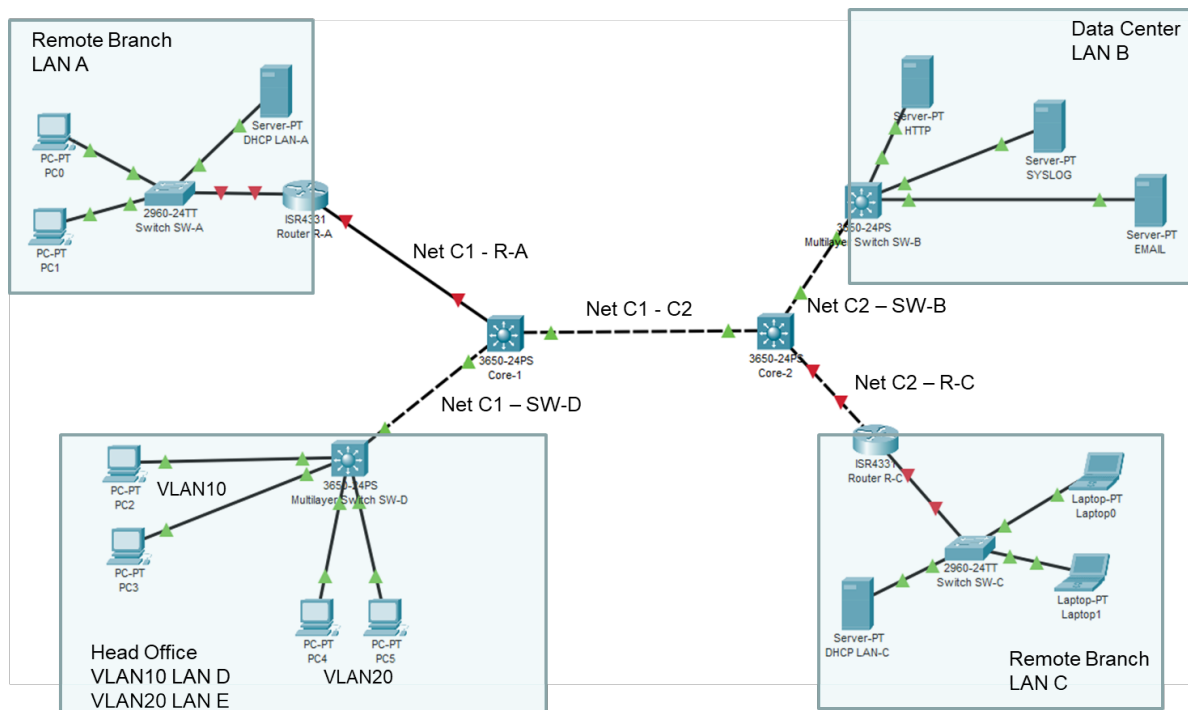


AMC Lab 2**Instruction****Deadline: 7.1.2021****Name: Andreas Grebe / Sample Solution**

Enterprise IP Network (version2, minor corrections in task 5)

