Lecturer Notes on OSI Model

The **Open Systems Interconnection (OSI) model** is a conceptual framework used to understand and implement network communications between different systems. It has **seven layers**:

1. **Physical Layer**: Deals with the physical connection between devices and the transmission of binary data over physical mediums.
2. **Data Link Layer**: Ensures error-free data transfer between adjacent network nodes and handles MAC addresses.
3. **Network Layer**: Manages data routing, forwarding, and addressing (e.g., IP addresses).
4. **Transport Layer**: Provides reliable data transfer services to the upper layers (e.g., TCP).
5. **Session Layer**: Manages sessions or connections between applications.
6. **Presentation Layer**: Translates data between the application layer and the network (e.g., encryption, compression).
7. **Application Layer**: Provides network services directly to end-user applications (e.g., HTTP, FTP).

TCP/IP Model(Internet protocol suite as defined in RFC 1122 and RFC 1123)

The **Transmission Control Protocol/Internet Protocol (TCP/IP) model** is a more practical framework used for network communications, especially on the internet. It has **four layers**:

1. **Network Interface Layer**: Corresponds to the OSI's Physical and Data Link layers, handling hardware addressing and the physical transmission of data.
2. **Internet Layer**: Similar to the OSI's Network layer, it manages logical addressing and routing (e.g., IP).
3. **Transport Layer**: Corresponds to the OSI's Transport layer, providing end-to-end communication services (e.g., TCP, UDP).
4. **Application Layer**: Combines the OSI's Session, Presentation, and Application layers, providing high-level protocols for data exchange (e.g., HTTP, FTP).

Key Differences

- **Layer Count**: OSI has seven layers, while TCP/IP has four.
- **Development**: OSI is a theoretical model developed by ISO, while TCP/IP is a practical model developed by the Department of defence.
- **Usage:** OSI is used as a reference model, whereas TCP/IP is widely used in real-world networking, especially on the internet.

Both models are essential for understanding how data is transmitted across networks, but they serve different purposes and are used in different contexts. Here's a brief overview of the main purpose of each layer in the OSI model:

1. **Physical Layer**: This layer is responsible for the physical connection between devices. It deals with the transmission and reception of raw binary data over a physical medium, such as cables, radio frequencies, or fibre optics.

2. **Data Link Layer**: This layer ensures reliable data transfer between adjacent network nodes. It handles error detection and correction, as well as framing and addressing using MAC addresses.
3. **Network Layer**: The main purpose of this layer is to manage data routing and forwarding. It determines the best path for data to travel from the source to the destination, using logical addressing (e.g., IP addresses).
4. **Transport Layer**: This layer provides reliable data transfer services to the upper layers. It ensures complete data transfer with error checking, flow control, and retransmission of lost data. Protocols like TCP and UDP operate at this layer.
5. **Session Layer**: This layer manages sessions or connections between applications. It establishes, maintains, and terminates connections, ensuring that data exchange is properly synchronized.
6. **Presentation Layer**: The main purpose of this layer is to translate data between the application layer and the network. It handles data formatting, encryption, and compression, ensuring that data is in a usable format for the application layer.
7. **Application Layer**: This layer provides network services directly to end-user applications. It includes protocols and services such as HTTP, FTP, and SMTP, which enable applications to communicate over the network.

Each layer has a specific role, and together they ensure smooth and efficient communication across a network. Let's compare the OSI and TCP/IP models in terms of their structure, purpose, and usage:

Structure:

OSI Model: Has **seven layers** (Physical, Data Link, Network, Transport, Session, Presentation, Application). **TCP/IP Model**: Has **four layers** (Network Interface, Internet, Transport, Application).

Purpose: OSI Model: A theoretical framework developed by the International Organization for Standardization (ISO) to **standardize network communications and provide a universal set of guidelines**.

- **TCP/IP Model**: A practical framework developed by the Department of defence for real-world network communications, especially on the internet.

Layer Functions: Physical and Data Link Layers (OSI) vs. **Network Interface Layer (TCP/IP)**: Both handle the physical transmission of data and hardware addressing.

- **Network Layer (OSI)** vs. **Internet Layer (TCP/IP)**: Both manage logical addressing and routing of data packets.
- **Transport Layer (Both Models)**: Provides end-to-end communication services, ensuring reliable data transfer (e.g., TCP, UDP).
- **Session, Presentation, and Application Layers (OSI)** vs. **Application Layer (TCP/IP)**: The OSI model separates these functions into three distinct layers, while the TCP/IP model combines them into a single layer that handles high-level protocols for data exchange.

Usage

- **OSI Model**: Primarily used as a reference model for understanding and designing network protocols and architectures.
- **TCP/IP Model**: Widely used in real-world networking, particularly for internet communications.

Key Differences

- **Layer Count**: OSI has more layers (seven) compared to TCP/IP (four).
- **Development**: OSI is more theoretical, while TCP/IP is more practical and widely implemented.
- **Flexibility**: The OSI model is more detailed and modular, making it easier to understand specific functions, whereas the TCP/IP model is more streamlined for practical use.

OSI Model	TCP/IP Model
It stands for **Open System Interconnection.**	It stands for **Transmission Control Protocol.**
OSI model has been developed by ISO (International Standard Organization).	It was developed by ARPANET (Advanced Research Project Agency Network).
It is an independent standard and generic protocol used as a communication gateway between the network and the end user.	It consists of standard protocols that lead to the development of an internet. It is a communication protocol that provides the connection among the hosts.
In the OSI model, the transport layer provides a guarantee for the delivery of the packets.	The transport layer does not provide the surety for the delivery of packets. But still, we can say that it is a reliable model.
This model is based on a vertical approach.	This model is based on a horizontal approach.
In this model, the session and presentation layers are separated, i.e., both the layers are different.	In this model, the session and presentation layer are not different layers. Both layers are included in the application layer.
It is also known as a reference model through which various networks are built. For example, the TCP/IP model is built from the OSI model. It is also referred to as a guidance tool.	It is an implemented model of an OSI model.
In this model, the network layer provides both connection-oriented and connectionless service.	The network layer provides only connectionless service.
Protocols in the OSI model are hidden and can be easily replaced when the technology changes.	In this model, the protocol cannot be easily replaced.
It consists of 7 layers.	It consists of 4 layers.

OSI model defines the services, protocols, and interfaces as well as provides a proper distinction between them. It is protocol independent.	In the TCP/IP model, services, protocols, and interfaces are not properly separated. It is protocol dependent.
The usage of this model is very low.	This model is highly used.
It provides standardization to the devices like router, motherboard, switches, and other hardware devices.	It does not provide the standardization to the devices. It provides a connection between various computers.

Summary

- **OSI Model**: Provides a comprehensive and detailed framework for understanding network communication.
- **TCP/IP Model**: Offers a simpler, more practical approach that is widely used in real-world networking.

Both models are essential for understanding different aspects of network communication, but they serve different purposes and are used in different contexts.