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Roll No : 221070011

Batch-A

Experiment No. 2

Aim : To subnet the given IP address into N no.of hosts.

Theory :

What is Subnetting ?

Subnetting is the process of dividing a larger network into smaller, more manageable sub-networks, or subnets. This technique improves network efficiency by reducing congestion, enhances security by isolating different segments of the network, and optimizes the use of IP addresses. By breaking a large network into smaller subnets, you can allocate IP addresses more precisely, ensuring better performance and easier management.

In Cisco Packet Tracer, subnetting can be simulated and explored by designing and configuring networks with multiple subnets. This allows you to practice assigning IP addresses, configuring subnet masks, and setting up routers to manage traffic between subnets. Through these simulations, you can gain a deeper understanding of how subnetting works and how it benefits network design and operation.

Why Subnetting is Important

- **Efficient IP Address Utilization**: Subnetting enables more efficient use of available IP addresses. By dividing a larger network into smaller subnets, you can allocate IP addresses based on actual needs, reducing waste and maximizing the use of address space.

- **Reduced Broadcast Traffic**: Subnets function as individual broadcast domains, limiting broadcast traffic to within each subnet. This reduction in overall network broadcast traffic enhances network performance and reduces congestion.
- **Enhanced Security**: Subnetting allows for the isolation of different segments of a network, making it possible to implement tighter security controls. This isolation is beneficial for securing different departments, teams, or services within an organization.
- **Simplified Network Management**: Managing smaller, segmented subnets is more straightforward than overseeing a single large and complex network. Subnetting simplifies network administration, monitoring, and troubleshooting.

IPv4 Subnetting: Key Concepts

IP Addressing: An IPv4 address is a 32-bit number, typically represented in dotted decimal format (e.g., 192.168.1.1). This address is divided into two main components:

- **Network Portion**: Identifies the specific network to which the device belongs.
- **Host Portion**: Identifies the individual device within that network.

The subnet mask is used to determine the division between the network portion and the host portion of the IP address. For instance, a common subnet mask for a Class C network is 255.255.255.0 or /24, which signifies that the first 24 bits of the IP address are used for the network portion and the remaining 8 bits are used for the host portion.

Classful vs Classless Subnetting

- **Classful Subnetting**: This method adheres to fixed network boundaries defined by classes such as Class A (/8), Class B (/16), or Class C (/24). Each class has a predetermined subnet mask, which limits the flexibility in subnetting and IP address allocation.
- **Classless Subnetting**: Also known as CIDR (Classless Inter-Domain Routing), this approach offers greater flexibility. CIDR allows for the use of custom subnet masks based on specific needs for the number of subnets or hosts, rather than adhering to fixed class boundaries. This method enables more efficient use of IP addresses and better network management.

How Subnetting Works:

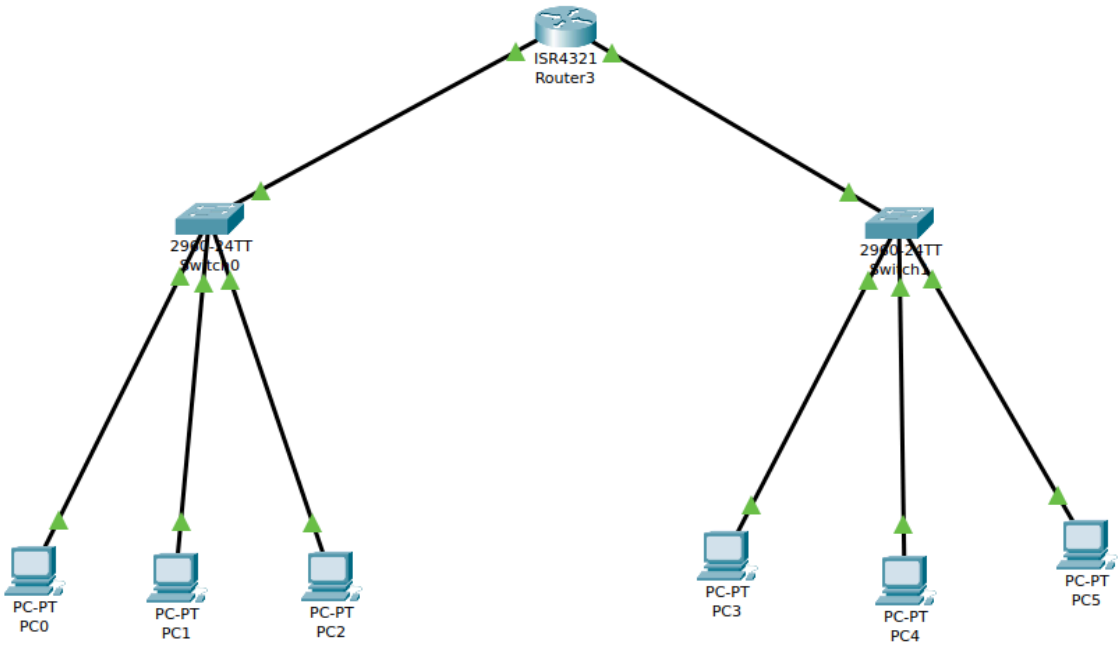
Subnetting involves dividing a larger network into smaller, more manageable sub-networks, or subnets, by borrowing bits from the host portion of the IP address. This process allows for better utilization of IP addresses and more efficient network management. Here's a step-by-step explanation:

