

INSTITUTE OF COMPUTER TECHNOLOGY  
B. TECH COMPUTER SCIENCE AND ENGINEERING

*Subject: Computer Networks[CN]*

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SEM : 5

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**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 (including network devices). The IP address range given to you is 192.XX.10.0/24. Design the network such that wastage of IP address is less. So, for designing purpose you can take 2 devices in each department (as first device and last device in network) for ease of the implementation.

**Calculation:**

**Reserved address:**

- Network Address
- Broadcast Address

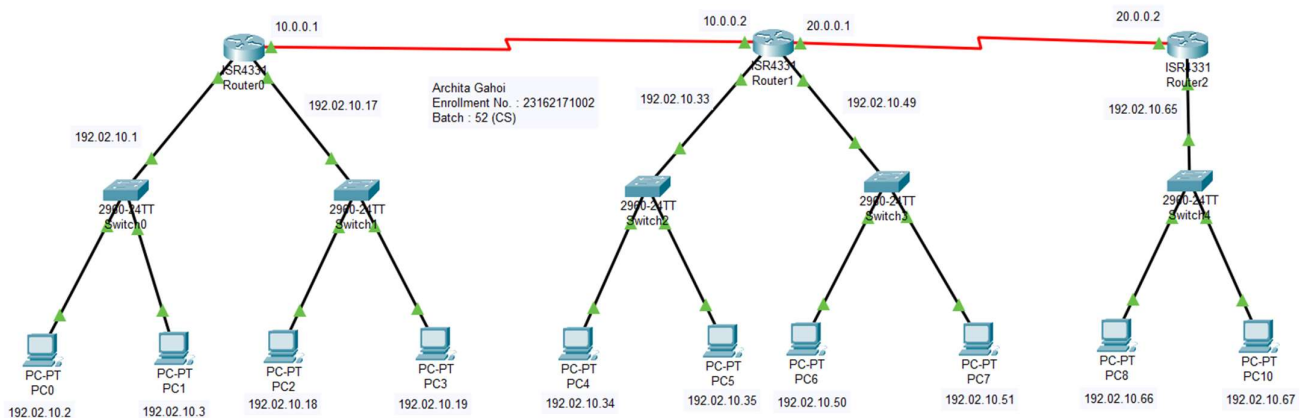
**Min host bit requirement:**

$$No. \text{ of devices} \leq 2^{n-2}$$

## Procedure:

- 1) Create network as given below
- 2) Calculate the number of bits required for host as per the given problem.
- 3) Get subnet mask for subnetting
- 4) Calculate IP address and design a network
- 5) Configure IP address (All Devices, Routers)
- 6) Configure static routing table (STATIC in routers)

### ⇒ Main Circuit



### ⇒ Calculate the number of bits required for host:

$$14 \leq 2^n - 2 \quad \text{so } n = 4 \text{ bit} \Rightarrow \text{host}$$

$$32 \text{ bit} - 4 \text{ bit} = 28 \text{ bit} \Rightarrow \text{subnet}$$

### ⇒ Subnet mask for subnetting

Old Subnet mask (Decimal form)	255.255.255.0
Old Subnet mask (Binary form)	11111111. 11111111. 11111111. 00000000
New Subnet mask (Decimal form)	255.255.255.240
New Subnet mask (Binary form)	11111111. 11111111. 11111111. 11110000

