SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
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DEPARTMENT OF ARTIFICIAL INTELIGENCE & MACHINE LEARNING

23AMT302- COMPUTER NETWORK AND SECURITY

UNIT 1 – Introduction and Application Layer

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Unveiling the Network: Fundamentals & Layers

Understanding the backbone of modern communication.

Networks connect billions of devices globally.

Key concepts: Connectivity, Protocols, Architecture.

NP

What is a Computer Network?

Definition

Interconnected devices sharing resources and information.

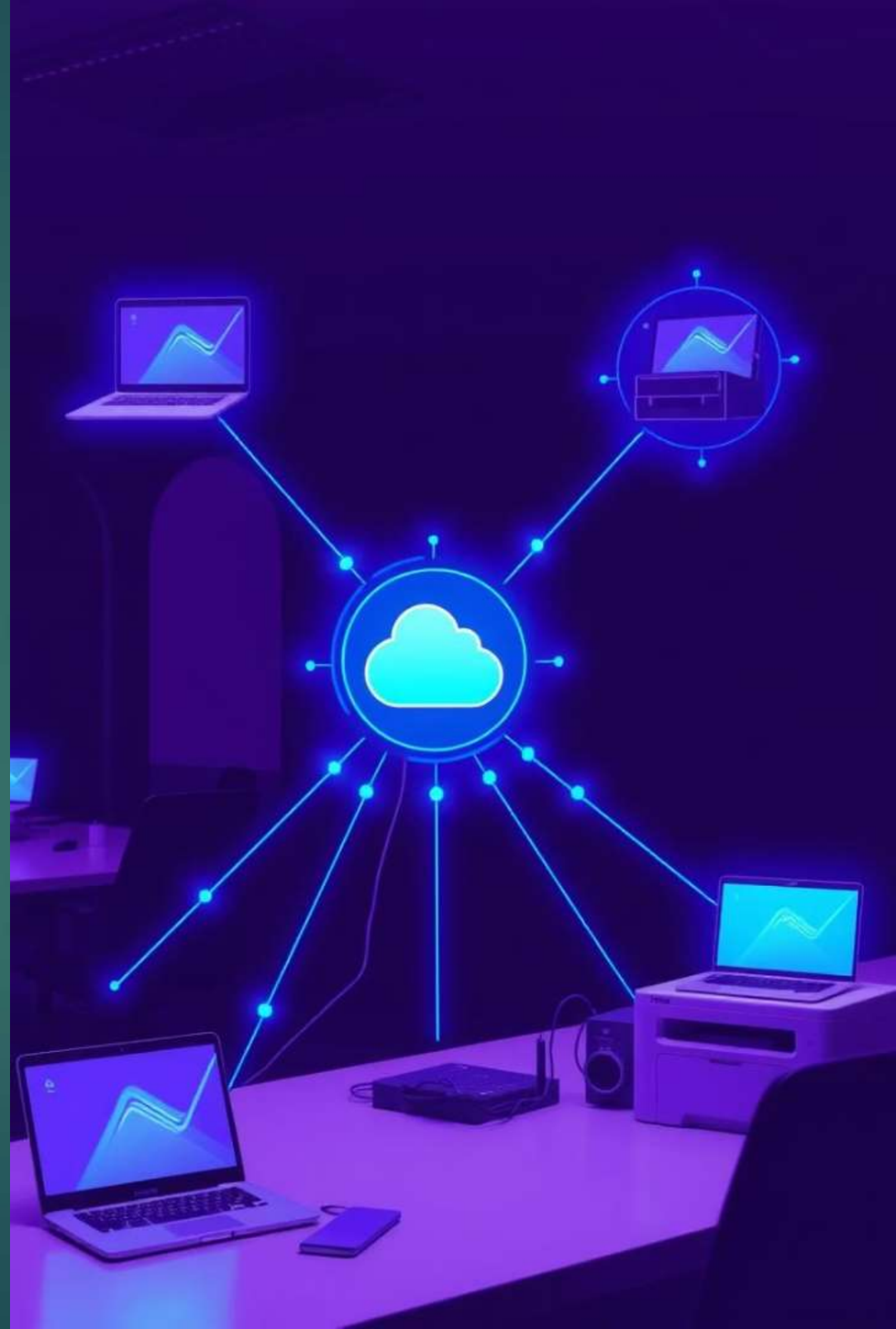
Purpose

Communication, resource sharing (e.g., printers, files), distributed processing.

