Working of all the layers in OSI Model

OSI Model

Introduction

- The Open System Interconnection(OSI) model is a framework that conceptualizes how computers communicate within a network.
- The OSI model is split into seven distinct layers, each one play a specific role with the overall operation.

History

- The OSI model was the first standardized model for network communications.
- It was adopted by the International Organization for Standardization(ISO) as an international standard in 1984.

Layers of OSI Model

- OSI model divides networking up into a vertical stack consisting 7 layers.
- Networking starts on the application layer at top layer(Layer 7) and proceeds to the bottom layer(Layer 1).

7 Layers of OSI model

Layer No	Layer Name	Description
7	Application	Enables the end user to access the network.
6	Presentation	Converts data into an understandable format and encrypts it.
5	Session	Enables and manages sessions of communication between computers.
4	Transport	Ensures reliable transfer of packets of data between users.

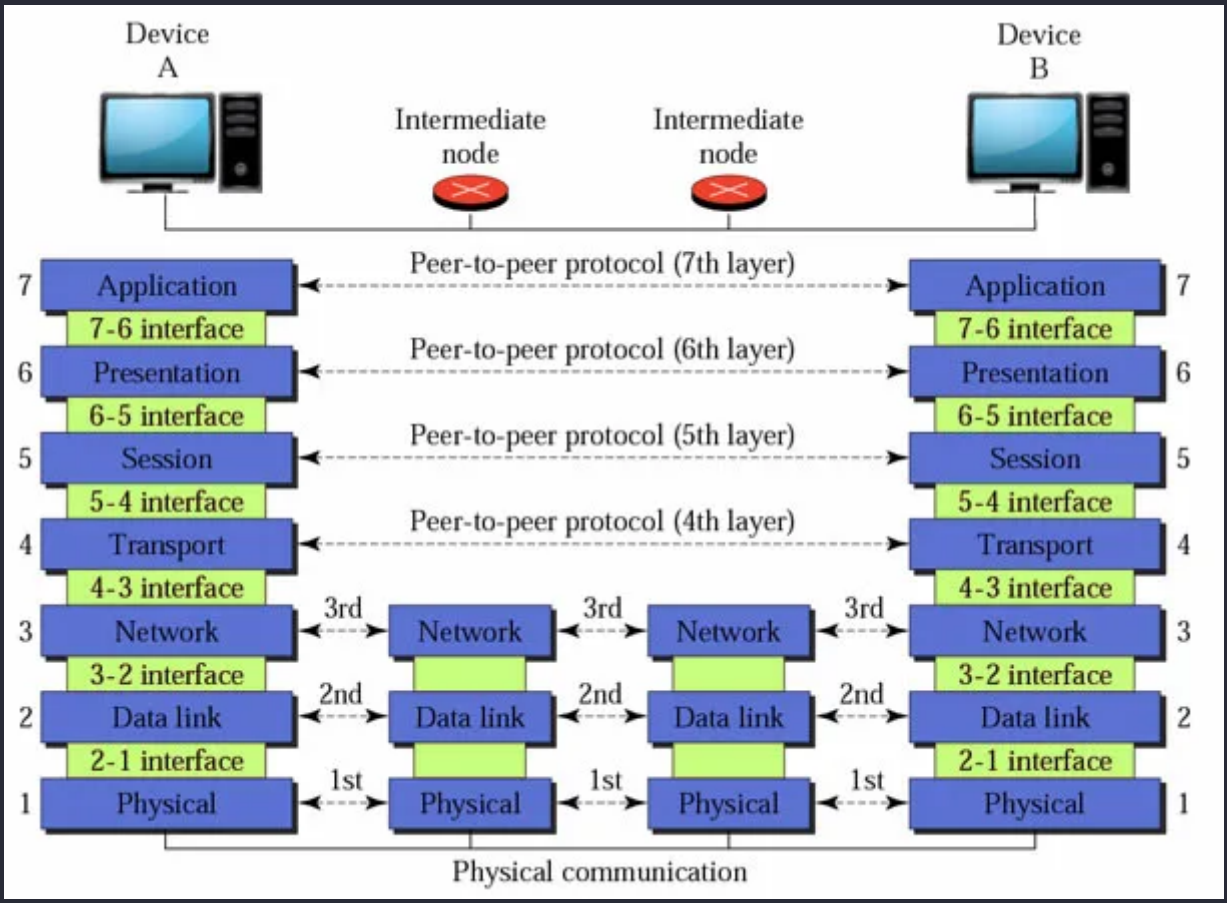
Layer No	Layer Name	Description
3	Network	Determines the transmission path of data using routing protocols.
2	Data Link	Formats data on the network and sends it from node to node.
1	Physical	Manages the relationship between the physical device and the transmission medium, be it wireless or cable.

