The OSI Model

Introduction

- Open Systems Interconnection Basic Reference Model (OSI Reference Model or **OSI Model**) is an abstract description for layered communications and computer network protocol design. It was developed as part of the **Open Systems Interconnection (OSI)** initiative.
- In its most basic form, it divides network architecture into seven layers. It is therefore often referred to as the **OSI Seven Layer Model.**
- Open Systems Interconnection (OSI) is a set of internationally recognized, non-proprietary standards for networking and for operating system involved in networking functions.

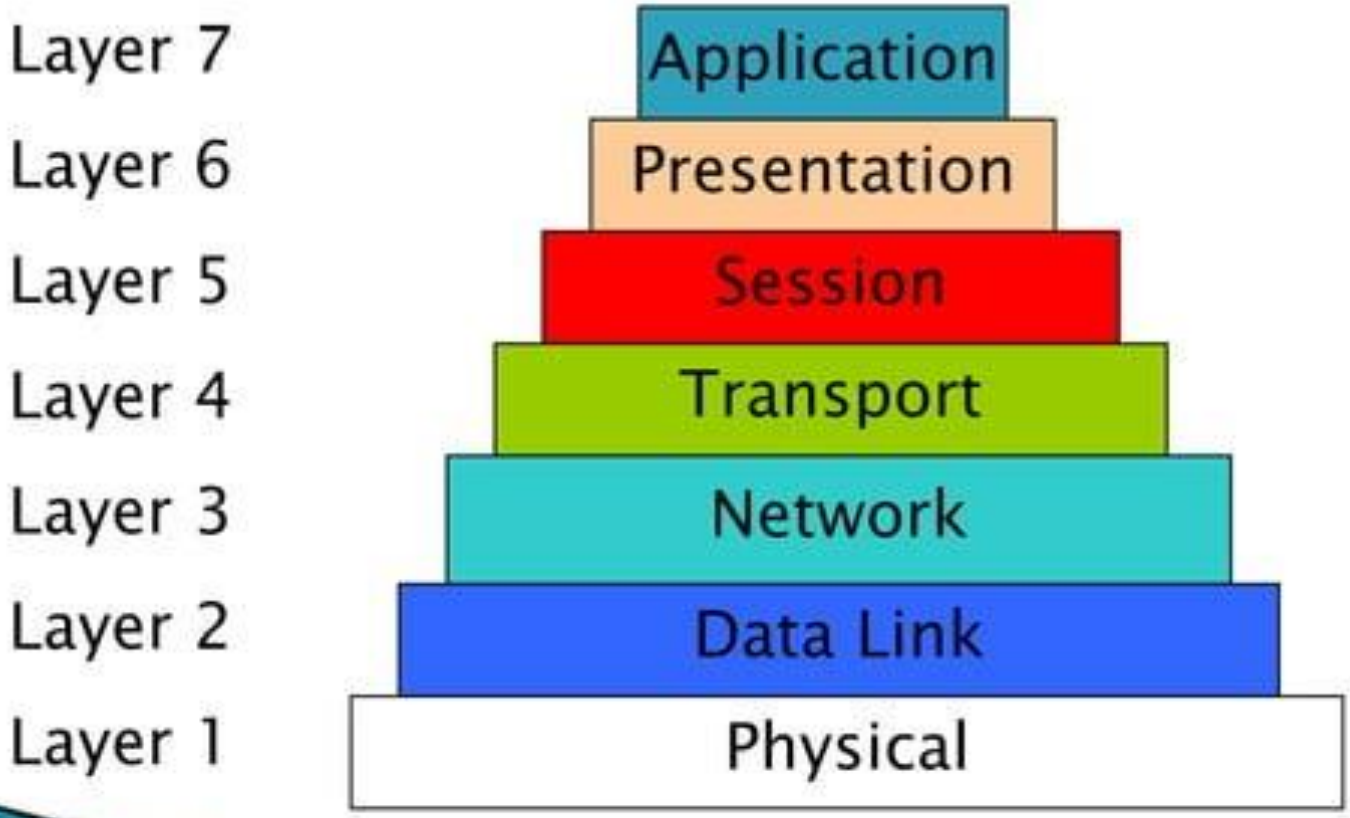
Why do we need the OSI Model?

- To address the problem of networks increasing in size and in number, the International Organization for Standardization (ISO) researched many network schemes and recognized that there was a need to create a network model

