Department of Computer Science and Engineering
Islamic University of Technology (IUT)
A subsidiary organ of OIC

Lab Report 04

CSE 4412: Data Communication and Networking Lab

Name: Hasin Mahtab Alvee
Student ID: 210042174
Section: SWE – B (Even)
Semester: 4th (Summer)
Academic Year: 2023-2024

Date of Submission: February 19th

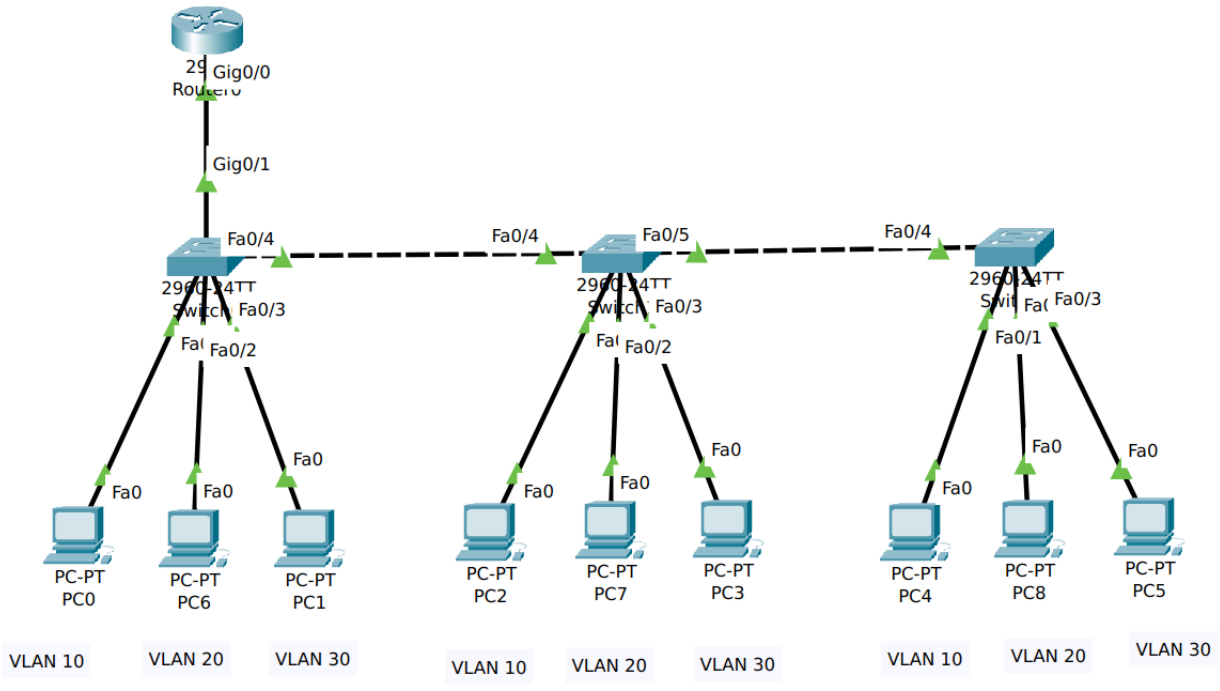
Title: Understanding the basics of Inter-VLAN communication using Router, L3 Switch along with basics of Static Routing

Objectives:

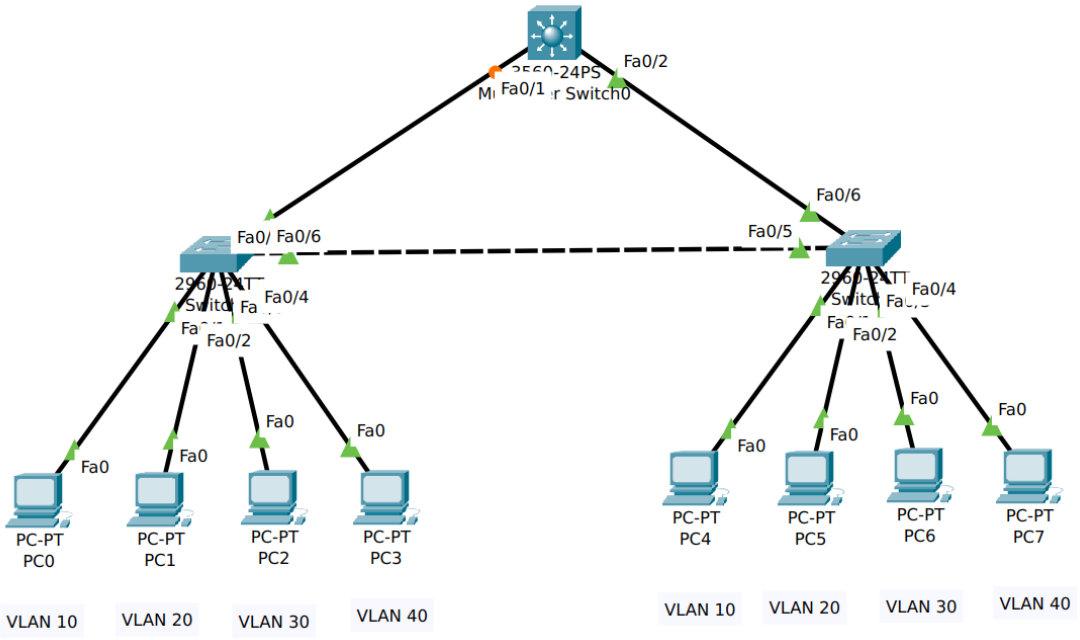
1. Understand and Implement Inter-VLAN using Router-on-a-stick
2. Understand and Implement Inter-VLAN using Multilayer Switches
3. Understand and Implement the Demo Static routing using ID