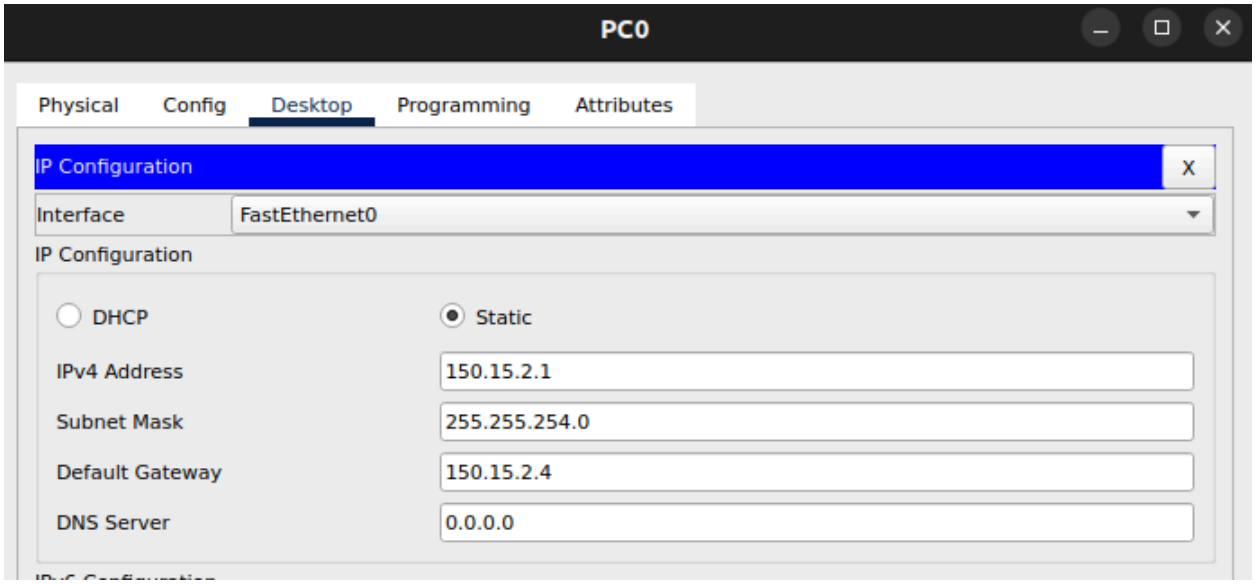
1. **Default Subnet Mask**: Each IP address is associated with a default subnet mask that defines the boundary between the network portion and the host portion of the address. For a Class C network, such as 192.168.1.0, the default subnet mask is 255.255.255.0 or /24. This means the first 24 bits of the IP address are used to identify the network, leaving 8 bits for host addresses.
2. **Borrowing Bits**: To create more subnets, you "borrow" bits from the host portion of the IP address. For example, if you borrow 2 bits from the host portion, you extend the subnet mask from /24 to /26. This results in a subnet mask of 255.255.255.192.
3. **Subnet Calculation**: With a /26 subnet mask, the network is divided into smaller subnets. The additional 2 bits borrowed from the host portion allow for 4 subnets (since 2^2 = 4). Each of these subnets has 64 IP

addresses in total (2^6 = 64, where 6 is the number of remaining bits for hosts).

4. **Address Allocation**: Within each /26 subnet, 2 addresses are reserved: one for the network address and one for the broadcast address. Therefore, each subnet has 62 usable IP addresses available for devices. This is calculated by subtracting the 2 reserved addresses from the total number of addresses in the subnet (64 - 2 = 62).

By borrowing bits and adjusting the subnet mask, subnetting enables more precise IP address allocation, creating multiple subnets each with a defined number of usable addresses. This method not only improves network organization but also enhances security and performance by isolating different segments of the network.