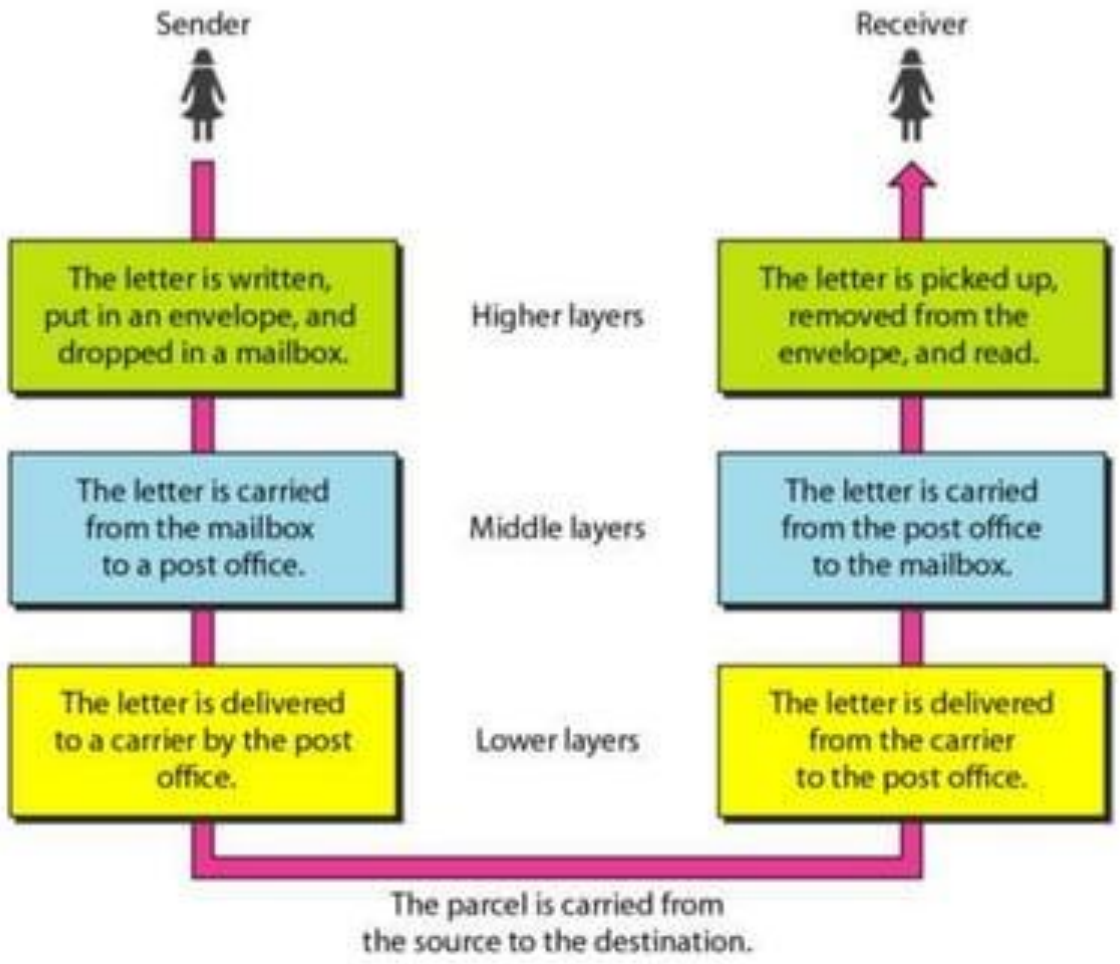
- This would help network builders implement networks that could communicate and work together

- ISO therefore, Introduced the OSI reference model in 1978 and revised it in 1984.

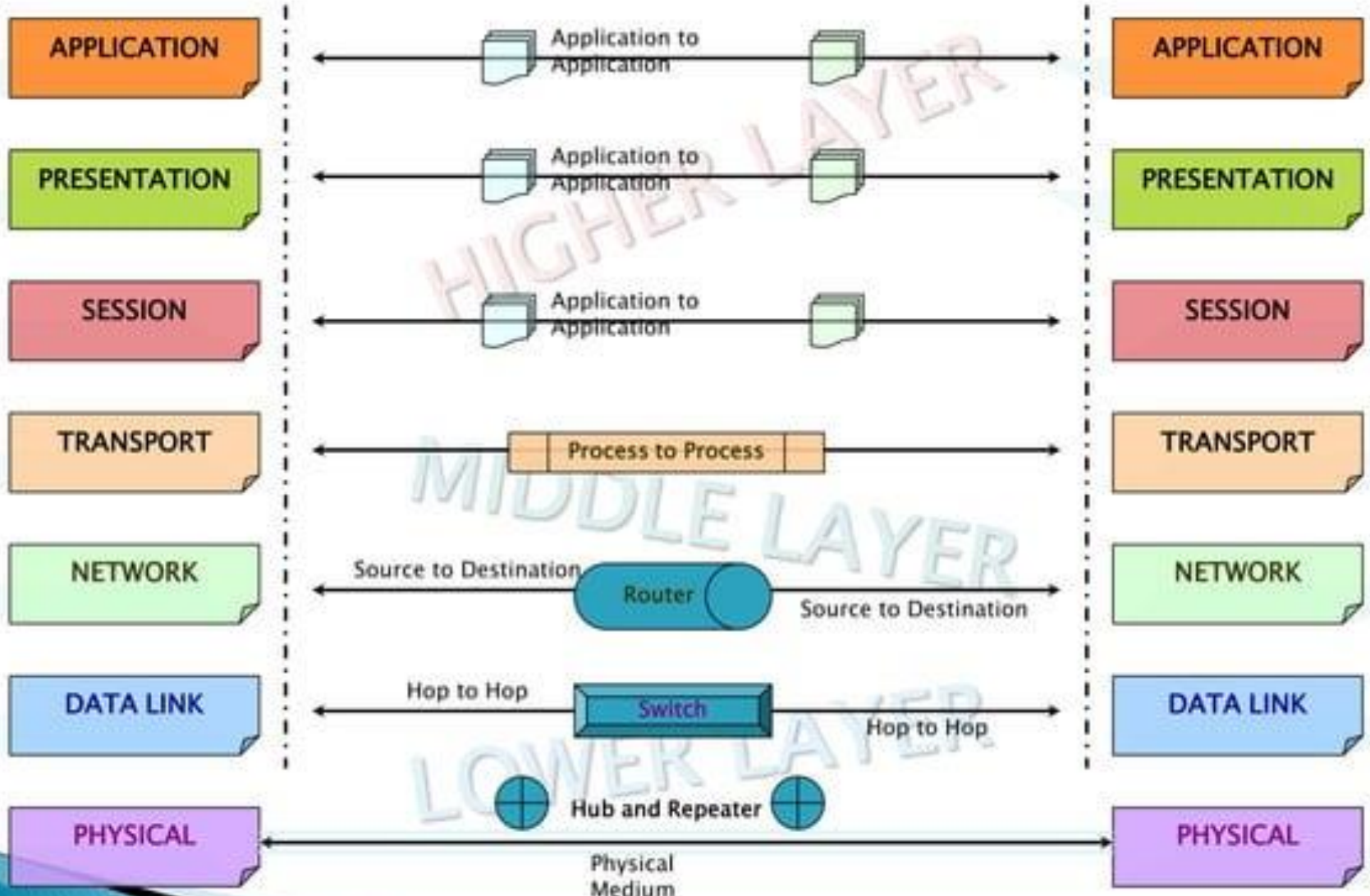
What are the seven layers ?