Core Components

Nodes (devices), Links (cables, wireless), Protocols (rules).

Global scale: Over 5.3 billion internet users as of 2023.



Types of Networks

PAN (Personal Area Network)	Bluetooth (up to 10 meters)	e.g., wireless earbuds.
LAN (Local Area Network)	Ethernet, Wi-Fi (up to 1000 meters)	e.g., office or home network.
MAN (Metropolitan Area Network)	City-wide coverage	e.g., fiber optic backbone for urban areas.
WAN (Wide Area Network)	Internet, MPLS (global reach)	e.g., corporate VPN connecting continents.

Network Topologies

Star

All devices connect to a central hub/switch; 90%+ common in LANs.

Bus

Single backbone cable; older, prone to single-point failure.

Ring

Data flows in a circle; used in some fiber optic networks (e.g., FDDI).

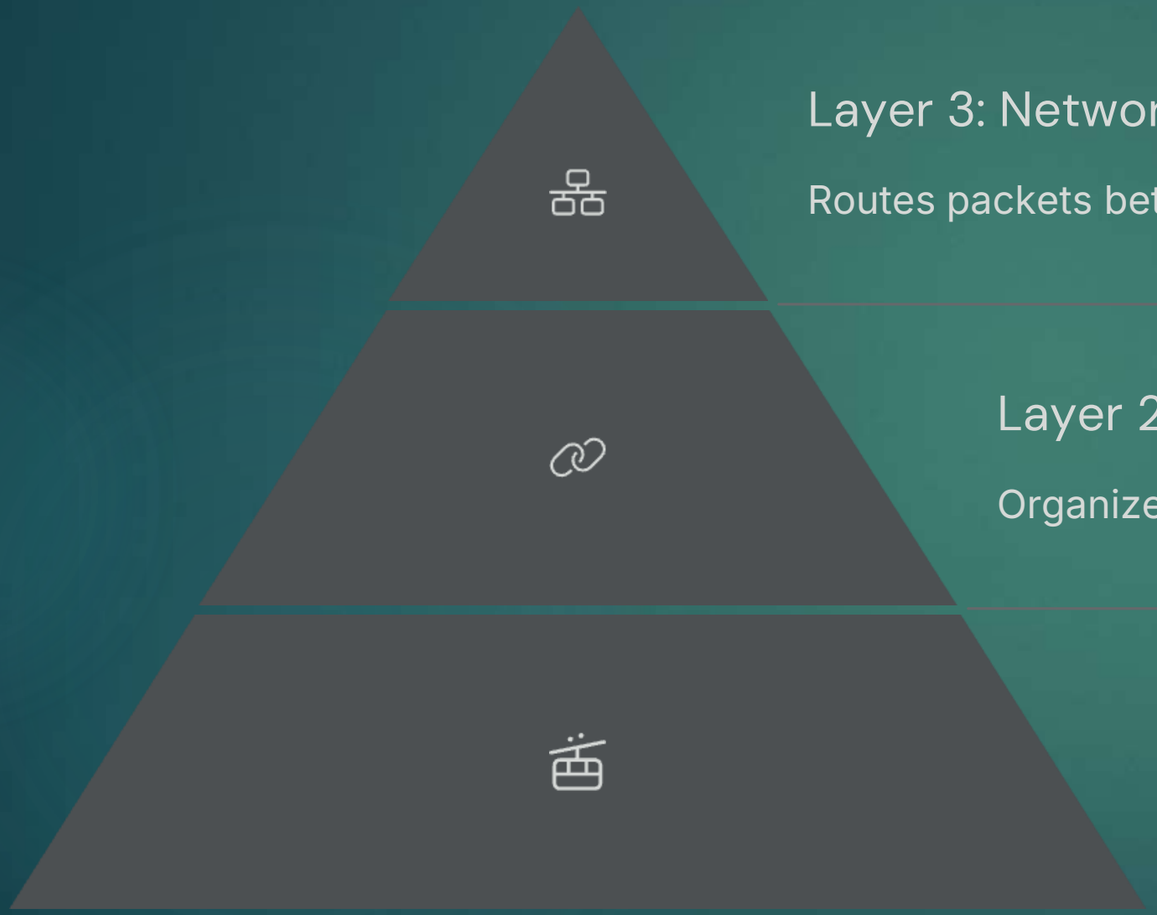
Mesh

Every device connected to every other; high redundancy, expensive; used in critical backbone.

