

## **LAB4: SUBNETTING AND SUPERNETTING USING CISCO PACKET TRACER**

### **✓ OBJECTIVES:**

- To understand the concept of subnetting and super netting
- To learn how to efficiently manage IP addresses
- To implement subnetting and supernetting using Cisco Packet Tracer
- To analyze how these techniques improve routing and network performance

### **✓ TOOLS AND SOFTWARE USED**

- Cisco Packet Tracer
- PC with Windows/Linux OS

### **✓ THEORY**

The term associated with this lab are given below:

#### **1. Subnetting**

Subnetting is the process of dividing a large IP network into smaller logical networks called subnets. It helps to efficiently utilize IP addresses, reduce network congestion, and improve security and performance.

#### **Working of Subnetting**

Subnetting works by borrowing bits from the host portion of an IP address and adding them to the network portion. This increases the number of network IDs while reducing the number of hosts available in each subnet. As a result, each subnet has its own unique network address, broadcast address, and valid host range. This structure allows better control over the network, efficient management of IP addresses, and reduced network traffic..

#### **Applications of Subnetting**

- Used in organizations to divide networks by departments (HR, IT, Finance, etc.)
- Helps ISPs allocate IP addresses efficiently
- Improves network security by isolating subnets
- Reduces broadcast traffic in large networks
- Commonly used in enterprise and campus networks

## 2. Supernetting

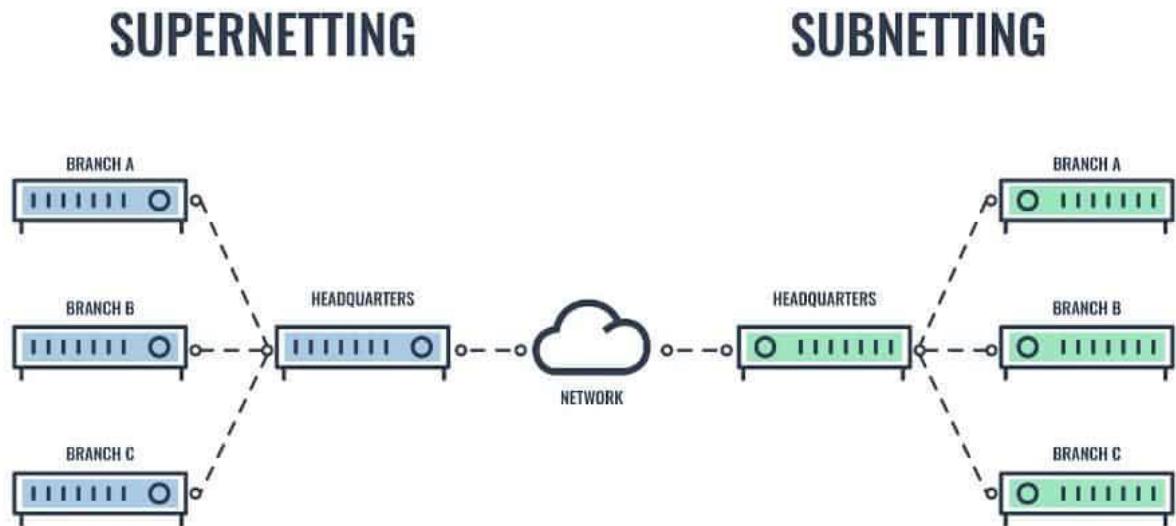
Supernetting is the process of combining multiple smaller IP networks into a single larger logical network called a supernet. It helps to reduce routing table size, improve routing efficiency, and simplify network management.

### Working of Supernetting

Supernetting works by borrowing bits from the network portion of an IP address and adding them to the host portion. This process reduces the number of network IDs while increasing the number of hosts in the combined network. By summarizing multiple contiguous networks into a single route using a shorter subnet mask, supernetting enables efficient routing and reduces routing overhead.