Function of each layer

1. Application Layer - This layer is not about the application itself but how the application accesses the network. eg- web browsing, Email, file transfer(FTP), management session(SSH).
2. Presentation Layer - The application may contain a lot of data and the data may not be understandable to the rest of the network so the presentation layer helps converting if needed, conversion may include services like encryption and compression, file formats also live here including images and video files.
3. Session Layer - The application may need to talk to several other end points so its important to track where these conversations are occurring, each of these conversation is called a session. eg - requests to remote services, SCP or session control protocol.
4. Transport Layer - The transport layer used to transfer the data to the endpoint. TCP and UDP are the most common protocols used in this layer. Data is broken down into segments. If using TCP this broken chunk of data is called segment and if using UDP it's called datagram. This layer uses port numbers as header.
5. Network Layer - In order to send a data from a host to another host we need some kind of addressing, In this layer adds network addresses and adds routing. Another header is added in this layer containing IP addresses.
6. Data Link - Builds logical link between devices, adds local address(MAC) and includes in a new header. A trailer is added with error correction information. Then the data is called frame. Data link layer has two sub-layers - i) LLC -

Logical Link Control sub-layer → responsible for translating between network layer and data link layer.
ii)MAC - Media Access Control → sub-layer is responsible for adding headers and trailers to the packet creating the frame and also responsible for error correction.

7. Physical Layer - This includes itself with physical components of the network as the radio freq, channel pulsing light , pins , electrical signals and standards of copper cabling. Encodes information into physical signals(0,1).

