Student Name	**Pratik Manoj Dharam**
SRN No	31232438
Roll No	20
Program	Computer Engg
Year	Third Year
Division	H
Subject	Computer Network Laboratory (BTECCE22506)
Assignment No	Three

Assignment Number - 03

Title : Subnetting and Supernetting in Computer Network

Problem Statement Using a Network Simulator (e.g. packet tracer) Configure subnetting and supernetting.

Theory :

Subnetting

Subnetting is a technique used in computer networking to divide a larger IP network into smaller, more manageable sub-networks or subnets. It's a fundamental concept in IP addressing and is used to efficiently allocate IP addresses and manage network resources. Subnetting allows network administrators to create logical divisions within a larger network, helping to improve network performance, security, and organization.

IP Address Classes: IP addresses are categorized into classes: A, B, and C. Each class has a default subnet mask that determines the default network and host portions of the IP address.

Subnet Mask: A subnet mask is a 32-bit binary number that separates the IP address into network and host portions. It is usually represented in decimal-dotted format (e.g., 255.255.255.0).

Subnetting: To subnet a network, you borrow bits from the host portion of the IP address to create additional subnets. This increases the number of available subnets but reduces the number of available host addresses within each subnet.

Subnet Size: The size of a subnet is determined by the number of borrowed bits. The formula to calculate the number of usable host addresses in a subnet is 2^(number of host bits) - 2. The "-2" accounts for the network address (all host bits set to 0) and the broadcast address (all host bits set to 1).

Benefits of Subnetting:

Efficient IP Address Allocation: Subnetting prevents wastage of IP addresses, as you can allocate addresses more precisely based on your network's needs.

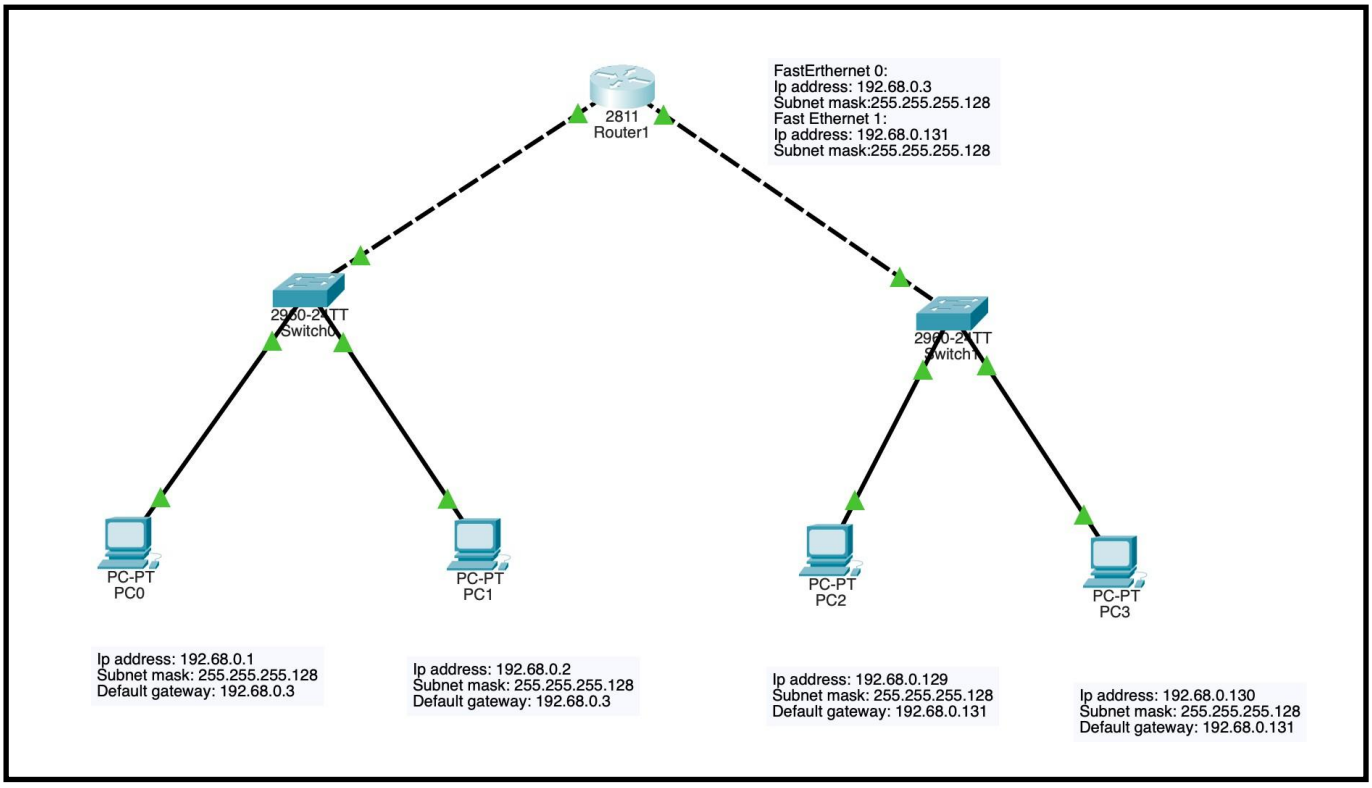
Improved Network Performance: Smaller subnets can reduce network congestion and improve the efficiency of communication.

