ENCOR Skills Assessment (Scenario 1)

Topology
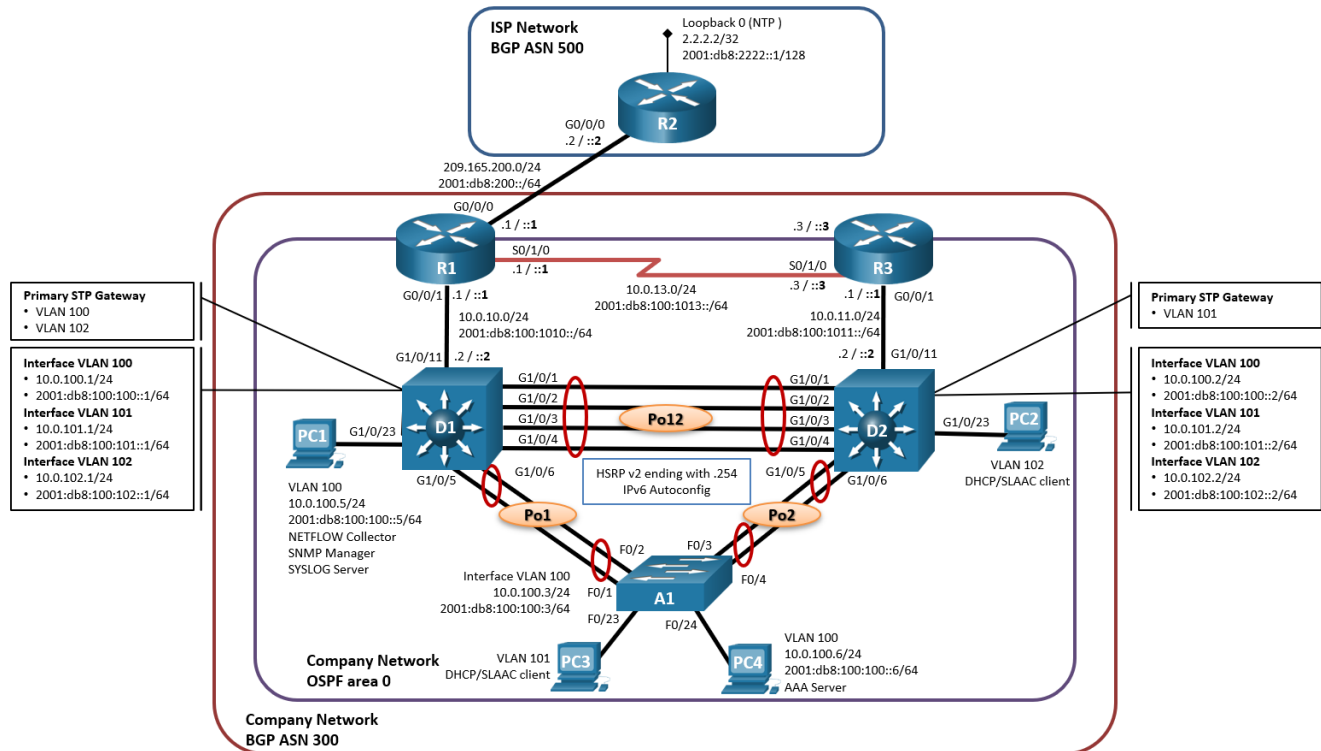
Addressing Table

Device	Interface	IPv4 Address	IPv6 Address	IPv6 Link-Local
R1	G0/0/0	209.165.200.225/27	2001:db8:200::1/64	fe80::1:1
	G0/0/1	10.0.10.1/24	2001:db8:100:1010::1/64	fe80::1:2
	S0/1/0	10.0.13.1/24	2001:db8:100:1013::1/64	fe80::1:3
R2	G0/0/0	209.165.200.226/27	2001:db8:200::2/64	fe80::2:1
	Loopback0	2.2.2.2/32	2001:db8:2222::1/128	fe80::2:3
R3	G0/0/1	10.0.11.1/24	2001:db8:100:1011::1/64	fe80::3:2
	S0/1/0	10.0.13.3/24	2001:db8:100:1013::3/64	fe80::3:3
D1	G1/0/11	10.0.10.2/24	2001:db8:100:1010::2/64	fe80::d1:1
	VLAN 100	10.0.100.1/24	2001:db8:100:100::1/64	fe80::d1:2
	VLAN 101	10.0.101.1/24	2001:db8:100:101::1/64	fe80::d1:3
	VLAN 102	10.0.102.1/24	2001:db8:100:102::1/64	fe80::d1:4
D2	G1/0/11	10.0.11.2/24	2001:db8:100:1011::2/64	fe80::d2:1

Device	Interface	IPv4 Address	IPv6 Address	IPv6 Link-Local
	VLAN 100	10.0.100.2/24	2001:db8:100:100::2/64	fe80::d2:2
	VLAN 101	10.0.101.2/24	2001:db8:100:101::2/64	fe80::d2:3
	VLAN 102	10.0.102.2/24	2001:db8:100:102::2/64	fe80::d2:4
A1	VLAN 100	10.0.100.3/23	2001:db8:100:100::3/64	fe80::a1:1
PC1	NIC	10.0.100.5/24	2001:db8:100:100::5/64	EUI-64
PC2	NIC	DHCP	SLAAC	EUI-64
PC3	NIC	DHCP	SLAAC	EUI-64
PC4	NIC	10.0.100.6/24	2001:db8:100:100::6/64	EUI-64

Objectives

Part 1: Build the Network and Configure Basic Device Settings and Interface Addressing

Part 2: Configure the Layer 2 Network and Host Support

Part 3: Configure Routing Protocols

Part 4: Configure First-Hop Redundancy

Part 5: Configure Security

Part 6: Configure Network Management Features

Part 7: Cleanup

Background / Scenario

In this skills assessment, you are responsible for completing the configuration of the network so there is full end-to-end reachability, so the hosts have reliable default gateway support, and so that management protocols are operational within the "Company Network" part of the topology. Be careful to verify that your configurations meet the provided specifications and that the devices perform as required.