**Tasks:**

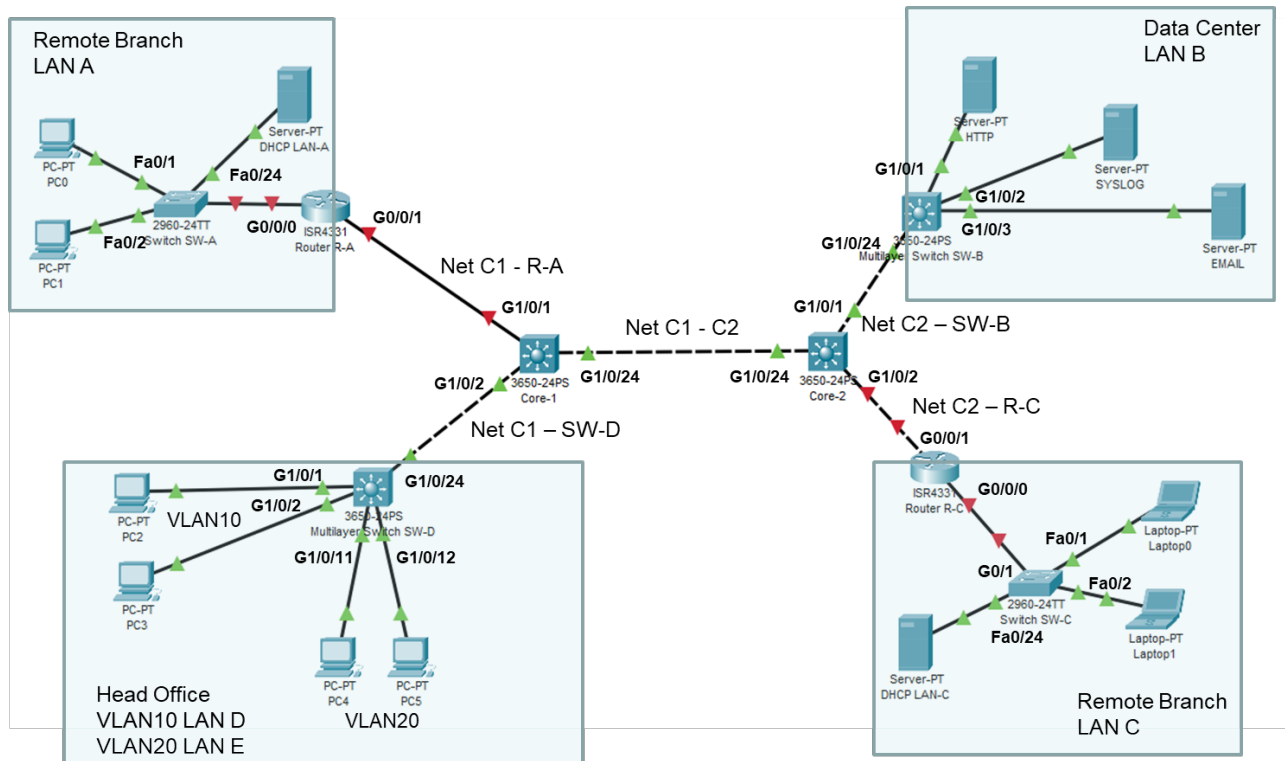
In this AMC lab you prepare an enterprise network, which is the basic network for final QoS implementation.

- | | |
|--------------|--|
| Tasks | Create PT Topology |
| | IP addressing from the Homework to the topology |
| | Configure network devices |
| | Configure hosts and servers |
| | Test connectivity |

Important Note: Write your answers in this PDF with red color
- with free Adobe Acrobat you may use Comments/Notes
Do not change the layout of this text
Do not use any other file format.
Do not create archive files

Task 1 - Create Enterprise Network

Topology



The topology is given in the network above. It includes



- 2 Routers ISR 4331
- 4 Multilayer Switches 3650-24PS
- 2 Switches 2960-24TT
- 2 DHCP Servers, 3 Data Center Servers
- 6 PC Hosts, 2 Laptop Hosts

Note: All interface to be used in this lab are named in the topology.

Part 1: Set Up Network Topology in PT

Step 1: Build topology in Packet Tracer.

COVID-19 Version: Build topology in **Packet Tracer**. Use and re-label the following devices:

- a. Build the network with ISR4331 Routers, 3650- Multilayer Switches, 2960 Switches, Servers, PCs and Laptops in Packet Tracer.
- b. Rename the devices.
- c. Cable the network according to the topology with straight-through TP cables  and cross-over cables .

Part 2: Subnet Addressing

Available are the IP addresses of the homework 172.16.0.0 / 16. In the following prepare the IP addressing table with IP address for each single interface.

You already calculated the IP Addresses and Subnet Masks for the required networks in your AMC Lab2 Homework.

