No shut

Task 3

Configure the Mgmt0 Interface using the following addresses. This is going to be used for the Peer-Keepalive communications for the vPC.

- **NX-01** – Mgmt0 – 192.168.1.1/24
- **NX-02** – Mgmt0 – 192.168.1.2/24

NX-01	**NX-02**
Interface mgmt0 Ip address 192.168.1.1/24 No shut	Interface mgmt0 Ip address 192.168.1.2/24 No shut

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Task 4

Configure a vPC Domain with a Domain-ID of 12 on NX-01 & NX-02. Configure the keepalive using the Mgmt0 IPs of the 2 switches. Configure Port-channel on both switches as the vPC peer-link interface.

NX-01

```
Feature vpc
!
Vpc Domain 12
 Peer-keepalive destination 192.168.1.2 source 192.168.1.1
!
Interface port-channel 12
 Vpc peer-link
```

NX-02

```
Feature vpc
!
Vpc Domain 12
 Peer-keepalive destination 192.168.1.1 source 192.168.1.2
!
Interface port-channel 12
 Vpc peer-link
```

Task 5

Configure a LACP vPC based on the Diagram between [NX-01 & NX-02] & SW5. Use a Port-Channel & vPC ID of **5** on NX-01 & NX-02. Configure a normal LACP Port-Channe on SW5 using a Port Channel ID as **5**. Configure the Port-Channel as a Trunk Port.

NX-01

```
Interface E 1/3
 Channel-group 5 mode active
 No shut
!
Interface Port-channel 5
 Switchport
 Switchport mode trunk
 Vpc 5
 No shut
```

NX-02

```
Interface E 1/3
 Channel-group 5 mode active
 No shut
!
Interface Port-channel 5
 Switchport
 Switchport mode trunk
 Vpc 5
 No shut
```

SW5

```
Interface range E 0/0-1
 Channel-group 5 mode active
```

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```
 No shut
!
Interface Port-channel 5
 Switchport trunk encapsulation dot1q
 Switchport mode trunk
 No shut
```

Task 6

Verify the Port-channel status by issuing the "**Show etherchannel summary**" command on SW5 and issuing the "**Show Port-channel summary**" command on NX-01 & NX-02 switches. You should also verify that the vPC is showing up on the Nexus Switches by issuing the "**Show vpc**".

Task 7

Configure a LACP port-channel between NX-03 & NX-03 based to bundle ports E 1/1 & E/2. Configure the Port Channel ID as **34**. Configure the Port-Channel as a Trunk Port. This port-channel will be used as the peer-link for a vPC between NX-03 & NX-04 in a later task.

NX-03	**NX-04**
Switchname NX-03 ! Feature LACP ! Interface E 1/1-2 Channel-group 34 mode active No shut ! Interface Port-channel 34 Switchport Switchport mode trunk No shut	Switchname NX-04 ! Feature LACP ! Interface E 1/1-2 Channel-group 34 mode active No shut ! Interface Port-channel 34 Switchport Switchport mode trunk No shut

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Task 8

Configure the E1/6 Interface using the following addresses. This is going to be used for the Peer-Keepalive communications for the vPC.

- **NX-03** – E 1/6 – 192.168.2.3/24
- **NX-04** – E 1/6 – 192.168.2.4/24

NX-03	**NX-04**
Interface E 1/6 No switchport Ip address 192.168.2.3/24 No shut	Interface E 1/6 No switchport Ip address 192.168.2.4/24 No shut

Task 9

Configure a vPC Domain with a Domain-ID of 34 on NX-03 & NX-04. Configure the keepalive using the E 1/6 IPs of the 2 switches. Configure Port-channel on both switches as the vPC peer-link interface.

NX-03

```
Feature vpc
!
Vpc Domain 34
 Peer-keepalive destination 192.168.2.4 source 192.168.2.3 vrf default
!
Interface port-channel 34
 Vpc peer-link
```

NX-04

```
Feature vpc
!
Vpc Domain 34
 Peer-keepalive destination 192.168.2.3 source 192.168.2.4 vrf default
!
Interface port-channel 34
 Vpc peer-link
```

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Task 10

Configure a LACP vPC based on the Diagram between [NX-03 & NX-04] & SW6. Use a Port-Channel & vPC ID of **6** on NX-01 & NX-02. Configure a normal LACP Port-Channe on SW6 using a Port Channel ID as **6**. Configure the Port-Channel as a Trunk Port.

NX-03	**NX-04**
Interface E 1/3 Channel-group 6 mode active No shut ! Interface Port-channel 6 Switchport Switchport mode trunk Vpc 6 No shut	Interface E 1/3 Channel-group 6 mode active No shut ! Interface Port-channel 6 Switchport Switchport mode trunk Vpc 6 No shut
SW6 Interface range E 0/0-1 Channel-group 6 mode active No shut ! Interface Port-channel 6 Switchport trunk encapsulation dot1q Switchport mode trunk No shut	

Task 11

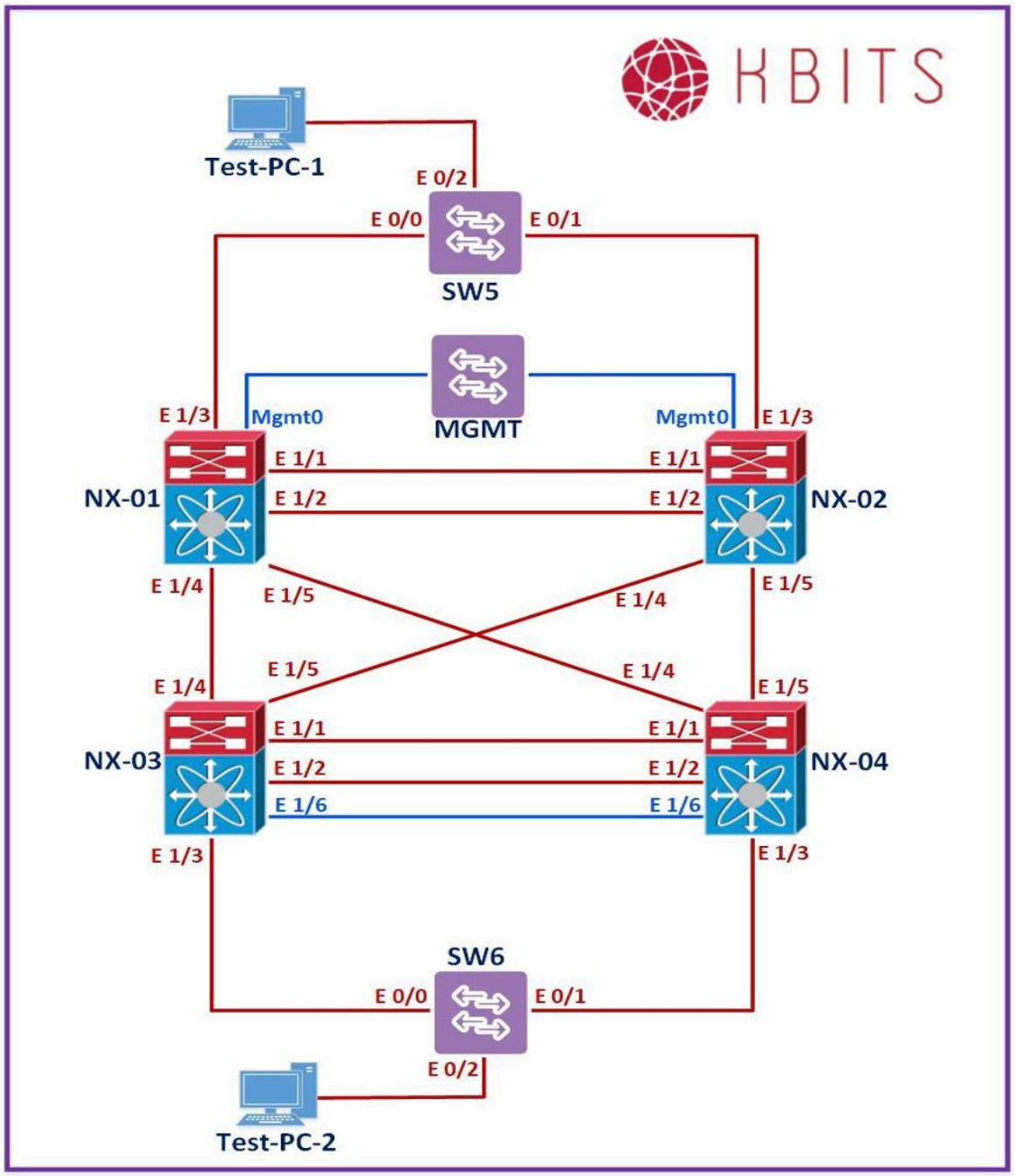
Verify the Port-channel status by issuing the "**Show etherchannel summary**" command on SW6 and issuing the "**Show Port-channel summary**" command on NX-03 & NX-03 switches. You should also verify that the vPC is showing up on the Nexus Switches by issuing the "**Show vpc**".

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Lab 2 – Configuring a Back-to-Back vPC

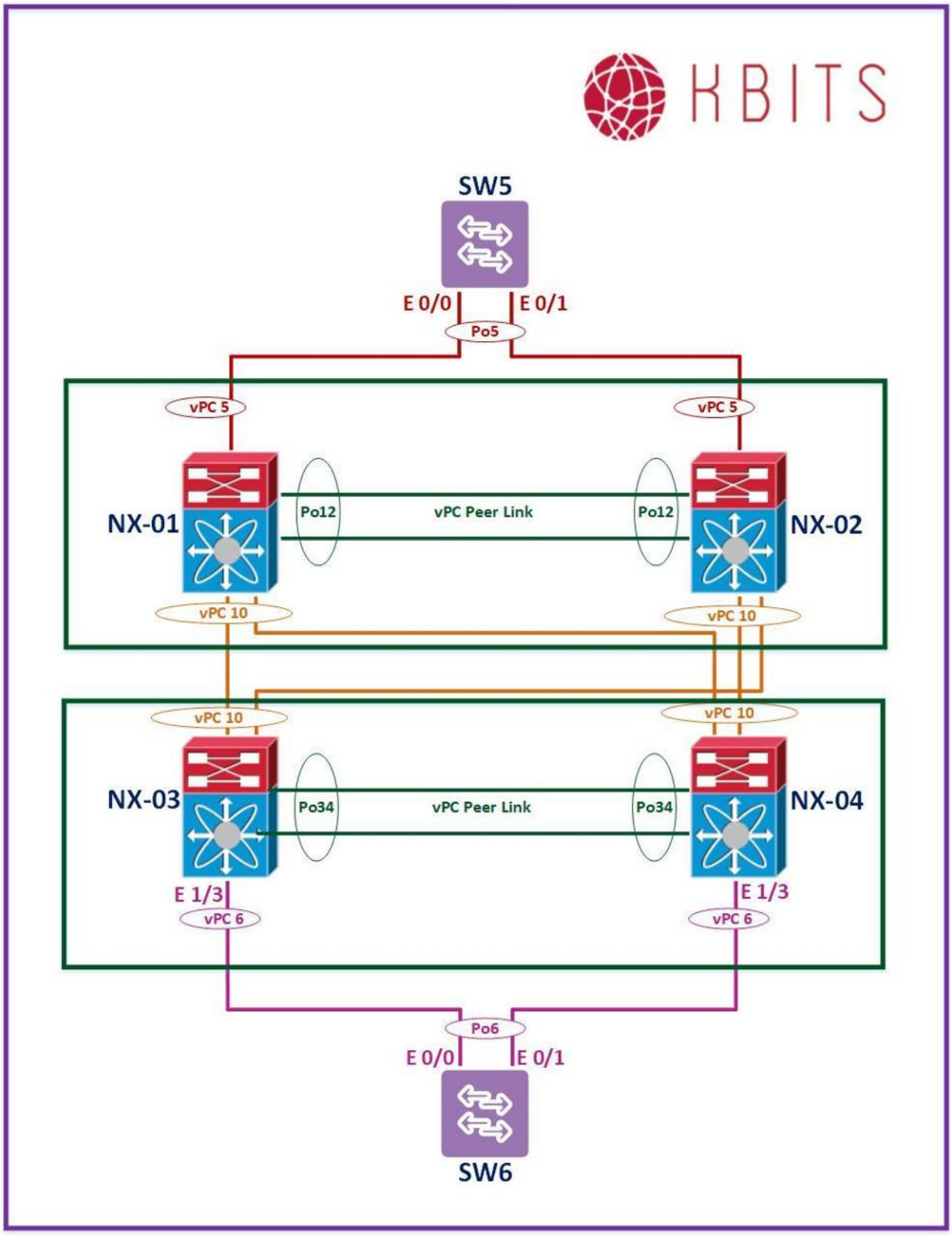
(Builds on Lab 1)

Physical Diagram



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Logical Diagram



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Task 1

Configure a LACP vPC based on the Diagram between [NX-01 & NX-01] & [NX-03 & NX-04]. Use a Port-Channel & vPC ID of **10**. Configure the Port-Channel as a Trunk Port.

NX-01	**NX-02**
Interface E 1/4-5 Channel-group 10 mode active No shut ! Interface Port-channel 10 Switchport Switchport mode trunk Vpc 10 No shut	Interface E 1/4-5 Channel-group 10 mode active No shut ! Interface Port-channel 10 Switchport Switchport mode trunk Vpc 10 No shut
NX-03	**NX-04**
Interface E 1/4-5 Channel-group 10 mode active No shut ! Interface Port-channel 10 Switchport Switchport mode trunk Vpc 10 No shut	Interface E 1/4-5 Channel-group 10 mode active No shut ! Interface Port-channel 10 Switchport Switchport mode trunk Vpc 10 No shut

Task 2

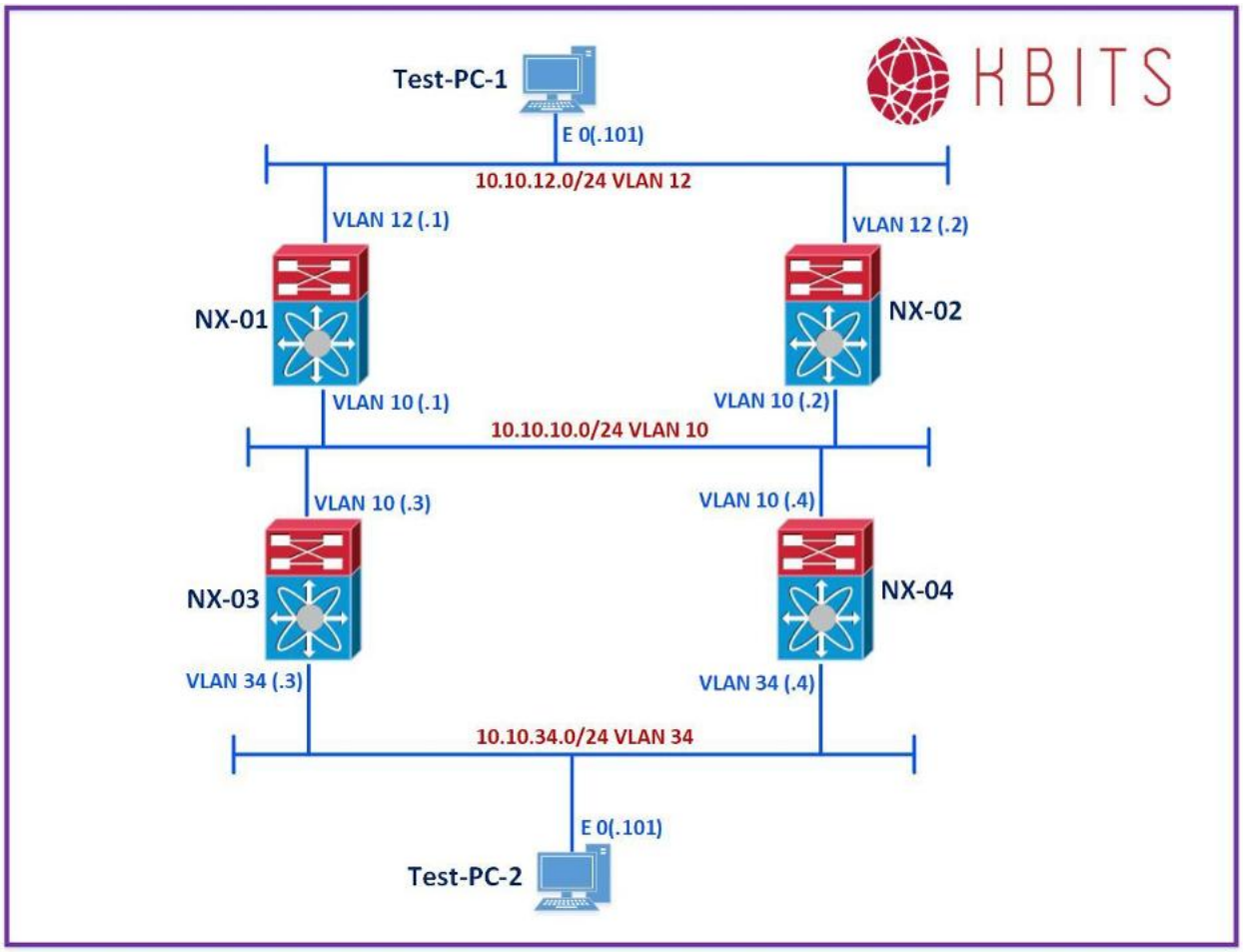
Verify the Port-channel status by issuing the "**Show Port-channel summary**" command on the 4 Nexus Switches. You should also verify that the vPC is showing up on the Nexus Switches by issuing the "**Show vpc**".

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Lab 3 – Configuring HSRP with vPC

(Builds on Lab 2)

L3 Logical Diagram



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Task 1

Configure SVIs on the Nexus Switches (NX-01) based on the Logical Diagram.

NX-01	**NX-02**
Feature interface-vlan ! Vlan 10,12 ! Interface Vlan 10 Ip address 10.10.10.1/24 No shut ! Interface Vlan 12 Ip address 10.10.12.1/24 No shut	Feature interface-vlan ! Vlan 10,12 ! Interface Vlan 10 Ip address 10.10.10.2/24 No shut ! Interface Vlan 12 Ip address 10.10.12.2/24 No shut
NX-03	**NX-04**
Feature interface-vlan ! Vlan 10,34 ! Interface Vlan 10 Ip address 10.10.10.3/24 No shut ! Interface Vlan 34 Ip address 10.10.34.3/24 No shut	Feature interface-vlan ! Vlan 10,34 ! Interface Vlan 10 Ip address 10.10.10.4/24 No shut ! Interface Vlan 34 Ip address 10.10.34.4/24 No shut

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Task 2

Configure EIGRP in AS 100 to connect all networks to each other. Use NEXUS as the EIGRP Instance Name.

NX-01	**NX-02**
Feature eigrp ! Router eigrp NEXUS Address-family ipv4 unicast Autonomous-system 100 ! Interface VLAN 10 Ip router eigrp NEXUS ! Interface VLAN 12 Ip router eigrp NEXUS	Feature eigrp ! Router eigrp NEXUS Address-family ipv4 unicast Autonomous-system 100 ! Interface VLAN 10 Ip router eigrp NEXUS ! Interface VLAN 12 Ip router eigrp NEXUS
NX-03	**NX-04**
Feature eigrp ! Router eigrp NEXUS Address-family ipv4 unicast Autonomous-system 100 ! Interface VLAN 10 Ip router eigrp NEXUS ! Interface VLAN 34 Ip router eigrp NEXUS	Feature eigrp ! Router eigrp NEXUS Address-family ipv4 unicast Autonomous-system 100 ! Interface VLAN 10 Ip router eigrp NEXUS ! Interface VLAN 34 Ip router eigrp NEXUS

Task 3

Configure HSRP between NX-01 and NX-02 on VLAN 12. Use the following parameters:

- Group ID: 12
- Virtual IP: 10.10.12.254
- Priority: NX-01 (105); NX-02 (100 – Default)
- Preemption: Enabled on both
- Authentication: MD5 using a key of Kbits@123

NX-01
Feature hsrp !

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```
interface Vlan12
  hsrp version 2
  hsrp 12
    authentication md5 key-string Kbits@123
    preempt
    priority 105
    ip 10.10.12.254
```

NX-02

```
Feature hsrp
!
interface Vlan12
  hsrp version 2
  hsrp 12
    authentication md5 key-string Kbits@123
    preempt
    ip 10.10.12.254
```

Task 4

Verify that the Switches are forming a HSRP pairing using the "**Show hsrp**" command. You can also use the "**Show hsrp brief**" command.

Task 5

Configure HSRP between NX-03 and NX-04 on VLAN 34. Use the following parameters:

- Group ID: 34
- Virtual IP: 10.10.34.254
- Priority: NX-03 (105); NX-04 (100 – Default)
- Preemption: Enabled on both
- Authentication: MD5 using a key of Cisco@123

NX-03

```
Feature hsrp
!
interface Vlan34
  hsrp version 2
  hsrp 34
    authentication md5 key-string Cisco@123
    preempt
    priority 105
    ip 10.10.34.254
```

NX-04

```
Feature hsrp
!
interface Vlan34
  hsrp version 2
  hsrp 34
    authentication md5 key-string Cisco@123
    preempt
    ip 10.10.34.254
```

Task 6

Verify that the Switches are forming a HSRP pairing using the "**Show hsrp**" command. You can also use the "**Show hsrp brief**" command.

Task 7

Configure SW5 & SW6 to connect Test-PC-1 & Test-PC-2 to the appropriate networks. Test-PC-1 should be assigned to **VLAN 12** & Test-PC-2 should be assigned to **VLAN 34**.

SW5	**SW6**
Interface E 0/2 Switchport mode access Switchport access vlan 12	Interface E 0/2 Switchport mode access Switchport access vlan 34

Task 8

Configure the Test PCs with the following below. They should be able to ping each other.

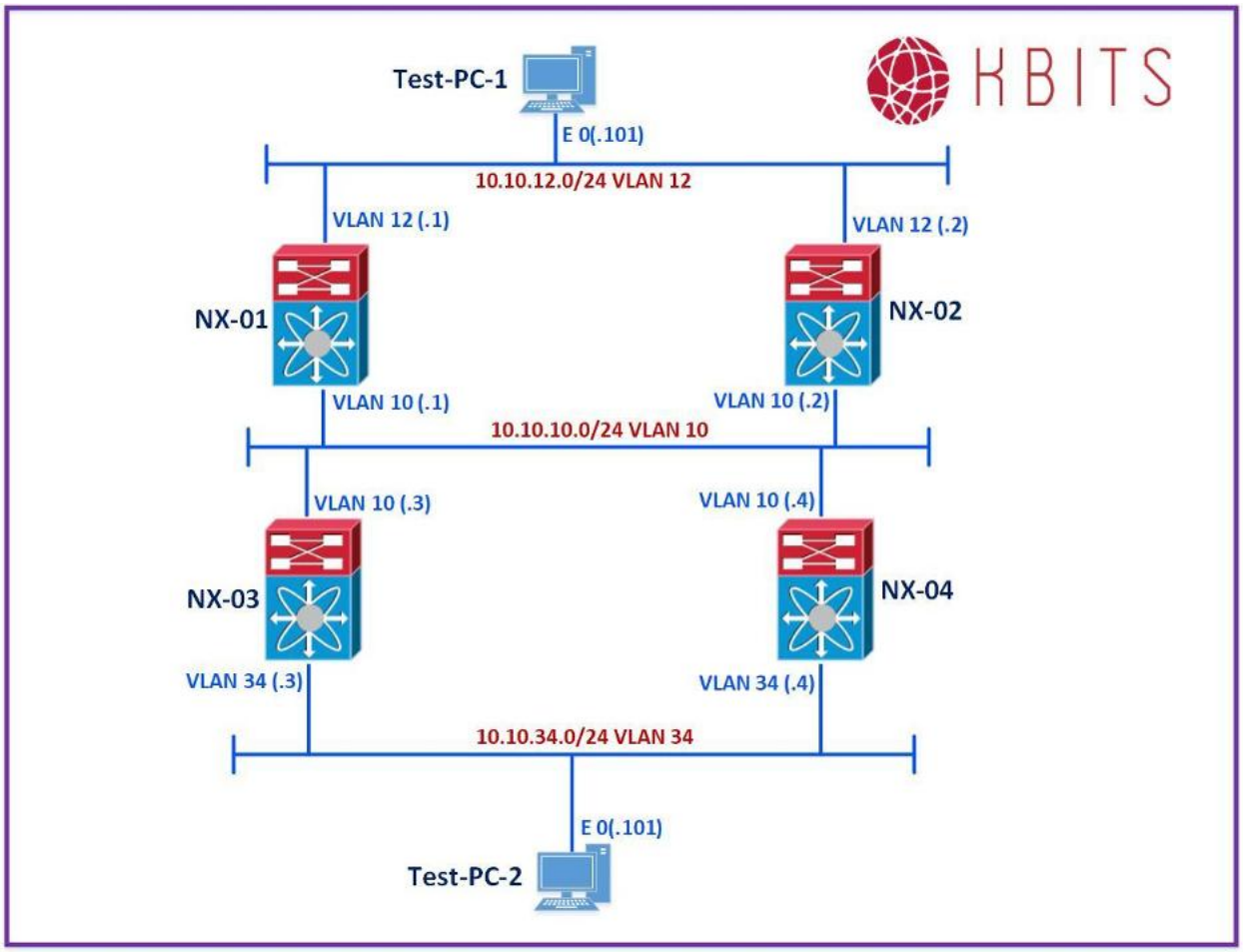
- **Test-PC-1**
  - IP: 10.10.12.101/24
  - Default Gateway: 10.10.12.254
- **Test-PC-2**
  - IP: 10.10.34.101/24
  - Default Gateway: 10.10.34.254

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Lab 4 – Configuring VRRP with vPC

(Builds on Lab 3)

L3 Logical Diagram



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Task 1
De-Configure HSRP on all devices.

NX-01 No Feature hsrp	**NX-02** No Feature hsrp
NX-03 No Feature hsrp	**NX-04** No Feature hsrp

Task 2
Configure VRRP between NX-01 and NX-02 on VLAN 12. Use the following parameters:

- Group ID: 12
- Virtual IP: 10.10.12.254
- Priority: NX-01 (105); NX-02 (100 – Default)
- Preemption: Enabled on both
- Authentication Key: Kbits@123

NX-01

```
Feature vrrp
!
interface Vlan12
  vrrp 12
    priority 105
    authentication text Cisco123
    address 10.10.12.254
    no shutdown
```

NX-02

```
Feature vrrp
!
interface Vlan12
  vrrp 12
    authentication text Cisco123
    address 10.10.12.254
    no shutdown
```

Task 3
Verify that the Switches are forming a VRRP pairing using the "**Show vrrp**" command. You can also use the "**Show vrrp detail**" command.

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Task 4

Configure VRRP between NX-03 and NX-04 on VLAN 34. Use the following parameters:

- Group ID: 34
- Virtual IP: 10.10.34.254
- Priority: NX-03 (105); NX-04 (100 – Default)
- Preemption: Enabled on both
- Authentication Key: Kbits@123

NX-03

```
Feature vrrp
!
interface Vlan34
  vrrp 34
    priority 105
    authentication text Cisco123
    address 10.10.34.254
    no shutdown
```

NX-04

```
Feature vrrp
!
interface Vlan34
  vrrp 34
    authentication text Cisco123
    address 10.10.34.254
    no shutdown
```

Task 5

Verify that the Switches are forming a VRRP pairing using the "**Show vrrp**" command. You can also use the "**Show vrrp detail**" command.

Task 6

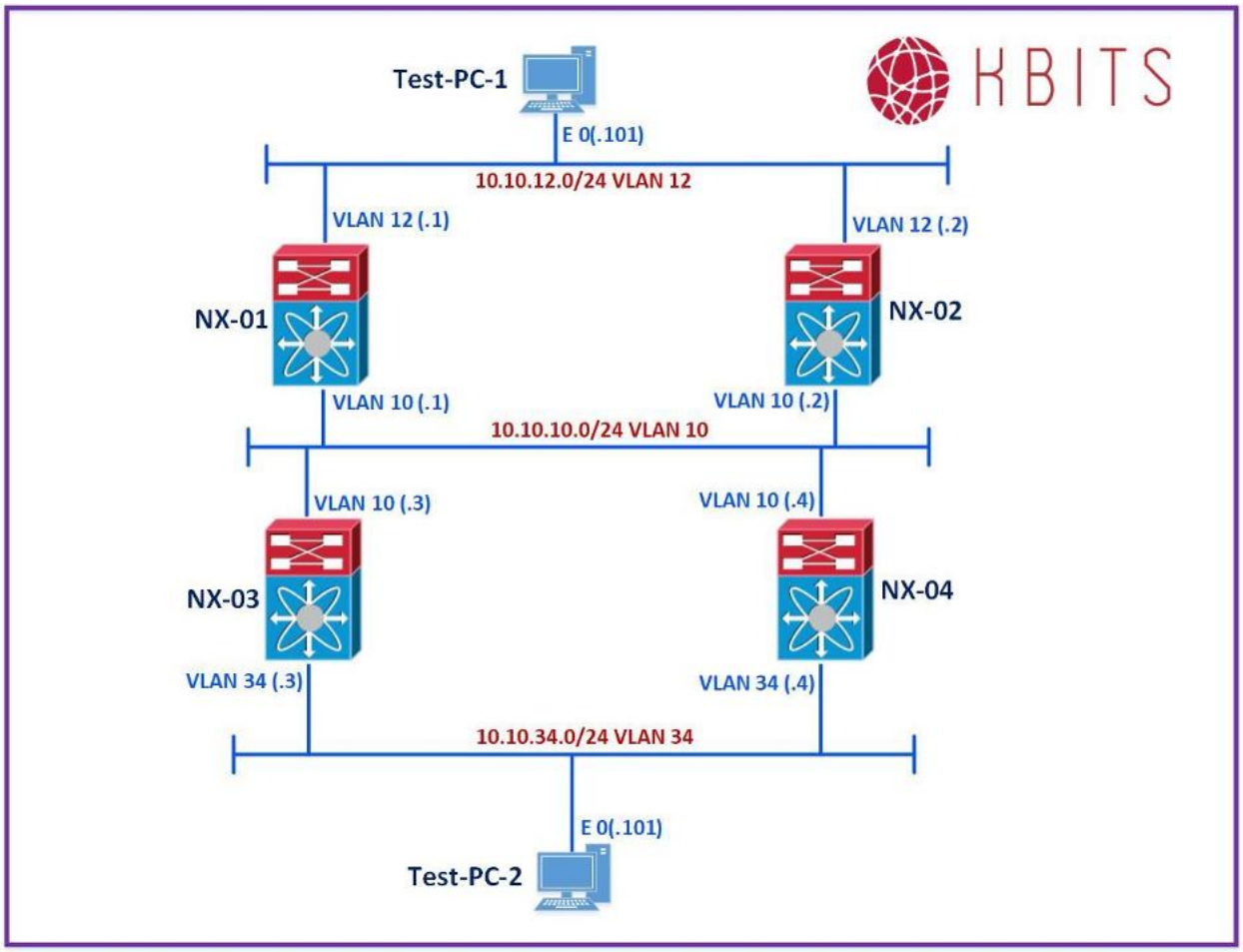
Verify the connectivity between **Test-PC-1** between **Test-PC-2**.

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Lab 5 – Configuring vPC Peer Gateway

(Builds on Lab 3)

L3 Logical Diagram



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Task 1

Configure the Nexus switches such the vPC peers can reply to an ARP request looking for the vPC's peer's IP Address.

NX-01 Vpc Domain 12 Peer-gateway	**NX-02** Vpc Domain 12 Peer-gateway
NX-03 Vpc Domain 34 Peer-gateway	**NX-04** Vpc Domain 34 Peer-gateway

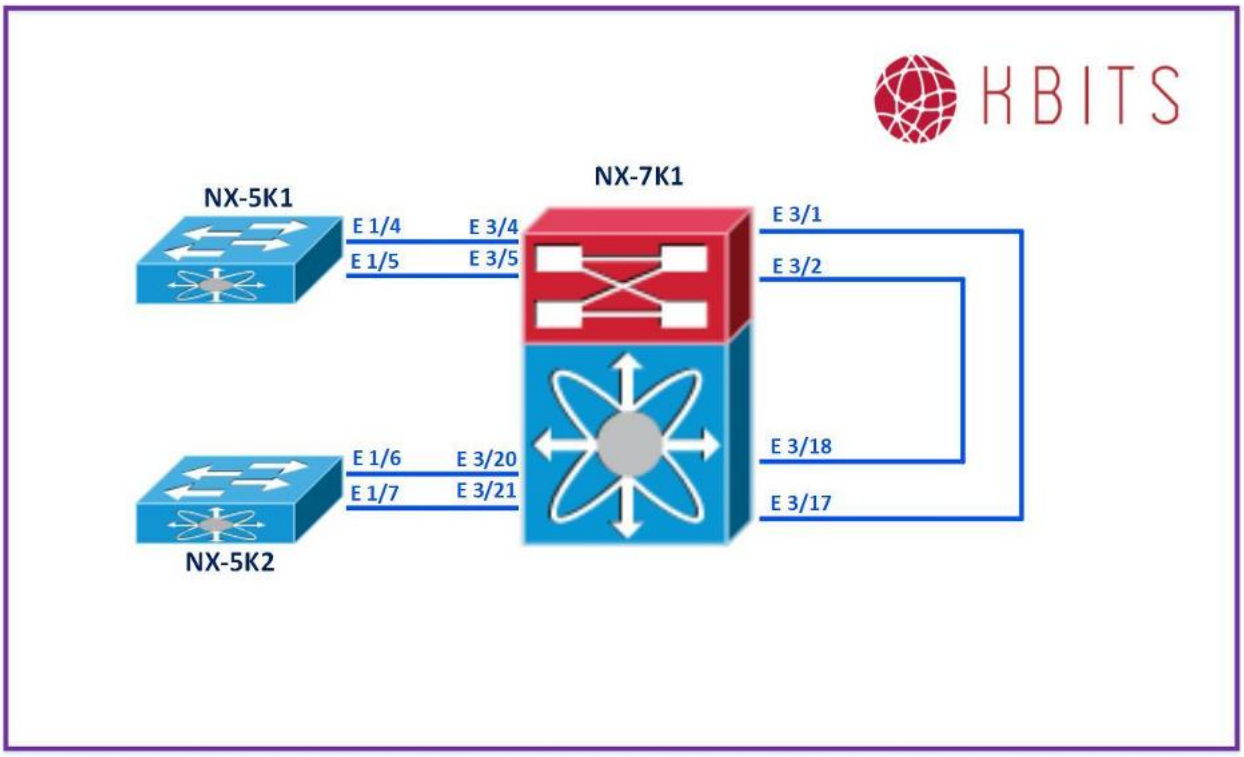
Task 2

Verify that the vPC Gateway capability has been enabled by issuing the "**Show vpc**" command on all the Nexus Switches.

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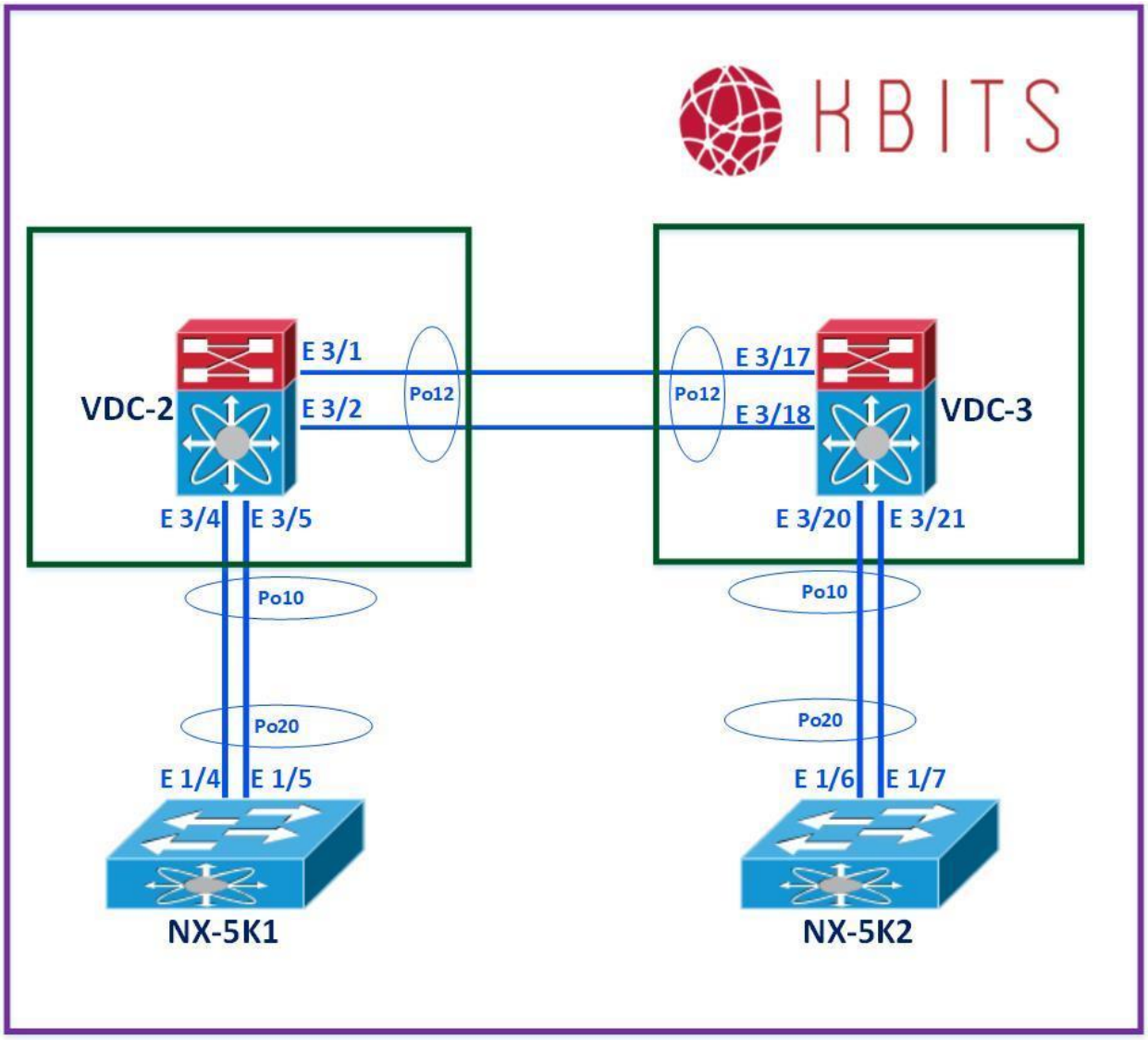
Lab 6 – Configuring Virtual Device Contexts (VDC)

Physical Diagram



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L3 Logical Diagram



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Task 1
Connect to **NX-7K1**. Configure the admin username with a password of Cisco@123. Configure it with a hostname of **VDC**.

NX-7K1
Hostname NX-7K1

Task 2
Configure 2 VDCs on 7K1 using the following information:

- VDC 2: Name : **VDC-2** ID: **2**
  - Interfaces : E 3/1-16
- VDC 3: Name : **VDC-3** ID: **3**
  - Interfaces : E 3/17-32

N7K-1
vdc VDC-2 id 2 allocate interface E 3/1-16 ! vdc VDC-3 id 3 allocate interface E 3/17-32

Task 3
Verify the Creation of the VDCs by using "**Show run vdc**" & "**Show vdc membership**" commands.

Task 4
Switch to VDC-2. Configure the password for the admin account as Cisco@123. Switchback to the default VDC. Switch to VDC-3. Configure the password for the admin account as Cisco@123. Switchback to the default VDC.

