**Week 2:**

**IP Addressing and Subnetting**

**Objective:** Learn IP addressing, subnetting, and their practical applications

**Task 1:**

Perform subnetting for a given IP address range and document results.

* **Classful addressing (legacy):** IPv4 address classes A, B, C determined by first octet ranges:
* Class A: 1.0.0.0 – 126.255.255.255 (default mask /8)
* Class B: 128.0.0.0 – 191.255.255.255 (default mask /16)
* **Class C:** 192.0.0.0 – 223.255.255.255 (default mask /24) → **192.168.10.0** is **Class C** in classful terms.
* **Classless addressing (CIDR):** Uses arbitrary prefix lengths (e.g., /26) — flexible and how modern networks are designed.

**Example (CIDR):**

* Base network: **192.168.10.0/24**
* Address range: **192.168.10.0 → 192.168.10.255**
* Total addresses: 256
* Usable hosts for /24 (if used as host network): 254 (192.168.10.1 → 192.168.10.254)

**Total number of subnets (inside/24)**

For a /24 split into subnets with prefix /N (where N > 24):

* Number of subnets = 2^(N − 24)

So:

* /25 → 2 subnets
* /26 → 4 subnets
* /27 → 8 subnets
* /28 → 16 subnets
* /29 → 32 subnets
* /30 → 64 subnet

**/25(block size=128):2subnets**

| **#** | **Network Address** | **Subnet Mask** | **CIDR** |  | **Usable IP Range** | **Broadcast** |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | 192.168.10.0 | 255.255.255.128 | /25 |  | 192.168.10.1 – 192.168.10.126 | 192.168.10.127 |
| 2 | 192.168.10.128 | 255.255.255.128 | /25 |  | 192.168.10.129 – 192.168.10.254 | 192.168.10.255 |

Total /25 subnets = **2**.

**/26 (Blocksize = 64 ): 4 subnets**

| **#** | **Network Address** | **Subnet Mask** | **CIDR** | **Usable IP Range** | **Broadcast** |
| --- | --- | --- | --- | --- | --- |
| 1 | 192.168.10.0 | 255.255.255.192 | /26 | 192.168.10.1 – 192.168.10.62 | 192.168.10.63 |
| 2 | 192.168.10.64 | 255.255.255.192 | /26 | 192.168.10.65 – 192.168.10.126 | 192.168.10.127 |
| 3 | 192.168.10.128 | 255.255.255.192 | /26 | 192.168.10.129 – 192.168.10.190 | 192.168.10.191 |
| 4 | 192.168.10.192 | 255.255.255.192 | /26 | 192.168.10.193 – 192.168.10.254 | 192.168.10.255 |

Total /26 subnets = **4**.

**/27 (Blocksize = 32 ): 8 subnets**

| **#** | **Network Address** | **Subnet Mask** | **CIDR** | **Usable IP Range** | **Broadcast** |
| --- | --- | --- | --- | --- | --- |
| 1 | 192.168.10.0 | 255.255.255.224 | /27 | 192.168.10.1 – 192.168.10.30 | 192.168.10.31 |
| 2 | 192.168.10.32 | 255.255.255.224 | /27 | 192.168.10.33 – 192.168.10.62 | 192.168.10.63 |
| 3 | 192.168.10.64 | 255.255.255.224 | /27 | 192.168.10.65 – 192.168.10.94 | 192.168.10.95 |
| 4 | 192.168.10.96 | 255.255.255.224 | /27 | 192.168.10.97 – 192.168.10.126 | 192.168.10.127 |
| 5 | 192.168.10.128 | 255.255.255.224 | /27 | 192.168.10.129 – 192.168.10.158 | 192.168.10.159 |
| 6 | 192.168.10.160 | 255.255.255.224 | /27 | 192.168.10.161 – 192.168.10.190 | 192.168.10.191 |
| 7 | 192.168.10.192 | 255.255.255.224 | /27 | 192.168.10.193 – 192.168.10.222 | 192.168.10.223 |
| 8 | 192.168.10.224 | 255.255.255.224 | /27 | 192.168.10.225 – 192.168.10.254 | 192.168.10.255 |

Total /27 subnets = **8**.

