



SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution



Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A+' Grade
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DEPARTMENT OF ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

23AMT302- COMPUTER NETWORK AND SECURITY

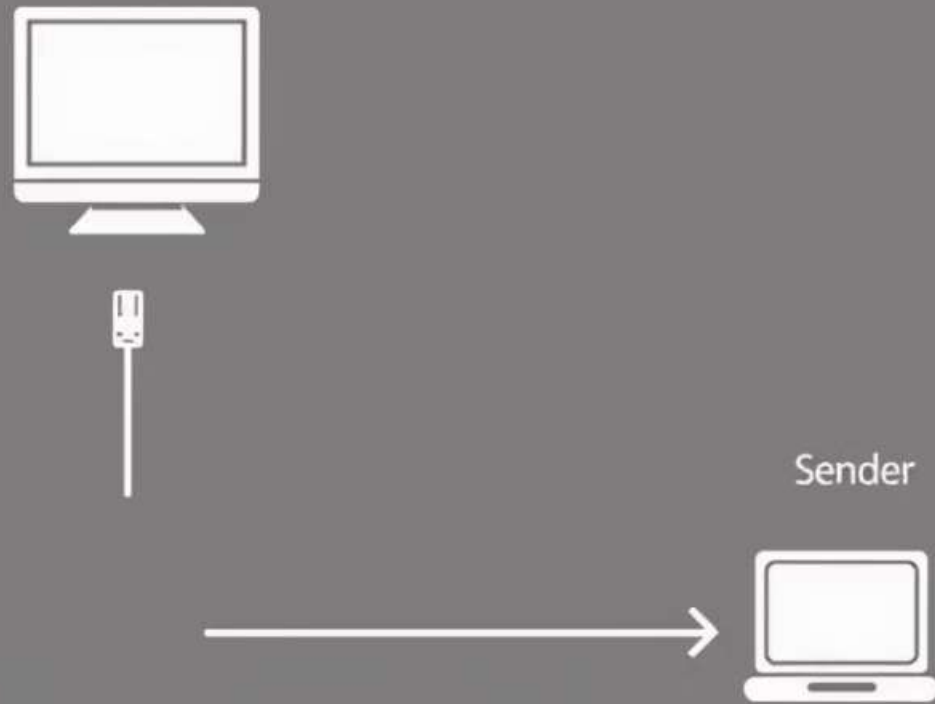
UNIT 1 – Introduction and Physical Layer

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Data Communication & Computer Networks: The Digital Backbone

Data communication underpins all modern digital interactions. Global internet traffic is projected to reach 4.8 ZB annually by 2025. It is essential for business, education, and social infrastructure.





What is Data Communication?

Fundamentals



Sender

Initiates the data transfer.



Medium

The pathway for data.



Receiver

Receives the transmitted data.



Protocol

Rules for communication.

Data communication is transferring data between devices. Key components include Sender, Receiver, Transmission Medium, and Protocol. An example is sending an email from your device to a server.

Types of Computer Networks: Scale and Scope

LAN (Local Area Network)

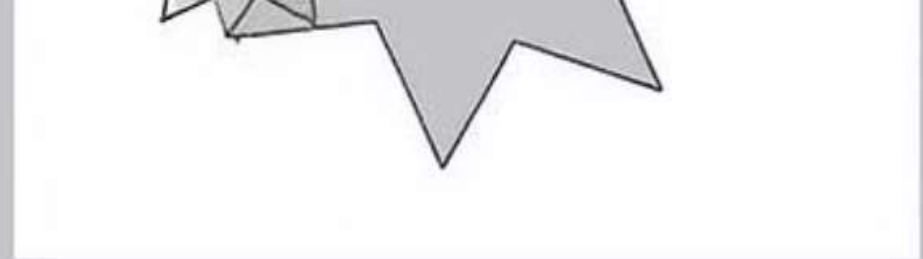
Small area, e.g., office building, campus. It covers up to 1 km, like a corporate campus with 500+ users.