Step 1: Inter-Router-Links

The following design rules are given for Inter-Router-Links

- Core-1 gets the first, Core-2 gets the second IP address of the interconnecting subnet
- Core-1 gets the first, R-A gets the second IP address of the interconnecting subnet
- Core-2 gets the first, SW-B gets the second IP address of the interconnecting subnet
- Core-2 gets the first, R-C gets the second IP address of the interconnecting subnet
- Core-1 gets the first, SW-D gets the second IP address of the interconnecting subnet
- Record the correct Inter-Router-Link addresses and masks in the following table 1.

Provide the correct IP Addresses from the calculated Subnets according to the design rules.

| Device | Interface | IP Address | Subnet Mask | Default Gateway |
|--------|-----------|--------------|-----------------|-----------------|
| Core-1 | G1/0/1 | 172.16.2.165 | 255.255.255.252 | N/A |
| | G1/0/2 | 172.16.2.169 | 255.255.255.252 | N/A |
| | G1/0/24 | 172.16.2.161 | 255.255.255.252 | N/A |
| Core-2 | G1/0/1 | 172.16.2.173 | 255.255.255.252 | N/A |
| | G1/0/2 | 172.16.2.177 | 255.255.255.252 | N/A |
| | G1/0/24 | 172.16.2.162 | 255.255.255.252 | N/A |
| R-A | G0/0/0 | 172.16.2.62 | 255.255.255.192 | N/A |
| | G0/0/1 | 172.16.2.166 | 255.255.255.252 | N/A |
| SW-B | G1/0/24 | 172.16.2.174 | 255.255.255.252 | N/A |
| | VLAN1 | 172.16.2.158 | 255.255.255.224 | N/A |
| R-C | G0/0/0 | 172.16.2.126 | 255.255.255.192 | N/A |
| | G0/0/1 | 172.16.2.178 | 255.255.255.252 | N/A |
| SW-D | G1/0/24 | 172.16.2.170 | 255.255.255.252 | N/A |
| | VLAN10 | 172.16.0.254 | 255.255.255.0 | N/A |
| | VLAN20 | 172.16.1.254 | 255.255.255.0 | N/A |

Step 2: LAN Addressing

The following design rules are given for LAN-A to LAN-E.

- LAN A:
 - R-A G0/0/0 is the Default Gateway in LAN A and gets the last available IP Address.
 - DHCP Server gets the second to the last available IP Address.
 - PC0 and PC1 get IP Address, Network Mask, and Default Gateway from DHCP Server.

- LAN B:
 - SW-B Interface G1/0/24 is Router Interface.
 - Switch Virtual Interface (SVI) Interface VLAN 1 is Default Gateway for LAN B and gets the last available IP Address.
 - HTTP-Server gets first, SYSLOG-Server gets second and EMAIL-Server gets third available IP Address

- LAN C:
 - R-C G0/0/0 is the Default Gateway in LAN C and gets the last available IP Address.
 - DHCP Server gets the second to the last available IP Address.
 - Laptop0 and Laptop1 get IP Address, Network Mask, and Default Gateway from DHCP Server.

- LAN D and LAN E:
 - SW-D Interface G1/0/24 is Router Interface.
 - Interface VLAN 10 is Default Gateway for LAN D and gets the last available IP Address.
 - PC2 and PC3 get first and second available IP Address in LAN D.
 - Interface VLAN 10 is Default Gateway for LAN E and gets the last available IP Address.
 - PC4 and PC5 get first and second available IP Address in LAN D.

Provide the correct IP Addresses from the calculated Subnets according to the design rules.

