

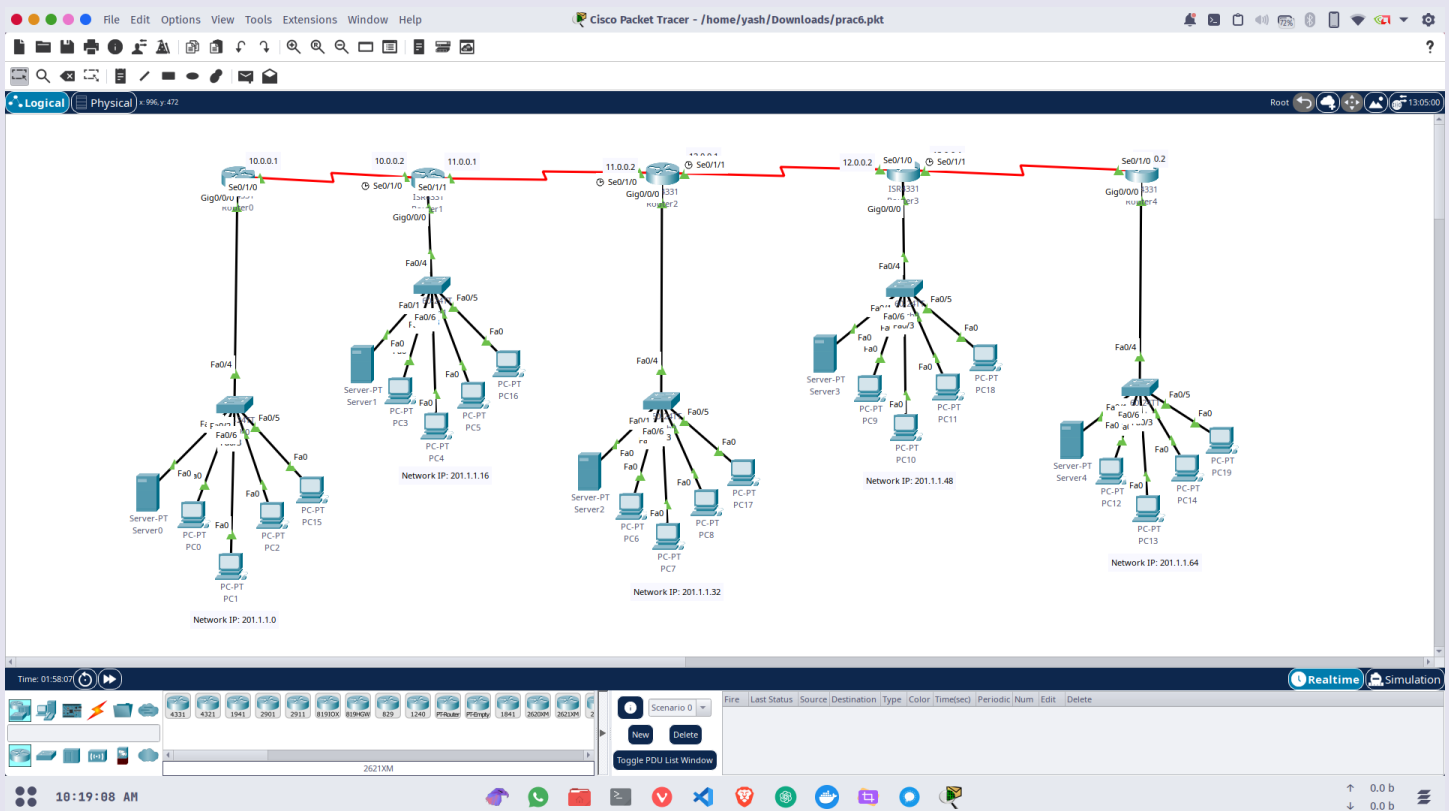
Practical 6

Aim : Design a Network of an organization using fundamentals of subnetting

Scenario : Organization named Zenith enterprise has setup a branch office at Noida and hired you as a Network Engineer. The branch office will be having 5 different Departments and each department has its own network. Each department has actually 14 devices. The IP address range given to you is 201.1.1.0/24. Design the network such that wastage of IP address is less. So, for designing purpose you can take 4 devices in each department. Also assign IP address dynamically to the device for ease of the implementation.