Note: The routers used with CCNP hands-on labs are Cisco 4221 routers with Cisco IOS XE Release 16.9.4 (universalk9 image). The switches used in the labs are Cisco Catalyst 3650 switches with Cisco IOS XE Release 16.9.4 (universalk9 image) and Cisco Catalyst 2960s with Cisco IOS Release 15.2(2) (lanbasek9 image). Other routers, switches, and Cisco IOS versions can be used. Depending on the model and Cisco IOS version, the commands available and the output produced might vary from what is shown in the labs.

Note: Make sure that the switches have been erased and have no startup configurations. If you are unsure, contact your instructor.

Note: The default Switch Database Manager (SDM) template on a Catalyst 2960 does not support IPv6. You must change the default SDM template to the dual-ipv4-and-ipv6 default template using the **sdm prefer dual-ipv4-and-ipv6 default** global configuration command. Changing the template will require a reboot.

Required Resources

- 3 Routers (Cisco 4221 with Cisco IOS XE Release 16.9.4 universal image or comparable)

- 2 Switches (Cisco 3650 with Cisco IOS XE release 16.9.4 universal image or comparable)

- 1 Switch (Cisco 2960 with Cisco IOS release 15.2 lanbase image or comparable)

- 4 PCs (Choice of operating system with a terminal emulation program)

- Console cables to configure the Cisco IOS devices via the console ports

- Ethernet and serial cables as shown in the topology

Instructions

Part 1: Build the Network and Configure Basic Device Settings and Interface Addressing

In Part 1, you will set up the network topology and configure basic settings and interface addressing.

Step 1: Cable the network as shown in the topology.