Record the LAN Interface Addresses and Masks in the following table2. If automatically provided by network protocol write DHCP.

| Device | Interface | IP Address | Subnet Mask | Default Gateway |
|--------------|-----------|--------------|-----------------|-----------------|
| R-A | G0/0/0 | 172.16.2.62 | 255.255.255.192 | N/A |
| | G0/0/1 | 172.16.2.166 | 255.255.255.252 | N/A |
| SW-B | G1/0/24 | 172.16.2.174 | 255.255.255.252 | N/A |
| | VLAN 1 | 172.16.2.158 | 255.255.255.224 | N/A |
| R-C | G0/0/0 | 172.16.2.126 | 255.255.255.192 | N/A |
| | G0/0/1 | 172.16.2.178 | 255.255.255.252 | N/A |
| SW-D | G1/0/24 | 172.16.2.170 | 255.255.255.252 | N/A |
| | VLAN 10 | 172.16.0.254 | 255.255.255.0 | N/A |
| | VLAN 20 | 172.16.1.254 | 255.255.255.0 | N/A |
| PC-0 | NIC | 172.16.2.1 | 255.255.255.192 | 172.16.2.62 |
| PC-1 | NIC | 172.16.2.2 | 255.255.255.192 | 172.16.2.62 |
| DHCP-LAN A | NIC | 172.16.2.61 | 255.255.255.192 | 172.16.2.62 |
| HTTP-Server | NIC | 172.16.2.129 | 255.255.255.224 | 172.16.2.158 |
| SYSLOG-Ser. | NIC | 172.16.2.130 | 255.255.255.224 | 172.16.2.158 |
| EMAIL-Server | NIC | 172.16.2.131 | 255.255.255.224 | 172.16.2.158 |
| Laptop-0 | NIC | 172.16.2.65 | 255.255.255.192 | 172.16.2.126 |
| Laptop-1 | NIC | 172.16.2.66 | 255.255.255.192 | 172.16.2.126 |
| DHCP-LAN C | NIC | 172.16.2.125 | 255.255.255.192 | 172.16.2.126 |
| PC-2 | NIC | 172.16.0.1 | 255.255.255.0 | 172.16.0.254 |
| PC-3 | NIC | 172.16.0.2 | 255.255.255.0 | 172.16.0.254 |
| PC-4 | NIC | 172.16.1.1 | 255.255.255.0 | 172.16.1.254 |
| PC-5 | NIC | 172.16.1.2 | 255.255.255.0 | 172.16.1.254 |

Task 2 – Configure Network Devices

Part 3: LAN Routers ISR 4331

Step 1: Configure ISR 4331 Router R-A

Open CLI of router R-A and configure the following tasks

- Enter the privileged EXEC mode `router>enable`
- Enter configuration mode `router#configure terminal`
- Assign a device name **R-A** to the router `router(config)#hostname R-A`
- Disable DNS lookup to prevent the router from attempting to translate incorrectly entered commands as though they were host names `R-A(config)#no ip domain-lookup`

Step 2: Configure Router R-A Interfaces

- Set Interface G0/0/0 description to LAN-A
- Set IP Address and Subnet Mask for Interface G0/0/0, and switch-on Interface G0/0/0
`R-A(config)#interface g0/0/0`
`R-A(config-if)#description LAN-A`
`R-A(config-if)#ip address 172.16.2.62 255.255.255.192`
`R-A(config-if)#no shutdown`
- Set Interface G0/0/1 description to Link-to-Core-1
- Set IP Address and Subnet Mask for Interface G0/0/1, and switch-on Interface G0/0/1
`R-A(config)#interface g0/0/1`
`R-A(config-if)#description Link-to-Core-1`
`R-A(config-if)#ip address 172.16.2.166 255.255.255.252`
`R-A(config-if)#no shutdown`

Step 3: Configure Static Default Route in Router R-A

- Configure a static default route in Router R-A with exit interface G0/0/1.
`R-A(config)#ip route 0.0.0.0 0.0.0.0 g0/0/1`

Step 4: Check IP Routing Table of Router R-A

- Record, which networks are routed in Router R-A.
`Network 172.16.2.0 / 26`
`Network 172.16.2.164 / 30`
`Network 0.0.0.0 / 0`

Step 5: Configure ISR 4331 Router R-C

Open CLI of router R-C and configure the following tasks

- Enter the privileged EXEC mode `router>enable`
- Enter configuration mode `router#configure terminal`
- Assign a device name **R-C** to the router `router(config)#hostname R-C`

