



**East West University**

**Spring 2023**

**Course Title: Computer Networks**

**Course code: CSE 405**

**Section: 2**

**Mini Project**

**Submitted To**

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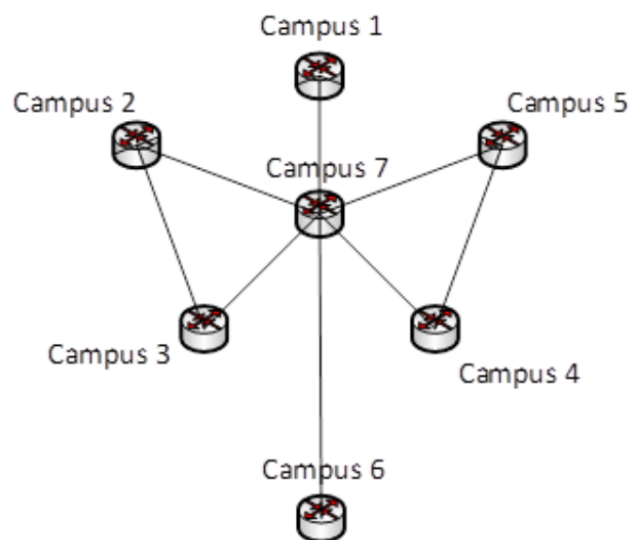
## Introduction

University of Scholars is a university with multiple campuses having multiple departments. In this project, a professional network design demonstration has been given for this university. This university has wired internet access to all the classrooms, labs, employee PCs, library and other administrative and academic wings, the university also provides wireless internet access for every campus. On top of that, the university runs a complex networked system to support several of its business processes like admissions, advising, results, eTender, library management, accounts and so on.

## Tasks

There are several requirements to be ensured in this network and those are given below-

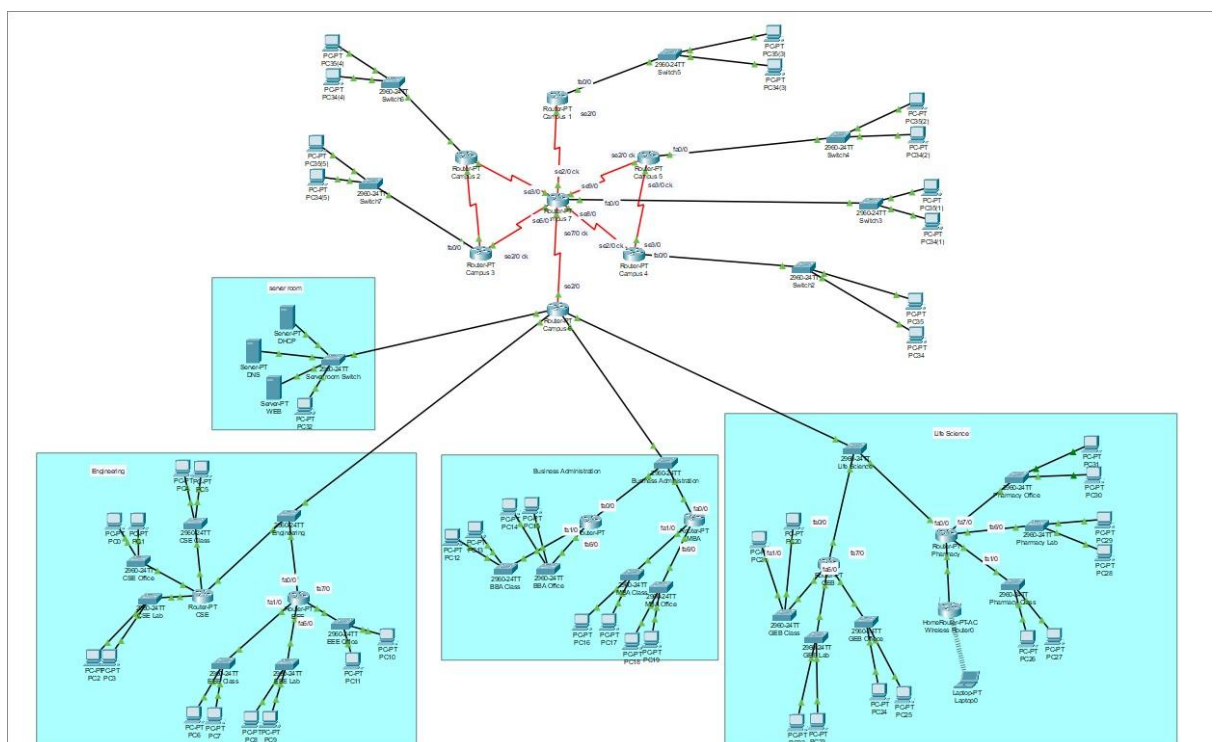
- There is a university web page that can be accessed through every device
- A single DNS server will provide the domain name [www.scholars.edu.bd](http://www.scholars.edu.bd)
- A single DHCP address will provide all the IP addresses for the end device
- Connectivity between the host needs to be established
- All the campuses are connected using the topology given below