### Applications of Supernetting

- Used in route summarization to reduce routing table size
- Improves routing performance in large networks
- Helps ISPs manage and advertise multiple networks efficiently
- Reduces routing overhead and processing time
- Commonly used in backbone and wide area networks (WANs)



✓ **PROCEDURE**

✓ Subnetting in Cisco Packet Tracer

- Open Cisco Packet Tracer
- Add routers, switches, and PCs
- Assign IP addresses according to the subnet table
- Configure router interfaces with appropriate IP addresses
- Set default gateway on each PC
- Verify connectivity using ping command

✓ Super-netting in Cisco Packet Tracer

- Create multiple networks as per given IP ranges
- Configure routing using static or dynamic routing
- Route summarization using supernet address
- Verify routing table and connectivity

✓ **NETWORK DESIGN**

Calculation of subnet :

Base network:192.168.1.0/24

Required number of subnet:4

Number of IP address per subnet :64(Block size)

/26(Borrowed 2 bits: $2^2=4$  subnets)

Subnet mask: 255.255.255.192(11111111 .11111111.11111111.11000000)

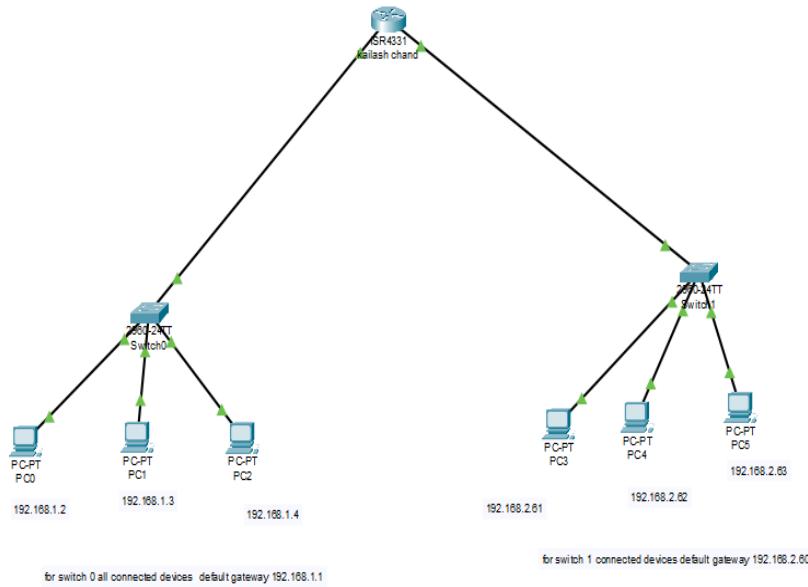
Subnet calculation Table

<u>Subnet</u>	<u>Network ID</u>	<u>Broadcast Address</u>	<u>1<sup>st</sup> usable IP</u>	<u>Last Usable IP</u>
<u>1</u>	<u>192.168.1.0</u>	<u>192.168.1.63</u>	<u>192.168.1.1</u>	<u>192.168.1.62</u>
<u>2</u>	<u>192.168.1.64</u>	<u>192.168.1.127</u>	<u>192.168.1.65</u>	<u>192.168.1.126</u>
<u>3</u>	<u>192.168.1.128</u>	<u>192.168.1.191</u>	<u>192.168.1.129</u>	<u>192.168.1.190</u>
<u>4</u>	<u>192.168.1.192</u>	<u>192.168.1.255</u>	<u>192.168.1.193</u>	<u>192.168.1.254</u>

## **Network Topology**

Subnetting:

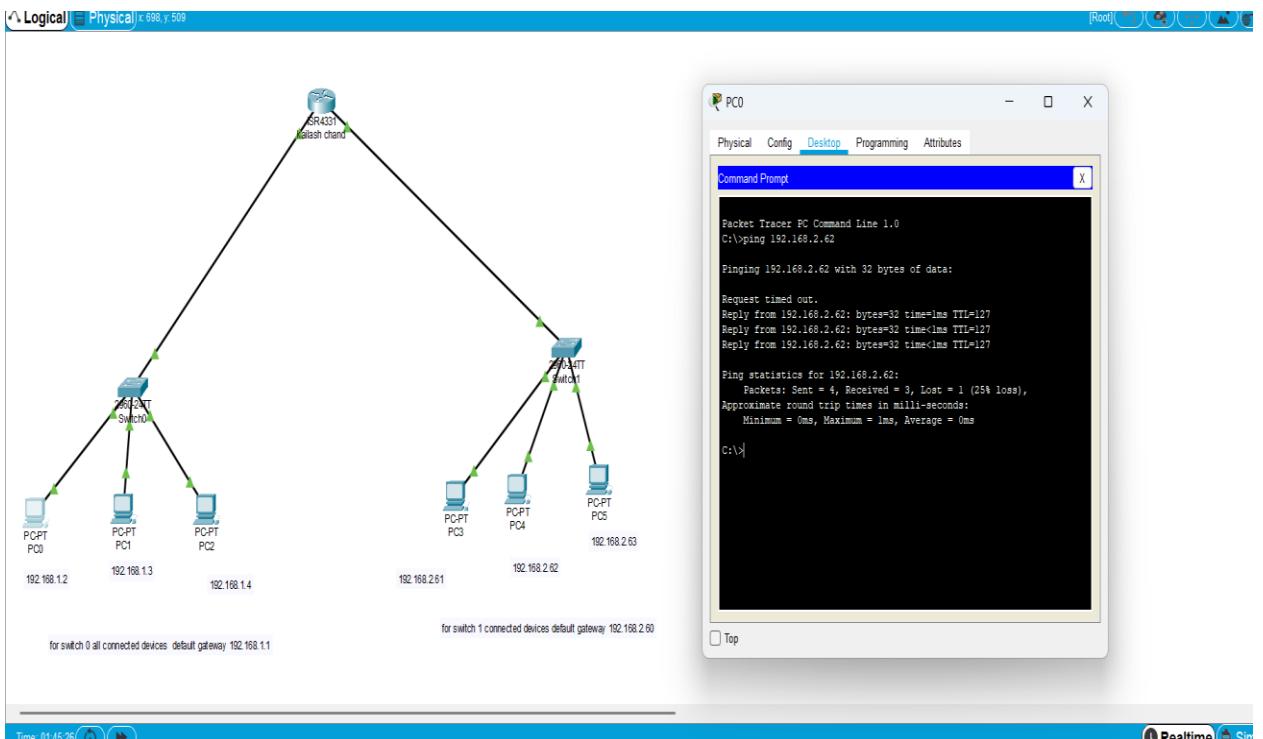
A network was set up using Router0 to link two subnets: 192.168.1.0/26 and 192.168.1.64/26. Switch0 connects PC0, PC1, and PC2 to the first subnet, while Switch1 connects PC3, PC4, and PC5 to the second. Both switches are linked to the router's interfaces.