- Disable DNS lookup to prevent the router from attempting to translate incorrectly entered commands as though they were host names `R-C(config)#no ip domain-lookup`

Step 6: Configure Router R-C Interfaces

- Set Interface G0/0/0 description to LAN-C
- Set IP Address and Subnet Mask for Interface G0/0/0, and switch-on Interface G0/0/0
`R-C(config)#interface g0/0/0`
`R-C(config-if)#description LAN-C`
`R-C(config-if)#ip address 172.16.2.126 255.255.255.192`
`R-C(config-if)#no shutdown`
- Set Interface G0/0/1 description to Link-to-Core-2
- Set IP Address and Subnet Mask for Interface G0/0/1, and switch-on Interface G0/0/1
`R-C(config)#interface g0/0/1`
`R-C(config-if)#description Link-to-Core-2`
`R-C(config-if)#ip address 172.16.2.178 255.255.255.252`
`R-C(config-if)#no shutdown`

Step 7: Configure Static Default Route in Router R-C

- Configure a static default route in Router R-C with exit interface G0/0/1.
`R-C(config)#ip route 0.0.0.0 0.0.0.0 g0/0/1`

Step 8: Check IP Routing Table of Router R-C

- Record, which networks are routed in Router R-C.
`Network 172.16.2.64 / 26`
`Network 172.16.2.176 / 30`
`Network 0.0.0.0 / 0`

Part 4: Core Multilayer Switches 3650

Step 1: Configure MS 3650 Core-1

Open CLI of switch 3650 and configure the following tasks

- Enter the privileged EXEC mode `switch>enable`
- Enter configuration mode `switch#configure terminal`
- Assign a device name **Core-1** to the switch `switch(config)#hostname Core-1`
- Disable DNS lookup to prevent the router from attempting to translate incorrectly entered commands as though they were host names `Core-1(config)#no ip domain-lookup`

Step 2: Configure MS 3650 Core-1 Interfaces

- Disable switchport mode at interfaces G1/0/1, G1/0/2, and G1/0/24
`Core-1(config)#interface range g1/0/1-2`
`Core-1(config-if)#no switchport`
`Core-1(config)#interface g1/0/24`
`Core-1(config-if)#no switchport`

- Set Interface G1/0/1 description to Link-to-R-A
- Set IP Address and Subnet Mask for Interface G1/0/1, and switch-on Interface G1/0/1
- Set Interface G1/0/2 description to Link-to-SW-D
- Set IP Address and Subnet Mask for Interface G1/0/2, and switch-on Interface G1/0/2
- Set Interface G1/0/24 description to Link-to-Core-2
- Set IP Address and Subnet Mask for Interface G1/0/24, and switch-on Interface G1/0/24

```
Core-1(config)#interface g1/0/1
Core-1(config-if)#description Link-to-R-A
Core-1(config-if)#ip address 172.16.2.165 255.255.255.252
Core-1(config-if)#no shutdown
Core-1(config-if)#interface g1/0/2
Core-1(config-if)#description Link-to-SW-D
Core-1(config-if)#ip address 172.16.2.169 255.255.255.252
Core-1(config-if)#no shutdown
Core-1(config-if)#interface g1/0/24
Core-1(config-if)#description Link-to-Core-2
Core-1(config-if)#ip address 172.16.2.161 255.255.255.252
Core-1(config-if)#no shutdown
```

Step 3: Configure Static Routes in MS 3650 Core-1

- Enable IP Routing
- For each LAN A – LAN E, configure a recursive static route to the LAN network with the next hop for each route.

```
Core-1(config)#ip routing
Core-1(config)#ip route 172.16.2.0 255.255.255.192 172.16.2.166
Core-1(config)#ip route 172.16.2.128 255.255.255.224 172.16.2.162
Core-1(config)#ip route 172.16.2.64 255.255.255.192 172.16.2.162
Core-1(config)#ip route 172.16.0.0 255.255.255.0 172.16.2.170
Core-1(config)#ip route 172.16.1.0 255.255.255.0 172.16.2.170
```