## Campus hierarchy

To implement this project first we need to organise the hierarchy of the university campus. In this scenario, this university has seven campuses. Assuming each campus has multiple divisions such as Engineering, Life Science, Business Administration and many more. Each division has various departments such as Engineering has CSE, and EEE. Life Science has GEB and pharmacy. Business Administration has BBA and MBA. At the very bottom, each department has a different type of activity such as class, lab, office etc.

We have to provide IP addresses in such a way so that every division, department and type of activity falls into different subnets. This will give us the opportunity to scale the network later and things remain organised. **Detailed network design has been shown for campus 6 assuming the main campus. All other campuses will follow the same strategies.**



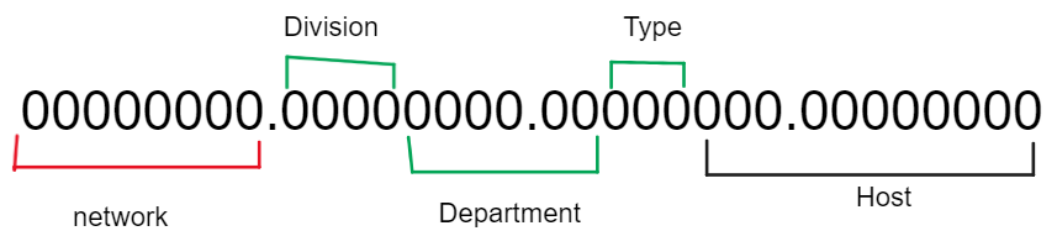
## Network Design

In this project, we are assuming campus 6 to be the main campus. Design inside a campus has been shown for campus 6. Other campuses will be implemented in the same way.

We are using Class A IP for inside the campus. Class C IP will be used to connect one campus to another campus. Class B will be used inside campus 3 assuming it has lesser subnets and hosts. As discussed earlier a campus will have divisions, departments and types of activity we will choose 13 bits for subnetting and as we are taking class A, the first 8 bits will be kept for the network.

The network part of the IP will be as same as the campus number. For example, if it is Campus 6, the network IP will be 6.0.0.0. The next 13 bits are kept for subnetting. Among them, the **first 4 bits** are for the division, **6 bits** for the department, **3 bits** for the section and **11 bits** for the Host.

In this way, we get  $2^{11} - 2 = 2046$  number of hosts for each subnet.



For the outer campus, we will use class C. For design simplicity, we are choosing the network IP in the given way below.