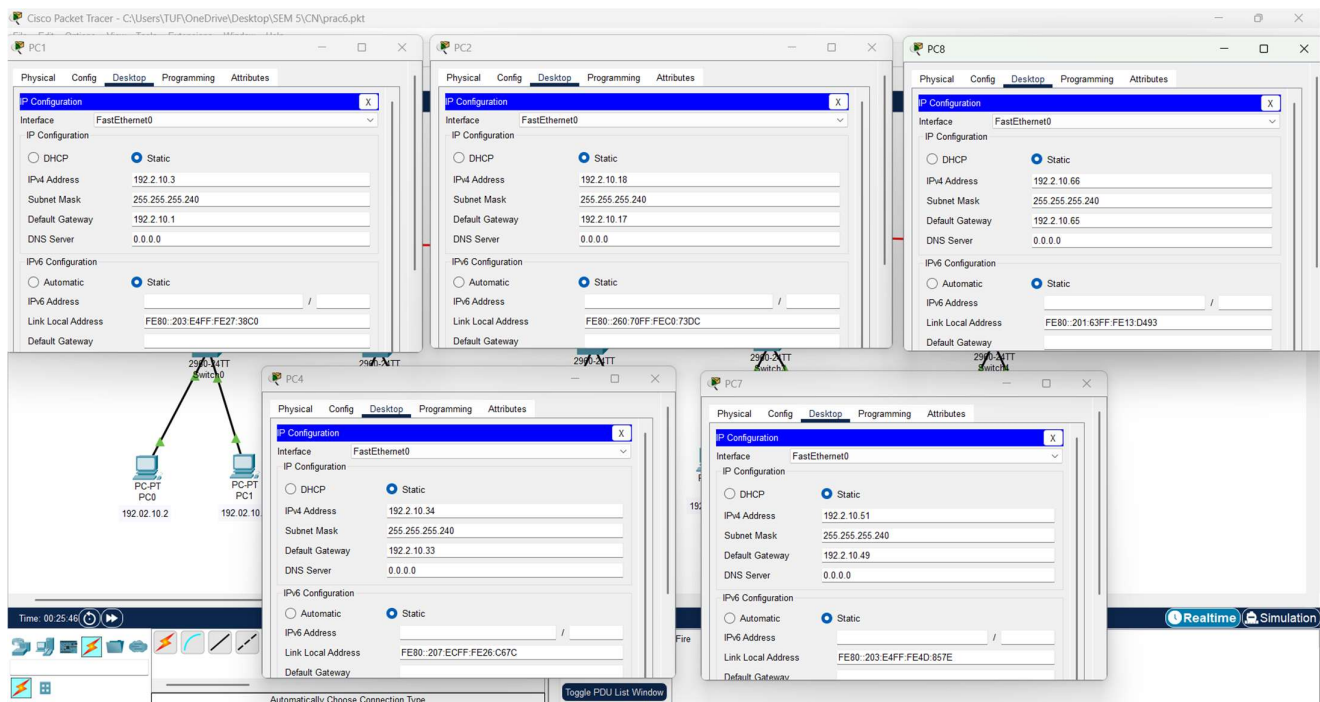
## ⇒ Calculate IP address and design a network

Dept.	Device	IP Address	Subnet Mask
Dept. 1	Network	192.02.10.0	255.255.255.240
	Default Gateway	192.02.10.1	255.255.255.240
	Host (First)	192.02.10.2	255.255.255.240
	Host (Last)	192.02.10.14	255.255.255.240
	Broadcast	192.02.10.02	255.255.255.240
Dept. 2	Network	192.02.10.16	255.255.255.240
	Default Gateway	192.02.10.17	255.255.255.240
	Host (First)	192.02.10.18	255.255.255.240
	Host (Last)	192.02.10.30	255.255.255.240
	Broadcast	192.02.10.31	255.255.255.240
Dept. 3	Network	192.02.10.32	255.255.255.240
	Default Gateway	192.02.10.33	255.255.255.240
	Host (First)	192.02.10.34	255.255.255.240
	Host (Last)	192.02.10.46	255.255.255.240
	Broadcast	192.02.10.47	255.255.255.240
Dept. 4	Network	192.02.10.48	255.255.255.240
	Default Gateway	192.02.10.49	255.255.255.240
	Host (First)	192.02.10.50	255.255.255.240
	Host (Last)	192.02.10.62	255.255.255.240
	Broadcast	192.02.10.63	255.255.255.240
Dept. 5	Network	192.02.10.64	255.255.255.240
	Default Gateway	192.02.10.65	255.255.255.240
	Host (First)	192.02.10.66	255.255.255.240
	Host (Last)	192.02.10.78	255.255.255.240
	Broadcast	192.02.10.79	255.255.255.240