Diagram of the experiment:

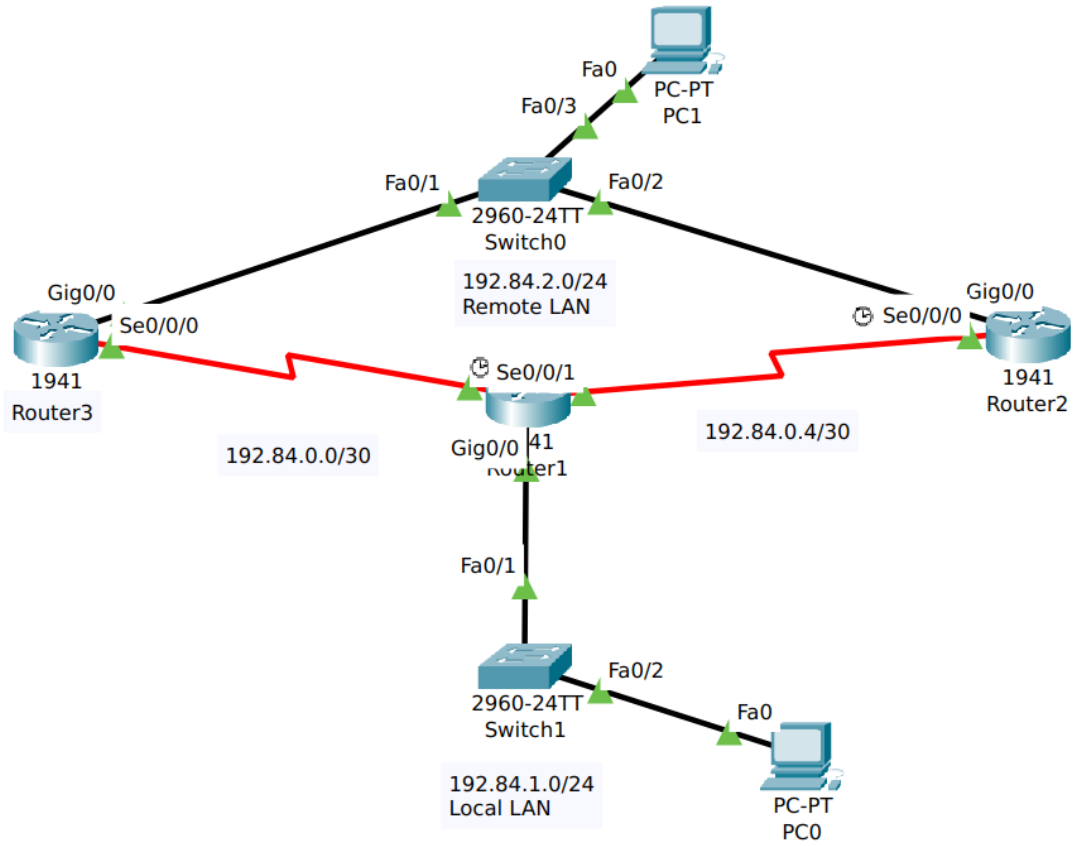
TASK 1:



TASK 2:


Fa0/2
Fa0/1
Switch0
Fa0/6
Fa0/ Fa0/6
Fa0/5
Fa0/4
Fa0/2
Fa0
PC-PT
PC0
PC1
PC2
PC3
PC4
PC5
PC6
PC7
VLAN 10
VLAN 20
VLAN 30
VLAN 40

TASK 3:


Fa0
PC-PT
PC1
Fa0/3
Fa0/1
Fa0/2
2960-24TT
Switch0
192.84.2.0/24
Remote LAN
Gig0/0
Se0/0/0
1941
Router3
Se0/0/1
Gig0/0
Se0/0/0
1941
Router2
192.84.0.0/30
192.84.0.4/30
Gig0/0
Fa0/1
Fa0/2
2960-24TT
Switch1
Fa0
192.84.1.0/24
Local LAN
PC-PT
PC0

Working Procedure:

TASK 1:

- After creating the topology accordingly, we need to create the VLANs – 10, 20, 30 and then configure them to each interfaces in access port mode.

