Indian Institute of Information Technology, Nagpur

Course: Computer Networks (CSL 302, Core)

5th Semester

Topics Covered

- Layered Architecture
- OSI Model

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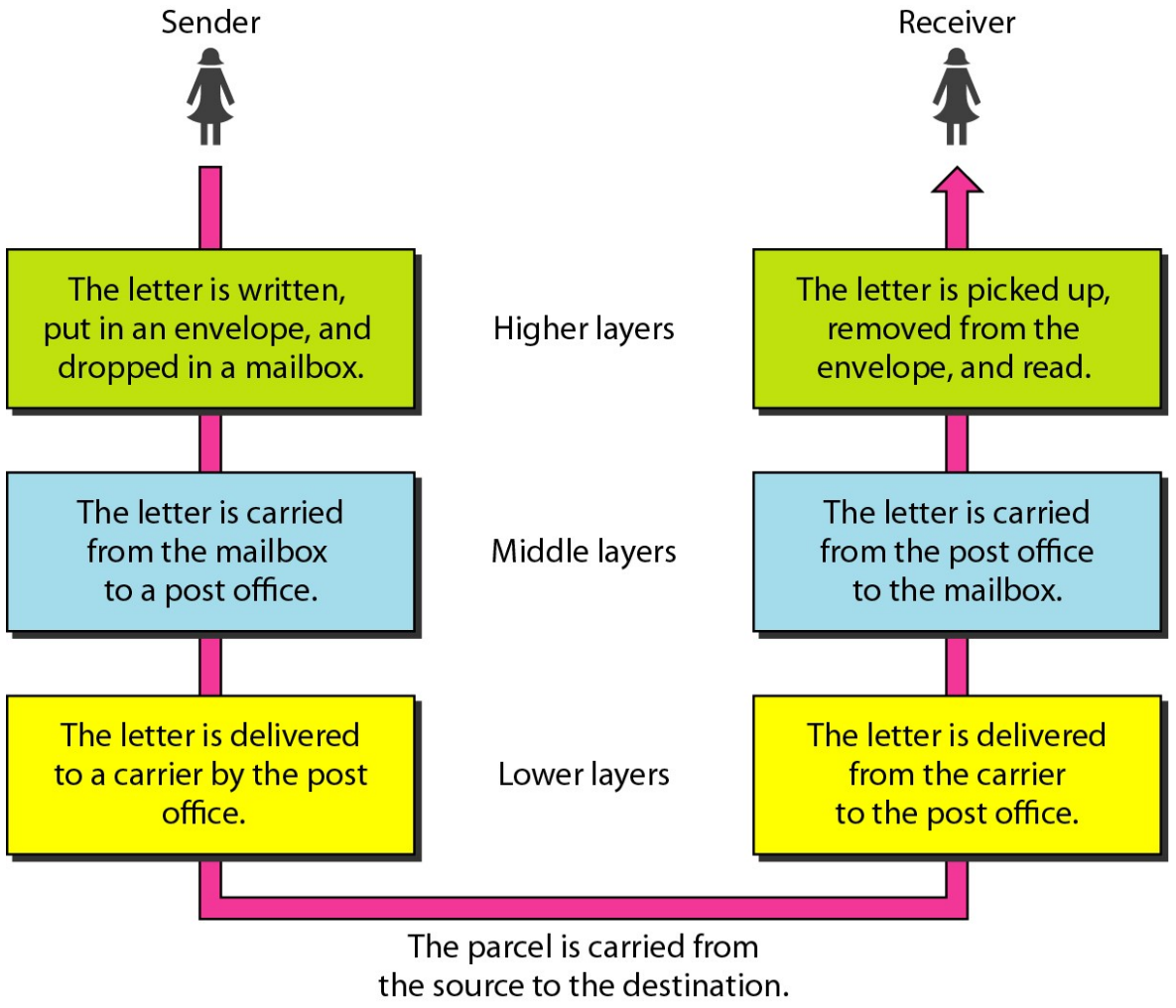
Introduction

- Computer network - complex piece of H/W and S/W
- Early attempts for implemention
  - Based on a single, complex, unstructured program with many interacting components
  - Resultant software - very difficult to test and modify
- The International organization of Standardization (ISO) has developed a layered approach to overcome such problem
- In a layered approach
  - Networking concept is divided into several layers, and each layer is assigned a particular task
  - Networking tasks depend upon the layers

