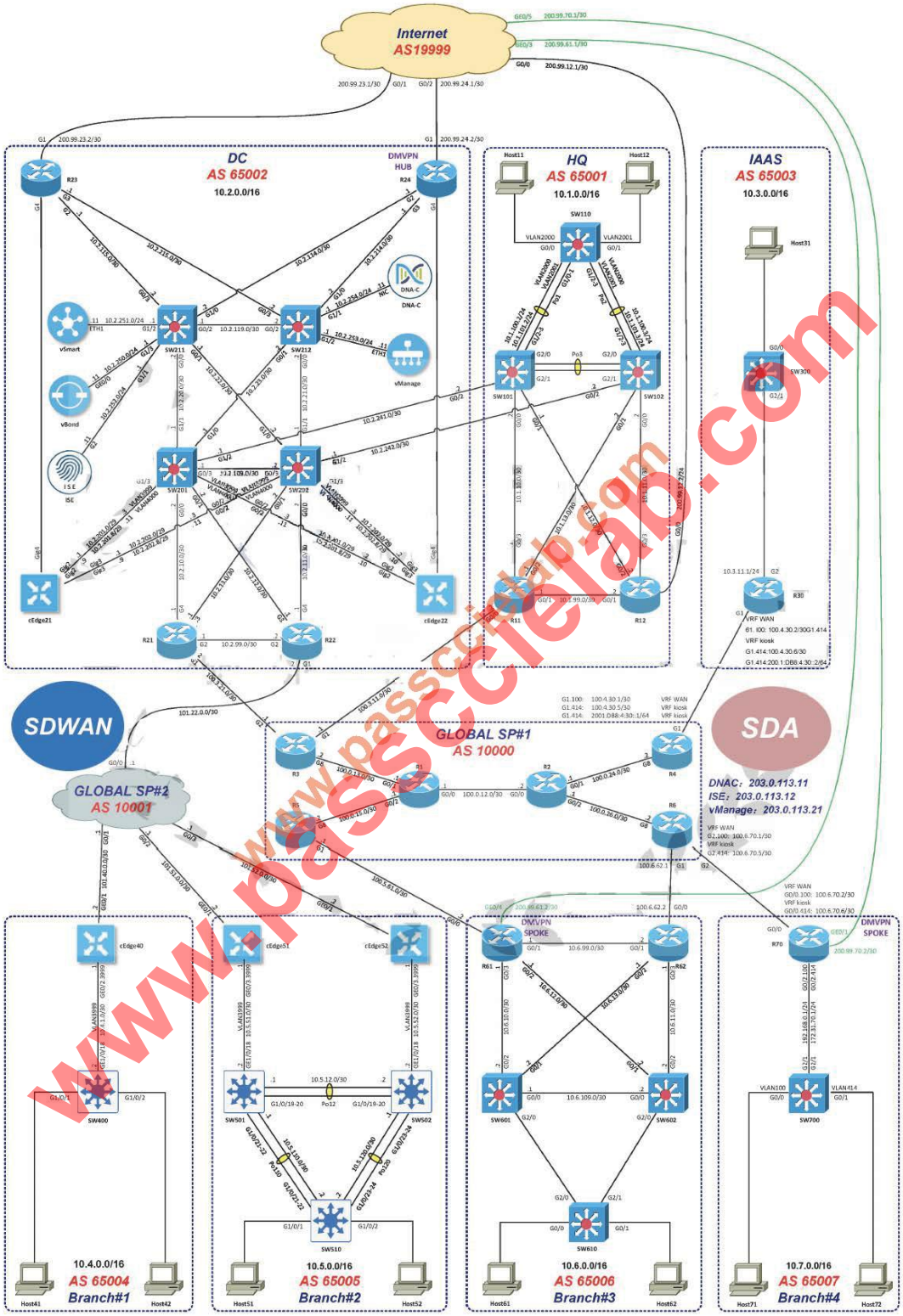
CCIE Enterprise Infrastructure LAB

Module2-DOO V3

Ver：3

Topology



Device Login Info:

Device	OOB IP address	Username	Password	No
DNAc	https://203.0.113.11	admin	CC!E!nfr4	Accessible from any HostXY.
ISE	https://203.0.113.12	admin	CC!E!nfr4	Accessible from any HostXY.
vManage	https://203.0.113.21	admin	CC!E!nfr4	Accessible from any HosyXY.
cEdges		admin	CC!E!nfr4	Accessible via clickable map
HostXY		cisco	cisco	Accessible via clickable map
R30		netadmin	CC!E!nfr4	Not accessible via clickable map. Accessible via NETCONF/RESTCONF from Host31.
SW400		netadmin	CC!E!nfra4	Accessible via clickable map.
SW501		netadmin	CC!E!nfr4	Accessible via clickable map.
SW502		netadmin	CC!E!nfr4	Accessible via clickable map.
SW510		netadmin	CC!E!nfr4	Accessible via clickable map.
TerminalServer		admin	Cisco	Accessible via clickable map.
vBond		admin	CC!E!nfr4	Accessible via clickable map.
vSmart		admin	admin	Accessible via clickable map.

Module Specific Instructions

Read before starting.

Module-specific guidelines

- The lab topology has several end hosts, named hostXY (for example, host11). They are all identical and they can all be used at your full discretion, including accessing the GUI of Cisco DNA Center, vmanage, and Cisco ISE through Firefox, performing IP connectivity tests, generating or capturing traffic, and performing coding Python or C.
- All hostXY devices are configured as DHCP Clients. If it is necessary to force the host to release and renew its DHCP lease, double-click the desktop icon "Reset Port".
- The web-based GUI of Cisco DNA Center, Cisco ISE, and vManage can be accessed only from the hostXY end hosts, using Firefox installed on these end hosts. These servers cannot be accessed directly from the desktop/workstation that you are working from. You must always connect to one of the hostXY and use them as a jump host to access Cisco DNA Center, ISE, and/or vManage. Always ignore any SSL/TLS certificate warnings in Firefox that may be displayed. Refer to the "Device Login into," table under Resources > Tables. for detailed access to these devices.
- R30 (10.3.11.1) can be accessed via RESTCONF and NETCONF from host31.
- Devices in the topology may have more interface, addresses and routes configured than what is shown in the diagrams and comparing tables: Ignore such interfaces, addresses, and routes entirely. Unless a task exactly requires you to use or modify them.
- Changing or removing parts of initial running configuration on devices, as opposed to adding new configuration, is allowed only if the task allows or requires it explicitly, or if there is no other way to accomplish the task.

SECTION1 Existing Network Review and Tuning

1.1 Introduction

Welcome to the Deploy, Operate, Optimize (DOO) module for XANDER Pharmaceuticals.

The topology you will be working on this module will be similar, but not necessarily identical, to the network that you helped design in the previous module.

It may also include technologies and feature sets not touched upon previously.

1.2: Configure VLANs

Ensure that the VLANs and forwarding are configured on all switches and switchports according to the following table.

Site	VLAN	Switch	Port(s)	802.1Q
HQ	2000	SW101	PO1, PO3	Yes
HQ	2000	SW102	PO2 PO3	Yes
HQ	2000	SW110	P01, P02	Yes
HQ	2000	SW110	GE0/0	NO
HQ	2001	SW101	P01, P03	Yes
HQ	2001	SW102	P02 P03	Yes
HQ	2001	SW110	P01, P02	Yes
HQ	2001	SW110	GE0/1	NO
Branch #3	2000	SW601	GE2/0	Yes
Branch #3	2000	SW602	GE2/0	Yes
Branch #3	2000	SW610	GE2/0-1	Yes
Branch #3	2000	SW610	GE2/0	NO
Branch #3	2001	SW601	GE2/0	Yes
Branch #3	2001	SW602	GE2/0	Yes
Branch #3	2001	SW610	GE2/0-1	Yes
Branch #3	2001	SW610	GE0/1	NO

Solution

SW101 & SW102:

This part of the content will be configured in Q1.3

SW110:

SW110(config)#interface g0/0

SW110(config-if)#switchport mode access

SW110(config-if)#switchport access vlan 2000

SW110(config-if)#no shutdown

SW110(config-if)#exit

SW110(config)#interface g0/1

SW110(config-if)#switchport mode access 2001

SW110(config-if)#no shuldown

SW110(config-if)#exit

SW110(config)#

SW601 & SW602:

SW110(config)#interface g2/0

SW60x(config-if)#switchport trunk encapsulation dot1q

SW60x(config-if)#switchport mode trunk

SW60x(config-if)#no shutdown

SW60x(config-if)#exit

SW60x(config)#

SW610:

SW610(config)#interface range g2/0-1

SW610(config-if-range)#switchport trunk encapsulation dot1q

SW610(config-if-range)#switchport mode trunk

SW610(config-if-range)#switchport trunk allowed vlan 1,2000,2001

SW610(config-if-range)#no shutdown

SW610(config-if-range)#exit

SW60x(config-if)#switchport trunk encapsulation dot1q

SW60x(config-if)#switchport mode trunk

SW60x(config-if)#no shutdown

SW60x(config-if)#exit

SW60x(config)#

SW610;

SW610(config)#interface range g2/0-1

SW610(config-if-range)#switchport trunk encapsulation dot1q

SW610(config-if-range)#switchport mode trunk

SW610(config-if-range)#switchport trunk allowed vlan 12000,2001

SW610(config-if-range)#no shutdown

SW610(config-if-range)#exit

SW610(config)#interface g0/0

SW610(config-if)#switchport mode access

SW610(config-if)#switchport access vlan 2000

SW610(config-if)#shutdown

SW610(config-if)#exit

SW610(config)#interface g0/1

SW610(config-if)#switchport mode access

SW610(config-if)#switchport access vlan 2001

SW610(config-if)#no shutdown

SW610(config-if)#exit

SW610(config)#

1.3: Configure EtherChannel

Ensure that the EtherChannel links are configured on the switches at Headquarters according to the following table.

EtherChannel ID	Switch A	Switchports	Switch B	Switchports	Type
1	SW101	GE1/2-3	SW110	GE1/0-1	802.3ad
2	SW102	GE1/2-3	SW110	GE1/2-3	802.3ad
3	SW101	GE2/0-1	SW102	GE2/0-1	802.3ad

Ensure the STP features are configured on the switches at Headquarters according to the following requirements:

- The protocol must support a separate instance for each VLAN.
- The protocol must support only three states.
- All endpoint-facing ports must bypass the STP forwarding delay, without configuring individual witchports.
- SW101 must be the root bridge for VLANs 2000-2001 and default VLAN , with SW102 as the secondary Use the owest possible priority values to achieve this.
- SW101 and SW102 must ignore superior BPDUs for the other switches at Headquarters. While uperior BPDUs are received, traffic must not be forwarded on the receiving port.

Solution

SW101:

```
SW101(config)#spanning-tree mode rapid-pvst
SW101(config)#spanning-tree vlan 12000.2001 priority 0
SW101(config)#spanning-tree portfast edge default
SW101(config)#no interface po1
SW101(config)#no interface po3
SW101(config)#interface range g1/2-3
SW101(config-if-range)#switchport trunk encapsulation dot1q
```

SW101(config-if-range)#switchport mod trunk

SW101(config-if-range)#no shutdown

SW101(config-if-range)#channel-group 1 mode active

SW101(config-if-range)#exit

SW101(config)#interface range g2/0-1

SW101(config-if-range)#switchport trunk encapsulation dot1q

SW101(config-if-range)#SWitchport mod trunk

SW101(config-if-range)#no shutdown

SW101(config-if-range)#channel-group 3 mode active

SW101(config-if-range)#exit

SW101(config-if-range)#inierface range po1, po3

SW101(config-if-range)#spanning-tree guard root

SW101(config-if-range)#exit

SW101(config)#

SW102:

SW102(config)#spanning-tree mode rapid-pvst

SW102(config)#spanning-tree vlan 1,2000,2001 priority 4096

SW102(config)#spanning-tree portfast edge default

SW102(config)#no interface po2

SW102(config)#no interface po3

SW102(config)#interface range g1/2-3

SW102(config-if-range)#switchport trunk encapsulation dot1q

SW102(config-if-range)#switchport mod trunk

SW102(config-if-range)#no shutdown

SW102(config-if-range)#channel-group 2 mode active

SW102(config-if-range)#exit

SW102(config)#interface range g2/0-1

SW102(config-if-range)#switch port trunk encapsulation dot1q

SW102(config-if-range)#switchport mod trunk

SW102(config-if-range)#no shutdown

SW102(config-if-range)#channel-group 3 mode active

SW102(config-if-range)#exit

SW102(config)#interface po2

SW102(config-if-range)#spanning-tree guard root

SW102(config-if-range)#exit

SW102(config)#interface range gi0/3, gi1/0-3

SW102(config-if-range)#spanning - tree guard root

SW102(config-if-range)#exi t

SW102(config)#

SW110:

SW110(config)#spanning-tree mode rapid-pvst

SW110(config)#spanning-tree portfast edge default

SW110(config)#no interface port-channel 1

SW110(config)#no interface port-channel 2

SW110(config)#interface range g1/0-1

SW110(config-if-range)#switchport trunk encapsulation dot1q

SWll'3(config-if-range)//switchport mod trunk

SW110(config-if-range)#no shutdown

SW110(config-if-range)#channel-group 1 mode active

SW110(config-if-range)#exit

SW110(config)#interface range g1/2-3

SW110(config-if-range)#switchport trunk encapsulation dotlq

SW110(contig-rf-range)#switchport mod trunk

SW110(config-if-range)#no shutdown

SW110(config-if-range)#channel-group 2 mode active

SW110(config-if-range)#exit

SW110(config)#

1.4: Configure Network Services

Note:There are variations of this task,please read the requirements carefully!

Old requirements:

Ensure that network services are configured at Headquarters accordingly to the following table.

VLAN	Subnet	Default Gateway	DHCP Server
2000	10.1.100.0/24	10.1.100.1	10.2.255.211
2001	10.1.101.0/24	10.1.101.1	10.2.255.211

Ensure that first-hop gateways for these VLANs are configured according to the following requirements:

- **Use a protocol that sends Hello messages by using a multicast address of 224.0.0.102 and supports up to 4,096 groups.**
- **Group numbers for each VLAN must match the respective VLAN ID.**
- **SW101 must be active and have a priority of 10 above the default.**
- **SW102 must be standby and have the default priority.Both first-hop gateway switches must transition to active if their priority becomes superior.**
- **Both first-hop gateway switches must generate ARPs for the VLAN by using the MAC address of their respective interfaces.**
- **DHCP requests must pass through two first-hop switches**

New requirements:

- **Send packets every 3 seconds.**
- **Requlres configuration password "CC!EInfr4",**
- **The following two requirements are removed:**
- **Both first-hop gateway switches must transition to active if their priority becomes superior.**
- **Both first-hop gateway switches must generate ARPs for the VLAN by using the MAC address of their respective interfaces.**

Variant solution:

HSRP solution 1(Timer for all groups):

SW101:

```
SW101(config)#interface Vlan2000
SW101(config-if)#standby version 2
SW101(config-if)#standby 2001 ip 10.1.100.1
SW101(config-if)#standby 2001 priority 110
SW101(config-if)#standby 2001 preempt
SW101(config-if)#standby 2001 authentication md5 key-string CC!E!nfr4
SW101(config-if)#ip helper-address 10.2.255.211
SW101(config-if)#standby timers 310          //Default Conficuration.
SW101(config-i)#no shutdown
SW101(config-if)#exit
SW101(conig)#interface Vlan2001
SW101(config-if)#standby version 2
SW101(config-if)#standby 2001 ip 10.1.101.1
SW101(config-if)#standby 2001 priority 110
SW101(config-if)#standby 2001 preempt
SW101(config-if)#standby 2001 authentication md5 key-string CCIEnfr4
SW101(config-if)#ip helper-address 10.2.255.211
SW101(config-if)#standby timers 310          //Default Configuration.
SW101(config-if)#no shutdown
SW101(config-if)#exit
SW101(config)#
```

SW102:

```
SW102(config)#interface Vlan2000
SW102(ccnig-if)#standby version 2
SW102(config-if)#standby 2000 ip 10.1.100.1
SW102(config-if)#standby 2000 preempt
SW102(config-if)#standby 2000 authentication md5 key-string CC!E!nfr4
```

SW102(config-if)#ip helper-address 10.2.255.211

SW102(config-if)#standby timers 310 //Default Configuration.