Procedure :

1. Design a network with 5 departments as seen in the figure.



2. Assign classless IP to one router's interfaces.

The screenshot shows the Packet Tracer interface with Router0 selected. The configuration window for GigabitEthernet0/0/0 is open, displaying the following settings:

- GLOBAL**
 - Port Status: ☒ On
 - Bandwidth: 1000 Mbps
 - Duplex: ☒ Full Duplex
 - MAC Address: 0060.5C68.C38E
- ROUTING**
 - Static: ☒ Enabled
- SWITCHING**
 - VLAN Database: 201.1.1.10
- INTERFACE**
 - IP Configuration: IPv4 Address: 201.1.1.10, Subnet Mask: 255.255.255.240
 - Tx Ring Limit: 10

The Equivalent IOS Commands section shows the following commands:

```
Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface GigabitEthernet0/0/0
Router(config-if)#
```

The network diagram shows Router0 connected to a switch (Fa0/4) which is connected to a server (Server-PT) and several PCs (PC-PT). The network IP is 201.1.1.0.

The screenshot shows the Packet Tracer interface with Router0 selected. The configuration window for Serial0/1/0 is open, displaying the following settings:

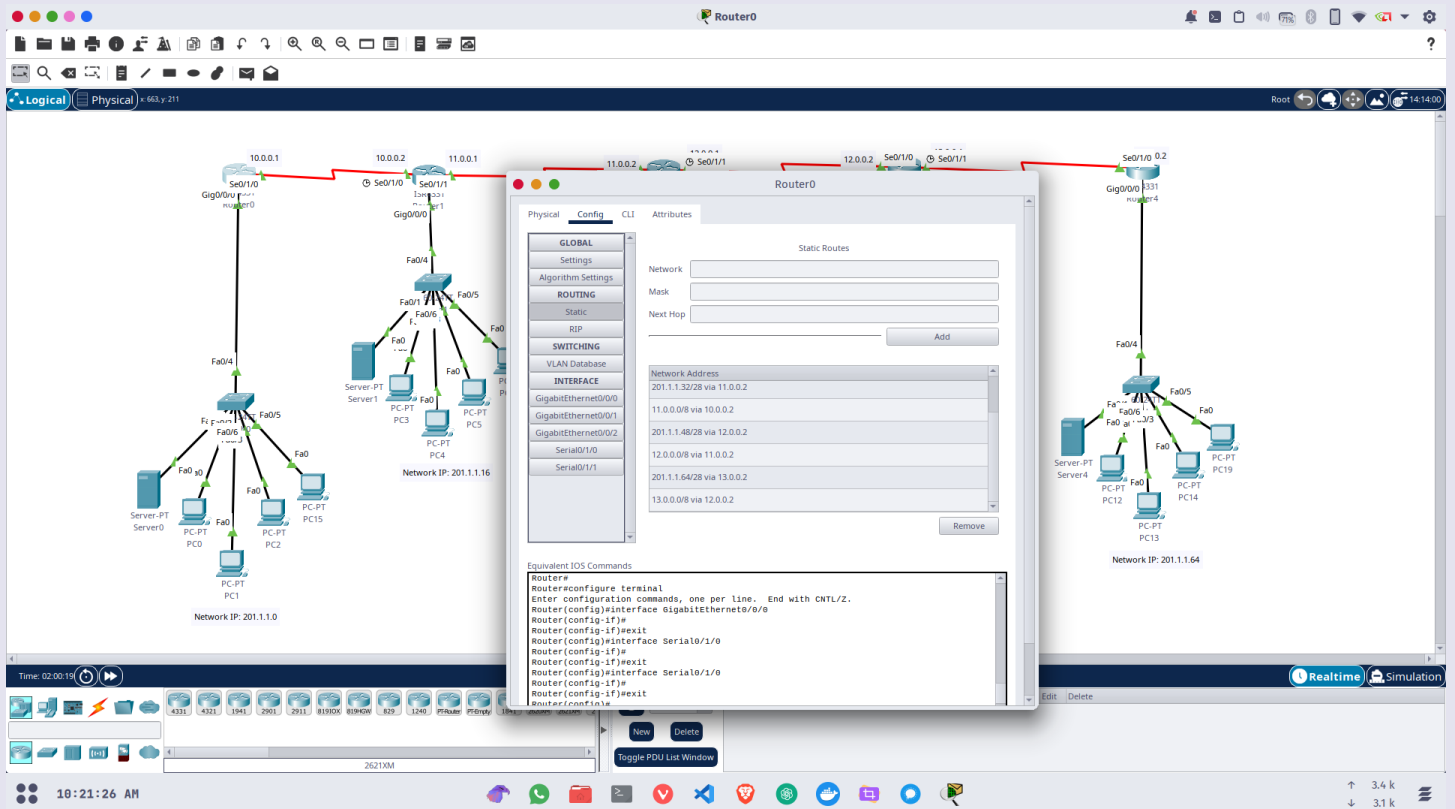
- GLOBAL**
 - Port Status: ☒ On
 - Duplex: ☒ Full Duplex
 - Clock Rate: 2000000
- ROUTING**
 - Static: ☒ Enabled
- SWITCHING**
 - VLAN Database: 201.1.1.10
- INTERFACE**
 - IP Configuration: IPv4 Address: 10.0.0.1, Subnet Mask: 255.0.0.0
 - Tx Ring Limit: 10