Cont…

- Example: Communication through postal mail

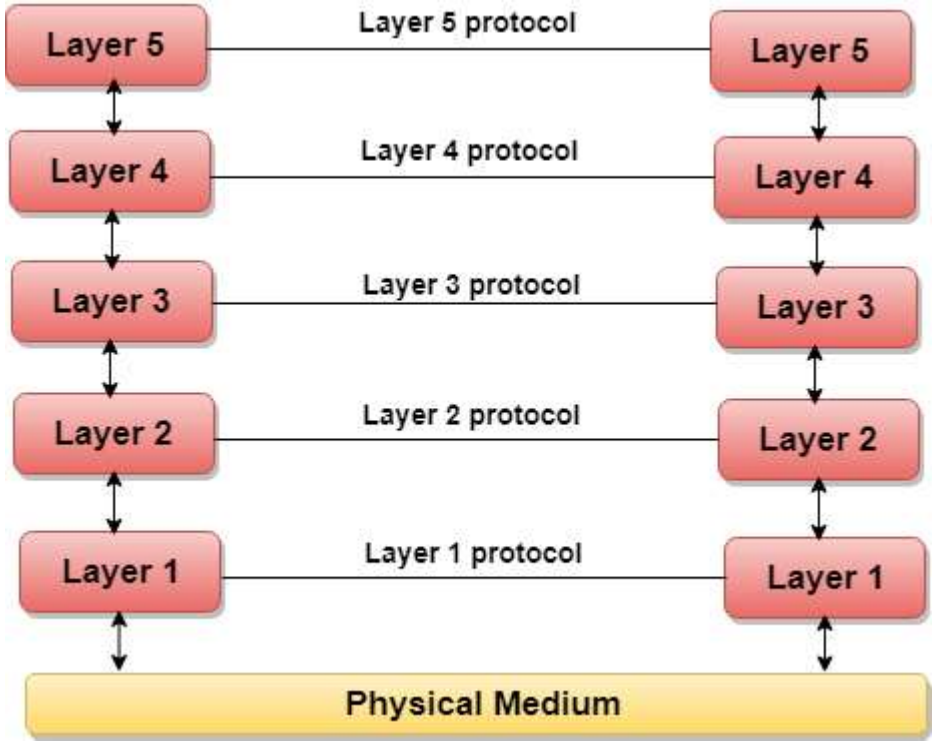


Cont…

- Layered Architecture
  - Aim - to divide the design into small pieces
  - Each lower layer adds its services to the higher layer to provide a full set of services to manage communications and run the applications
  - Provides modularity and clear interfaces
    - i.e. provides interaction between subsystems
  - Ensures the independence between layers
    - by providing the services from lower to higher layer without defining how the services are implemented
  - Any modification in a layer will not affect other layers

Cont…

- An example of the five-layered architecture



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- Basic elements of layered architecture
  - **Service:** Set of actions/assistances that a layer provides to the higher layer
  - **Protocol:** Defines a set of rules that a layer uses to exchange the information with peer entity
  - **Interface:** Way through which the message is transferred from one layer to another layer

Cont…

- Need for Layered architecture
  - Divide-and-conquer approach
    - Makes a design process in such a way that the unmanageable tasks are divided into small and manageable tasks
  - Modularity
    - Provides the independence of layers, which is easier to understand and implement
  - Easy to modify
    - Implementation in one layer can be changed without affecting other layers
  - Easy to test
    - Each layer can be analyzed and tested individually

Open System Interconnection Model

- The International Standards Organization (ISO) introduced Open System Interconnection (OSI) Model in the late 1970s
- ISO OSI model
  - A Reference Model - describes how information from a software application in one computer moves through a physical medium to the software application in another computer
  - Consists of seven layers, and each layer performs particular network functions
  - Each layer is self-contained, so that tasks assigned to each layer can be performed independently