**192.<source>.<desitnation>.Host**

If campus 1 is connected to campus 7 the network will be 192.1.7.0

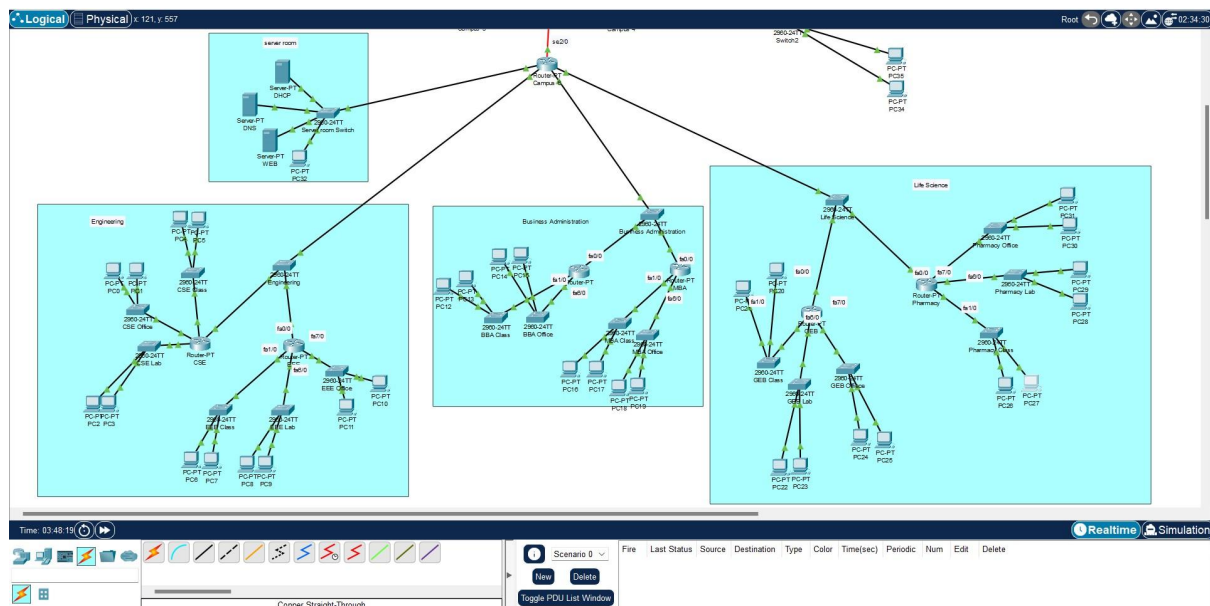
## Tools and software

We are using a Cisco packet tracer and the component we will be using are mentioned below.

1. Routers
2. Switches
3. PC
4. Wireless Router
5. Servers (DNS, DHCP, WEB)
6. Wire
7. Wireless end device (Laptop)

## Campus 6

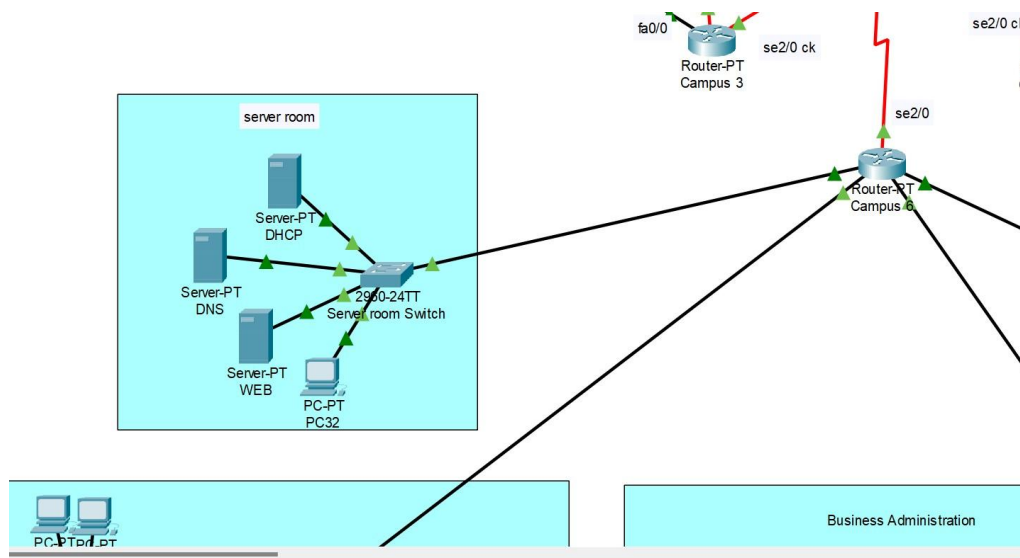
Inside Campus 6 the network is 6.0.0.0 and it contains a server room and 3 division. Each division has 2 departments.



## Server Room Setup

The server room is connected to the main campus or campus 6. In the server room, we have 3 servers and those are DHCP, DNS and WEB server. There is a PC to operate the servers. We configure server pools for all the subnets from DHCP and the webpage is served on the WEB server, DNS is there to provide the domain name of the website.

For example here the web server's IP is 6.8.8.4. When any PC types the URL [www.scholars.edu.bd](http://www.scholars.edu.bd), the DNS server provides the IP for the URL.



The DNS server configuration is given below

The screenshot shows the 'DNS' configuration window in a network management interface. The 'Services' tab is selected. The 'DNS Service' is set to 'On'. The 'Resource Records' section shows a table with one record:

No.	Name	Type	Detail
0	scholars.edu.bd	A Record	6.8.8.4

The 'Name' field is empty, and the 'Type' is set to 'A Record'. The 'Address' field is empty. There are 'Add', 'Save', and 'Remove' buttons below the table.

The DHCP server setup is given below.