## Configuration:

## IP Address:

⇒ PCS



## ⇒ Routers

### Router 0

Router0

Physical Config CLI Attributes

**GLOBAL**

Settings

Algorithm Settings

**ROUTING**

Static

RIP

**SWITCHING**

VLAN Database

**INTERFACE**

GigabitEthernet0/0/0

GigabitEthernet0/0/1

GigabitEthernet0/0/2

Serial0/1/0

Serial0/1/1

GigabitEthernet0/0/0

Port Status

Bandwidth

Duplex

MAC Address

IP Configuration

IPv4 Address

Subnet Mask

Tx Ring Limit

10

Equivalent IOS Commands

```
Router(config-if)#ip address 10.0.0.1 255.0.0.0
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/1/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed state to up

Router(config-if)#exit
Router(config)#
Router(config)#
Router(config)#interface GigabitEthernet0/0/0
Router(config-if)#
```

Top

Router0

Physical Config CLI Attributes

**GLOBAL**

Settings

Algorithm Settings

**ROUTING**

Static

RIP

**SWITCHING**

VLAN Database

**INTERFACE**

GigabitEthernet0/0/0

GigabitEthernet0/0/1

GigabitEthernet0/0/2

Serial0/1/0

Serial0/1/1

GigabitEthernet0/0/1

Port Status

Bandwidth

Duplex

MAC Address

IP Configuration

IPv4 Address

Subnet Mask

Tx Ring Limit

10

Equivalent IOS Commands

```
%LINK-5-CHANGED: Interface Serial0/1/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed state to up

Router(config-if)#exit
Router(config)#
Router(config)#interface GigabitEthernet0/0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/0/1
Router(config-if)#
```

Top

Router0

Physical Config CLI Attributes

**GLOBAL**

Settings

Algorithm Settings

**ROUTING**

Static

RIP

**SWITCHING**

VLAN Database

**INTERFACE**

GigabitEthernet0/0/0

GigabitEthernet0/0/1

GigabitEthernet0/0/2

Serial0/1/0

Serial0/1/1

Serial0/1/0

Port Status

Duplex

Clock Rate

IP Configuration

IPv4 Address

Subnet Mask

Tx Ring Limit

10

Equivalent IOS Commands

```
Router(config-if)#exit
Router(config)#
Router(config)#interface GigabitEthernet0/0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/0/1
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/0
Router(config-if)#
```

Top

## ⇒ Configure static routing table (STATIC in routers)

Router	Dept.	Network	Subnet Mask	Next Hop
Router0	Dept.3	192.02.10.32	255.255.255.240	10.0.0.2
	Dept.4	192.02.10.48	255.255.255.240	10.0.0.2
	Dept.5	192.02.10.64	255.255.255.240	10.0.0.2
Router1	Dept.1	192.02.10.0	255.255.255.240	10.0.0.1
	Dept.2	192.02.10.16	255.255.255.240	10.0.0.1
	Dept.5	192.02.10.64	255.255.255.240	20.0.0.2
Router2	Dept.1	192.02.10.0	255.255.255.240	20.0.0.1
	Dept.2	192.02.10.16	255.255.255.240	20.0.0.1
	Dept.3	192.02.10.32	255.255.255.240	20.0.0.1
	Dept.4	192.02.10.48	255.255.255.240	20.0.0.1

Router0

Physical Config CLI Attributes

Static Routes

Network:

Mask:

Next Hop:

Add

Network Address

192.2.10.32/28 via 10.0.0.2

192.2.10.48/28 via 10.0.0.2

192.2.10.64/28 via 10.0.0.2

Remove

Equivalent IOS Commands

```
Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
Router(config)#ip route 192.02.10.32 255.255.255.240 10.0.0.2
Router(config)#ip route 192.02.10.48 255.255.255.240 10.0.0.2
Router(config)#ip route 192.02.10.64 255.255.255.240 10.0.0.2
Router(config)#
Router(config)#
Router(config)#
```

☐ Top

Router1

Physical Config CLI Attributes

Static Routes

Network:

Mask:

Next Hop:

Add

Network Address

192.2.10.0/28 via 10.0.0.1

192.2.10.16/28 via 10.0.0.1

192.2.10.64/28 via 20.0.0.2

Remove

Equivalent IOS Commands

```
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/1
Router(config-if)#
Router(config-if)#exit
Router(config)#
Router(config)#
```

