

Week 5: Study of Basic Network Configuration Commands, Classification of IP Address, and Subnetting

Aim:

To study and practice basic network configuration commands, understand the classification of IP addresses, and perform subnetting using Cisco Packet Tracer.

Requirements:

1. **Hardware/Software:**
 - o Personal Computer / Laptop
 - o Cisco Packet Tracer software installed
2. **Components in Packet Tracer:**
 - o PCs - 4
 - o Switches - 2
 - o Router -1
 - o Copper Straight-Through and Cross-Over cables

Description:

1. IP Address

An IP (Internet Protocol) address is a unique number assigned to each device in a network to identify it and enable communication.

Format: **IPv4** – 32-bit address divided into four octets (e.g., 192.168.1.1)

Two parts:

- **Network part** – Identifies the network
- **Host part** – Identifies the specific device (host) in that network

2. IP Address Classes

Address Class	1st Octet Range (Decimal)	1st Octet Bits (Red dots do not change)	Network (N) and Host (H) Portion	Default Mask (Decimal)	Number of Possible Networks and Hosts per Network
A	0 – 127	00000000 – 01111111	N.H.H.H	255.0.0.0	128 Nets (2^7) 16,777,214 Hosts ($2^{24} - 2$)
B	128 – 191	10000000 – 10111111	N.N.H.H	255.255.0.0	16,384 Nets (2^{14}) 65,534 Hosts ($2^{16} - 2$)
C	192 – 223	11000000 – 11011111	N.N.N.H	255.255.255.0	2,09,150 Nets (2^{21}) 254 Hosts ($2^8 - 2$)
D	224 – 239	11100000 – 11101111	NA (Multicast)	-	-
E	240 – 255	11110000 – 11111111	NA (Experimental)	-	-

IP address Slash Notation:

Class	Subnet Mask (in Decimal)	Subnet Mask (in Binary)	Slash Notation
A	255.0.0.0	11111111.00000000.00000000.00000000	/8
B	255.255.0.0	11111111.11111111.00000000.00000000	/16
C	255.255.255.0	11111111.11111111.11111111.00000000	/24

3. Subnetting

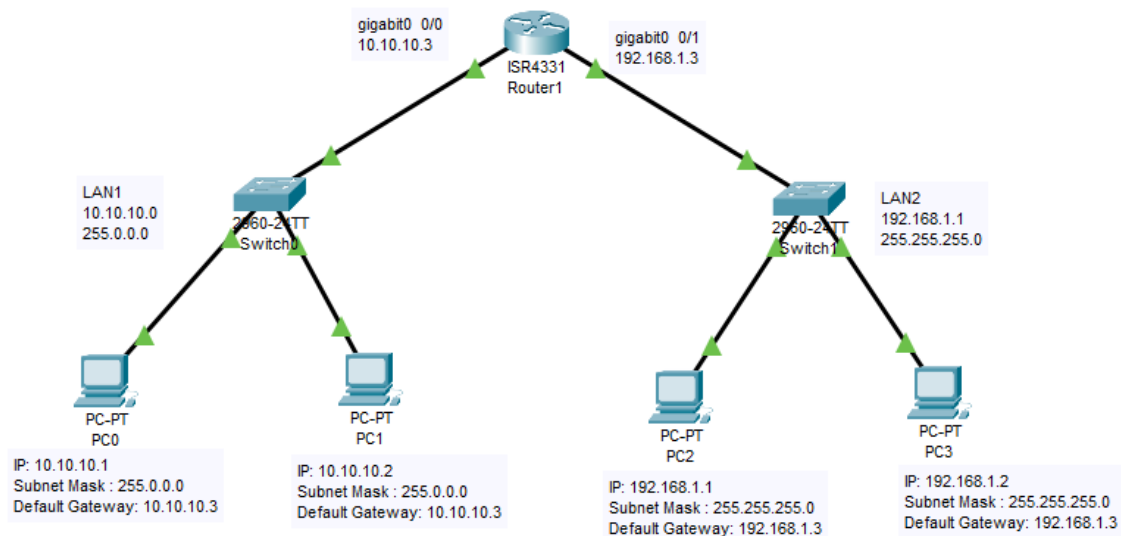
Subnetting is the process of dividing a network into smaller sub-networks to improve efficiency, reduce congestion, and enhance security.

