

### Academic Tasks-1

Course Code: CSE307	Course Title: INTERNET WORKING ESSENTIALS
Course Instructor: BHUPINDER KAUR	
Academic Task No.: CA 1 DESIGN	Academic Task Title: UNIVERSITY CAMPUS NETWORK
Date of Allotment: 19/02/2025	Date of submission: 26/02/2025
Student's Roll no: K23FSB24	Student's Reg. no: 12310811
Evaluation Parameters: (Parameters on which student is to be evaluated- To be mentioned by students as specified at the time of assigning the task by the instructor)	

**Learning Outcomes:** (Student to write briefly about learnings obtained from the academic tasks)

#### **Declaration:**

I declare that this Assignment is my individual work. I have not copied it from any other student's work or from any other source except where due acknowledgement is made explicitly in the text, nor has any part been written for me by any other person.

**Student's Signature:** Sumit Singh Ranawat

**Evaluator's comments (For Instructor's use only)**

General Observations	Suggestions for Improvement	Best part of assignment

**Evaluator's Signature and Date:**

**Marks Obtained:** \_\_\_\_ **Max. Marks:** .....

# University Campus Network Report

## 1. Physical Network Setup

### Overview:

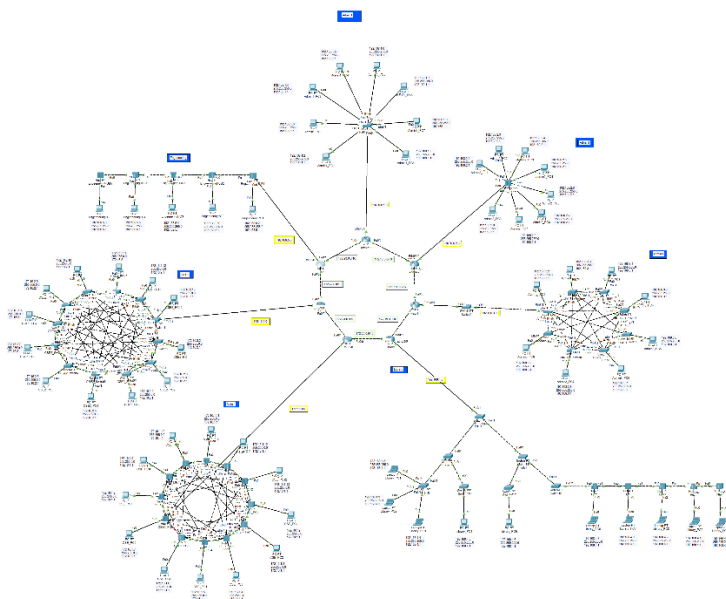
This network design covers seven buildings on a university campus, each with a unique topology. A total of **seven routers** are interconnected in a **ring topology** to ensure reliability and prevent network failures. The connection between buildings utilizes **fiber-optic cables** to support high-speed data transfer.

### Implementation:

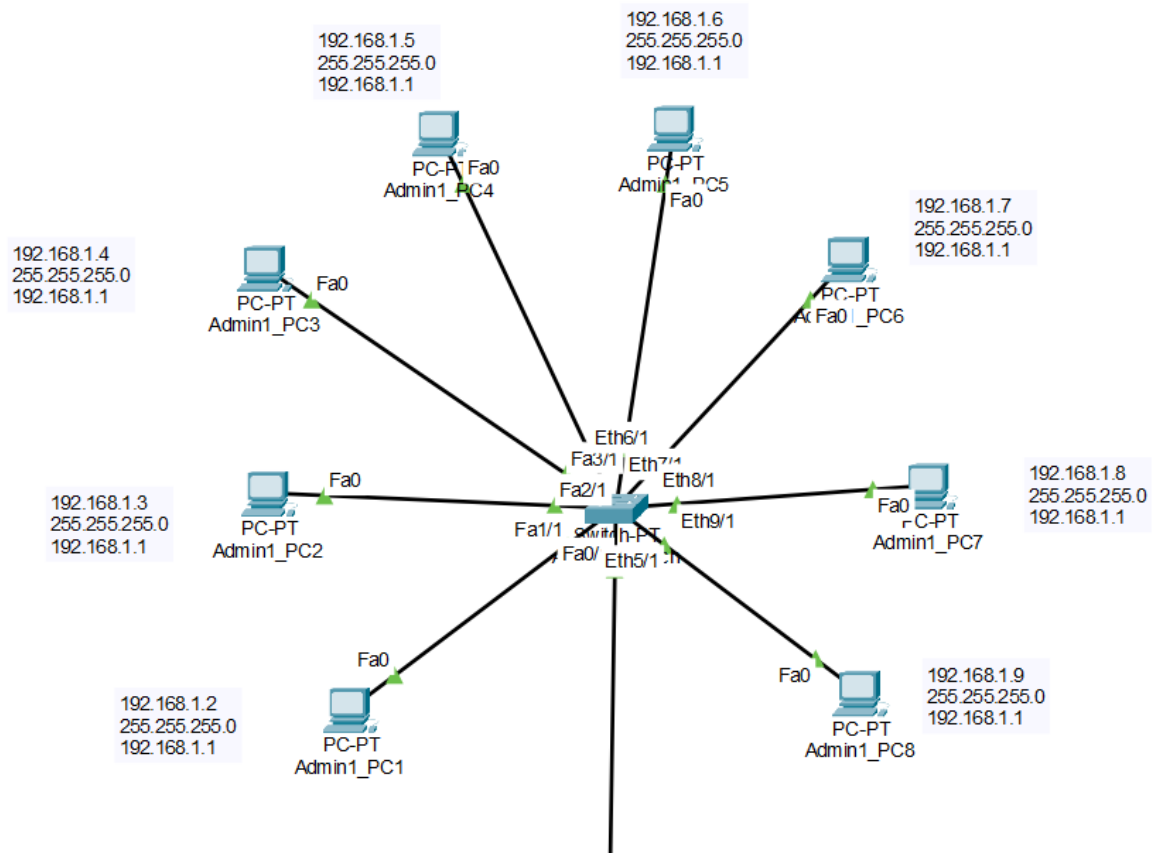
- **Admin Building 1:** Star topology with a switch.
- **Admin Building 2:** Star topology using a hub.
- **Admin Building 3:** Mesh topology with a switch.
- **Library:** Hybrid topology (switch + hub).
- **Computer Science Department 1:** Mesh topology using a hub.
- **Computer Science Department 2:** Mesh topology with switches.
- **Engineering Department:** Bus topology using a hub.