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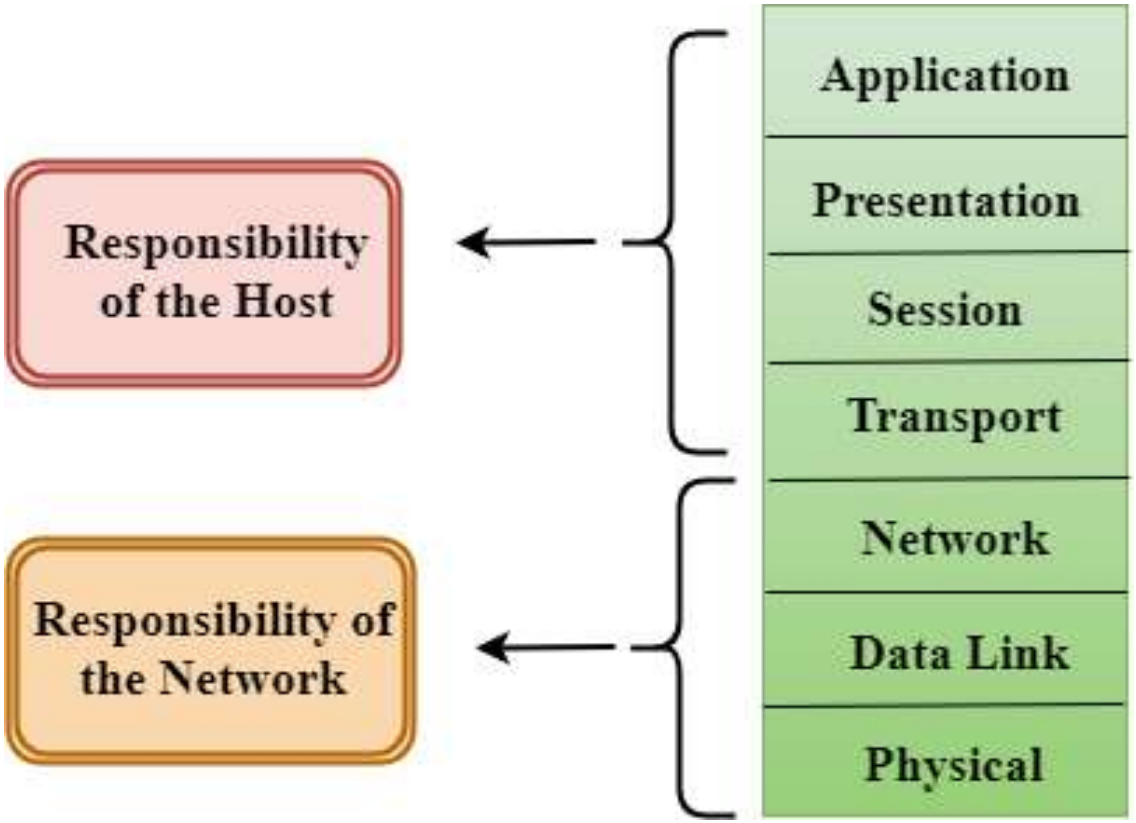