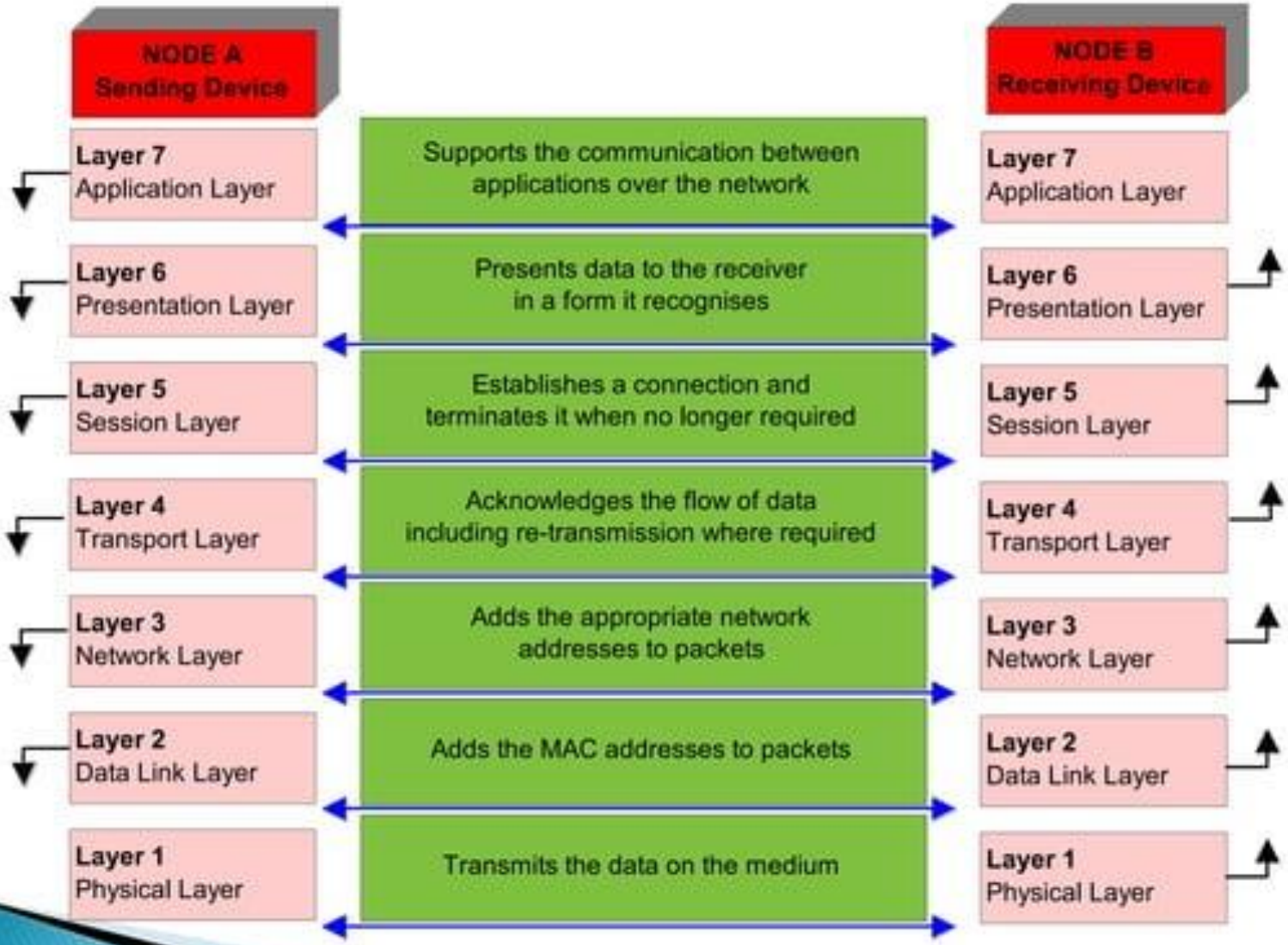
Tasks involved in sending letter



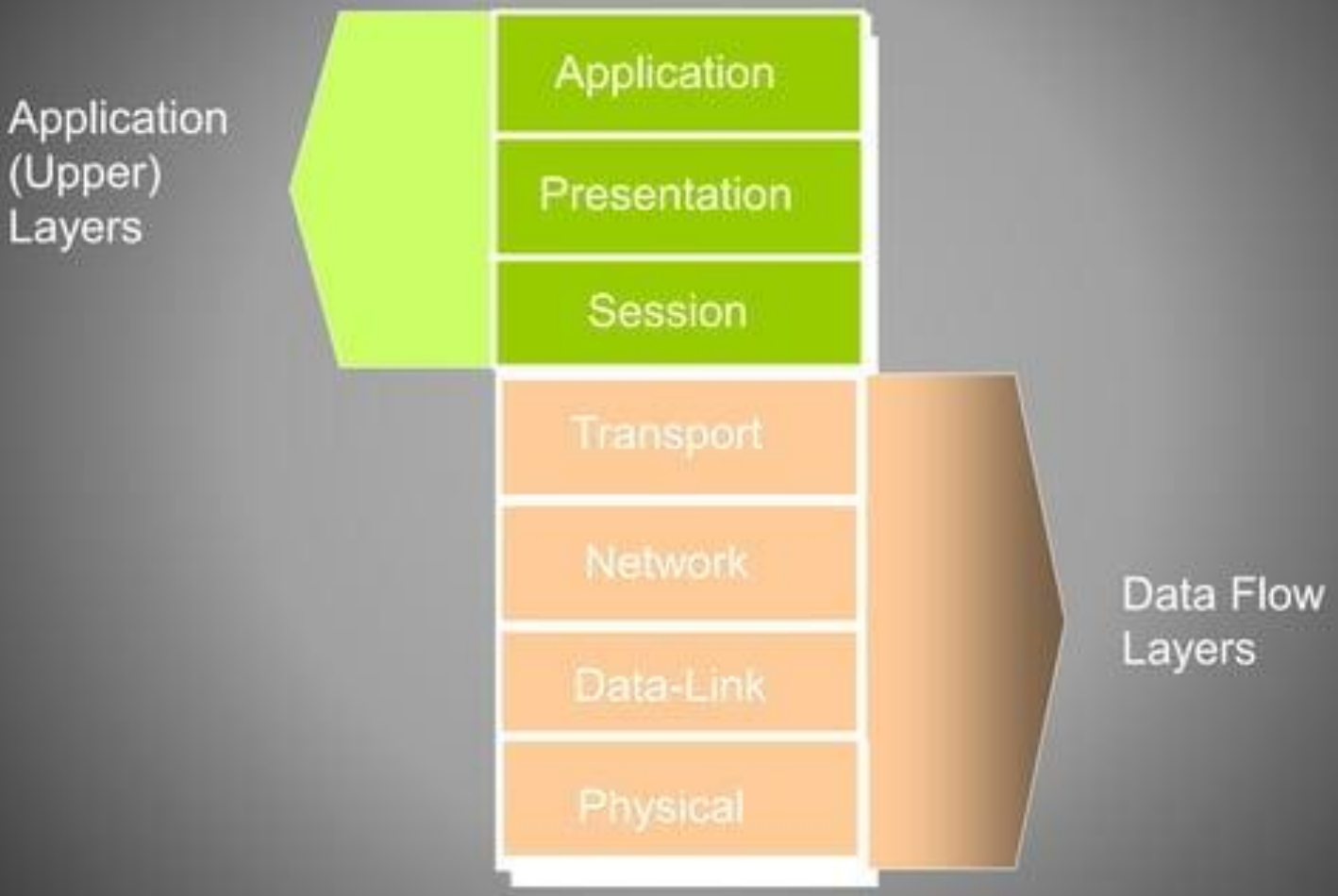
OSI Model's 7 Layers



The layers at Work



OSI Model


Application
(Upper)
Layers
Application
Presentation
Session
Transport
Network
Data-Link
Physical
Data Flow
Layers

Layer 7 – The Application Layer

- The top layer of the OSI model
- Provides a set of interfaces for sending and receiving applications to gain access to and use network services. Processing.
- This layer deal with networking applications. Examples:
  - Email
  - Web browsers

Layer 6 – The Presentation Layer

This layer is responsible for presenting the data in the required format which may include:

- Code Formatting/Translation
- Encryption
- Compression

LAYER 6 – The PRESENTATION Layer

- Manages data-format information for networked communications (the network's translator).
- For outgoing messages, it converts data into a generic format for network transmission; for incoming messages, it converts data from the generic network format to a format that the receiving application can understand.
- This layer is also responsible for certain protocol conversions, data encryption/decryption, or data compression/decompression.
- A special software facility called a "*redirector*" operates at this layer to determine if a request is network related or not and forwards network-related requests to an appropriate network resource.