Attach the devices as shown in the topology diagram, and cable as necessary.

Step 2: Configure basic settings for each device.

a. Console into each device, enter global configuration mode, and apply the basic settings. The startup configurations for each device are provided below.

Router R1

```
hostname R1
ipv6 unicast-routing
no ip domain lookup
banner motd # R1, ENCOR Skills Assessment, Scenario 1 #
line con 0
 exec-timeout 0 0
 logging synchronous
 exit
interface g0/0/0
 ip address 209.165.200.225 255.255.255.224
 ipv6 address fe80::1:1 link-local
 ipv6 address 2001:db8:200::1/64
 no shutdown
 exit
interface g0/0/1
 ip address 10.0.10.1 255.255.255.0
 ipv6 address fe80::1:2 link-local
 ipv6 address 2001:db8:100:1010::1/64
 no shutdown
 exit
interface s0/1/0
 ip address 10.0.13.1 255.255.255.0
 ipv6 address fe80::1:3 link-local
 ipv6 address 2001:db8:100:1013::1/64
 no shutdown
 exit
```

Router R2

```
hostname R2
ipv6 unicast-routing
```

```
no ip domain lookup
banner motd # R2, ENCOR Skills Assessment, Scenario 1 #
line con 0
 exec-timeout 0 0
 logging synchronous
 exit
interface g0/0/0
 ip address 209.165.200.226 255.255.255.224
 ipv6 address fe80::2:1 link-local
 ipv6 address 2001:db8:200::2/64
 no shutdown
 exit
interface Loopback 0
 ip address 2.2.2.2 255.255.255.255
 ipv6 address fe80::2:3 link-local
 ipv6 address 2001:db8:2222::1/128
 no shutdown
 exit
```

Router R3

```
hostname R3
ipv6 unicast-routing
no ip domain lookup
banner motd # R3, ENCOR Skills Assessment, Scenario 1 #
line con 0
 exec-timeout 0 0
 logging synchronous
 exit
interface g0/0/1
 ip address 10.0.11.1 255.255.255.0
 ipv6 address fe80::3:2 link-local
 ipv6 address 2001:db8:100:1011::1/64
 no shutdown
 exit
interface s0/1/0
 ip address 10.0.13.3 255.255.255.0
 ipv6 address fe80::3:3 link-local
 ipv6 address 2001:db8:100:1010::2/64
 no shutdown
 exit
```

Switch D1

```
hostname D1
ip routing
ipv6 unicast-routing
no ip domain lookup
```

```
banner motd # D1, ENCOR Skills Assessment, Scenario 1 #
line con 0
 exec-timeout 0 0
 logging synchronous
 exit
vlan 100
 name Management
 exit
vlan 101
 name UserGroupA
 exit
vlan 102
 name UserGroupB
 exit
vlan 999
 name NATIVE
 exit
interface g1/0/11
 no switchport
 ip address 10.0.10.2 255.255.255.0
 ipv6 address fe80::d1:1 link-local
 ipv6 address 2001:db8:100:1010::2/64
 no shutdown
 exit
interface vlan 100
 ip address 10.0.100.1 255.255.255.0
 ipv6 address fe80::d1:2 link-local
 ipv6 address 2001:db8:100:100::1/64
 no shutdown
 exit
interface vlan 101
 ip address 10.0.101.1 255.255.255.0
 ipv6 address fe80::d1:3 link-local
 ipv6 address 2001:db8:100:101::1/64
 no shutdown
 exit
interface vlan 102
 ip address 10.0.102.1 255.255.255.0
 ipv6 address fe80::d1:4 link-local
 ipv6 address 2001:db8:100:102::1/64
 no shutdown
 exit
ip dhcp excluded-address 10.0.101.1 10.0.101.109
ip dhcp excluded-address 10.0.101.141 10.0.101.254
ip dhcp excluded-address 10.0.102.1 10.0.102.109
```

```
    ip dhcp excluded-address 10.0.102.141 10.0.102.254
    ip dhcp pool VLAN-101
     network 10.0.101.0 255.255.255.0
     default-router 10.0.101.254
     exit
    ip dhcp pool VLAN-102
     network 10.0.102.0 255.255.255.0
     default-router 10.0.102.254
     exit
    interface range g1/0/1-10, g1/0/12-24, g1/1/1-4
     shutdown
     exit
```