Fig: OSI model

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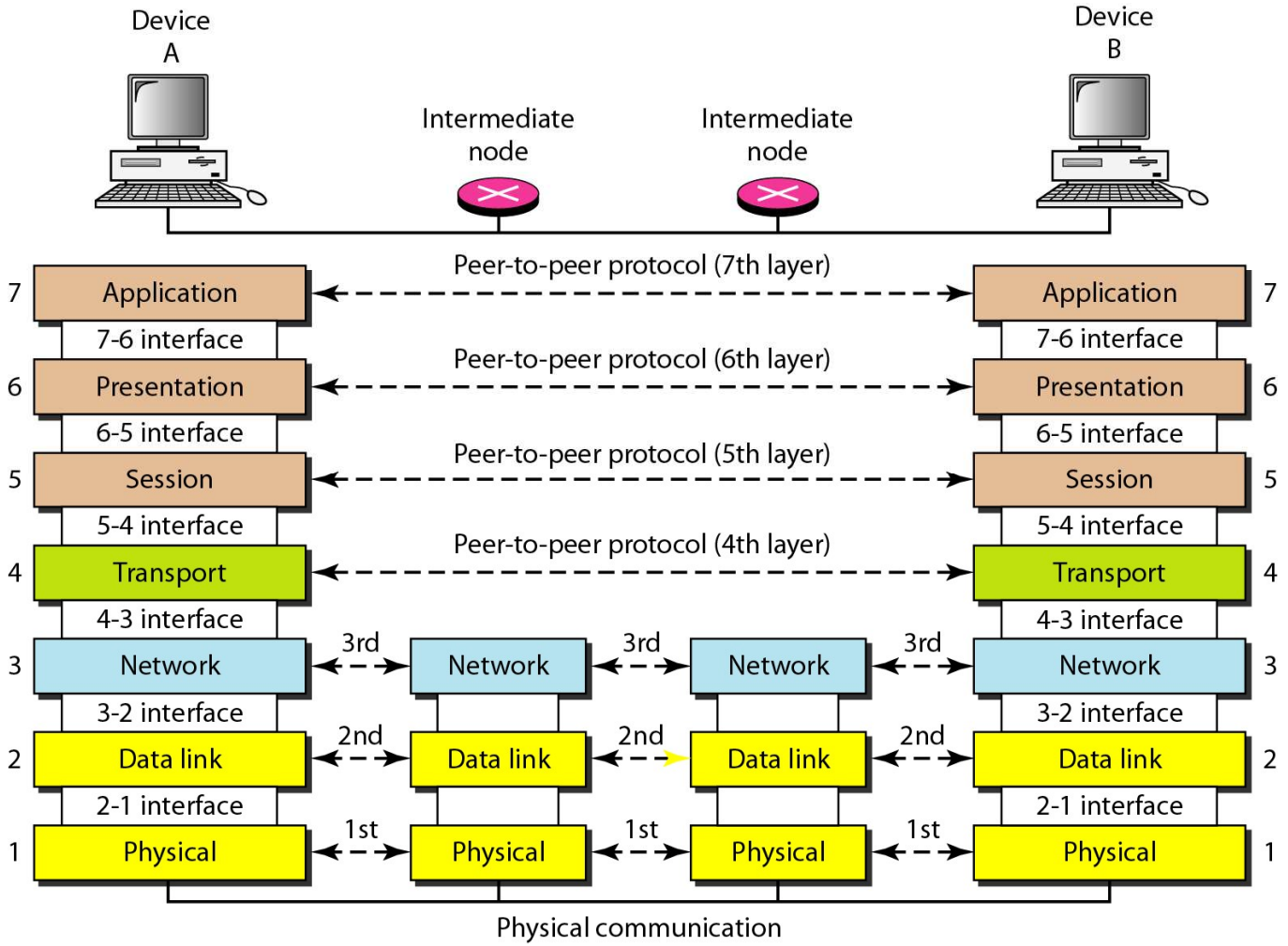
- OSI Model



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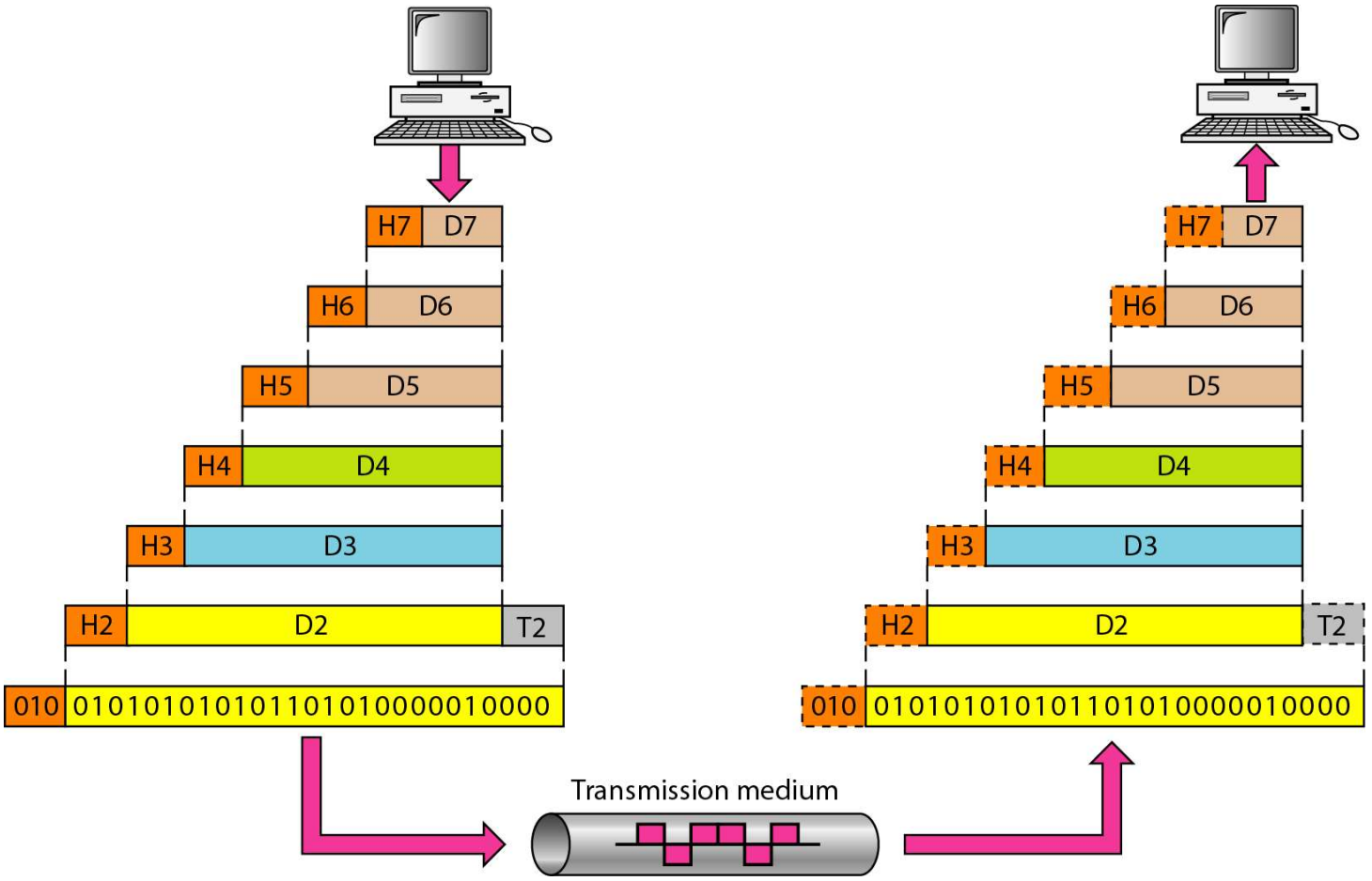
H7
D7
H6
D6
H5
D5
H4
D4
H3
D3
H2
D2
T2
010
0101010101011010100000010000
Transmission medium