N7K-1
Switchto vdc VDC-2
VDC-2
Configure the password on the setup wizard as : **Cisco@123** ! switchback
VDC-3

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Configure the password on the setup wizard as : **Cisco@123** ! switchback

Task 5

Configure the prompt to only display the current VDC.

N7K-1 no vdc combined-hostname

Task 6

Configure a port-channel between VDC-2 & VDC-3 using the Physical and Logical Diagrams above. Use LACP as the Port-Channel negotiation Protocol. Configure the Port-Channel ID on both switches as "**12**". Configure the Port-channel as a Trunk.

VDC-2	**VDC-3**
Feature LACP ! Interface E 3/1-2 Channel-group 12 mode active No shut ! Interface Port-channel 12 Switchport Switchport mode trunk No shut	Feature LACP ! Interface E 3/17-18 Channel-group 12 mode active No shut ! Interface Port-channel 12 Switchport Switchport mode trunk No shut

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Task 7

Configure a port-channel between VDC-2 & NX-5K1 using the Physical and Logical Diagrams above. Use LACP as the Port-Channel negotiation Protocol.". Configure the Port-channel as a Trunk.

VDC-2	**NX-5K1**
Feature LACP ! Interface E 3/4 -5 Channel-group 10 mode active No shut ! Interface Port-channel 10 Switchport Switchport mode trunk No shut	Feature LACP ! Interface E 1/4 – 5 Channel-group 20 mode active No shut ! Interface Port-channel 20 Switchport Switchport mode trunk No shut

Task 8

Configure a port-channel between VDC-3 & NX-5K2 using the Physical and Logical Diagrams above. Use LACP as the Port-Channel negotiation Protocol.". Configure the Port-channel as a Trunk.

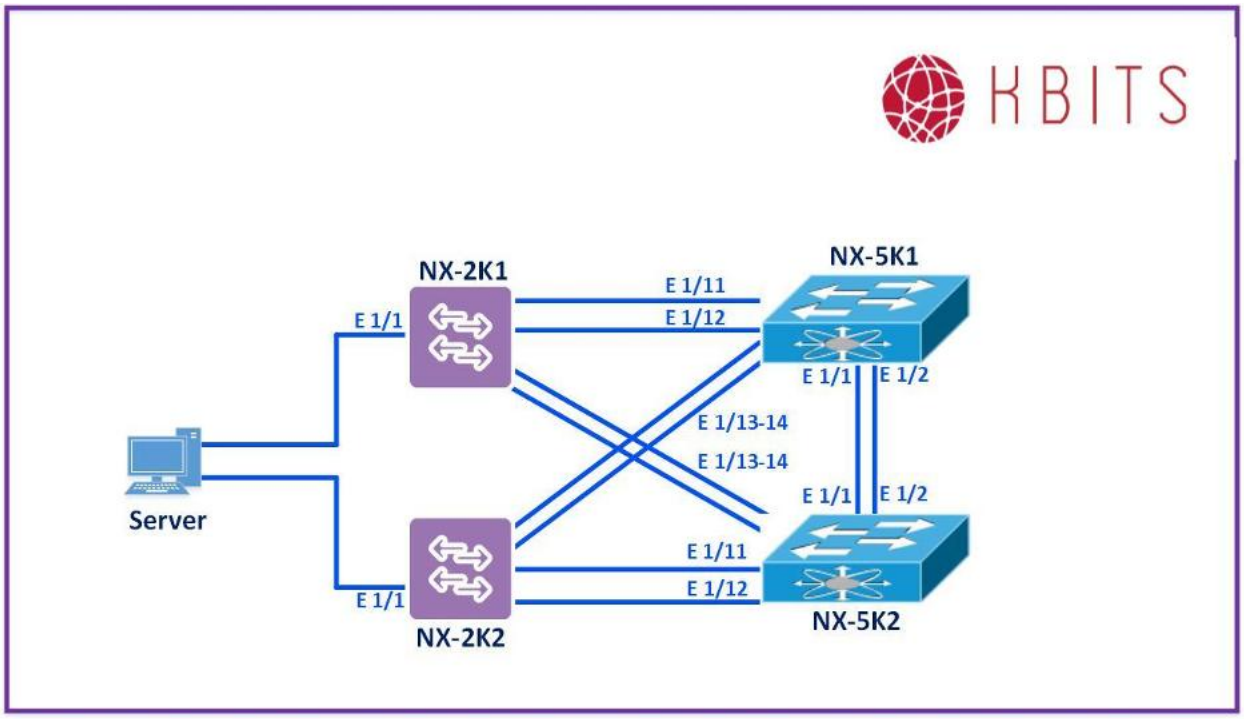
VDC-3	**NX-5K2**
Feature LACP ! Interface E 3/20 - 21 Channel-group 10 mode active No shut ! Interface Port-channel 10 Switchport Switchport mode trunk No shut	Feature LACP ! Interface E 1/6 – 7 Channel-group 20 mode active No shut ! Interface Port-channel 20 Switchport Switchport mode trunk No shut

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Lab 7 – Configuring FEX - Using Port Channels

(Builds on Lab 6)

Physical Diagram



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Task 1

Configure **NX-5K1** Ports E 1/11 & E 1/12 as FEX ports towards **NX-2K1**. We will be using Port Channels to connect to the FEX Switches. Use **101** as the FEX Identifier and Port Channel ID.

NX-5K1

```
Feature fex
!
Interface E 1/11-12
 channel-group 101 mode on
 no shut
!
Interface port-channel 101
 switchport mode fex-fabric
 fex associate 101
```

Task 2

Use the "**Show Fex**" command to verify comes online. It will take a couple of minutes to come online.

Task 3

Configure **NX-5K2** Ports E 1/11 & E 1/12 as FEX ports towards **NX-2K2**. We will be using Port Channels to connect to the FEX Switches. Use **102** as the FEX Identifier and Port Channel ID.

NX-5K2

```
Feature fex
!
Interface E 1/11-12
 channel-group 102 mode on
 no shut
!
Interface port-channel 102
 switchport mode fex-fabric
 fex associate 102
```

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Task 4

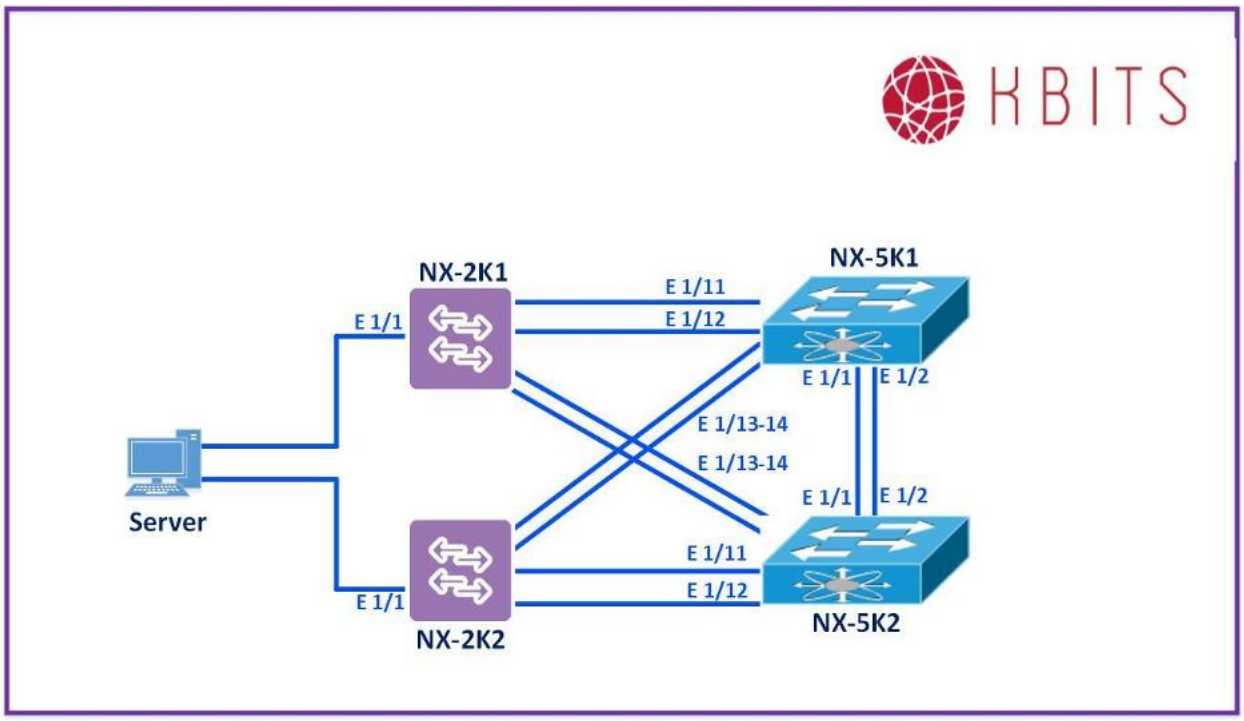
Use the "**Show Fex**" command to verify comes online. It will take a couple of minutes to come online.

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Lab 8 – Configuring FEX - Using vPC

(Builds on Lab 7)

Physical Diagram



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Task 1

De-configure the port-channels created on **NX-5K1** and **NX-5K2** towards **NX-2K1** and **NX-2K2** respectively.

NX-5K1	**NX-5K2**
No Interface port-channel 101 ! Default Interface E 1/11-12	No Interface port-channel 101 ! Default Interface E 1/11-12

Task 2

Configure a LACP port-channel between **NX-5K1** and **NX-5K2** to bundle ports E 1/1 & E/2. Configure the Port Channel ID as **12**. Configure the Port-Channel as a Trunk Port. This port-channel will be used as the peer-link for a vPC between **NX-5K1** and **NX-5K2** in a later task.

NX-5K1	**NX-5K2**
Feature LACP ! Interface E 1/1-2 Channel-group 12 mode active No shut ! Interface Port-channel 12 Switchport Switchport mode trunk No shut	Feature LACP ! Interface E 1/1-2 Channel-group 12 mode active No shut ! Interface Port-channel 12 Switchport Switchport mode trunk No shut

Task 3

Configure the Mgmt0 Interface using the following addresses. This is going to be used for the Peer-Keepalive communications for the vPC.

- **NX-5K1** – Mgmt0 – 192.1.68.1.1/24
- **NX-5K2** – Mgmt0 – 192.1.68.1.2/24

NX-5K1	**NX-5K2**
Interface mgmt0 Ip address 192.168.1.1/24 No shut	Interface mgmt0 Ip address 192.168.1.1/24 No shut

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Task 4

Configure a vPC Domain with a Domain-ID of 12 on **NX-5K1** and **NX-5K2**. Configure the keepalive using the Mgmt0 IPs of the 2 switches. Configure Port-channel on both switches as the vPC peer-link interface.

NX-5K1 Feature vpc ! Vpc Domain 12 Peer-keepalive destination 192.168.1.2 source 192.168.1.1 ! Interface port-channel 12 Vpc peer-link
NX-5K2 Feature vpc ! Vpc Domain 12 Peer-keepalive destination 192.168.1.1 source 192.168.1.2 ! Interface port-channel 12 Vpc peer-link

Task 5

Verify that the vPC is showing up on the Nexus Switches by issuing the "**Show vpc**" command.

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Task 6

Configure **NX-5K1** Ports E 1/11 & E 1/12 as FEX ports towards **NX-2K1**. Configure **NX-5K2** Ports E 1/13 & E 1/14 as FEX ports towards **NX-2K1**. We will be using Port Channels to configure the Links. Use **101** as the FEX Identifier and Port Channel ID on both Switches.

NX-5K1	**NX-5K2**
Feature fex ! Interface E 1/11-12 channel-group 101 mode on no shut ! Interface port-channel 101 switchport mode fex-fabric fex associate 101 vpc 101	Feature fex ! Interface E 1/13-14 channel-group 101 mode on no shut ! Interface port-channel 101 switchport mode fex-fabric fex associate 101 vpc 101

Task 7

Configure **NX-5K1** Ports E 1/13 & E 1/14 as FEX ports towards **NX-2K2**. Configure **NX-5K2** Ports E 1/11 & E 1/12 as FEX ports towards **NX-2K2**. We will be using Port Channels to configure the Links. Use **102** as the FEX Identifier and Port Channel ID on both Switches.

NX-5K1	**NX-5K2**
Feature fex ! Interface E 1/13-14 channel-group 102 mode on no shut ! Interface port-channel 102 switchport mode fex-fabric fex associate 102 vpc 102	Feature fex ! Interface E 1/11-12 channel-group 102 mode on no shut ! Interface port-channel 102 switchport mode fex-fabric fex associate 102 vpc 102

Task 8

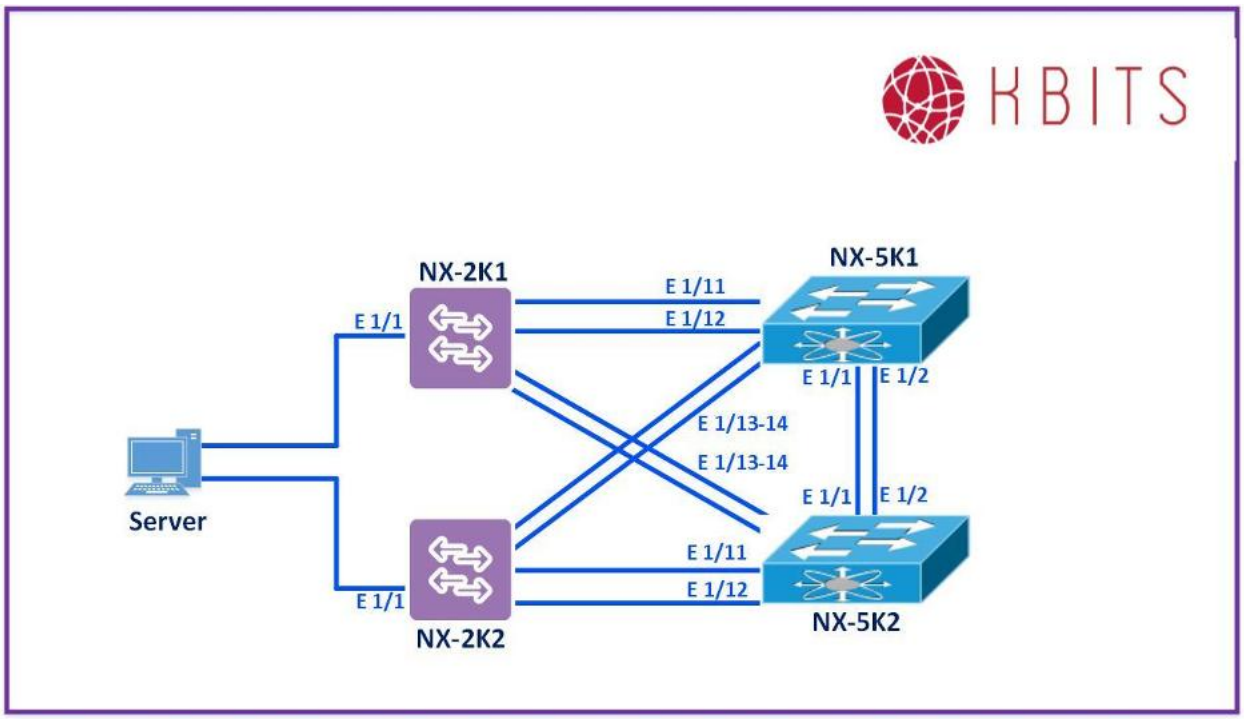
Use the "**Show Fex**" command to verify that the FEX Switchds come online. It will take a couple of minutes to come online.

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Lab 9 – Configuring Enhanced vPC to Connect the Server with Redundancy

(Builds on Lab 8)

Physical Diagram



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Task 1

Server has the ability to configure NIC Teaming. Configure the ports facing the Server as a Port-channel for FEX Switch ports. Configure the Port-Channel ID as **111**. The Switch is trunking towards the FEX Switches. This type of configuration is known as **Enhanced vPC**.

NX-5K1	**NX-5K2**
Interface E 101/1/1 Channel-group 111 No shut ! Interface E 102/1/1 Channel-group 111 No shut ! Interface Port-channel 111 Switchport Switchport mode trunk No shut	Interface E 101/1/1 Channel-group 111 No shut ! Interface E 102/1/1 Channel-group 111 No shut ! Interface Port-channel 111 Switchport Switchport mode trunk No shut

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CCIE Data Center v3 – ACI

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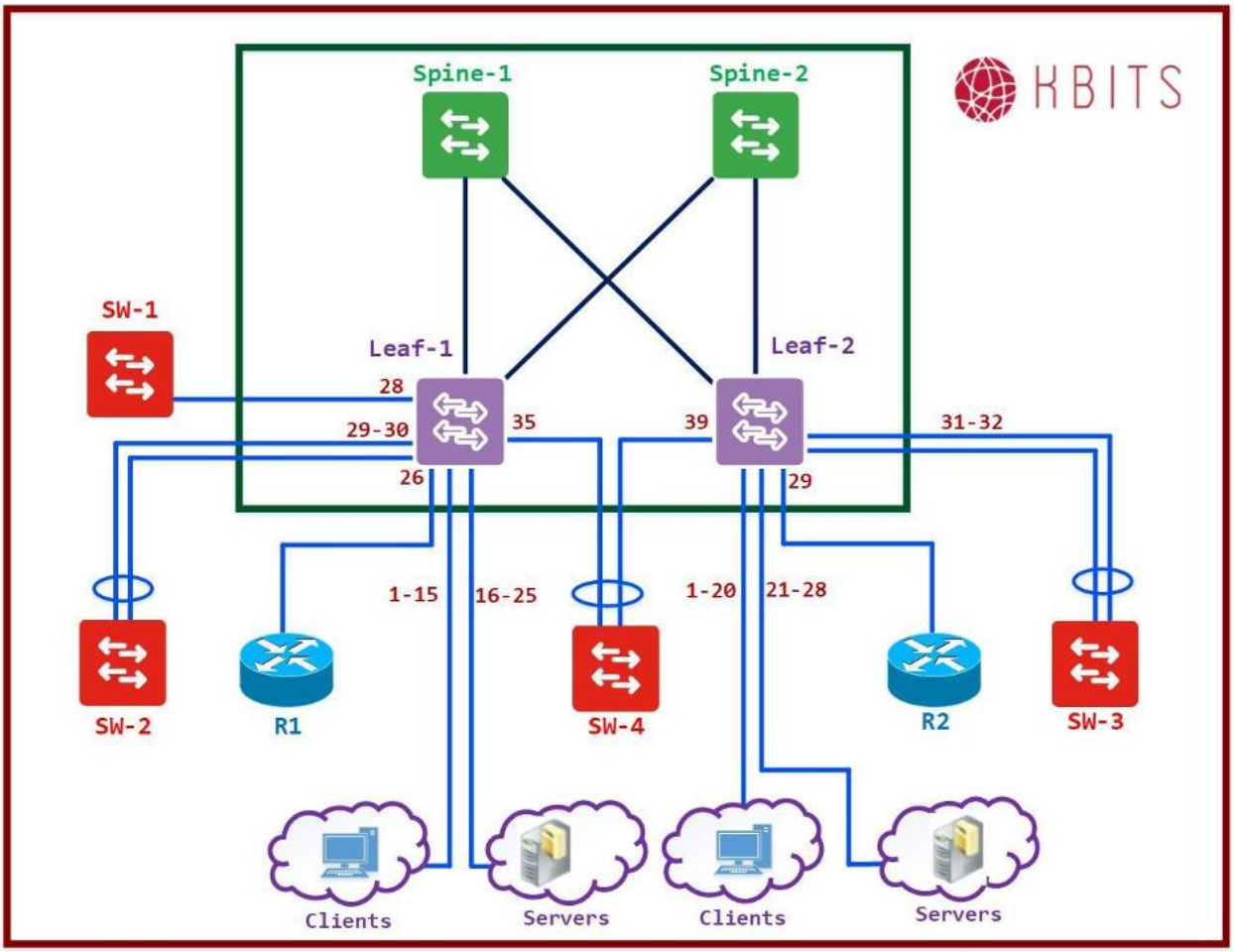
Module 1 – Fabric Discovery & Access Provisioning



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Lab 1 – Fabric Discovery

Physical Topology



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Fabric Discovery

- Discovery the Fabric and assign the Node Name and Node ID based on the following table:

Node Name	Node ID	POD#
LEAF-01	101	1
LEAF-02	102	1
SPINE-01	201	1
SPINE-02	202	1

- Log into you APIC using the Username and Password provided.
- Click **Fabric -> Inventory -> Fabric Membership**
- You will see the first Leaf discovered.
- Right-click the Leaf and click **Register Switch.**
- Assign is parameters from the above table for LEAF-01.
- Click **Update**.
- The first Leaf will be registered. It will be assigned an IP Address from the Bootstrap Pool.
- It will discover the Spines. We have 2 Spines. They should show up in the Fabric Membership window.
- Right-click the first Spine switch and click **Register Switch.**
- Assign is parameters from the above table for SPINE-01.
- Click **Update**.
- Repeat the process for the second Spine switch. Assign it the parameters from the above table for SPINE-02.
- Click **Update**.
- It will discover the 2nd Leaf switch now.
- Right-click the second Leaf switch and click **Register Switch.**

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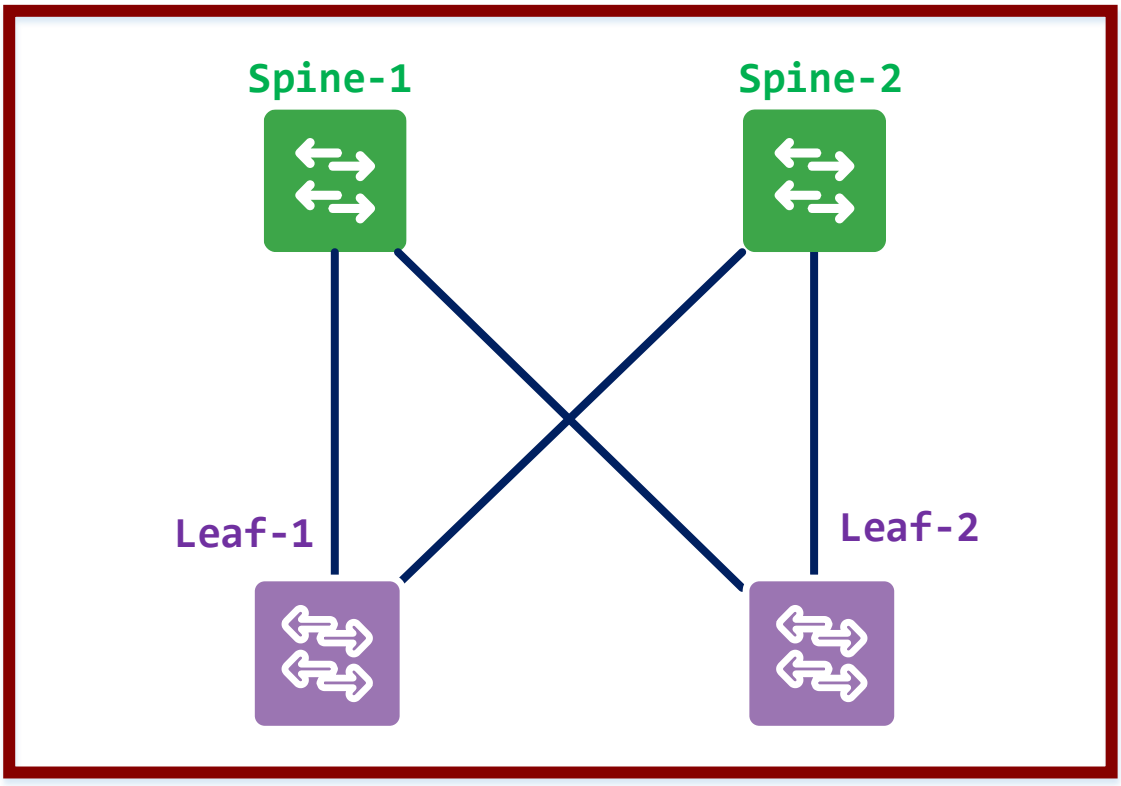
- Assign is parameters from the above table for LEAF-02.
- Click **Update**.
- Your Fabric Membershp should like the following diagram.

Fabric Membership

ACTIONS

Serial Number	Pod ID	Node ID	Node Name	Rack Name	Model	Role	IP	Decomissioned	Supported Model	SSL Certificate
TEP-1-101	1	101	LEAF-01		N9K-C9396PX	leaf	10.0.56.95/32	False	True	yes
TEP-1-102	1	102	LEAF-02		N9K-C9396PX	leaf	10.0.80.94/32	False	True	n/a
TEP-1-103	1	201	SPINE-01		N9K-C9508	spine	10.0.56.94/32	False	True	yes
TEP-1-104	1	202	SPINE-02		N9K-C9508	spine	10.0.56.93/32	False	True	yes

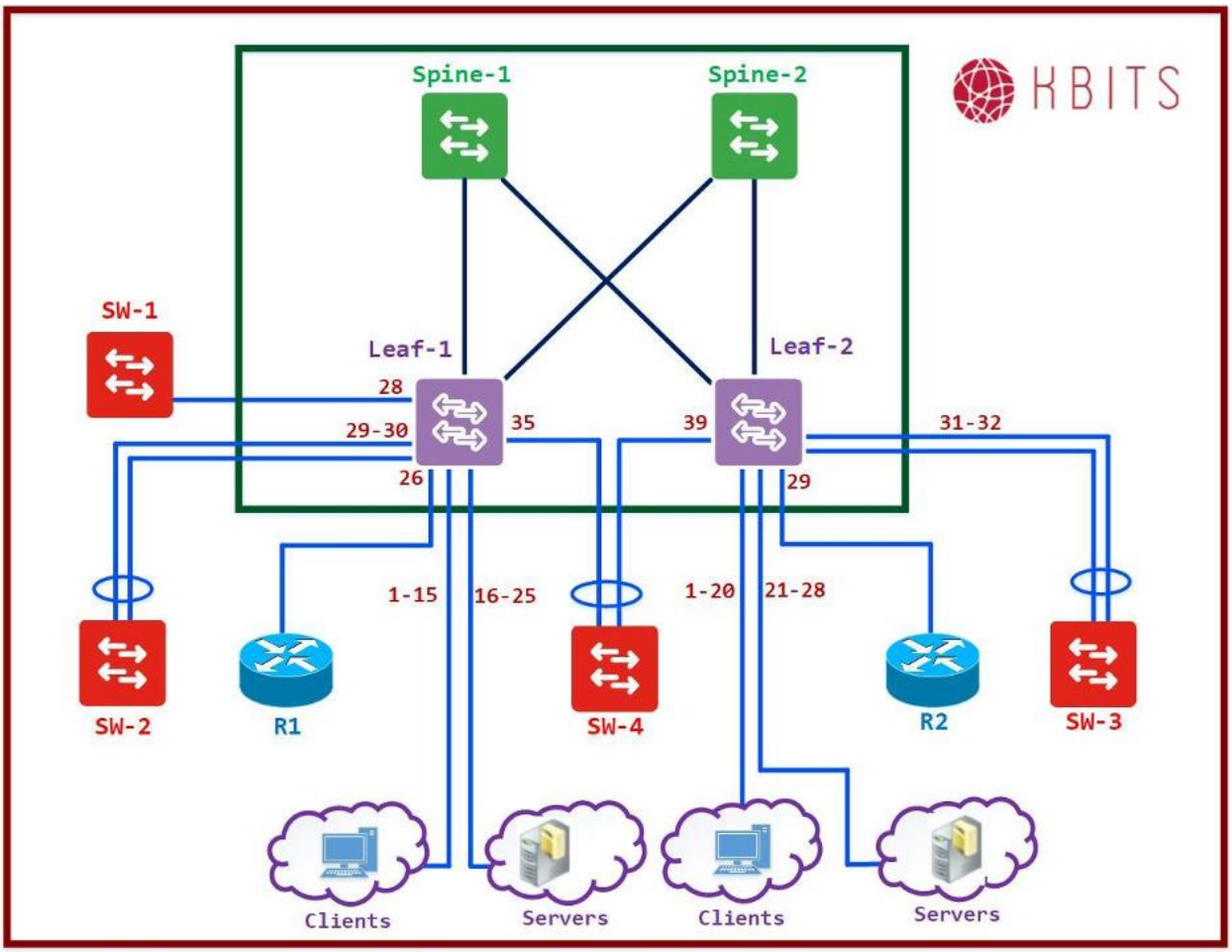
- Notice the IP Address and Role. The role is automatically detected based on the Switch Model.
- This portion of your topology is configured now.



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Lab 2 – Access Provisioning – Interface Policies

Physical Topology



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Access Provisioning – Access Port Interface Policies

Note: The Access Provisioning labs are based on the Fabric Provisioning completed in Lab 1.

- You are planning on configuring the above topology for ACI. Besides the devices displayed above, the Servers & Clients will be connected to the following ports on the 2 Leaf switches.
  - **Clients**
    - LEAF-01 – Ports 1/1 – 15
    - LEAF-02 – Ports 1/1 – 20
  - **Servers**
    - LEAF-01 – Ports 1/16 – 25
    - LEAF-02 – Ports 1/21 – 28

- The port properties for the Devices will be based on the following table:

	Clients	Servers	Routers	Switches
CDP	Disabled	Disabled	Enabled	Enabled
LLDP	Disabled	Enabled	Disabled	Disabled
Port Security	1	5	1	
Storm Control	50%	60%		60%
Speed	1G	10G	10G	40G
STP	Enabled	Enabled	Enabled	

- Configure all the Policies defined in the table above.

Task 1 – Configure the Interface Policies – CDP

- Click **Fabric -> Access Policies -> Policies -> Interface -> CDP Interface -> Right-click -> Create CDP Interface Policy**

- Configure CDP Policies based on the following:
  - **Policy # 1**
    - Name: **CDP-ON**
    - Admin-State: **Enabled**
  - **Policy # 2**
    - Name: **CDP-OFF**
    - Admin-State: **Disabled**

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Task 2 – Configure the Interface Policies – LLDP

- Click **Fabric -> Access Policies -> Policies -> Interface -> LLDP Interface -> Right-click -> Create LLDP Interface Policy**

- Configure LLDP Policies based on the following:
  - **Policy # 1**
    - Name: **LLDP-ON**
    - Transmit – **Enabled**
    - Receive – **Enabled**
  - **Policy # 2**
    - Name: **LLDP-OFF**
    - Transmit – **Disabled**
    - Receive – **Disabled**

Task 3 – Configure the Interface Policies – Link Level

- Click Click **Fabric -> Access Policies -> Policies -> Interface -> Link Level -> Right-click -> Create Link Level Policy**

- Configure Link Level Policies based on the following:
  - **Policy # 1**
    - Name: **1G-AUTO**
    - Speed – **1 gbps**
  - **Policy # 2**
    - Name: **10G-AUTO**
    - Speed – **10 gbps**
  - **Policy # 3**
    - Name: **40G-AUTO**
    - Speed – **40 gbps**

Task 4 – Configure the Interface Policies –Port Security

- Click **Fabric -> Access Policies -> Policies -> Interface -> Port Security -> Right-click -> Create Port Security Policy**

- Configure Port-Secutiy Policies based on the following:
  - **Policy # 1**
    - Name: **PS-1**
    - Parameters: **Maximum EndPoints – 1**
  - **Policy # 2**
    - Name: **PS-5**
    - Parameters: **Maximum EndPoints – 5**

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Task 5 – Configure the Interface Policies – Storm Control

- Click **Fabric -> Access Policies -> Policies -> Interface -> Storm Control -> Right-click -> Create Storm Control Policy**

- Configure Storm Control Policies based on the following:
  - **Policy # 1**
    - Name: **SC-50**
    - Percentages: **50**
  - **Policy # 2**
    - Name: **SC-60**
    - Percentages: **60**

Task 6 – Configure the Interface Policies – BPDU Guard

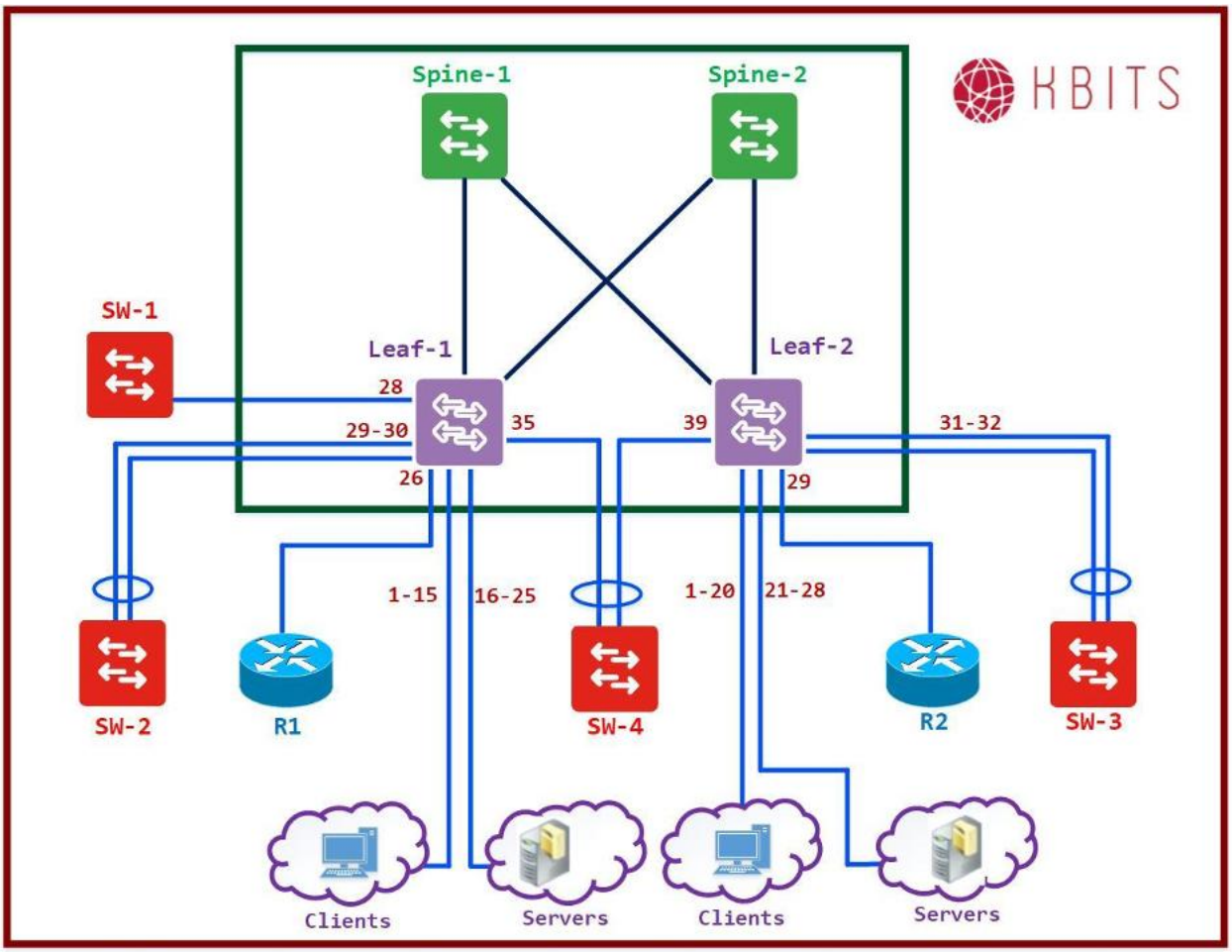
- Click **Fabric -> Access Policies -> Policies -> Interface -> Spanning Tree -> Right-click -> Create Spanning Tree Policy**

- Configure Spanning Tree Policies based on the following:
  - **Policy # 1**
    - Name: **STP-BPDUGUARD**
    - BPDU Guard: **Enabled**

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Lab 3 – Access Provisioning – Leaf Access Port IPGs

Physical Topology



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Access Provisioning – Leaf Access Port IPGs

- Configure the IPGs for Clients, Servers & Routers based on the table below. Switch IPG's will be created later.

	Clients	Servers	Routers	Switches
CDP	Disabled	Disabled	Enabled	Enabled
LLDP	Disabled	Enabled	Disabled	Disabled
Port Security	1	5	1	
Storm Control	50%	60%		60%
Speed	1G	10G	10G	40G
STP	Enabled	Enabled	Enabled	

Task 1 – Configure the Interface Policy Groups – Clients

- Click **Fabric -> Access Policies -> Interfaces -> Leaf Interfaces -> Policy Groups -> Leaf Access Port -> Right-click -> Create Leaf Access Port Policy Group**

- Configure Client IPGs based on the following:
  - Name: **IPG-CLIENTS**
  - CDP: **CDP-OFF**
  - LLDP: **LLDP-OFF**
  - Port Security: **PS-1**
  - Storm Control: **SC-50**
  - Link Level: **1G-AUTO**
  - Spanning Tree: **STP-BPDUGUARD**

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Task 2 – Configure the Interface Policy Groups – Servers

- Click **Fabric -> Access Policies -> Interfaces -> Leaf Interfaces -> Policy Groups -> Leaf Access Port -> Right-click -> Create Leaf Access Port Policy Group**

- Configure Client IPGs based on the following:
  - Name: **IPG-SERVERS**
  - CDP: **CDP-OFF**
  - LLDP: **LLDP-ON**
  - Port Security: **PS-5**
  - Storm Control: **SC-60**
  - Link Level: **10G-AUTO**
  - Spanning Tree: **STP-BPDUGUARD**

Task 3 – Configure the Interface Policy Groups – Routers

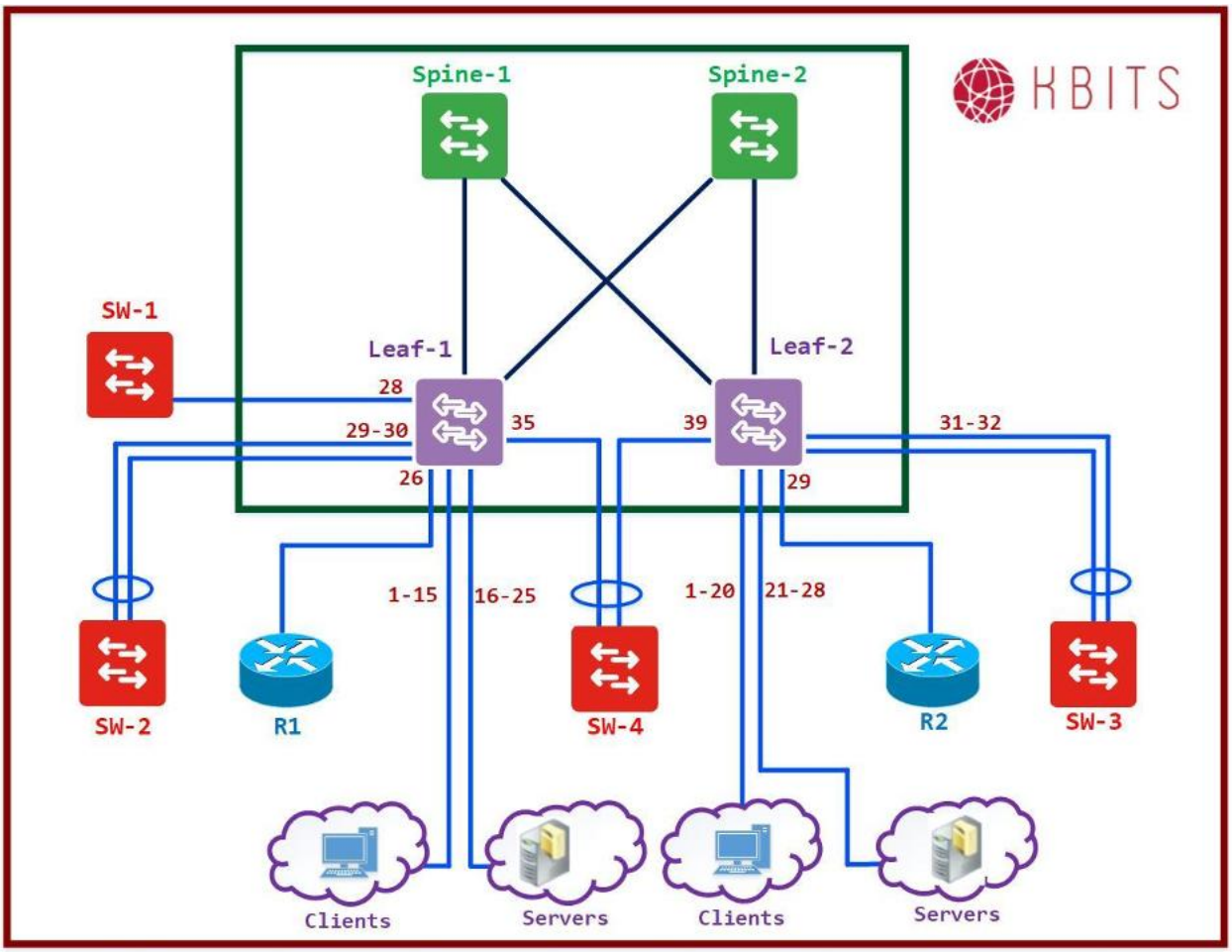
- Click **Fabric -> Access Policies -> Interfaces -> Leaf Interfaces -> Policy Groups -> Leaf Access Port -> Right-click -> Create Leaf Access Port Policy Group**

- Configure Client IPGs based on the following:
  - Name: **IPG-ROUTERS**
  - CDP: **CDP-ON**
  - LLDP: **LLDP-OFF**
  - Port Security: **PS-1**
  - Link Level: **10G-AUTO**
  - Spanning Tree: **STP-BPDUGUARD**

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Lab 4 – Access Provisioning – Switch IPGs

Physical Topology



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Access Provisioning – Port Channel IPGs

- Configure the IPGs for SW1, SW2 & SW3 based on the table below. Use LACP Active for the Port-Channel Protocol. SW4 IPG will be created later.