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Subnet Mask
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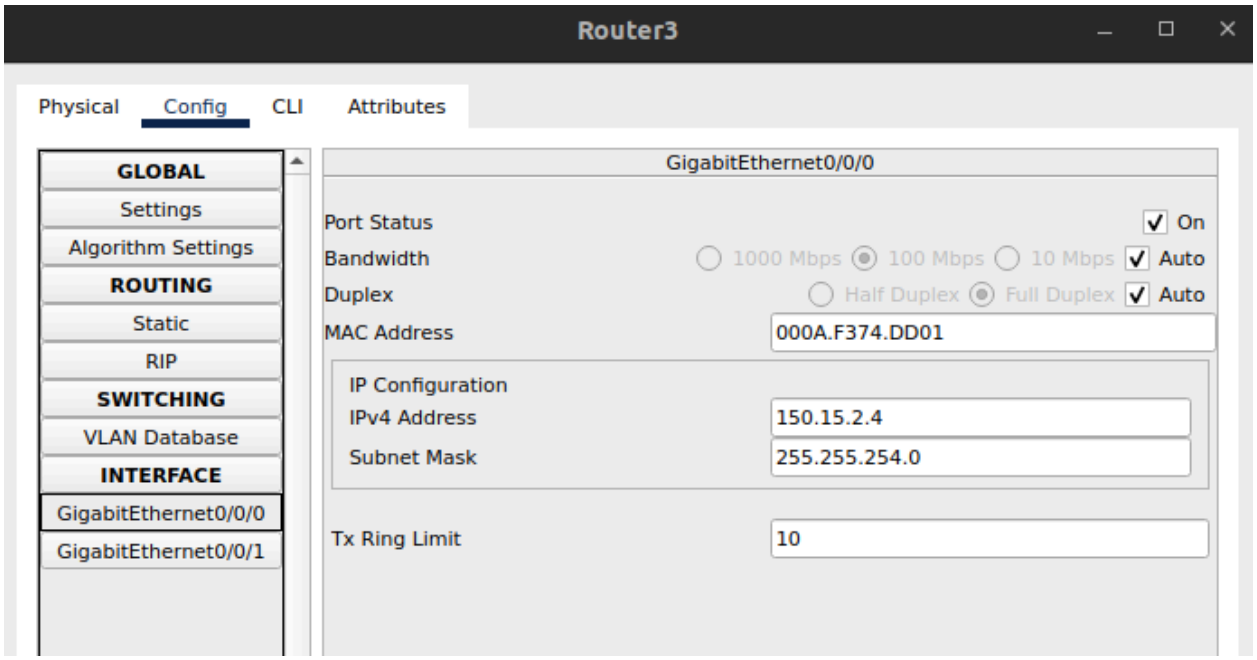
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10 Mbps
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Tx Ring Limit