- For each non-connected Inter-Router-Network (Link Core-2 to SW-B, and Core-2 to R-C), configure a static route to the network with exit interface G1/0/24.

```
Core-1(config)#ip route 172.16.2.172 255.255.255.252 g1/0/24
Core-1(config)#ip route 172.16.2.176 255.255.255.252 g1/0/24
```

If you know how to define **summary routes**, you may use summary route configuration, but **DO NOT use any static default route**.

or

```
Core-1(config)#ip route 172.16.2.172 255.255.255.248 g1/0/24
```

Step 4: Check IP Routing Table of MS 3650 Core-1

- Record, which networks are routed in MS 3650 Core-1 (sh ip route).

All 3 directly connected networks and 7 routed networks:

| | |
|-----------|-------------------------|
| Static | Network 172.16.0.0/24 |
| Static | Network 172.16.1.0/24 |
| Static | Network 172.16.2.0/26 |
| Static | Network 172.16.2.64/26 |
| Static | Network 172.16.2.128/27 |
| Connected | Network 172.16.2.160/30 |
| Connected | Network 172.16.2.164/30 |
| Connected | Network 172.16.2.168/30 |
| Static | Network 172.16.2.172/30 |
| Static | Network 172.16.2.176/30 |

Step 5: Configure MS 3650 Core-2

Open CLI of switch 3650 and configure the following tasks

- Enter the privileged EXEC mode switch>enable
- Enter configuration mode switch#configure terminal
- Assign a device name **Core-2** to the switch switch(config)#hostname Core-2
- Disable DNS lookup to prevent the router from attempting to translate incorrectly entered commands as though they were host names Core-2(config)#no ip domain-lookup

Step 6: Configure MS 3650 Core-2 Interfaces

- Disable switchport mode at interfaces G1/0/1, G1/0/2, and G1/0/24
Core-2(config)#interface range g1/0/1-2
Core-2(config-if)#no switchport
Core-2(config)#interface g1/0/24
Core-2(config-if)#no switchport
- Set Interface G1/0/1 description to Link-to-SW-B
- Set IP Address and Subnet Mask for Interface G1/0/1, and switch-on Interface G1/0/1
- Set Interface G1/0/2 description to Link-to-R-C
- Set IP Address and Subnet Mask for Interface G1/0/1, and switch-on Interface G1/0/2
- Set Interface G1/0/24 description to Link-to-Core-1
- Set IP Address and Subnet Mask for Interface G1/0/24, and switch-on Interface G1/0/24
Core-2(config)#interface g1/0/1
Core-2(config-if)#description Link-to-SW-B
Core-2(config-if)#ip address 172.16.2.173 255.255.255.252
Core-2(config-if)#no shutdown
Core-2(config-if)#interface g1/0/2
Core-2(config-if)#description Link-to-R-C
Core-2(config-if)#ip address 172.16.2.177 255.255.255.252
Core-2(config-if)#no shutdown
Core-2(config-if)#interface g1/0/24
Core-2(config-if)#description Link-to-Core-1

Core-2(config-if)#ip address 172.16.2.162 255.255.255.252

Core-2(config-if)#no shutdown

Step 7: Configure Static Routes in MS 3650 Core-2

- Enable IP Routing

Core-2(config)#ip routing

- For LAN B and LAN C, configure a recursive static route to the LAN network with the next hop for each route.

Core-2(config)#ip route 172.16.2.128 255.255.255.224 172.16.2.174

Core-2(config)#ip route 172.16.2.64 255.255.255.192 172.16.2.178

- For all other non-connected Networks, configure a static **default** route to the exit interface G1/0/24 to router Core-1.

