Data Communications And Computer Networks

(PROJECT REPORT)

BSCS-6A

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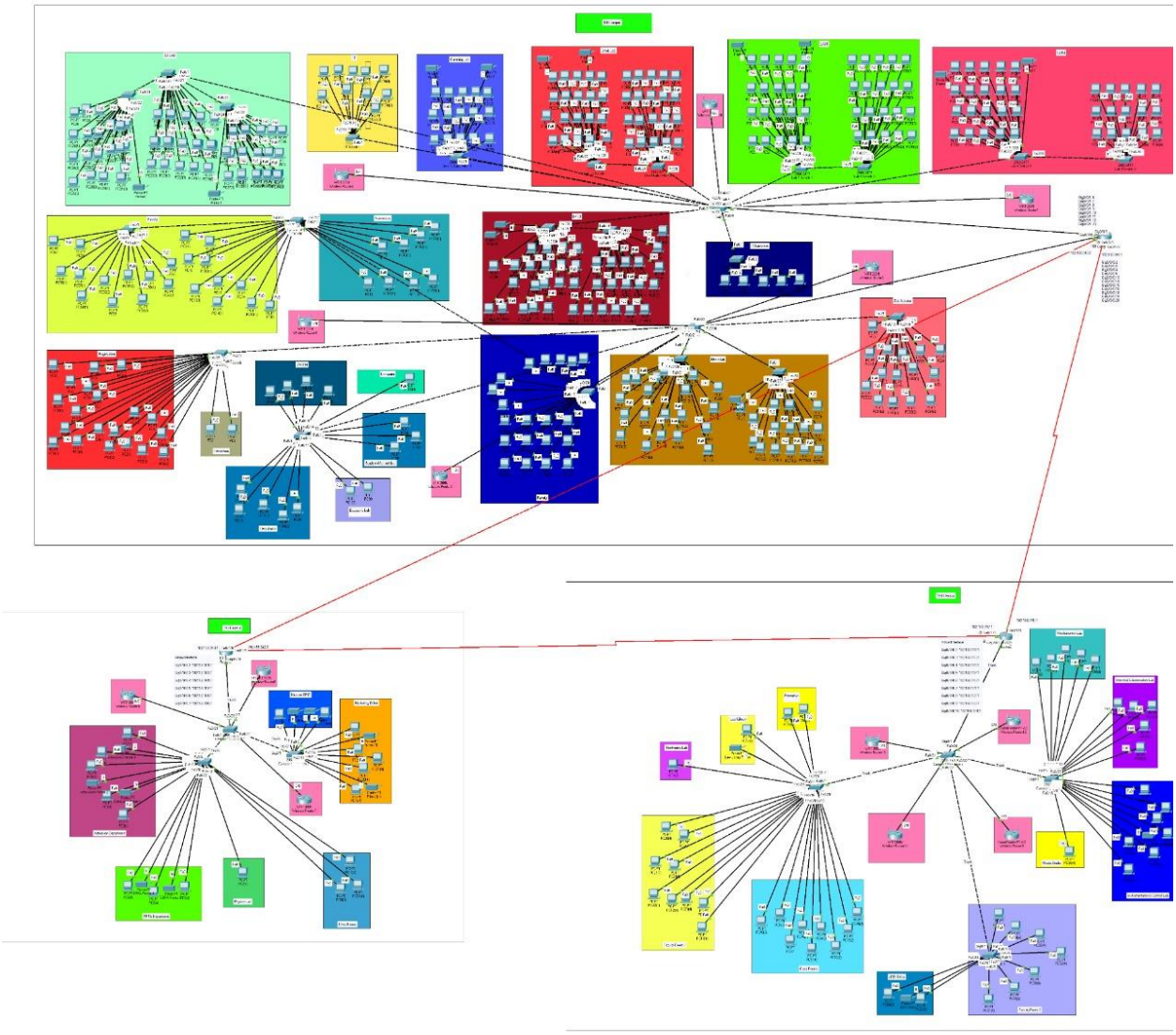
Objective

The aim of this project is to provide a demonstration of SZABIST Karachi University's Network. There are many departments working in isolation from each other within each campus, some departments may require some form of occasional and routinely connectivity for work purposes. At the same time, backup for each department would be necessary because of faulty and maintenance should not impact the department's performance. Hence, developing the network was a challenging task.