Switch D2

```
    hostname D2
    ip routing
    ipv6 unicast-routing
    no ip domain lookup
    banner motd # D2, ENCOR Skills Assessment, Scenario 1 #
    line con 0
     exec-timeout 0 0
     logging synchronous
     exit
    vlan 100
     name Management
     exit
    vlan 101
     name UserGroupA
     exit
    vlan 102
     name UserGroupB
     exit
    vlan 999
     name NATIVE
     exit
    interface g1/0/11
     no switchport
     ip address 10.0.11.2 255.255.255.0
     ipv6 address fe80::d1:1 link-local
     ipv6 address 2001:db8:100:1011::2/64
     no shutdown
     exit
    interface vlan 100
     ip address 10.0.100.2 255.255.255.0
     ipv6 address fe80::d2:2 link-local
     ipv6 address 2001:db8:100:100::2/64
```

```
     no shutdown
     exit
    interface vlan 101
     ip address 10.0.101.2 255.255.255.0
     ipv6 address fe80::d2:3 link-local
     ipv6 address 2001:db8:100:101::2/64
     no shutdown
     exit
    interface vlan 102
     ip address 10.0.102.2 255.255.255.0
     ipv6 address fe80::d2:4 link-local
     ipv6 address 2001:db8:100:102::2/64
     no shutdown
     exit
    ip dhcp excluded-address 10.0.101.1 10.0.101.209
    ip dhcp excluded-address 10.0.101.241 10.0.101.254
    ip dhcp excluded-address 10.0.102.1 10.0.102.209
    ip dhcp excluded-address 10.0.102.241 10.0.102.254
    ip dhcp pool VLAN-101
     network 10.0.101.0 255.255.255.0
     default-router 10.0.101.254
     exit
    ip dhcp pool VLAN-102
     network 10.0.102.0 255.255.255.0
     default-router 10.0.102.254
     exit
    interface range g1/0/1-10, g1/0/12-24, g1/1/1-4
     shutdown
     exit
```

Switch A1

```
    hostname A1
    no ip domain lookup
    banner motd # A1, ENCOR Skills Assessment, Scenario 1 #
    line con 0
     exec-timeout 0 0
     logging synchronous
     exit
    vlan 100
     name Management
     exit
    vlan 101
     name UserGroupA
     exit
    vlan 102
     name UserGroupB
```

```
  exit
vlan 999
 name NATIVE
 exit
interface vlan 100
 ip address 10.0.100.3 255.255.255.0
 ipv6 address fe80::a1:1 link-local
 ipv6 address 2001:db8:100:100::3/64
 no shutdown
 exit
interface range f0/5-22
 shutdown
 exit
```

b. Save the running configuration to startup-config on all devices.

c. Configure PC 1 and PC 4 host addressing as shown in the addressing table. Assign a default gateway address of 10.0.100.254 which will be the HSRP virtual IP address used in Part 4.

Part 2: Configure the Layer 2 Network and Host Support

In this part of the Skills Assessment, you will complete the Layer 2 network configuration and set up basic host support. At the end of this part, all the switches should be able to communicate. PC2 and PC3 should receive addressing from DHCP and SLAAC.