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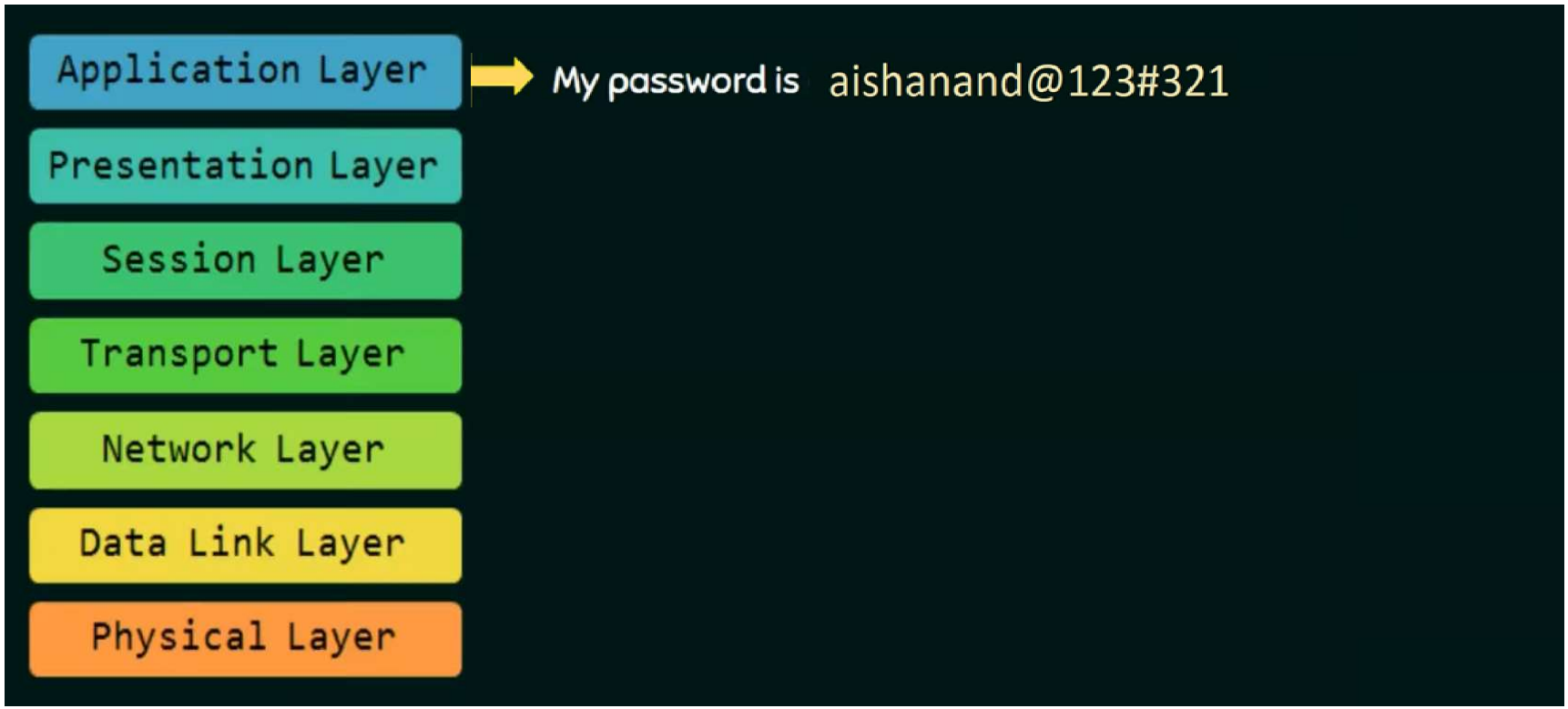
- Layers in OSI Reference Model