OUR PROJECT DESIGN INFRASTRUCTURE



1. EQUIPMENT USED

1.1 Laptop

A laptop is a small personal computer that is designed to be portable and usable from any physical location.

1.2 PC

A PC (personal computer) general purpose computer designed to be used by a single person only.

1.3 Printer

Printer is an output device that prints image or text pages on paper. In networking, a common printer is assigned to multiple users provided they have access to the network.

1.4 Routers

Routers are networking devices that operate at layer 3 (Network Link Layer) of the OSI model. Their main purpose is to analyze, forward, and receive data frames across the networks.When a data frame arrives it checks the destination address, and refers to the routing table to find the shortest path for the data packet to its destination address.

1.5 Server

A computer that provides shared data, resources, services to other devices connected across a network.

1.6 Switches

Switches are networking devices that operate at layer 2 (Data Link Layer) of the OSI model. Their main purpose is to send and receive data packets across the network, so it enables us to provide communication over connected devices.

1.7 Copper Straight Wires

A straight-through cable is a type of twisted pair cable that is used in local area networks to connect a computer to a network hub such as a router. This type of cable is also sometimes called a patch cable and is an alternative to wireless connections where one or more computers access a router through a wireless signal. On a straight-through cable, the wired pins match.

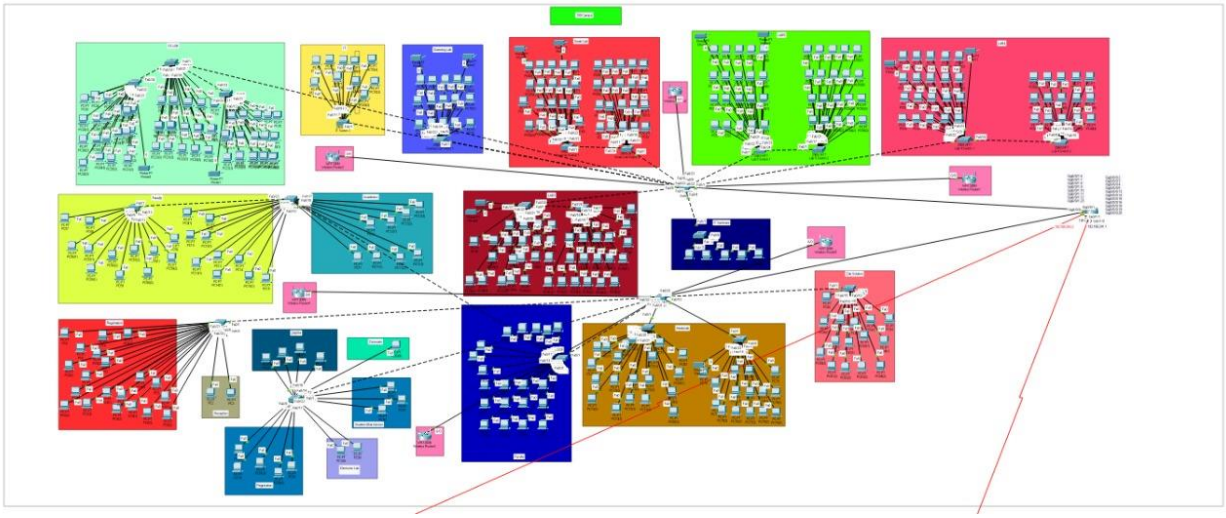
1.8 Copper Cross

An Ethernet crossover cable is a type of Ethernet cable used to connect computing devices together directly. The internal wiring of Ethernet crossover cables reverses the transmit and receive signals. It is most often used to connect two devices of the same type: e.g. two computers (via network interface controller) or two switches to each other.

1.9 Serial DTE Wire

DTE stands for data terminal equipment which generally is a terminal or a computer. DTE is an end instrument that converts user information into signals or reconverts received signal.These can also be called tail circuits.

2. CAMPUS-100



2.1 Network Capacity

In this campus we have more than 400 users that are expected to be working at the same time. Switch to Switch connectivity is done through Copper Cross Cable. PC to Switch and Switch to Router are connected through Copper Straight wire. Router to Router connectivity is achieved through Serial DTE cable.