Your configuration tasks are as follows:

Task#	Task	Specification	Points
2.1	On all switches, configure IEEE 802.1Q trunk interfaces on interconnecting switch links	Enable 802.1Q trunk links between: • D1 and D2 • D1 and A1 • D2 and A1	6
2.2	On all switches, change the native VLAN on trunk links.	Use VLAN 999 as the native VLAN.	6
2.3	On all switches, enable the Rapid Spanning-Tree Protocol.	Use Rapid Spanning Tree.	3
2.4	On D1 and D2, configure the appropriate RSTP root bridges based on the information in the topology diagram. D1 and D2 must provide backup in case of root bridge failure.	Configure D1 and D2 as root for the appropriate VLANs with mutually supporting priorities in case of switch failure.	2
2.5	On all switches, create LACP EtherChannels as shown in the topology diagram.	Use the following channel numbers: • D1 to D2 – Port channel 12 • D1 to A1 – Port channel 1 • D2 to A1 – Port channel 2	3

Task#	Task	Specification	Points
2.6	On all switches, configure host access ports connecting to PC1, PC2, PC3, and PC4.	Configure access ports with appropriate VLAN settings as shown in the topology diagram. Host ports should transition immediately to forwarding state.	4
2.7	Verify IPv4 DHCP services.	PC2 and PC3 are DHCP clients and should be receiving valid IPv4 addresses.	1
2.8	Verify local LAN connectivity.	PC1 should successfully ping: • D1: 10.0.100.1 • D2: 10.0.100.2 • PC4: 10.0.100.6 PC2 should successfully ping: • D1: 10.0.102.1 • D2: 10.0.102.2 PC3 should successfully ping: • D1: 10.0.101.1 • D2: 10.0.101.2 PC4 should successfully ping: • D1: 10.0.100.1 • D2: 10.0.100.2 • PC1: 10.0.100.5	1

Part 3: Configure Routing Protocols

In this part, you will configure IPv4 and IPv6 routing protocols. At the end of this part, the network should be fully converged. IPv4 and IPv6 pings to the Loopback 0 interface from D1 and D2 should be successful.

Note: Pings from the hosts will not be successful because their default gateways are pointing to the HSRP address which will be enabled in Part 4.

Your configuration tasks are as follows:

Task#	Task	Specification	Points
3.1	On the "Company Network" (i.e., R1, R3, D1, and D2), configure single-area OSPFv2 in area 0.	Use OSPF Process ID **4** and assign the following router-IDs: • R1: 0.0.4.1 • R3: 0.0.4.3 • D1: 0.0.4.131 • D2: 0.0.4.132 On R1, R3, D1, and D2, advertise all directly connected networks / VLANs in Area 0. • On R1, do not advertise the R1 – R2 network. • On R1, propagate a default route. Note that the default route will be provided by BGP. Disable OSPFv2 advertisements on: • D1: All interfaces except G1/0/11 • D2: All interfaces except G1/0/11	8
3.2	On the "Company Network" (i.e., R1, R3, D1, and D2), configure classic single-area OSPFv3 in area 0.	Use OSPF Process ID **6** and assign the following router-IDs: • R1: 0.0.6.1 • R3: 0.0.6.3 • D1: 0.0.6.131 • D2: 0.0.6.132 On R1, R3, D1, and D2, advertise all directly connected networks / VLANs in Area 0. • On R1, do not advertise the R1 – R2 network. • On R1, propagate a default route. Note that the default route will be provided by BGP. Disable OSPFv3 advertisements on: • D1: All interfaces except G1/0/11 • D2: All interfaces except G1/0/11	8