Physical Config **SERVICES** Desktop Programming Attributes

**SERVICES**

- HTTP
- DHCP**
- DHCPv6
- TFTP
- DNS
- SYSLOG
- AAA
- NTP
- EMAIL
- FTP
- IoT
- VM Management
- Radius EAP

DHCP

Interface: FastEthernet0 Service: ☒ On ☐ Off

Pool Name: serverPool

Default Gateway: 6.8.8.1

DNS Server: 6.8.8.3

Start IP Address: 6.8.8.11

Subnet Mask: 255.255.248.0

Maximum Number of Users: 512

TFTP Server: 0.0.0.0

WLC Address: 0.0.0.0

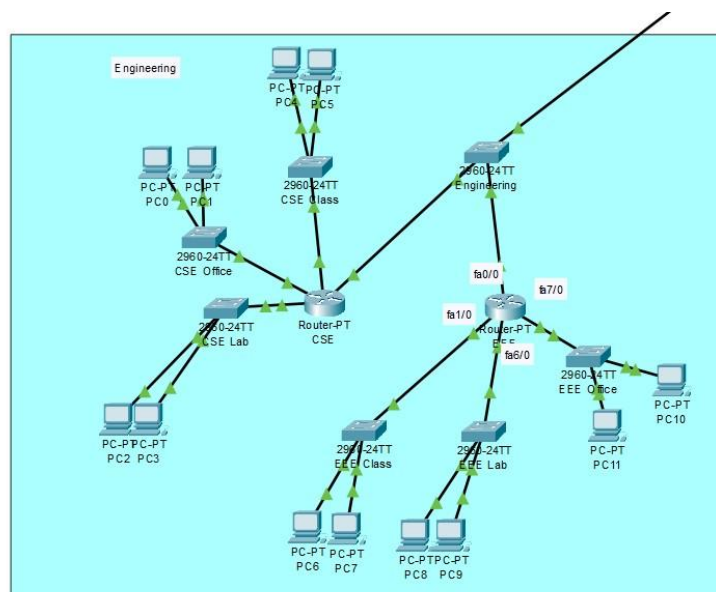
Buttons: Add Save Remove

Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Max User	TFTP Server	WLC Address
wireless	6.48.160.1	6.8.8.3	6.48.160.11	255.255.248.0	512	0.0.0.0	0.0.0.0
CSEclass	6.16.72.1	6.8.8.3	6.16.72.11	255.255.248.0	512	0.0.0.0	0.0.0.0
CSElab	6.16.80.1	6.8.8.3	6.16.80.11	255.255.248.0	512	0.0.0.0	0.0.0.0
CSEoffice	6.16.88.1	6.8.8.3	6.16.88.11	255.255.248.0	512	0.0.0.0	0.0.0.0
EEEClass	6.16.136.1	6.8.8.3	6.16.136.11	255.255.248.0	512	0.0.0.0	0.0.0.0
EEElab	6.16.144.1	6.8.8.3	6.16.144.11	255.255.248.0	512	0.0.0.0	0.0.0.0
EEEoffice	6.16.152.1	6.8.8.3	6.16.152.11	255.255.248.0	512	0.0.0.0	0.0.0.0
BBAClass	6.32.72.1	6.8.8.3	6.32.72.11	255.255.248.0	512	0.0.0.0	0.0.0.0
BBAClab	6.32.80.1	6.8.8.3	6.32.80.11	255.255.248.0	512	0.0.0.0	0.0.0.0