2.2 Topologies

Each network within the Campus-100 is connected by following Star topology, while the campus is linked with other campuses by Ring topology.

2.3 Model of Equipment

In this campus,Cisco Switch 2960 are used for switches, while for routers Cisco Router 4321 are used.

2.4 Total Equipment

Network Name	PC	Switch	Printer	Copper Straight Wire	Copper Cross Wire
Classes Network	60	3	2	42	3
Reception Network	2pc	1	0	2	1
Faculty Network	45	2	0	45	3
Academic Network	8	1	0	8	1
CS Lab Network	60	3	2	62	3
Lab 3 Network	40	2	2	42	2
Lab 4 Network	40	2	2	42	2
Lab 5 Network	40	2	2	42	2
Smart Lab Network	40	2	2	42	2
Game Lab Network	15	1	2	17	1
IT Net Network	10	1	0	10	1
Media Lab Network	40	1	0	41	0
Zab Solution Network	15	1	0	15	1
Registration Network	5	0	0	5	0
Counselor Network	1	0	0	1	0
Student Affair Advisor	3	0	0	3	0

Network					
Zab FM Network	4	0	0	4	0
Electronic Lab Network	2	0	0	2	0
IT Hardware Network	5	1	0	5	1

All these networks are connected Main Campus-100 Switch 1 or 2, both Switches are connected to Main Campus Router.

Device Name	Copper Straight Wire	Copper Cross Wire	Serial DTE
Campus-100 Switch 1	4	3	0
Campus-100 Switch 2	2	6	0
Campus-100 Router	2	0	2

2.5 VLAN

VLAN	Network Name	Network
2	Classes Network	192.168.51.0
3	Reception Network	192.168.52.0
4	Faculty Network	192.168.53.0
5	Academic Network	192.168.54.0
6	CS Lab Network	192.168.55.0
7	Lab 3 Network	192.168.56.0
8	Lab 4 Network	192.168.57.0
9	Lab 5 Network	192.168.58.0
10	Smart Lab Network	192.168.59.0

11	Game Lab Network	192.168.60.0
12	IT Net Network	192.168.61.0
13	Media Lab Network	192.168.63.0
14	Zab Solution Network	192.168.64.0
15	Registration Network	192.168.65.0
16	Counselor Network	192.168.66.0
18	Student Affair Advisor Network	192.168.68.0
19	Zab FM Network	192.168.69.0
20	Electronic Lab Network	192.168.70.0
23	IT Hardware Network	192.168.71.0

2.6 Access Point Configuration

Main Switch 1
vlan 25
name Wifi
exit
interface range fastEthernet 0/21-24
switchport mode access
switchport access vlan 25

Main Switch 2
vlan 25
name Wifi
exit
interface range fastEthernet 0/21-24
switchport mode access
switchport access vlan 25

Router

interface Gig0/0/0.25

encapsulation dot1Q 25
ip address 192.168.245.1 255.255.255.0
exit

ip dhcp pool Wifi
default-router 192.168.245.1
network 192.168.245.0 255.255.255.0
dns-server 8.8.8.8
exit

interface Gig0/0/1.25
encapsulation dot1Q 25
ip address 192.168.246.1 255.255.255.0
exit

ip dhcp pool Wifi
default-router 192.168.246.1
network 192.168.246.0 255.255.255.0
dns-server 8.8.8.8
exit

6 Wifi Routers is used

2.7 Protocols

The protocols applied in this project are Telenet, DHCP, and RIP.

2.7a Telnet

Telnet is a network protocol used to virtually access a computer and to provide a two-way, collaborative and text-based communication channel between two machines. It follows a user command Transmission Control Protocol/Internet Protocol (TCP/IP) networking protocol for creating remote sessions.