	Clients	Servers	Routers	Switches
CDP	Disabled	Disabled	Enabled	Enabled
LLDP	Disabled	Enabled	Disabled	Disabled
Port Security	1	5	1	
Storm Control	50%	60%		60%
Speed	1G	10G	10G	40G
STP	Enabled	Enabled	Enabled	

Task 1 – Configure the Interface Policies – Port-Channel

- Click **Fabric -> Access Policies -> Policies -> Interface -> Port Channel -> Right-click -> Create Port Channel Policy**

- Configure Port-Channel Policy based on the following:
  - **Policy # 1**
    - Name: **LACP-Active**
    - Mode: **Active**

Task 2 – Configure the Interface Policy Groups – SW1

- Click **Fabric -> Access Policies -> Interfaces -> Leaf Interfaces -> Policy Groups -> Leaf Access Port -> Right-click -> Create Leaf Access Port Policy Group**

- Configure Client IPGs based on the following:
  - Name: **IPG-SW1**
  - CDP: **CDP-OFF**
  - LLDP: **LLDP-ON**
  - Storm Control: **SC-60**
  - Link Level: **40G-AUTO**

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Task 3 – Configure the Interface Policy Groups – SW2

- Click **Fabric -> Access Policies -> Interfaces -> Leaf Interfaces -> Policy Groups -> PC Interface -> Right-click -> Create PC Interface Policy Group**

- Configure Client IPGs based on the following:
  - Name: **IPG-SW2-PC**
  - CDP: **CDP-OFF**
  - LLDP: **LLDP-ON**
  - Storm Control: **SC-60**
  - Link Level: **40G-AUTO**
  - Port Channel: **LACP-Active**

Task 4 – Configure the Interface Policy Groups – SW3

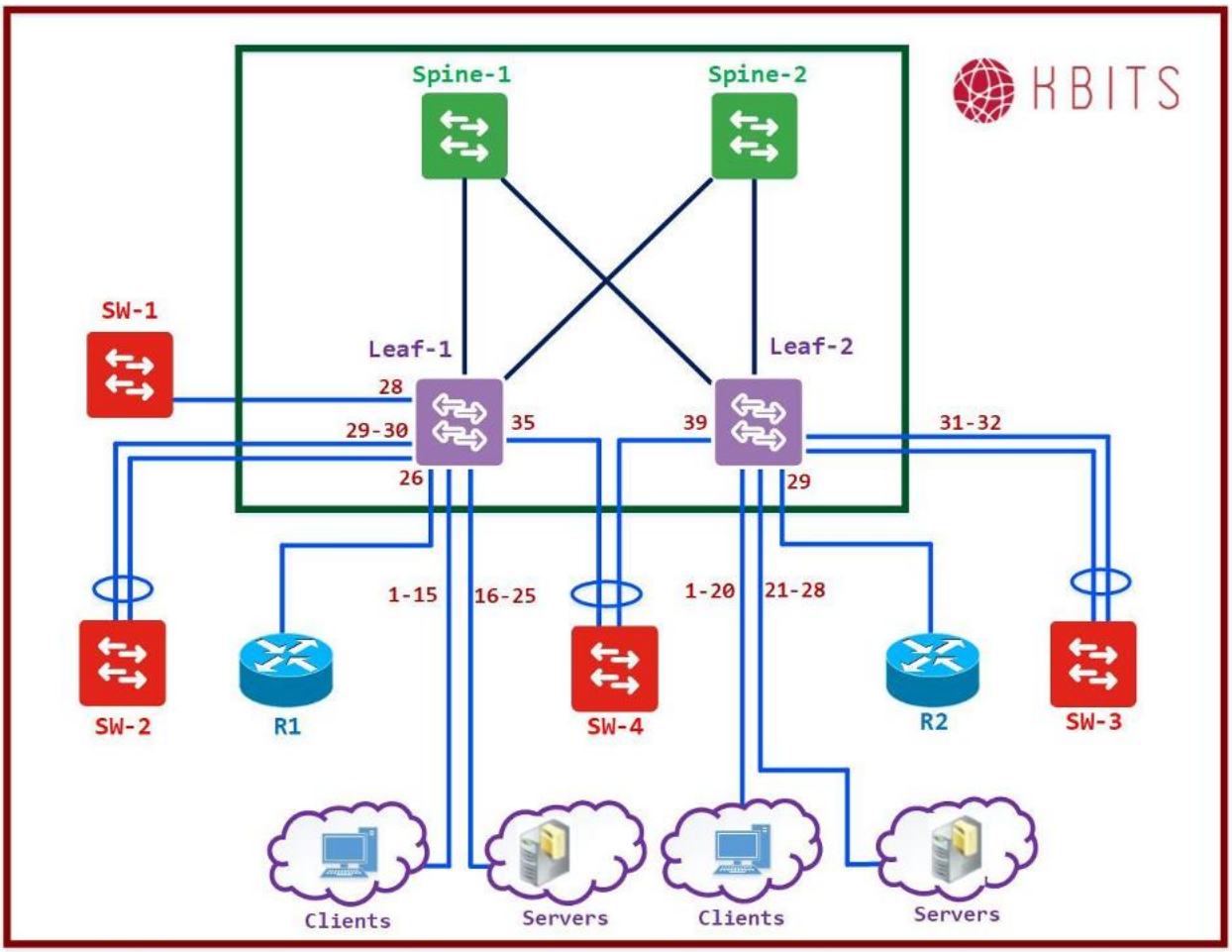
- Click **Fabric -> Access Policies -> Interfaces -> Leaf Interfaces -> Policy Groups -> PC Interface -> Right-click -> Create PC Interface Policy Group**

- Configure Client IPGs based on the following:
  - Name: **IPG-SW3-PC**
  - CDP: **CDP-OFF**
  - LLDP: **LLDP-ON**
  - Storm Control: **SC-60**
  - Link Level: **40G-AUTO**
  - Port Channel: **LACP-Active**

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Lab 5 – Access Provisioning – Configuring vPC Domain

Physical Topology



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Access Provisioning – vPC

Task 1 – Configure a vPC Domain between Leaf-01 & Leaf-02

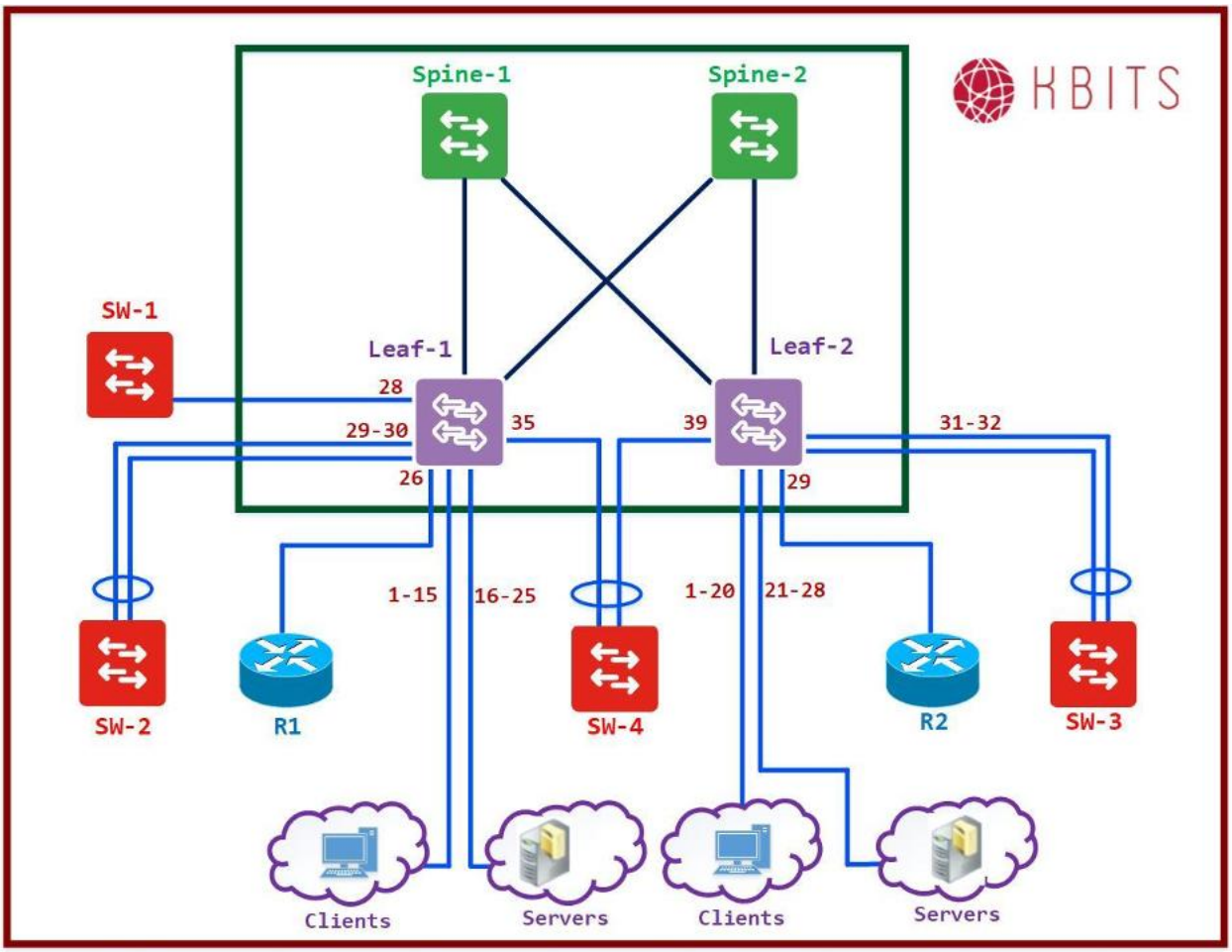
- Click **Fabric -> Access Policies -> Policies -> Switch -> Virtual Port Channel Default -> Right-click -> Create vPC Explicit Protection Group**

- Configure a vPC between Leaf-01 & Leaf-02. Use the following parameters:
  - Name: **vPC-LEAF-01-02**
  - Domain ID: **12**
  - VPC Domain Policy: **Default**
  - Switch 1: **101**
  - Switch 2: **102**

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Lab 6 – Access Provisioning – vPC IPG

Physical Topology



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Access Provisioning – Virtual Port Channel IPGs

- Configure a IPG for a SW4 based on the table below. Use LACP Active for the Port-Channel Protocol.

	Clients	Servers	Routers	Switches
CDP	Disabled	Disabled	Enabled	Enabled
LLDP	Disabled	Enabled	Disabled	Disabled
Port Security	1	5	1	
Storm Control	50%	60%		60%
Speed	1G	10G	10G	40G
STP	Enabled	Enabled	Enabled	

Task 1 – Configure the Interface Policy Groups – SW4

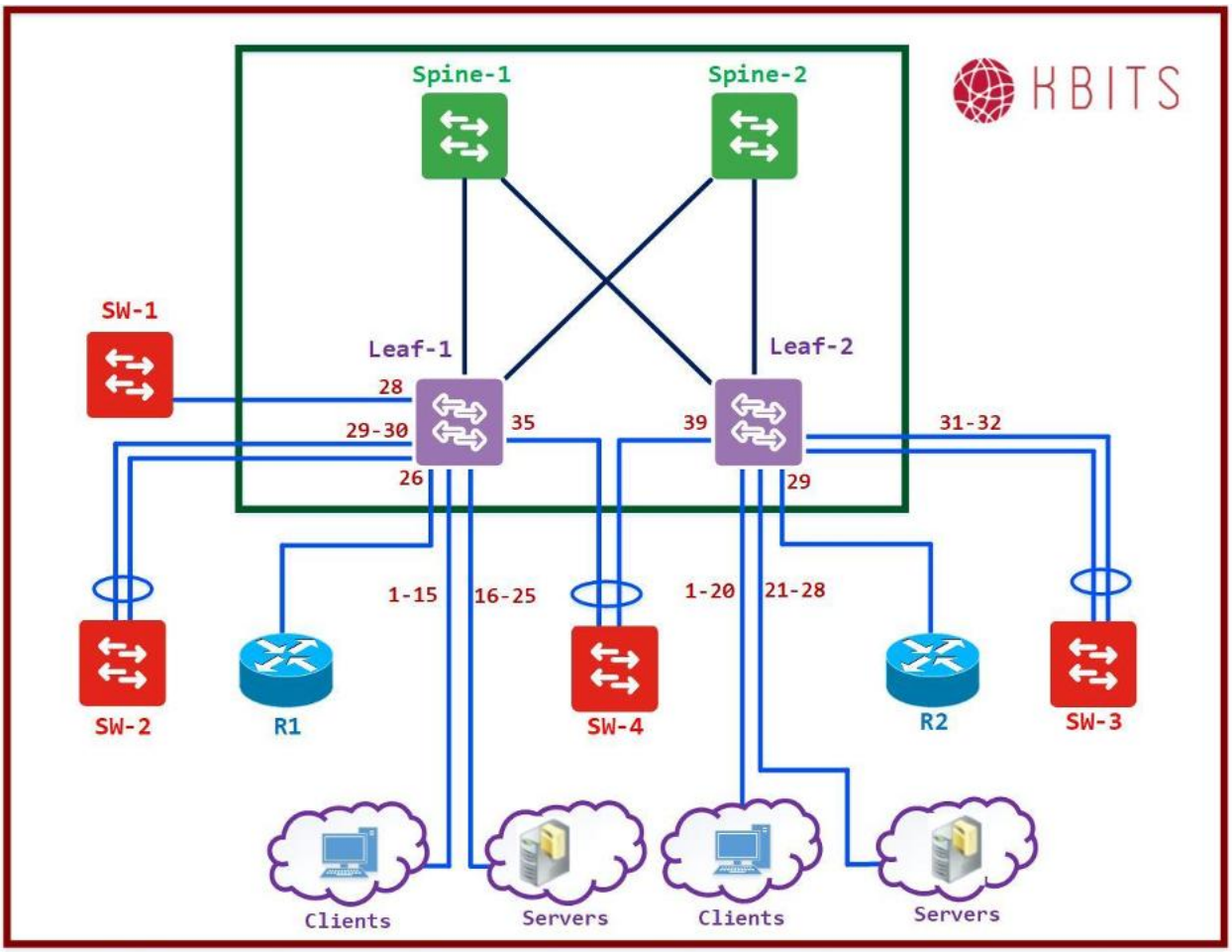
- Click **Fabric -> Access Policies -> Interfaces -> Leaf Interfaces -> Policy Groups -> VPC Interface -> Right-click -> Create VPC Interface Policy Group**

- Configure Client IPGs based on the following:
  - Name: **IPG-SW4-vPC**
  - CDP: **CDP-OFF**
  - LLDP: **LLDP-ON**
  - Storm Control: **SC-60**
  - Link Level: **40G-AUTO**
  - Port Channel: **LACP-Active**

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Lab 7 – Access Provisioning – Interface Profile

Physical Topology



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Access Provisioning – Leaf Interface Profile

- You are planning on configuring the above topology for ACI. Besides the devices displayed above, the Servers & Clients will be connected to the following ports on the 2 Leaf switches.

Task 1 – Configure Interface Profiles

- Click **Fabric -> Access Policies -> Interfaces -> Leaf Interfaces -> Profiles -> Right-click -> Create Leaf Interface Profile**

- Configure an Interface Profiles based on the following:

Interface Profile: **INT-PROF-1**		
Interface Names	**Ports**	**IPGs**
E1-15-CLIENTS	1/1-15	IPG-CLIENTS
E16-25-SERVERS	1/16-25	IPG-SERVERS
E26-27-ROUTERS	1/26-27	IPG-ROUTERS
E28-SW1	1/28	IPG-SW1
E29-30-SW2-PC	1/29-30	IPG-SW2-PC
E35-SW4-vPC	1/35	IPG-SW4-vPC

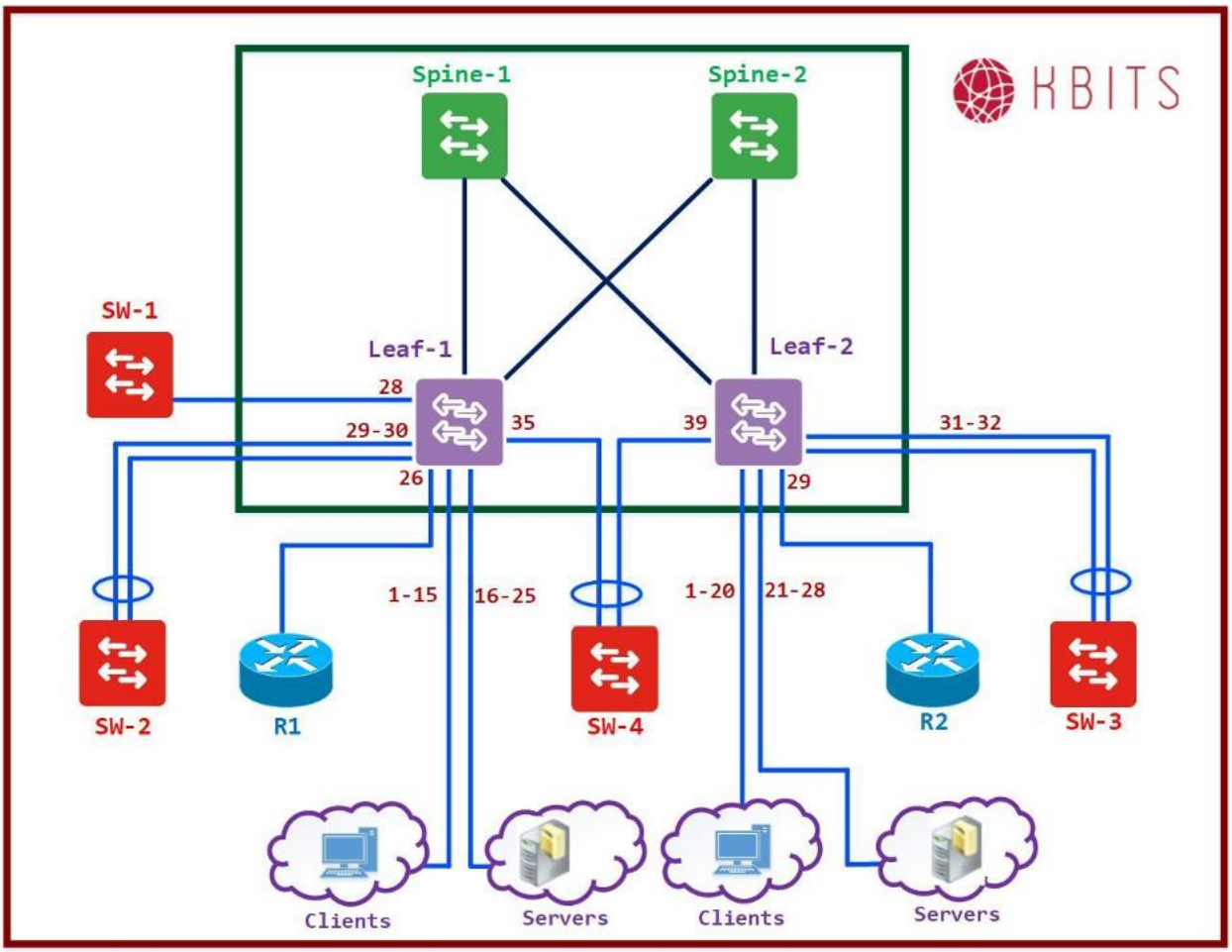
- Configure an Interface Profiles based on the following:

Interface Profile: **INT-PROF-2**		
Interface Names	**Ports**	**IPGs**
E1-20-CLIENTS	1/1-20	IPG-CLIENTS
E21-28-SERVERS	1/21-28	IPG-SERVERS
E29-30-ROUTERS	1/29-30	IPG-ROUTERS
E31-32-SW3-PC	1/31-32	IPG-SW3-PC
E39-SW4-vPC	1/39	IPG-SW4-vPC

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Lab 8 – Access Provisioning – Switch Profile

Physical Topology



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Access Provisioning – Leaf Switch Profile

- Assign the Interface Profiles created in the previous labs to the appropriate Leaf Switches.

Task 1 – Configure Switch Profiles

- Click **Fabric -> Access Policies -> Switches -> Leaf Switches -> Profiles -> Right-click -> Create Leaf Profile**

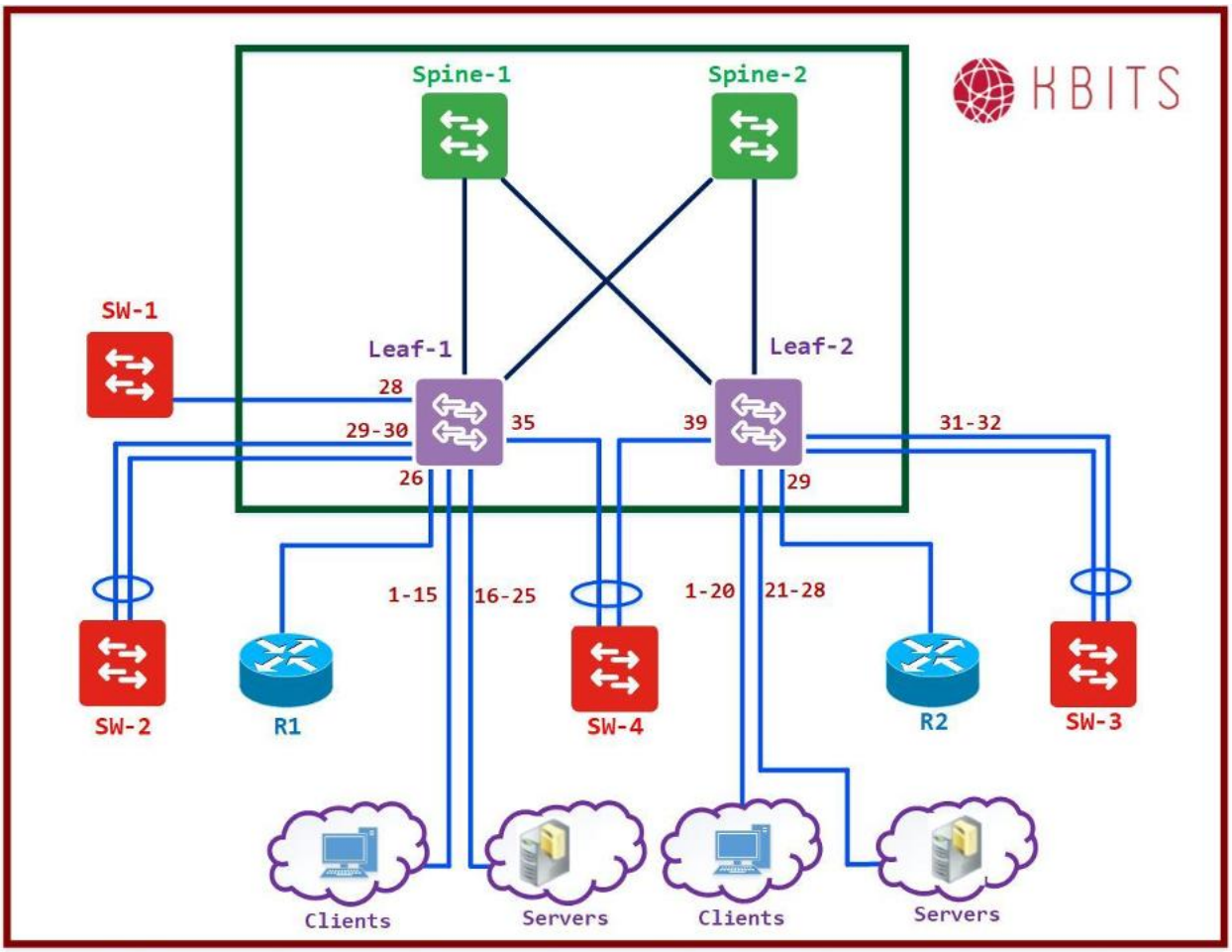
- Configure a Switch Profile based on the following:
  - Name: **SW-PROF-1**
  - Leaf Name: **LEAF-01**
  - Leaf Node ID: **101**
  - Interface profile: **INT-PROF-1**

- Configure a Switch Profile based on the following:
  - Name: **SW-PROF-2**
  - Leaf Name: **LEAF-02**
  - Leaf Node ID: **102**
  - Interface profile: **INT-PROF-2**

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Lab 9 – Access Provisioning – VLAN Pools

Physical Topology



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Access Provisioning – VLAN Pool

- Create a VLAN Pool to be assigned to the Domain

Task 1 – Configure VLAN Pool

- Click **Fabric -> Access Policies -> Pools -> VLANS -> Right-click -> Create VLAN Pool**

- Create a Pool of VLANs that will be used within ACI for Physical ACI Ports:
  - Name: **VLAN-POOL-ACI**
  - Leaf Name: **Static Allocation**
  - Range: **1-500**

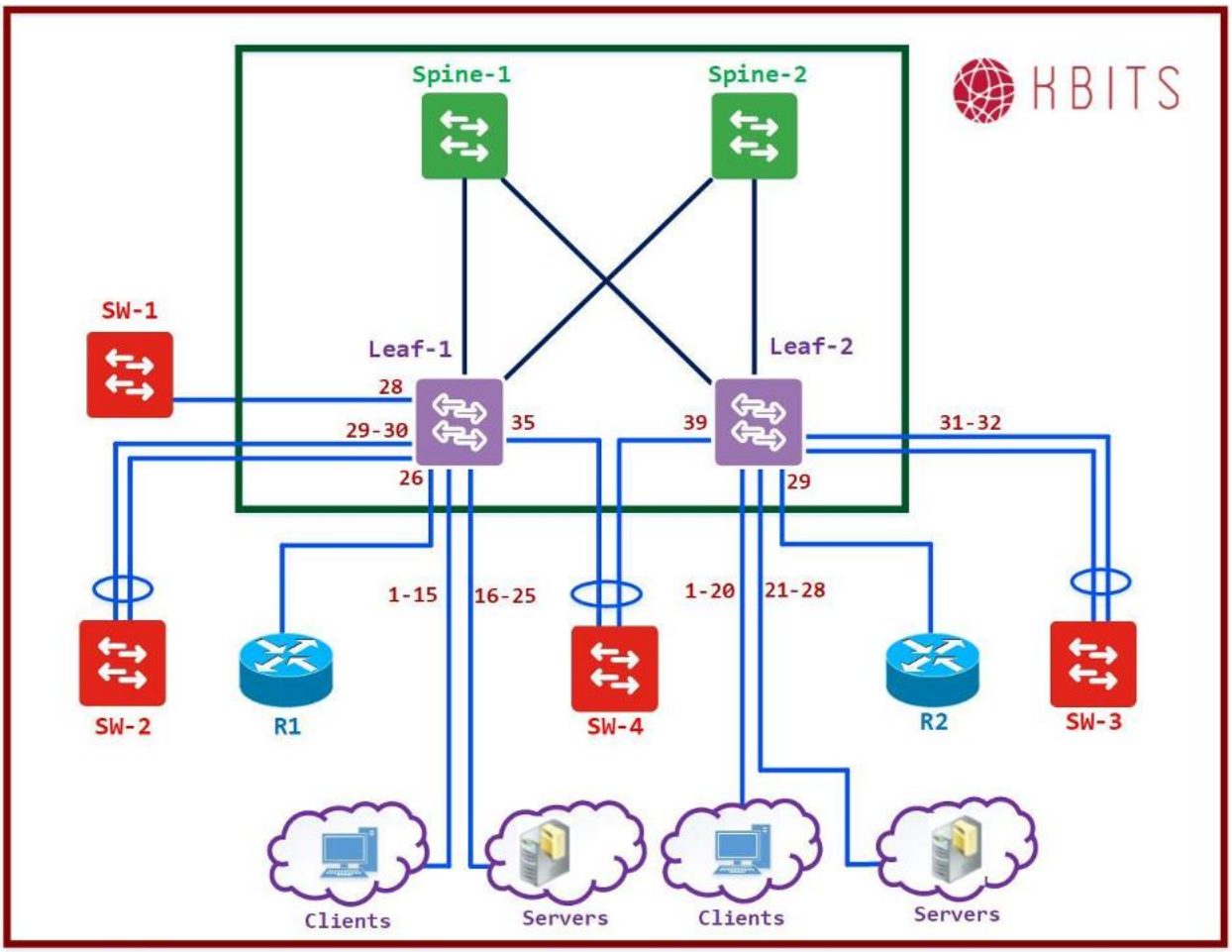
- Create a Pool of VLANs that will be used within ACI for External Bridged Ports ACI Ports:
  - Name: **VLAN-POOL-L2**
  - Leaf Name: **Static Allocation**
  - Range: **400-500**

- Create a Pool of VLANs that will be used within ACI for External Routed Ports ACI Ports:
  - Name: **VLAN-POOL-L3**
  - Leaf Name: **Static Allocation**
  - Range: **1-400**

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Lab 10 – Access Provisioning – Domains

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Access Provisioning – Domains

- Create Domains to specify port types.

Task 1 – Configure a Physical Domain (Physical ACI Ports)

- Click **Fabric -> Access Policies -> Physical and External Domains -> Physical Domains -> Right-click -> Create Physical domain**

- Create a Physical Domain and link it to the VLAN Pool based on the following:
  - Name: **ACI-PORTS**
  - VLAN Pool: **VLAN-POOL-ACI**

Task 2 – Configure an External L2 Domain (Connecting to Non-ACI Switches for L2OUT)

- Click **Fabric -> Access Policies -> Physical and External Domains -> External Bridged Domain -> Right-click -> Create L2 domain**

- Create an External Bridge Domain and link it to the VLAN Pool based on the following:
  - Name: **EXT-L2-PORTS**
  - VLAN Pool: **VLAN-POOL-L2**

Task 3 – Configure an External L3 Domain (Connecting to Non-ACI L3 Devices for L3OUT)

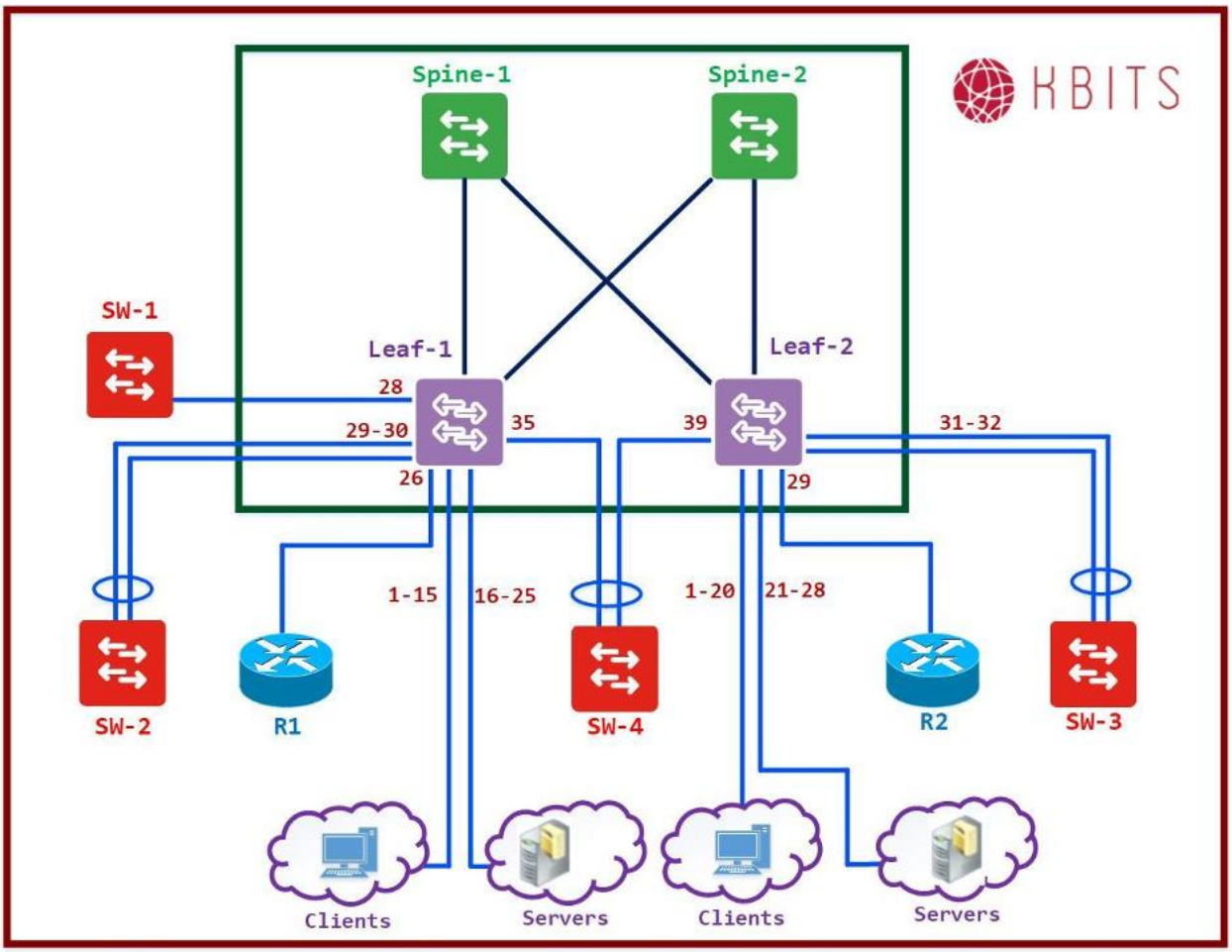
- Click **Fabric -> Access Policies -> Physical and External Domains -> L3 Domain -> Right-click -> Create L3 Domain**

- Create an External Routed Domain and link it to the VLAN Pool based on the following:
  - Name: **EXT-L3-PORTS**
  - VLAN Pool: **VLAN-POOL-L3**

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Lab 11 – Access Provisioning – AAEP

Physical Topology



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Access Provisioning – AAEP

- Link the Port Types (Domains/VLANs) to IPGs (Physical Ports)

Task 1 – Create a AAEP for Physical ACI Ports

- Click **Fabric -> Access Policies -> Policies -> Global -> Attachable Access Entity Profile -> Right-click -> Create Attachable Access Entity Profile**

- Create an AAEP for ACI Ports and link it to the Domain & IPGs based on the following:
  - Name: **AAEP-ACI**
  - Domain: **ACI-PORTS**
  - IPGs: **IPG-CLIENTS & IPG-SERVERS**

Task 2 – Create a AAEP for External L2 Ports

- Click **Fabric -> Access Policies -> Policies -> Global -> Attachable Access Entity Profile -> Right-click -> Create Attachable Access Entity Profile**

- Create an AAEP for ACI Ports and link it to the Domain & IPGs based on the following:
  - Name: **AAEP-L2-PORTS**
  - Domain: **EXT-L2-PORTS**
  - IPGs: **IPG-SW1, IPG-SW2-PC, IPG-SW3-PC & IPG-SW4-vPC**

Task 3 – Create a AAEP for External L3 Ports

- Click **Fabric -> Access Policies -> Policies -> Global -> Attachable Access Entity Profile -> Right-click -> Create Attachable Access Entity Profile**

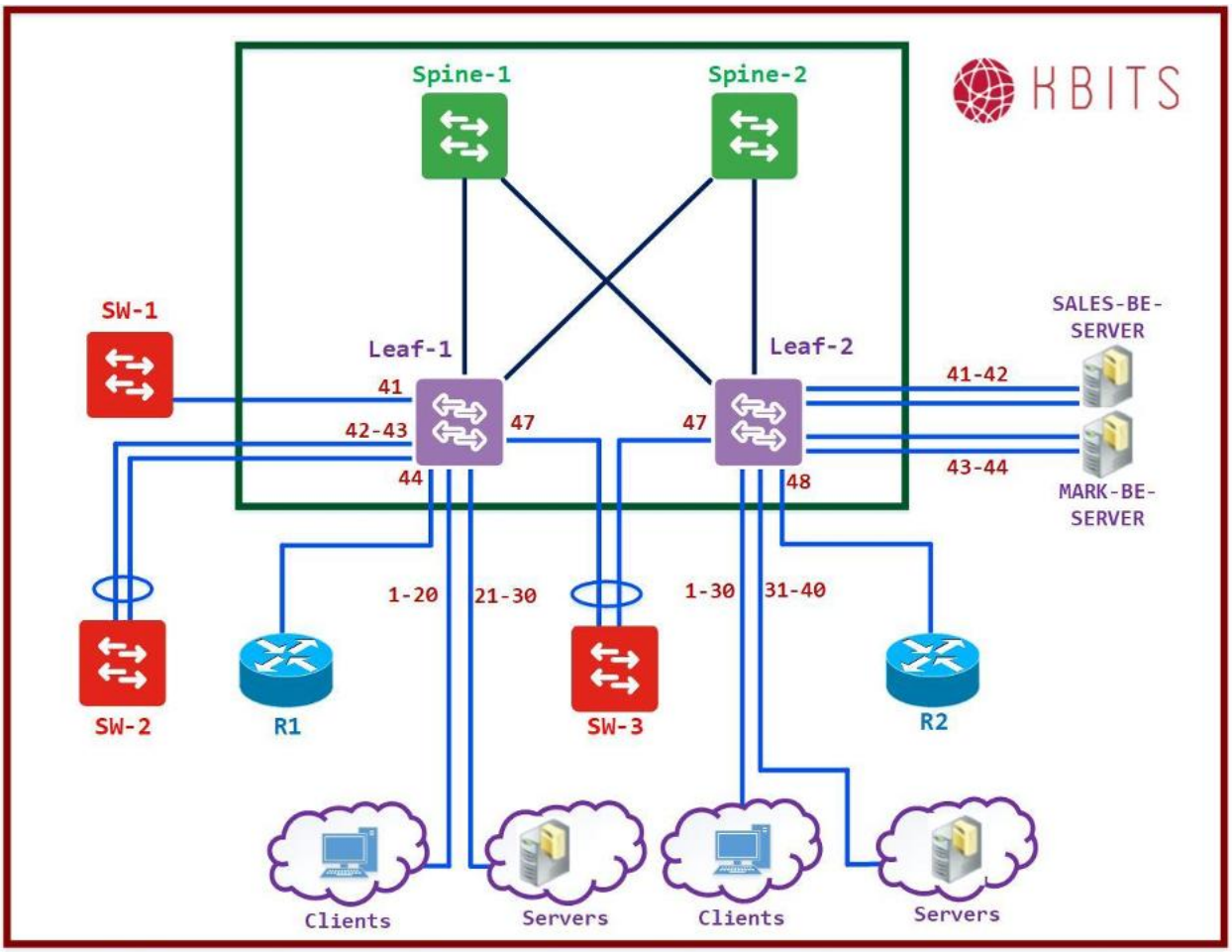
- Create an AAEP for ACI Ports and link it to the Domain & IPGs based on the following:
  - Name: **AAEP-L3-PORTS**
  - Domain: **EXT-L3-PORTS**
  - IPGs: **IPG-ROUTERS**

This completes the Access Provisioning Process. The next set of labs will repeat it for a different physical topology.

