Experiment - 6

Aim → Implementation and understanding the use of Sub-netting and VLSM (Variable Length subnet masking) with Cisco Packet Tracer.

Objective 1 → An overview on classless IPv4 addressing, CIDR notation, sub-netting and VLSM used in computer networking.

Classless IPv4 Addressing → classless addressing improves upon traditional classful addressing by using subnet masks to define network and host portions, regardless of rigid class boundaries. It allows for efficient IP allocation and flexible network design reducing wastage of address space.

CIDR Notation (Classless Inter-Domain Routing) → CIDR uses the format <IP address>/<Prefix Length> (e.g., 192.168.1.0/24) to specify the network portion. It enables:

i) Efficient Routing → Combines multiple IP ranges into a single route.
ii) Scalability → Supports both large and small networks.
iii) Flexibility → Frees IP allocation from class constraints.

Subnetting → Subnetting divides a larger network into smaller sub-networks for better management, reduced congestion, and enhanced security. Key points:

i) A subnet mask defines the network / host (e.g., /26 or 255.255.255.192)
ii) Example → Subnet 192.168.1.0/24 into 4 subnets as /26, creating ranges like 192.168.1.0 - 192.168.1.63.

VLSM (Variable Length Subnet Mask) → VLSM enables subnets of varying sizes within the same network, allowing precise allocation of IPs based on needs:

- Example → For a /24 block, ~~design~~ assign /25 for 100 hosts, /126 for 50 hosts & /127 for 25 hosts avoiding address wastage.

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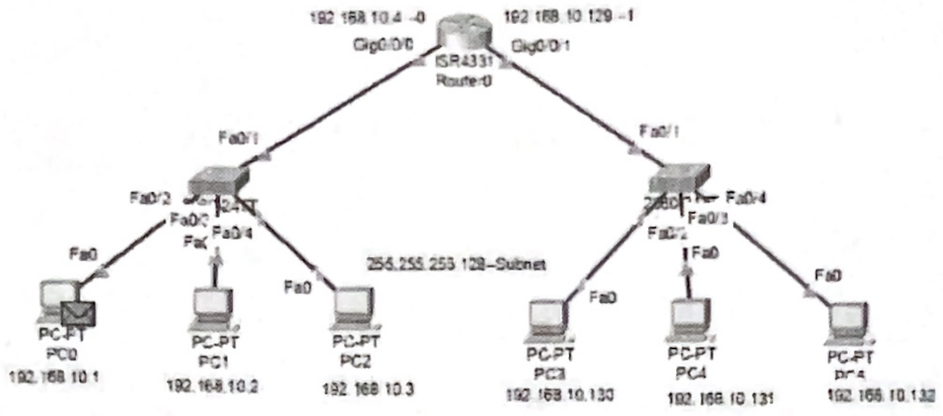
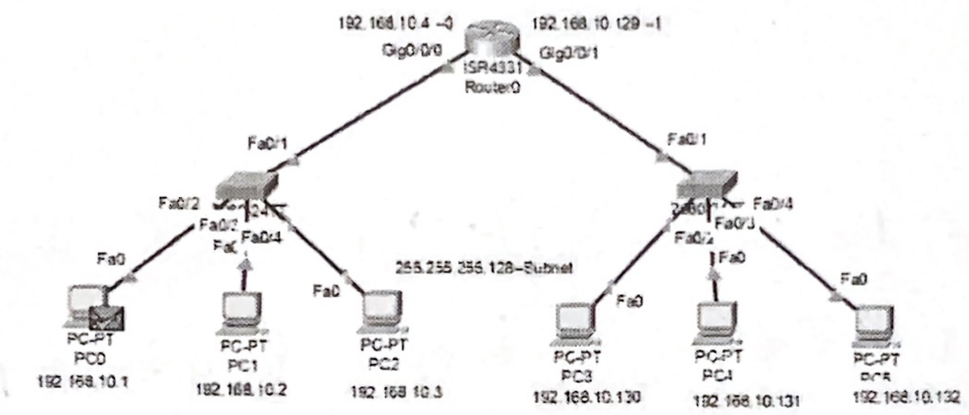
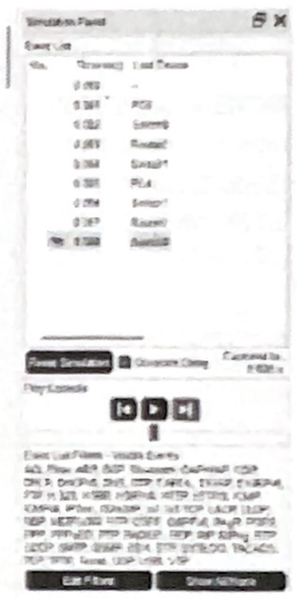
Objective 2 → Implementing the sub-netting technique to divide a network into smaller subnets and analysing the communication between PCs in both intra and ~~intra~~ inter-subnets.