WAN (Wide Area Network)

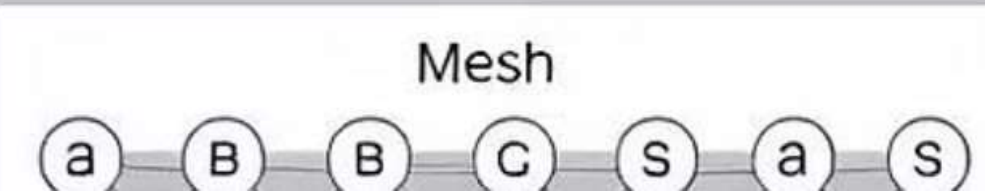
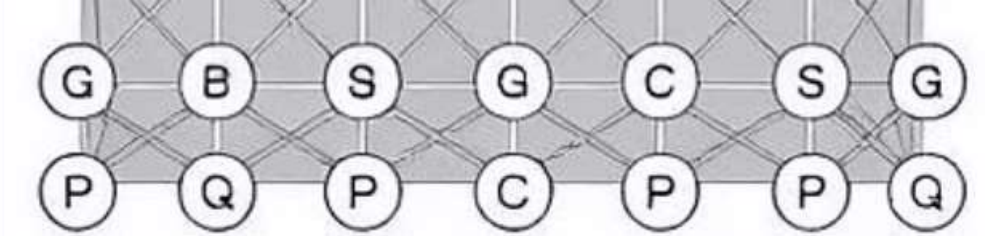
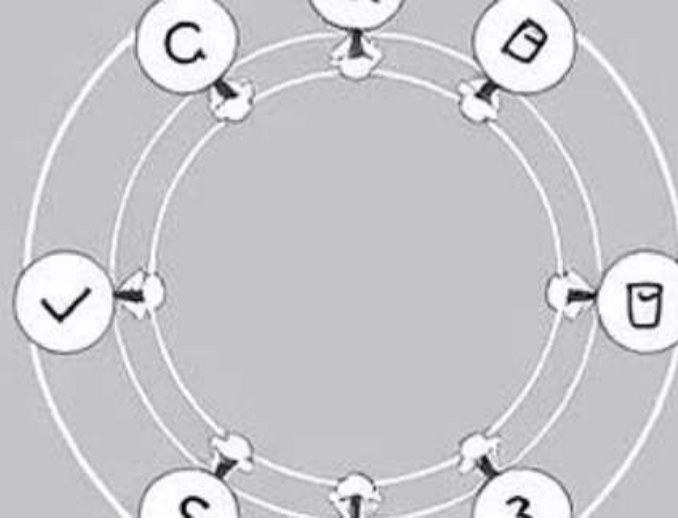
Large geographical area, e.g., Internet, connecting continents. It connects distant LANs, leveraging fiber optics.

MAN (Metropolitan Area Network)

City-wide connectivity. It often utilizes fiber for high-speed, 100 Mbps to 10 Gbps access.



Busking



Network Topologies: Structuring Connectivity

Star

Central hub/switch; common in offices, reliable (single point of failure at center). Dominant topology, used in 90%+ of modern Ethernet LANs.

Bus

Single backbone; simple, older technology (collision prone, limited scalability). Max 10 Mbps speed, largely obsolete for new installations.

Ring

Data flows in one direction; token-based access (e.g., FDDI). Each device acts as a repeater, less common now.

Mesh

Every device connected to every other; highly redundant, complex (expensive). Used in critical infrastructure like data centers for 99.999% uptime.

Transmission Media: The Data Pathways



1

Twisted Pair

Ethernet (Cat5e, Cat6, Cat7) up to 10 Gbps over 100m.

2

Coaxial Cable

Older cable TV, short-distance LANs (up to 10 Mbps).