The Equivalent IOS Commands section shows the following commands:

```
Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface gigabitEthernet0/0/0
Router(config-if)#exit
Router(config)#interface Serial0/1/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/0
Router(config-if)#
```

The network diagram shows Router0 connected to a switch (Fa0/4) which is connected to a server (Server-PT) and several PCs (PC-PT). The network IP is 201.1.1.0.

3. Similarly, configure all the routers and add static routing.



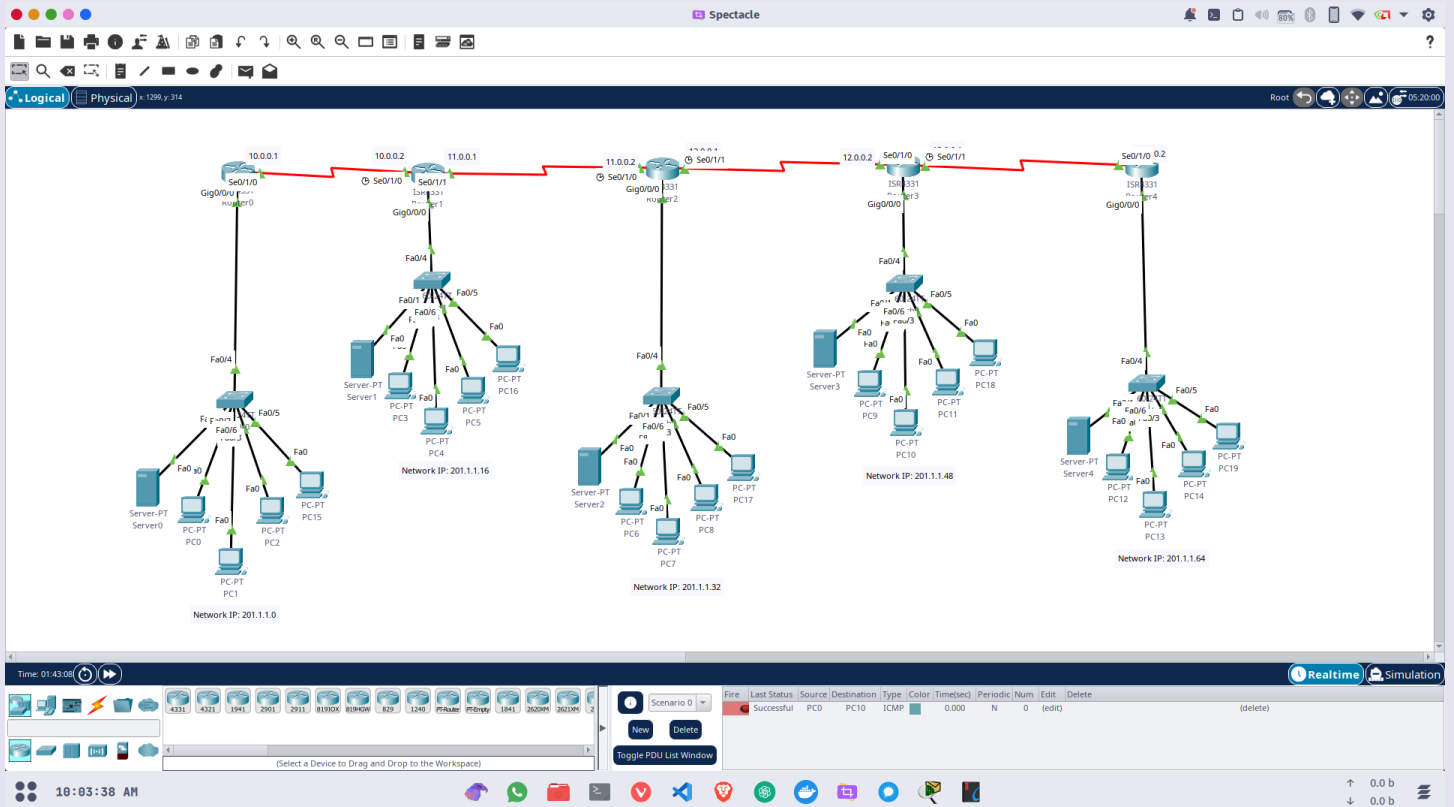
4. Enable and configure DHCP services in all servers of the departments.