Following is the 100-Campus Telenet Configuration:

Campus 100 Router vlan 1 IP 192.168.201.1
Main Switch 1 vlan 1 IP 192.168.201.2
Main Switch 2 vlan 1 IP 192.168.201.3
Lab 4 Switch 1 vlan 1 IP 192.168.201.5
Lab 4 Switch 2 vlan 1 IP 192.168.201.4

Lab 5 Switch 1 vlan 1 IP 192.168.201.6
Lab 5 Switch 2 vlan 1 IP 192.168.201.7
Smart Lab Switch 1 vlan 1 IP 192.168.201.8
Smart Lab Switch 2 vlan 1 vlan 1 IP 192.168.201.9
Gaming Lab Switch 1 vlan 1 vlan 1 IP 192.168.201.10
IT Switch 1 vlan 1 IP 192.168.201.11
CS Lab Switch 1 vlan 1 IP 192.168.201.12
CS Lab Switch 2 vlan 1 IP 192.168.201.13
CS Lab Switch 3 vlan 1 IP 192.168.201.14
Hardware Room Switch 1 vlan 1 IP 192.168.201.15
Lab 3 Switch 1 vlan 1 IP 192.168.201.16
Lab 3 Switch 2 vlan 1 IP 192.168.201.17
Counselor Switch 1 vlan 1 IP 192.168.201.18
Reception And Classes Switch 1 vlan 1 IP 192.168.201.19
Registration Switch 1 vlan 1 IP 192.168.201.20
Zab Solution Switch 1 vlan 1 IP 192.168.201.21
Media Lab Switch 1 vlan 1 IP 192.168.201.22
Media Lab Switch 1 vlan 1 IP 192.168.201.23
Media Lab Switch 1 vlan 1 IP 192.168.201.24
Electronics Lab Switch 1 vlan 1 IP 192.168.201.25
Faculty Switch 1 vlan 1 IP 192.168.201.26
Faculty and Academics Switch 2 vlan 1 IP 192.168.201.27
Faculty Switch 3 vlan 1 IP 192.168.201.28

2.7b DHCP

Dynamic Host Configuration Protocol (DHCP) is a network management protocol used to automate the process of configuring devices on IP networks, thus allowing them to use network services such as DNS, NTP, and any communication protocol based on UDP or TCP**.**

Following is the 100-Campus DHCP Configuration:

```
ip dhcp pool Classes
 network 192.168.51.0 255.255.255.0
 default-router 192.168.51.1
 dns-server 8.8.8.8
ip dhcp pool Reception
 network 192.168.52.0 255.255.255.0
 default-router 192.168.52.1
ip dhcp pool Faculty
 network 192.168.53.0 255.255.255.0
 default-router 192.168.53.1
ip dhcp pool Academic
 network 192.168.54.0 255.255.255.0
 default-router 192.168.54.1
ip dhcp pool Cslab
 network 192.168.55.0 255.255.255.0
 default-router 192.168.55.1
 dns-server 8.8.8.8
ip dhcp pool Lab3
 network 192.168.56.0 255.255.255.0
 default-router 192.168.56.1
ip dhcp pool Lab4
 network 192.168.57.0 255.255.255.0
 default-router 192.168.57.1
ip dhcp pool Lab5
 network 192.168.58.0 255.255.255.0
 default-router 192.168.58.1
ip dhcp pool Labsmart
 network 192.168.59.0 255.255.255.0
 default-router 192.168.59.1
ip dhcp pool Gamelab
 network 192.168.60.0 255.255.255.0
 default-router 192.168.60.1
```

```
ip dhcp pool It
 network 192.168.61.0 255.255.255.0
 default-router 192.168.61.1
ip dhcp pool medialab
 network 192.168.63.0 255.255.255.0
 default-router 192.168.63.1
 dns-server 8.8.8.8
ip dhcp pool zabsolution
 network 192.168.64.0 255.255.255.0
 default-router 192.168.64.1
 dns-server 8.8.8.8
ip dhcp pool registration
 network 192.168.65.0 255.255.255.0
 default-router 192.168.65.1
ip dhcp pool consoulor
 network 192.168.66.0 255.255.255.0
 default-router 192.168.66.1
ip dhcp pool ithardware
 network 192.168.72.0 255.255.255.0
 default-router 192.168.72.1
 dns-server 8.8.8.8
ip dhcp pool studentaffairadvisor
 network 192.168.68.0 255.255.255.0
 default-router 192.168.68.1
 dns-server 8.8.8.8
ip dhcp pool zabfm
 network 192.168.69.0 255.255.255.0
 default-router 192.168.69.1
 dns-server 8.8.8.8
ip dhcp pool electroniclab
 network 192.168.70.0 255.255.255.0
 default-router 192.168.70.1
 dns-server 8.8.8.8
```