### Snapshot:

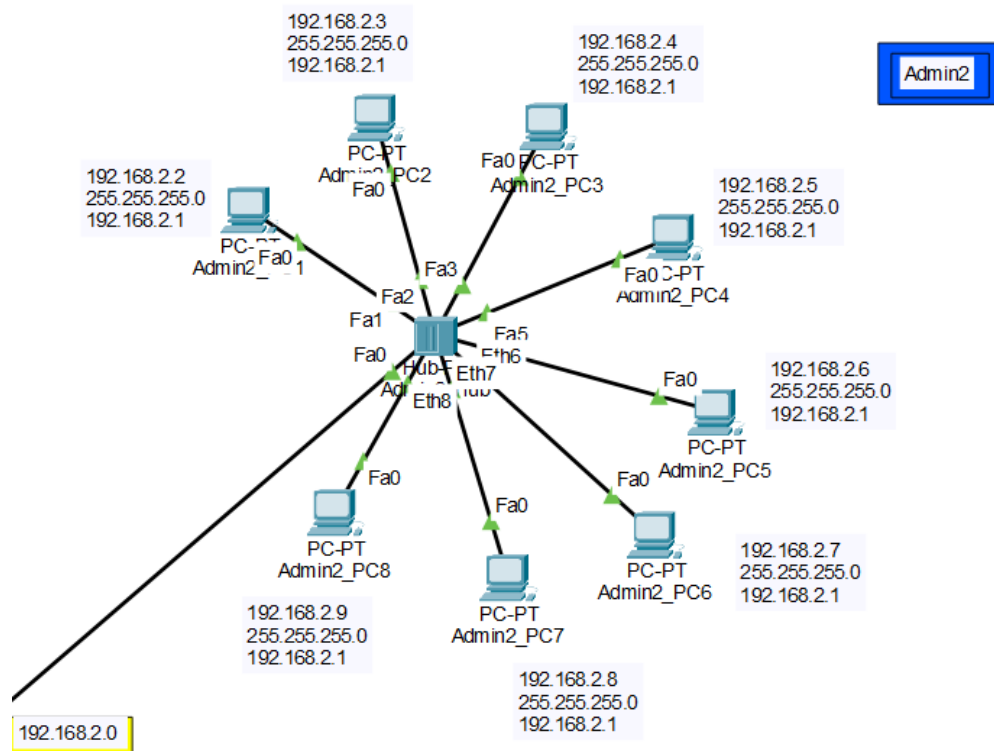
## The Network Designed

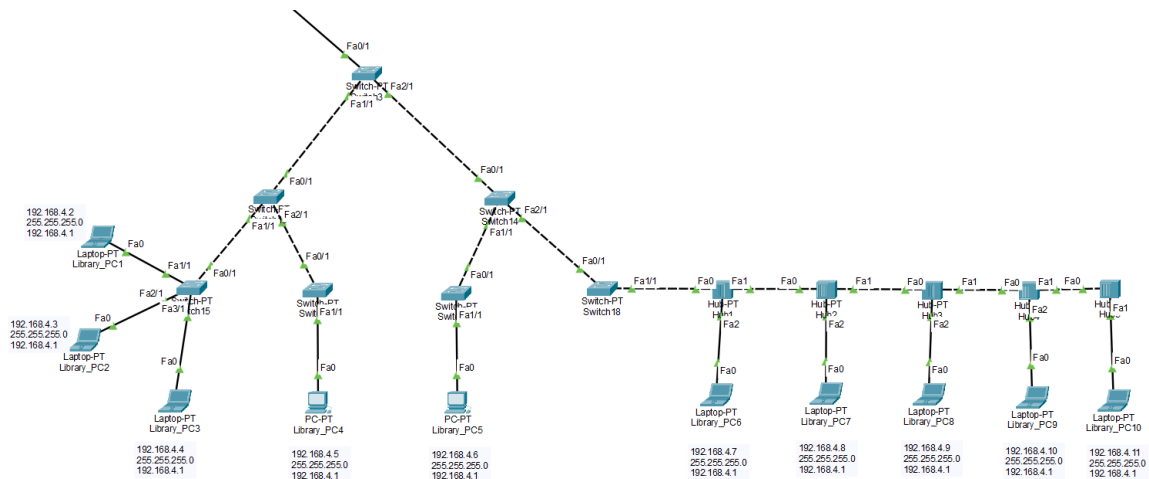


## Admin1 – Star topology with Switch

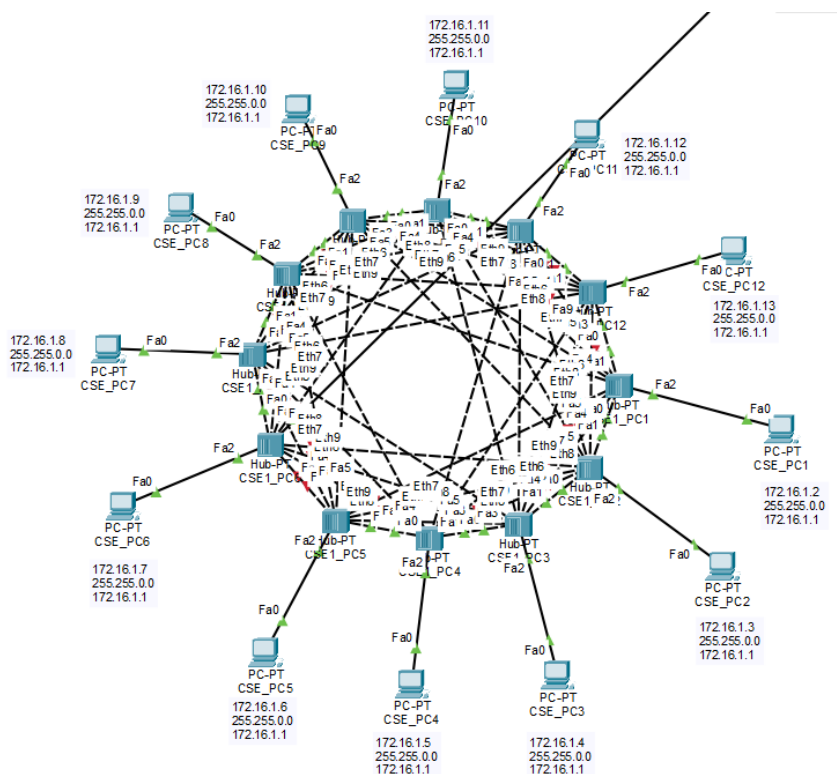


## Admin2 – Star topology with hub

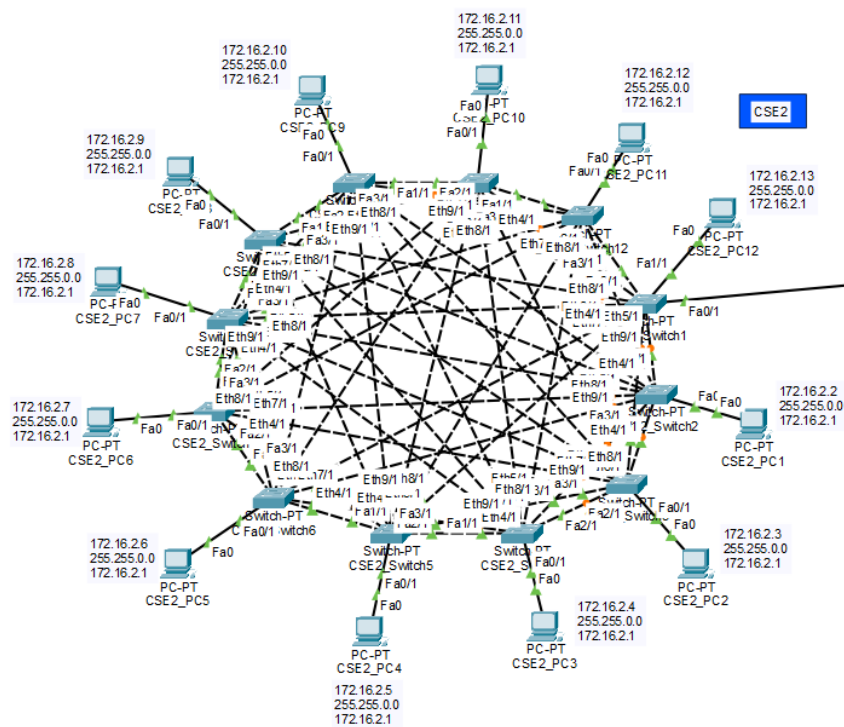




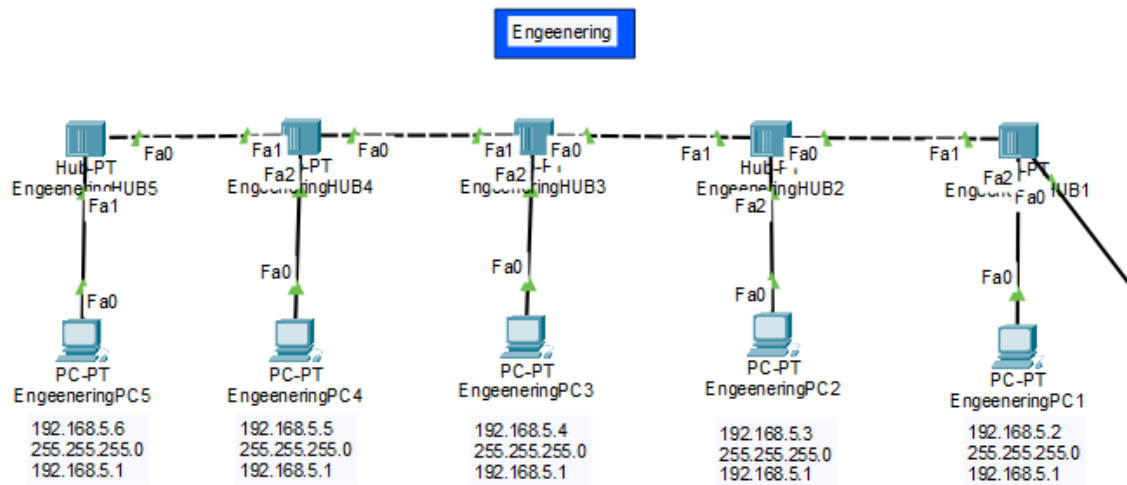
## Computer Science Department 1 - Mesh topology using a hub.



## Computer Science Department 2 - Mesh topology with switches.



## Engineering Department - Bus topology using a hub.



## 2. IP Addressing Scheme

### Overview:

The network is assigned IPv4 addresses from **Class B (172.16.0.0/16)** and **Class C (192.168.0.0/24)** ranges. Each building has its dedicated subnet, and routers use **/30 subnets** for point-to-point links.

### IP Address Allocation:

Building	Subnet Assigned	Subnet Mask	IP Range
Admin 1	192.168.1.0	255.255.255.0	192.168.1.1 - 192.168.1.8
Admin 2	192.168.2.0	255.255.255.0	192.168.2.1 - 192.168.2.8
Admin 3	192.168.3.0	255.255.255.0	192.168.3.1 - 192.168.3.8
Library	192.168.4.0	255.255.255.0	192.168.4.1 - 192.168.4.10
CSE 1	172.16.1.0	255.255.255.0	172.16.1.1 - 172.16.1.12
CSE 2	172.16.2.0	255.255.255.0	172.16.2.1 - 172.16.2.12
Engineering	192.168.5.0	255.255.255.0	192.168.5.1 - 192.168.5.5

### Router-to-Router Connections:

- Subnet for routers: 172.17.0.0 - 172.23.0.0 (point-to-point links)