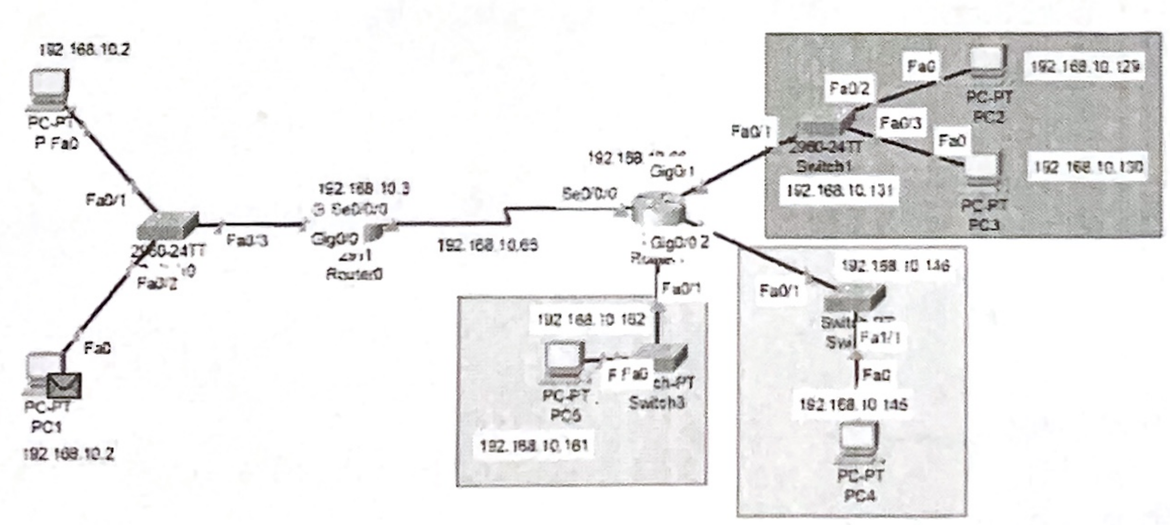


Assigning the same subnet to each PC of different networks and then pinging PC0 to PC4.