Enhanced Security: Subnets can isolate different parts of a network, improving security by restricting the flow of traffic.

Simplified Management: Dividing a large network into smaller subnets makes it easier to manage and troubleshoot network issues.

Important point about subnetting

- A subnet is a smaller portion of large network treated as its own separate network. To create subnet we borrow bits from host portion and assign them as network bits. This mean more networks, fewer hosts.
- If the network bits on two addresses do not match, then the two packets are intended for two separate networks.
- On a 32 bits IP address at least eight bits must belong to the network portion and at least 2 bits must belong to the host portion.
- Each IP address has a predefined IP class and that cannot be changed.
- Each class has a predefined default subnet mask that tell us the octets, which are already part of the network portion, as well as how many bits we have available to work with.
- Whatever network class is it, we cannot change those bits that are already assigned.
- We cannot assign the network ID and the broadcast address to a host.
- Regardless how many bits are left in the host field, network ID and the broadcast address must be reserved.
- Subnet bits start at the left and go to the right, without skipping bits.



Super Netting

Supernetting, also known as route aggregation, is a technique used to combine multiple smaller networks (subnets) into a single larger network. This reduces the number of routes that a router must manage, leading to more efficient routing.

Let's consider a scenario where we have two contiguous Class C networks, and we want to combine them into a single supernet.

Key Points of Supernetting:

1. **Aggregation of Routes**: Supernetting combines multiple contiguous IP address ranges into a single, larger address range, reducing the number of entries in the routing table.
2. **CIDR Notation**: It uses CIDR notation, which allows for flexible network sizes by specifying an IP address range followed by a subnet mask (e.g., 192.168.0.0/22).
3. **Efficient Address Allocation**: Unlike traditional class-based addressing, supernetting allocates IP addresses based on need rather than fixed class boundaries, conserving address space.
4. **Reduced Routing Table Size**: By combining multiple networks into one, supernetting significantly reduces the size of routing tables, making routing more efficient.
5. **Internet Backbone Optimization**: Widely used by ISPs and network administrators to manage routes on the Internet backbone, leading to more streamlined and scalable routing.
6. **Forwarding Efficiency**: Helps routers and other network devices forward data packets more quickly by minimizing the number of route lookups.
7. **Compatibility**: Supernetting is compatible with IPv4 and IPv6, making it relevant for modern networks as they transition to newer IP standards.

Benefits of Supernetting:

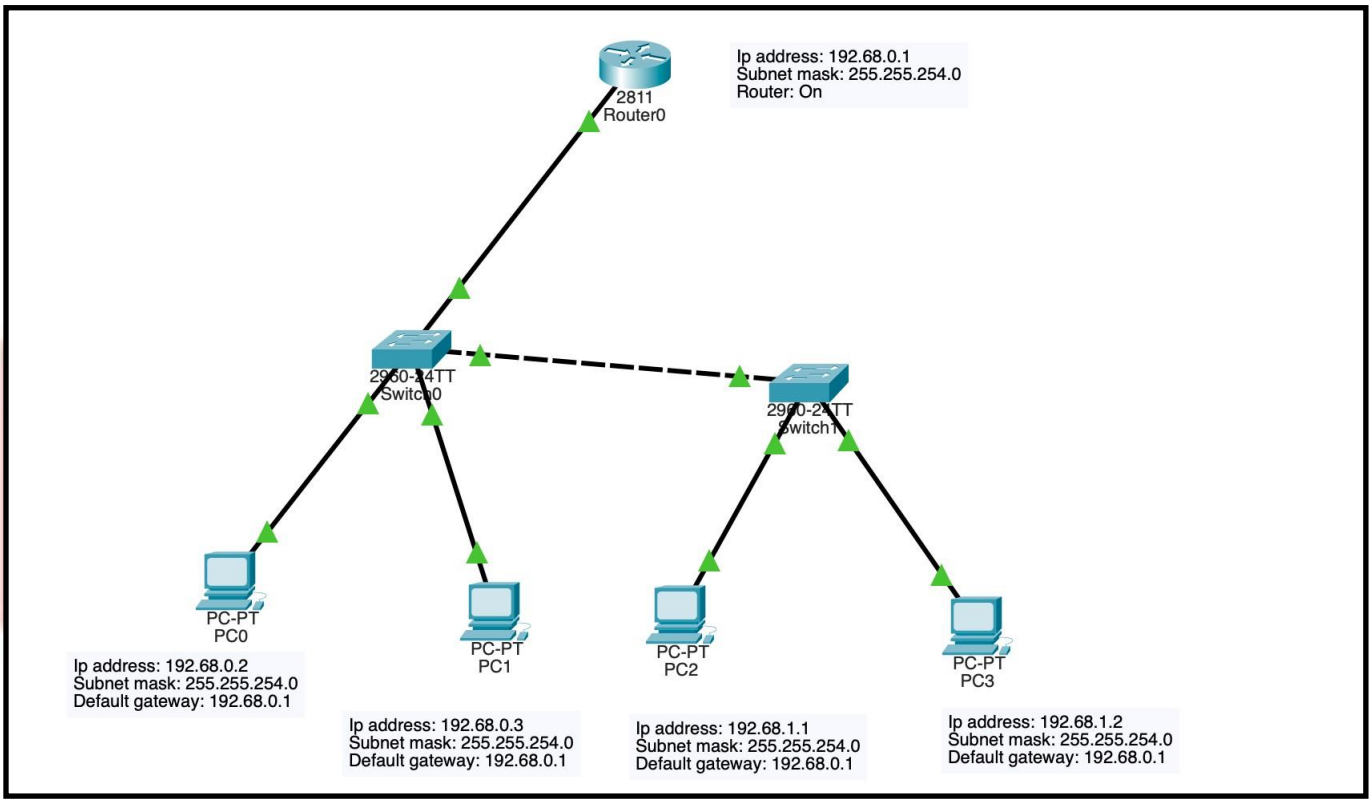
1. **Reduced Network Complexity**: Supernetting simplifies network architecture by consolidating multiple subnets, making it easier to manage.
2. **Improved Routing Efficiency**: Fewer routing entries lead to faster packet processing and less CPU and memory usage on routers, enhancing overall network performance.
3. **Scalability**: Makes networks more scalable by allowing the addition of new subnets without significantly increasing the routing table size.
4. **Enhanced Network Performance**: By reducing the number of routing entries, supernetting decreases latency and improves data transfer speeds across the network.
5. **Decreased Administrative Overhead**: Simplifies network administration by reducing the need for manual configuration and maintenance of numerous routes.

6. **Conservation of IP Addresses**: Maximizes the efficient use of IP address space, helping mitigate address exhaustion, especially in IPv4 environments.

7. **Better Traffic Management**: Facilitates efficient traffic aggregation, enabling more straightforward and more effective load balancing across network links.

8. **Cost Savings**: Reducing the number of routing entries lowers operational costs by minimizing the need for high-performance hardware to handle large routing tables.

9. **Improved Network Stability**: Simplified routing reduces the chance of routing errors and misconfigurations, enhancing the overall stability of the network.



Conclusion : Subnetting and supernetting are critical networking techniques that enhance the efficiency, scalability, and manageability of modern networks.

- **Subnetting** allows for the division of a large network into smaller, more manageable segments, improving security, performance, and resource utilization. It is particularly valuable for internal network management, providing precise control over IP address allocation, traffic flow, and security policies.

- **Supernetting**, on the other hand, consolidates multiple smaller networks into larger address blocks, simplifying routing and optimizing IP address allocation. It is especially useful for Internet Service Providers (ISPs) and organizations needing efficient routing and IP address conservation.