**/28 (Blocksize = 16 ): 16 subnets**

| **#** | **Network Address** | **Subnet Mask** | **CIDR** | **Usable IP Range** | **Broadcast** |
| --- | --- | --- | --- | --- | --- |
| 1 | 192.168.10.0 | 255.255.255.240 | /28 | 192.168.10.1 – 192.168.10.14 | 192.168.10.15 |
| 2 | 192.168.10.16 | 255.255.255.240 | /28 | 192.168.10.17 – 192.168.10.30 | 192.168.10.31 |
| 3 | 192.168.10.32 | 255.255.255.240 | /28 | 192.168.10.33 – 192.168.10.46 | 192.168.10.47 |
| 4 | 192.168.10.48 | 255.255.255.240 | /28 | 192.168.10.49 – 192.168.10.62 | 192.168.10.63 |
| 5 | 192.168.10.64 | 255.255.255.240 | /28 | 192.168.10.65 – 192.168.10.78 | 192.168.10.79 |
| 6 | 192.168.10.80 | 255.255.255.240 | /28 | 192.168.10.81 – 192.168.10.94 | 192.168.10.95 |
| 7 | 192.168.10.96 | 255.255.255.240 | /28 | 192.168.10.97 – 192.168.10.110 | 192.168.10.111 |
| 8 | 192.168.10.112 | 255.255.255.240 | /28 | 192.168.10.113 – 192.168.10.126 | 192.168.10.127 |
| 9 | 192.168.10.128 | 255.255.255.240 | /28 | 192.168.10.129 – 192.168.10.142 | 192.168.10.143 |
| 10 | 192.168.10.144 | 255.255.255.240 | /28 | 192.168.10.145 – 192.168.10.158 | 192.168.10.159 |
| 11 | 192.168.10.160 | 255.255.255.240 | /28 | 192.168.10.161 – 192.168.10.174 | 192.168.10.175 |
| 12 | 192.168.10.176 | 255.255.255.240 | /28 | 192.168.10.177 – 192.168.10.190 | 192.168.10.191 |
| 13 | 192.168.10.192 | 255.255.255.240 | /28 | 192.168.10.193 – 192.168.10.206 | 192.168.10.207 |
| 14 | 192.168.10.208 | 255.255.255.240 | /28 | 192.168.10.209 – 192.168.10.222 | 192.168.10.223 |
| 15 | 192.168.10.224 | 255.255.255.240 | /28 | 192.168.10.225 – 192.168.10.238 | 192.168.10.239 |
| 16 | 192.168.10.240 | 255.255.255.240 | /28 | 192.168.10.241 – 192.168.10.254 | 192.168.10.255 |

Total /28 subnets = **16**.

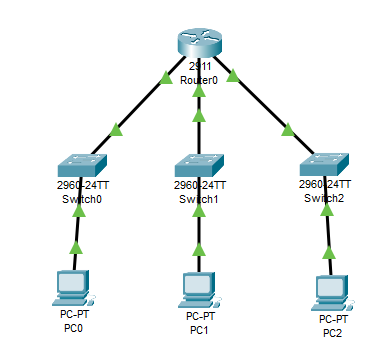
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**Task 2:**

Assign IP addresses to devices in a basic network setup in Packet Tracer

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**Configuration :**

Router#

Router#

Router#sh ip interface brief

Interface IP-Address OK? Method Status Protocol

GigabitEthernet0/0 192.168.10.1 YES manual up up

GigabitEthernet0/1 192.168.20.1 YES manual up up

GigabitEthernet0/2 192.168.30.1 YES manual up up

Vlan1 unassigned YES unset administratively down down

Router#

Router#

Router#

Router#show ip route

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP

D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2

E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP

i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area

\* - candidate default, U - per-user static route, o - ODR

P - periodic downloaded static route

Gateway of last resort is not set

192.168.10.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.10.0/24 is directly connected, GigabitEthernet0/0

L 192.168.10.1/32 is directly connected, GigabitEthernet0/0

192.168.20.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.20.0/24 is directly connected, GigabitEthernet0/1

L 192.168.20.1/32 is directly connected, GigabitEthernet0/1

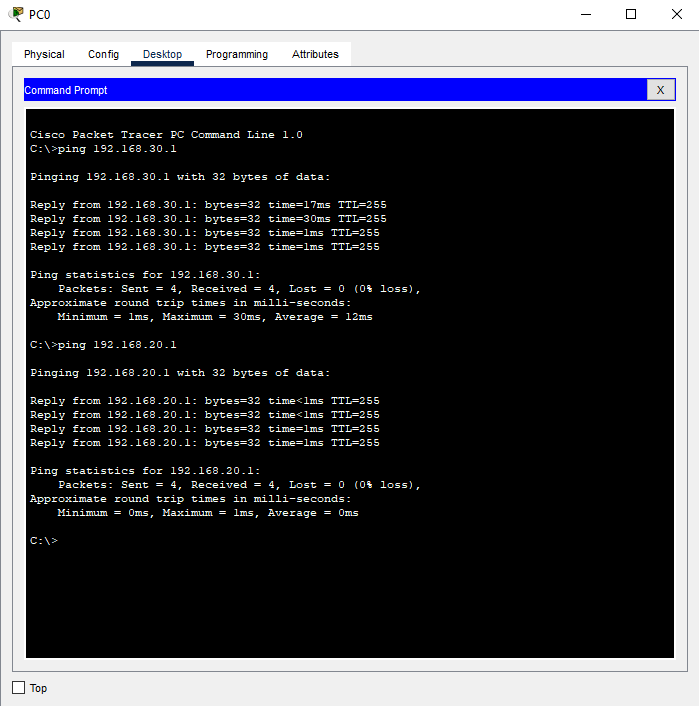
192.168.30.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.30.0/24 is directly connected, GigabitEthernet0/2

L 192.168.30.1/32 is directly connected, GigabitEthernet0/2

Router#

**Results :**

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