☐ Top

Router2

Physical Config CLI Attributes

Static Routes

Network:

Mask:

Next Hop:

Add

Network Address

192.2.10.0/28 via 20.0.0.1

192.2.10.16/28 via 20.0.0.1

192.2.10.32/28 via 20.0.0.1

192.2.10.48/28 via 20.0.0.1

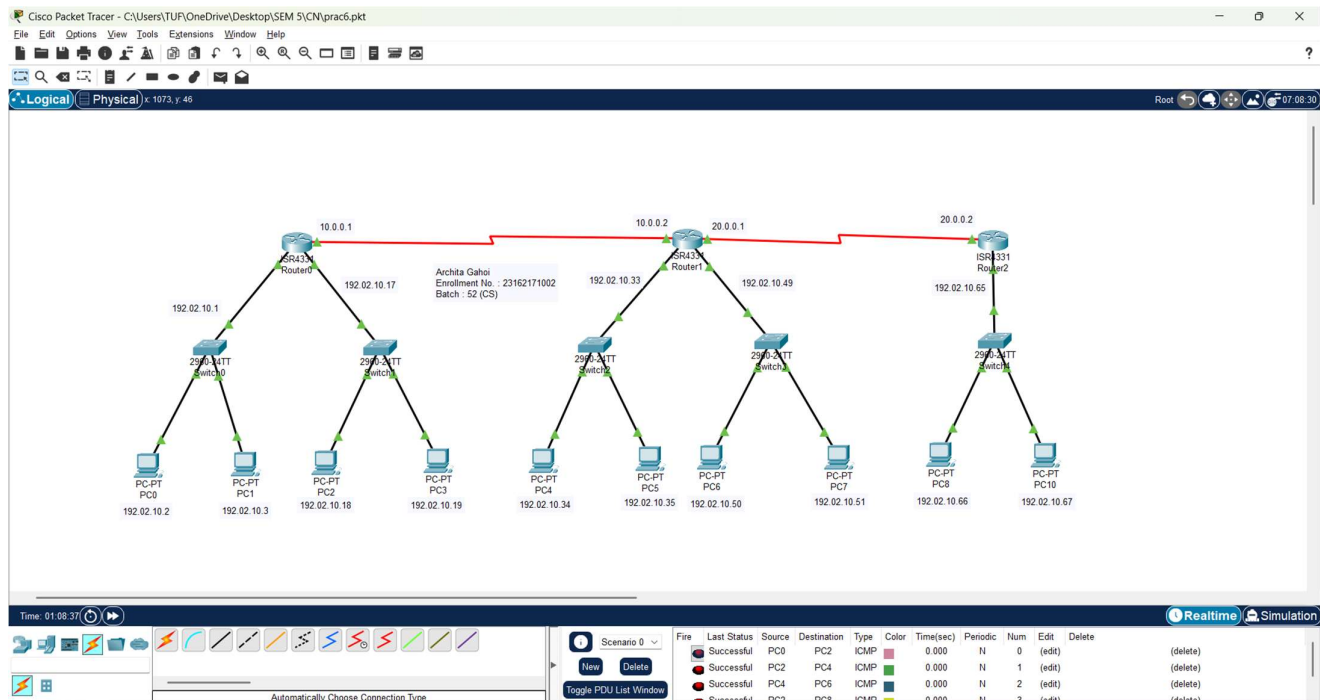
Remove

Equivalent IOS Commands

```
Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
Router(config)#ip route 192.02.10.0 255.255.255.240 20.0.0.1
Router(config)#ip route 192.02.10.16 255.255.255.240 20.0.0.1
Router(config)#ip route 192.02.10.32 255.255.255.240 20.0.0.1
Router(config)#ip route 192.02.10.48 255.255.255.240 20.0.0.1
Router(config)#
Router(config)#
Router(config)#
```

☐ Top

## Output:



## Conclusion:

In this practical, we successfully designed a network for an organization using the principles of subnetting. The process allowed efficient allocation of IP addresses by dividing a larger network into smaller subnets based on departmental needs. This approach enhanced IP address utilization, improved network performance and security, and made management more systematic. Overall, the sub netted network design ensured scalability, organized communication, and readiness for future expansion within the organization.