IOS Command Line Interface

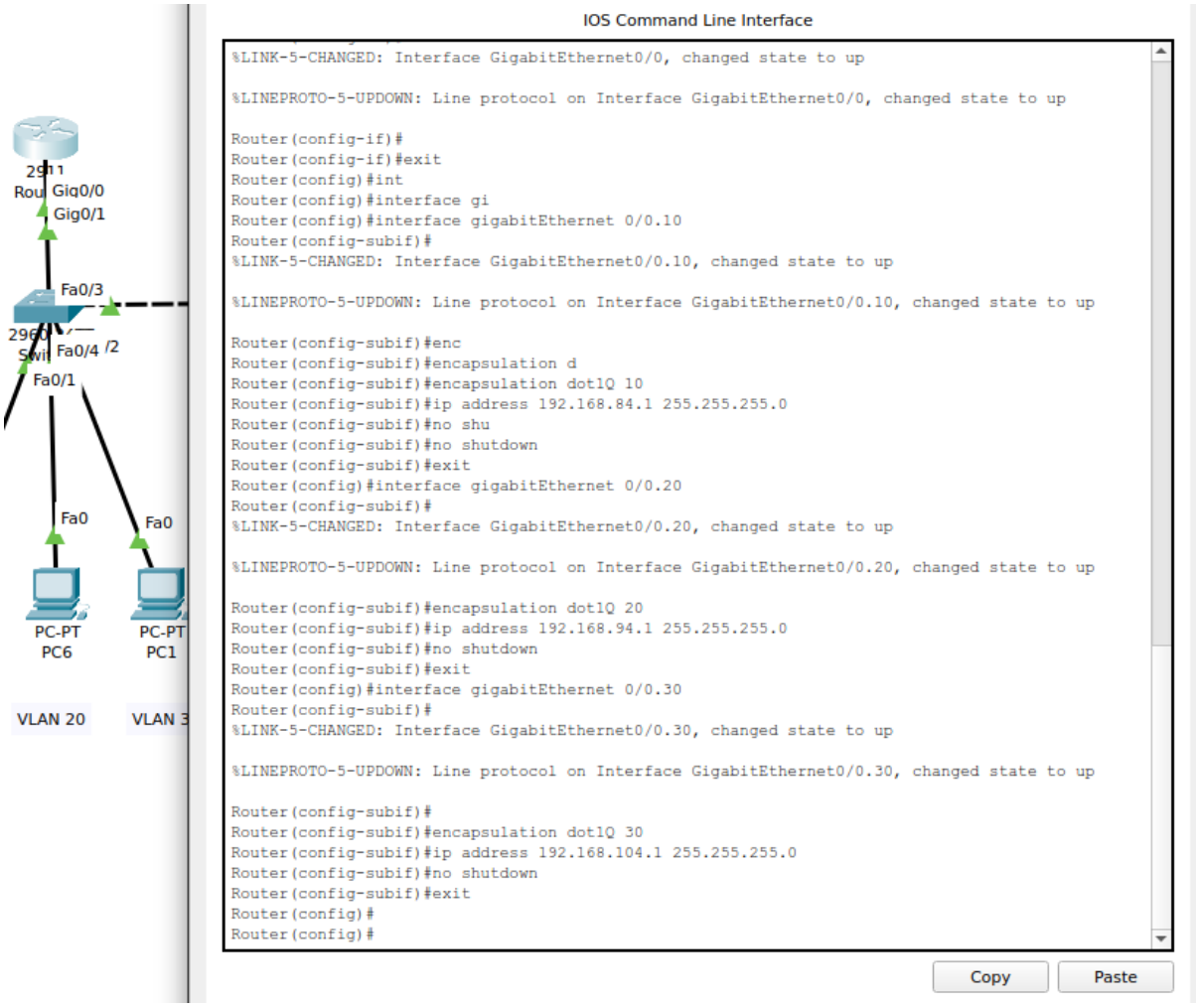
```
Switch>
Switch>
Switch>en
Switch#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#host sl
sl(config)#vlan 10
sl(config-vlan)#name Students
sl(config-vlan)#exit
sl(config)#vlan 20
sl(config-vlan)#name Teachers
sl(config-vlan)#exit
sl(config)#vlan 30
sl(config-vlan)#name Admin
sl(config-vlan)#exit
sl(config)#int
sl(config)#interface fa
sl(config)#interface fastEthernet 0/1
sl(config-if)#swi
sl(config-if)#switchport mo
sl(config-if)#switchport mode acc
sl(config-if)#switchport mode access
sl(config-if)#swi
sl(config-if)#switchport acc
sl(config-if)#switchport access vll
sl(config-if)#switchport access vla
sl(config-if)#switchport access vlan 10
sl(config-if)#no s
sl(config-if)#no sh
sl(config-if)#no shutdown
sl(config-if)#exit
sl(config)#interface fastEthernet 0/2
sl(config-if)#switchport mode access
sl(config-if)#switchport access vlan 20
sl(config-if)#no shutdown
sl(config-if)#exit
sl(config)#interface fastEthernet 0/3
sl(config-if)#switchport mode access
sl(config-if)#switchport access vlan 30
sl(config-if)#no shutdown
sl(config-if)#exit
sl(config)#
```

Copy Paste

Top

- Then we need to set the IP addresses, Masks and default gateways for the PCs according to the specific VLANs.

- Now we connect a Router-on-a-stick to the first switch and configure it.



- Finally we need to set the Trunk for the switch and the router.