## Snapshot:

**Admin 1** 192.168.1.0 255.255.255.0 192.168.1.1 - 192.168.1.8

Admin1\_PC8

Physical Config Desktop Programming Attributes

IP Configuration X

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IP Address 192.168.1.9

Subnet Mask 255.255.255.0

Default Gateway 192.168.1.1

DNS Server 0.0.0.0

IPv6 Configuration

☐ DHCP ☐ Auto Config ☒ Static

IPv6 Address /

Link Local Address FE80::201:63FF:FEAD:6488

IPv6 Gateway

IPv6 DNS Server

802.1X

☐ Use 802.1X Security

☐ Top

**Admin 2** 192.168.2.0 255.255.255.0 192.168.2.1 - 192.168.2.8

Admin2\_PC8

Physical Config Desktop Programming Attributes

IP Configuration X

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IP Address 192.168.2.9

Subnet Mask 255.255.255.0

Default Gateway 192.168.2.1

DNS Server 0.0.0.0

IPv6 Configuration

☐ DHCP ☐ Auto Config ☒ Static

IPv6 Address /

Link Local Address FE80::209:7CFF:FE41:7DC7

IPv6 Gateway

IPv6 DNS Server

802.1X

☐ Use 802.1X Security

☐ Top

**Admin 3** 192.168.3.0 255.255.255.0 192.168.3.1 - 192.168.3.8

Admin3\_PC8

Physical

Config

Desktop

Programming

Attributes

IP Configuration

X

InterfaceFastEthernet0

IP Configuration

DHCP

Static

IP Address192.168.3.9

Subnet Mask255.255.255.0

Default Gateway192.168.3.1

DNS Server0.0.0.0

IPv6 Configuration

DHCP

Auto Config

Static

IPv6 Address

Link Local AddressFE80::290:2BFF:FEB3:E9E6

IPv6 Gateway

IPv6 DNS Server

802.1X

Use 802.1X Security

Top

**Library** 192.168.4.0 255.255.255.0 192.168.4.1 - 192.168.4.10

Library\_PC10

Physical

Config

Desktop

Programming

Attributes

IP Configuration

X

InterfaceFastEthernet0

IP Configuration

DHCP

Static

IP Address192.168.4.11

Subnet Mask255.255.255.0

Default Gateway192.168.4.1

DNS Server0.0.0.0

IPv6 Configuration

DHCP

Auto Config

Static

IPv6 Address

Link Local AddressFE80::207:ECFF:FEDA:8001

IPv6 Gateway

IPv6 DNS Server

802.1X

Use 802.1X Security

Top



**CSE 1** 172.16.1.0 255.255.255.0 172.16.1.1 - 172.16.1.12

CSE\_PC12

Physical Config Desktop Programming Attributes

IP Configuration X

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IP Address 172.16.1.13

Subnet Mask 255.255.0.0