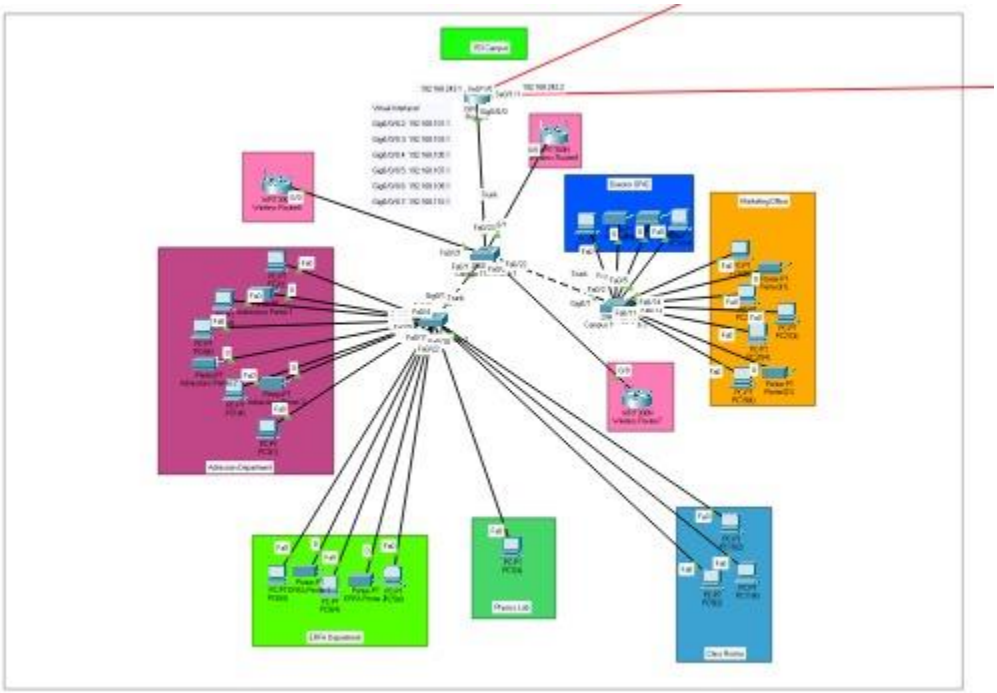
2.7c RIP

Routing Information Protocol (RIP) is a dynamic routing protocol which uses hop count as a routing metric to find the best path between the source and the destination network

Following is the 100-Campus RIP Configuration:

```
router rip
 version 2
 network 192.168.51.0
 network 192.168.52.0
 network 192.168.53.0
 network 192.168.54.0
 network 192.168.55.0
 network 192.168.56.0
 network 192.168.57.0
 network 192.168.58.0
 network 192.168.59.0
 network 192.168.60.0
 network 192.168.61.0
 network 192.168.63.0
 network 192.168.64.0
 network 192.168.65.0
 network 192.168.66.0
 network 192.168.68.0
 network 192.168.69.0
 network 192.168.70.0
 network 192.168.71.0
 network 192.168.72.0
 network 192.168.241.0
 network 192.168.243.0
```

3. CAMPUS-153



3.1 Network Capacity

In this campus we have more than 20 users that are expected to be working at the same time. Switch to Switch connectivity is done through Copper Cross Cable. PC to Switch and Switch to Router are connected through Copper Straight wire. Router to Router connectivity is achieved through Serial DTE cable

3.2 Topologies

Each network within the Campus-153 is connected by following Star topology, while the campus is linked with other campuses by Ring topology.

3.3 Model of Equipment

In this campus,Cisco Switch 2960 are used for switches, while for routers Cisco Router 4321 are used.

3.4 Total Equipment

Network Name	PC	Switch	Printer	Copper Straight Wire	Copper Cross Wire
Classrooms Network	3	0	1	4	0
Physics Lab network	1	0	0	1	0
Admission Department Network	5	0	3	8	0
ERFA department Network	3	0	2	5	0
Director ORIC Network	2	0	2	4	0
Marketing Office Network	5	0	2	7	0

All these networks are connected Main Campus-153 Switch 2 or 3, both Switches are connected to Main Campus-153 Switch 1 that is connected to the Main Campus Router.