3

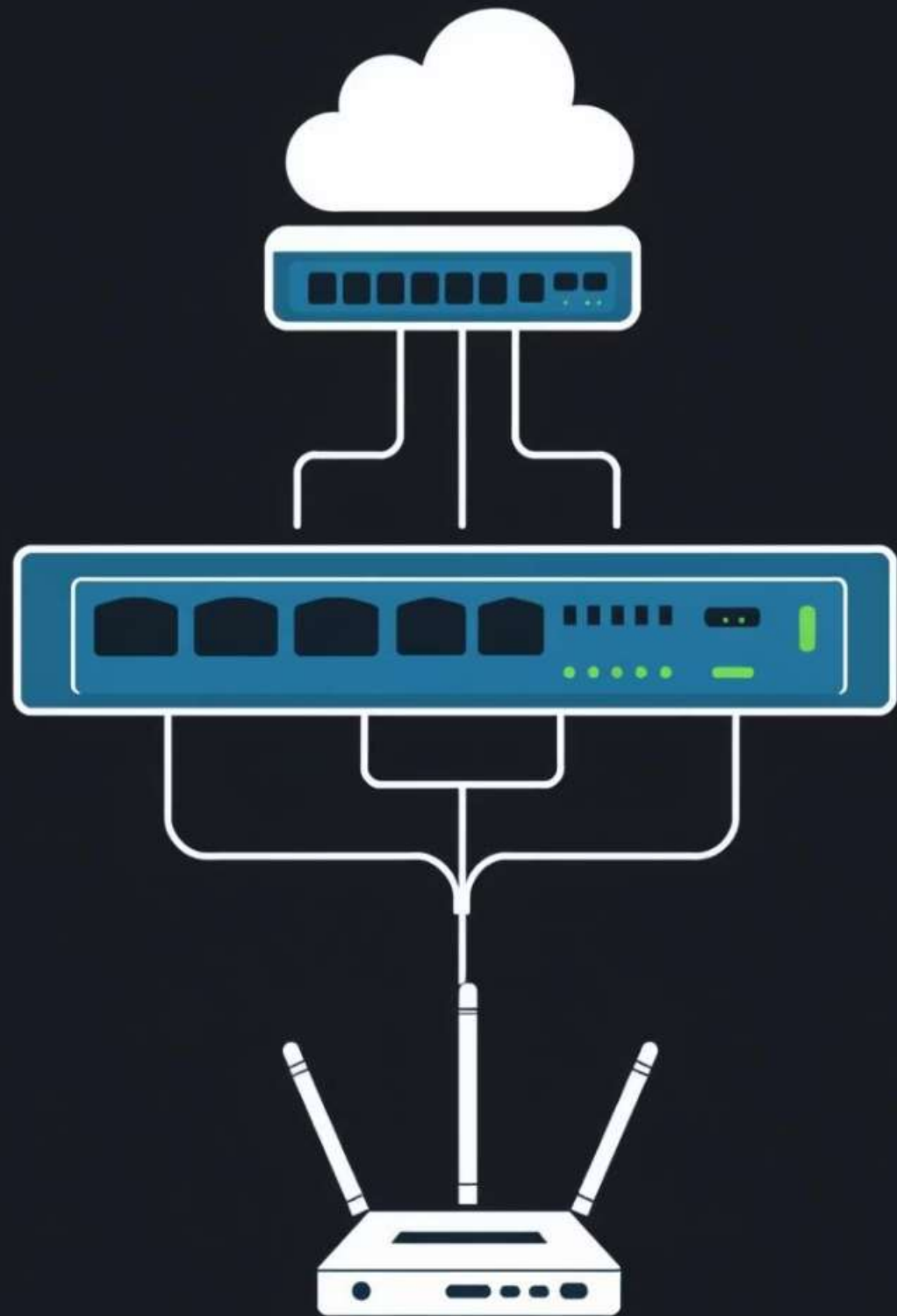
Fiber Optic

High bandwidth (terabits/sec), long distances, immune to EMI.

4

Wireless

Radio Waves (Wi-Fi, Bluetooth) and Microwaves.



Network Devices: Enabling Communication

1

Hub

Broadcasts data to all.
Operates at Layer 1.
Largely replaced by switches.

2

Switch

Forwards data efficiently.
Operates at Layer 2.
Improves network performance.