Default Gateway 172.16.1.1

DNS Server 0.0.0.0

IPv6 Configuration

☐ DHCP ☐ Auto Config ☒ Static

IPv6 Address /

Link Local Address FE80::290:2BFF:FEBC:3944

IPv6 Gateway

IPv6 DNS Server

802.1X

☐ Use 802.1X Security

☐ Top

**CSE 2** 172.16.2.0 255.255.255.0 172.16.2.1 - 172.16.2.12

CSE2\_PC12

Physical Config Desktop Programming Attributes

IP Configuration X

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IP Address 172.16.2.13

Subnet Mask 255.255.0.0

Default Gateway 172.16.2.1

DNS Server 0.0.0.0

IPv6 Configuration

☐ DHCP ☐ Auto Config ☒ Static

IPv6 Address /

Link Local Address FE80::201:96FF:FEA9:7425

IPv6 Gateway

IPv6 DNS Server

802.1X

☐ Use 802.1X Security

☐ Top

**Engineering** 192.168.5.0 255.255.255.0 192.168.5.1 - 192.168.5.5

The screenshot shows a configuration window titled 'EngeneeringPC5' with tabs for Physical, Config, Desktop, Programming, and Attributes. The 'Config' tab is active, displaying the 'IP Configuration' for the 'FastEthernet0' interface. The configuration is set to 'Static' with the following values:

Field	Value
Interface	FastEthernet0
IP Configuration	Static
IP Address	192.168.5.6
Subnet Mask	255.255.255.0
Default Gateway	192.168.5.1
DNS Server	0.0.0.0

Below the IP Configuration section is the 'IPv6 Configuration' section, which is currently set to 'Static' with empty fields for IPv6 Address, Link Local Address, IPv6 Gateway, and IPv6 DNS Server. At the bottom, there is a '802.1X' section with a checkbox for 'Use 802.1X Security' which is unchecked. A 'Top' button is located at the bottom left of the window.

## Examples Of IP addressing in routers

In all the routers connected to the topology the IP `_._._.1` has been used for routers to put it in simple.

And in the subnetting the routers are given the IP 172.17.0.1 to 172.23.0.2 to make it easy to prepare.

Here are some snapshots for it.

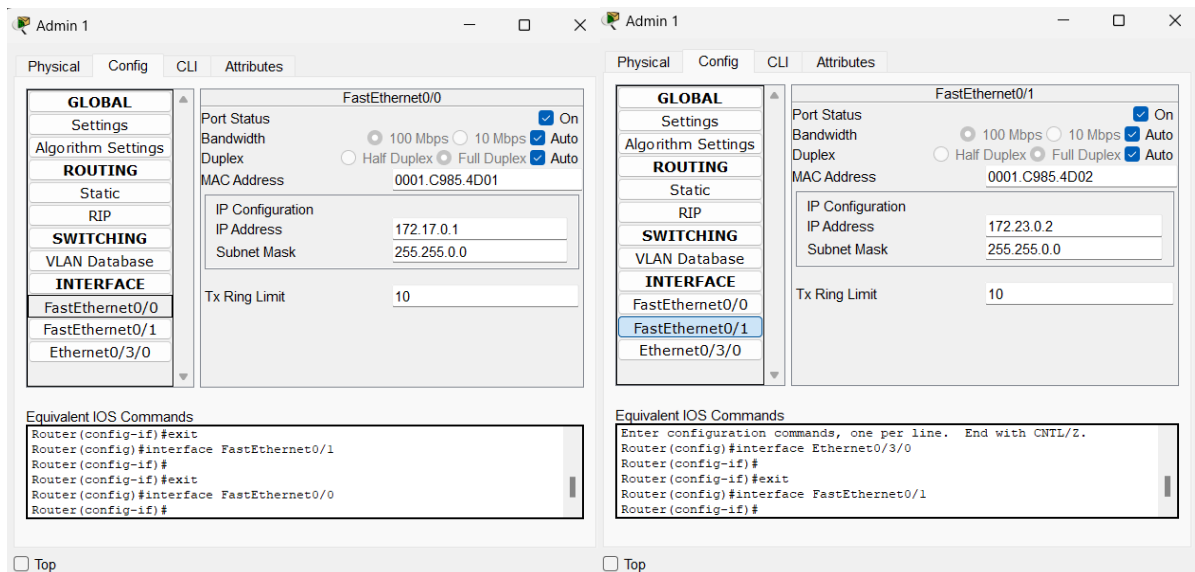
The screenshot shows a configuration window titled 'Admin 1' with tabs for Physical, Config, CLI, and Attributes. The 'Config' tab is active, displaying the configuration for the 'Ethernet0/3/0' interface. The configuration includes:

Field	Value
Port Status	On
Bandwidth	10 Mbps
Duplex	Full Duplex
MAC Address	0010.11DE.BE73
IP Configuration	Static
IP Address	192.168.1.1
Subnet Mask	255.255.255.0
Tx Ring Limit	10

At the bottom, there is a section for 'Equivalent IOS Commands' showing the following commands:

```
Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface Ethernet0/3/0
Router(config-if)#
```

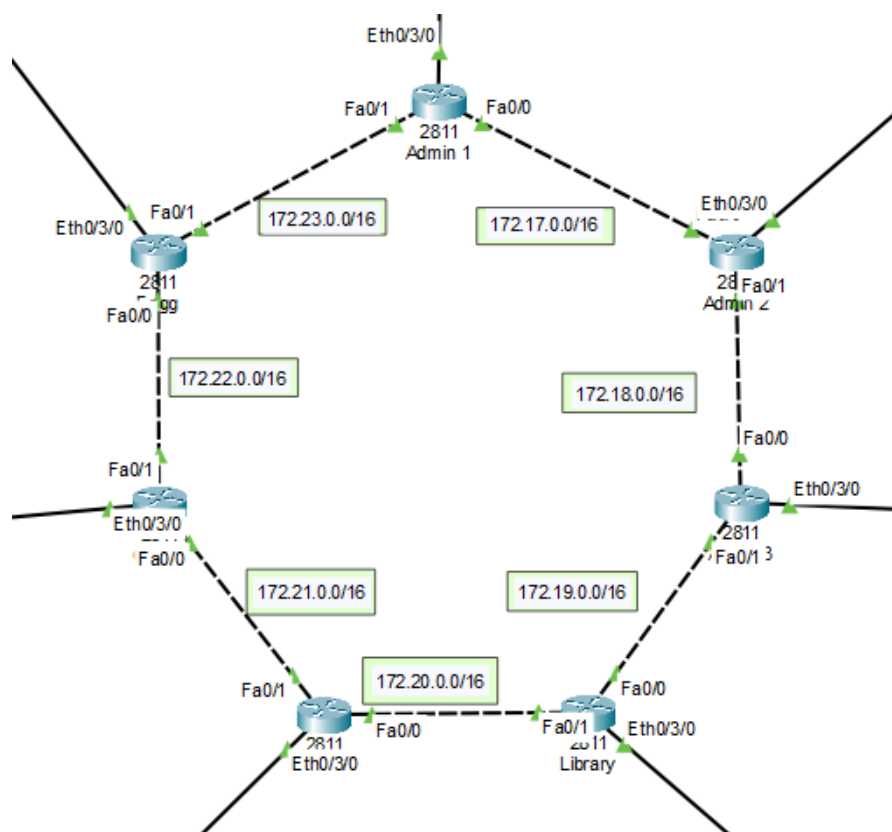
A 'Top' button is located at the bottom left of the window.