Core-2(config)#ip route 0.0.0.0 0.0.0.0 g1/0/24

Step 8: Check IP Routing Table of MS 3650 Core-2

- Record, which networks are routed in MS 3650 Core-2 (sh ip route).

All 3 directly connected networks, 2 routed networks and default route (*):

Static Network 172.16.2.64/26

Static Network 172.16.2.128/27

Connected Network 172.16.2.160/30

Connected Network 172.16.2.172/30

Connected Network 172.16.2.176/30

Static* Network 0.0.0.0/0 (default route)

Part 5: LAN Multilayer Switches 3650

Step 1: Configure MS 3650 SW-B

Open CLI of switch 3650 and configure the following tasks

- Enter the privileged EXEC mode switch>enable
- Enter configuration mode switch#configure terminal
- Assign a device name **SW-B** to the switch switch(config)#hostname SW-B
- Disable DNS lookup to prevent the router from attempting to translate incorrectly entered commands as though they were host names SW-B(config)#no ip domain-lookup

Step 2: Configure MS 3650 SW-B VLAN, Interfaces and Routing

Switch SW-B is access switch for data center servers and routes to the core network.

- Enable IP Routing

SW-B (config)#ip routing

- Disable switch port behavior at interface g1/0/24 and create a layer 3 router interface. Switch-on the interface. Set Interface G1/0/24 description to Link-to-Core-2

SW-B (config)#interface g1/0/24

SW-B(config-if)#no switchport

SW-B(config-if)#description Link-to-Core-2

```
SW-B(config-if)#ip address 172.16.2.174 255.255.255.252
```

```
SW-B (config-if)#no shutdown
```

- Configure a static default route to the router Core-2 interface G1/0/1 IP address.

```
SW-B (config)#ip route 0.0.0.0 0.0.0.0 172.16.2.173
```

All servers are connected by default to VLAN1.

- Create a virtual (SVI) interface VLAN1 with the IP address of table 2 as Default Gateway for VLAN 1. Switch-on this interface.

```
SW-B (config)#interface vlan 1
```

```
SW-B(config-if)#ip address 172.16.2.158 255.255.255.224
```

```
SW-B (config-if)#no shutdown
```

Step 3: Check IP Routing Table of MS 3650 SW-B

- Record, which networks are routed in MS 3650 SW-B (sh ip route).

All 2 directly connected networks and a default route:

```
Connected      Network 172.16.2.128/27
```

```
Connected      Network 172.16.2.172/30
```

```
Static*        Network 0.0.0.0/0 (default route)
```

Step 4: Configure MS 3650 SW-D

Open CLI of switch 3650 and configure the following tasks

- Enter the privileged EXEC mode

```
switch>enable
```
- Enter configuration mode

```
switch#configure terminal
```
- Assign a device name **SW-D** to the switch

```
switch(config)#hostname SW-D
```
- Disable DNS lookup to prevent the router from attempting to translate incorrectly entered commands as though they were host names

```
SW-D(config)#no ip domain-lookup
```

Step 5: Configure MS 3650 SW-D VLANs and VLAN Interfaces

Switch SW-D is access switch for VLAN 10 and VLAN 20.

- Create VLAN 10, name voice, and VLAN 20, name data

```
SW-D(config)#vlan 10
```

```
SW-D(config-vlan)#name voice
```

```
SW-D(config-vlan)#vlan 20
```

```
SW-D(config-vlan)#data
```

- For interface range G1/0/1 to G1/0/10, configure switchport access mode to VLAN 10

```
SW-D(config)#interface range g1/0/1-10
```

```
SW-D(config-if)#switchport mode access
```

```
SW-D(config-if)#switchport access vlan 10
```

- For interface range G1/0/11 to G1/0/20, configure switchport access mode to VLAN 20

```
SW-D(config)#interface range g1/0/11-20
```

```
SW-D(config-if)#switchport mode access
```

```
SW-D(config-if)#switchport access vlan 20
```

- Cross-check VLAN mapping (sh ip vlan br)
Reconfigure, if mapping is not matched.