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Lab 12 – Access Provisioning – Topology 2 – Interface Policies

Physical Topology



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Access Provisioning – Access Port Interface Policies

Note: The Access Provisioning labs are based on the Fabric Provisioning completed in Lab 1.

- You are planning on configuring the above topology for ACI. Besides the devices displayed above, the Servers & Clients will be connected to the following ports on the 2 Leaf switches.
  - **Clients**
    - LEAF-01 – Ports 1/1 – 20
    - LEAF-02 – Ports 1/1 – 30
  - **Servers**
    - LEAF-01 – Ports 1/21 – 30
    - LEAF-02 – Ports 1/31 – 40

- The port properties for the Devices will be based on the following table:

	Clients	Servers	Routers	Switches
CDP	Disabled	Disabled	Enabled	Enabled
LLDP	Disabled	Enabled	Disabled	Disabled
Port Security	1	5	1	
Storm Control	50%	60%		60%
Speed	1G	10G	10G	40G
STP	Enabled	Enabled	Enabled	

- Configure all the Policies defined in the table above.

Task 1 – Configure the Interface Policies – CDP

- Click **Fabric -> Access Policies -> Policies -> Interface -> CDP Interface -> Right-click -> Create CDP Interface Policy**

- Configure CDP Policies based on the following:
  - **Policy # 1**
    - Name: **CDP-ON**
    - Admin-State: **Enabled**
  - **Policy # 2**
    - Name: **CDP-OFF**
    - Admin-State: **Disabled**

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Task 2 – Configure the Interface Policies – LLDP

- Click **Fabric -> Access Policies -> Policies -> Interface -> LLDP Interface -> Right-click -> Create LLDP Interface Policy**

- Configure LLDP Policies based on the following:
  - **Policy # 1**
    - Name: **LLDP-ON**
    - Transmit – **Enabled**
    - Receive – **Enabled**
  - **Policy # 2**
    - Name: **LLDP-OFF**
    - Transmit – **Disabled**
    - Receive – **Disabled**

Task 3 – Configure the Interface Policies – Link Level

- Click **Fabric -> Access Policies -> Policies -> Interface -> Link Level -> Right-click -> Create Link Level Policy**

- Configure Link Level Policies based on the following:
  - **Policy # 1**
    - Name: **1G-AUTO**
    - Speed – **1 gbps**
  - **Policy # 2**
    - Name: **10G-AUTO**
    - Speed – **10 gbps**
  - **Policy # 3**
    - Name: **40G-AUTO**
    - Speed – **40 gbps**

Task 4 – Configure the Interface Policies –Port Security

- Click **Fabric -> Access Policies -> Policies -> Interface -> Port Security -> Right-click -> Create Port Security Policy**

- Configure Port-Secutiy Policies based on the following:
  - **Policy # 1**
    - Name: **PS-1**
    - Parameters: **Maximum EndPoints – 1**
  - **Policy # 2**
    - Name: **PS-5**
    - Parameters: **Maximum EndPoints – 5**

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Task 5 – Configure the Interface Policies – Storm Control

- Click **Fabric -> Access Policies -> Policies -> Interface -> Storm Control -> Right-click -> Create Storm Control Policy**

- Configure Storm Control Policies based on the following:
  - **Policy # 1**
    - Name: **SC-50**
    - Percentages: **50**
  - **Policy # 2**
    - Name: **SC-60**
    - Percentages: **60**

Task 6 – Configure the Interface Policies – BPDU Guard

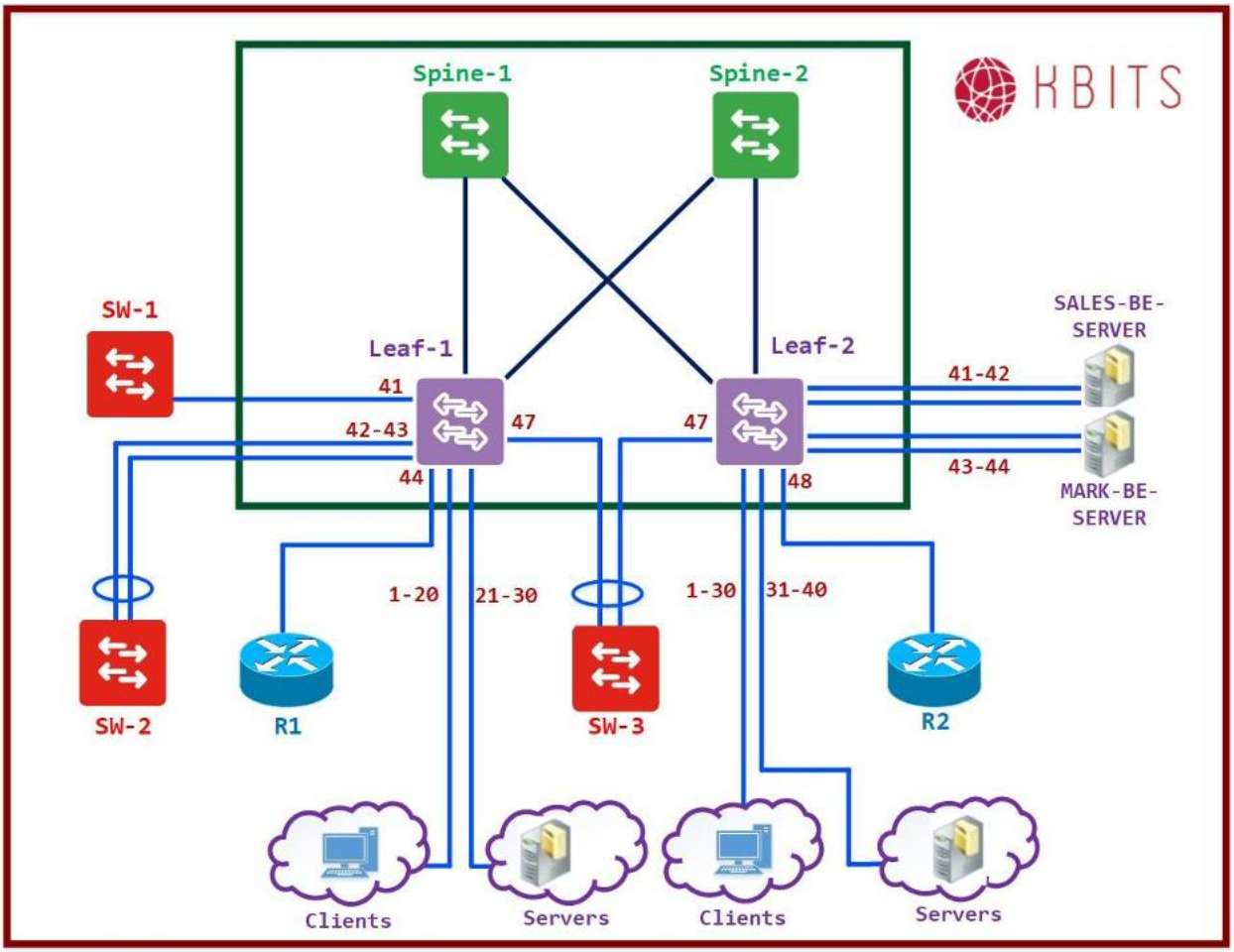
- Click **Fabric -> Access Policies -> Policies -> Interface -> Spanning Tree -> Right-click -> Create Spanning Tree Policy**

- Configure Spanning Tree Policies based on the following:
  - **Policy # 1**
    - Name: **STP-BPDUGUARD**
    - BPDU Guard: **Enabled**

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Lab 13 – Access Provisioning – Topology 2 – Leaf Access Port IPGs

Physical Topology



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Access Provisioning – Leaf Access Port IPGs

- Configure the IPGs for Clients, Servers & Routers based on the table below. Switch IPG's will be created later.

	Clients	Servers	Routers	Switches
CDP	Disabled	Disabled	Enabled	Enabled
LLDP	Disabled	Enabled	Disabled	Disabled
Port Security	1	5	1	
Storm Control	50%	60%		60%
Speed	1G	10G	10G	40G
STP	Enabled	Enabled	Enabled	

Task 1 – Configure the Interface Policy Groups – Clients

- Click **Fabric -> Access Policies -> Interfaces -> Leaf Interfaces -> Policy Groups -> Leaf Access Port -> Right-click -> Create Leaf Access Port Policy Group**

- Configure Client IPGs based on the following:
  - Name: **IPG-CLIENTS**
  - CDP: **CDP-OFF**
  - LLDP: **LLDP-OFF**
  - Port Security: **PS-1**
  - Storm Control: **SC-50**
  - Link Level: **1G-AUTO**
  - Spanning Tree: **STP-BPDUGUARD**

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Task 2 – Configure the Interface Policy Groups – Servers

- Click **Fabric -> Access Policies -> Interfaces -> Leaf Interfaces -> Policy Groups -> Leaf Access Port -> Right-click -> Create Leaf Access Port Policy Group**

- Configure Client IPGs based on the following:
  - Name: **IPG-SERVERS**
  - CDP: **CDP-OFF**
  - LLDP: **LLDP-ON**
  - Port Security: **PS-5**
  - Storm Control: **SC-60**
  - Link Level: **10G-AUTO**
  - Spanning Tree: **STP-BPDUGUARD**

Task 3 – Configure the Interface Policy Groups – Routers

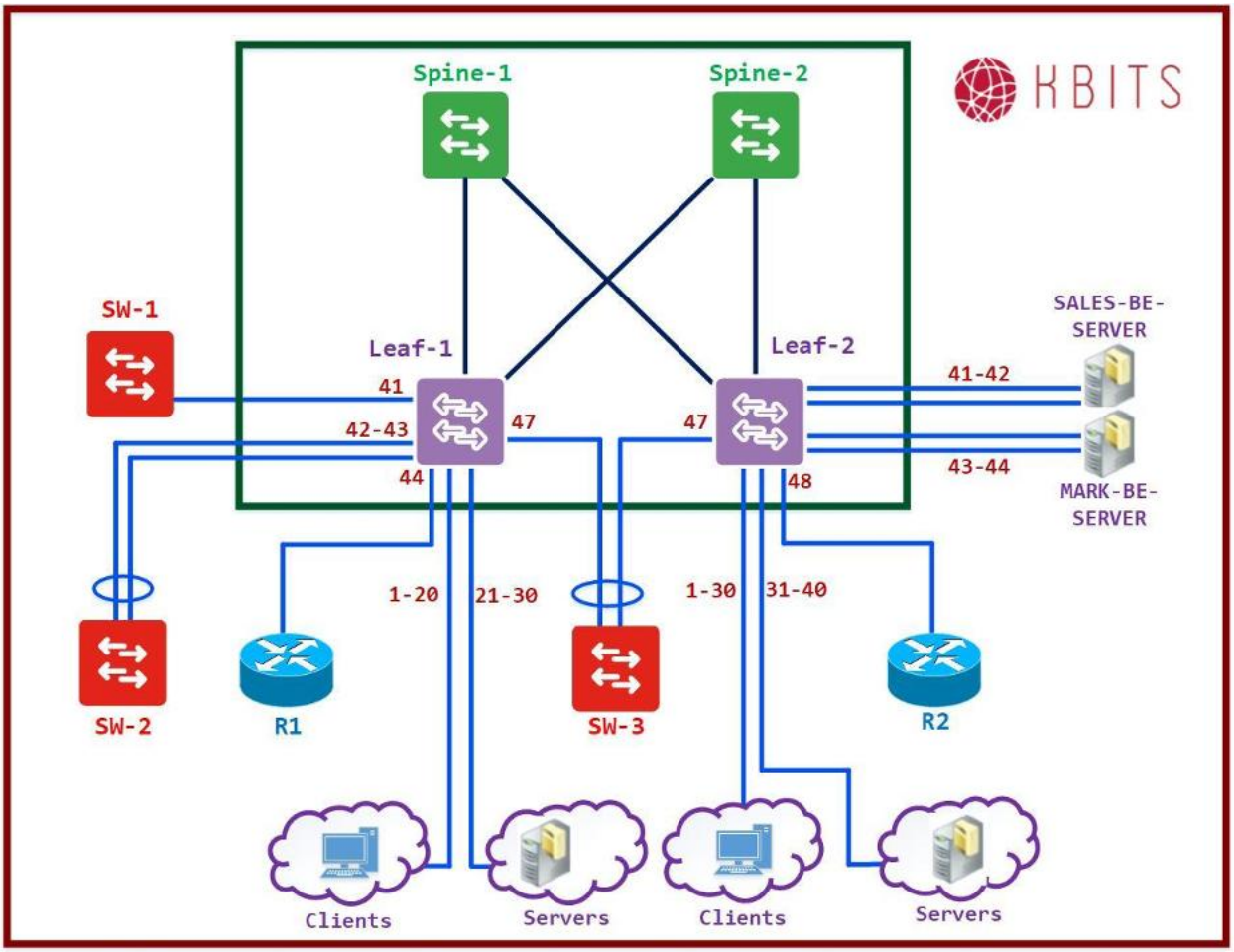
- Click **Fabric -> Access Policies -> Interfaces -> Leaf Interfaces -> Policy Groups -> Leaf Access Port -> Right-click -> Create Leaf Access Port Policy Group**

- Configure Client IPGs based on the following:
  - Name: **IPG-ROUTERS**
  - CDP: **CDP-ON**
  - LLDP: **LLDP-OFF**
  - Port Security: **PS-1**
  - Link Level: **10G-AUTO**
  - Spanning Tree: **STP-BPDUGUARD**

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Lab 14 – Access Provisioning – Topology 2 – Switch & PC IPGs

Physical Topology



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Access Provisioning – Port Channel IPGs

- Configure the IPGs for SW1 & SW2 based on the table below. Use LACP Active for the Port-Channel Protocol. SW3 IPG will be created later.

	Clients	Servers	Routers	Switches
CDP	Disabled	Disabled	Enabled	Enabled
LLDP	Disabled	Enabled	Disabled	Disabled
Port Security	1	5	1	
Storm Control	50%	60%		60%
Speed	1G	10G	10G	40G
STP	Enabled	Enabled	Enabled	

Task 1 – Configure the Interface Policies – Port-Channel

- Click **Fabric -> Access Policies -> Policies -> Interface -> Port Channel -> Right-click -> Create Port Channel Policy**

- Configure Port-Channel Policy based on the following:
  - **Policy # 1**
    - Name: **LACP-Active**
    - Mode: **Active**

Task 2 – Configure the Interface Policy Groups – SW1

- Click **Fabric -> Access Policies -> Interfaces -> Leaf Interfaces -> Policy Groups -> Leaf Access Port -> Right-click -> Create Leaf Access Port Policy Group**

- Configure Client IPGs based on the following:
  - Name: **IPG-SW1**
  - CDP: **CDP-OFF**
  - LLDP: **LLDP-ON**
  - Storm Control: **SC-60**
  - Link Level: **40G-AUTO**

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Task 3 – Configure the Interface Policy Groups – SW2

- Click **Fabric -> Access Policies -> Interfaces -> Leaf Interfaces -> Policy Groups -> PC Interface -> Right-click -> Create PC Interface Policy Group**

- Configure Client IPGs based on the following:
  - Name: **IPG-SW2-PC**
  - CDP: **CDP-OFF**
  - LLDP: **LLDP-ON**
  - Storm Control: **SC-60**
  - Link Level: **40G-AUTO**
  - Port Channel: **LACP-Active**

Task 4 – Configure the Interface Policy Groups – SALES-BE-SERVER

- Click **Fabric -> Access Policies -> Interfaces -> Leaf Interfaces -> Policy Groups -> PC Interface -> Right-click -> Create PC Interface Policy Group**

- Configure Client IPGs based on the following:
  - Name: **IPG-SALES-BE-PC**
  - CDP: **CDP-OFF**
  - LLDP: **LLDP-ON**
  - Port Security: **PS-5**
  - Storm Control: **SC-60**
  - Link Level: **10G-AUTO**
  - Spanning Tree: **STP-BPDUGUARD**
  - Port Channel: **LACP-Active**

Task 5 – Configure the Interface Policy Groups – MARK-BE-SERVER

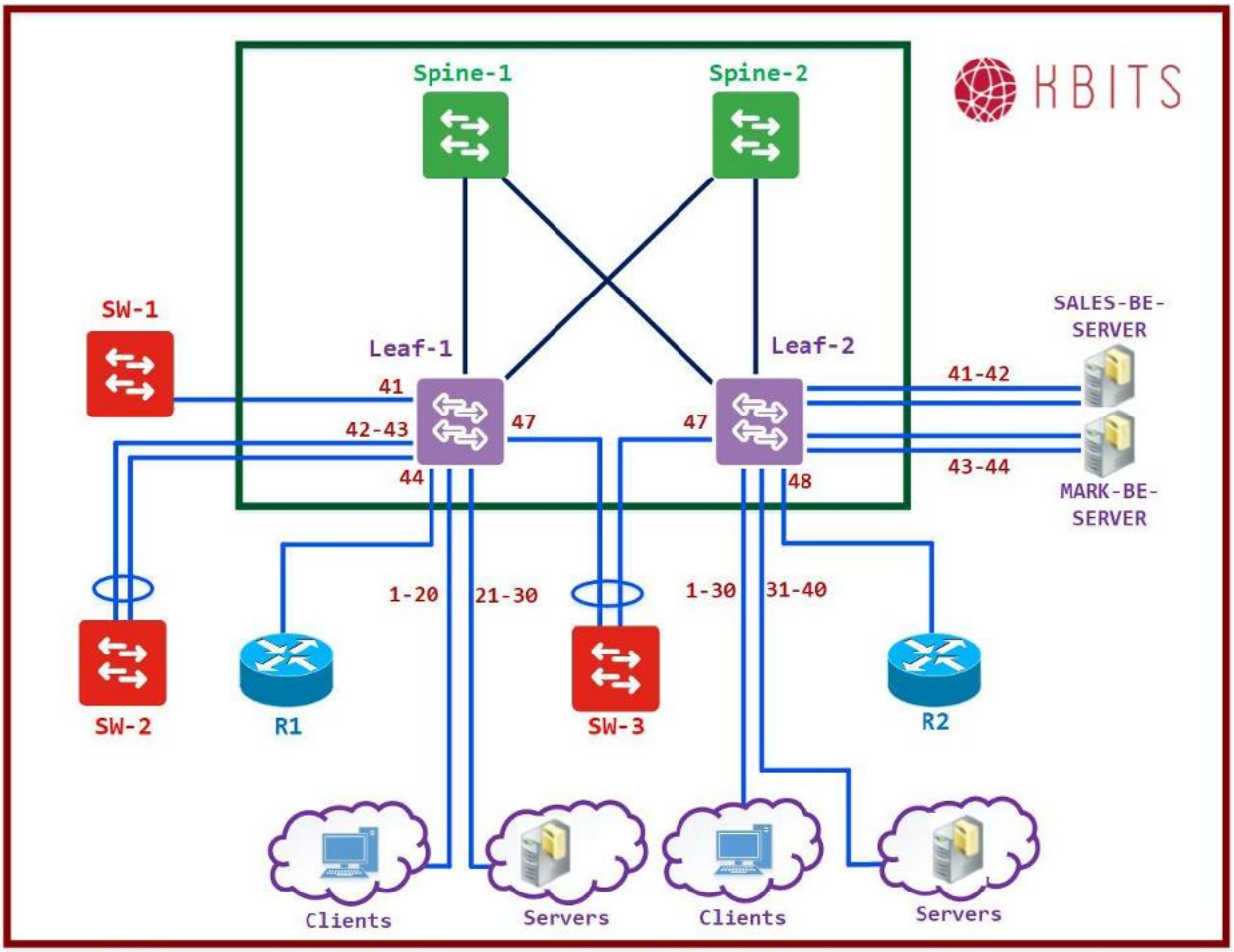
- Click **Fabric -> Access Policies -> Interfaces -> Leaf Interfaces -> Policy Groups -> PC Interface -> Right-click -> Create PC Interface Policy Group**

- Configure Client IPGs based on the following:
  - Name: **IPG-MARK-BE-PC**
  - CDP: **CDP-OFF**
  - LLDP: **LLDP-ON**
  - Port Security: **PS-5**
  - Storm Control: **SC-60**
  - Link Level: **10G-AUTO**
  - Spanning Tree: **STP-BPDUGUARD**
  - Port Channel: **LACP-Active**

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Lab 15 – Access Provisioning – Topology 2 – Configuring vPC Domain

Physical Topology



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Access Provisioning – vPC

Task 1 – Configure a vPC Domain between Leaf-01 & Leaf-02

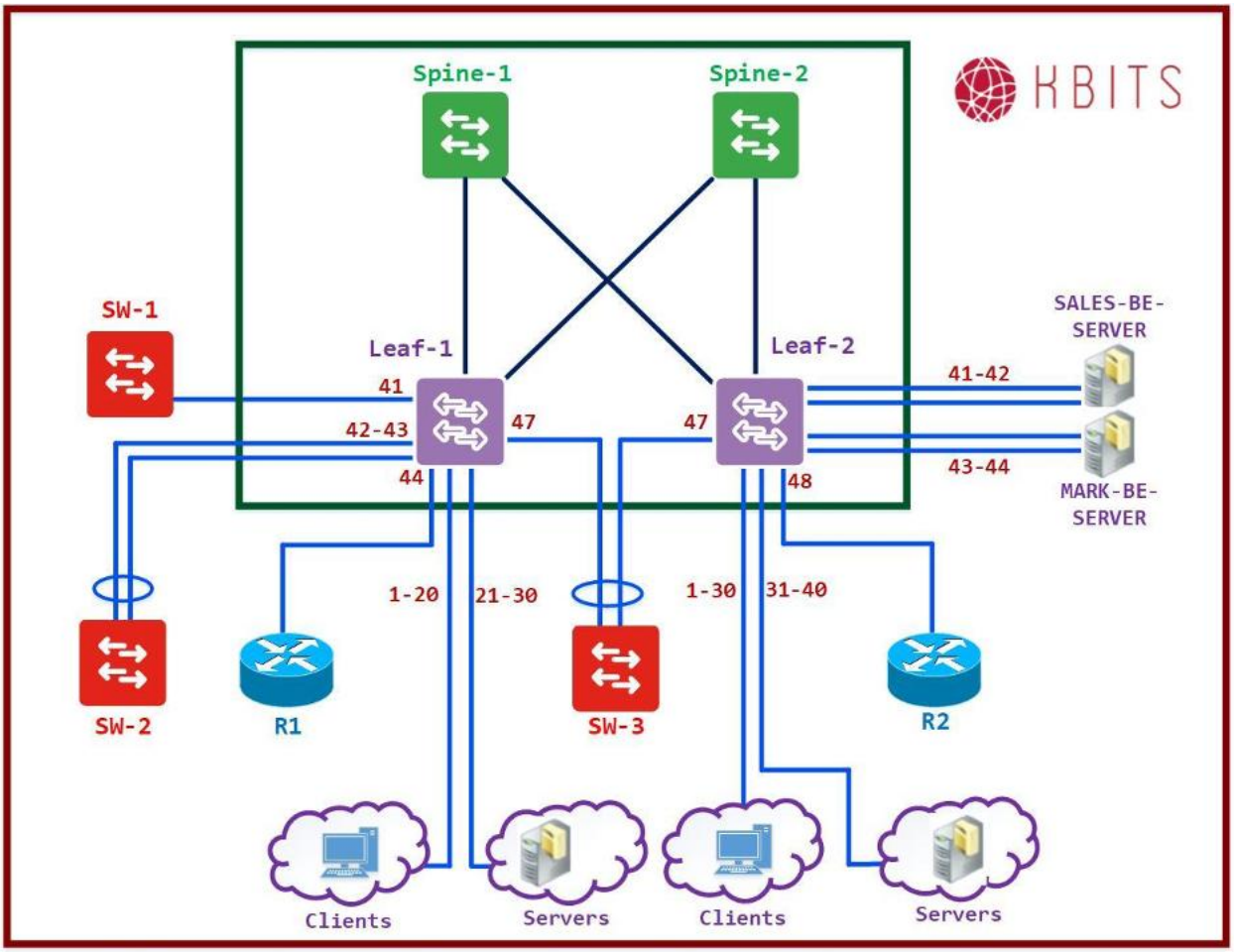
- Click **Fabric -> Access Policies -> Policies -> Switch -> Virtual Port Channel Default -> Right-click -> Create vPC Explicit Protection Group**

- Configure a vPC between Leaf-01 & Leaf-02. Use the following parameters:
  - Name: **vPC-LEAF-01-02**
  - Domain ID: **12**
  - VPC Domain Policy: **Default**
  - Switch 1: **101**
  - Switch 2: **102**

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Lab 16 – Access Provisioning – Topology 2 – vPC IPG

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Access Provisioning – Virtual Port Channel IPGs

- Configure a IPG for a SW4 based on the table below. Use LACP Active for the Port-Channel Protocol.

	Clients	Servers	Routers	Switches
CDP	Disabled	Disabled	Enabled	Enabled
LLDP	Disabled	Enabled	Disabled	Disabled
Port Security	1	5	1	
Storm Control	50%	60%		60%
Speed	1G	10G	10G	40G
STP	Enabled	Enabled	Enabled	

Task 1 – Configure the Interface Policy Groups – SW3

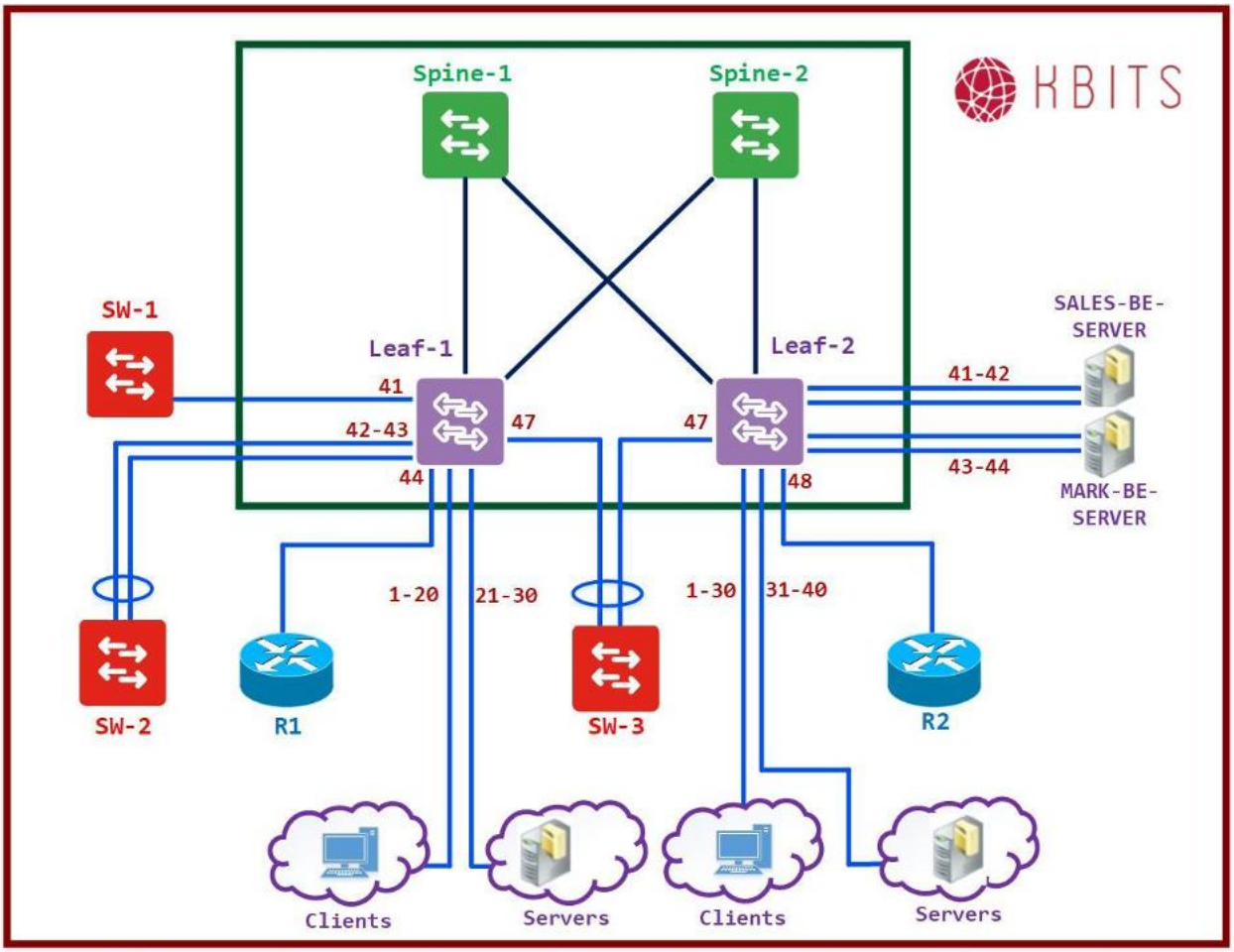
- Click **Fabric -> Access Policies -> Interfaces -> Leaf Interfaces -> Policy Groups -> VPC Interface -> Right-click -> Create VPC Interface Policy Group**

- Configure Client IPGs based on the following:
  - Name: **IPG-SW3-vPC**
  - CDP: **CDP-OFF**
  - LLDP: **LLDP-ON**
  - Storm Control: **SC-60**
  - Link Level: **40G-AUTO**
  - Port Channel: **LACP-Active**

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Lab 17 – Access Provisioning – Topology 2 – Interface Profile

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Access Provisioning – Leaf Interface Profile

- You are planning on configuring the above topology for ACI. Besides the devices displayed above, the Servers & Clients will be connected to the following ports on the 2 Leaf switches.

Task 1 – Configure Interface Profiles

- Click **Fabric -> Access Policies -> Interfaces -> Leaf Interfaces -> Profiles -> Right-click -> Create Leaf Interface Profile**

- Configure an Interface Profiles based on the following:

Interface Profile: **INT-PROF-1**		
Interface Names	**Ports**	**IPGs**
E1-20-CLIENTS	1/1-20	IPG-CLIENTS
E21-30-SERVERS	1/21-30	IPG-SERVERS
E41-SW1	1/41	IPG-SW1
E42-43-SW2-PC	1/42-43	IPG-SW2-PC
E44-45-ROUTERS	1/44-45	IPG-ROUTERS
E47-SW3-vPC	1/47	IPG-SW3-vPC

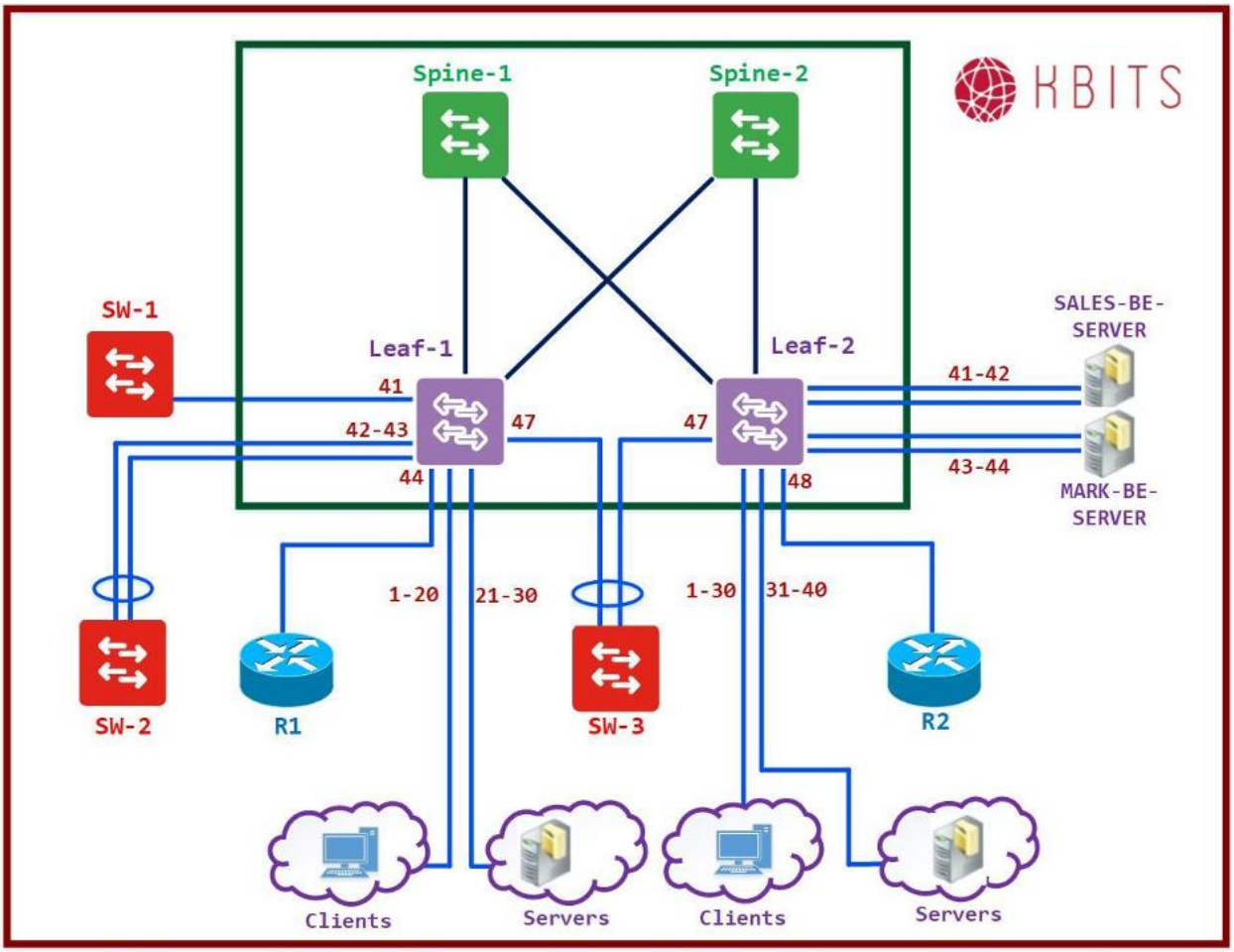
- Configure an Interface Profiles based on the following:

Interface Profile: **INT-PROF-2**		
Interface Names	**Ports**	**IPGs**
E1-30-CLIENTS	1/1-30	IPG-CLIENTS
E31-40-SERVERS	1/31-40	IPG-SERVERS
E41-42-SALES-BE-SERVER	1/41-42	IPG-SALES-BE-PC
E43-44-SALES-BE-SERVER	1/43-44	IPG-MARK-BE-PC
E47-SW3-vPC	1/47	IPG-SW3-vPC
E48-ROUTERS	1/48	IPG-ROUTERS

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Lab 18 – Access Provisioning – Topology 2 – Switch Profile

Physical Topology



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Access Provisioning – Leaf Switch Profile

- Assign the Interface Profiles created in the previous labs to the appropriate Leaf Switches.