3

Router

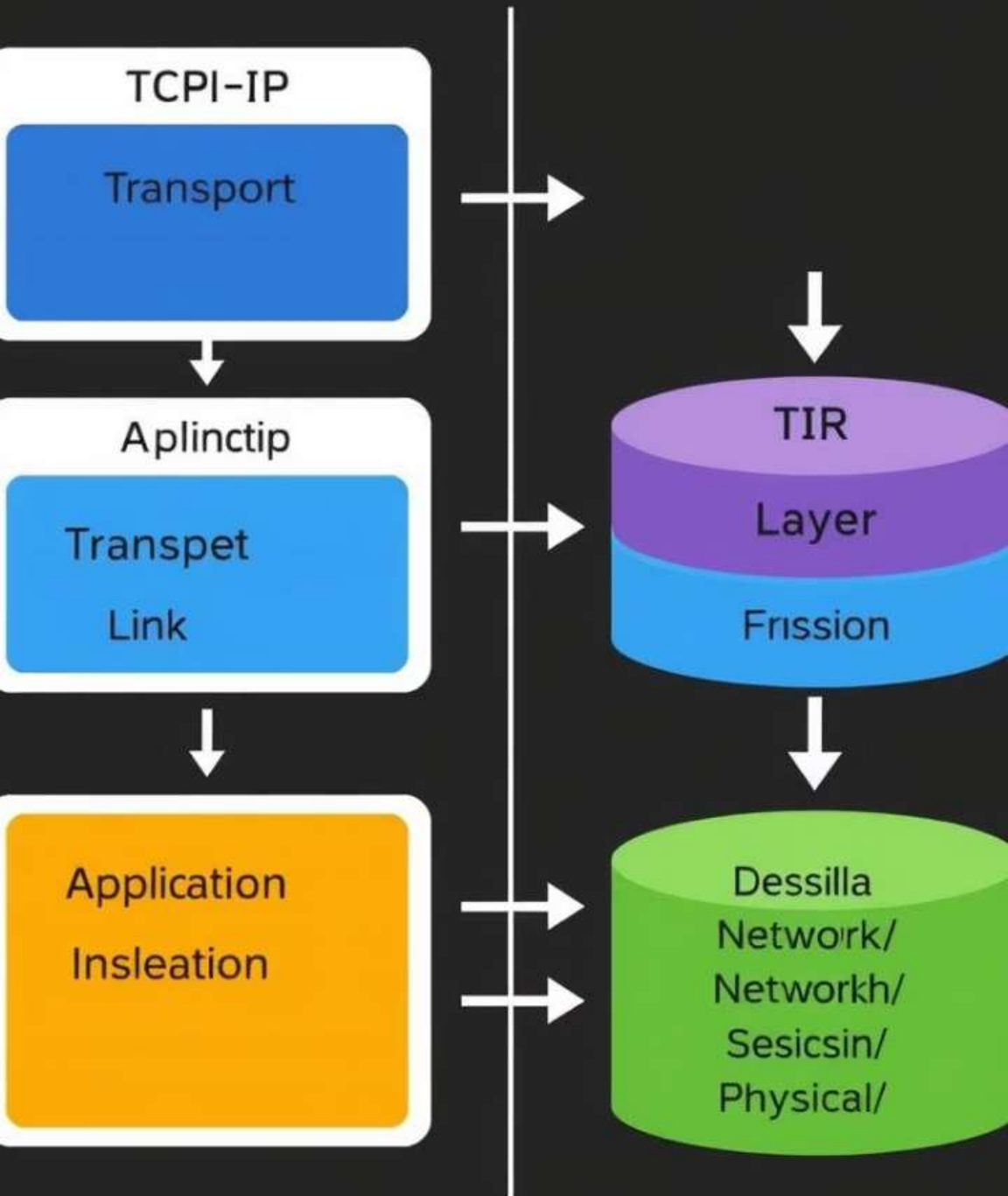
Connects different networks. Forwards data using IP addresses. Crucial for the internet.

4

Modem

Modulates/demodulates signals. Converts digital signals for ISP access.

4P/IP model if 4 wwe 4 azhes he seet t OSI



Network Protocols & Standards: The Language of Data



TCP/IP

The internet's fundamental protocol suite. IP handles addressing and routing. TCP ensures reliable, ordered data delivery.



OSI Model

7-layer conceptual framework. Standardizes functions for interoperability. Layer 7 is Application, Layer 1 is Physical.



HTTP/HTTPS

Protocols for web browsing. HTTPS adds encryption for security.

