# Data Transmission : How Data Travels Across Devices

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# Introduction

▶ Data Transmission refers to the process of transferring data between electronic devices.

▶ Transmission can occur through wired media (such as Ethernet cables) or wireless technologies (such as Bluetooth and Wi-Fi).

▶ It is commonly used in applications such as email communication, video conferencing, web browsing, and file sharing.

▶ The process is governed by network models and relies on standard transmission protocols to ensure reliable and efficient data exchange.

# OSI Model

▶ 7-layer reference model for data communication.

▶ Layers: Application → Presentation → Session → Transport → Network → Data Link → Physical

▶ Each layer adds or removes information to manage communication.

▶ Standardizes data exchange across different systems and networks.

# Sender to Receiver – Data Flow

- Sender: Data flows from Application layer down to the Physical layer.

- Physical Layer: Transmits bits over the communication medium.

- Receiver: Bits flow from Physical layer up to the Application layer.

- Example: Sending an email or file across a network.

# Transmission Media

▶ Wired: Ethernet, Fiber Optic, Coaxial – High speed, stable connection

▶ Wireless: Wi-Fi, Bluetooth, Infrared – Portable, flexible

▶ Media type affects speed, reliability, and interference.

▶ Choice depends on range, cost, and performance requirements.

# Data Encapsulation & Decapsulation

▶ Data is split and wrapped with headers at each OSI layer.

▶ Units: Bits → Frames → Packets → Segments → Data

▶ Encapsulation occurs at the sender; Decapsulation at the receiver.

▶ Each layer processes only its specific header.

# Error Correction & Detection

▶ Errors may occur due to noise or interference.

▶ Common techniques: Parity Bits, Checksums, CRC (Cyclic Redundancy Check).

▶ Ensures reliable and accurate data delivery.

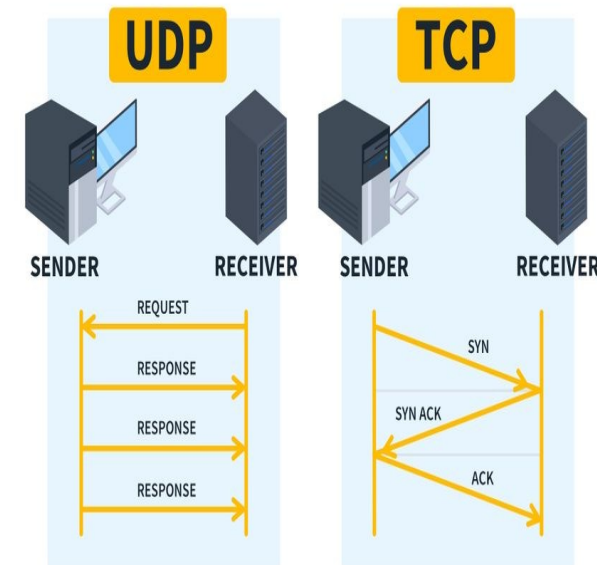▶ Used in file transfers, streaming, and network communication.

| Sent | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |

Transmission
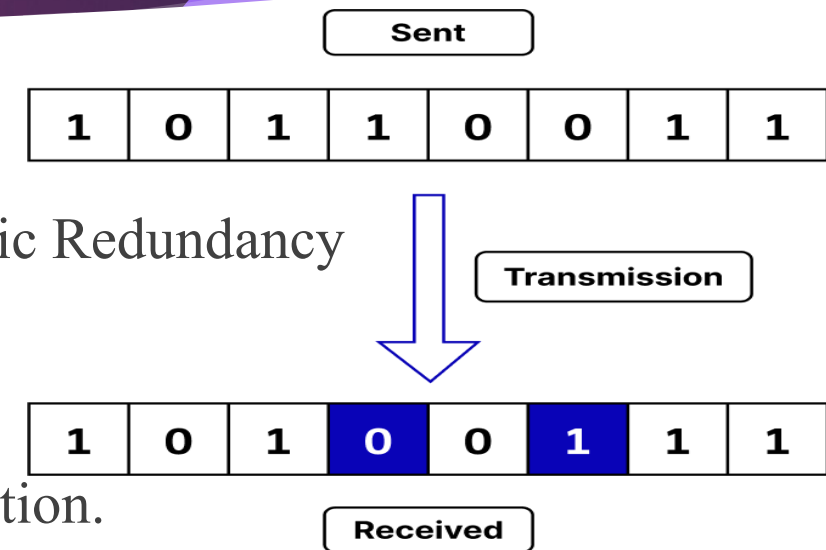
| Received | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 |

# Transmission Modes

▶ Full-Duplex: Both devices send and receive simultaneously (e.g., telephones).

▶ Half-Duplex: Devices take turns to send data (e.g., walkie-talkies).

▶ Simplex: One-way communication only (e.g., keyboard to PC).

▶ Full-duplex is faster, while half-duplex is simpler.

# Transmission Protocols & Security

▶ TCP: Reliable, ordered, and error-checked data delivery.

▶ UDP: Faster, but no delivery guarantee (used in streaming/gaming).

▶ Encryption Protocols: HTTPS, SSL/TLS ensure secure data transfer.

▶ Firewalls and VPNs protect against external threats.

# Thank You