Device Name	Copper Straight Wire	Copper Cross Wire	Serial DTE
Campus-153 Switch 1	1	2	0
Campus-153 Switch 2	17	1	0
Campus-153 Switch 3	10	1	0
Campus-153 Router	1	0	2

3.5 VLAN

VLAN	Name	Network
2	Classrooms Network	192.168.101.0
3	Physics Lab network	192.168.103.0
4	Admission Department Network	192.168.105.0
5	ERFA department Network	192.168.107.0
6	Director ORIC Network	192.168.109.0
7	Marketing Office Network	192.168.110.0

3.6 Access Point Configuration

Main Switch
vlan 25
name Wifi
exit
interface range fastEthernet 0/21-24
switchport mode access
switchport access vlan 25

Router

interface Gig0/0/0.25
encapsulation dot1Q 25
ip address 192.168.245.1 255.255.255.0
exit

ip dhcp pool Wifi
default-router 192.168.245.1
network 192.168.245.0 255.255.255.0
dns-server 8.8.8.8
exit

3 Wifi Routers is used

3.7 Protocols

The protocols applied in this project are Telenet, DHCP, and RIP.

3.7a Telnet

Telnet is a network protocol used to virtually access a computer and to provide a two-way, collaborative and text-based communication channel between two machines. It follows a user command Transmission Control Protocol/Internet Protocol (TCP/IP) networking protocol for creating remote sessions.

Following is the 153-Campus Telnet Configuration:

Campus 153 Router vlan 1 IP 192.168.201.31
Campus 153 Switch 1 vlan 1 IP 192.168.201.32
Campus 153 Switch 2 vlan 1 IP 192.168.201.33
Campus 153 Switch 3 vlan 1 IP 192.168.201.34

3.7b DHCP

Dynamic Host Configuration Protocol (DHCP) is a network management protocol used to automate the process of configuring devices on IP networks, thus allowing them to use network services such as DNS, NTP, and any communication protocol based on UDP or TCP**.**

Following is the 153-Campus DHCP Configuration:

```
ip dhcp pool Admission_Department
 network 192.168.105.0 255.255.255.0
 default-router 192.168.105.1
 dns-server 8.8.8.8
ip dhcp pool ERFA_Department
 network 192.168.107.0 255.255.255.0
 default-router 192.168.107.1
 dns-server 8.8.8.8
ip dhcp pool Class_Rooms
 network 192.168.101.0 255.255.255.0
 default-router 192.168.101.1
 dns-server 8.8.8.8
ip dhcp pool Physics_Lab
 network 192.168.103.0 255.255.255.0
 default-router 192.168.103.1
 dns-server 8.8.8.8
ip dhcp pool Director_ORIC
 network 192.168.109.0 255.255.255.0
 default-router 192.168.109.1
 dns-server 8.8.8.8
ip dhcp pool Marketing_Office
 network 192.168.110.0 255.255.255.0
 default-router 192.168.110.1
 dns-server 8.8.8.8
```