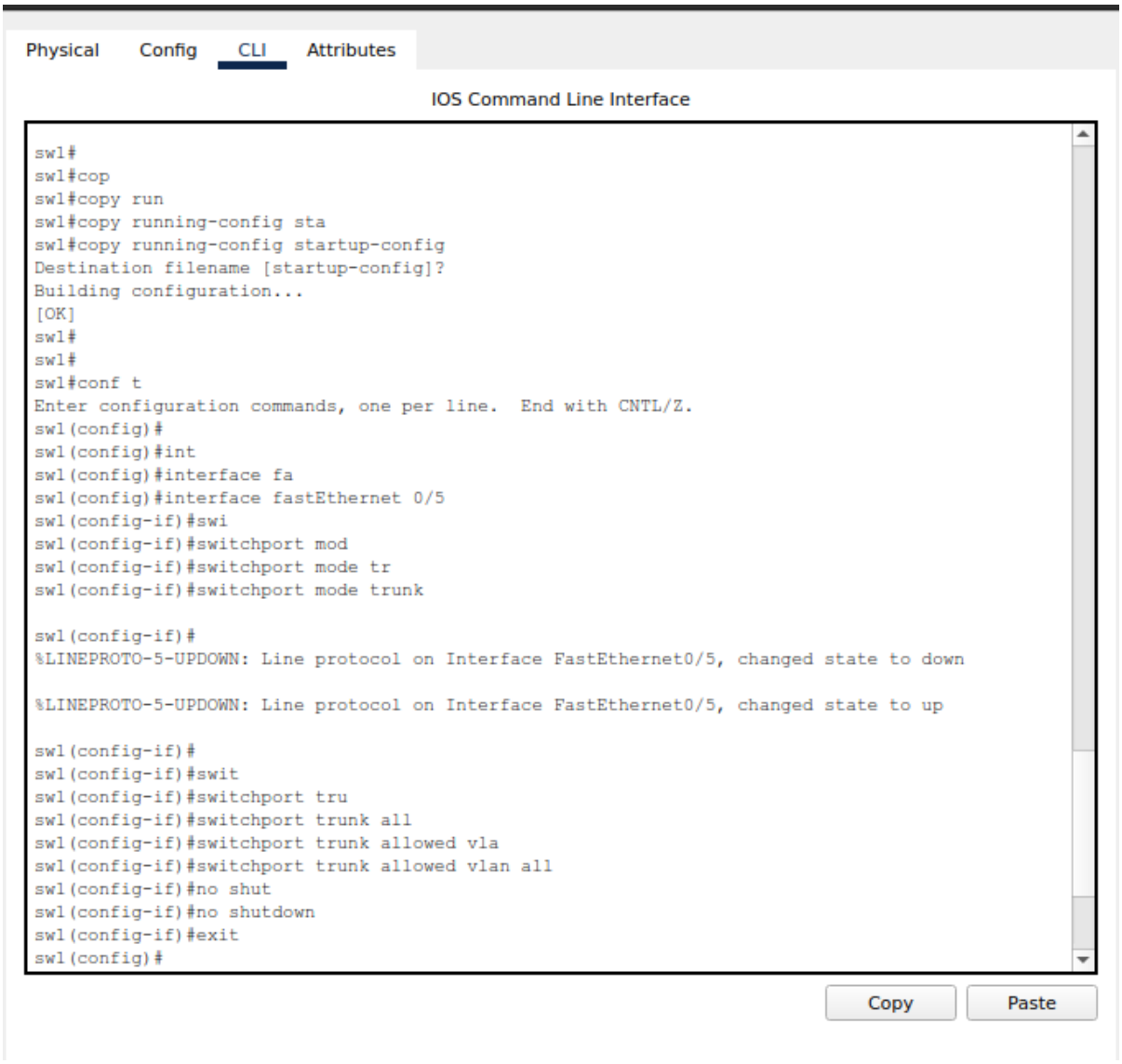
```
Enter configuration commands, one per line.  End with CNTL/Z.
Sl(config)#int
Sl(config)#interface gi
Sl(config)#interface gigabitEthernet 0/1
Sl(config-if)#swi
Sl(config-if)#switchport mo
Sl(config-if)#switchport mode tr
Sl(config-if)#switchport mode trunk
Sl(config-if)#swi
Sl(config-if)#switchport tr
Sl(config-if)#switchport trunk all
Sl(config-if)#switchport trunk allowed vl
Sl(config-if)#switchport trunk allowed vlan all
Sl(config-if)#no
Sl(config-if)#no sh
Sl(config-if)#no shutdown
Sl(config-if)#exit
```

TASK 2:

- We create a topology using the Multilayer Switch, with 2 switches and 4 PCs.
- Then we configure the VLANs 10, 20, 30 and 40 accordingly.

```
Switch#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#host sw1
sw1(config)#
sw1(config)#vlan 10
sw1(config-vlan)#name Students
sw1(config-vlan)#exit
sw1(config)#vlan 20
sw1(config-vlan)#name Teachers
sw1(config-vlan)#exit
sw1(config)#vlan 30
sw1(config-vlan)#name Admin
sw1(config-vlan)#exit
sw1(config)#vlan 40
sw1(config-vlan)#name Manager
sw1(config-vlan)#exit
sw1(config)#
sw1(config)#int
sw1(config)#interface fa
sw1(config)#interface fastEthernet 0/1
sw1(config-if)#swit
sw1(config-if)#switchport mo
sw1(config-if)#switchport mode acc
sw1(config-if)#switchport mode access
sw1(config-if)#swi
sw1(config-if)#switchport acc
sw1(config-if)#switchport access vl
sw1(config-if)#switchport access vlan 10
sw1(config-if)#no shu
sw1(config-if)#no shutdown
sw1(config-if)#exit
sw1(config)#interface fastEthernet 0/2
sw1(config-if)#switchport mode access
sw1(config-if)#switchport access vlan 20
sw1(config-if)#no shutdown
sw1(config-if)#exit
sw1(config)#interface fastEthernet 0/3
sw1(config-if)#switchport mode access
sw1(config-if)#switchport access vlan 30
sw1(config-if)#no shutdown
sw1(config-if)#exit
sw1(config)#interface fastEthernet 0/4
sw1(config-if)#switchport mode access
sw1(config-if)#switchport access vlan 40
sw1(config-if)#no shutdown
sw1(config-if)#exit
sw1(config)#
sw1(config)#exit
sw1#
%SYS-5-CONFIG_I: Configured from console by console
```

- We set the Trunk for both the switches.



- Then we configure the IP addresses, Masks and default gateways for the devices according to my ID.
- Now we configure the trunk ports from the switches to the Multilayer switch.

```
mlsw(config)#int
mlsw(config)#interface ra
mlsw(config)#interface range fa0/1-2
mlsw(config-if-range)#swi
mlsw(config-if-range)#switchport tr
mlsw(config-if-range)#switchport trunk en
mlsw(config-if-range)#switchport trunk encapsulation do
mlsw(config-if-range)#switchport trunk encapsulation dotlq
mlsw(config-if-range)#swi
mlsw(config-if-range)#switchport mo
mlsw(config-if-range)#switchport mode tr
mlsw(config-if-range)#switchport mode trunk
mlsw(config-if-range)#no shu
mlsw(config-if-range)#no shutdown
mlsw(config-if-range)#
```

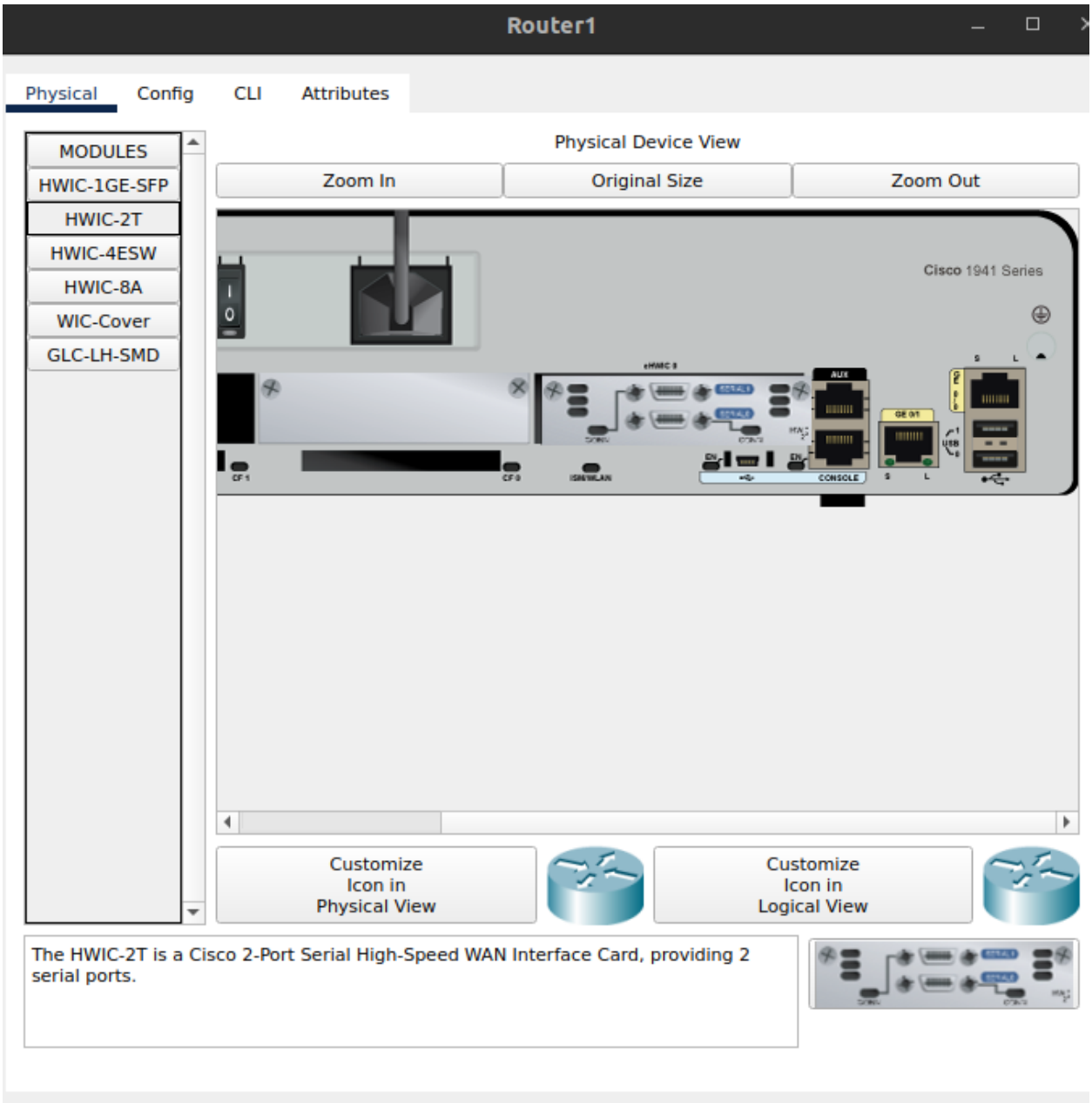
- We need to define and set the IP routing for the VLANs in the Multilayer switch and allocate IP addresses to them.

```
Switch(config)#
Switch(config)#host mlsw
mlsw(config)#
mlsw(config)#
mlsw(config)#ip rou
mlsw(config)#ip rou
mlsw(config)#vlan 10
mlsw(config-vlan)#ip rou
mlsw(config-vlan)#ip routing
mlsw(config)#exit
mlsw#
%SYS-5-CONFIG_I: Configured from console by console

mlsw#
mlsw#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
mlsw(config)#vlan 20
mlsw(config-vlan)#ip routing
mlsw(config)#
mlsw(config)#exit
mlsw#
%SYS-5-CONFIG_I: Configured from console by console

mlsw#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
mlsw(config)#vlan 30
mlsw(config-vlan)#ip routing
mlsw(config)#vlan 40
mlsw(config-vlan)#ip routing
```