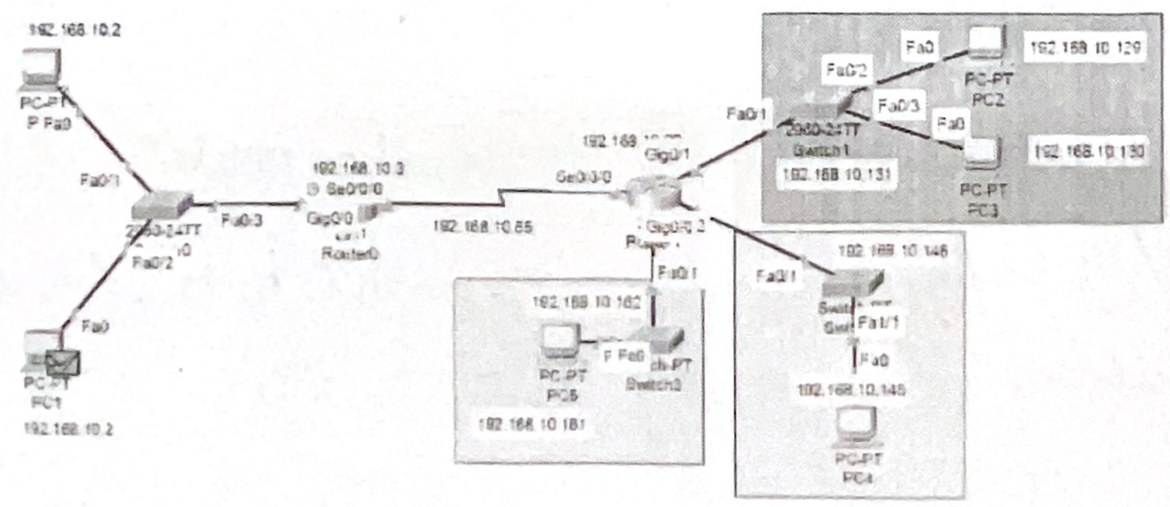


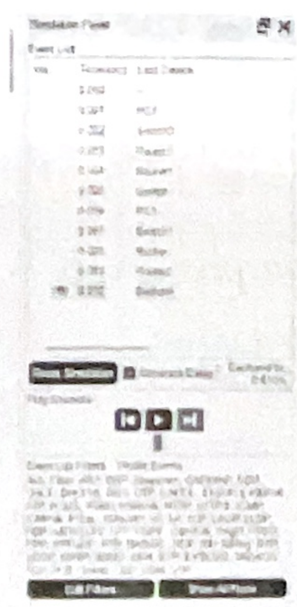


Objective 3 → Implementing the VLSM technique to optimise the IPv4 address allocations to PCs and interfaces in a given network and analysing the communication between PCs in the network.



Pinging from PC0 to PC3, using ~~static~~ VLSM method.





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Exercises →

1) Express the following classful IP addresses in CIDR notation →

i) 192.34.1.9 → Class C

CIDR Notation : 192.34.1.9/24

ii) 10.10.10.1 → Class A

CIDR Notation : 10.10.10.1/8

iii) 129.10.14.15 → Class B

CIDR Notation : 129.10.14.15/16

Classful Default Masks →

- Class A → /8 (255.0.0.0)
- Class B → /16 (255.255.0.0)
- Class C → /24 (255.255.255.0)

2) Given the IP address of a device as 192.168.10.126/25. Find the subnet mask and network ID in dotted decimal notation.

Ans→ IP address → 192.168.10.126

CIDR notation → /25 that means first 25 bits are subnet mask

Binary → IP address → 11000000.10101000.00001010.01111110

CIDR → 11111111.11111111.11111111.10000000

Network ID → 11000000.10101000.00001000.00000000

↳ in decimal → 192.168.10.0

So, the subnet mask → 255.255.255.128

Network ID → 192.168.10.0

3) A network with ID 200.1.2.0 is divided into 3 subnets, find number of hosts per subnet. Also, for all the subnets, find -

a) Subnet Address b) First Host ID c) Last Host ID d) Broadcast Address.

Ans→ Network ID → 200.1.2.0

No. of subnets → 3

- The network 200.12.0 belongs to class C with a default subnet mask of /24

To create 3 subnets →

- Minimum bits required : $\lceil \log_2(3) \rceil = 2$

  Using 2 bits for subnetting gives $2^2 = 4$ subnets (sufficient for 3 subnets)

- New Subnet Mask : /26
- Host per Subnet : $2^{32-26} - 2 = 64 - 2 = 62$

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With a subnet mask of /26, the increment is 256 - 192 = 64.

Subnet Details →

Subnet 1 →

a) Subnet Address

Subnet	Subnet Address	First Host	Last Host	Broadcast Address
1	200.1.2.0	200.1.2.1	200.1.2.62	200.1.2.63
2	200.1.2.64	200.1.2.65	200.1.2.126	200.1.2.127
3	200.1.2.128	200.1.2.129	200.1.2.190	200.1.2.191

4) Design a network using VLSM for the following requirements with the given network 10.0.0.0/24
Assign IP addresses accordingly : (a) Network A : 60 hosts (b) Network B : 30 hosts
(c) Network C : 14 hosts (d) Network D : 6 hosts

Ans → Network → 10.0.0.0/24

IPs → $2^{32-24} = 256$ IPs

Network	Hosts Required	Hosts Needed (Power of 2)	Subnet Mask	IPs Available
A	60	64	/26 (255.255.255.192)	64
B	30	32	/27 (255.255.255.224)	32
C	14	16	/28 (255.255.255.240)	16
D	6	8	/29 (255.255.255.248)	8

Allocation Table →

Network	Subnet Address	First Host	Last Host	Broadcast Address	Subnet Mask
A	10.0.0.0/26	10.0.0.1	10.0.0.62	10.0.0.63	255.255.255.192
B	10.0.0.64/27	10.0.0.65	10.0.0.94	10.0.0.95	255.255.255.224
C	10.0.0.96/28	10.0.0.97	10.0.0.110	10.0.0.111	255.255.255.240
D	10.0.0.128/29	10.0.0.113	10.0.0.118	10.0.0.119	255.255.255.248

Name:_____ Regd No.:_____