Task 1 – Configure Switch Profiles

- Click **Fabric -> Access Policies -> Switches -> Leaf Switches -> Profiles -> Right-click -> Create Leaf Profile**

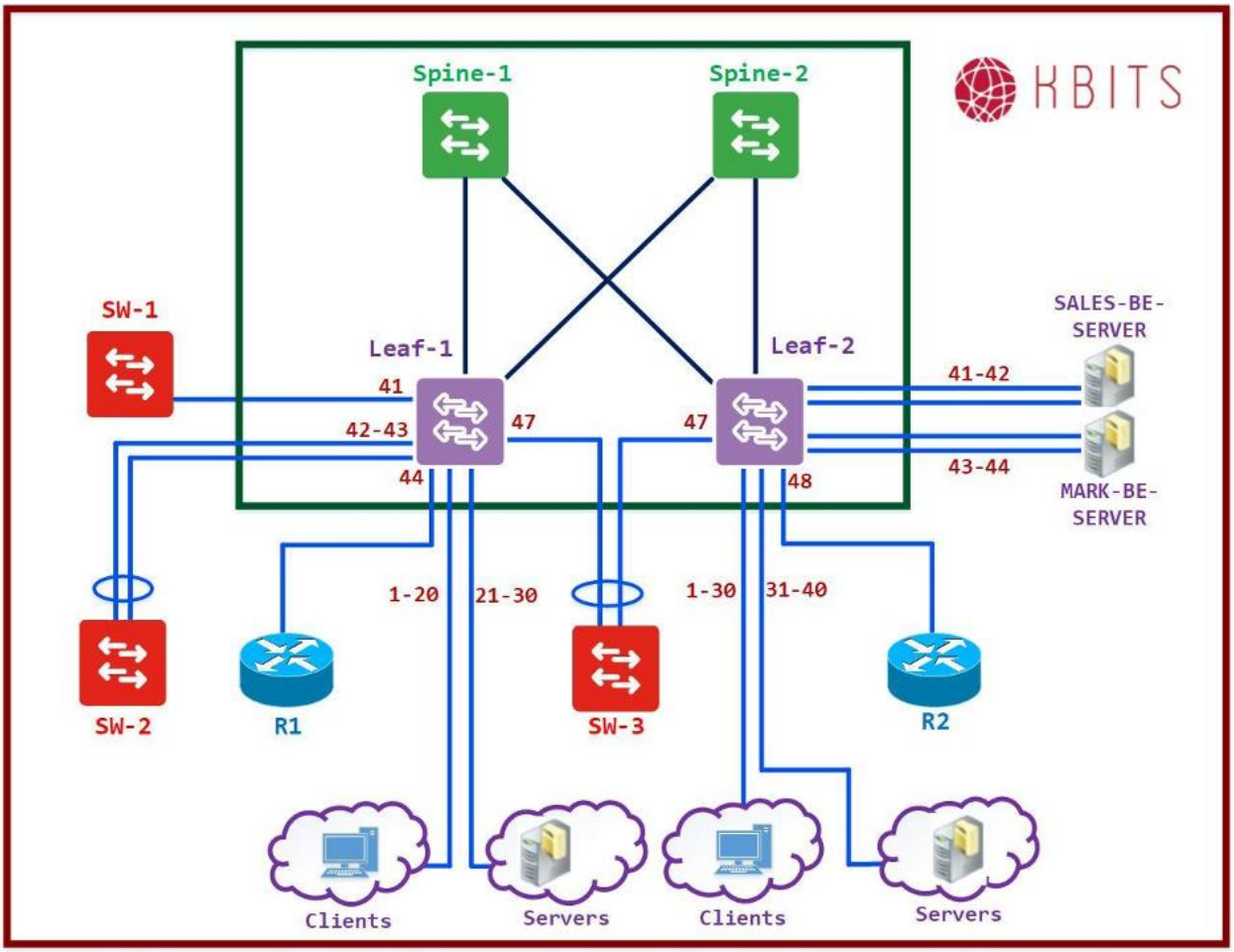
- Configure a Switch Profile based on the following:
  - Name: **SW-PROF-1**
  - Leaf Name: **LEAF-01**
  - Leaf Node ID: **101**
  - Interface profile: **INT-PROF-1**

- Configure a Switch Profile based on the following:
  - Name: **SW-PROF-2**
  - Leaf Name: **LEAF-02**
  - Leaf Node ID: **102**
  - Interface profile: **INT-PROF-2**

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Lab 19 – Access Provisioning – Topology 2 – VLAN Pools

Physical Topology



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Access Provisioning – VLAN Pool

- Create a VLAN Pool to be assigned to the Domain

Task 1 – Configure VLAN Pool

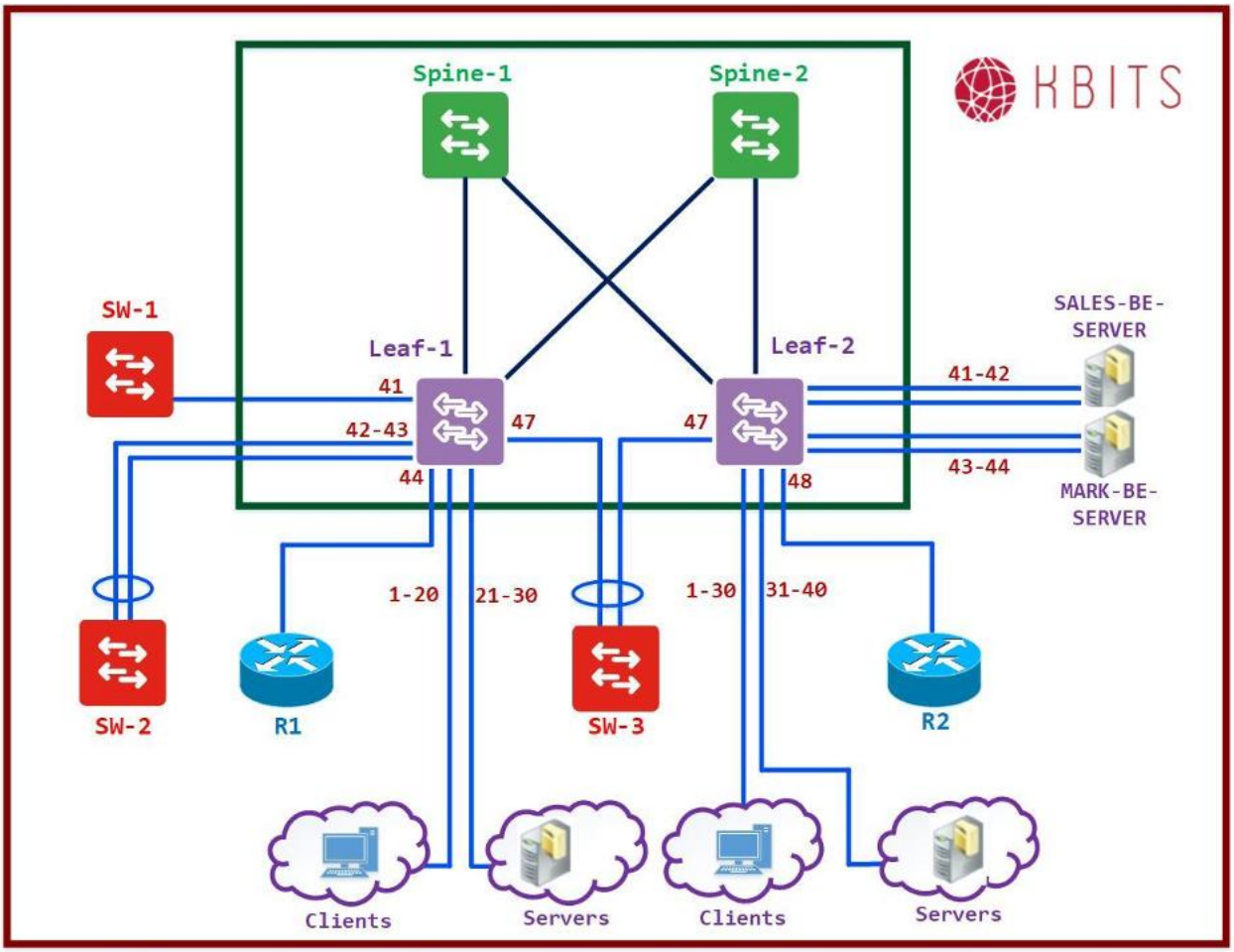
- Click **Fabric -> Access Policies -> Pools -> VLANS -> Right-click -> Create VLAN Pool**

- Create a Pool of VLANs that will be used within the ACI Fabric:
  - Name: **VLAN-POOL**
  - Leaf Name: **Static Allocation**
  - Range: **1-500**

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Lab 20 – Access Provisioning – Topology 2 – Domains

Physical Topology



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Access Provisioning – Domains

- Create Domains to specify port types.

Task 1 – Configure a Physical Domain (Physical ACI Ports)

- Click **Fabric -> Access Policies -> Physical and External Domains -> Physical Domains -> Right-click -> Create Physical domain**

- Create a Physical Domain and link it to the VLAN Pool based on the following:
  - Name: **ACI-PORTS**
  - VLAN Pool: **VLAN-POOL**

Task 2 – Configure an External L2 Domain (Connecting to Non-ACI Switches for L2OUT)

- Click **Fabric -> Access Policies -> Physical and External Domains -> External Bridged Domains -> Right-click -> Create L2 Domain**

- Create an External Brige Domain and link it to the VLAN Pool based on the following:
  - Name: **EXT-L2-PORTS**
  - VLAN Pool: **VLAN-POOL**

Task 3 – Configure an External L3 Domain (Connecting to Non-ACI L3 Devices for L3OUT)

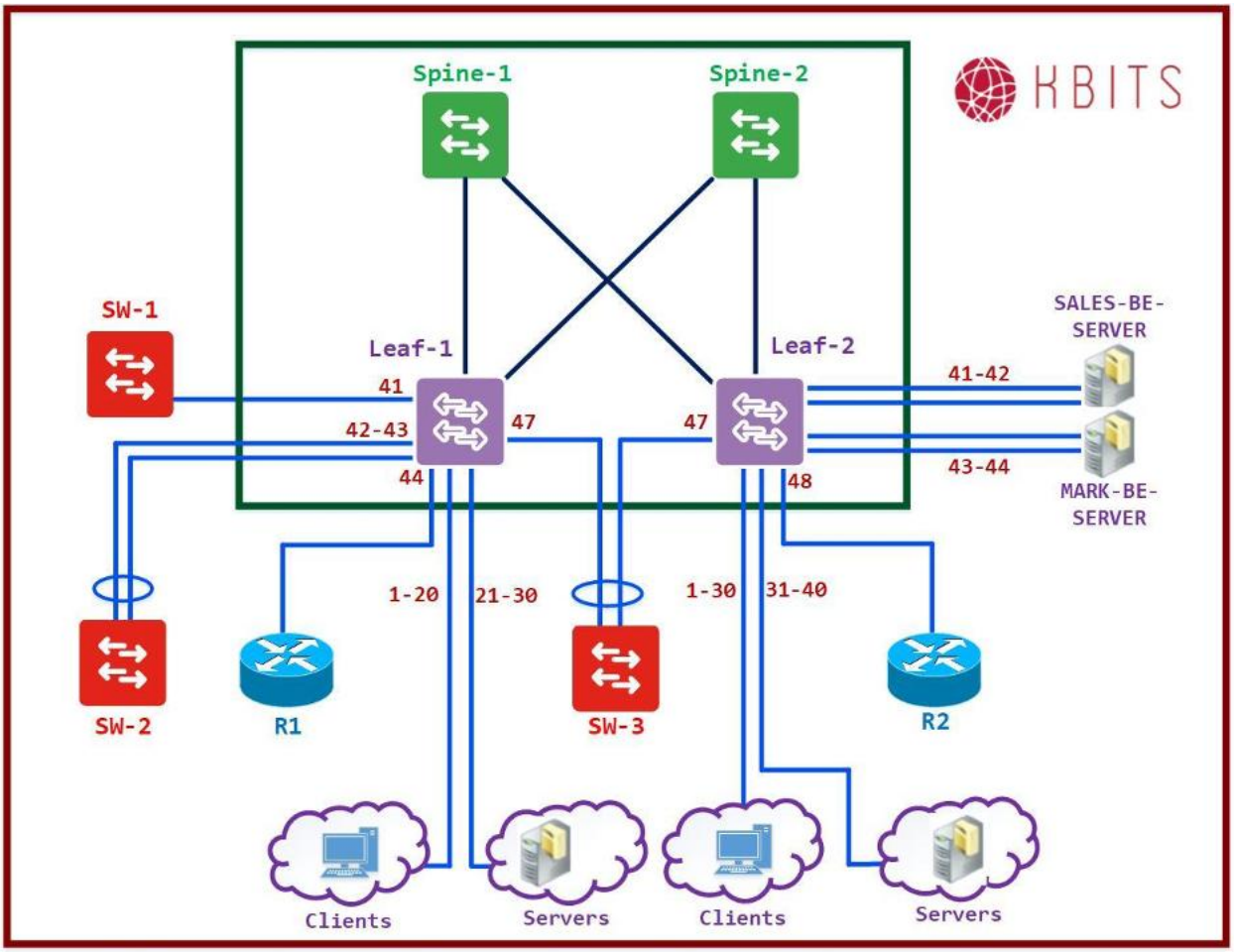
- Click **Fabric -> Access Policies -> Physical and External Domains -> External L3 Domains -> Right-click -> Create L3 Domain**

- Create an External Routed Domain and link it to the VLAN Pool based on the following:
  - Name: **EXT-L3-PORTS**
  - VLAN Pool: **VLAN-POOL**

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Lab 21 – Access Provisioning – Topology 2 – AAEP

Physical Topology



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Access Provisioning – AAEP

- Link the Port Types (Domains/VLANs) to IPGs (Physical Ports)

Task 1 – Create a AAEP for Physical ACI Ports

- Click **Fabric -> Access Policies -> Policies -> Global -> Attachable Access Entity Profile -> Right-click -> Create Attachable Access Entity Profile**

- Create an AAEP for ACI Ports and link it to the Domain & IPGs based on the following:
  - Name: **AAEP-ACI**
  - Domain: **ACI-PORTS**
  - IPGs: **IPG-CLIENTS, IPG-SERVERS, IPG-SALES-BE-PC & IPG-MARK-BE-PC**

Task 2 – Create a AAEP for External L2 Ports

- Click **Fabric -> Access Policies -> Policies -> Global -> Attachable Access Entity Profile -> Right-click -> Create Attachable Access Entity Profile**

- Create an AAEP for ACI Ports and link it to the Domain & IPGs based on the following:
  - Name: **AAEP-L2-PORTS**
  - Domain: **EXT-L2-PORTS**
  - IPGs: **IPG-SW1, IPG-SW2-PC & IPG-SW3-vPC**

Task 3 – Create a AAEP for External L3 Ports

- Click **Fabric -> Access Policies -> Policies -> Global -> Attachable Access Entity Profile -> Right-click -> Create Attachable Access Entity Profile**

- Create an AAEP for ACI Ports and link it to the Domain & IPGs based on the following:
  - Name: **AAEP-L3-PORTS**
  - Domain: **EXT-L3-PORTS**
  - IPGs: **IPG-ROUTERS**

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CCIE Data Center v3 – ACI

Authored By:

Khawar Butt

Hepta CCIE # 12353
(R/S, Security, SP, Voice,
Storage, Data Center, Wireless)

CCDE # 20110020

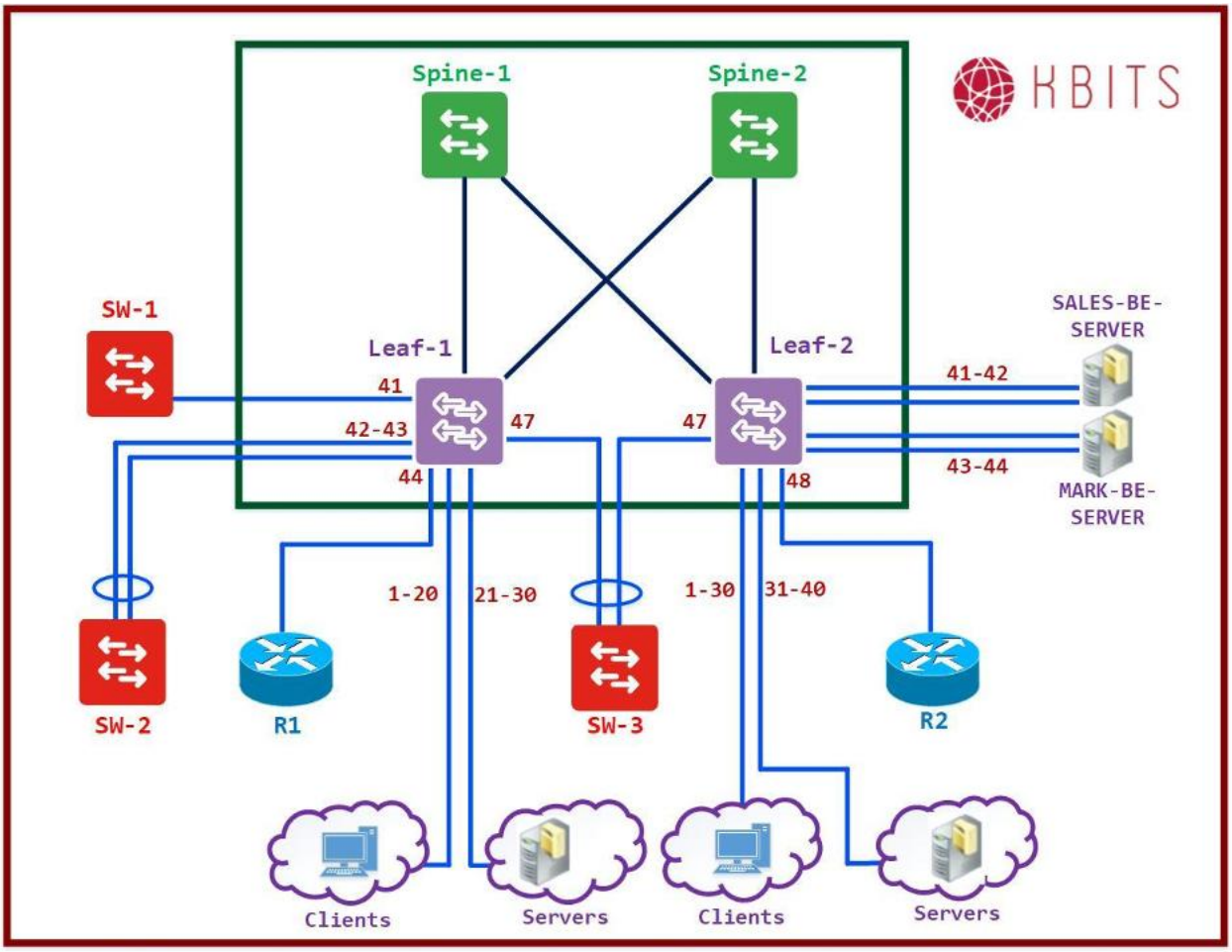
Module 2 – Tenant Provisioning



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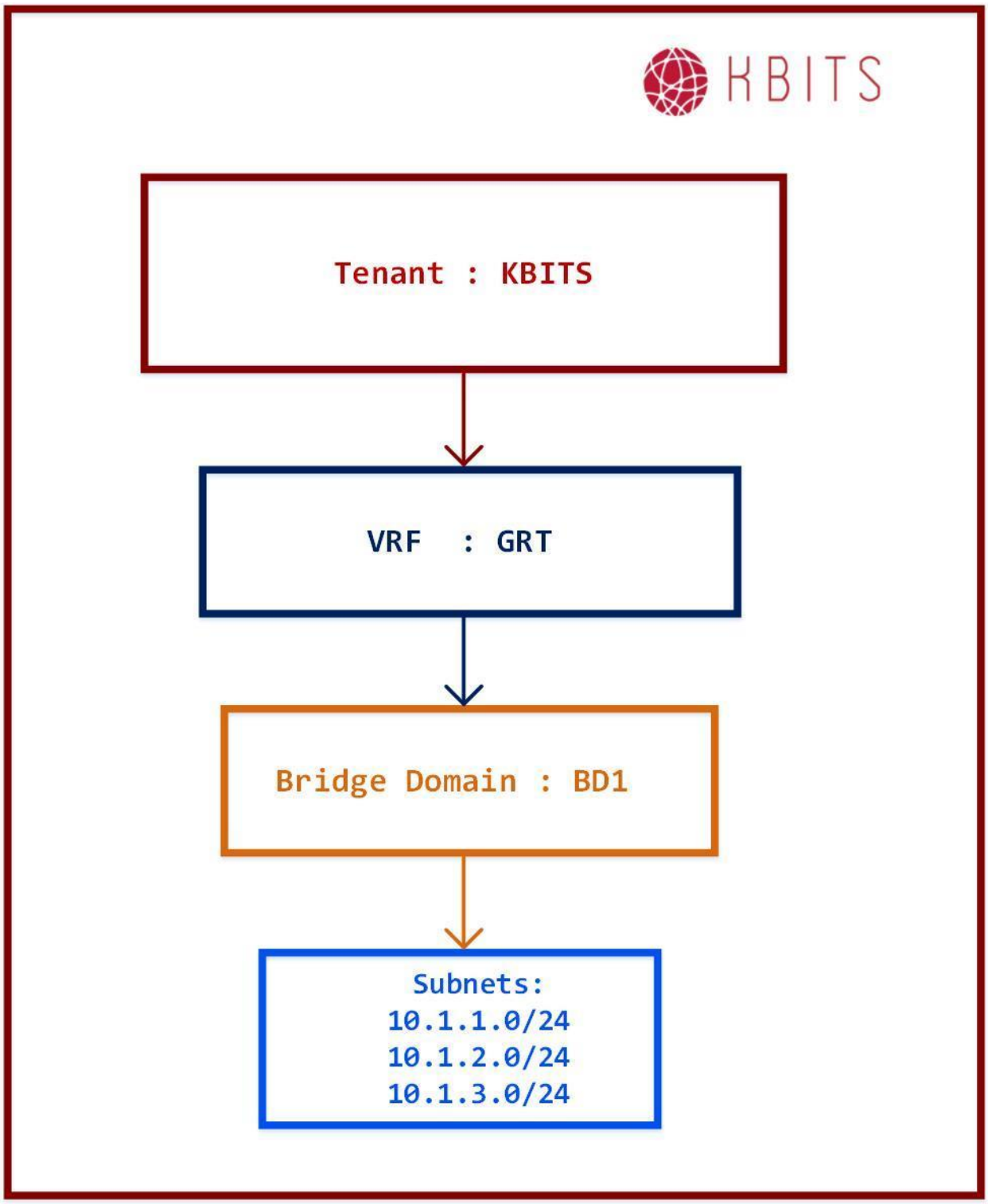
Lab 1 – Tenant Provisioning – Creating a Tenant & VRF

Physical Topology



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Logical Topology



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Tenant Provisioning – Creating a Tenant

Note: The Access Provisioning labs are based on the Access Provisioning completed for Topology 2.

Task 1 – Create the Tenant

- Click **Tenant -> Add a Tenant**

- Create a Tenant based on the following:
  - Name: **KBITS**

Task 2 – Create a VRF

- Create a VRF within Tenant **KBITS** based on the following:
  - Name: **GRT**

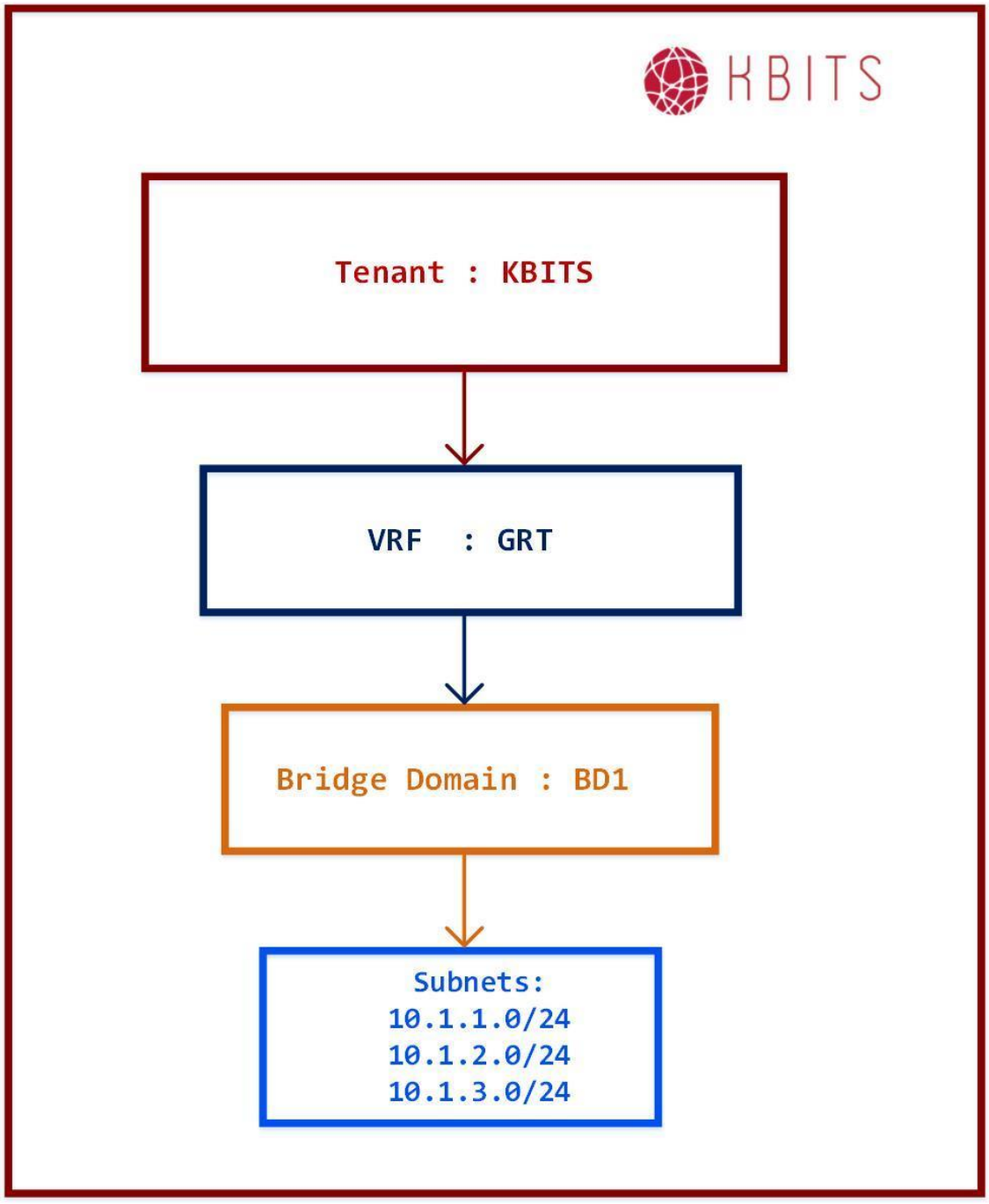
- Click **Tenant -> KBITS -> Networking -> VRF -> Right-click -> Create VRF**

- Create a VRF based on the information above.

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Lab 2 – Tenant Provisioning – Creating a Bridge Domain

Logical Topology



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Tenant Provisioning – Creating a Bridge Domain

Task 1 – Create a Bridge Domain

- Create a Bridge Domain within Tenant **KBITS** based on the following:
  - Name: **BD1**
  - VRF: **GRT**
  - Subnets/GW: **10.1.1.254/24, 10.1.2.254/24 & 10.1.3.254/24**
  -

- Click **Tenant -> KBITS -> Networking -> Bridge Domain -> Right-click -> Create Bridge Domain**

- Create the Bridge Domain based on the information above.

- Configure the Subnets/GW based on the information above. The Subnets should have the ability to be shared externally and between VRFs.

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CCIE Data Center v3 – ACI

Authored By:

Khawar Butt

Hepta CCIE # 12353
(R/S, Security, SP, Voice,
Storage, Data Center, Wireless)

CCDE # 20110020

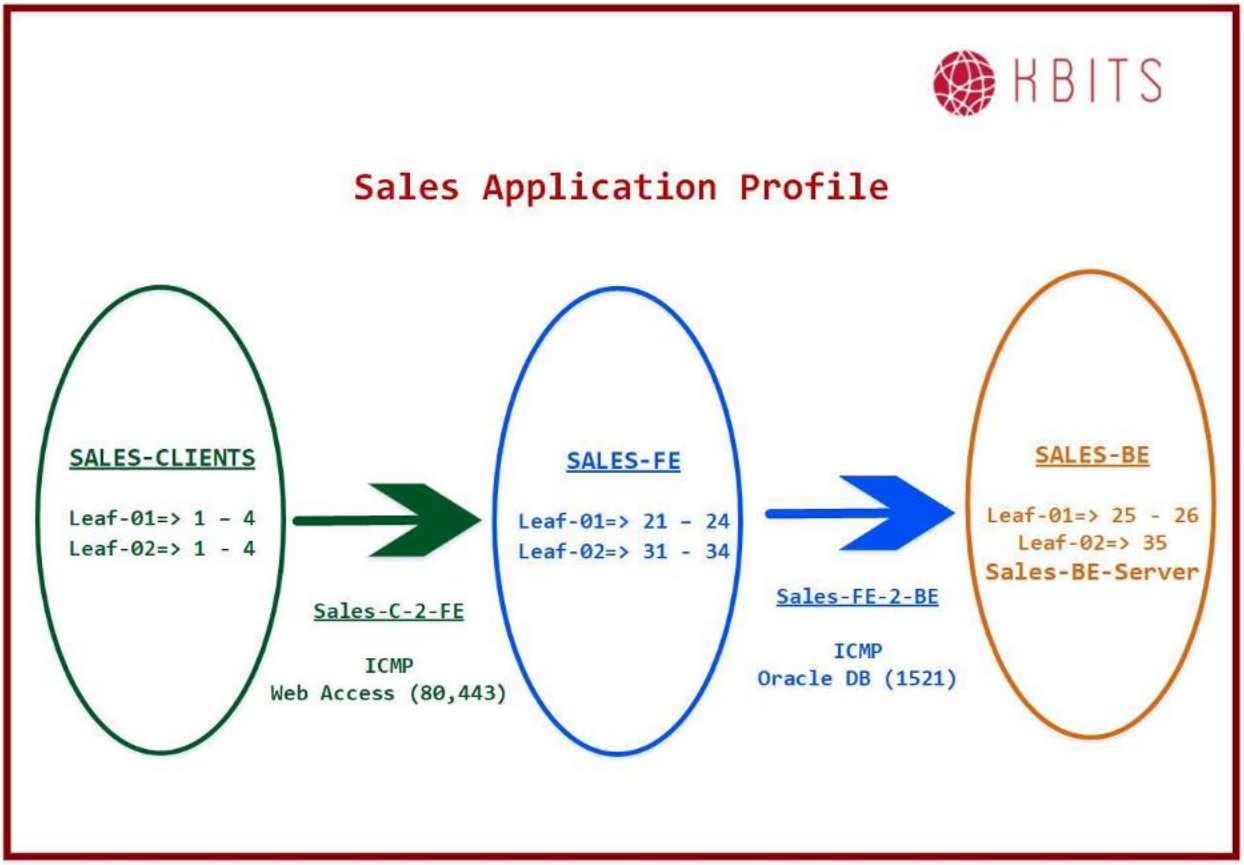
Module 3 – Application Provisioning



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Lab 1 – Application Provisioning – Creating Application Profile and EPGs for Sales

Sales Application



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Application Provisioning – Creating an Application Profile

Note: The Application Provisioning labs are based on the Successful completion of Module 2 – Tenant Provisioning

Task 1 – Create an Application Profile

- Click **Tenant -> KBITS -> Application Profiles -> Right-click -> Create Application Profile**

- Create an Application Profile based on the following:
  - Name: **SALES-APPS**

Task 2 – Create EndPoint Groups (EPGs)

- Click **Tenant -> KBITS -> Application Profiles -> SALES-APPS -> Application EGPs -> Right-click -> Create Application EPG**

- Create EPGs based on the following:
  - Name: **SALES-CLIENTS**
  - Bridge domain: **BD1**

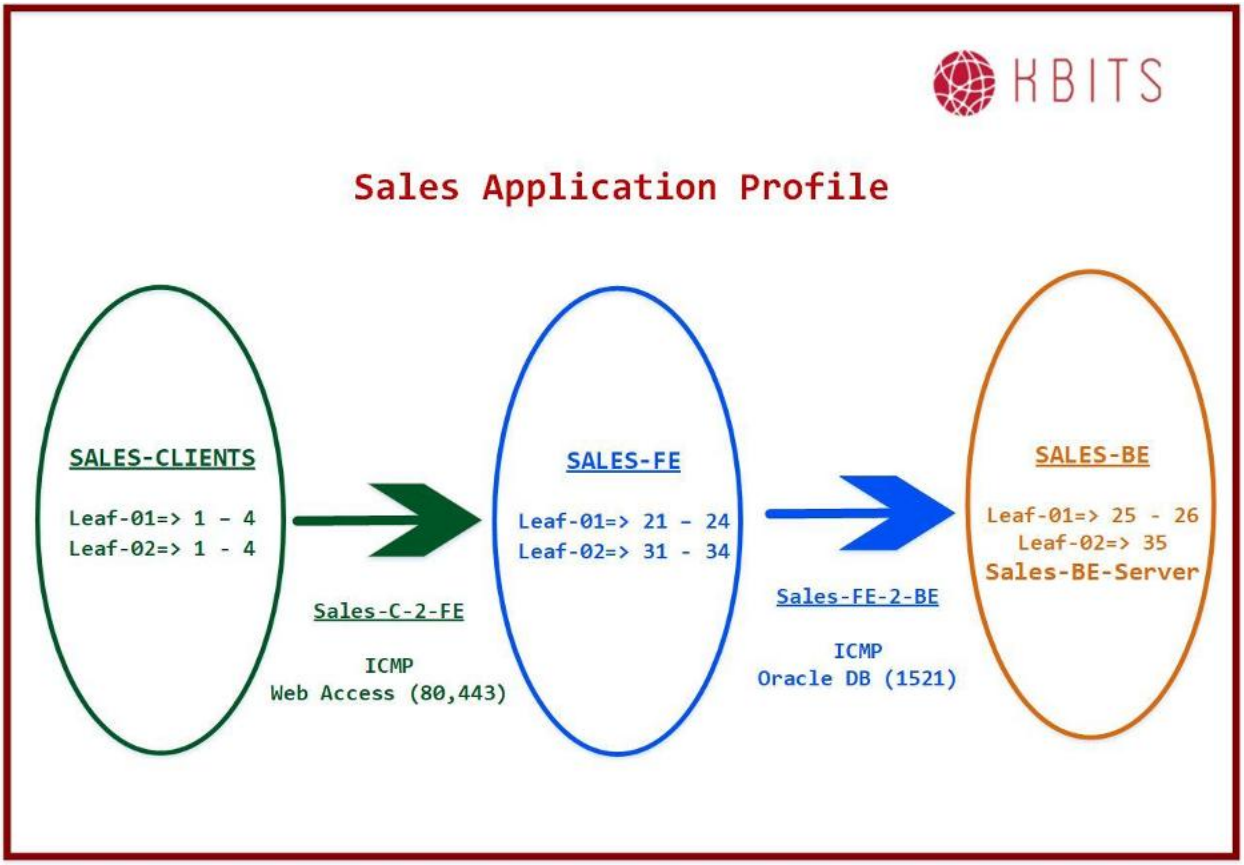
  - Name: **SALES-FE**
  - Bridge domain: **BD1**

  - Name: **SALES-BE**
  - Bridge domain: **BD1**

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Lab 2 – Application Provisioning – Assign Ports to EPGs in the Sales Application Profile

Sales Application



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Application Provisioning – Port Assignments

Task 1 – Assign ports to the "SALES Client" EPGs

- Click **Tenant -> KBITS -> Application Profiles -> SALES-APPS -> Application EPGs -> SALES-CLIENTS -> Static Ports -> Right-click -> Deploy Static EPG on PC, VPC or Interface**

- Assign Ports to the **SALES-CLIENT** EPG based on the following:

Port	VLAN	Port-Type	Deployment
LEAF-01 – 1 /1	10	Access	Immediate
LEAF-01 – 1 /2	10	Access	Immediate
LEAF-01 – 1 /3	10	Access	Immediate
LEAF-01 – 1 /4	10	Access	Immediate
LEAF-02 – 1 /1	10	Access	Immediate
LEAF-02 – 1 /2	10	Access	Immediate
LEAF-02 – 1 /3	10	Access	Immediate
LEAF-02 – 1 /4	10	Access	Immediate

Task 2 – Assign ports to the "SALES FE" EPGs

- Click **Tenant -> KBITS -> Application Profiles -> SALES-APPLICATION-PROFILE -> Application EPGs -> SALES-FE -> Static Ports -> Right-click -> Deploy Static EPG on PC, VPC or Interface**

- Assign Ports to the **SALES-FE** EPG based on the following:

Port	VLAN	Port-Type	Deployment
LEAF-01 – 1 /21	20	Trunk	Immediate
LEAF-01 – 1 /22	20	Trunk	Immediate
LEAF-01 – 1 /23	20	Trunk	Immediate
LEAF-01 – 1 /24	20	Trunk	Immediate
LEAF-02 – 1 /31	20	Trunk	Immediate
LEAF-02 – 1 /32	20	Trunk	Immediate
LEAF-02 – 1 /33	20	Trunk	Immediate
LEAF-02 – 1 /34	20	Trunk	Immediate

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Task 3 – Assign ports to the "SALES BE" EPGs

- Click **Tenant -> KBITS -> Application Profiles -> SALES-APPLICATION-PROFILE -> Application EPGs -> SALES-BE -> Static Ports -> Right-click -> Deploy Static EPG on PC, VPC or Interface**

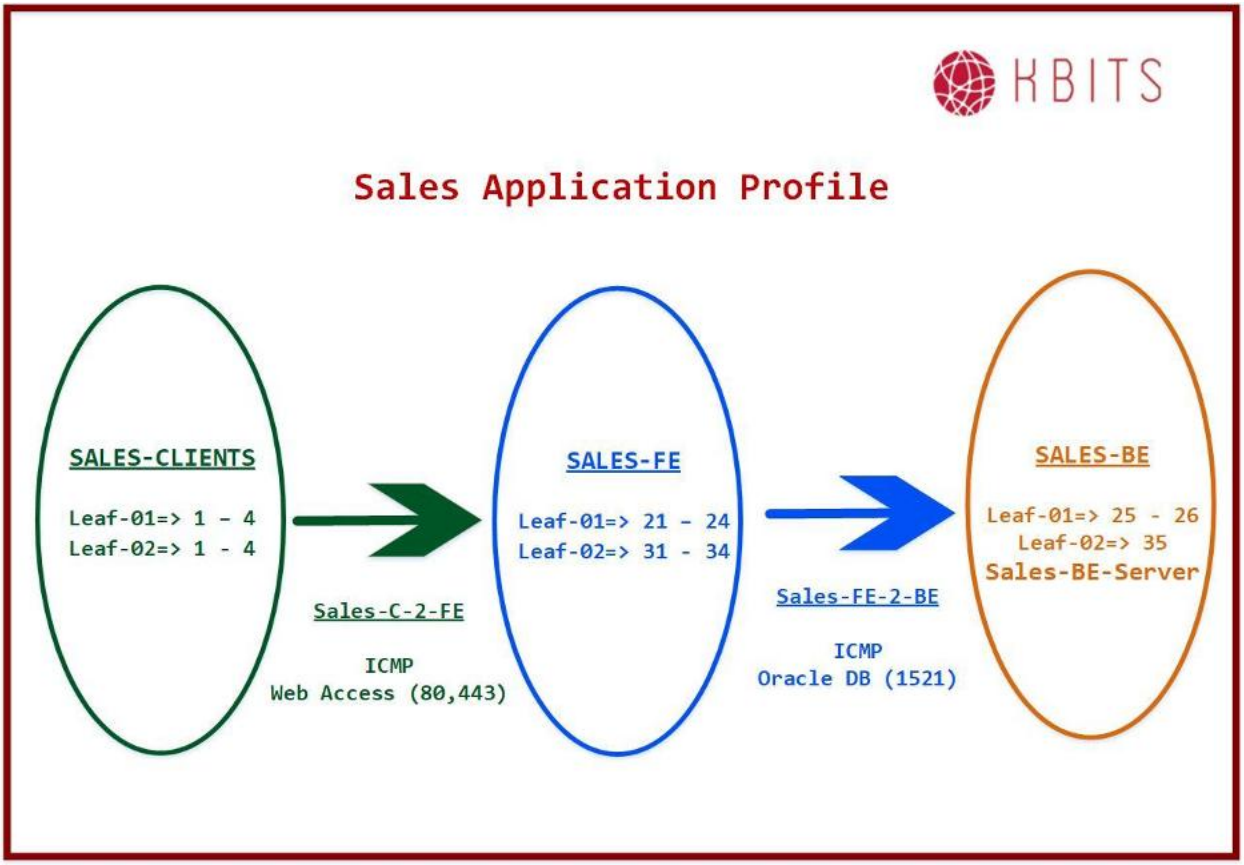
- Assign Ports to the **SALES-BE** EPG based on the following:

Port	VLAN	Port-Type	Deployment
LEAF-01 – 1 /25	30	Trunk	Immediate
LEAF-01 – 1 /26	30	Trunk	Immediate
LEAF-02 – 1 /35	30	Trunk	Immediate
SALES-BE-PC	30	Trunk	Immediate

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Lab 3 – Application Provisioning – Creating Filters based on Sales Application

Sales Application



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Application Provisioning – Creating Filters

Task 1 – Create a Filter for Web-Access

- Click **Tenant -> KBITS -> Contracts -> Filters -> Create Filter**

- Create a Filter for Web Access based on the following:

  - Name: **Web-Access**
  - Policy#1:
    - Name: **HTTP**
    - Ethertype: **IP**
    - Protocol: **TCP**
    - Destination Port Range: **HTTP To HTTP**
  - Policy#2:
    - Name: **HTTPS**
    - Ethertype: **IP**
    - Protocol: **TCP**
    - Destination Port Range: **HTTPS To HTTPS**

Task 2 – Create a Filter for PING

- Click **Tenant -> KBITS -> Contracts -> Filters -> Create Filter**

- Create a Filter for PING based on the following:

  - Name: **ICMP-PING**
  - Policy#1:
    - Name: **PING**
    - Ethertype: **IP**
    - Protocol: **ICMP**

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Task 3 – Create a Filter for Oracle DB Access