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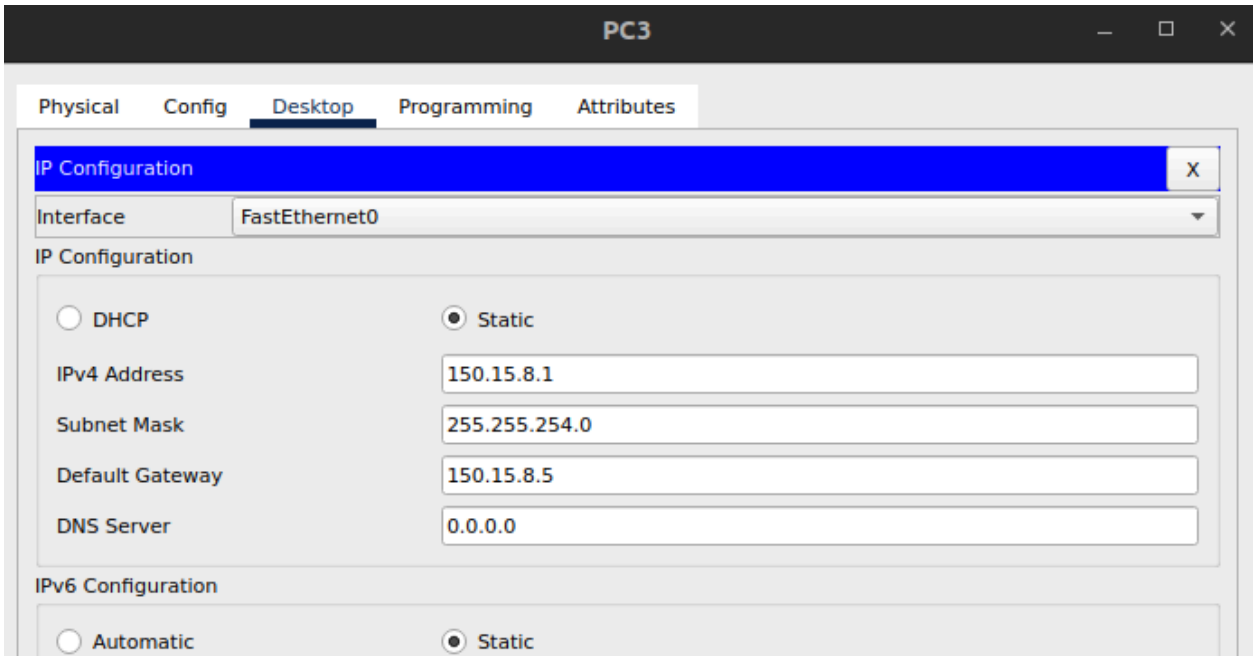
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DNS Server
0.0.0.0
IPv6 Configuration
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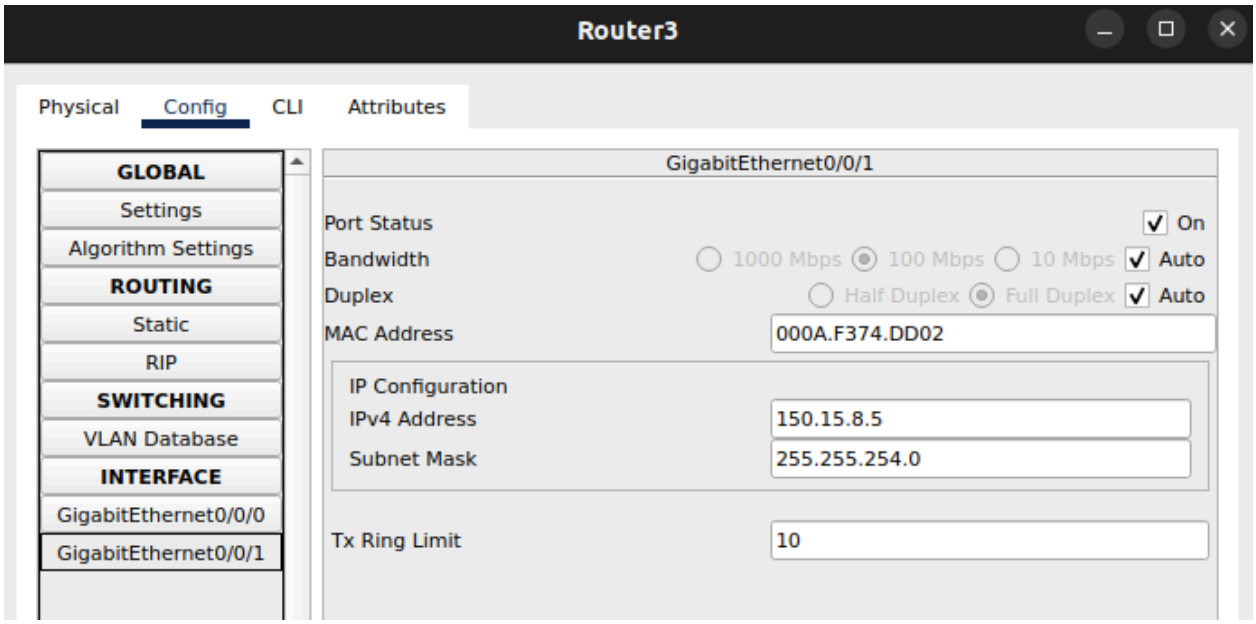
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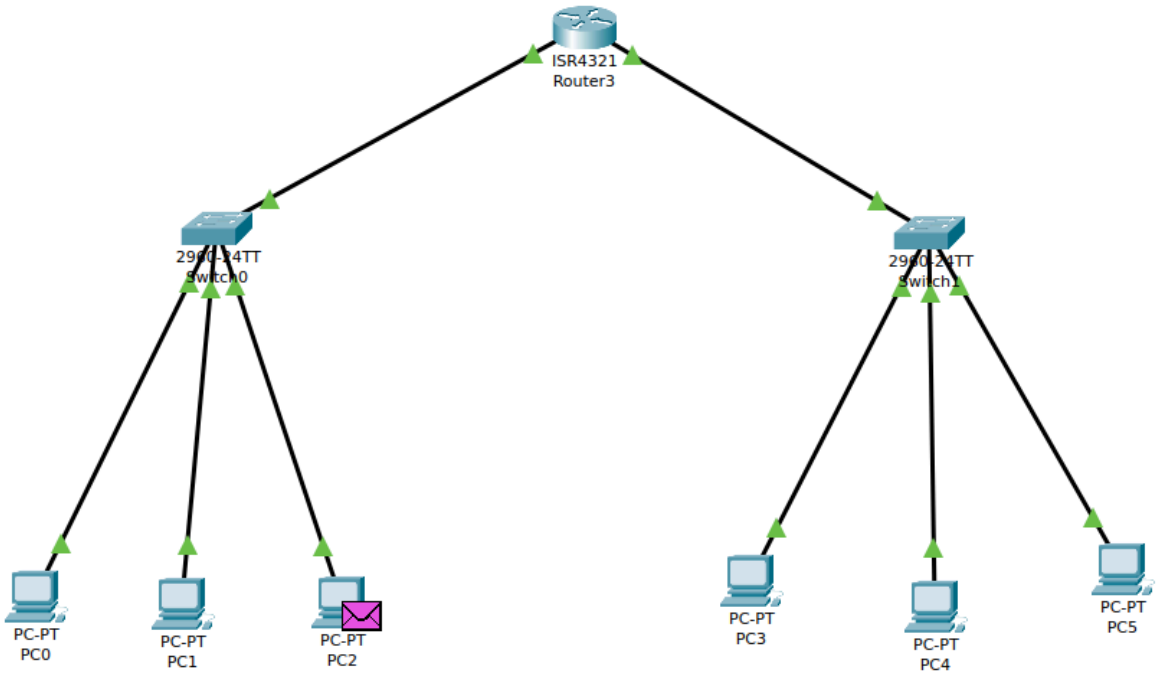