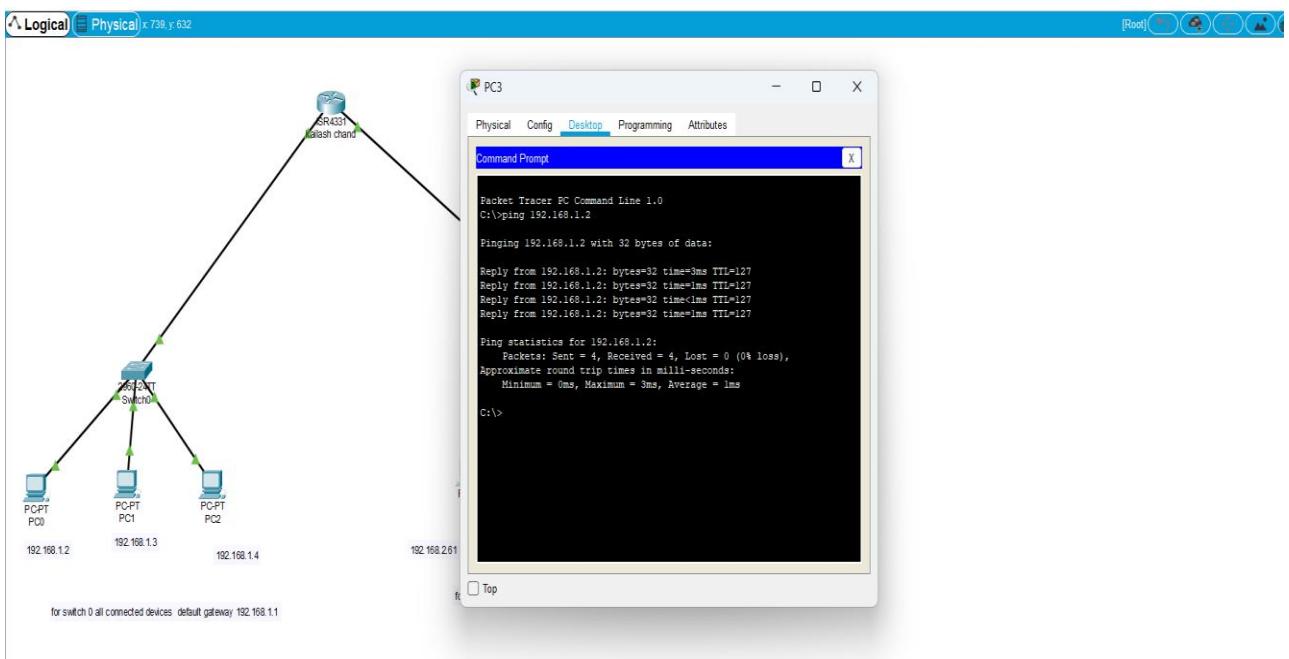
## Configuration table Subnetting

Device	IPV4	Subnet-mask	Default gateway
Router0 (FastEthernet0/0)	192.168.1.1	255.255.255.192	N/A
Router0 (FastEthernet0/1)	192.168.2.60	255.255.255.192	N/A
Pc0(Subnet 1)	192.168.1.2	255.255.255.192	192.168.1.1
Pc1(Subnet 1)	192.168.1.3	255.255.255.192	192.168.1.1
Pc2(Subnet 1)	192.168.1.4	255.255.255.192	192.168.1.1
Pc3(Subnet 1)	192.168.2.61	255.255.255.192	192.168.2.60
Pc4(Subnet 1)	192.168.2.62	255.255.255.192	192.168.2.60
Pc5(Subnet 1)	192.168.2.63	255.255.255.192	192.168.2.60