SW102(config-i)#no shutdown

SW102(config-if)#exit

SW102(config)#interface Vlan2001

SW102(config-if)#standby version 2

SW102(config-if)#standby 2001 ip 10.1.101.1

SW102(config-i)#standby 2001 preempt

SW102(config-if)#standby 2001 authentication md5 key-string CCIEnfr4

SW102(config-if)#ip helper-address 10.2.255.211

SW102(config-if)#standby timers 310 //Default Configuration.

SW102(config-if)#no shutdown

SW102(config-if)#exit

HSRP solution 2(Timer for single group):

SW101:

```
SW101(config)#interface Vlan2000
SW101(config-if)#standby version 2
SW101(config-if)#standby 2001 ip 10.1.100.1
SW101(config-if)#standby 2001 priority 110
SW101(config-if)#standby 2001 preempt
SW101(config-i)#standby 2001 authentication md5 key-string CC:EInfr4
SW101(config-if)#ip helper-address 10.2.255.211
SW101(config-i)#standby 2000 timers 310                    //Default Configuration.
SW101(config-if)#exit
SW101(config)#interface Vlan2001
SW101(config-if)#standby version 2
SW101(config-if)#standby 2001 ip 10.1.1011
SW101(config-i)#standby 2001 priority 110
SW101(config-if)#standby 2001 preempt
SW101(config-if)#standby 2001 authentication md5 key-string CCIEInfr4
SW101(config-i)#ip helper-address 10.2.255.211
SW101(config-if)#standby 2000 timers 310                   //Default Configuration.
SW101(config-if)#exit
SW101(config)#
```

SW102:

```
SW102(config)#interface Vlan2000
SW102(confg-i)#standby version 2
SW1C2(config-if#standby 2000 ip 10.1.100.1
SW102(config-if)#standby 2000 preempt
SW102(config-if)#standby 2000 authentication md5 key-string CCIEInfr4
SW102(config-if)#ip helper-address 10.2.255.211
```

SW102(config-i)#standby 2000 timers 310 //Default Configuration.

SW102(config-if)#exitSW102(config)#interface Vlan2001

SW102(config-if)#standby version 2

SW102(config-if)#standby 2001ip 10.1.101.1

SW102(config-if)#standby 2001 preempt

SW102(config-if)#standby 2001 authentication md5 key-string CCIEnfr4

SW102(config-if)#ip helper-address 10.2.255.211

SW102(config-if)#standby 2001 timers 310 //Default Configuration.

SW102(config-if)#exit

SW102(config)#

1.5 Intra-Site Routing (DC -HQ)

Ensure that OSPF is configured for IPv4 Intra-site routing between all Layer 3 non-SD-WAN routers at Headquarters and data center sites according to the following requirements:

- **All the OSPF neighbours in the data centers and at Headquarters must be fully established.**
- **OSPF must be enabled on all interfaces, except for the following.**
  - **R23 - GE4**
  - **R24 - GE4**
  - **R21 - GE1**
  - **R22 - GE1**
  - **R11 - GE0/0**
  - **R12 - GE0/0**
- **Ensure that the EBGP routes received by DC R21 are redistributed to the distribution switches.**

New requirements:

- **The links between SW101-SW201and SW102-SW202 require configuration authentication.**
- **All routers at the DC site must use Loopback0 as the router ID.**

Variant solution

There is no algorithm requirement or requirement to use md5(For SW101/SW102/SW201/SW202):

SW101&SW102:

SW10#(config)#interface range Vlan2000-2001

SW10x(config-if-range)#ip ospf 1 area 0

SW10x(config-if-range)#exit

SW10x(config)#key chain CCIE

SW10x(config-keychain)#key 1

SW10x(config-keychain-key)#key-string CCIEnfr4

SW10x(config-keychain-key)#cryptographic-algorithm hmac-sha-512 //For example,sha-512 is required.