Introduction to Network Models

- **Why Models?** Standardize communication, ensure interoperability, simplify troubleshooting.
- **OSI (Open Systems Interconnection) Model:** 7 layers, theoretical, ISO standard (1984).
- **TCP/IP (Transmission Control Protocol/Internet Protocol) Model:** 4/5 layers, practical, underpins the Internet.
- Key Concept: Encapsulation (data wrapped as it moves down layers).

The OSI Model: Lower Layers (1–3)



Layer 3: Network

Routes packets between networks; IP addresses; logical addressing.

Layer 2: Data Link

Organizes bits into frames; MAC addresses; error detection.

Layer 1: Physical

Transmits raw bits over physical medium (e.g., Ethernet Cat6 cable: 10 Gbps).

The OSI Model: Upper Layers (4–7)

Layer 7: Application

Provides network services to applications (HTTP, SMTP).

Layer 6: Presentation

Translates data format; handles encryption/decryption (SSL/TLS).

Layer 5: Session

Establishes, manages, and terminates communication sessions.

Layer 4: Transport

Manages end-to-end communication; TCP vs. UDP; port numbers.

The TCP/IP Model

1

Origin

Developed by DoD in the 1970s; practical implementation focus.

2

Application Layer

Combines OSI Session, Presentation, Application layers (e.g., HTTP, FTP, DNS).

3

Transport Layer

TCP and UDP protocols (e.g., TCP for reliable data, UDP for streaming video).