## Ping from PC0 to PC4

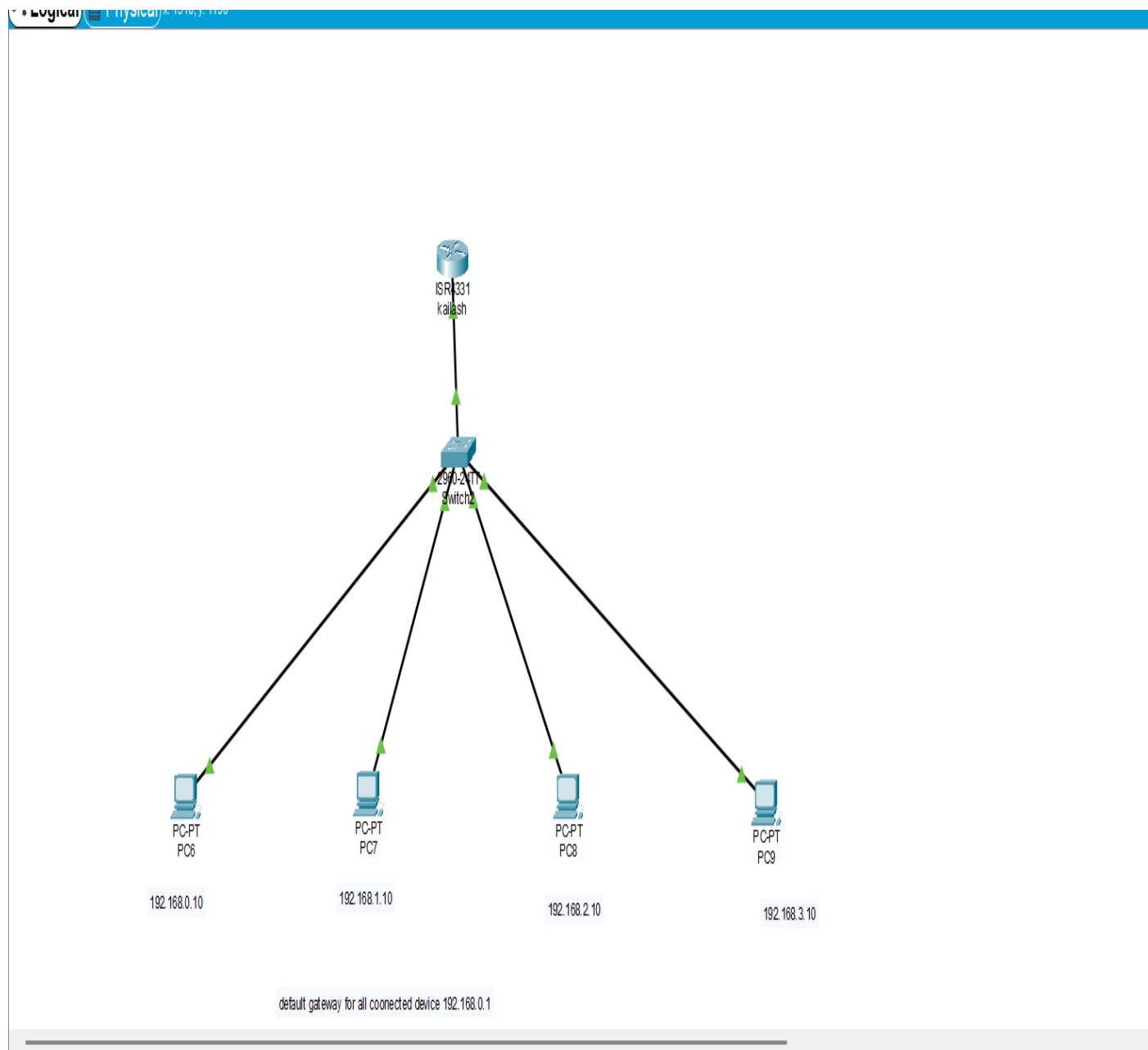


## Ping from PC3 to PC0



## Supernetting:

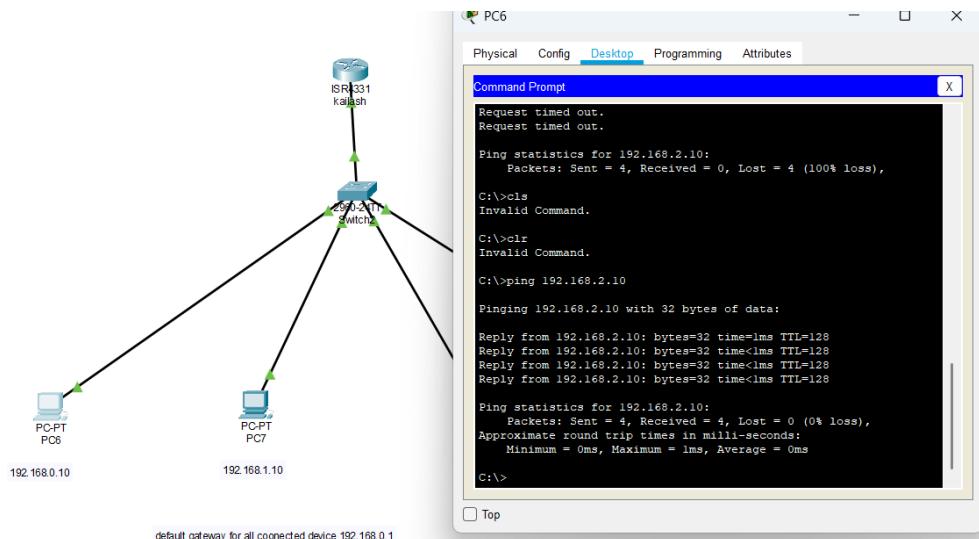
The network has one router, one switch, and four PCs (PC6–PC9). All PCs connect to the switch, which connects to the router.



## Configuration Table:

<b>Device</b>	<b>IPV4</b>	<b>Subnet-mask</b>	<b>Default gateway</b>
Router0 (FastEthernet0/0)	192.168.0.1	255.255.252.0	N/A
PC6	192.168.0.10	255.255.252.0	192.168.0.1
PC7	192.168.1.10	255.255.252.0	192.168.0.1
PC8	192.168.2.10	255.255.252.0	192.168.0.1
PC9	192.168.3.10	255.255.252.0	192.168.0.1

## Ping from PC6 to PC8



✓ **PRECAUTION**

1. Double-check IP addresses and subnet masks before assigning them to devices.
2. Ensure routers are properly configured to allow communication between subnets.
3. Avoid overlapping IP addresses when subnetting or supernetting.
4. Test connectivity using ping or other diagnostic commands after configuration.
5. Save your Packet Tracer project frequently to prevent loss of work.

✓ **DISCUSSION**

Subnetting is the process of dividing a large network into smaller, more manageable subnetworks. It helps improve network performance, security, and efficient use of IP addresses. Supernetting, on the other hand, combines multiple smaller networks into a larger network to simplify routing. In Cisco Packet Tracer, we can configure IP addresses, subnet masks, and routing protocols to implement subnetting and supernetting. By designing a network topology, assigning IP addresses to devices, and verifying connectivity with the ping command, we can see how subnetting and supernetting work in practice.

✓ **RESULT**

After configuring subnetted networks in Packet Tracer, all devices within the same subnet were able to communicate successfully. Devices in different subnets required a router for communication, and proper routing allowed data to flow between subnets. Similarly, implementing supernetting reduced the number of routing entries, making communication across combined networks more efficient. Using commands like ping and checking the routing table confirmed that the network was correctly configured and functional.

✓ **CONCLUSION**

Subnetting helps organize large networks into smaller, efficient segments, while supernetting simplifies routing by combining smaller networks. Cisco Packet Tracer is an effective tool for visualizing and testing these concepts. By practicing subnetting and supernetting, students and network administrators can better understand IP addressing, routing, and network design. Proper implementation ensures optimized network performance and easier management.