☐ Top

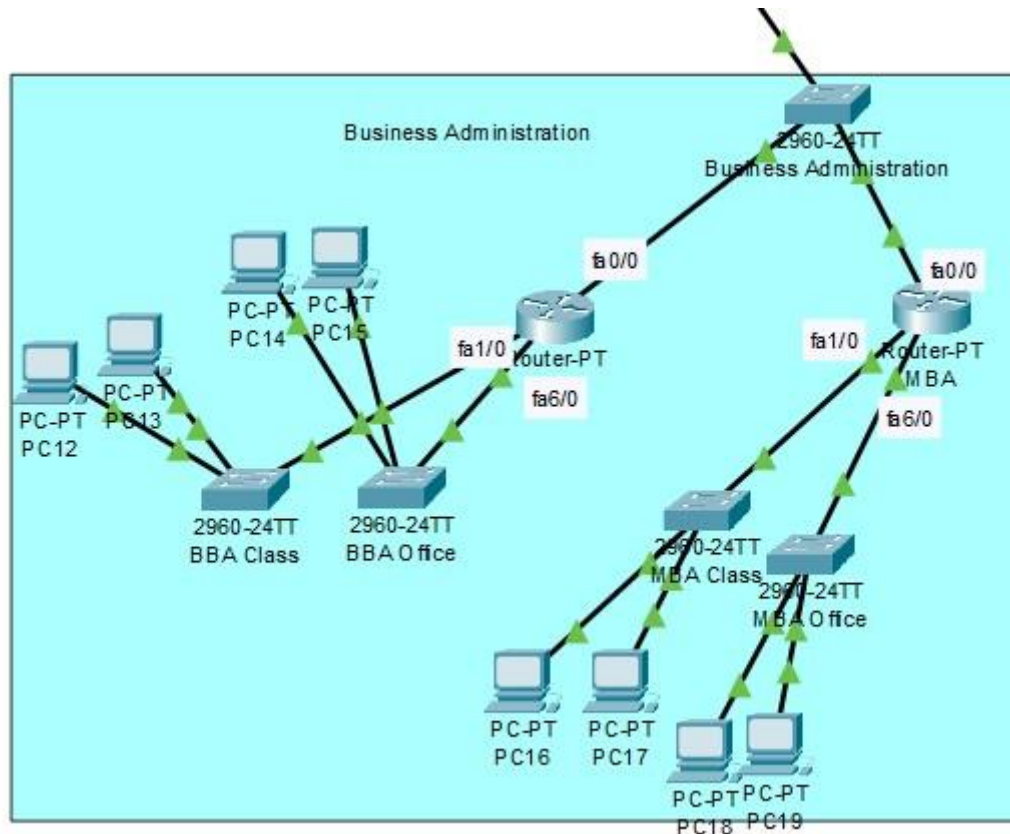
## Engineering Division

To denote this department the 4 bits of the subnet is 0001. This division has two departments. One is CSE another is EEE. For CSE the next 6 bits of the subnet are 000001 and for EEE those are 000010. For class, the next 3 bits are 001, for lab 010 and for office, it will be 011.



## Business Administration

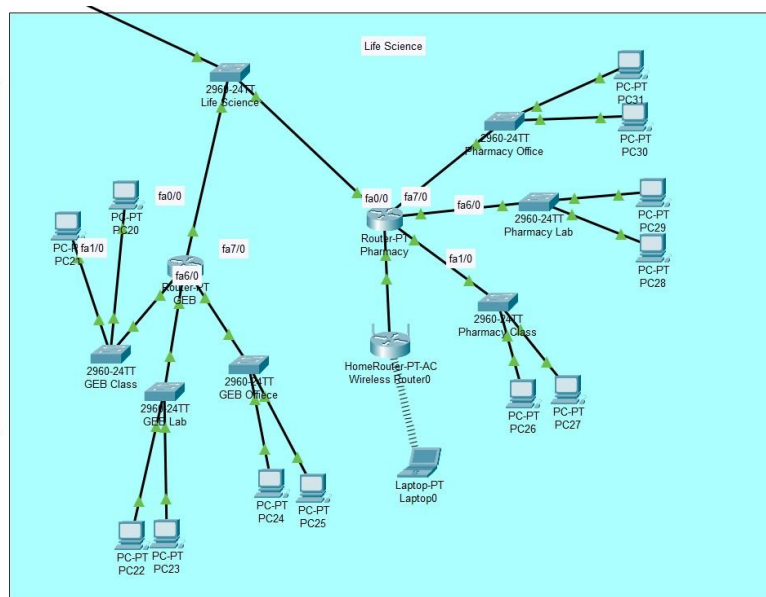
To denote this department the 4 bits of the subnet is 0010. This division has two departments. One is BBA another is MBA. For BBA the next 6 bits of the subnet are 000001 and for MBA those are 000010. For class, the next 3 bits are 001, for office, it will be 010.



## Life Science

To denote this department the 4 bits of the subnet is 0011. This division has two departments. One is GEB another is Pharmacy. For GEB the next 6 bits of the subnet are 000001 and for Pharmacy, those are 000010. For class, the next 3 bits are 001, for lab 010 and for office, it will be 011.





## End Device

From an end device we have to request for the IP address from the DHCP server once it is done we can access the website.