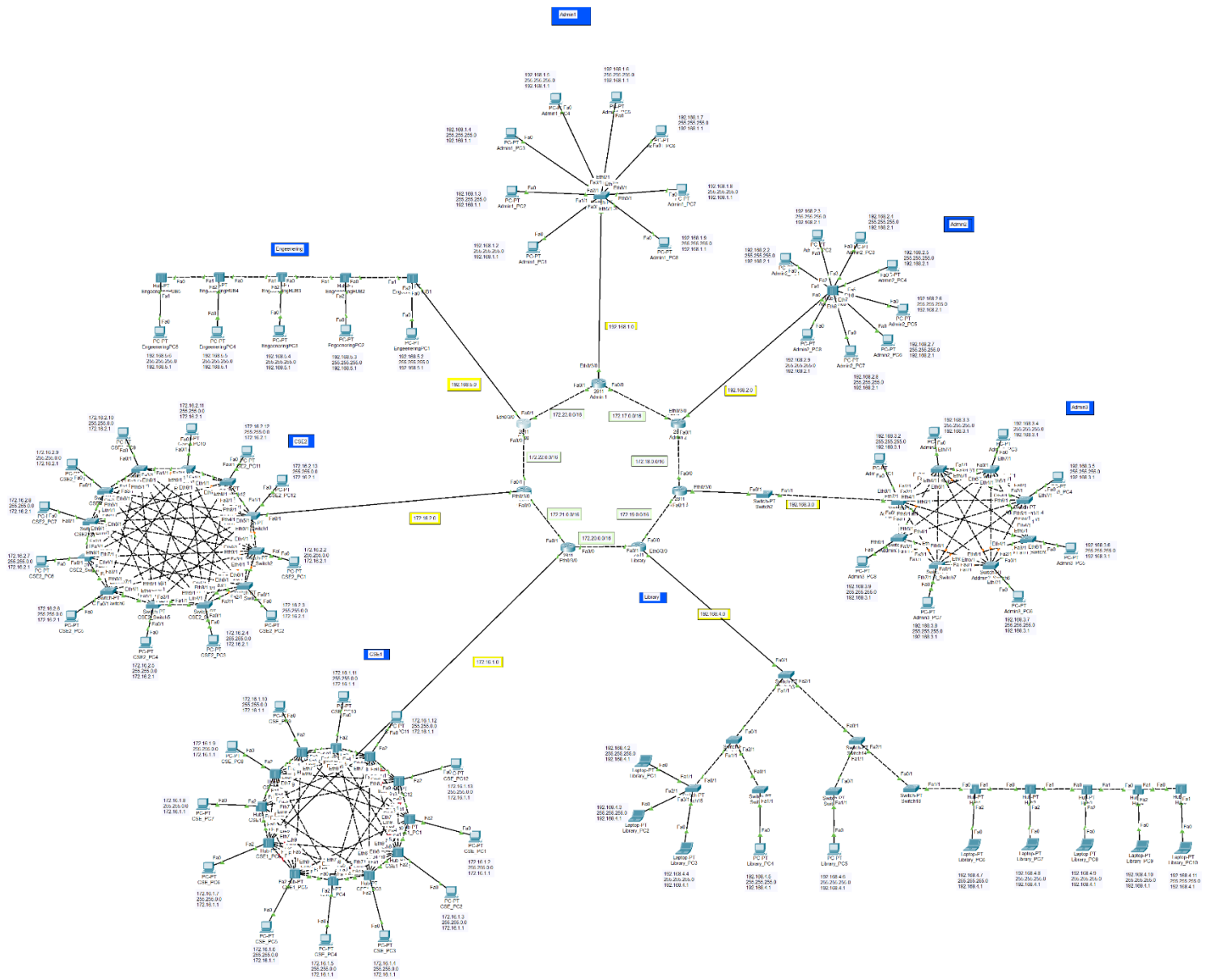
### 3. Routing Configuration

#### Overview:

To enable efficient communication between buildings, **OSPF (Open Shortest Path First) Dynamic Routing** is implemented. OSPF ensures fast convergence and optimized path selection.



# Snapshot:



## Admin1 Router

```
Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router rip
Router(config-router)#network 192.168.1.0
Router(config-router)#network 172.17.0.0
Router(config-router)#network 172.23.0.0
Router(config-router)#
```

## Admin2 Router

```
Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router rip
Router(config-router)#network 192.168.2.0
Router(config-router)#network 172.17.0.0
Router(config-router)#network 172.18.0.0
Router(config-router)#
```

## Admin3 Router

```
Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router rip
Router(config-router)#network 192.168.3.0
Router(config-router)#network 172.18.0.0
Router(config-router)#network 172.19.0.0
Router(config-router)#
```

## Library Router

```
Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router rip
Router(config-router)#network 192.168.4.0
Router(config-router)#network 172.19.0.0
Router(config-router)#network 172.20.0.0
Router(config-router)#
```

### CSE1 Router

```
Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router rip
Router(config-router)#network 172.16.1.0
Router(config-router)#network 172.20.0.0
Router(config-router)#network 172.21.0.0
Router(config-router)#
```

### CSE2 Router

```
Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router rip
Router(config-router)#network 172.16.2.0
Router(config-router)#network 172.21.0.0
Router(config-router)#network 172.22.0.0
Router(config-router)#
```

### Engineering Router

```
Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router rip
Router(config-router)#network 192.168.5.0
Router(config-router)#network 172.22.0.0
Router(config-router)#network 172.23.0.0
Router(config-router)#
```

## 4. Network Communication Testing

### Overview:

To verify connectivity, a **packet sharing test** was performed between devices in different buildings. The successful replies confirm that the network is functioning correctly.

All the networks are fully functional and are properly communicating with each other.