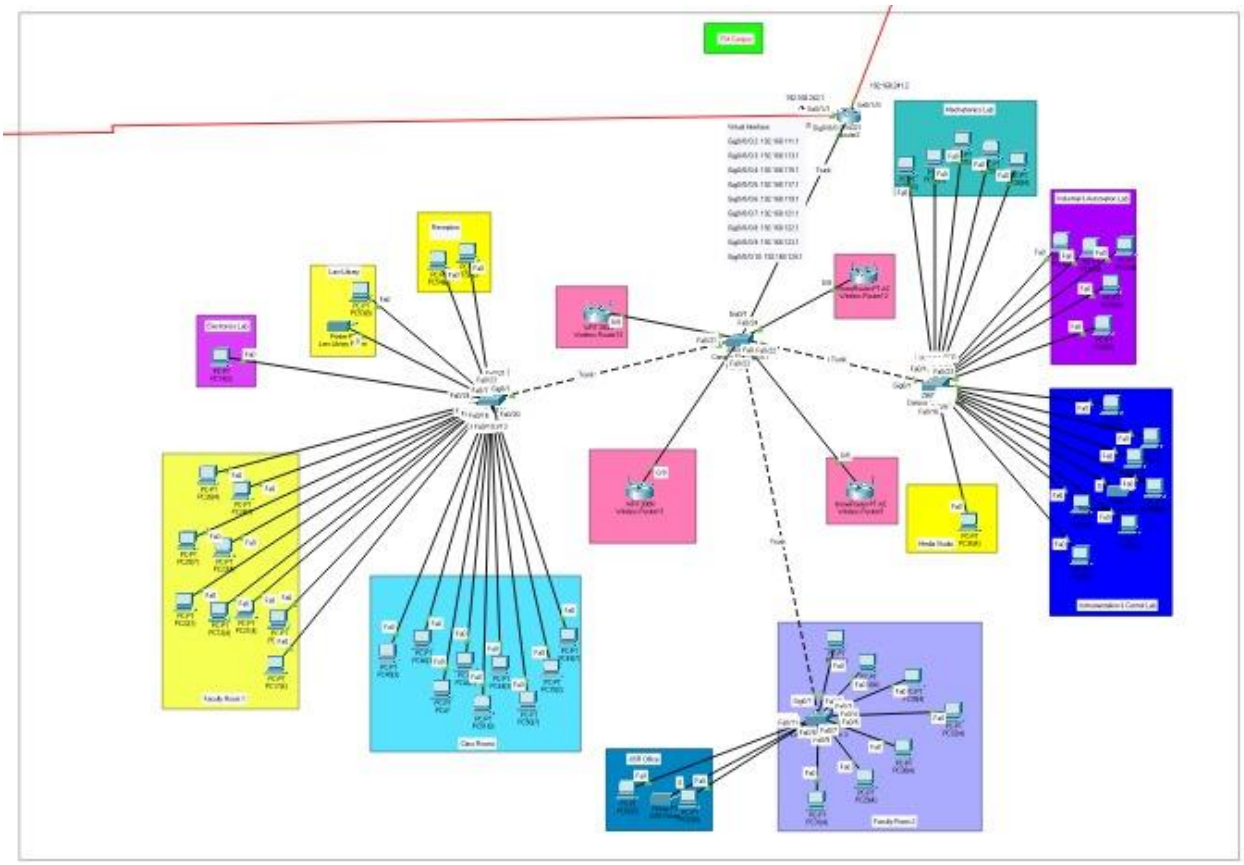
3.7c RIP

Routing Information Protocol (RIP) is a dynamic routing protocol which uses hop count as a routing metric to find the best path between the source and the destination network

Following is the 153-Campus RIP Configuration:

```
router rip
 version 2
 network 192.168.101.0
 network 192.168.103.0
 network 192.168.105.0
 network 192.168.107.0
 network 192.168.109.0
 network 192.168.110.0
 network 192.168.242.0
 network 192.168.243.0
```

5. CAMPUS-154



4.1 Network Capacity

In this campus we have more than 50 users that are expected to be working at the same time. Switch to Switch connectivity is done through Copper Cross Cable. PC to Switch and Switch to Router are connected through Copper Straight wire. Router to Router connectivity is achieved through Serial DTE cable

4.2 Topologies

Each network within the Campus-100 is connected by following Star topology, while the campus is linked with other campuses by Ring topology.

4.3 Model of Equipment

In this campus,Cisco Switch 2960 are used for switches, while for routers Cisco Router 4321 are used.

4.4 Total Equipment

Network Name	PC	Switch	Printer	Copper Straight Wire	Copper Cross Wire
ClassRooms Network	9	0	0	9	0
Electronics Lab Network	1	0	0	1	0
Reception Network	2	0	0	2	0
Law Library Network	1	0	1	1	0
Instrumentation & Control Lab Network	7	0	1	8	0
Media Studio Network	1	0	0	1	0
Mechatronics Lab Network	5	0	0	5	0

Industrial & Automation Lab Network	5	0	0	5	0
JISR Office Network	2	1	0	3	0

All these networks are connected Main Campus-154 Switch 2 or 4, all Switches are connected to the Main Campus Router.

