

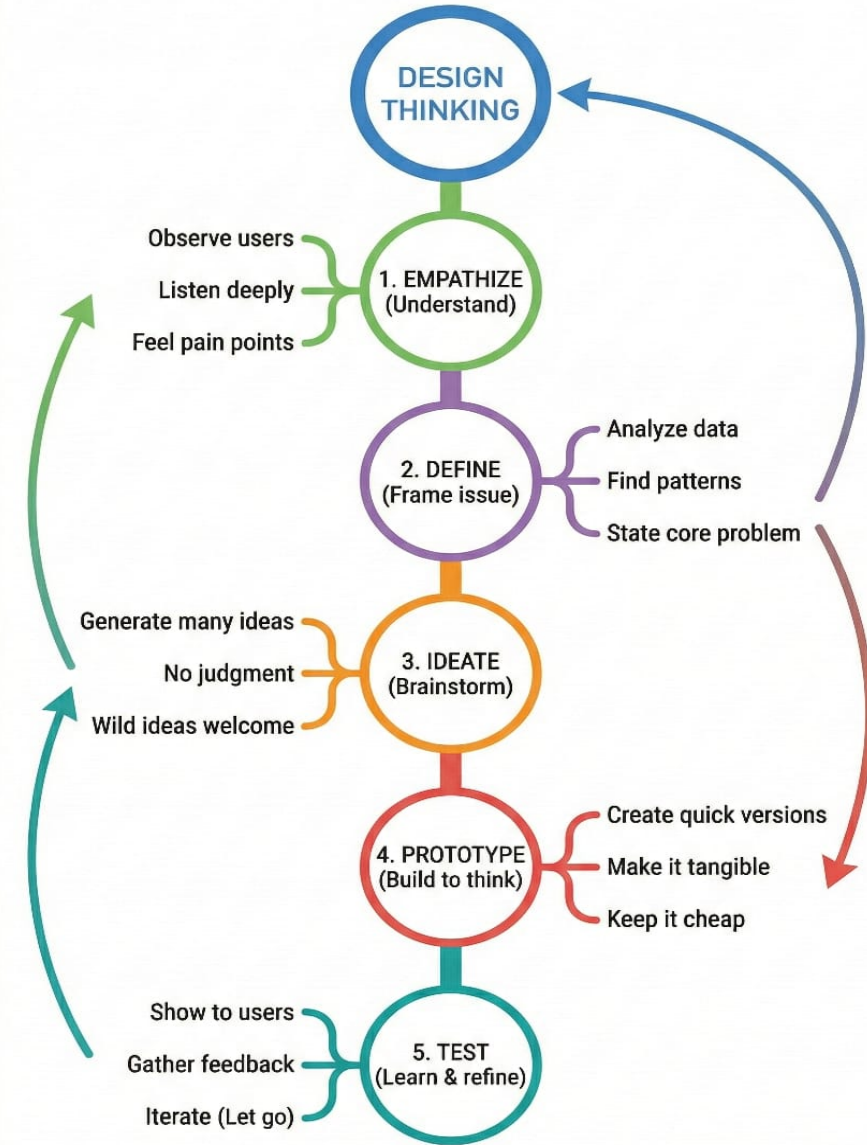
23ITT204 - COMPUTER NETWORK

UNIT 3 - NETWORK LAYER

SUBNETTING

Subnetting in the Network Layer

Efficient IP Address Management



What is Subnetting?

Subnetting is the practice of dividing a large IP network into smaller, manageable subnetworks called subnets. This critical networking technique isolates traffic, dramatically improving network performance, security, and organizational structure.

Operating at Layer 3 (Network Layer) of the OSI model, subnetting enables intelligent routing between different network segments, allowing administrators to optimize resource allocation and control data flow.



Performance

Reduces broadcast traffic and network congestion by containing communications within smaller segments

Security

Isolates sensitive departments and creates controlled network boundaries

Organization

Logical grouping of devices by department, function, or location

- ❏ **Real-world example:** A company with a 256-address Class C network splits it into dedicated subnets for Sales, HR, and IT departments, ensuring each team has isolated, secure network access.

How Subnet Masks Define Network Boundaries

A subnet mask is the fundamental tool that separates an IP address into its Network and Host portions, determining which part identifies the network and which part identifies individual devices.