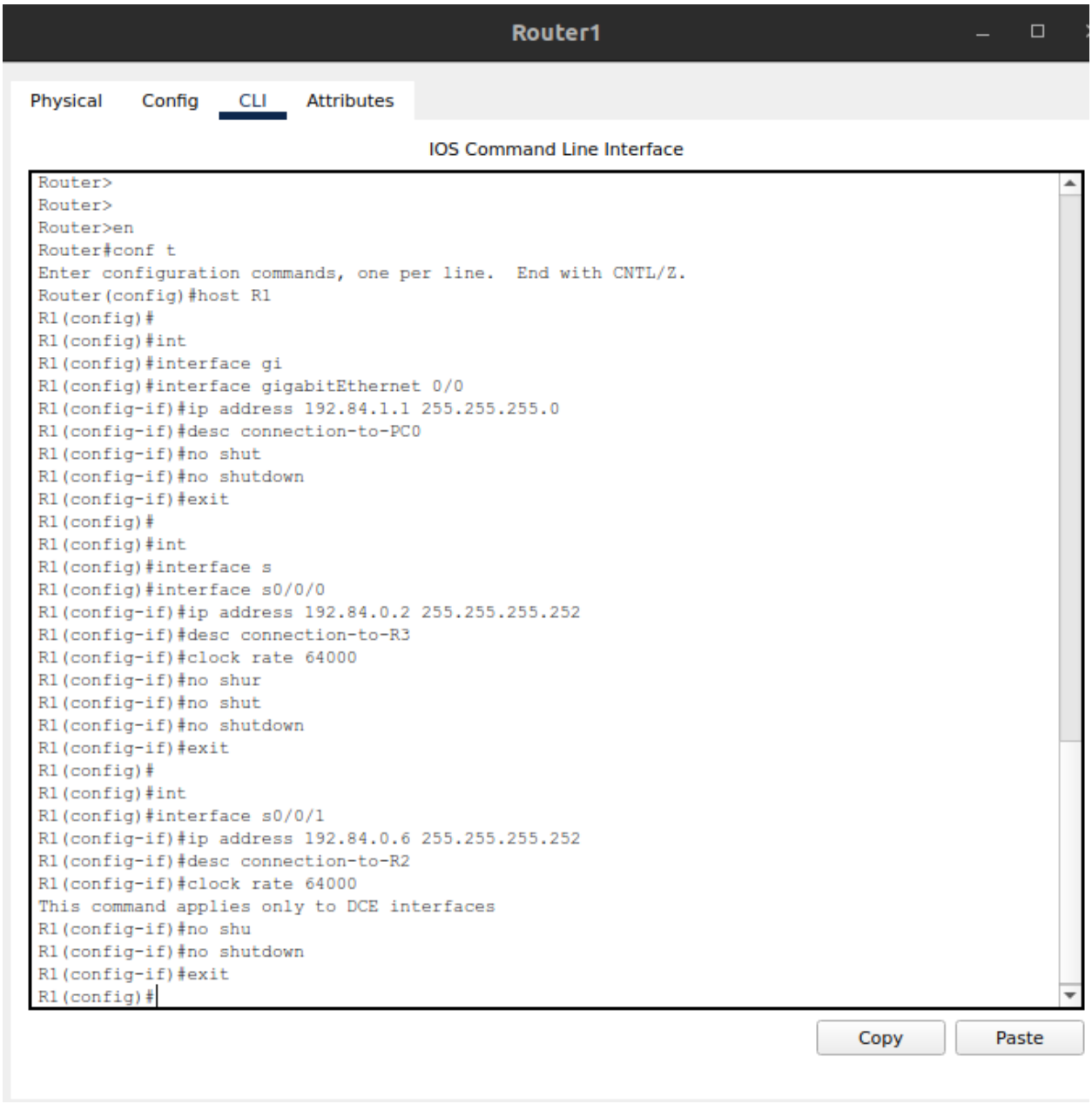
```
mlsw(config-if-range)#
mlsw(config-if-range)#int vlan 10
mlsw(config-if)#
%LINK-5-CHANGED: Interface Vlan10, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan10, changed state to up

mlsw(config-if)#ip address 192.168.85.1 255.255.255.0
mlsw(config-if)#no shu
mlsw(config-if)#no shutdown
mlsw(config-if)#exit
mlsw(config)#
mlsw(config)#int vlan 20
mlsw(config-if)#
%LINK-5-CHANGED: Interface Vlan20, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan20, changed state to up

mlsw(config-if)#ip address 192.168.86.1 255.255.255.0
mlsw(config-if)#no shutdown
mlsw(config-if)#exit
mlsw(config)#int vlan 30
mlsw(config-if)#
%LINK-5-CHANGED: Interface Vlan30, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan30, changed state to up

mlsw(config-if)#ip address 192.168.87.1 255.255.255.0
mlsw(config-if)#no shutdown
mlsw(config-if)#exit
mlsw(config)#int vlan 40
mlsw(config-if)#
%LINK-5-CHANGED: Interface Vlan40, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan40, changed state to up

mlsw(config-if)#ip address 192.168.88.1 255.255.255.0
mlsw(config-if)#no shutdown
mlsw(config-if)#exit
```