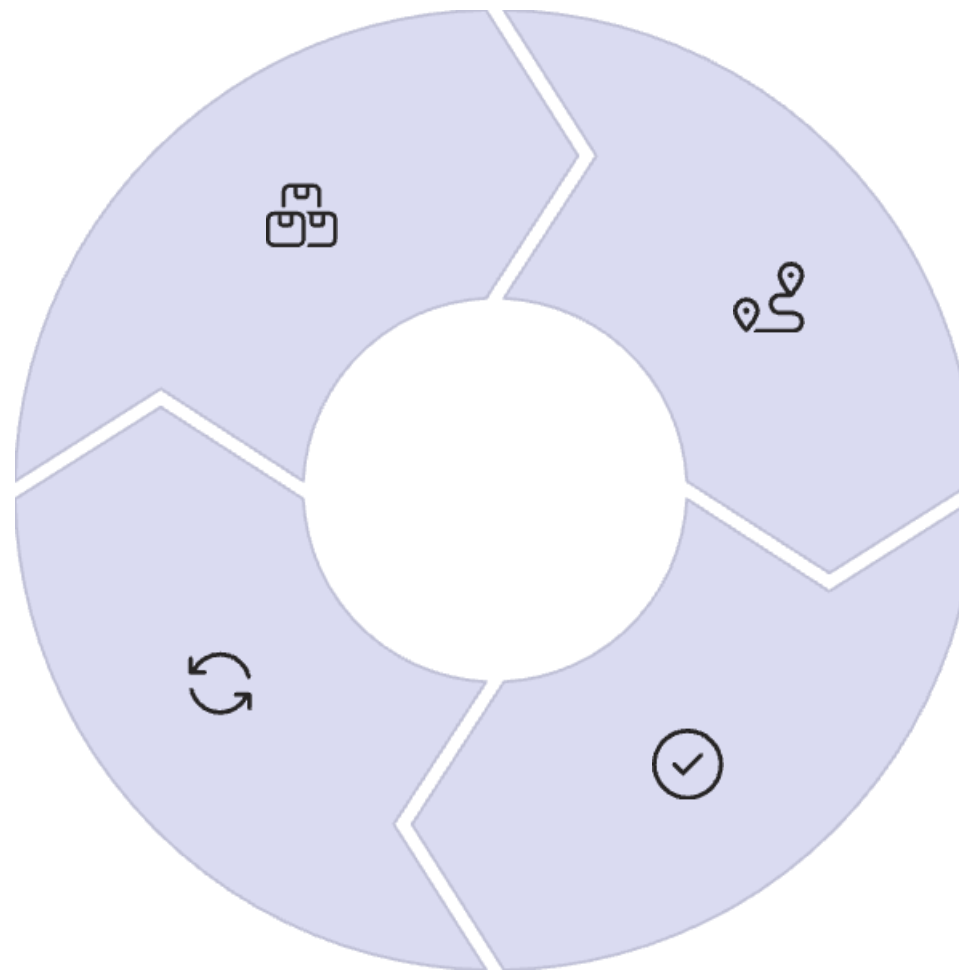
Data Flow: Packet Switching & Reliability

Packetize

Data is broken into small packets (e.g., 1500 bytes).

Reassemble

Packets are reassembled at the destination.



Independent Travel

Packets travel independently, possibly different paths.

Acknowledge

Receiver confirms receipt of packets via ACKs.

Network Security Fundamentals: Protecting Data



Firewalls

Monitor/control network traffic based on rules. Protects internal networks from unauthorized access.



Encryption

Converts data into code to prevent unauthorized access. SSL/TLS secures 90%+ of web traffic.



VPNs

Creates secure, encrypted connections over public networks. Essential for remote work.

Ransomware attacks increased 150% in 2023. Data breaches average \$4.45M cost in 2023 globally.



Conclusion: The Evolving Landscape of Connectivity



5G

Low latency, high bandwidth wireless connectivity.



IoT

Billions of interconnected devices expanding networks.



AI Networks

AI-driven optimization and management of networks.



Quantum

Emerging quantum networking for ultimate security.

Data communication forms the bedrock of our digital world. Constant innovation drives faster speeds, greater security, and new applications. Continued investment in network infrastructure is critical for global progress.