SW10x(config-keychain-key)#exit

SW10x(config-keychain)#exit

SW10x(config)#interface GigabitEthernet0/2

SW10x(config-if)#ip ospf authentication key-chain CCIE

SW10x(config-if)#exit

SW10x(config)#

SW202:

SW202(config)#router ospf 1

SW202(config-router)#router-id 10.2.255.202

SW202(config-router)#no passive-interface g1/2

SW202(config-router)# exit

SW202(config)#interface Vlan3999

SW202(config-if)#no shutdown

Sw2C2(config-if)#exit

SW202(config)#interface Vlan4000

SW202(config-if)#no shutdown

SW202(config-if)#exit

SW202(config)#key chain CCIE

SW202(config-keychain)#key 1

SW202(config-keychain-key)#key-string CC!E!nfr4

SW202(config-keychain-key)#cryptographic-algorithm hmac-sha-512 //For example,sha-512 is required.

SW202(config-keychain-key)#exit

SW202(config-keychain)#exit

SW202(config)#interface GigabitEthernet1/2

SW202(config-if)#ip ospf authentication key-chain CCIE

SW202(config-if)#exit

SW202(config)#

Or select an algorithm based on requirements (For SW101/SW102/SW201/SW202):

SW101&SW102:

SW10x(config)#interface range Vlan2000-2001

SW10x(config-if-range)#ip ospf 1 area0

SW10x(config-if-range)#exit

SW10x(config)#interface GigabitEthernet0/2

SW10x(config-if)#ip ospf authentication message-digest

SW10x(config-i)#ip ospf message-digest-key 1 md5 CC!E!nfr4

SW10x(config-if)#exit

SW10x(config)#

SW201:

SW201(config)#router ospf 1

SW201(config-router)#router-id 10.2.255.201

SW201(config-router)#no passive-interface g1/2

SW201(config-router)#exit

SW201(config)#interface Vlan3999

SW201(config-if)#no shutdown

SW201(config-if)#exit

SW201(config)#interface Vlan4000

SW201(config-if)#no shutdown

SW201(config-if)#exit

SW201(config)#interface GigabitEthernet1/2

SW201(config-if)#i ospf authentication message-digest

SW201(config-if)ip ospf message-digest-key 1 md5 CCIEInfr4

SW201(config-if)exit

SW201(conig)#

SW202

SW202(config)#router ospf1

SW202(config-router)#router-id 10.2.255.202

SW202(config-router)#no passive-interface g1/2

SW202(config-router)#exit

SW202(config)#interface Vlan3999

SW202(config-if)#no shutdown

SW202(config-if)#exit

SW202(config)#interface Vlan4000

SW202(config-if)#no shutdown

SW202(config-if)#exit

SW202(config)#interface GigabitEthernet1/2

R11&R12:

R1x(config)#interface range g0/1-3,lo0

R1x(config-if-range)#ip ospf 1 area 0

R1x(config-if-range)#exit

R1x(config)#

R21:

R21(config)#router ospf1

R21(config-router)#router-id 10.2.255.21

R21(config-router)#exit

R21(config)#interface range g2-4,lo0

R21(config-if-range)#ip ospf 1 area 0

R21(config-if-range)#exit

R21(config)#

R22:

R22(config)#router ospf 1

R22(config-router)#router-id 102.255.22

R22(config-router)#exit

R22(config)#interface range g2-4,lo0

R22(config-if-range#ip ospf 1 area 0

R22(config-if-range)lexit

R22(config)#

R23:

R23(config)#router ospf1

R23(config-router)#router-id 10.2.255.23

R23(config-router)#exit

R23(config)#interface range g2-3,lo0

R23(config-if-range)#ip ospf 1 area 0

R23(contig-if-range)#exit

R23(config)#

R24:

R24(contig)#router ospf1

R24(config-router)#router-id 10.2.255.24

R24(config-router)#exit

R24(config)#interface range g2-3,lo0

R24(config-if-range)#ip ospf 1 area 0

R24(config-if-range)#exit

R24(config)#

R21:

R21(config)#router ospf1

R21(config-router)#redistribute bgp65002 subnets metric-type 1

R21(config-router)#exit

R21(config)#

cEdge21:

User Access Verification

Username:adminPassword:CC!E!nfr4

cEdge21#cEdge21#config-transaction

cEdge21(config)#sdwan

cEdge21(config sdwan)#interface GigabitEthernet2 //Intf name cannot be abbreviated!(case sensitive)

cEdge21(config-interface-GigabitEthernet2)#tunnel-interface

cEdge21(config-tunnel-interface)#allow-service ospf

cEdge21(config-tunnel-interface}#exit

cEdge21(config-interface-CigabitEthernet2)#exit

cEdge21(config-sdwan)#interface GigabitEthernet3 //Intf name cannot be abbreviated!(case sensitive)

cEdge21(config-interface-GigabitEthernet3)#tunnel-interface

cEdge21(config-tunnel-interface)#allow-service ospf

cEdge21(config tunnel-interface)#exit

cEdge21(corfig-interface-GigabitEthermet3)#commit

Commit complete.

cEdge21 (config-interface-GigabitEthernet3)#end

cEage21#

cEdge22:

User Access Verification

Username:admin

Password:CCIEnfr4

cEdge22#

cEdge22#config-transaction

cEdge22(config)#sdwan

cEdge22(config-sdwan)#interface GigabitEthernet2 //Intf name cannot be abbreviated!(case sensitive)

cEdge22(config-interface-GigabitEthernet2)#tunnel-interface

cEdge22(config-tunnel-interface)#allow-service ospf

cEdge22(config-tunnel-interface)#exit

cEdge22(config-interface-GigabitEthernet2)#exit

cEdge22(config-sdwan)#interface GigabitEthernet3 //Intf name cannot be abbreviated!(cuse sensitive)

cEdge22(config-interface-GigabitEthernet3)#tunnel-interface

cEdge22(config-tunnel-interface)#allow-service ospf

cEdge22(config-tunnel-interface)#exit

cEdge22(config-interface-GigabitEthernet3)#commit

Commit complete.

cEdge22(config-interface-GigabitEthernet3)#end

cEdge22#

1.6: Intra-Site Routing (BR3)

Ensure the Branch #3 is configured with IGP to enable route propagation from the LAN into Xanders WAN. The solution must meet the following requirements:

- **Branch #3 must use an EIGRP named mode by using a process named ccie and the autonomous system number 65006.**
- **Branch #3 must use EIGRP MD5 authentication for all LAN-facing peering.**
  - **A key chain CCIE_MD5 must be used to complete this task.**
    - **String CC!E!nfr4**
- **All LAN subnets must advertise to EIGRP**
  - **Do not use redistribution to achieve this task.**
  - **Use a single command to advertise all subnets.**

Solution

R61;

```
R61(contig)#key chain CCIE_MD5
R61(coniig - keycham)#key 1
R61(coniig - keycham)#key-string CC!E!nfr4
R61(config-keychain-key)#exit
R6l(config-keycham)#exit
R61(config)#router eigrp ccie
R61(config -route)#address-family ipv4 unicast autonomous-system 65006
R61(config -route-if)#network 10.0.0.0
R61(config -route)#interface g0/1
R61(config -route-af-interface)#authentication mode md5
R61(config -route-af-interface)#authentication key-chain CCIE_MD5
R61(config -route-af-interface)#no passive-interface
R61(config -route-af-interface)#exit
R61(config -route-af)#af-interface g0/2
```

R61(config -route-af-interface)#authentication mode md5

R61(config -route-af-interface)#authentication key-chain CCIE_MD5

R61(config -route-af-interface)#no passive-interface

R61(config -route-af-interface)#exit

R61(config -route-af)# interface gO/3

R61(config -route-af-interface)#authentication mode md5

R61(config -route-af-interface)#authentication key-chain CCIE_MD5

R61(config -route-af-interface)#no passive-interface

R61(config -route-af-interface)#exit

R61(coniig-router-af)#exit

R61(config- router)#exit

R61(config)#

R62;

R62(config)#key chain CCIE_MD5

R62(config-keychain)#key 1

R62(config-keychain-key)# key-string CC!E!nfr4

R62(config-keychain-key)#exit

R6 2(config-keychain)#exit

R62(config)#

SW601 & SW602:

SW60x(config)#key chain CCIE_MD5

SW60x(config-keychain)#key 1

SW60x(config-keychain- key)# key-string CC!E!nfr4

SW60x(config-keychain- key)#exit

SW60x(config-keychain)#exit

SW60x(config)#router eigrp ccie

SW60x(config-router)#address-family ipv4 unicast:autonomous-system 65006

SW60x(config-router-af)#netwo rk 10.0.0.0