Layer 5 – The Session Layer

- This layer establishes, manages, and terminates sessions between two communicating hosts.
- Creates Virtual Circuit
- Coordinates communication between systems
- Organize their communication by offering three different modes
  - Simplex
  - Half Duplex
  - Full Duplex

LAYER 5 – The SESSION Layer

- Enables two networked resources to hold ongoing communications (called a session) across a network
- Applications on either end of the session are able to exchange data for the duration of the session
- This layer is:
  - Responsible for initiating, maintaining and terminating sessions
  - Responsible for security and access control to session information (via session participant identification)
  - Responsible for synchronization services, and for checkpoint services

Layer 4 – The Transport Layer

- This layer breaks up the data from the sending host and then reassembles it in the receiver.
- It provides reliable data transport across the network.
- Other features of this layer are:
  - Sequencing
  - Acknowledgment
  - Retransmission
  - Flow Control

LAYER 4 – The TRANSPORT Layer

- Manages the transmission of data across a network
- Manages the flow of data between parties by segmenting long data streams into smaller data chunks (based on allowed "packet" size for a given transmission medium)
- Reassembles chunks into their original sequence at the receiving end
- Provides acknowledgements of successful transmissions and requests resends for packets which arrive with errors

Layer 3 – The Network Layer

- End to End Delivery
- Provide logical addressing that routers use for path determination
- Internetwork Communication
- Packet forwarding
- Packet Filtering
- Makes "Best Path Determination"

LAYER 3 – The NETWORK Layer

- Handles addressing messages for delivery, as well as translating logical network addresses and names into their physical counterparts
- Responsible for deciding how to route transmissions between computers
- This layer also handles the decisions needed to get data from one point to the next point along a network path
- This layer also handles packet switching and network congestion control

Layer 2 – The Data Link Layer

- Performs Physical Addressing
- This layer provides reliable transit of data across a physical link.
- Access to media using MAC address
- Error detection
- LLC and MAC
- Logical Link Control performs Link establishment
- MAC Performs Access method

Preamble	DMAC	SMAC	Data length	DATA	FCS

LAYER 2 – The DATA LINK Layer

- Handles special data frames (packets) between the Network layer and the Physical layer
- At the receiving end, this layer packages raw data from the physical layer into data frames for delivery to the Network layer
- At the sending end this layer handles conversion of data into raw formats that can be handled by the Physical Layer