- Click **Tenant -> KBITS -> Contracts -> Filters -> Create Filter**

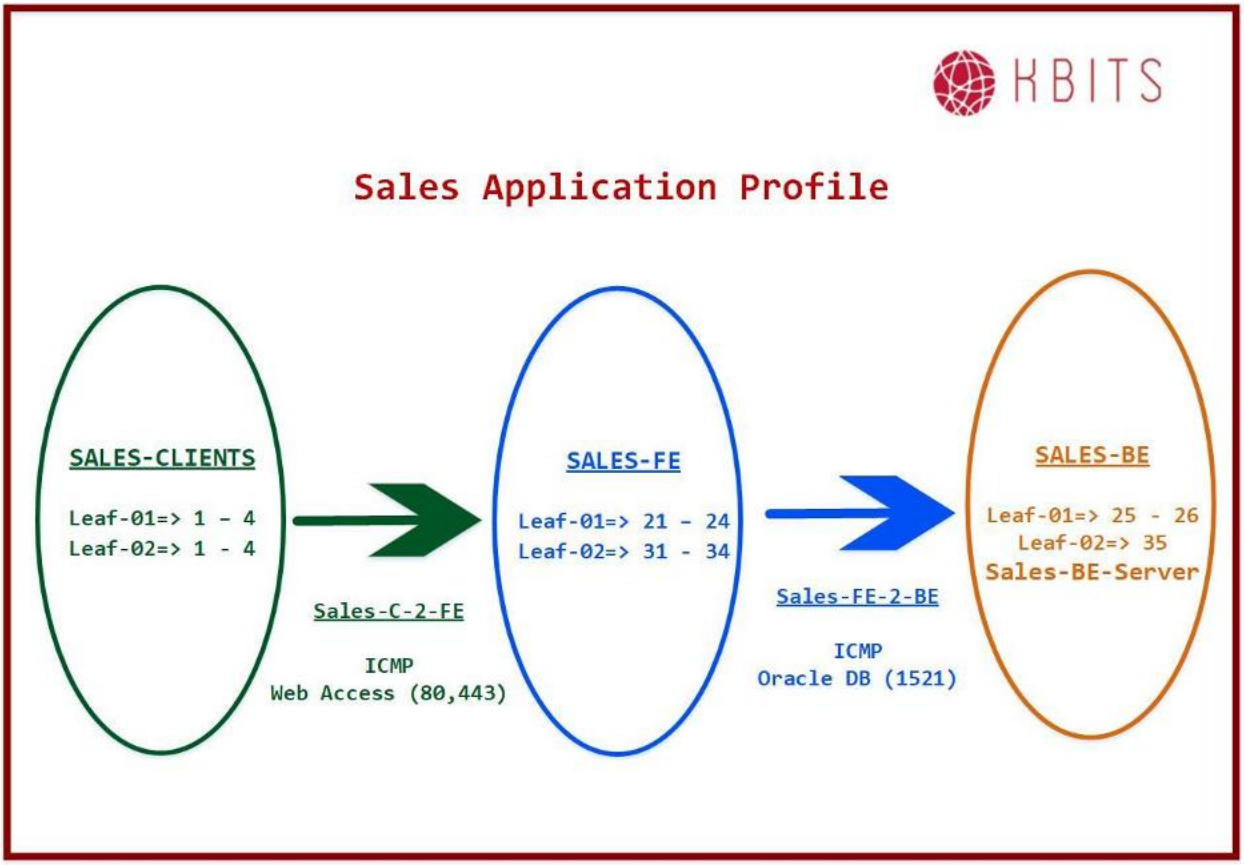
- Create a Filter for Oracle DB Access based on the following:

  - Name: **ORACLE-DB-ACCESS**
  - Policy#1:
    - Name: **ORACLE-DB**
    - Ethertype: **IP**
    - Protocol: **TCP**
    - Destination Port Range: **1521 To 1521**

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Lab 4 – Application Provisioning – Creating Contracts based on Sales Application Profile

Sales Application



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Application Provisioning – Creating Contracts

Task 1 – Create a Contract for traffic from SALES-CLIENTS EPG towards SALES-FE EPG

- Click **Tenant -> KBITS -> Contracts -> Standard -> Create Contract**

- Create a Contract allowing Access from the SALES-CLIENTS EPG towards the SALES-FE EPG based on the following:

  - Contract Name: **SALES-C-2-FE**
  - Subject Name: **SALES-C-2-FE**
  - Filters:
    - Name: **KBITS/Web-Access**
    - Name: **KBITS/ICMP-PING**

Task 2 – Create a Contract for traffic from SALES-FE EPG towards SALES-BE EPG

- Click **Tenant -> KBITS -> Contracts -> Standard -> Create Contract**

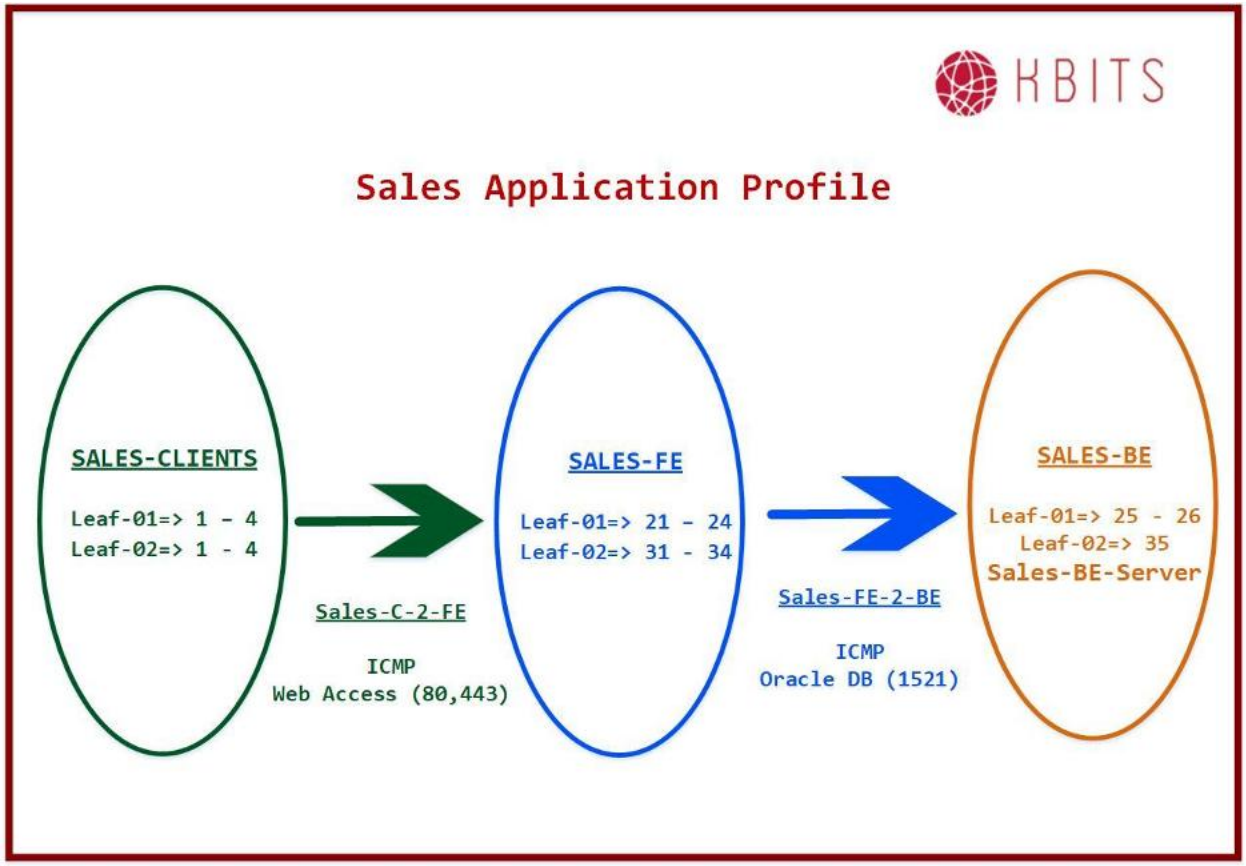
- Create a Contract allowing Access from the SALES-FE EPG towards the SALES-BE EPG based on the following:

  - Contract Name: **SALES-FE-2-BE**
  - Subject Name: **SALES-FE-2-BE**
  - Filters:
    - Name: **KBITS/ORACLE-DB-ACCESS**
    - Name: **KBITS/ICMP-PING**

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Lab 5 – Application Provisioning – Provisioning Contracts based on Sales Application Profile

Sales Application



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Application Provisioning – Provisioning Contracts

Task 1 – Provisioning the SALES-C-2-FE contract for the SALES-CLIENT EPG

- Click **Tenant -> KBITS -> Application Profiles -> SALES-APPS -> Application EPGs -> SALES-CLIENTS -> Contracts -> Right-click -> Add Consumed Contract**

- Provision the SALES-C-2-FE contract as a Consumed Contract.

  - Contract Name: **SALES-C-2-FE**
  - Provision type: **Consumed**

Task 2 – Provisioning the SALES-C-2-FE contract for the SALES-FE EPG

- Click **Tenant -> KBITS -> Application Profiles -> SALES-APPS -> Application EPGs -> SALES-FE -> Contracts -> Right-click -> Add Provided Contract**

- Provision the SALES-C-2-FE contract as a Provided Contract.

  - Contract Name: **SALES-C-2-FE**
  - Provision type: **Provided**

Task 3 – Provisioning the SALES-FE-2-BE contract for the SALES-FE EPG

- Click **Tenant -> KBITS -> Application Profiles -> SALES-APPS -> Application EPGs -> SALES-FE -> Contracts -> Right-click -> Add Consumed Contract**

- Provision the SALES-FE-2-BE contract as a Consumed Contract.

  - Contract Name: **SALES-FE-2-BE**
  - Provision type: **Consumed**

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Task 4 – Provisioning the SALES-FE-2-BE contract for the SALES-BE EPG

- Click **Tenant -> KBITS -> Application Profiles -> SALES-APPS -> Application EPGs -> SALES-BE -> Contracts -> Right-click -> Add Provided Contract**

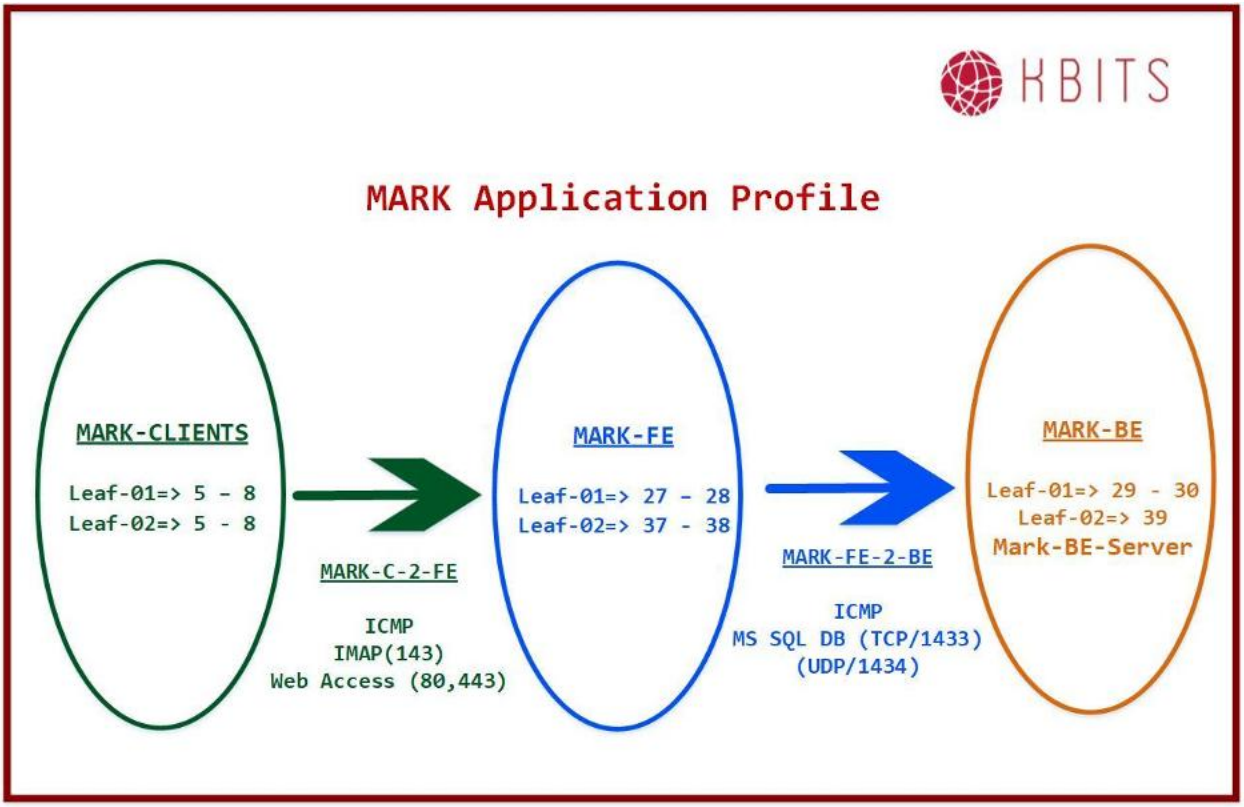
- Provision the SALES-FE-2-BE contract as a Provided Contract.

    - Contract Name: **SALES-FE-2-BE**
    - Provision type: **Provided**

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Lab 6 – Application Provisioning – Creating Application Profile and EPGs for Mark

MARK Application



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Application Provisioning – Creating an Application Profile

Note: The Application Provisioning labs are based on the Successful completion of Module 2 – Tenant Provisioning

Task 1 – Create an Application Profile

- Click **Tenant -> KBITS -> Application Profiles -> Right-click -> Create Application Profile**

- Create an Application Profile based on the following:
  - Name: **MARK-APPS**

Task 2 – Create EndPoint Groups (EPGs)

- Click **Tenant -> KBITS -> Application Profiles -> MARK-APPS -> Application EGPs -> Right-click -> Create Application EPG**

- Create EPGs based on the following:
  - Name: **MARK-CLIENTS**
  - Bridge domain: **BD1**

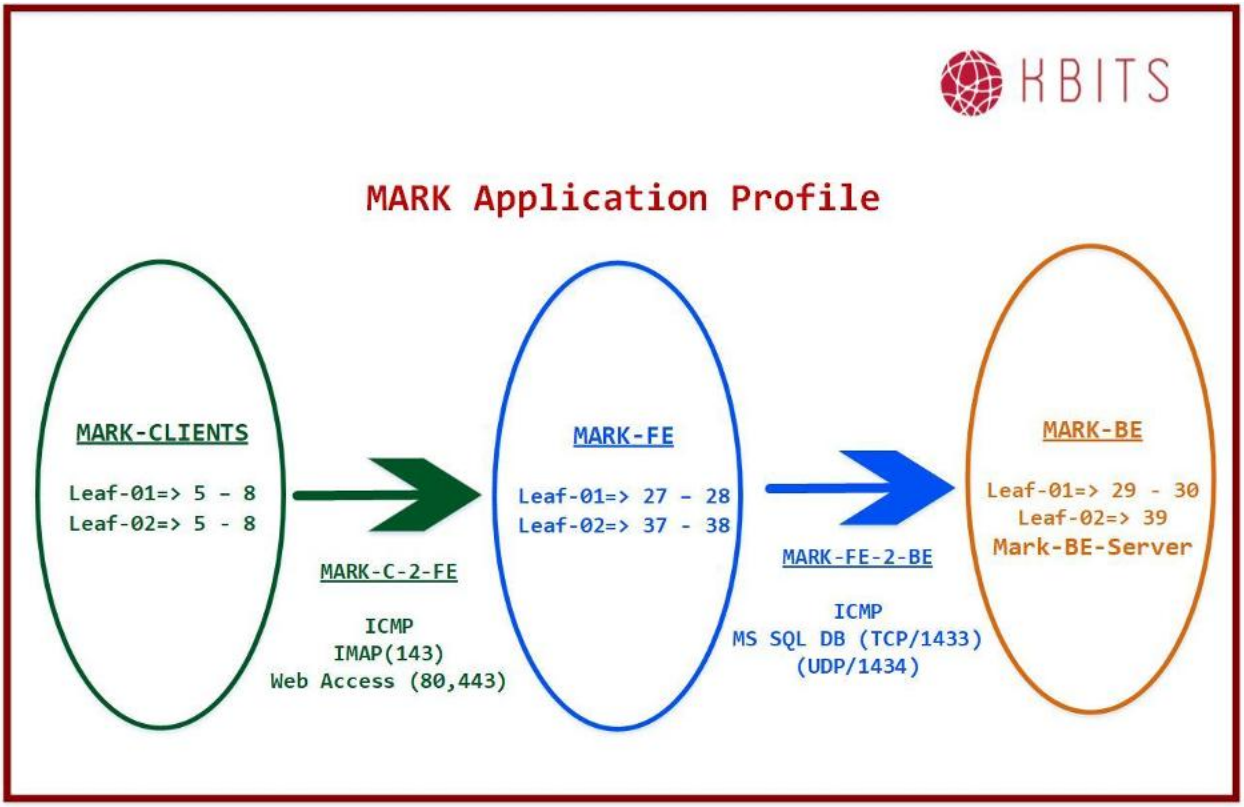
  - Name: **MARK-FE**
  - Bridge domain: **BD1**

  - Name: **MARK-BE**
  - Bridge domain: **BD1**

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Lab 7 – Application Provisioning – Assign Ports to EPGs in the Mark Application Profile

MARK Application



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Application Provisioning – Port Assignments

Task 1 – Assign ports to the "MARK Client" EPGs

- Click **Tenant -> KBITS -> Application Profiles -> MARK-APPS -> Application EPGs -> MARK-CLIENTS -> Static Ports -> Right-click -> Deploy Static EPG on PC, VPC or Interface**

- Assign Ports to the **MARK-CLIENTS** EPG based on the following:

Port	VLAN	Port-Type	Deployment
LEAF-01 – 1 /5	40	Access	Immediate
LEAF-01 – 1 /6	40	Access	Immediate
LEAF-01 – 1 /7	40	Access	Immediate
LEAF-01 – 1 /8	40	Access	Immediate
LEAF-02 – 1 /5	40	Access	Immediate
LEAF-02 – 1 /6	40	Access	Immediate
LEAF-02 – 1 /7	40	Access	Immediate
LEAF-02 – 1 /8	40	Access	Immediate

Task 2 – Assign ports to the "MARK FE" EPGs

- Click **Tenant -> KBITS -> Application Profiles -> MARK-APPS -> Application EPGs -> MARK-FE -> Static Ports -> Right-click -> Deploy Static EPG on PC, VPC or Interface**

- Assign Ports to the **MARK-FE** EPG based on the following:

Port	VLAN	Port-Type	Deployment
LEAF-01 – 1 /27	50	Trunk	Immediate
LEAF-01 – 1 /28	50	Trunk	Immediate
LEAF-02 – 1 /37	50	Trunk	Immediate
LEAF-02 – 1 /38	50	Trunk	Immediate

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Task 3 – Assign ports to the "MARK BE" EPGs

- Click **Tenant -> KBITS -> Application Profiles -> MARK-APPS -> Application EPGs -> MARK-BE -> Static Ports -> Right-click -> Deploy Static EPG on PC, VPC or Interface**

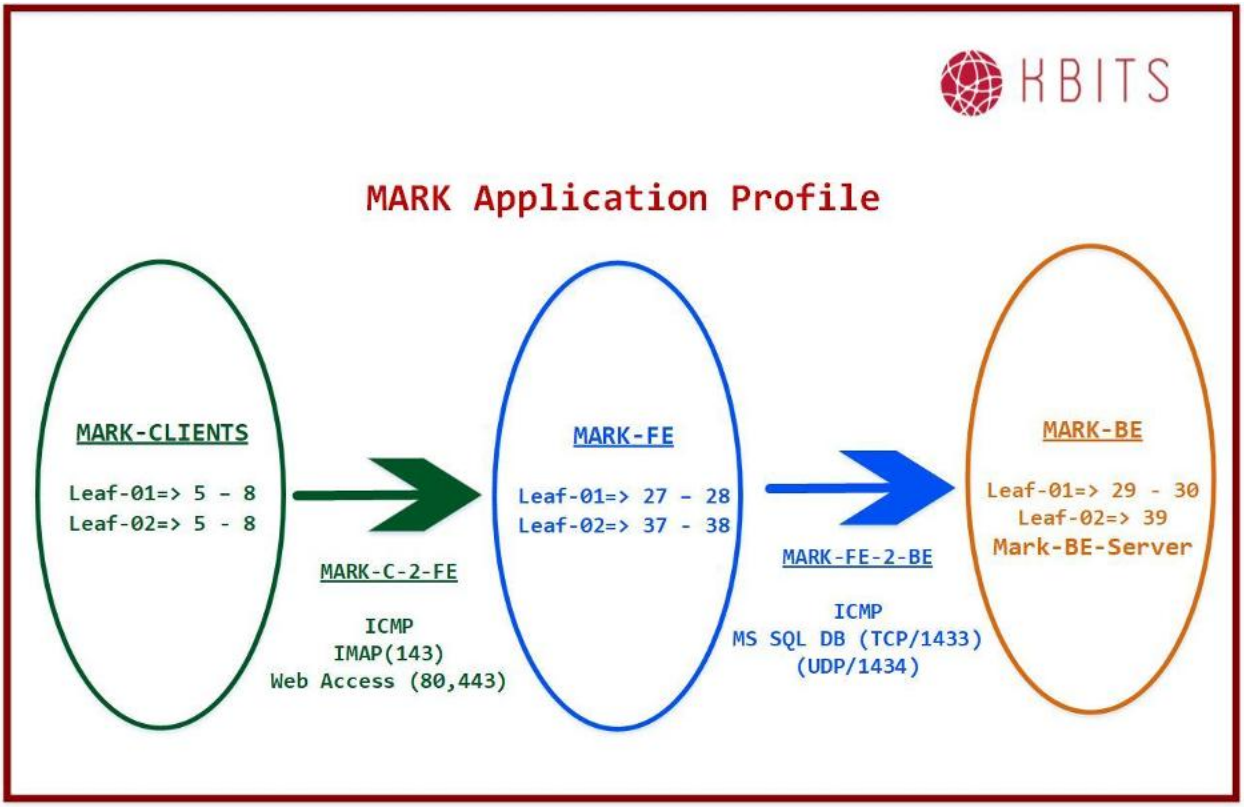
- Assign Ports to the **MARK-BE** EPG based on the following:

Port	VLAN	Port-Type	Deployment
LEAF-01 – 1 /29	60	Trunk	Immediate
LEAF-01 – 1 /30	60	Trunk	Immediate
LEAF-02 – 1 /39	60	Trunk	Immediate
MARK-BE-PC	60	Trunk	Immediate

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Lab 8 – Application Provisioning – Creating Filters based on Mark Application

MARK Application



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Application Provisioning – Creating Filters

Task 1 – Create a Filter for IMAP

- Click **Tenant -> KBITS -> Contracts -> Filters -> Create Filter**

- Create a Filter for Web Access based on the following:

  - Name: **IMAP**
  - Policy#1:
    - Name: **IMAP4**
    - Ethertype: **IP**
    - Protocol: **TCP**
    - Destination Port Range: **143 To 143**

Task 2 – Create a Filter for MS SQL DB Access

- Click **Tenant -> KBITS -> Contracts -> Filters -> Create Filter**

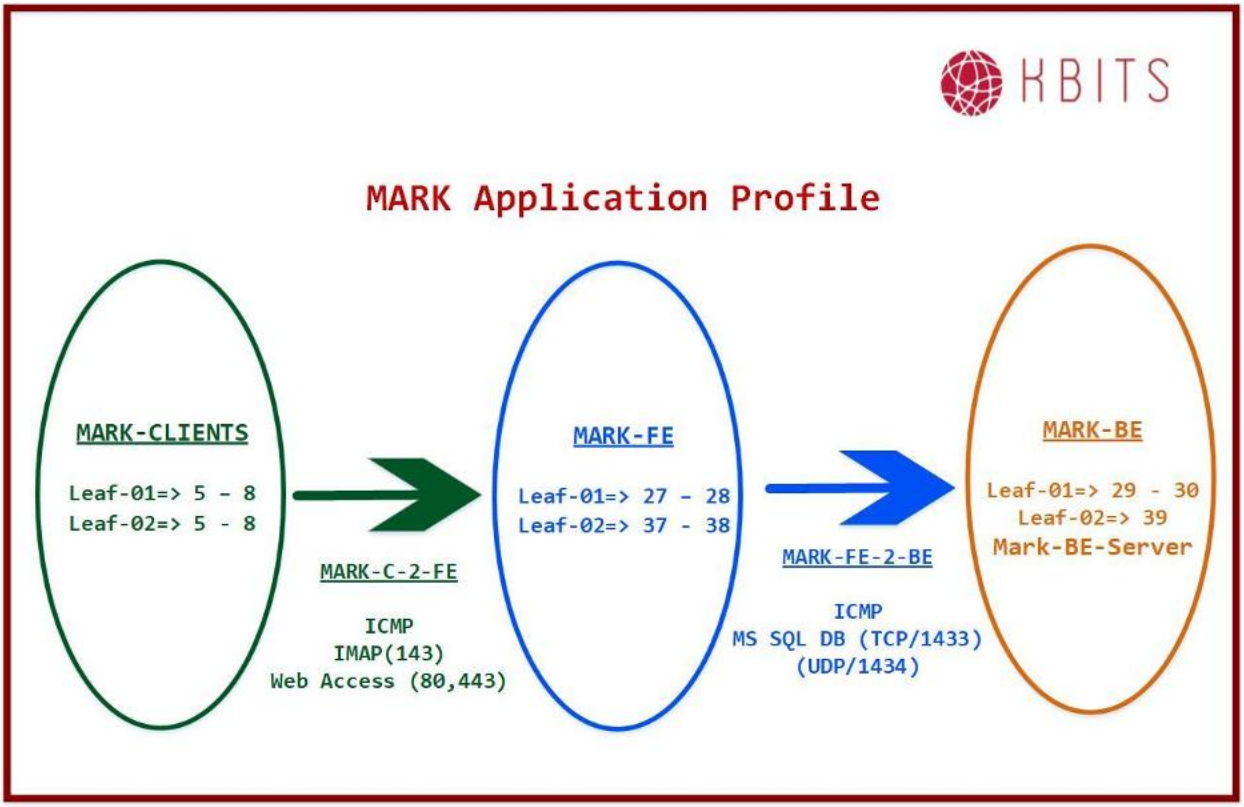
- Create a Filter for Oracle DB Access based on the following:

  - Name: **MS-SQL-DB-ACCESS**
  - Policy#1:
    - Name: **MS-SQL-DB-TCP**
    - Ethertype: **IP**
    - Protocol: **TCP**
    - Destination Port Range: **1433 To 1433**
  - Policy#2:
    - Name: **MS-SQL-DB-UDP**
    - Ethertype: **IP**
    - Protocol: **UDP**
    - Destination Port Range: **1434 To 1434**

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Lab 9 – Application Provisioning – Creating Contracts based on Mark Application Profile

MARK Application



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Application Provisioning – Creating Contracts

Task 1 – Create a Contract for traffic from MARK-CLIENTS EPG towards MARK-FE EPG

- Click **Tenant -> KBITS -> Contracts -> Standard -> Create Contract**

- Create a Contract allowing Access from the MARK-CLIENTS EPG towards the MARK-FE EPG based on the following:

  - Contract Name: **MARK-C-2-FE**
  - Subject Name: **MARK-C-2-FE**
  - Filters:
    - Name: **KBITS/IMAP**
    - Name: **KBITS/Web-Access**
    - Name: **KBITS/ICMP-PING**

Task 2 – Create a Contract for traffic from MARK-FE EPG towards MARK-BE EPG

- Click **Tenant -> KBITS -> Contracts -> Standard -> Create Contract**

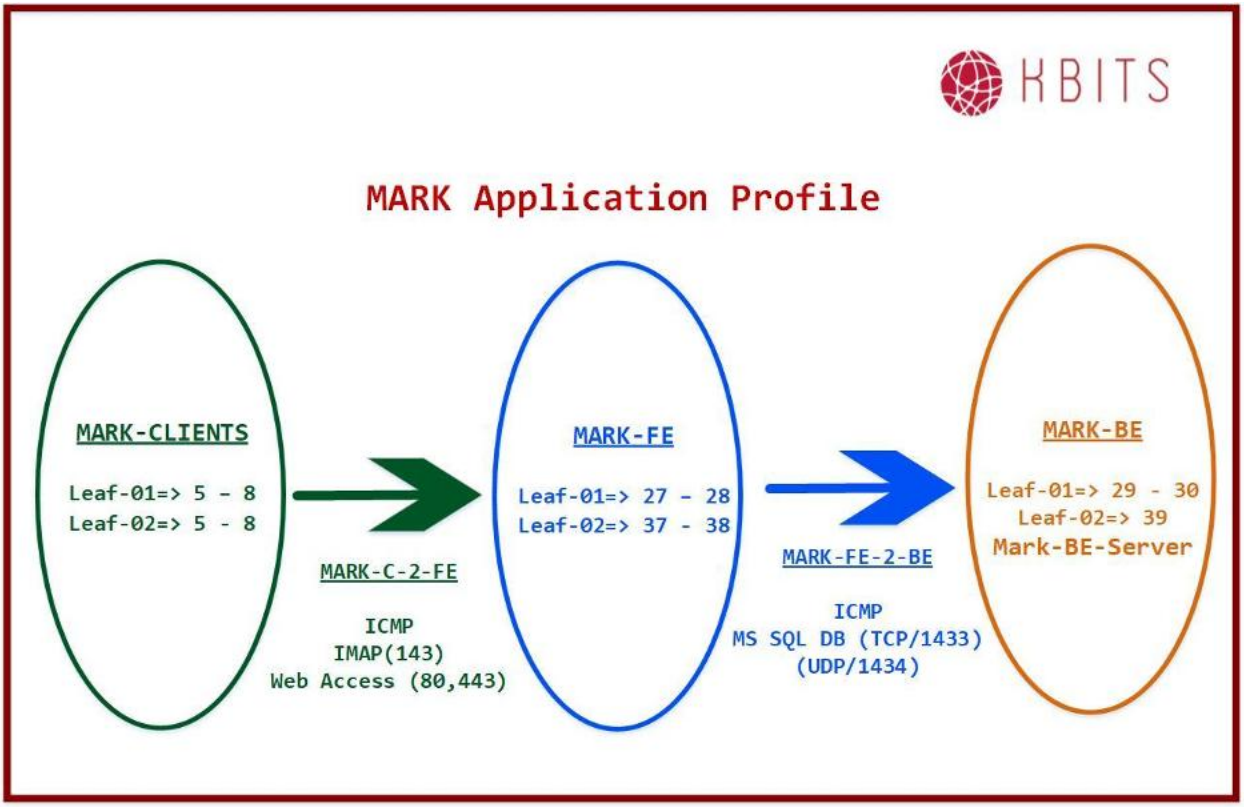
- Create a Contract allowing Access from the MARK-FE EPG towards the MARK-BE EPG based on the following:

  - Contract Name: **MARK-FE-2-BE**
  - Subject Name: **MARK-FE-2-BE**
  - Filters:
    - Name: **KBITS/MS-SQL-DB-ACCESS**
    - Name: **KBITS/ICMP-PING**

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Lab 10 – Application Provisioning – Provisioning Contracts based on Mark Application Profile

MARK Application



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Application Provisioning – Provisioning Contracts

Task 1 – Provisioning the MARK-C-2-FE contract for the MARK-CLIENT EPG

- Click **Tenant -> KBITS -> Application Profiles -> MARK-APPS -> Application EPGs -> MARK-CLIENTS -> Contracts-> Right-click -> Add Consumed Contract**

- Provision the MARK-C-2-FE contract as a Consumed Contract.

  - Contract Name: **MARK-C-2-FE**
  - Provision type: **Consumed**

Task 2 – Provisioning the MARK-C-2-FE contract for the MARK-FE EPG

- Click **Tenant -> KBITS -> Application Profiles -> MARK-APPS -> Application EPGs -> MARK-FE -> Contracts-> Right-click -> Add Provided Contract**

- Provision the MARK-C-2-FE contract as a Provided Contract.

  - Contract Name: **MARK-C-2-FE**
  - Provision type: **Provided**

Task 3 – Provisioning the MARK-FE-2-BE contract for the MARK-FE EPG

- Click **Tenant -> KBITS -> Application Profiles -> MARK-APPS -> Application EPGs -> MARK-FE -> Contracts-> Right-click -> Add Consumed Contract**

- Provision the MARK-FE-2-BE contract as a Consumed Contract.

  - Contract Name: **MARK-FE-2-BE**
  - Provision type: **Consumed**

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Task 4 – Provisioning the MARK-FE-2-BE contract for the MARK-BE EPG

- Click **Tenant -> KBITS -> Application Profiles -> MARK-APPS -> Application EPGs -> MARK-BE -> Contracts-> Right-click -> Add Provided Contract**

- Provision the MARK-FE-2-BE contract as a Provided Contract.

    - Contract Name: **MARK-FE-2-BE**
    - Provision type: **Provided**

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CCIE Data Center v3 – ACI

Authored By:

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CCDE # 20110020

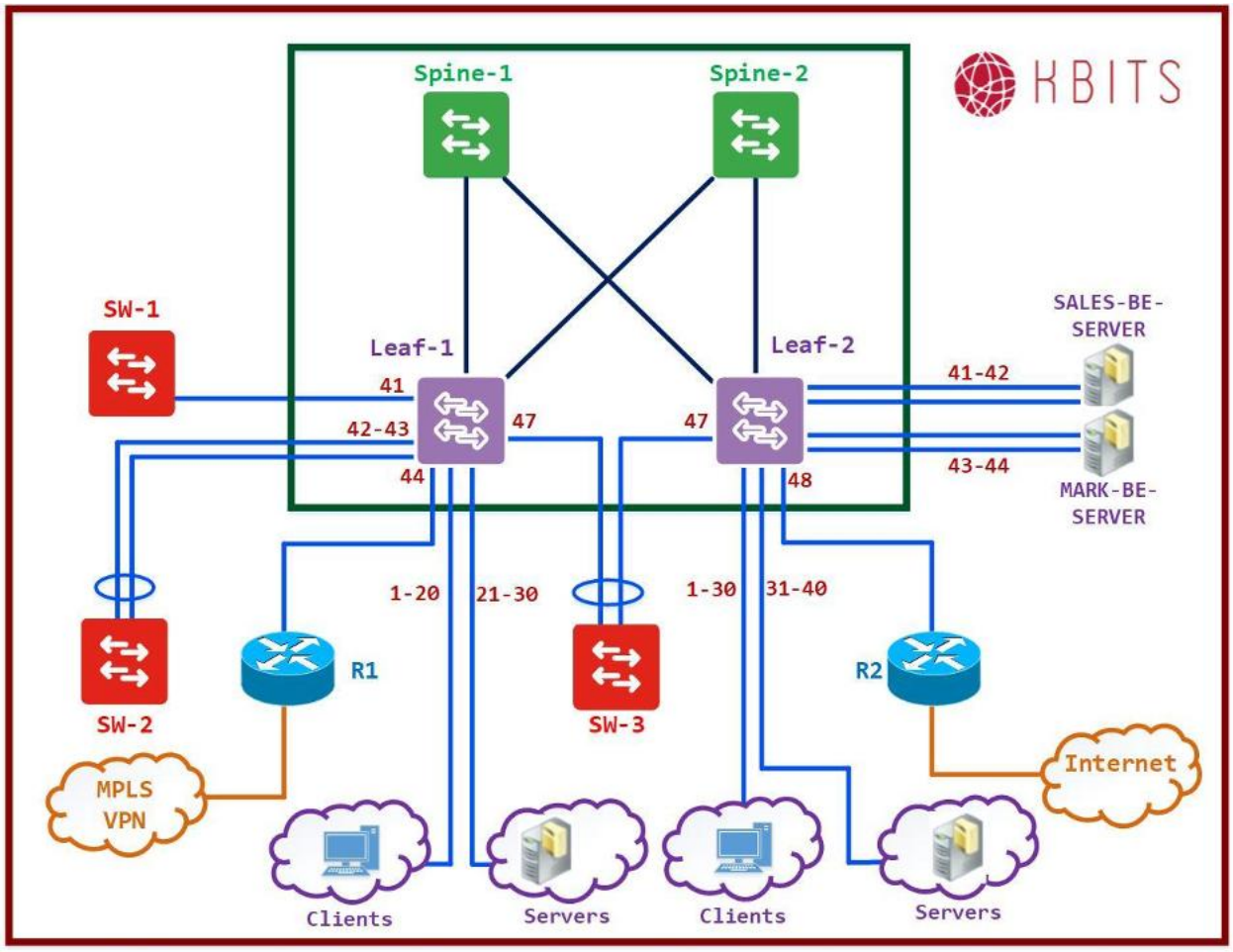
Module 4 – External Domains – L2OUT & L3OUT



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Lab 1 – Configuring L2OUT – External Bridged Outside

Physical Topology



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Configuring L2OUT

Note: The External Domain Labs are based on the successful completion of Module 3.

- The VLAN 10 & 20 are stretched between ACI & Non-ACI Domains.
- Devices connected to VLAN 10 are located on Non-ACI Switches SW1 & SW2. Sales Clients are allocated to this VLAN.
- Devices connected to VLAN 20 are located on Non-ACI Switches SW2 & SW3. Sales FE are allocated to this VLAN.