The screenshot displays a network simulation environment with a central configuration window for 'Server1'. The window is divided into several tabs: Physical, Config, Services, Desktop, Programming, and Attributes. The 'Services' tab is active, showing the DHCP configuration for the 'FastEthernet0' interface. The service is set to 'On'. The configuration includes a pool name 'serverPool', a default gateway of '201.1.1.30', a DNS server of '201.1.1.17', and a start IP address of '201.1.1.16' with a subnet mask of '255.255.255.240'. The maximum number of users is set to '16'. The TFTP server is '0.0.0.0' and the WLC address is '0.0.0.0'. Below the configuration fields, there is a table with columns for Pool Name, Default Gateway, DNS Server, Start IP Address, Subnet Mask, Max User, TFTP Server, and WLC Address. The table contains one entry: 'serverPool' with the specified values.

Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Max User	TFTP Server	WLC Address
serverPool	201.1.1.30	201.1.1.17	201.1.1.16	255.255.255.240	16	0.0.0.0	0.0.0.0

The background of the simulation shows a network topology with various devices including servers (Server-PT Server0, Server-PT Server1, Server-PT Server4), switches (Fa0/4, Fa0/5, Fa0/6), and PCs (PC0, PC1, PC2, PC3, PC4, PC12, PC13, PC14, PC15, PC19). The network is connected via GigabitEthernet and FastEthernet interfaces. The status bar at the bottom indicates the time is 10:21:59 AM and the simulation is running in Realtime mode.

5. Transfer a packet to check the network connectivity.



Calculations :

No. of departments = 5

Each dept. has 14 devices

IP address range = 201.1.1.0/24

Step-1: requirement $\leq 2^n - 2$

$$14 \leq 2^n - 2$$

$$\text{Let } n=4; \quad 14 \leq 2^4 - 2$$

$$14 \leq 16 - 2$$

$$14 \leq 14$$

Hence, condition is fulfilled. So, $n=4$

Step-2: 201.1.1.0/24 (class C)

old subnet : 255.255.255.0

Now, as $n=4$

New subnet: $\underbrace{11111111.11111111.11111111}_{\text{network } \uparrow} . \underbrace{11110000}_{\text{hosts}}$

255.255.255.240 / 28 (32-4 = 28)

Step-3:

Dept-1: Network IP : 201.1.1.0/28

First valid Host IP : 201.1.1.1/28

Last valid Host IP : 201.1.1.14/28

Broadcast IP : 201.1.1.15/28

Dept - 2: Network IP : 201.1.1.16 / 28
First valid host IP : 201.1.1.17 / 28
Last valid host IP : 201.1.1.30 / 28
Broadcast IP : 201.1.1.31 / 28

Dept. - 3: Network IP : 201.1.1.32 / 28
First valid host IP : 201.1.1.33 / 28
Last valid host IP : 201.1.1.46 / 28
Broadcast IP : 201.1.1.47 / 28

Dept. - 4: Network IP : 201.1.1.48 / 28
First valid host IP : 201.1.1.49 / 28
Last valid host IP : 201.1.1.62 / 28
Broadcast IP : 201.1.1.63 / 28

Dept - 5: Network IP : 201.1.1.64 / 28
First valid host IP : 201.1.1.65 / 28
Last valid host IP : 201.1.1.78 / 28
Broadcast IP : 201.1.1.79 / 28

Conclusion: This experiment ensures the understanding of using classless IP addresses for different networks, using same main network and thus decreasing the wastage of IP addresses.