Task#	Task	Specification	Points
3.3	On R2 in the "ISP Network", configure MP-BGP.	Configure two default static routes via interface Loopback 0: • An IPv4 default static route. • An IPv6 default static route. Configure R2 in BGP ASN **500** and use the router-id 2.2.2.2. Configure and enable an IPv4 and IPv6 neighbor relationship with R1 in ASN 300. In IPv4 address family, advertise: • The Loopback 0 IPv4 network (/32). • The default route (0.0.0.0/0). In IPv6 address family, advertise: • The Loopback 0 IPv4 network (/128). • The default route (::/0).	4
3.4	On R1 in the "ISP Network", configure MP-BGP.	Configure two static summary routes to interface Null 0: • A summary IPv4 route for 10.0.0.0/8. • A summary IPv6 route for 2001:db8:100::/48. Configure R1 in BGP ASN **300** and use the router-id 1.1.1.1. Configure an IPv4 and IPv6 neighbor relationship with R2 in ASN 500. In IPv4 address family: • Disable the IPv6 neighbor relationship. • Enable the IPv4 neighbor relationship. • Advertise the 10.0.0.0/8 network. In IPv6 address family: • Disable the IPv4 neighbor relationship. • Enable the IPv6 neighbor relationship. • Advertise the 2001:db8:100::/48 network.	4

Part 4: Configure First Hop Redundancy

In this part, you will configure HSRP version 2 to provide first-hop redundancy for hosts in the "Company Network".

Your configuration tasks are as follows:

Task#	Task	Specification	Points
4.1	On D1, create IP SLAs that test the reachability of R1 interface G0/0/1.	Create two IP SLAs. • Use SLA number **4** for IPv4. • Use SLA number **6** for IPv6. The IP SLAs will test availability of R1 G0/0/1 interface every 5 seconds. Schedule the SLA for immediate implementation with no end time. Create an IP SLA object for IP SLA 4 and one for IP SLA 6. • Use track number **4** for IP SLA 4. • Use track number **6** for IP SLA 6. The tracked objects should notify D1 if the IP SLA state changes from down to up after 10 seconds, or from up to down after 15 seconds.	2
4.2	On D2, create IP SLAs that test the reachability of R3 interface G0/0/1.	Create two IP SLAs. • Use SLA number **4** for IPv4. • Use SLA number **6** for IPv6. The IP SLAs will test availability of R3 G0/0/1 interface every 5 seconds. Schedule the SLA for immediate implementation with no end time. Create an IP SLA object for IP SLA 4 and one for IP SLA 6. • Use track number **4** for IP SLA 4. • Use track number **6** for IP SLA 6. The tracked objects should notify D1 if the IP SLA state changes from down to up after 10 seconds, or from up to down after 15 seconds.	2

Task#	Task	Specification	Points
4.3	On D1, configure HSRPv2.	D1 is the primary router for VLANs 100 and 102; therefore, their priority will also be changed to 150. Configure HSRP version 2. Configure IPv4 HSRP group **104** for VLAN 100: • Assign the virtual IP address **10.0.100.254**. • Set the group priority to **150**. • Enable preemption. • Track object 4 and decrement by 60. Configure IPv4 HSRP group **114** for VLAN 101: • Assign the virtual IP address **10.0.101.254**. • Enable preemption. • Track object 4 to decrement by 60. Configure IPv4 HSRP group **124** for VLAN 102: • Assign the virtual IP address **10.0.102.254**. • Set the group priority to **150**. • Enable preemption. • Track object 4 to decrement by 60. Configure IPv6 HSRP group **106** for VLAN 100: • Assign the virtual IP address using **ipv6 autoconfig**. • Set the group priority to **150**. • Enable preemption. • Track object 6 and decrement by 60. Configure IPv6 HSRP group **116** for VLAN 101: • Assign the virtual IP address using **ipv6 autoconfig**. • Enable preemption. • Track object 6 and decrement by 60. Configure IPv6 HSRP group **126** for VLAN 102: • Assign the virtual IP address using **ipv6 autoconfig**. • Set the group priority to **150**. • Enable preemption. • Track object 6 and decrement by 60.	8