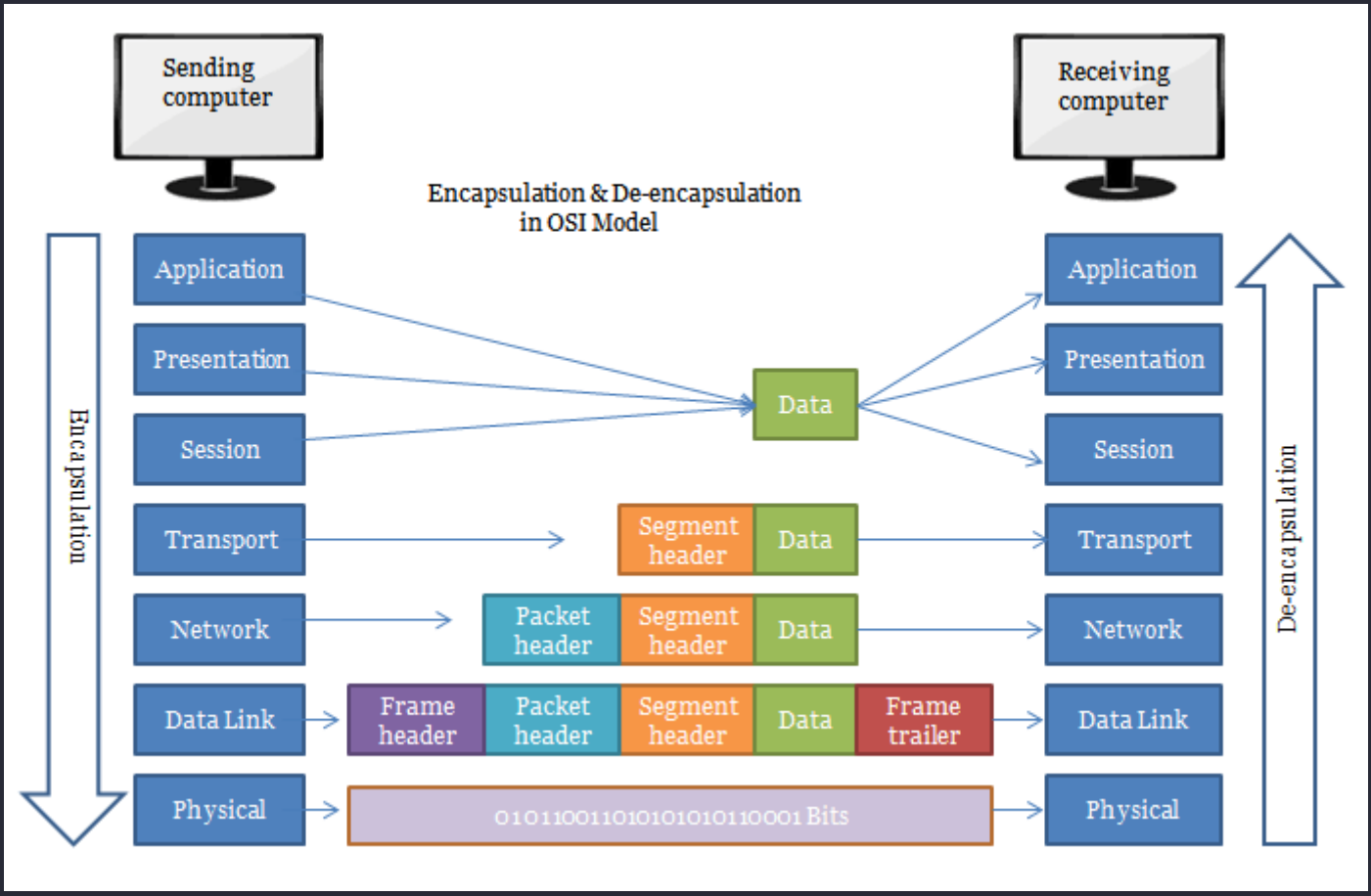


How data moves form application layer to physical layer :

1. When an application on an host needs to send data on another host the data moves through application layer.
2. The data needs to be formatted in a way that it can be understood. Data is formatted here such as Images or video or exe.
3. The session layer tracks application processes this includes remote procedure call and service requests. This layer builds a session between a local app to a remote application.
4. When the data reaches the transport layer it is broken into manageable chunks. Then a header is added, it contents the

port number of the source and the destination, the server reverses it and uses it.

Data Encapsulation and De-encapsulation



Advantages of OSI model

- It divides network communication into 7 layers which makes it easier to understand and troubleshoot.
- It standardizes network communications, as each layer has fixed functions and protocols.
- Diagnosing network problems is easier with the *OSI model*.
- It is easier to improve with advancements as each layer can get updates separately.

Conclusion

The OSI (Open Systems Interconnection) model is a vital framework for understanding and designing network systems. By dividing networking functions into seven distinct layers, it provides a clear structure for developing and managing network protocols and technologies. Each layer, from physical connections to application interactions, plays an essential role in facilitating efficient communication.

The OSI model's standardized approach enhances interoperability between diverse systems and simplifies troubleshooting by isolating issues to specific layers. This model remains a foundational tool in networking, helping professionals design robust, scalable, and secure networks. Its enduring relevance underscores its importance in the ever-evolving landscape of digital communication, making it a cornerstone of networking education and practice.