Ports G1/0/1 .. G1/0/10 in VLAN voice
Ports G1/0/11 .. G1/0/20 in VLAN data
- Create a virtual (SVI) interface VLAN10 with the IP address of table 2 as Default Gateway for VLAN 10.
Switch-on this interface.

SW-D(config)#interface vlan 10
SW-D(config-if)#ip address 172.16.0.154 255.255.255.0
SW-D(config-if)#no shutdown
- Create a virtual (SVI) interface VLAN20 with the IP address of table 2 as Default Gateway for VLAN 10.
Switch-on this interface.

SW-D(config)#interface vlan 20
SW-D(config-if)#ip address 172.16.1.154 255.255.255.0
SW-D(config-if)#no shutdown

Step 6: Configure MS 3650 SW-D Routing

Switch SW-D routes to the core network.

- Enable IP Routing
SW-D(config)#ip routing
- Disable switch port behavior at interface g1/0/24 and create a layer 3 router interface. Switch-on the interface. Set Interface G1/0/24 description to Link-to-Core-1
SW-D(config)#interface g1/0/24
SW-D(config-if)#no switchport
SW-D(config-if)#description Link-to-Core-1
SW-D(config-if)#ip address 172.16.2.170 255.255.255.252
SW-D(config-if)#no shutdown
- Configure a static default route to the router Core-1 interface G1/0/2 IP address.
SW-D(config)#ip route 0.0.0.0 0.0.0.0 172.16.2.169

Step 7: Check IP Routing Table of MS 3650 SW-D

- Record, which networks are routed in MS 3650 SW-D (sh ip route).

All 3 directly connected networks and a default route:

| | |
|-----------|-----------------------------------|
| Connected | Network 172.16.0.0/24 |
| Connected | Network 172.16.1.0/24 |
| Connected | Network 172.16.2.168/30 |
| Static* | Network 0.0.0.0/0 (default route) |

Task 3 – Configure PCs, Laptops, Servers

Part 1: PCs and Laptops in LAN A, LAN C, LAN D, and LAN E

Step 1: LAN A

- Configure DHCP Server LAN A to provide the IP addresses, network mask and default gateway of table 2 network, excluding the IP address of DHCP Server and Default Gateway in LAN A. Configure the PCs to get IP connectivity by DHCP.
- Test connectivity by pinging the Default Gateway. **Works**

Step 2: LAN C

- Configure DHCP Server LAN C to provide the IP addresses, network mask and default gateway of table 2 network, excluding the IP address of DHCP Server and Default Gateway in LAN C. Configure the Laptops to get IP connectivity by DHCP.
- Test connectivity by pinging the Default Gateway. **Works**

Step 3: LAN D and LAN E

- Configure the IP Addressing of PCs according to your Addressing Table.
- Test connectivity by pinging the Default Gateway. **Works**

Part 2: Servers in LAN B and Connectivity Test

Step 1: LAN B

- Configure static IP addresses to the servers according to addressing table 2.
- From each server, test connectivity by pinging the Default Gateway. **Works**
- From each server, test to ping the Default Gateway of LAN A, LAN C, LAN D, and LAN E. Search for routing errors and reconfigure your network, if ping is not working. **Works**
- From PC0, Laptop0, PC3, and PC5 ping the HTTP Server in LAN B. Search for routing errors and reconfigure your network, if ping is not working. **Works**

Checkout

When you successfully finished this Lab

1. Save your results and answers **in this PDF file**.
2. Save the running configuration of **Router Core-1** and of **Multilayer Switch SW-D** in a text file (.txt).
3. Upload 2 files (.pdf and .txt) in Ilias.

Lab Demonstration

Following the deadline for the delivery of Lab2, you will have to present your PT solution in a ZOOM Session.

- Date for the ZOOM Session will be Tuesday Jan. 12 from 2 pm.
- The Link and schedule will be provided after Lab2 deadline.
- You will share your desktop to display your PT solution.