### Snapshots:

From Admin1\_PC1 to Admin2\_PC2

The image displays a network simulation interface. On the left, a topology diagram shows several devices: Admin1\_PC1 (192.168.2.3), Admin1\_PC2 (255.255.255.0), Admin1\_PC3 (192.168.2.1), Admin1\_PC4 (192.168.2.9), Admin1\_PC5 (255.255.255.0), Admin1\_PC6 (192.168.2.1), Admin1\_PC7 (192.168.3.0), and Admin1\_PC8 (192.168.2.1). These devices are connected to a central hub (Admin1\_Hub) which is connected to Admin2\_PC2 (192.168.2.3). The interface includes a 'Simulation Panel' with an 'Event List' table, 'Reset Simulation' and 'Constant Delay' buttons, 'Play Controls' (play, pause, stop), and 'Event List Filters - Visible Events' (ACL Filter, ARP, BGP, Bluetooth, CAPWAP, CDP, DHCP, DHCPv6, DNS, DTP, EAPOL, EIGRP, EIGRPv6, FTP, H.323, HSRP, HSRPv6, HTTP, HTTPS, ICMP, ICMPv6, IPSec, ISAKMP, IoT, IoT TCP, LACP, LLDP, NDP, NETFLOW, NTP, OSPF, OSPFv6, PAgP, POP3, PPP, PPPoE, PTP, RADIUS, REP, RIP, RIPng, RTP, SCCP, SMTP, SNMP, SSH, STP, SYSLOG, TACACS, TCP, TFTP, Telnet, UDP, USB, VTP). The 'Event List' table shows a series of ICMP and STP events. The 'Event List Filters' section shows a list of visible events. The 'Simulation Panel' also includes a 'Realtime' button and a 'Simulation' button. The bottom status bar shows the current status of the simulation: 'Fire', 'Last Status', 'Source', 'Destination', 'Type', 'Color', 'Time(sec)', 'Periodic', 'Num', 'Edit', and 'Delete'.

Vis.	Time(sec)	Last Device	At Device	Type
	0.007	Admin2_Hub	Admin2_...	ICMP
	0.007	Admin2_Hub	Admin2_...	ICMP
	0.008	Admin 2	Admin 1	ICMP
	0.009	Admin 1	Admin1_...	ICMP
	0.010	Admin1_S...	Admin1_...	ICMP
	0.996	--	Admin1_...	STP
	0.997	Admin1_S...	Admin1_...	STP
	0.997	Admin1_S...	Admin1_...	STP
	0.997	Admin1_S...	Admin1_...	STP
	0.997	Admin1_S...	Admin 1	STP
	0.997	Admin1_S...	Admin1_...	STP
	0.997	Admin1_S...	Admin1_...	STP
	0.997	Admin1_S...	Admin1_...	STP
	0.997	Admin1_S...	Admin1_...	STP
	0.997	Admin1_S...	Admin1_...	STP
	0.997	Admin1_S...	Admin1_...	STP
	0.997	Admin1_S...	Admin1_...	STP
	1.506	--	CSE2_S...	STP

Reset Simulation ☒ Constant Delay Captured to: 1.506 s

Play Controls





Event List Filters - Visible Events  
ACL Filter, ARP, BGP, Bluetooth, CAPWAP, CDP, DHCP, DHCPv6, DNS, DTP, EAPOL, EIGRP, EIGRPv6, FTP, H.323, HSRP, HSRPv6, HTTP, HTTPS, ICMP, ICMPv6, IPSec, ISAKMP, IoT, IoT TCP, LACP, LLDP, NDP, NETFLOW, NTP, OSPF, OSPFv6, PAgP, POP3, PPP, PPPoE, PTP, RADIUS, REP, RIP, RIPng, RTP, SCCP, SMTP, SNMP, SSH, STP, SYSLOG, TACACS, TCP, TFTP, Telnet, UDP, USB, VTP

Edit Filters Show All/None

Event List Realtime Simulation

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	Admi...	Admin2_P...	ICMP		0.000	N	0	(edit)	(delete)







From Admin1\_PC2 to Admin3\_PC1

										 Realtime	 Simulation
Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete	
	Successful	Admi...	Admin3_P...	ICMP		0.000	N	0	(edit)	(delete)	









From Admin1\_PC3 to Library\_PC5

										Realtime	Simulation
Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete	
	Successful	Admi...	Library_PC5	ICMP		0.000	N	0	(edit)	(delete)	





From CSE1\_PC1 to Admin2\_PC1

										 Realtime	 Simulation
Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete	
	Failed	CSE_...	Admin2_P...	ICMP		0.000	N	0	(edit)	(delete)	
	Successful	CSE_...	Admin2_P...	ICMP		0.000	N	1	(edit)	(delete)	

From Admin2\_PC8 to CSE2\_PC12

										 Realtime	 Simulation
Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete	
	Failed	Admi...	CSE2_PC12	ICMP		0.000	N	0	(edit)	(delete)	
	Failed	Admi...	CSE2_PC12	ICMP		0.000	N	1	(edit)	(delete)	
	Successful	Admi...	CSE2_PC12	ICMP		0.000	N	2	(edit)	(delete)	

From Engineering\_PC1 to Admin2\_PC1

										 Realtime	 Simulation
Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete	
	Successful	Eng...	Admin2_P...	ICMP		0.000	N	0	(edit)	(delete)	



## Observation

Due to the vast network and the use of outdated software versions, packets are failing multiple times before successfully reaching their destination. This issue highlights the need for upgrading software and optimizing network performance.

## Conclusion

Designing this university campus network was both an enjoyable and enlightening experience. Exploring multiple strategies to structure the buildings' network led to the innovative idea of connecting routers in a **ring topology** for better efficiency and redundancy. However, some issues were encountered, and I plan to refine the design further to improve network stability and performance in the future.

GitHub : <https://github.com/SumitSingh3101/Networking-Laboratory>

Yours Faithfull

Sumit Singh Ranawat

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