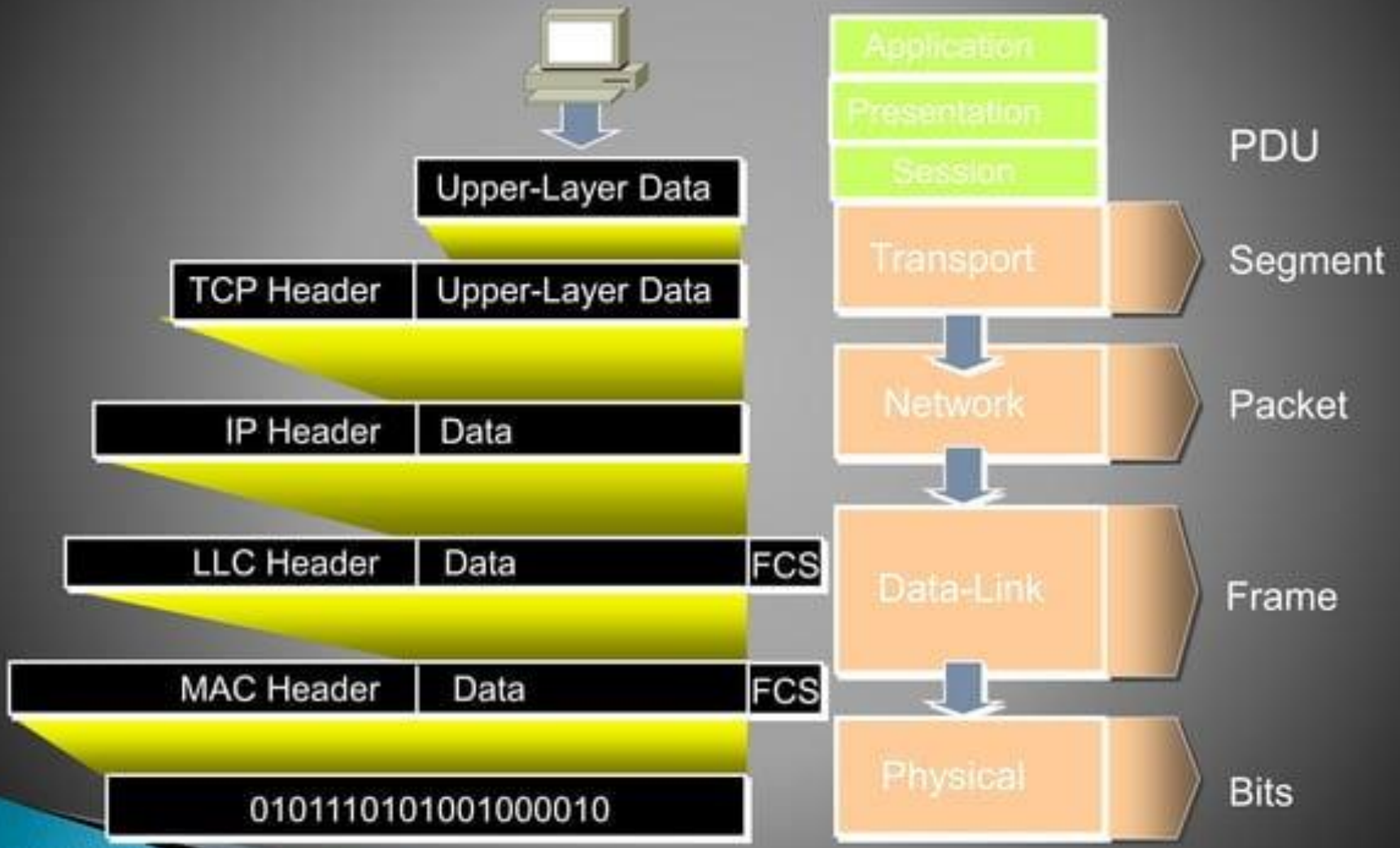
Layer 1 – The Physical Layer

- This is the physical media through which the data, represented as electronic signals, is sent from the source host to the destination host.
- Move bits between devices
- Encoding

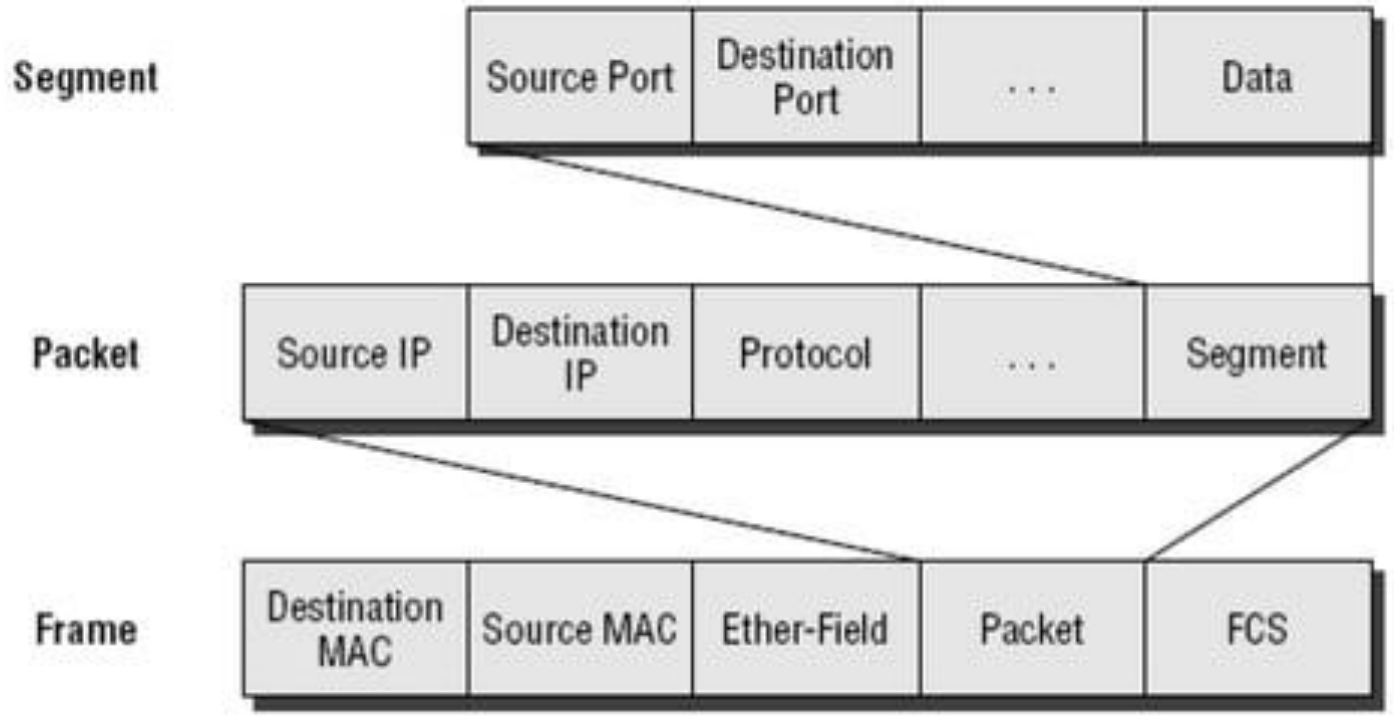
LAYER 1 – The PHYSICAL Layer

- Converts bits into electronic signals for outgoing messages.
- Converts electronic signals into bits for incoming messages.
- This layer manages the interface between the computer and the network medium (coax, twisted pair, etc.)
- This layer tells the driver software for the MAU (media attachment unit, ex. network interface cards (NICs, modems, etc.)) what needs to be sent across the medium.
- The bottom layer of the OSI model.