TASK 3:

- First we need to set up the topology, using routers and switches. We need to add a HWIC – 2T in the routers, for them to have access to serial ports, to connect DCE interfaces.



- Now we configure the first router with the serial port to connect to other 2 routers and the switch for the local LAN.



- Similarly, we can configure the other 2 routers with their serial ports to connect to the other routers and switches.

Router2

Physical Config CLI Attributes

IOS Command Line Interface

```
255K bytes of non-volatile configuration memory.
249856K bytes of ATA System CompactFlash 0 (Read/Write)

Press RETURN to get started!


%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to up

%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up


Router>
Router>en
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#host R2
R2(config)#
R2(config)#
R2(config)#int
R2(config)#interface s0/0/0
R2(config-if)#ip address 192.84.0.5 255.255.255.252
R2(config-if)#desc connection-to-R1
R2(config-if)#no shu
R2(config-if)#no shutdown
R2(config-if)#exit
R2(config)#
R2(config)#int
R2(config)#interface gi
R2(config)#interface gigabitEthernet 0/0
R2(config-if)#ip address 192.84.2.1 255.255.255.0
R2(config-if)#desc connection-to-RemoteLAN
R2(config-if)#no shu
R2(config-if)#no shutdown
R2(config-if)#exit
R2(config)#
```