Device Name	Copper Straight Wire	Copper Cross Wire	Serial DTE
Campus-154 Switch 2	23	1	0
Campus-154 Switch 4	10	1	0
Campus-154 Router	1	0	2

4.5 VLAN

VLAN	Name	Network
2	ClassRooms Network	192.168.111.0
3	Electronics Lab Network	192.168.113.0
4	Reception Network	192.168.115.0
5	Law Library Network	192.168.117.0
6	Instrumentation & Control Lab Network	192.168.119.0
7	Media Studio Network	192.168.121.0

8	Mechatronics Lab Network	192.168.122.0
9	Industrial & Automation Lab Network	192.168.123.0
10	JISR Office Network	192.168.124.0

4.6 Access Point Configuration

Main Switch 2
vlan 25
name Wifi
exit
interface range fastEthernet 0/21-24
switchport mode access
switchport access vlan 25

Router

interface Gig0/0/0.25
encapsulation dot1Q 25
ip address 192.168.245.1 255.255.255.0
exit

ip dhcp pool Wifi
default-router 192.168.245.1
network 192.168.245.0 255.255.255.0
dns-server 8.8.8.8
exit

4 Wifi Routers is used

4.7 Protocols

The protocols applied in this project are Telenet, DHCP, and RIP.

4.7a Telnet

Telnet is a network protocol used to virtually access a computer and to provide a two-way, collaborative and text-based communication channel between two machines. It follows a user

command Transmission Control Protocol/Internet Protocol (TCP/IP) networking protocol for creating remote sessions.

Following is the 154-Campus Telnet Configuration:

Campus 154 Router vlan 1 IP 192.168.201.36
Campus 154 Switch 1 vlan 1 IP 192.168.201.37
Campus 154 Switch 2 vlan 1 IP 192.168.201.38
Campus 154 Switch 3 vlan 1 IP 192.168.201.39
Campus 154 Switch 4 vlan 1 IP 192.168.201.40

4.7b DHCP

Dynamic Host Configuration Protocol (DHCP) is a network management protocol used to automate the process of configuring devices on IP networks, thus allowing them to use network services such as DNS, NTP, and any communication protocol based on UDP or TCP**.**

Following is the 154-Campus DHCP Configuration:

```
ip dhcp pool Class_Rooms
 network 192.168.111.0 255.255.255.0
 default-router 192.168.111.1
 dns-server 8.8.8.8
ip dhcp pool Faculty_Rooms
ip dhcp pool Faculty_Room_1
 network 192.168.113.0 255.255.255.0
 default-router 192.168.113.1
 dns-server 8.8.8.8
ip dhcp pool Faculty_Room_2
 network 192.168.113.0 255.255.255.0
 default-router 192.168.113.1
 dns-server 8.8.8.8
ip dhcp pool Reception
 network 192.168.115.0 255.255.255.0
 default-router 192.168.115.1
 dns-server 8.8.8.8
ip dhcp pool Law_Library
 network 192.168.117.0 255.255.255.0
 default-router 192.168.117.1
 dns-server 8.8.8.8
ip dhcp pool Mechatronics_Lab
 network 192.168.122.0 255.255.255.0
 default-router 192.168.122.1
 dns-server 8.8.8.8
ip dhcp pool Media_Studio
 network 192.168.121.0 255.255.255.0
 default-router 192.168.121.1
 dns-server 8.8.8.8
ip dhcp pool Instrumentation_&_Control_Lab
 network 192.168.119.0 255.255.255.0
 default-router 192.168.119.1
 dns-server 8.8.8.8
```

```
ip dhcp pool Industrial_&_Automation_Lab
 network 192.168.123.0 255.255.255.0
 default-router 192.168.123.1
 dns-server 8.8.8.8
ip dhcp pool JISR_Office
 network 192.168.124.0 255.255.255.0
 default-router 192.168.124.1
 dns-server 8.8.8.8
```

4.7c RIP

Routing Information Protocol (RIP) is a dynamic routing protocol which uses hop count as a routing metric to find the best path between the source and the destination network

Following is the 154-Campus RIP Configuration:

```
router rip
 version 2
 network 192.168.111.0
 network 192.168.113.0
 network 192.168.115.0
 network 192.168.117.0
 network 192.168.119.0
 network 192.168.121.0
 network 192.168.122.0
 network 192.168.123.0
 network 192.168.124.0
 network 192.168.241.0
 network 192.168.242.0
```