Standard Mask

255.255.255.0 means the first 24 bits identify the network, leaving 8 bits for host addresses



Bit Borrowing

Subnetting "borrows" bits from the host portion to create multiple smaller networks

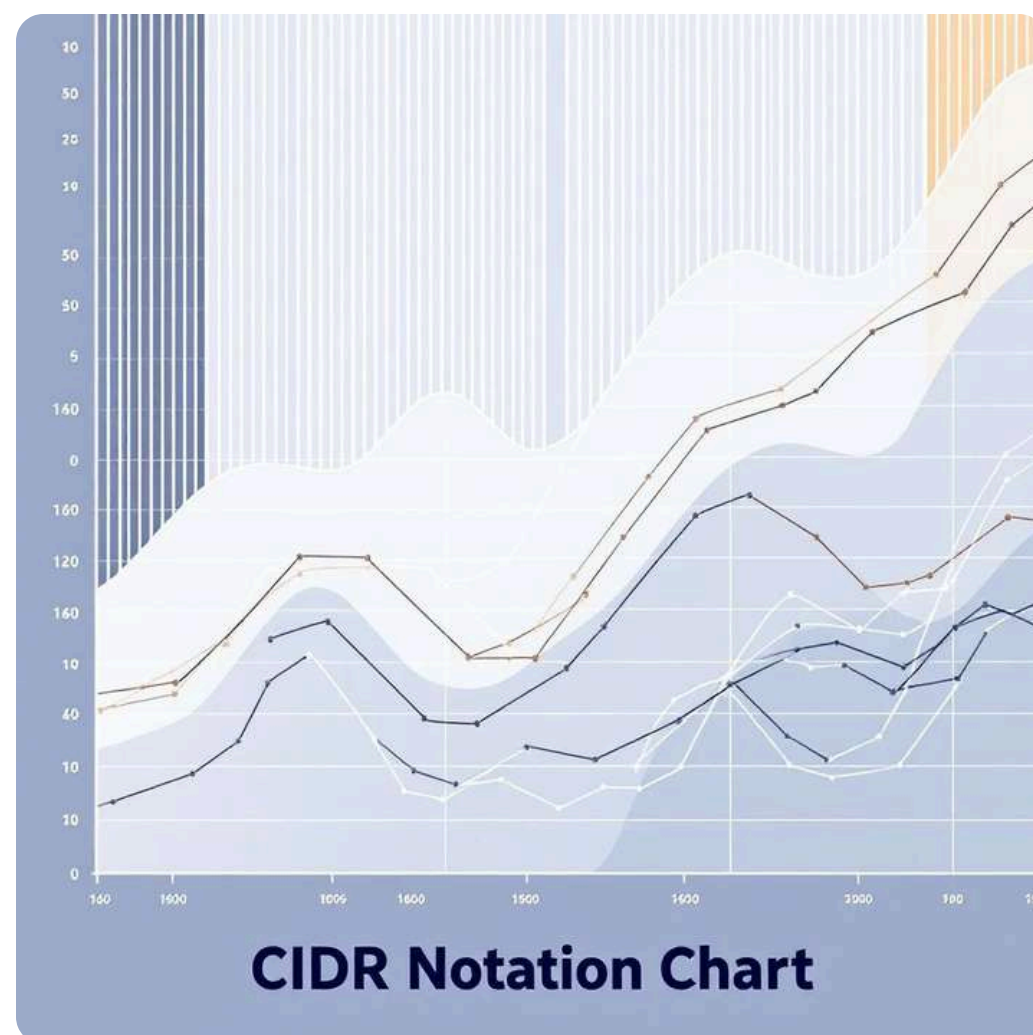


Smart Routing

Routers use subnet masks to efficiently route traffic within and between network segments

The Magic of CIDR Notation

CIDR (Classless Inter-Domain Routing) notation like **/24** or **/27** represents how many bits are used for the network portion. The higher the number, the smaller the subnet and fewer available host addresses.



Real-World Subnetting Example

Transforming 192.168.1.0/24 Network

Before Subnetting

Original network: 192.168.1.0/24 with 256 IP addresses shared by all devices across the entire organization

- No traffic isolation between departments
- Security vulnerabilities from shared broadcast domain
- Inefficient IP address utilization

After Strategic Subnetting

Three optimized subnets tailored to departmental needs:

- **Sales:** 192.168.1.0/27 (32 IPs, 30 usable)
- **HR:** 192.168.1.32/28 (16 IPs, 14 usable)
- **IT:** 192.168.1.48/26 (64 IPs, 62 usable)

112

Total IPs Allocated

Only 44% of original network used, leaving room for growth

75%

Broadcast Reduction

Dramatic decrease in network congestion and traffic overhead

3x

Security Improvement

Each department isolated with dedicated network boundaries

Key Takeaway: Intelligent subnetting transforms a flat, inefficient network into a secure, scalable infrastructure that optimizes IP address usage while enhancing performance and security across organizational boundaries.