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- Layers in OSI Reference Model

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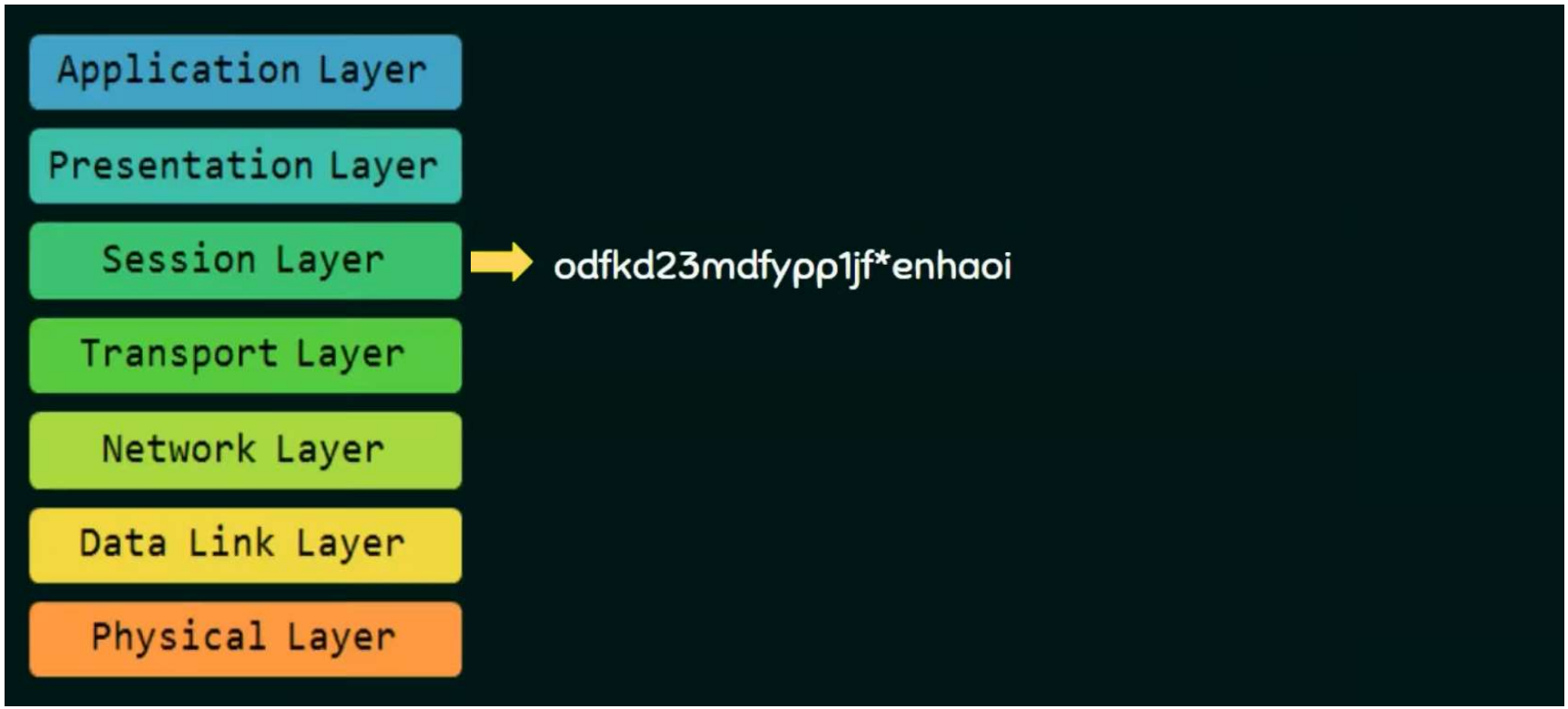
- Layers in OSI Reference Model