Copy Paste

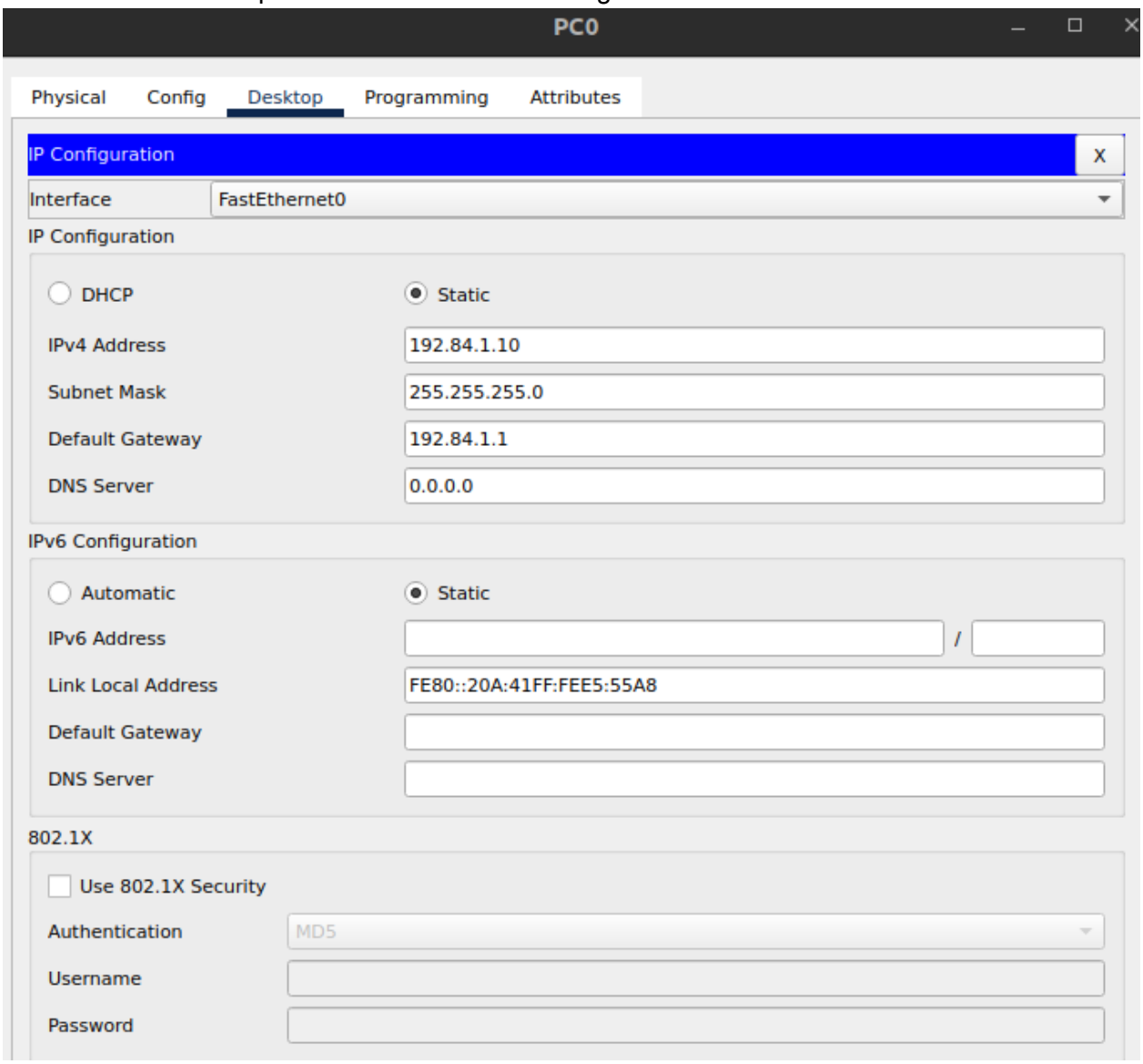
Physical Config CLI Attributes

IOS Command Line Interface

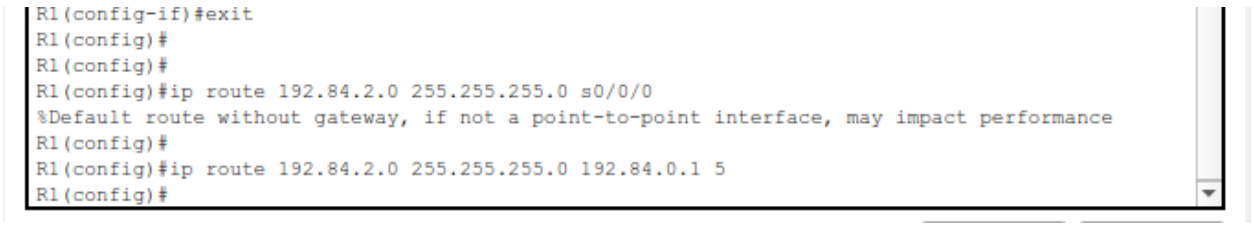
```
Press RETURN to get started!


%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to up

%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up


Router>
Router>
Router>en
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#host R3
R3(config)#
R3(config)#
R3(config)#int
R3(config)#interface s
R3(config)#interface s0/0/0
R3(config-if)#ip address 192.84.0.1 255.255.255.252
R3(config-if)#desc connection-to-R1
R3(config-if)#no shu
R3(config-if)#no shutdown
R3(config-if)#exit
R3(config)#
R3(config)#int
R3(config)#interface gi
R3(config)#interface gigabitEthernet 0/0
R3(config-if)#ip address 192.84.2.2 255.255.255.0
R3(config-if)#desc connection-to-RemoteLAN
R3(config-if)#no shu
R3(config-if)#no shutdown
R3(config-if)#exit
R3(config)#
R3(config)#
```

Copy Paste

- Then we set up the PC0 and PC1 according to the IP and Mask.



- Finally, we set up the IP, Masks and HOP routes for the 3 routers.



Questions (Answer to the point):

1. Why do we need L3 Switches?
   Ans: A layer 3 switch can perform the functionality of both a switch and a routing, which makes it efficient to handle large amount of network traffic.

2. What is the use router in Inter-Vlan Routing?
   Ans: The routers direct the network traffic from one VLAN to other VLANs.

3. What changes are needed while configuring VLANs using L3 switches instead of Router-on-a-stick approach?
   Ans: For L3 switches we assign IP addresses directly to VLAN interfaces instead of using sub-interfaces.

4. What is next-hop floating address?
   Ans: The next-hop floating address is a backup route that is used to get to the specified destination if the main route fails.

5. What is the disadvantage of static routing?
   Ans: If any device is changed in a topology, we need to manually configure the network interfaces, which is not necessary in dynamic routing.

Challenges (if any):

- **In the second task, I forgot to set up the Trunk connections between the switches.**

- **In the third task, I had trouble figuring out which serial port should route to which one.**