PCS

Physical Config Desktop Programming Attributes

IP Configuration

Interface FastEthernet0

IP Configuration

☒ DHCP ☐ Static

IPv4 Address 6.16.72.12

Subnet Mask 255.255.248.0

Default Gateway 6.16.72.1

DNS Server 6.8.8.3

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address

Link Local Address

Default Gateway

DNS Server

802.1X

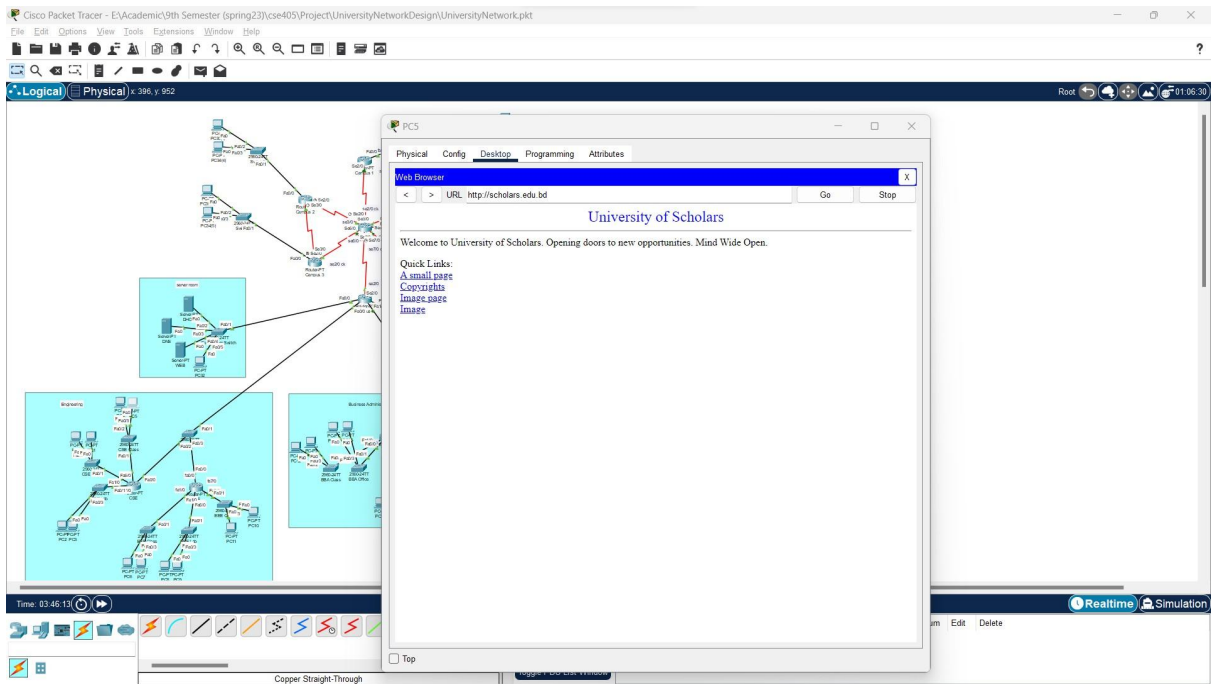
☐ Use 802.1X Security

Authentication MD5

Username

Password

☐ Top



## **Conclusion**

To conclude we can say that for proper subnetting this network is scalable according to the needs of the campuses and it will be helpful for all the students across the campuses. It will connect all of them and will be able to share materials safely, securely and fast.

## **Limitations**

1. In the Cisco Packet Tracer sometimes the routers struggle to navigate which creates problem
2. The Cisco Packet Tracer crashes sometimes

## Router Configuration Code

Campus 6

```
interface se2/0
ip address 192.7.6.2 255.255.255.0
no shut
do wr
exit
```

```
interface se3/0
ip address 6.0.8.1 255.255.248.0
clock rate 64000
no shut
do wr
exit
```

```
interface fa0/0
ip address 6.16.0.1 255.255.248.0
ip helper-address 6.8.8.2
no shut
do wr
exit
```

```
interface fa1/0
ip address 6.32.0.1 255.255.248.0
ip helper-address 6.8.8.2
no shut
do wr
exit
```

```
interface fa9/0
ip address 6.48.0.1 255.255.248.0
ip helper-address 6.8.8.2
no shut
do wr
exit
```

```
router ospf 6
network 6.0.0.0 0.0.7.255 area 1
network 192.7.6.0 0.0.0.255 area 1
```

exit

#### Router CSE

```
interface fa0/0
ip address 6.16.64.1 255.255.248.0
ip helper-address 6.8.8.2
no shut
do wr
exit
```

```
interface fa6/0
ip address 6.16.72.1 255.255.248.0
ip helper-address 6.8.8.2
no shut
do wr
exit
```

```
interface fa7/0
ip address 6.16.80.1 255.255.248.0
ip helper-address 6.8.8.2
no shut
do wr
exit
```

```
interface fa1/0
ip address 6.16.88.1 255.255.248.0
ip helper-address 6.8.8.2
no shut
do wr
exit
```

```
router ospf 8
network 6.0.0.0 0.0.7.255 area 1
exit
```

