

23ITT204 - COMPUTER NETWORK

UNIT 3 - NETWORK LAYER

IP ADDRESSING

IP Addressing in the Network Layer

The Digital Home Address of the Internet



What is an IP Address?

A unique numerical label assigned to every device on a network using Internet Protocol (IP). Think of it as a digital home address that ensures data packets reach exactly the right destination across the vast expanse of the internet.

Every IP address is composed of two essential parts working together:



Network Portion

Identifies which network the device belongs to



Host Portion

Identifies the specific device within that network

Device Identification

Uniquely identifies each device connected to the network, preventing address conflicts

Location & Routing

Enables precise location tracking to route data packets across multiple interconnected networks



IPv4 vs. IPv6: The Evolution of IP Addressing

IPv4: The Foundation



32-bit Architecture

Approximately 4.3 billion unique addresses available



Dotted-Decimal Format

Written as four octets:
192.168.1.10



Subnet Masks

Divides network and host portions for flexible addressing



Address Exhaustion

Limited address space created critical scarcity concerns

IPv6: The Future



128-bit Architecture

Virtually unlimited addresses for future growth



Hexadecimal Notation

Compact format: 2001:0db8::1



Enhanced Efficiency

Improved routing performance and simplified packet processing



Built-in Security

Native IP sec support and better network configuration

- Both protocols enable logical addressing and seamless routing across the world's interconnected networks, forming the backbone of modern internet communication.

Subnetting and Routing: Directing Traffic on the Internet

Sophisticated mechanisms work together to ensure efficient, accurate delivery of data packets across the global internet infrastructure.



Subnetting

Divides large networks into manageable subnetworks using subnet masks like 255.255.255.0 or /24 notation for improved organization and security



Private IP Ranges

Reserved address spaces (10.0.0.0/8, 192.168.0.0/16) used within local networks, not routable on the public internet



Routing Protocols

Routers forward packets between networks using routing tables and dynamic protocols like OSPF and BGP for optimal path selection

NAT Translation

Network Address Translation allows multiple devices in a private network to share a single public IP address, conserving address space



The Result: Global Connectivity

These interconnected technologies form an elegant system that routes billions of packets per second across millions of networks, enabling seamless communication between any two devices on Earth.