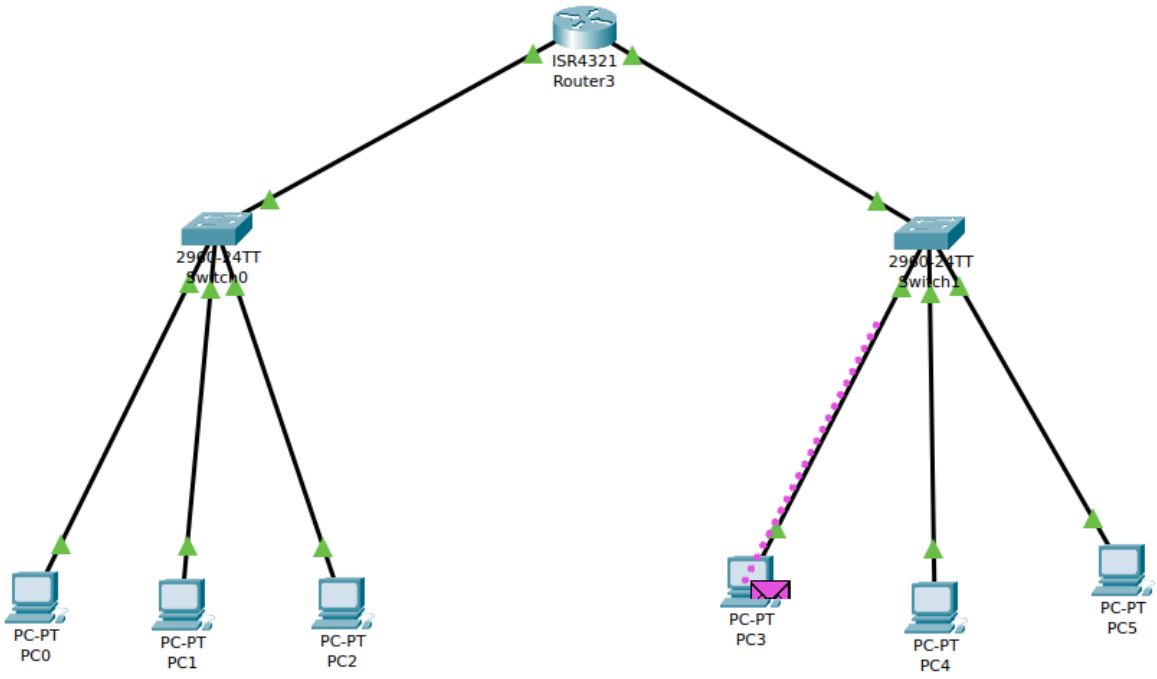

Conclusion :

In this experiment, we learnt about subnetting, why subnetting is used and IPV4 subnetting and implemented it in Cisco packet tracer.