#### Router EEE

```
interface fa0/0
ip address 6.16.128.1 255.255.248.0
ip helper-address 6.8.8.2
no shut
do wr
exit
```

```
interface fa1/0
ip address 6.16.136.1 255.255.248.0
ip helper-address 6.8.8.2
no shut
do wr
exit
```

```
interface fa6/0
ip address 6.16.144.1 255.255.248.0
ip helper-address 6.8.8.2
no shut
do wr
exit
```

```
interface fa7/0
ip address 6.16.152.1 255.255.248.0
ip helper-address 6.8.8.2
no shut
do wr
exit
```

```
router ospf 9
network 6.0.0.0 0.0.7.255 area 1
exit
```

## Router BBA

```
interface fa0/0
ip address 6.32.64.1 255.255.248.0
ip helper-address 6.8.8.2
no shut
do wr
exit
```

```
interface fa1/0
ip address 6.32.72.1 255.255.248.0
ip helper-address 6.8.8.2
no shut
do wr
exit
```

```
interface fa6/0
```

```
ip address 6.32.80.1 255.255.248.0
ip helper-address 6.8.8.2
no shut
do wr
exit
```

```
router ospf 10
network 6.0.0.0 0.0.7.255 area 1
exit
```

#### Router MBA

```
interface fa0/0
ip address 6.32.128.1 255.255.248.0
ip helper-address 6.8.8.2
no shut
do wr
exit
```

```
interface fa1/0
ip address 6.32.136.1 255.255.248.0
ip helper-address 6.8.8.2
no shut
do wr
exit
```

```
interface fa6/0
ip address 6.32.144.1 255.255.248.0
ip helper-address 6.8.8.2
no shut
do wr
exit
```

```
router ospf 11
network 6.0.0.0 0.0.7.255 area 1
exit
```

#### Router GEB

```
interface fa0/0
ip address 6.48.64.1 255.255.248.0
ip helper-address 6.8.8.2
no shut
```

```
do wr
exit
```

```
interface fa1/0
ip address 6.48.72.1 255.255.248.0
ip helper-address 6.8.8.2
no shut
do wr
exit
```

```
interface fa6/0
ip address 6.48.80.1 255.255.248.0
ip helper-address 6.8.8.2
no shut
do wr
exit
```

```
interface fa7/0
ip address 6.48.88.1 255.255.248.0
ip helper-address 6.8.8.2
no shut
do wr
exit
```

```
router ospf 12
network 6.0.0.0 0.0.7.255 area 1
exit
```

## Router Pharmacy

```
interface fa0/0
ip address 6.48.128.1 255.255.248.0
ip helper-address 6.8.8.2
no shut
do wr
exit
```

```
interface fa1/0
ip address 6.48.136.1 255.255.248.0
ip helper-address 6.8.8.2
no shut
do wr
exit
```



```
interface fa6/0
ip address 6.48.144.1 255.255.248.0
ip helper-address 6.8.8.2
no shut
do wr
exit
```

```
interface fa7/0
ip address 6.48.152.1 255.255.248.0
ip helper-address 6.8.8.2
no shut
do wr
exit
```

```
router ospf 13
network 6.0.0.0 0.0.7.255 area 1
exit
```

#### Campus 4

```
interface se2/0
ip address 192.4.7.1 255.255.255.0
clock rate 64000
no shut
do wr
exit
```

```
interface se3/0
ip address 192.5.4.2 255.255.255.0
no shut
do wr
exit
```

```
interface fa0/0
ip address 4.16.0.1 255.255.248.0
ip helper-address 6.8.8.2
no shut
do wr
exit
```

```
router ospf 4
network 4.0.0.0 0.0.7.255 area 1
network 192.4.7.0 0.0.0.255 area 1
network 192.5.4.0 0.0.0.255 area 1
exit
```

## Campus 5

```
interface se2/0
ip address 192.5.7.1 255.255.255.0
clock rate 64000
no shut
do wr
exit
```

```
interface se3/0
ip address 192.5.4.1 255.255.255.0
clock rate 64000
no shut
do wr
exit
```

```
interface fa0/0
ip address 5.16.0.1 255.255.248.0
ip helper-address 6.8.8.2
no shut
do wr
exit
```

```
router ospf 5
network 5.0.0.0 0.0.7.255 area 1
network 192.5.7.0 0.0.0.255 area 1
network 192.5.4.0 0.0.0.255 area 1
exit
```