Data Encapsulation

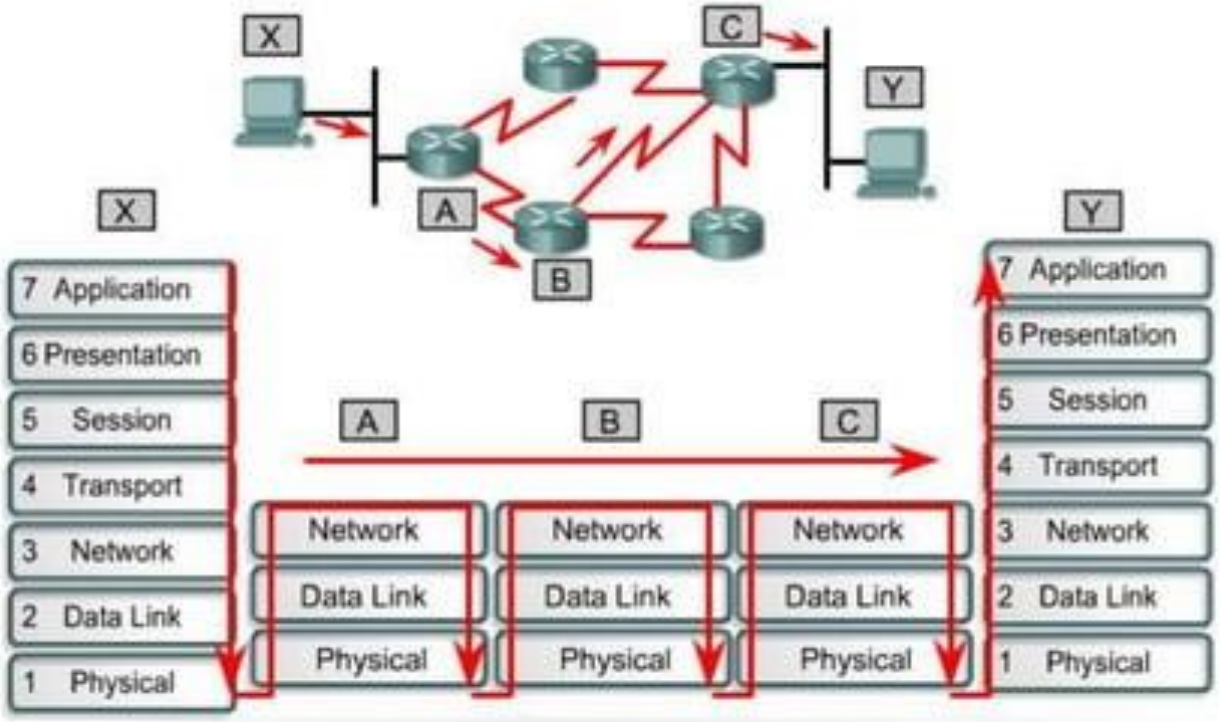


Data Encapsulation



Bit 1011011100011110000

Data Flow Through a Network



Data flow in a network focuses on layers one, two and three of the OSI model. This is after being transmitted by the sending host and before arriving at the receiving host.

TCP/IP MODEL

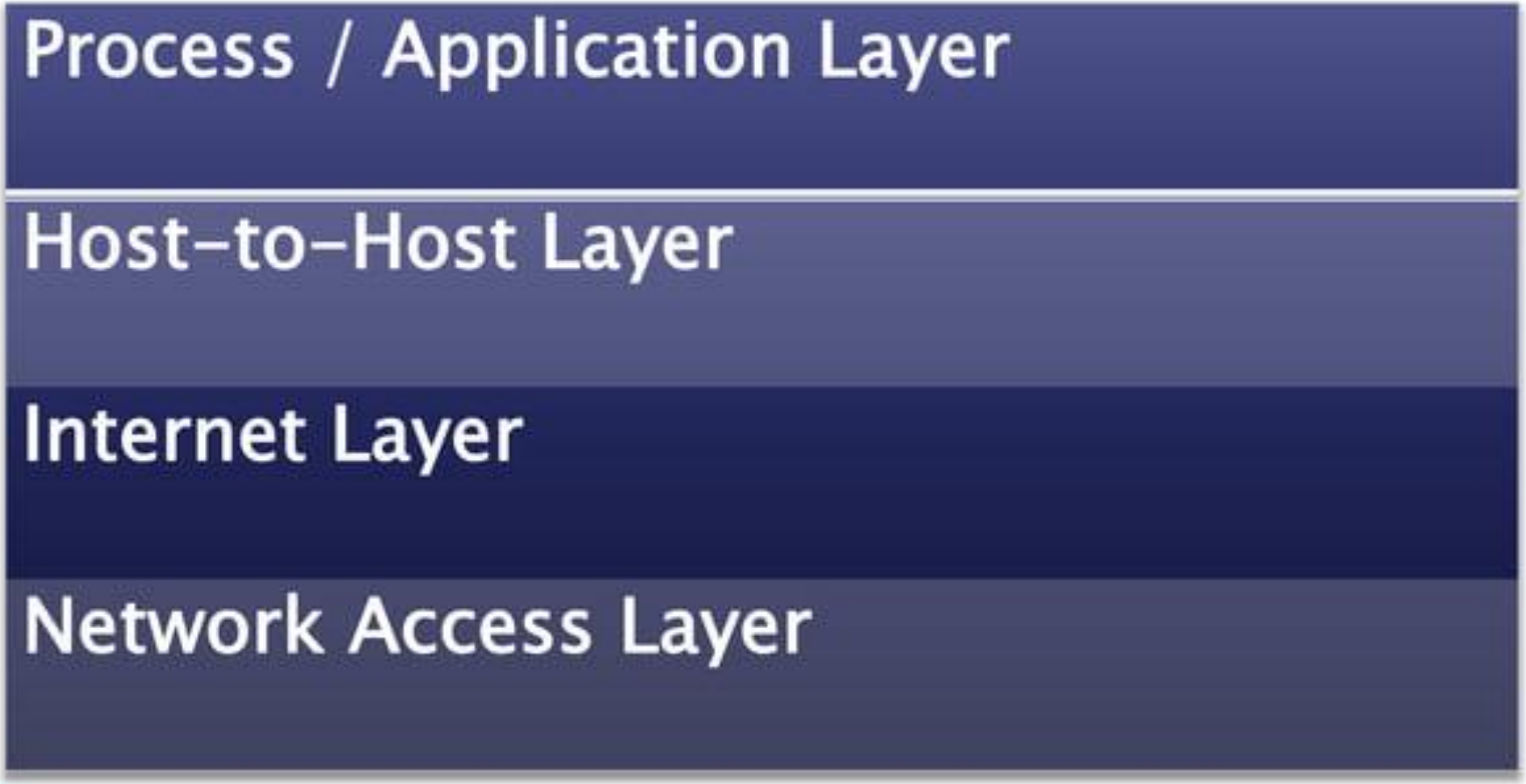
Why Another Model?

