Introduction to Networking Concepts

- **Lecture: Overview of Computer Networks, Network Models (OSI and TCP/IP)**
- **Objective:**
  The goal of this lecture is to provide students with a foundational understanding of networking concepts and how communication happens between computers in a network. We will also cover the two most common models used in networking: the OSI and TCP/IP models.

What is a Computer Network?

- A computer network is a set of computers connected together for the purpose of sharing resources (such as file sharing, internet access, and device sharing like printers).
- These resources are exchanged over communication channels like cables, Wi-Fi, and fiber optics.

Types of Computer Networks:

- **LAN (Local Area Network):** A network that spans a relatively small geographical area, typically a single building or campus.
- **WAN (Wide Area Network):** A network that covers a broad area (e.g., the Internet), connecting multiple LANs.
- **MAN (Metropolitan Area Network):** A network covering a city or town.
- **PAN (Personal Area Network):** A network that connects devices in a person's workspace (e.g., Bluetooth).

Network Devices and Terms:

- **Host (or Node):** A device on the network (e.g., a computer, smartphone).
- **Router:** A device that forwards data packets between computer networks.
- **Switch:** A device that connects devices in a LAN and directs data to its destination.
- **Protocol:** A set of rules that govern how data is transmitted over a network.

Introduction to Network Models:

- A **network model** is a layered approach to understanding how different aspects of networking interact.

The OSI (Open Systems Interconnection) Model:

The OSI model is a conceptual framework that standardizes network communication into seven layers:

- **Physical Layer:** Deals with the physical connection between devices (e.g., cables, switches).
- **Data Link Layer:** Responsible for node-to-node data transfer and error detection/correction.
- **Network Layer:** Handles the routing of data packets across networks (e.g., IP addresses).
- **Transport Layer:** Ensures reliable data transfer with error recovery and flow control (e.g., TCP, UDP).
- **Session Layer:** Manages sessions or connections between applications.
- **Presentation Layer:** Translates data between the network and application (e.g., encryption, data compression).
- **Application Layer:** Provides network services to end-user applications (e.g., HTTP, FTP).

The TCP/IP Model:

- The **TCP/IP model** is more practical and closely aligned with real-world network protocols. It consists of four layers:
- **Network Interface Layer (Link Layer):** Combines physical and data link layers of the OSI model.
- **Internet Layer:** Handles the routing and addressing of data packets (e.g., IP).
- **Transport Layer:** Manages data flow and error handling (e.g., TCP for reliable communication and UDP for connectionless communication).
- **Application Layer:** Covers protocols that allow applications to exchange data (e.g., HTTP, SMTP, FTP).

Key Differences between OSI and TCP/IP Models

- The OSI model is more theoretical and has seven layers, while the TCP/IP model is more practical and has four layers.
- OSI is protocol-independent, while TCP/IP was developed specifically for the Internet.

Lecture Conclusion

By the end of this lecture, students should:

- Understand the basics of what a computer network is and the different types.
- Recognize the main devices involved in networks, such as routers and switches.
- Grasp the importance of network protocols and the layered approach in network communication.
- Be able to explain the differences between the OSI and TCP/IP models.