LAB 4: Subnetting and Supernetting using Cisco Packet Tracer

Objectives

- To learn and apply subnetting and supernetting concepts through Cisco Packet Tracer by creating networks, assigning IP addresses, and checking connectivity with ping.

Theory

Introduction

Efficient IP address management and proper routing are fundamental for seamless communication in computer networks. To achieve this, network engineers often use techniques like subnetting and supernetting. Subnetting allows a large network to be split into smaller, more organized segments, improving management and performance. On the other hand, supernetting combines several networks into a single, larger network, simplifying routing and reducing complexity. These methods are key to designing scalable and reliable network infrastructures.

Subnetting

Subnetting is the process of dividing a large IP network into smaller, more manageable sub-networks called subnets. It helps improve network performance, enhance security, and efficiently utilize IP addresses by reducing broadcast traffic. Each subnet has its own network address, host range, and broadcast address, making network management and troubleshooting easier.

Supernetting

Subnetting breaks a network into smaller parts, supernetting takes the opposite approach by merging multiple consecutive IP networks into a single, larger network. This technique helps streamline routing and keeps routing tables manageable, which is especially useful for large-scale networks and internet service providers. Both subnetting and supernetting are essential tools for designing networks that are efficient, scalable, and easy to mana

Network Topology

1. Subnetting

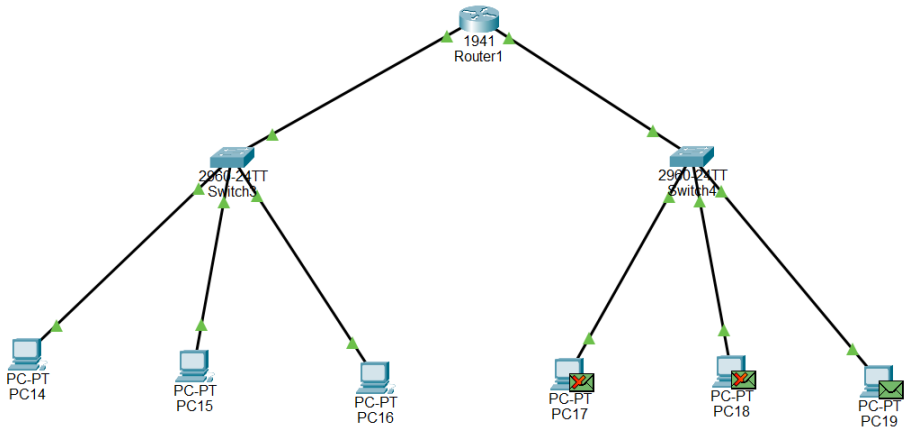

Fig: Subnetting

This network diagram shows a basic LAN setup connected through a central router. At the top, Router1 (Cisco 1941) serves as the main routing device, linking two separate LAN segments. Each segment uses a 2960-24TT switch to connect multiple PCs, allowing communication within the local network. On the left switch, PC14, PC15, and PC16 are connected, forming one LAN, while the right switch connects PC17, PC18, and PC19, forming another LAN. The red crosses on PC17 and PC18 indicate that these devices are either turned off or disconnected. This topology enables PCs in the same segment to communicate directly through their switch and allows communication between different LAN segments through the router.

Base Network Address: 192.168.1.0/24

Required Number of Subnets: 4

Borrowed Bits: 2

New Subnet Mask: /26 (255.255.255.192)

Number of IP addresses per subnet: 64 (62 usable)

Subnet Details:

Subnet 1:

Network ID: 192.168.1.0/26

First Host: 192.168.1.1

Last Host: 192.168.1.62

Broadcast ID: 192.168.1.63

Subnet 2:

Network ID: 192.168.1.64/26

First Host: 192.168.1.65

Last Host: 192.168.1.126

Broadcast ID: 192.168.1.127

Configuration

For Switch 3 :

Device	IPv4 Address	Subnet Mask	Default gateway
PC14	192.168.1.2	255.255.255.192	192.168.1.1
PC15	192.168.1.3	255.255.255.192	192.168.1.1
PC16	192.168.1.4	255.255.255.192	192.168.1.1

For switch 4:

Device	IPV4	Subnet Mask	Default gateway
PC17	192.168.1.66	255.255.255.192	192.168.1.65
PC18	192.168.1.67	255.255.255.192	192.168.1.65
PC19	192.168.1.68	255.255.255.192	192.168.1.65

2. Supernetting

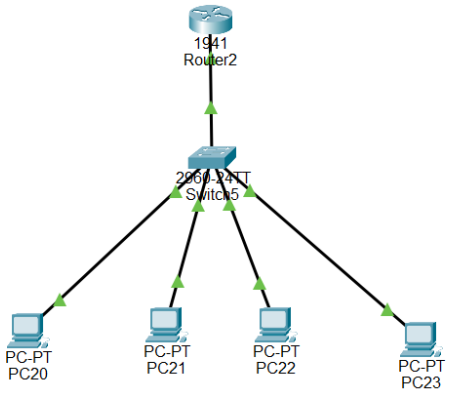

Fig: Supernetting

The diagram illustrates a simple LAN setup where Router2 is connected to a central switch (2960-24TT). Four PCs (PC20, PC21, PC22, PC23) are connected to the switch, allowing them to communicate with each other within the network. The router serves as a gateway, enabling the PCs to access other networks or the internet. This configuration demonstrates basic network design and device interconnection using Cisco Packet Tracer.

Given
Networks:

192.168.0.0/24

192.168.1.0/24

192.168.2.0/24

192.168.3.0/24

Number of networks: 4 (2^2)

New Supernet Mask: /22 (255.255.252.0)

Supernet Address: 192.168.0.0/22

IP Address Range:

First Host: 192.168.0.1

Last Host: 192.168.3.254

Broadcast Address: 192.168.3.255

Configuration:

Device	IPV4	Subnet Mask	Default Gateway
PC20	192.168.0.10	255.255.252.0	192.168.1.1
PC21	192.168.1.10	255.255.252.0	192.168.1.1
PC22	192.168.2.10	255.255.252.0	192.168.1.1
PC23	192.168.3.10	255.255.252.0	192.168.1.1

Discussion

This experiment focused on the practical implementation of subnetting and supernetting using Cisco Packet Tracer. In the subnetting exercise, the network 192.168.1.0/24 was successfully divided into four equal subnets using a /26 subnet mask, which provided 62 usable IP addresses per subnet. Proper configuration of IP addresses, subnet masks, and default gateways allowed smooth communication among devices within each subnet. In the supernetting exercise, multiple consecutive Class C networks were combined into a single larger network using a /22 subnet mask. This approach simplified routing and enabled efficient communication across the merged networks. The correctness of all configurations was verified through successful ping tests, confirming proper IP assignment and network connectivity.

Conclusion

In conclusion, the experiment effectively demonstrated the concepts of subnetting and supernetting in a practical environment using Cisco Packet Tracer. The successful communication between devices, confirmed through ping tests, shows that the networks were designed and configured correctly. This experiment highlights the importance of subnetting and supernetting in creating efficient, scalable, and well-organized networks.