Task 1 – Configure a L2OUT – VLAN 10

- Click **Tenant -> KBITS -> Networking -> External Bridge Networks -> Right-click -> Create Bridged Outside**

- Configure a Bridge Outside based on the following:

  - Name: **L2OUT-SALES-CLIENTS-VLAN-10**
  - External Bridge Domain: **EXT-L2-PORTS**
  - Bridge Domain: **BD1**
  - VLAN: **10**
  - External L2 Connection:
    - Port: **Leaf-1 - 101/1/41**
    - PC: **IPG-SW2-PC**
  - External L2OUT Network EPG: **L2OUT-SALES-CLIENTS**

Task 2 – Configure a L2OUT – VLAN 20

- Click **Tenant -> KBITS -> Networking -> External Bridge Networks -> Right-click -> Create Bridged Outside**

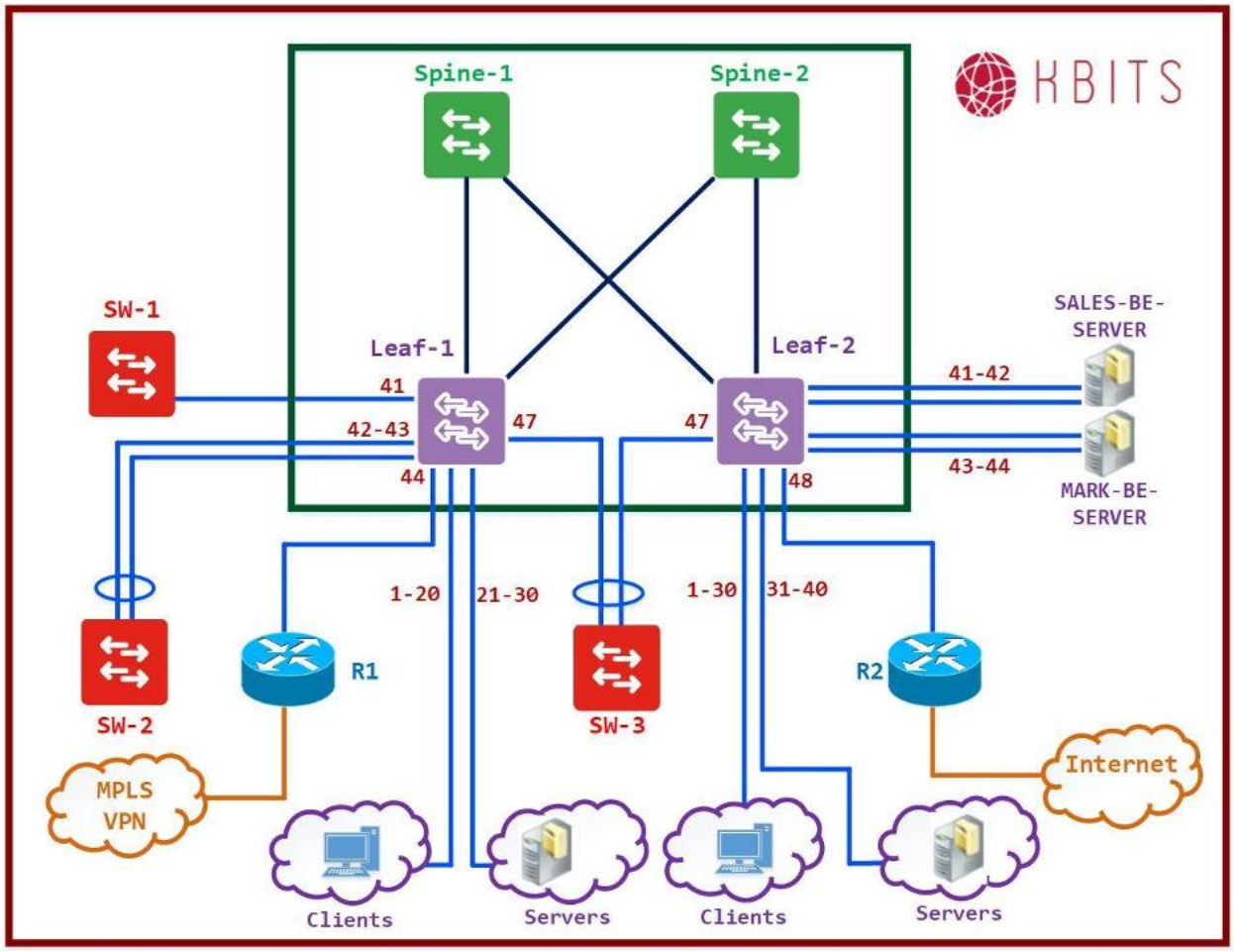
- Configure a Bridge Outside based on the following:

  - Name: **L2OUT-SALES-CLIENTS-VLAN-20**
  - External Bridge Domain: **EXT-L2-PORTS**
  - Bridge Domain: **BD1**
  - VLAN: **20**
  - External L2 Connection:
    - PC: **IPG-SW2-PC**
    - vPC: **IPG-SW3-vPC**
  - External L2OUT Network EPG: **L2OUT-SALES-FE**

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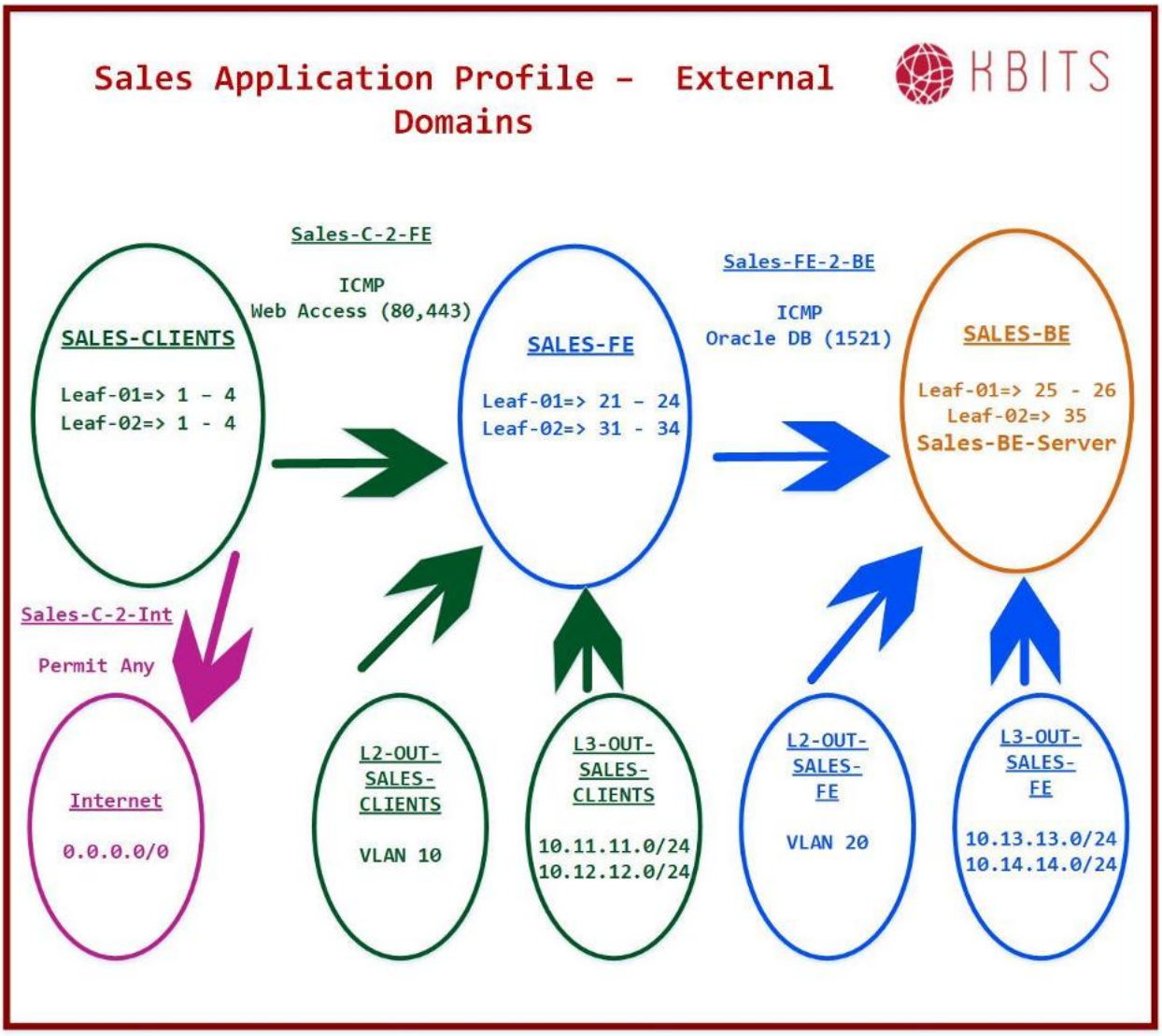
Lab 2 – Configuring L2OUT – Provisioning Contracts

Physical Topology



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L2OUT Provisioning Contracts

Task 1 – Provisiong the SALES-C-2-FE contract for the L2-OUT-SALES-CLIENTS EPG

- Click **Tenant -> KBITS -> Networking -> External Bridge Networks -> L2OUT-SALES-CLIENTS-VLAN-10 -> Networks -> SALES-CLIENTS-L2OUT -> Contracts**

- Provision the SALES-C-2-FE contract as a Consumed Contract.

  - Contract Name: **SALES-C-2-FE**
  - Provision type: **Consumed**

Task 2 – Provisiong the SALES-FE-2-BE contract for the L2-OUT-SALES-FE EPG

- Click **Tenant -> KBITS -> Networking -> External Bridge Networks -> L2OUT-SALES-FE-VLAN-20 -> Networks -> SALES-FE-L2OUT -> Contracts**

- Provision the SALES-FE-2-BE contract as a Consumed Contract.

  - Contract Name: **SALES-FE-2-BE**
  - Provision type: **Consumed**

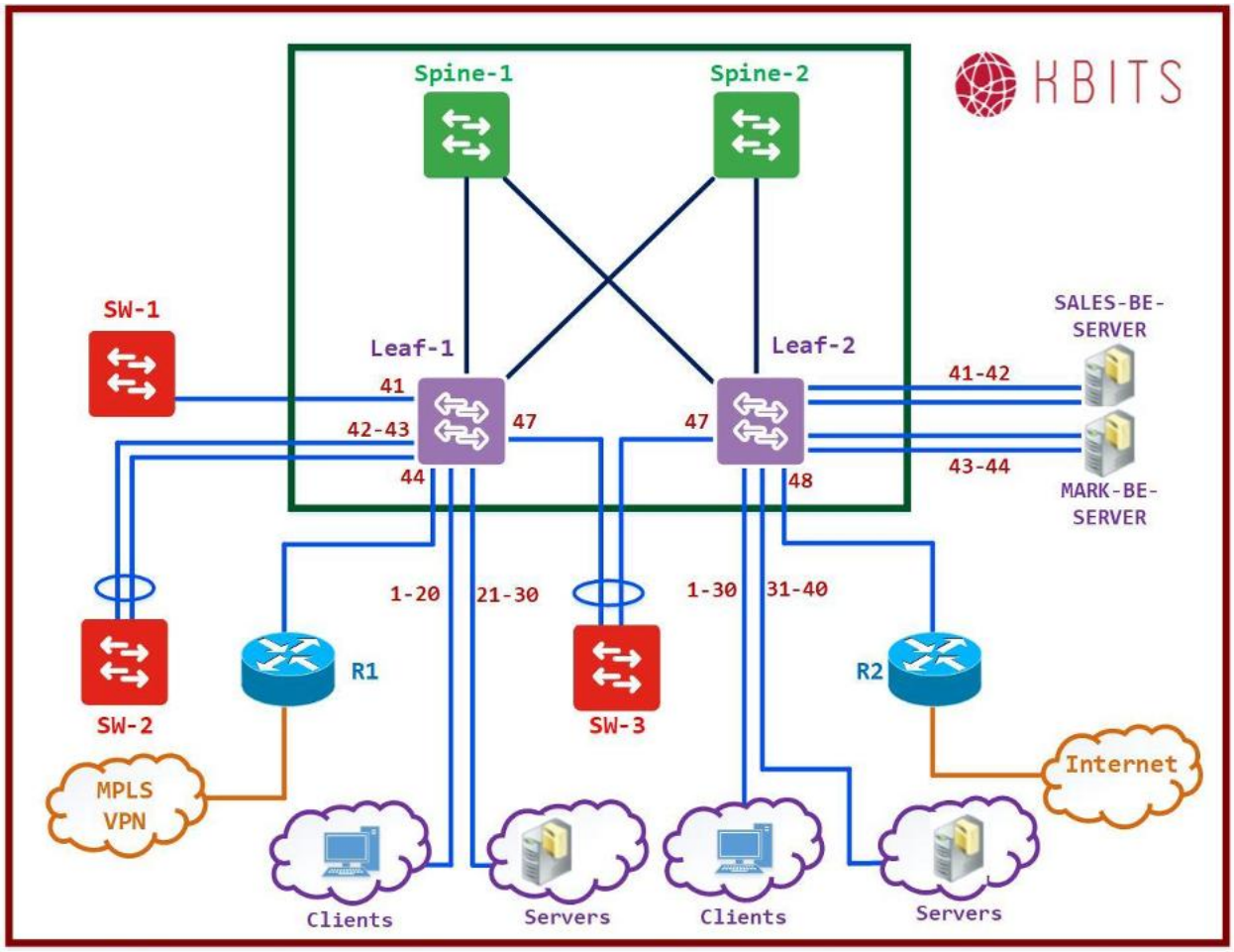
- Provision the SALES-C-2-FE contract as a Provisioned Contract.

  - Contract Name: **SALES-C-2-FE**
  - Provision type: **Provided**

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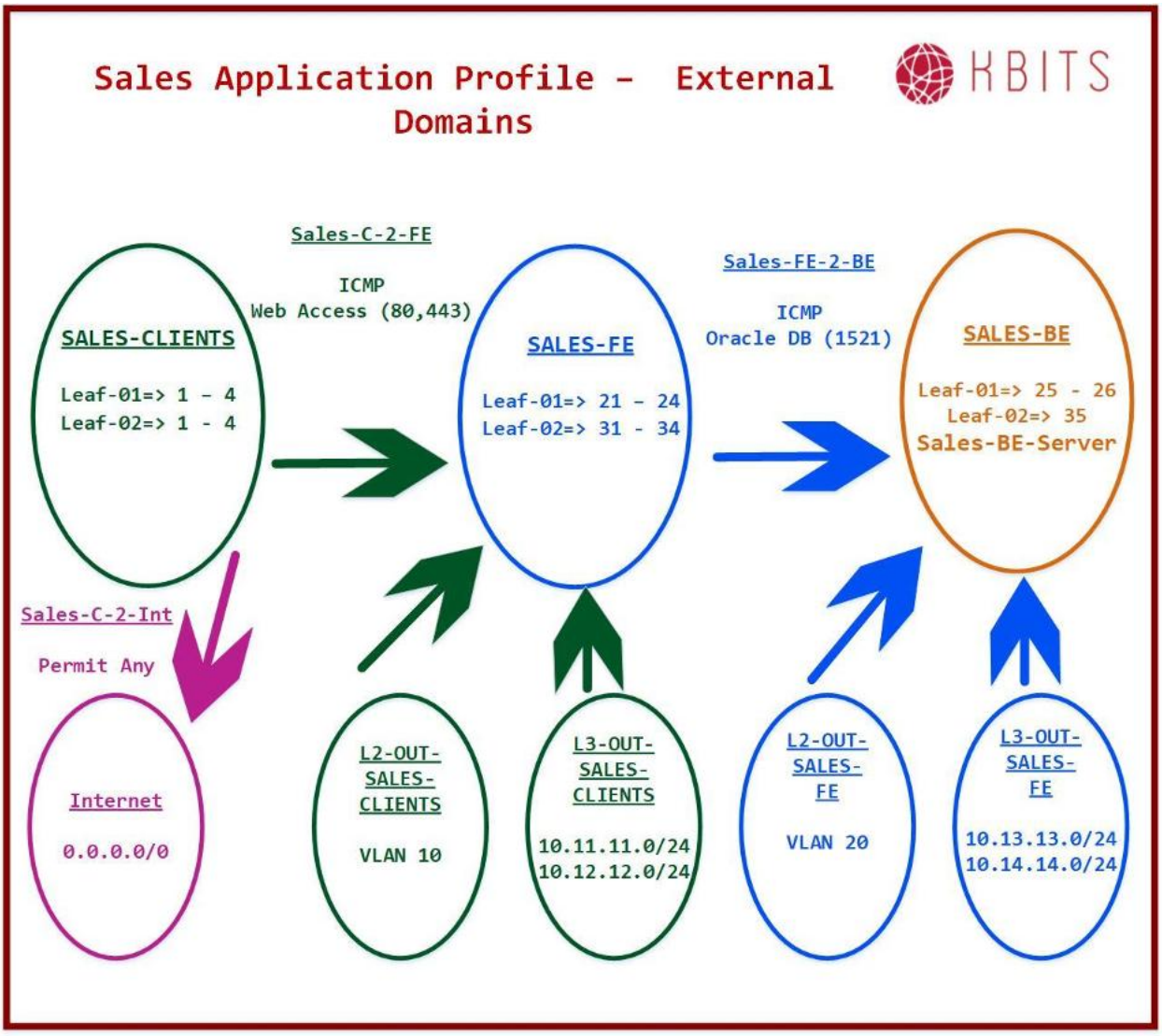
Lab 3 – Configuring L3OUT – Configuring MP-BGP in the Fabric

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Task 1 – Configure a POD Policy Group

- Click **Fabric -> Fabric Policies -> Pods -> Policy Group -> Right-click -> Create Pod Policy Group**

- Configure the Policy Group based on the following:

  - Name: MY-POD-POLICY-GROUP
  - BGP Route Reflector Policy: default (**Click the Edit Link**)

Task 2 – Configure the Fabric for MP-BGP

- Configure the Policy based on the following:

  - AS: 65001
  - Route Reflectors: Spine1(103) & Spine2(104)

- Click **Submit.**

Task 3 – Configure a POD Profile

- The Profile links to the POD Policy Group created in the previous step.

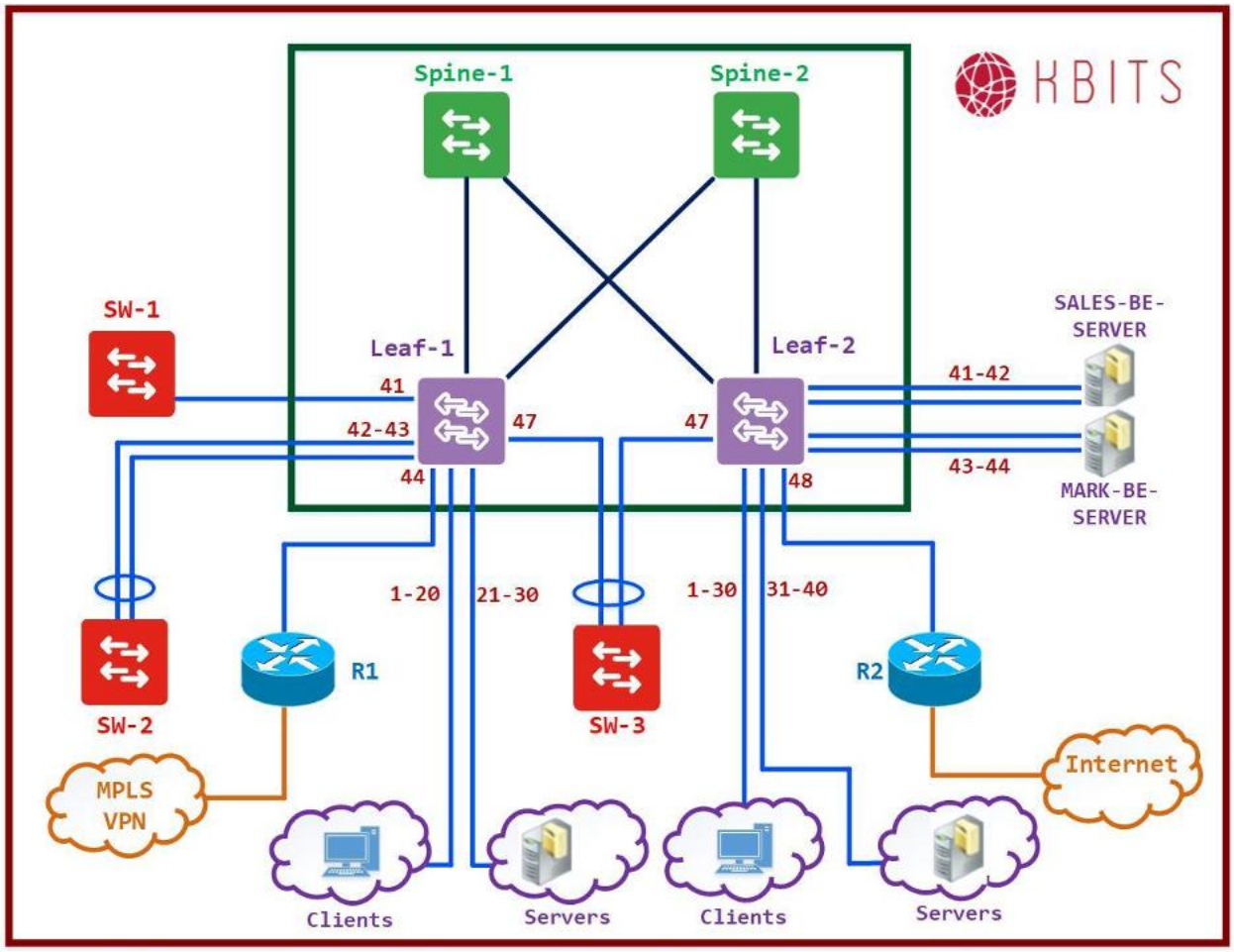
- Click **Fabric -> Fabric Policies -> Pods -> Profiles -> Pod Profile Default -> default**

- Configure the Fabric Policy Group as **MY-POD-POLICY-GROUP**

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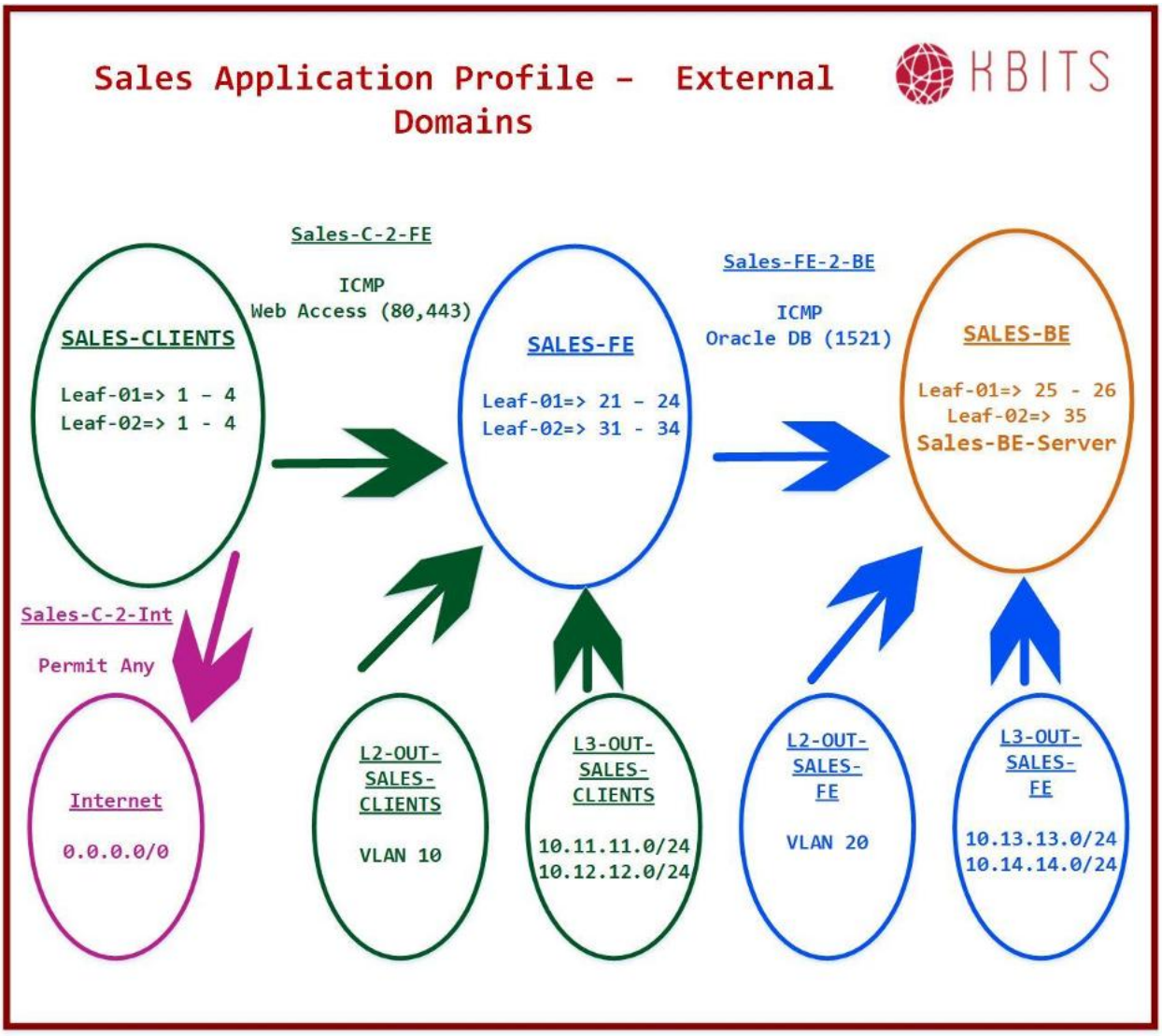
Lab 4 – Configuring L3OUT – Configuring Routed Outside - EIGRP

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Task 1 – Configure the L3OUT using EIGRP

- Click **Tenant -> KBITS -> Networking -> L3Outs -> Right-click -> Create L3OUT**

- The Create L3Out Wizard is initiated. Configure the **Identity Page** based on the following and click **Next**.

  Name: **L3OUT-EIGRP**
  VRF: **GRT**
  External Routed Domain: **EXT-L3-PORTS**

  Protocol: **EIGRP**
  AS # : **111**

- Configure the **Nodes & Interfaces Page** based on the following and click **Next**.

  Interface Type: Layer 3: **Routed**
  Layer 2: **Port**

  Node ID: **Leaf-01(Node-101)**
  Router-ID: **11.11.11.11**
  Interface: **Eth1/44**
  IP Address: **192.1.100.11/24**

- Configure the **Protocols Page** based on the following and click **Next**.

  Node: Node-101:

  Interface: 1/44: Policy: **default**

- Configure the **External EPG Page** based on the following and click **Finish**.

  Uncheck the "Default EPG for all Exernal Networks"

  Name: **L3OUT-SALES-CLIENTS**
  Networks: 10.11.11.0/24 & 10.12.12.0/24

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- Click **Tenant -> KBITS -> Networking -> L3Outs -> L3OUT-EIGRP -> External EPGs -> Right-click -> Create External EPG**

  Name: **L3OUT-SALES-FE**
  Networks: 10.13.13.0/24 & 10.14.14.0/24

- Click **Submit.**

Task 2 – Associating the L3OUT with the Bridge Domain

- Click **Tenant -> KBITS -> Networking -> Bridge Domains -> BD1 -> Policy -> L3 Configurations -> Associated L3OUT**

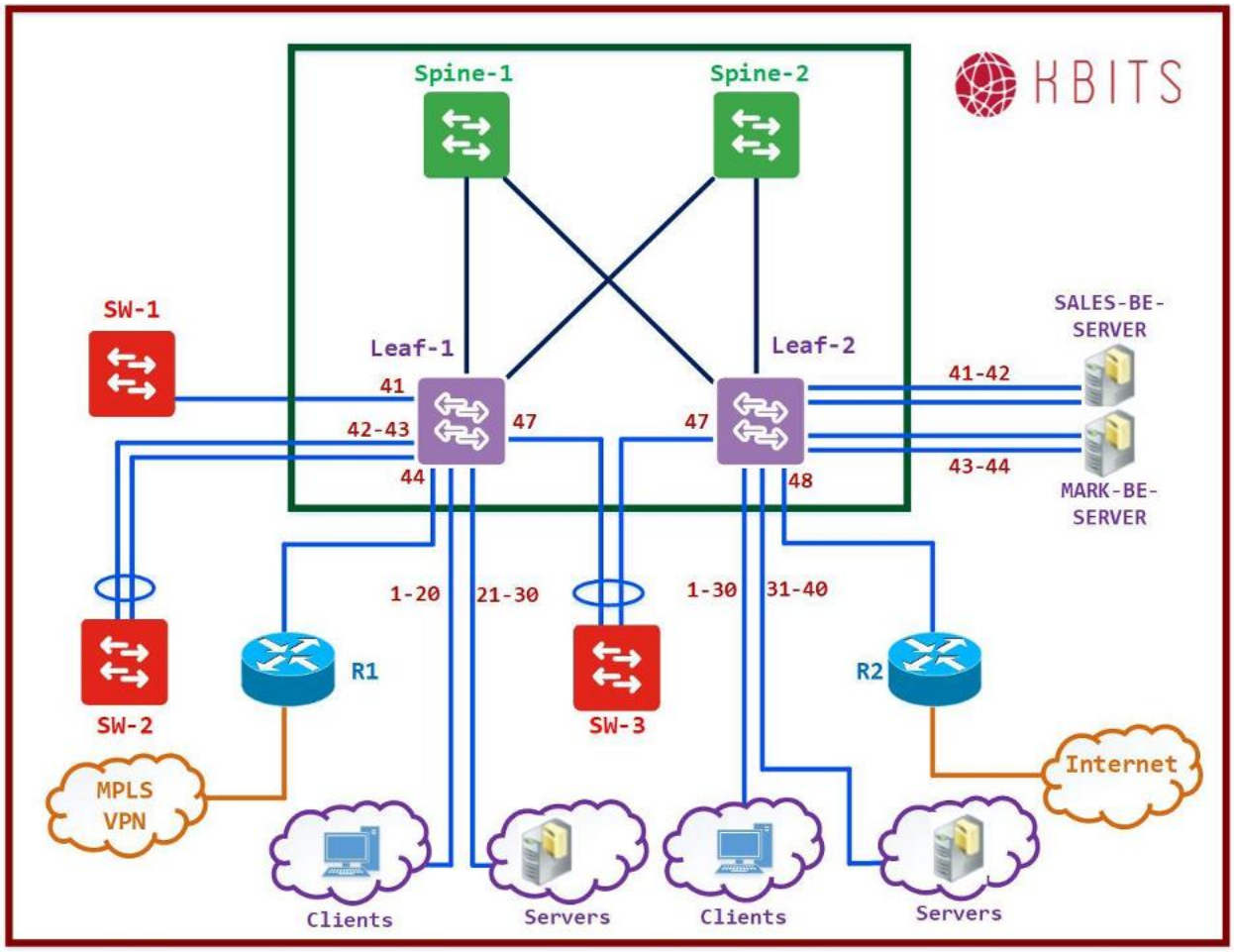
- **Select L3OUT-EIGRP** from the drop-down list and update.

- Click **Submit.**

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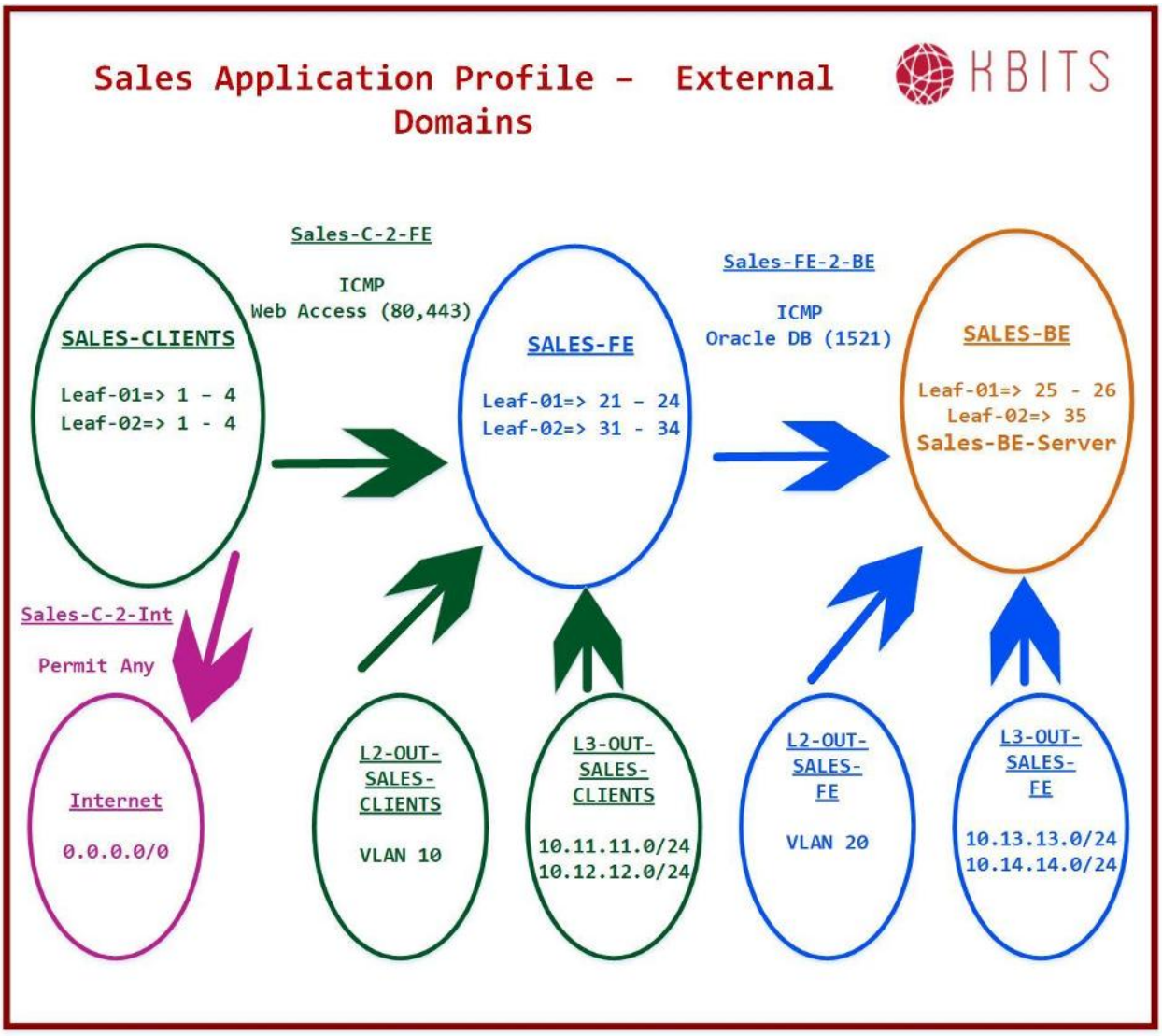
Lab 5 – Configuring L3OUT – Provisioning Contracts

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L3OUT Provisioning Contracts

Task 1 – Provisioning the SALES-C-2-FE contract for the L3-OUT-SALES-CLIENTS EPG

- Click **Tenant -> KBITS -> Networking -> L3Outs -> L3OUT-EIGRP -> External EPGs -> L3OUT-SALES-CLIENTS -> Contracts -> Consumed Contracts**

- Provision the SALES-C-2-FE contract as a **Consumed Contract.**

  - Contract Name: **SALES-C-2-FE**

Task 2 – Provisioning the SALES-FE-2-BE contract for the L3-OUT-SALES-FE EPG

- Click **Tenant -> KBITS -> Networking -> L3Outs -> L3OUT-EIGRP -> External EPGs -> L3OUT-SALES-FE -> Contracts -> Provided Contracts**

- Provision the SALES-C-2-FE contract as a **Provided Contract**.

  - Contract Name: **SALES-C-2-FE**

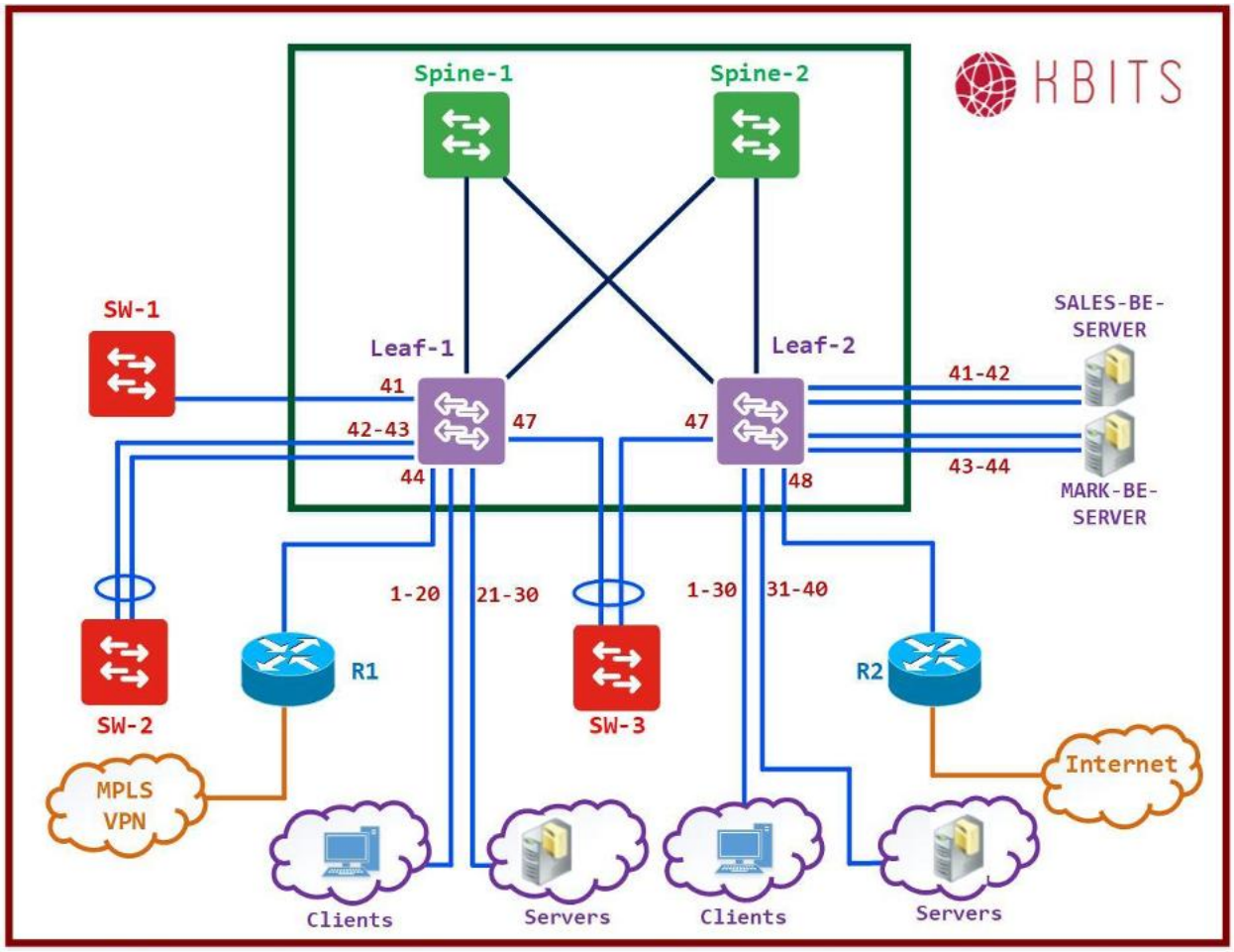
- Click **Consumed Contracts** to Provision the SALES-FE-2-BE contract as a **Consumed Contract**.

  - Contract Name: **SALES-FE-2-BE**

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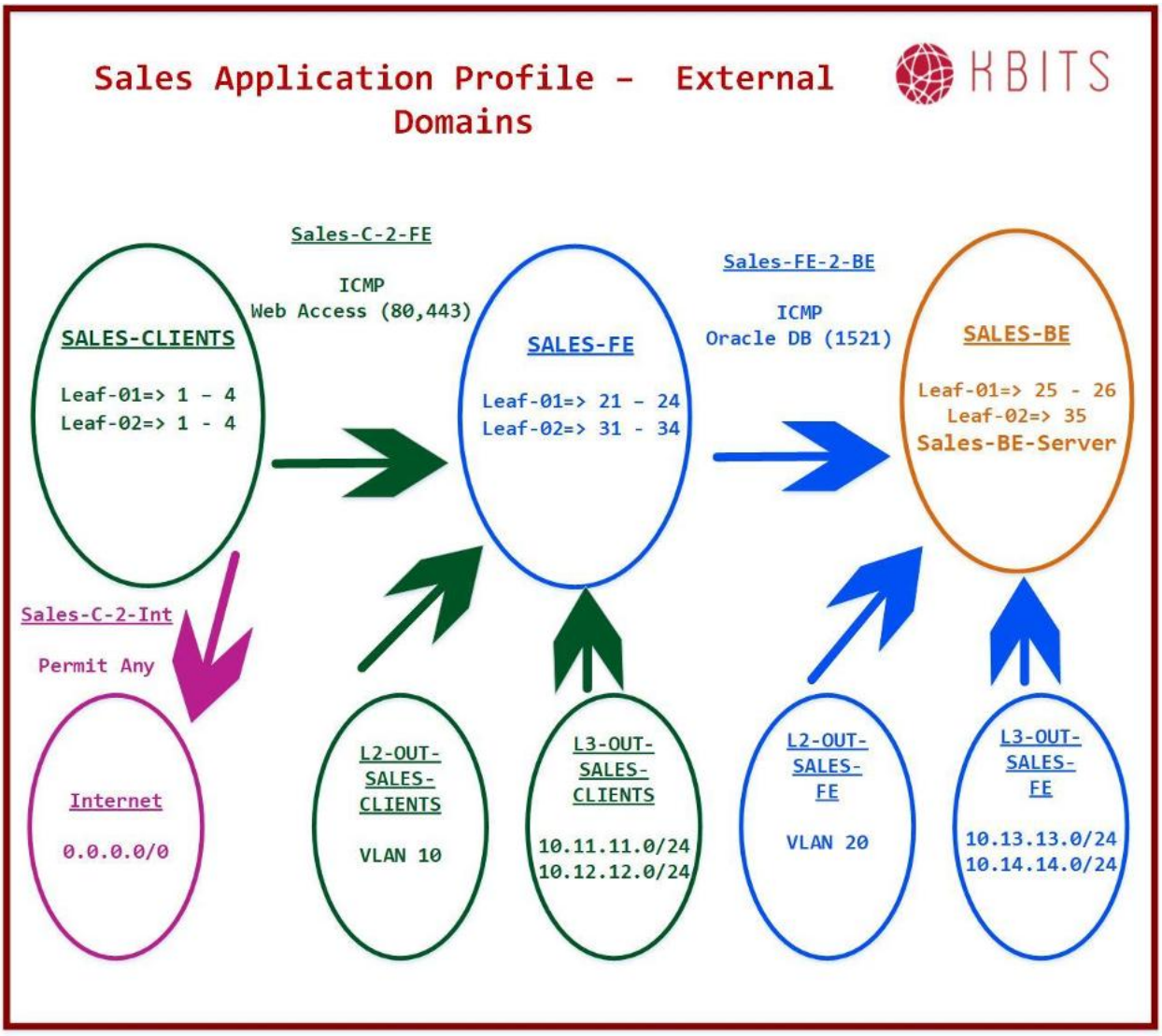
Lab 6 – Configuring L3OUT – Configuring Routed Outside – OSPF

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Task 1 – Configure the L3OUT using OSPF

- Click **Tenant -> KBITS -> Networking -> L3Outs -> Right-click -> Create L3OUT**

- The Create L3Out Wizard is initiated. Configure the **Identity Page** based on the following and click **Next**.