4

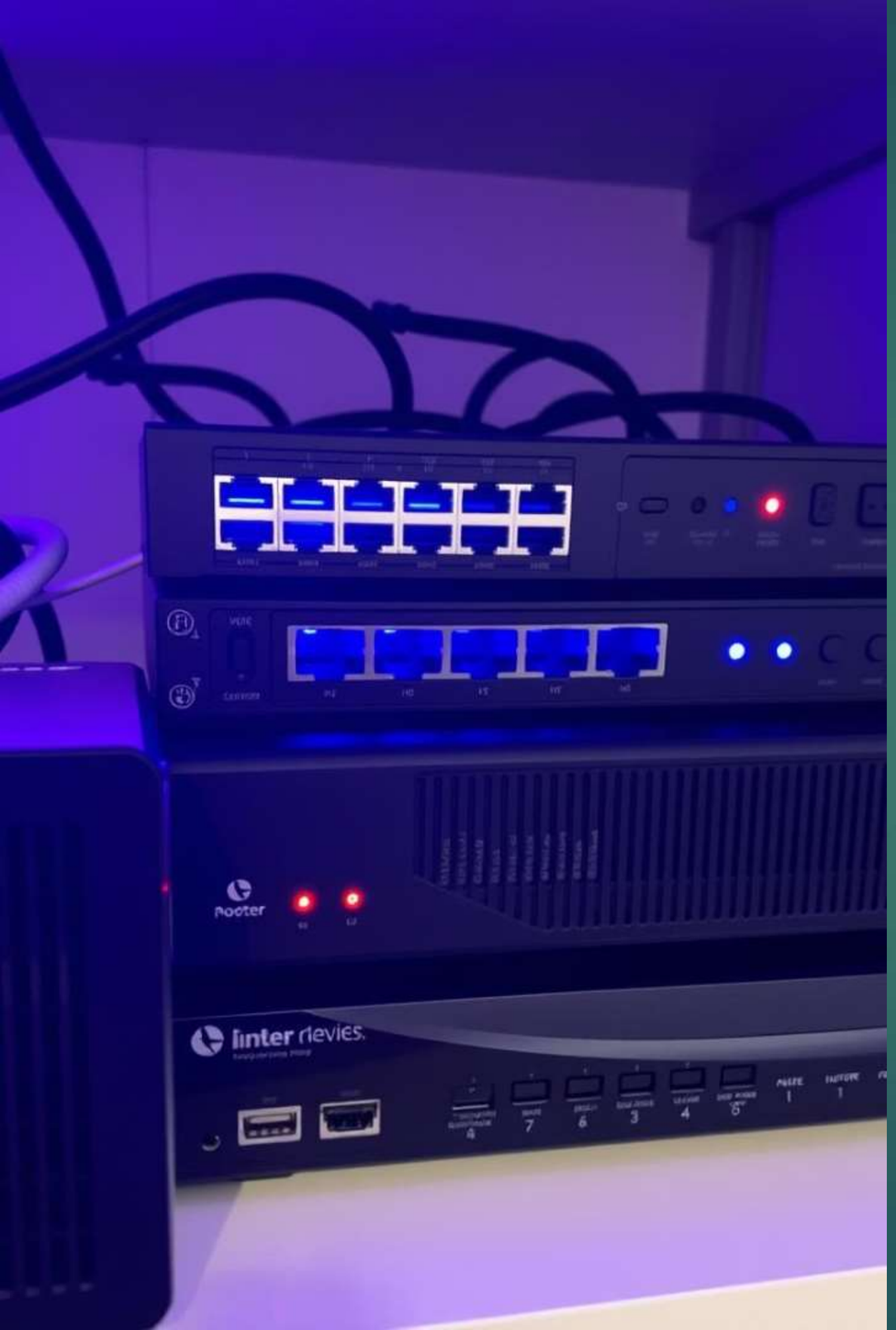
Internet Layer

IP for logical addressing and routing (equivalent to OSI Layer 3).

5

Network Access Layer

Combines OSI Physical and Data Link layers (e.g., Ethernet, Wi-Fi).



Key Networking Devices

Hub

Layer 1, broadcasts all traffic, inefficient (e.g., 10Mbps shared bandwidth).

Switch

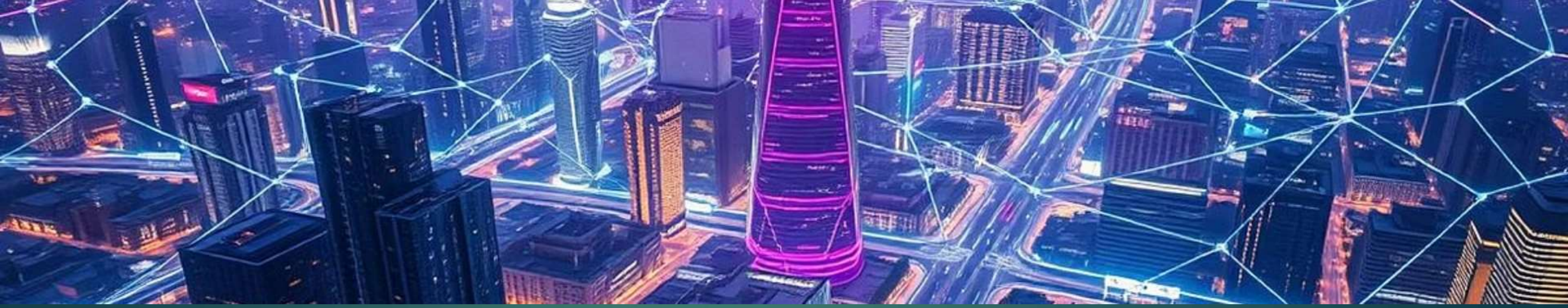
Layer 2, intelligent forwarding using MAC addresses; reduces network congestion by 10x vs. hubs.

Router

Layer 3, connects different networks, makes routing decisions; handles 1M+ packets/sec.

Firewall

Network security device; filters traffic based on defined rules (e.g., blocks specific port access).



Conclusion: The Foundation of Connectivity

Integral to Modern Life

Networks are essential for business and daily activities.

Structured Framework

Layered models ensure interoperability and order.

Crucial for Expertise

Understanding basics aids troubleshooting and design.

Future Trends

5G, IoT, AI-driven automation shaping networks.