## Campus 2

```
interface se3/0
ip address 192.2.3.1 255.255.255.0
clock rate 64000
no shut
do wr
```

exit

```
interface se2/0
ip address 192.2.7.1 255.255.255.0
clock rate 64000
no shut
do wr
exit
```

```
interface fa0/0
ip address 2.16.0.1 255.255.248.0
ip helper-address 6.8.8.2
no shut
do wr
exit
```

```
router ospf 2
network 2.0.0.0 0.0.7.255 area 1
network 192.2.3.0 0.0.0.255 area 1
network 192.2.7.0 0.0.0.255 area 1
exit
```

Campus 1

```
interface se2/0
ip address 192.7.1.2 255.255.255.0
no shut
do wr
exit
```

```
interface fa0/0
ip address 1.16.0.1 255.255.248.0
ip helper-address 6.8.8.2
no shut
do wr
exit
```

```
router ospf 1
network 1.0.0.0 0.0.7.255 area 1
network 192.7.1.0 0.0.0.255 area 1
exit
```

Campus 3 Class B

```
interface se3/0
ip address 193.2.3.2 255.255.255.0
no shut
do wr
exit
```

```
interface se2/0
ip address 193.3.7.1 255.255.255.0
clock rate 64000
no shut
do wr
exit
```

```
interface fa0/0
ip address 128.1.1.1 255.255.0.0
ip helper-address 6.8.8.2
no shut
do wr
exit
```

```
router ospf 3
network 128.1.0.0 0.0.255.255 area 1
network 192.2.3.0 0.0.0.255 area 1
network 192.3.7.0 0.0.0.255 area 1
exit
```

Router 7

```
interface se2/0
ip address 192.7.1.1 255.255.255.0
clock rate 64000
no shut
do wr
exit
```

```
interface se3/0
ip address 192.2.7.2 255.255.255.0
no shut
do wr
exit
```

```
interface se6/0
ip address 192.3.7.2 255.255.255.0
```

```
no shut
do wr
exit
```

```
interface se7/0
ip address 192.7.6.1 255.255.255.0
clock rate 64000
no shut
do wr
exit
```

```
interface se8/0
ip address 192.4.7.2 255.255.255.0
no shut
do wr
exit
```

```
interface se9/0
ip address 192.5.7.2 255.255.255.0
no shut
do wr
exit
```

```
interface fa0/0
ip address 7.16.0.1 255.255.248.0
ip helper-address 6.8.8.2
no shut
do wr
exit
```

```
router ospf 7
network 7.0.0.0 0.0.7.255 area 1
network 192.7.1.0 0.0.0.255 area 1
network 192.2.7.0 0.0.0.255 area 1
network 192.3.7.0 0.0.0.255 area 1
network 192.4.7.0 0.0.0.255 area 1
network 192.5.7.0 0.0.0.255 area 1
network 192.7.6.0 0.0.0.255 area 1
exit
```

```
router ospf 2
network 2.0.0.0 0.0.7.255 area 1
network 192.2.3.0 0.0.0.255 area 1
network 192.2.7.0 0.0.0.255 area 1
exit
```

```
router ospf 3
network 128.1.0.0 0.0.255.255 area 1
network 192.2.3.0 0.0.0.255 area 1
network 192.3.7.0 0.0.0.255 area 1
exit
```

```
router ospf 6
network 6.0.0.0 0.0.7.255 area 1
network 192.7.6.0 0.0.0.255 area 1
exit
```

```
router ospf 4
network 4.0.0.0 0.0.7.255 area 1
network 192.4.7.0 0.0.0.255 area 1
network 192.5.4.0 0.0.0.255 area 1
exit
```

```
router ospf 5
network 5.0.0.0 0.0.7.255 area 1
network 192.5.7.0 0.0.0.255 area 1
network 192.5.4.0 0.0.0.255 area 1
exit
```

```
router ospf 7
network 7.0.0.0 0.0.7.255 area 1
network 192.7.1.0 0.0.0.255 area 1
network 192.2.7.0 0.0.0.255 area 1
network 192.3.7.0 0.0.0.255 area 1
network 192.4.7.0 0.0.0.255 area 1
network 192.5.7.0 0.0.0.255 area 1
network 192.7.6.0 0.0.0.255 area 1
exit
```

```
router ospf 14
network 6.0.0.0 0.0.7.255 area 1
exit
```

server room router

```
interface se2/0
ip address 6.0.8.2 255.255.248.0
no shut
do wr
exit
```

```
interface fa0/0
ip address 6.8.8.1 255.255.248.0
no shut
do wr
exit
```