Although the OSI reference model is universally recognized, the historical and technical open standard of the Internet is Transmission Control Protocol / Internet Protocol (TCP/IP).

The TCP/IP reference model and the TCP/IP protocol stack make data communication possible between any two computers, anywhere in the world, at nearly the speed of light.

The U.S. Department of Defense (DoD) created the TCP/IP reference model because it wanted a network that could survive any conditions, even a nuclear war.

TCP/IP Protocol Stack



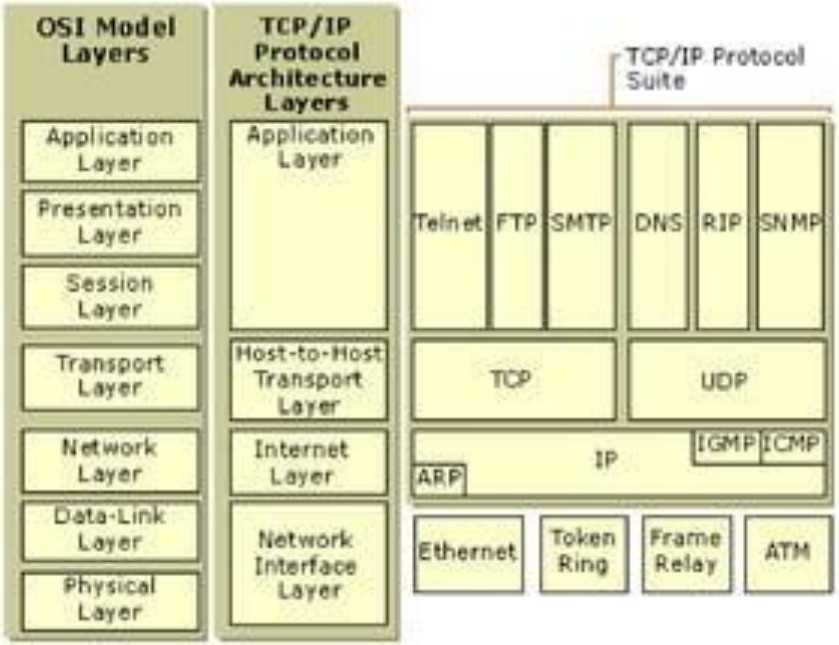
TCP/IP Model

- **Process/Application Layer**
  The Process layer contains protocols that implements user level functions such as mail delivery, file transfer and remote login. This layer is actually the combination of upper three layers of OSI model i.e. Application, Presentation and Session.
- **Host-to Host Layer**
  The Host-to Host layer handles connection assignation, flow control, retransmission of lost data, and other generic data flow management.

TCP/IP Model

- **Internet Layer**
  The Internet layer is responsible for delivering data across a series of different physical networks that interconnect a source and destination machine. Routing protocols are most closely associated with this layer, as is the IP Protocol, the internet's fundamental protocol.
- **Network Access Layer**
  The Network Access layer is responsible for delivering data over the particular hardware media in use. Different protocols are selected from this layer, depending on the type of physical network.

TCP/IP Protocol Suite



OSI(Open System Interconnection)	TCP/IP(Transmission Control Protocol / Internet Protocol)
1. OSI provides layer functioning and also defines functions of all the layers.	1. TCP/IP model is more based on protocols and protocols are not flexible with other layers.
2. In OSI model the transport layer guarantees the delivery of packets	2. In TCP/IP model the transport layer does not guarantees delivery of packets.
3. Follows horizontal approach	3. Follows vertical approach.
4. OSI model has a separate presentation layer	4. TCP/IP does not have a separate presentation layer
5. OSI is a general model.	5. TCP/IP model cannot be used in any other application.
6. Network layer of OSI model provide both connection oriented and connectionless service.	6. The Network layer in TCP/IP model provides connectionless service.
7. OSI model has a problem of fitting the protocols in the model	7. TCP/IP model does not fit any protocol
8. Protocols are hidden in OSI model and are easily replaced as the technology changes.	8. In TCP/IP replacing protocol is not easy.
9. OSI model defines services, interfaces and protocols very clearly and makes clear distinction between them.	9. In TCP/IP it is not clearly separated its services, interfaces and protocols.
10. It has 7 layers	10. It has 4 layers