Formula:

- **Number of subnets** = 2^n (where n = number of bits in network part – fixed bits in network part of first octet)
- **Number of hosts per subnet** = $2^h - 2$ (where h = remaining host bits)

Procedure:

A. Creating the Network in Cisco Packet Tracer



1. Open Cisco Packet Tracer.
2. From the **End Devices** section, drag **PC0** and **PC1** onto the workspace.
3. From the **Switches** section, drag 2 switches (connect as shown in figure).
4. Connect **PC0** and **PC1** to the switch0 using **Copper Straight-Through** cables.
5. Click on **PC0** → **Desktop** → **IP Configuration** and assign:
 - IP Address: 10.10.10.1
 - Subnet Mask: 255.0.0.0

6. Click on **PC1 → Desktop → IP Configuration** and assign:
 - IP Address: 10.10.10.1
 - Subnet Mask: 255.0.0.0
7. Connect **PC2** and **PC3** to the switch1 using **Copper Straight-Through** cables.
8. Click on **PC2 → Desktop → IP Configuration** and assign:
 - IP Address: 192.168.1.1
 - Subnet Mask: 255.255.255.0
9. Click on **PC3 → Desktop → IP Configuration** and assign:
 - IP Address: 192.168.1.1
 - Subnet Mask: 255.255.255.0

10. Configure the Router

- Open the CLI of **Router0**:

```
Router> enable
Router# configure terminal
Router(config)# interface GigabitEthernet0/0/0
(Router(config-if)# ip address <IP> <Subnet Mask>)
Router(config-if)# ip address 10.10.10.3 255.0.0.0
Router(config-if)# exit
Router(config)# interface GigabitEthernet0/0/1
Router(config-if)# ip address 192.168.1.3 255.255.255.0
Router(config-if)# exit
```

11. Test connectivity using **Command Prompt**:

- On PC0/PC1, type: ping 192.168.1.1 / 192.168.1.2
- On PC2/PC3, type: ping 10.10.10.1 / 10.10.10.2

Classification and Subnetting Example :

- Given network: 192.168.1.0/24 (Class C) - subnet mask = 255.255.255.0 (/24)
- Required: 4 subnets
- Subnet ranges:
 1. 192.168.1.0 - 192.168.1.63
 2. 192.168.1.64 - 192.168.1.127
 3. 192.168.1.128 - 192.168.1.191
 4. 192.168.1.192 - 192.168.1.255

Basic Network Configuration Commands:

Command	Purpose	Syntax / Example	Sample Output
ipconfig	Displays current IP configuration of the PC.	ipconfig	IP Address.....: 192.168.1.1 Subnet Mask.....: 255.255.255.0

			Default Gateway.....: 192.168.1.254
ping <IP>	Tests network connectivity between devices.	ping 192.168.1.2	Reply from 192.168.1.2: bytes=32 time<1ms TTL=128
enable	Switches from User EXEC mode (>) to Privileged EXEC mode (#).	enable	Switch> → Switch#
configure terminal	Enters Global Configuration mode to make changes.	configure terminal	Switch(config)#
interface fastethernet 0/0	Enters interface configuration mode.	interface fastethernet 0/0	Switch(config-if)#
ip address <IP> <Subnet>	Assigns IP address to an interface.	ip address 192.168.1.1 255.255.255.0	(No direct output, moves to next line)
no shutdown	Activates the interface (brings it up).	no shutdown	%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up
exit	Exits from current mode to previous mode.	exit	Switch(config)#
show running-config	Displays the current running configuration.	show running-config	interface FastEthernet0/0 ip address 192.168.1.1 255.255.255.0 no shutdown
show ip route	Shows routing table entries.	show ip route	C 192.168.1.0/24 is directly connected, FastEthernet0/0

Results:

- Successfully configured IP addresses for network devices.
- Verified connectivity between devices using ping.
- Practiced basic network configuration commands.
- Classified IP addresses into classes A, B, C, D, E.
- Performed subnetting and verified subnet ranges.