  Name: **L3OUT-OSPF**
  VRF: **GRT**
  External Routed Domain: **EXT-L3-PORTS**

  Protocol: **OSPF**
  Area #: **0**
  Area Type: **Regular**

- Configure the **Nodes & Interfaces Page** based on the following and click **Next**.

  Interface Type: Layer 3: **Routed**
  Layer 2: **Port**

  Node ID: **Leaf-02(Node-102)**
  Router-ID: **22.22.22.22**
  Interface: **Eth1/48**
  IP Address: **192.1.200.22/24**

- Configure the **Protocols Page** based on the following and click **Next**.

  Node: Node-102:

  Interface: 1/48: Policy: **default**

- Configure the **External EPG Page** based on the following and click **Finish**.

  Uncheck the "Default EPG for all Exernal Networks"

  Name: **Internet**
  Networks: 0.0.0.0/0

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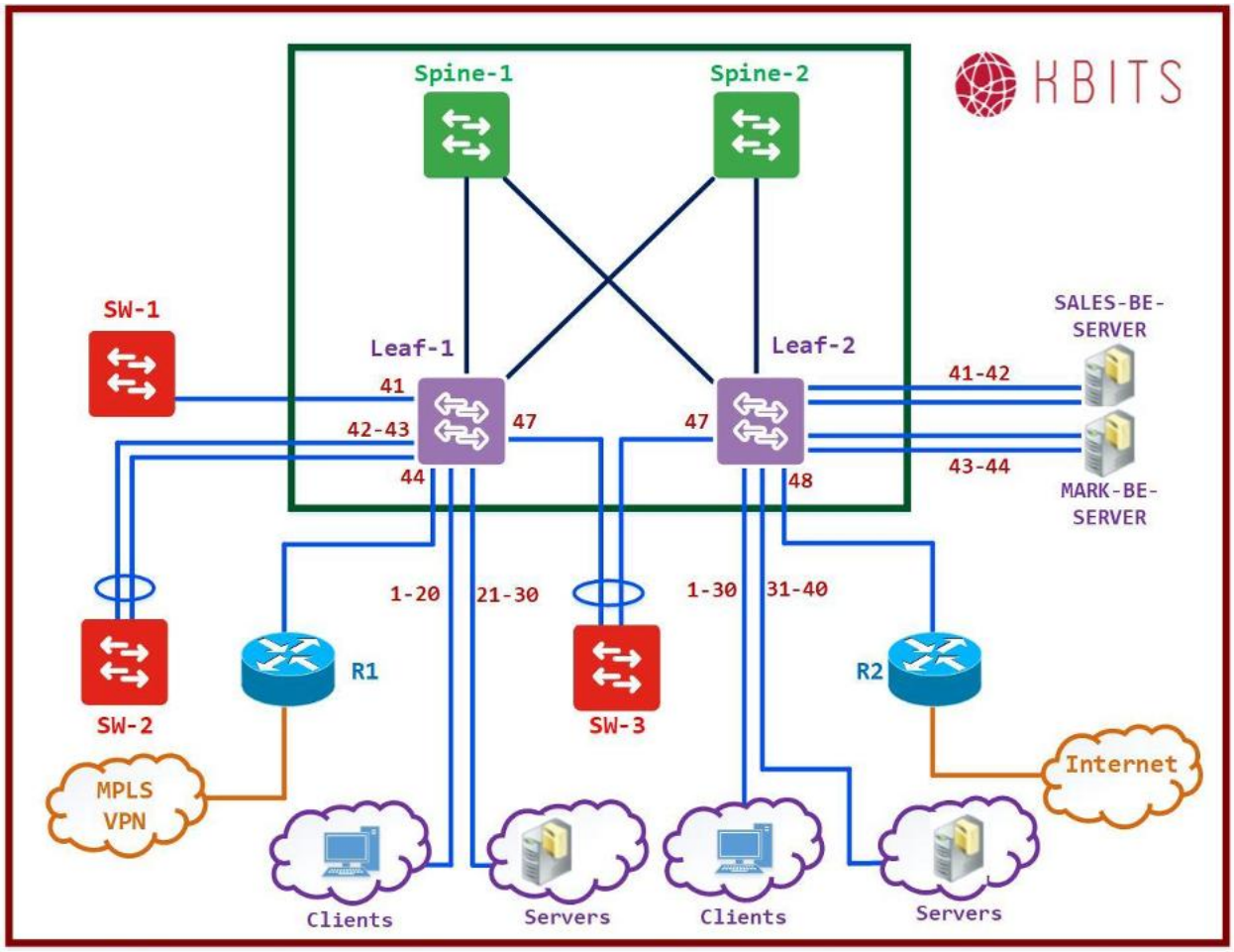
Task 2 – Associating the L3OUT with the Bridge Domain

- Click **Tenant -> KBITS -> Networking -> Bridge Domains -> BD1 -> Policy -> L3 Configurations -> Associated L3OUT**
- **Select L3OUT-OSPF** from the drop-down list and update.
- Click **Submit.**

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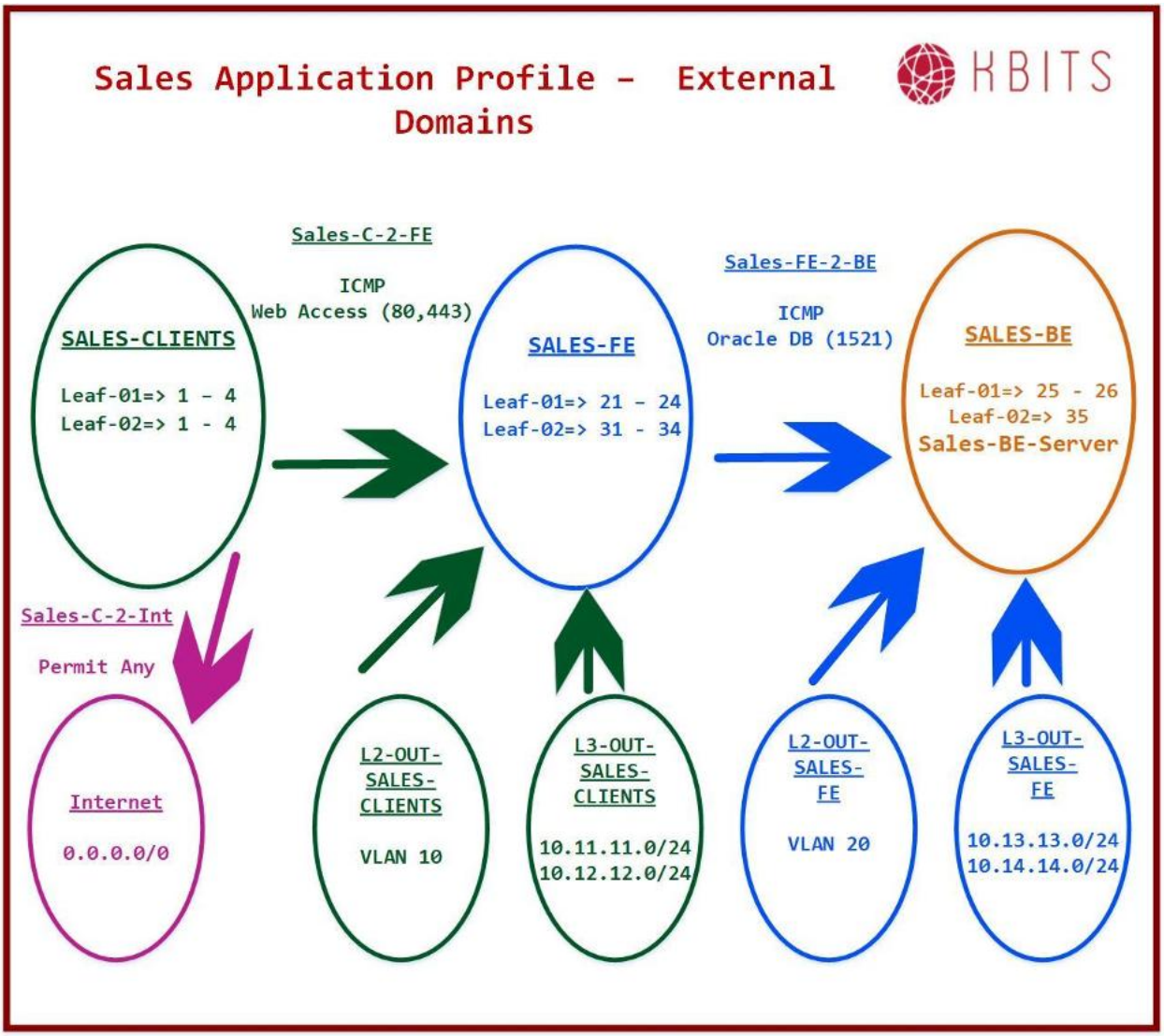
Lab 7 – Configuring L3OUT – Provisioning Internet Contract

Physical Topology



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Creating Filters

Task 1 – Create a Filter for Internet

- Click **Tenant -> KBITS -> Contracts -> Filters -> Create Filter**

- Create a Filter for Web Access based on the following:

  - Name: **Internet**
  - Policy#1:
    - Name: **Internet**
    - Ethertype: **IP**
    - Protocol: **Any**
    - Destination Port Range: **Unspecified to Unspecified**

Creating Contracts

Task 1 – Create a Contract for traffic from SALES-CLIENTS EPG towards the Internet

- Click **Tenant -> KBITS -> Contracts -> Standard -> Create**

- Create a Contract allowing Access from the SALES-CLIENTS EPG towards the Internet based on the following:

  - Contract Name: **SALES-C-2-INT**
  - Subject Name: **SALES-C-2-INT**
  - Filters:
    - Name: **KBITS/Internet**

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L3OUT Provisioning Contracts

Task 1 – Provisiong the SALES-C-2-INT contract for the L3-OUT-SALES-CLIENTS EPG

- Click **Tenant -> KBITS -> Networking -> L3Outs -> L3OUT-OSPF -> External EPGs -> Internet -> Contracts -> Provided Contracts**

- Provision the SALES-C-2-INT contract as a **Provided Contract.**
  - Contract Name: **SALES-C-2-INT**

Task 2 – Provisiong the SALES-FE-2-BE contract for the L3-OUT-SALES-FE EPG

- Click **Tenant -> KBITS -> Application Profiles -> SALES-APPS -> Application EPGs -> SALES-CLIENTS -> Contracts -> Right-click -> Add Consumed Contract**

- Provision the SALES-C-2-INT contract as a Consumed Contract.
  - Contract Name: **SALES-C-2-INT**
  - Provision type: **Consumed**

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CCIE Data Center v3 – ACI

Authored By:

Khawar Butt

Hepta CCIE # 12353
(R/S, Security, SP, Voice, Storage, Data Center, Wireless)

CCDE # 20110020

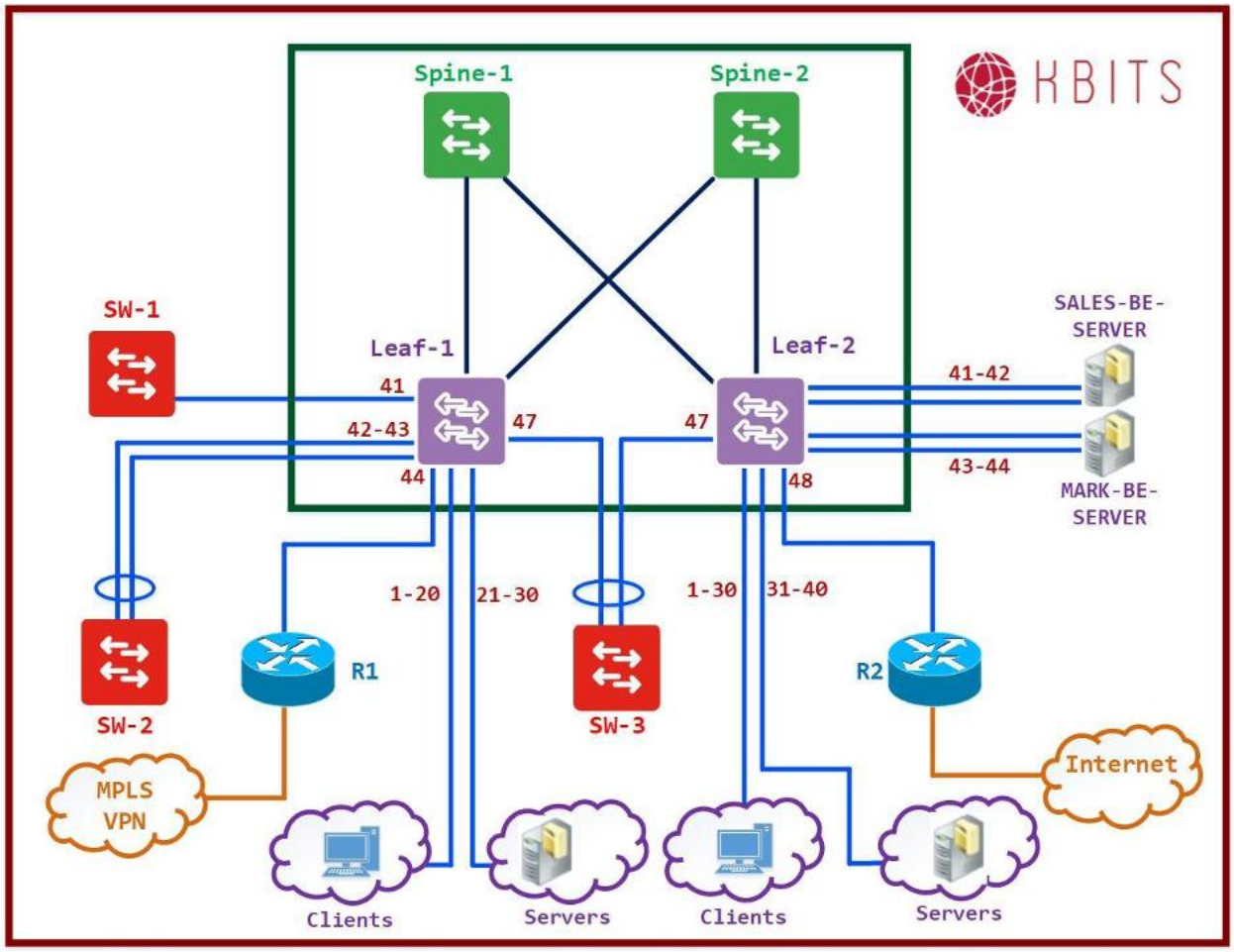
Module 5 – Advanced Implementations



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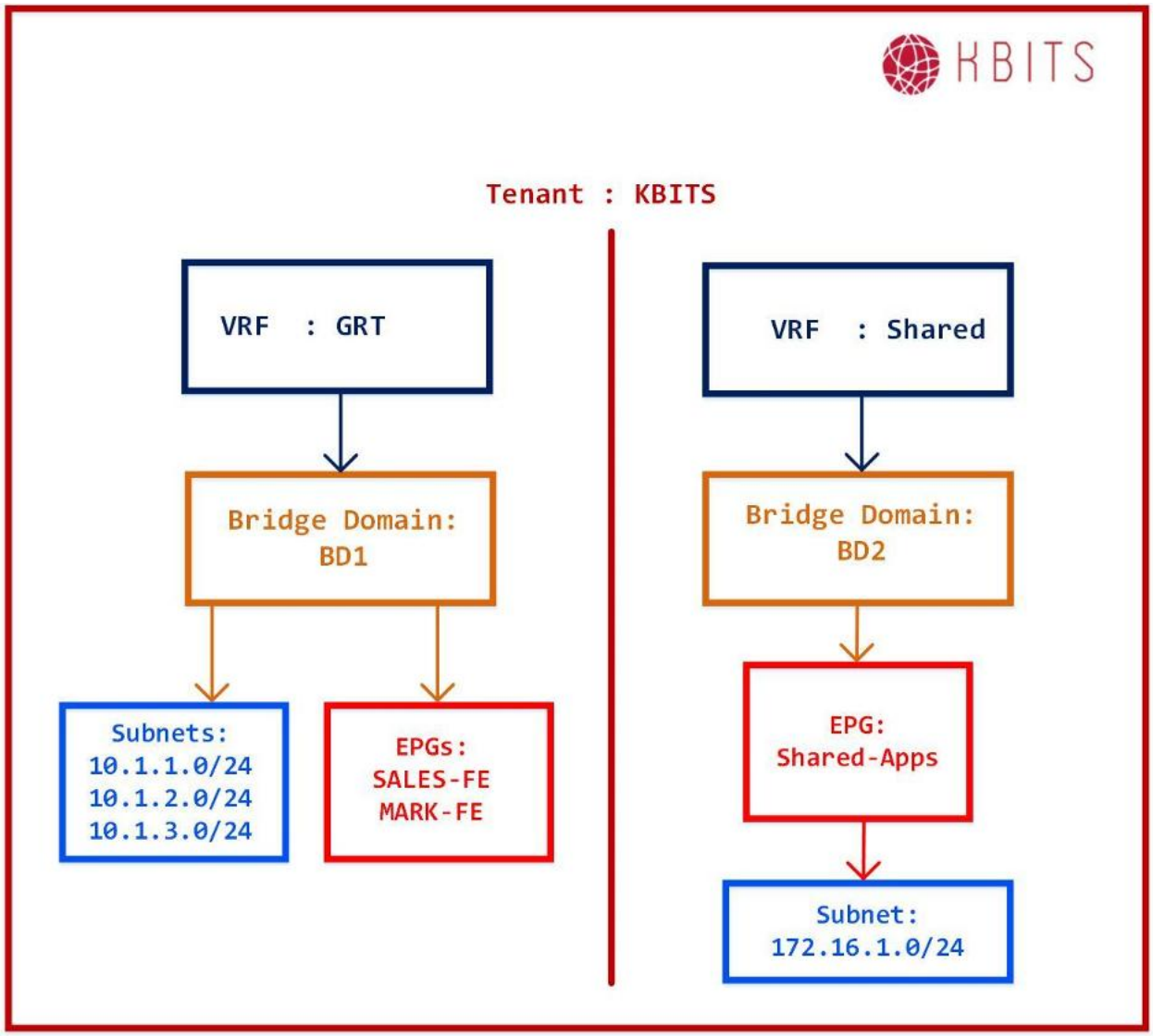
Lab 1 – Inter-VRF Communications

Physical Topology



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Scenario & Bakground:

- The **KBITS** Tenant is already configured with a VRF named **GRT** which contains a bridge domain named **BD1**. **BD1** is already linked to the subnets and EPGs based on the above diagram.
- The **KBITS** Tenant was to add another VRF that will contain a bridge domain named **BD2**. BD2 will be linked to an EPG named **Shared-Apps**. The Devices/Apps in this EPG will be required to provide access to Devices/Apps in EPGs **SALES-FE** & **MARK-FE** in the **GRT** VRF.

Task 1 – Create a VRF

- Create a VRF within Tenant **KBITS** based on the following:
  - Name: **Shared**

- Click **Tenant -> KBITS -> Networking -> VRF -> Right-click -> Create VRF**

- Create a VRF based on the information above.

Task 2 – Create a Bridge Domain

- Create a Bridge Domain within Tenant **KBITS** based on the following:
  - Name: **BD2**
  - VRF: **Shared**

- Click **Tenant -> KBITS -> Networking -> Bridge Domain -> Right-click -> Create Bridge Domain**

- Create the Bridge Domain based on the information above.

Task 3 – Create an Application Profile

- Click **Tenant -> KBITS -> Application Profiles -> Right-click -> Create Application Profile**

- Create an Application Profile based on the following:
  - Name: **Shared-Apps-Profile**

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Task 4 – Create an EndPoint Groups (EPGs)

- Click **Tenant -> KBITS -> Application Profiles -> Shared-Apps-Profile -> Application EPGs -> Right-click -> Create Application EPG**

- Create the EPG based on the following:
  - Name: **Shared-Apps**
  - Bridge domain: **BD2**

Task 5 – Create the subnet under the Provider EPG (Shared-Apps) based on the following:

- Click **Tenant -> KBITS -> Application Profiles -> Shared-Apps-Profile -> Application EPGs -> Shared-Apps -> Subnets -> Right-click -> Create Subnet**

- Create the Subnet based on the Diagram (**172.16.1.0/24**). Check the "**Shared Between VRFs**" Checkbox.

Task 6 – Assign port to the "Shared-Apps" EPG

- Click **Tenant -> KBITS -> Application Profiles -> Shared-Apps-Profile -> Application EPGs -> Shared-Apps -> Static Ports -> Right-click -> Deploy Static EPG on PC, VPC or Interface**

- Assign Port to the **Shared-Apps** EPG based on the following:

Port	VLAN	Port-Type	Deployment
LEAF-02 – 40	70	Trunk	Immediate

Task 7 – Create a Contract for traffic that will be provided by the EPG Shared-Apps

- Click **Tenant -> KBITS -> Contracts -> Standard -> Create Contract**

- Create a Contract based on the following:

  - Contract Name: **Shared-Apps-Access**
  - Scope: **Tenant**
  - Subject Name: **Shared-Apps-Access**
  - Filters:
    - Name: **KBITS/Web-Access**
    - Name: **KBITS/ICMP-PING**
    - Name: **KBITS/ORACLE-DB-ACCESS**

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Task 8 – Provision the Shared-Apps-Access contract for Shared-Apps EPG

- Click **Tenant -> KBITS -> Application Profiles -> Shared-Apps-Profile -> Application EPGs -> Shared-Apps -> Contracts -> Right-click -> Add Provided Contract**

- Provision the Shared-Apps-Access contract as a Provided Contract.

    - Contract Name: **Shared-Apps-Access**
    - Provision type: **Provided**

Task 9 – Provision the Shared-Apps-Access contract for the SALES-FE & MARK-FE EPGs

- Click **Tenant -> KBITS -> Application Profiles -> SALES-APPS -> Application EPGs -> SALES-FE -> Contracts -> Right-click -> Add Consumed Contract**

- Provision the Shared-Apps-Access contract as a Consumed Contract.

    - Contract Name: **Shared-Apps-Access**
    - Provision type: **Consumed**

- Click **Tenant -> KBITS -> Application Profiles -> MARK-APPS -> Application EPGs -> MARK-FE -> Contracts -> Right-click -> Add Consumed Contract**

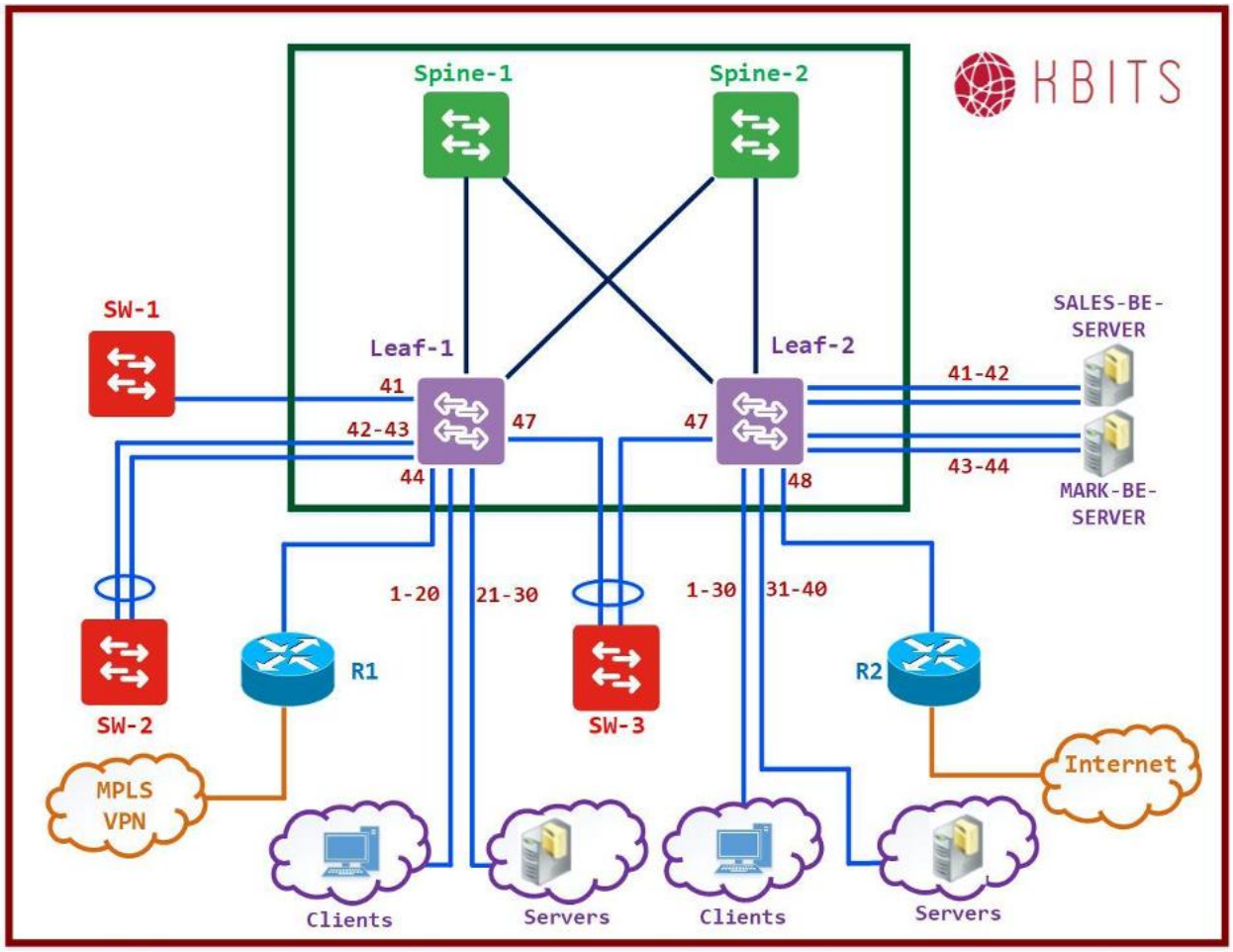
- Provision the Shared-Apps-Access contract as a Consumed Contract.

    - Contract Name: **Shared-Apps-Access**
    - Provision type: **Consumed**

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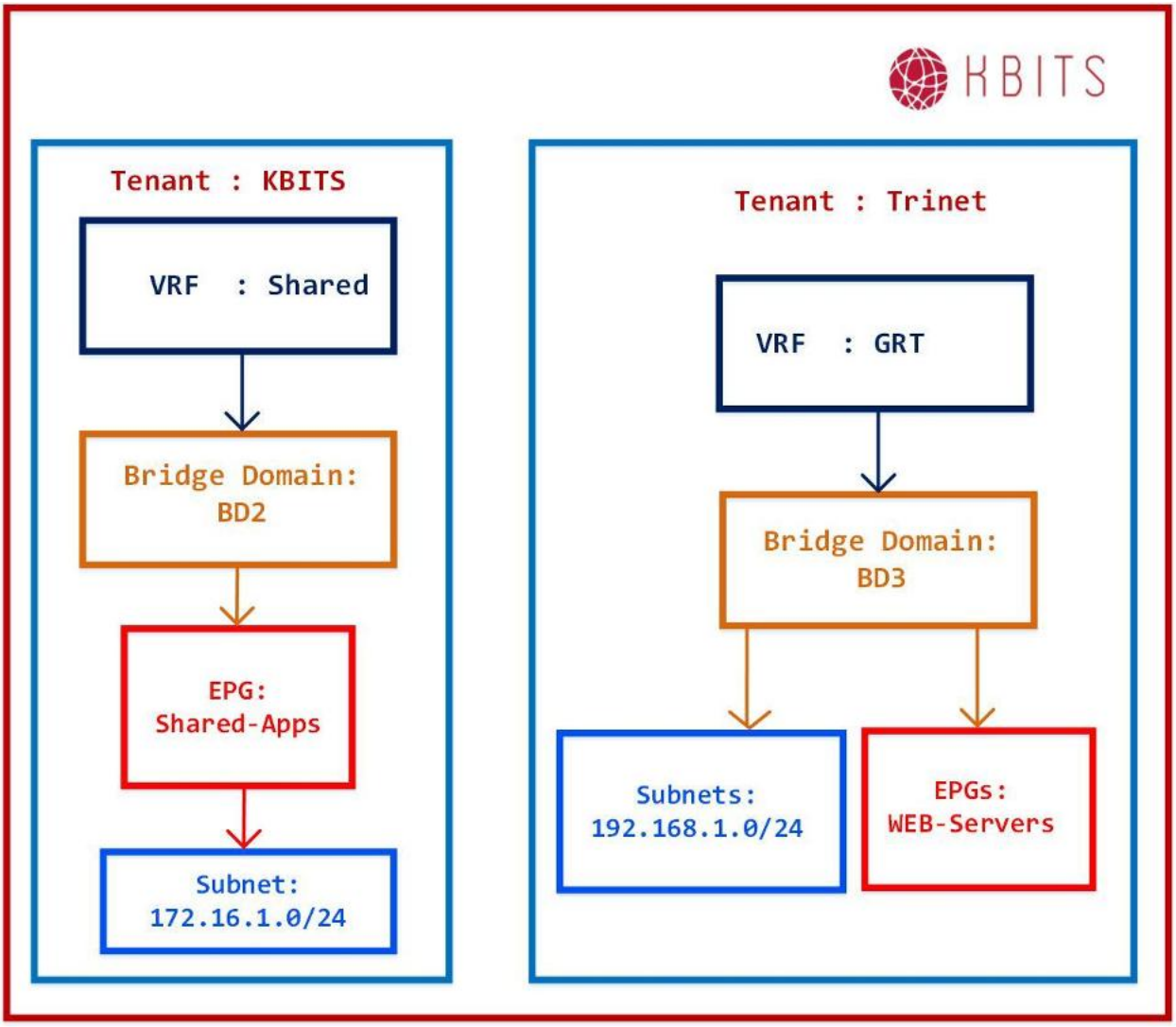
Lab 2 – Inter-Tenant Communications

Physical Topology



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Logical Topology



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Scenario & Bakground:

- The **KBITS** Tenant is already configured with a VRF named **Shared** which contains a bridge domain named **BD2**. **BD2** is already linked to EPGs based on the above diagram. The EPG is already link to the subnet based on the above diagram.
- A new Tenant name **Trinet** wants to use the infrastructure and access the Shared-Apps EPG. Create the **Trinet** Tenant based on the above diagram and provision it to access the **Shared-Apps** EPG.

Task 1 – Create the Tenant

- Click **Tenant -> Add a Tenant**

- Create a Tenant based on the following:
  - Name: **Trinet**

Task 2 – Create a VRF

- Create a VRF within Tenant **Trinet** based on the following:
  - Name: **GRT**

- Click **Tenant -> Trinet -> Networking -> VRF -> Right-click -> Create VRF**

- Create a VRF based on the information above.

Task 3 – Create a Bridge Domain

- Create a Bridge Domain within Tenant **Trinet** based on the following:
  - Name: **BD3**
  - VRF: **GRT**
  - Subnet/GW: **192.168.1.254/24**

- Click **Tenant -> Trinet -> Networking -> Bridge Domain -> Right-click -> Create Bridge Domain**

- Create the Bridge Domain based on the information above.

- Configure the Subnet/GW based on the information above. The Subnet should have the ability to be shared externally and between VRFs.

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Task 4 – Create an Application Profile

- Click **Tenant -> Trinet-> Application Profiles -> Right-click -> Create Application Profile**

- Create an Application Profile based on the following:
  - Name: **WEB-APPS**

Task 5 – Create EndPoint Groups (EPG)

- Click **Tenant -> Trinet -> Application Profiles -> WEB-APPS -> Application EGPs -> Right-click -> Create Application EPG**

- Create the EPG based on the following:
  - Name: **Web-Servers**
  - Bridge domain: **BD3**

Task 6 – Create a Contract for traffic that will be provided by the EPG Shared-Apps

- Click **Tenant -> KBITS -> Contracts -> Standard -> Create Contract**

- Create a Contract based on the following:

  - Contract Name: **Inter-Tenant-Access**
  - Scope: **Global**
  - Subject Name: **Inter-Tenant-Access**
  - Filters:
    - Name: **KBITS/ORACLE-DB-ACCESS**
    - Name: **KBITS/ICMP-PING**

Task 7 – Export the Inter-Tenant-Access Contract to Trinet

- Click **Tenant -> KBITS -> Contracts -> Standard Contracts -> Right-click and Export Contract**

- Export the Inter-Tenant-Access contract based on the following:

  - Export Contract Name: **Inter-Tenant-DB-Access**
  - Contract Name: **Inter-Tenant-Access**
  - Tenant: **Trinet**

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Task 8 – Provision the Inter-Tenant-Access contract for Shared-Apps EPG

- Click **Tenant -> KBITS -> Application Profiles -> Shared-Apps-Profile -> Application EPGs -> Shared-Apps -> Contracts -> Right-click -> Add Provided Contract**

- Provision the Inter-Tenant-Access contract as a Provided Contract.

    - Contract Name: **Inter-Tenant-Access**
    - Provision type: **Provided**

Task 9 – Provision the Inter-Tenant-DB-Access contract for the Web-Servers EPG in the Trinet tenant

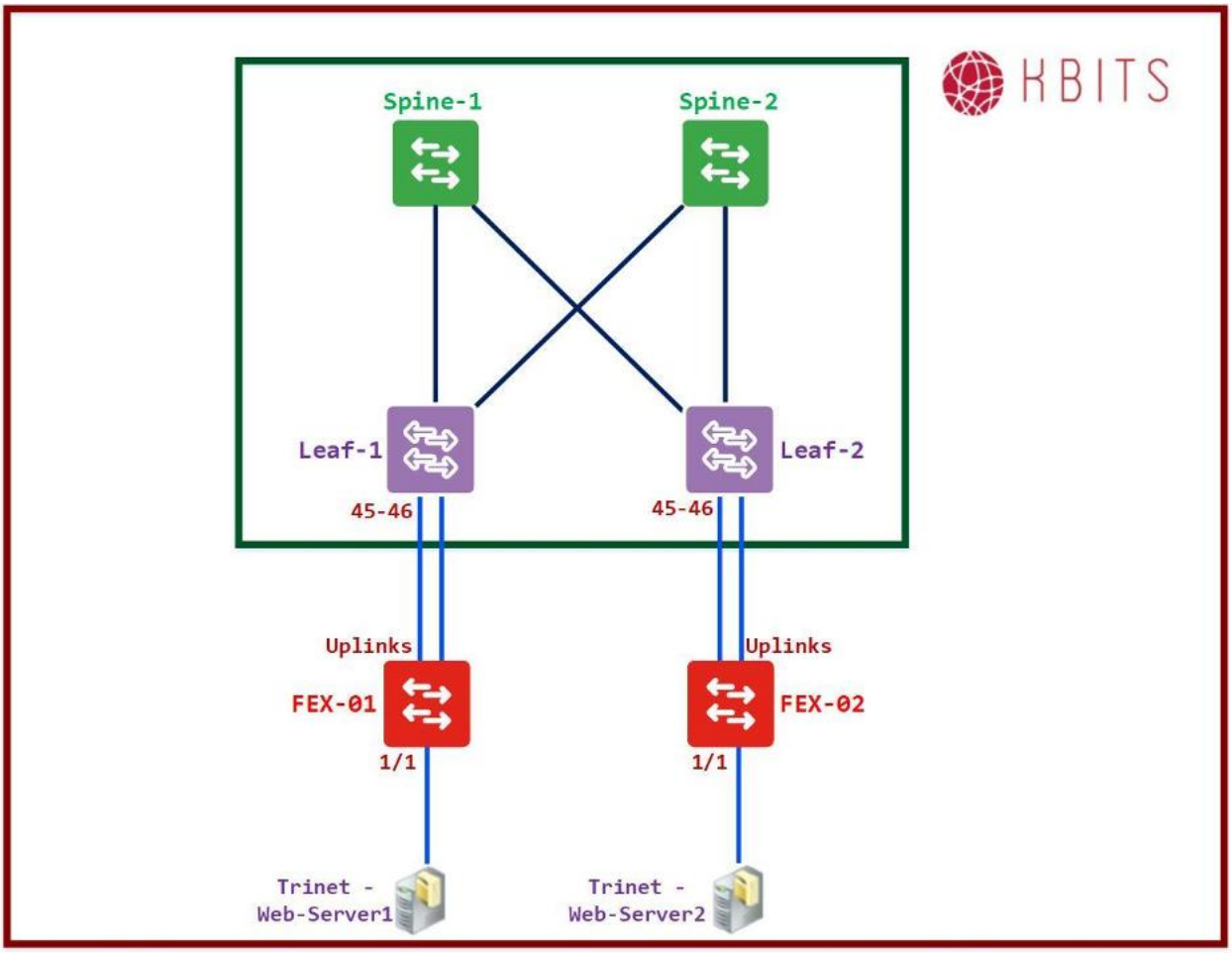
- Click **Tenant -> Trinet -> Application Profiles -> WEB-APPS -> Application EPGs -> Web-Servers -> Contracts -> Add Consumed Contract Interface**

- Provision the Inter-Tenant-DB-Access contract as a Consumed Interface Contract.

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Lab 3 – Configuring FEX in ACI

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Task 1 – Create FEX Profiles

- Click **Fabric -> Access Policies -> Interfaces -> Leaf Interfaces -> Profiles -> Right-click -> Create FEX Profile**

- Configure FEX Profiles based on the above diagram. FEX Profile for **FEX-01** should be named **FEX-1** and the FEX Profile for **FEX-02** should be named **FEX-2**. Configure the Ports 1/1 to use the existing IPG **IPG-SERVERS**.

Task 2 – Assign the FEX Profiles to the Interface Profiles

- Click **Fabric -> Access Policies -> Interfaces -> Leaf Interfaces -> Profiles -> <Interface Profile Name>**

- Configure Interface Profiles based on the following:

Interface Profiles				
Name	**Port Name**	**Ports**	**FEX-ID**	**FEX-Profile**
INT-PROF-1	E45-45	1/45-46	101	FEX-1
INT-PROF-2	E45-46	1/45-46	102	FEX-2

Task 3 – Assign ports to the "Web-Servers" EPG in the Trinet tenant

- Click **Tenant -> Trinet -> Application Profiles -> WEB-APPS -> Application EPGs -> Web-Servers -> Static Ports -> Right-click -> Deploy Static EPG on PC, VPC or Interface**

- Assign Ports to the **Web-Servers** EPG based on the following:

Port	VLAN	Port-Type	Deployment
LEAF-01 – 101/1 /1	80	Trunk	Immediate
LEAF-02 – 102/1 /1	80	Trunk	Immediate

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