Task#	Task	Specification	Points
	On D2, configure HSRPv2.	D2 is the primary router for VLAN 101; therefore, the priority will also be changed to 150. Configure HSRP version 2. Configure IPv4 HSRP group **104** for VLAN 100: • Assign the virtual IP address **10.0.100.254**. • Enable preemption. • Track object 4 and decrement by 60. Configure IPv4 HSRP group **114** for VLAN 101: • Assign the virtual IP address **10.0.101.254**. • Set the group priority to **150**. • Enable preemption. • Track object 4 to decrement by 60. Configure IPv4 HSRP group **124** for VLAN 102: • Assign the virtual IP address **10.0.102.254**. • Enable preemption. • Track object 4 to decrement by 60. Configure IPv6 HSRP group **106** for VLAN 100: • Assign the virtual IP address using **ipv6 autoconfig**. • Enable preemption. • Track object 6 and decrement by 60. Configure IPv6 HSRP group **116** for VLAN 101: • Assign the virtual IP address using **ipv6 autoconfig**. • Set the group priority to **150**. • Enable preemption. • Track object 6 and decrement by 60. Configure IPv6 HSRP group **126** for VLAN 102: • Assign the virtual IP address using **ipv6 autoconfig**. • Enable preemption. • Track object 6 and decrement by 60.	

Part 5: Security

In this part you will configure various security mechanisms on the devices in the topology.

Your configuration tasks are as follows:

Task#	Task	Specification	Points
5.1	On all devices, secure privileged EXEC using the SCRYPT encryption algorithm.	Password: **cisco12345cisco**	3

Task#	Task	Specification	Points
5.2	On all devices, create a local user and secure it using the SCRYPT encryption algorithm.	SCRYPT encrypted account specifics: • Local user name: **sadmin** • Privilege level **15** • Password: **cisco12345cisco**	3
5.3	On all devices (except R2), enable AAA.	Enable AAA.	2
5.4	On all devices (except R2), configure the RADIUS server specifics.	RADIUS server specifics: • RADIUS server IP address is 10.0.100.6. • RADIUS server UDP ports 1812 and 1813. • Password: **$trongPass**	2
5.5	On all devices (except R2), configure the AAA authentication method list.	AAA authentication specifics: • Use the default method list • Validate against the RADIUS server group • Otherwise, use the local database.	2
5.6	Verify the AAA service on all devices (except R2).	Log out and log in to all devices (except R2) using the username **raduser** and the password **upass123**. You should be successful.	2

Part 6: Configure Network Management Features

In this part, you will configure various network management features.

Your configuration tasks are as follows:

Task#	Task	Specification	Points
6.1	On all devices, set the local clock to the current UTC time.	Set the local clock to the current UTC time.	3
6.2	Configure R2 as an NTP master.	Configure R2 as an NTP master at stratum level 3.	1
6.3	Configure NTP on R1, R3, D1, D2, and A1.	Configure NTP as follows: • R1 must synchronize with R2. • R3, D1, and A1 to synchronize time with R1. • D2 to synchronize time with R3.	5
6.4	Configure Syslog on all devices except R2.	Syslogs should be sent to PC1 at 10.0.100.5 at the WARNING level.	5

Task#	Task	Specification	Points
6.5	Configure SNMPv2c on all devices except R2.	SNMPv2 specifics: • Only Read-Only SNMP will be used. • Limit SNMP access to PC1's IP address. • Configure the SNMP contact value to your name. • Set the community string to **ENCORSA**. • On R3, D1, and D2, enable traps config and ospf to be sent. • On R1, enable traps bgp, config, and ospf to be sent. • On A1, enable traps config to be sent.	10

Part 7: Cleanup

NOTE: DO NOT PROCEED WITH CLEANUP UNTIL YOUR INSTRUCTOR HAS GRADED YOUR SKILLS ASSESSMENT AND HAS INFORMED YOU THAT YOU MAY BEGIN CLEANUP.

Unless directed otherwise by the instructor, restore host computer network connectivity, and then turn off power to the host computers.

Remove NVRAM configuration files (if saved) and vlan databases from all devices before turning them off or reloading them.