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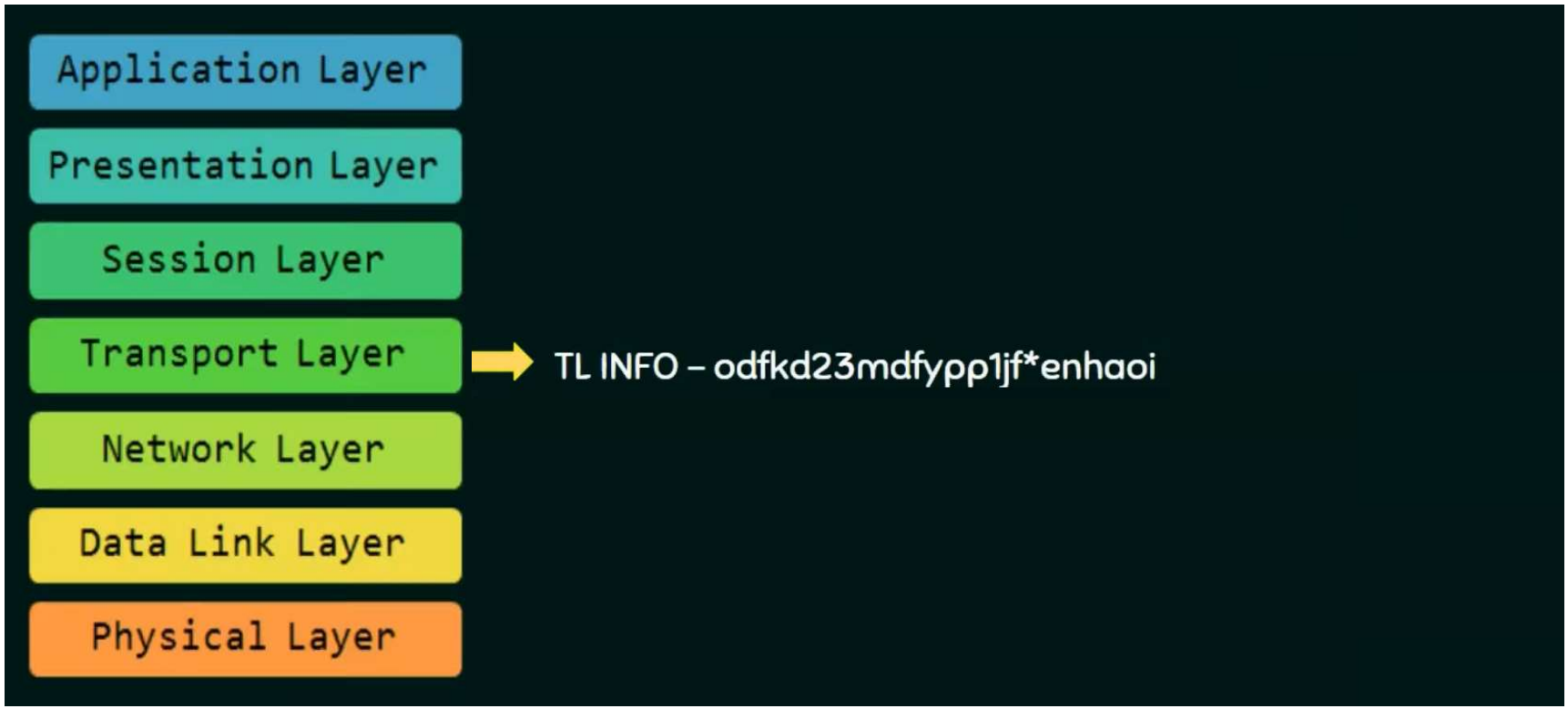
- Layers in OSI Reference Model



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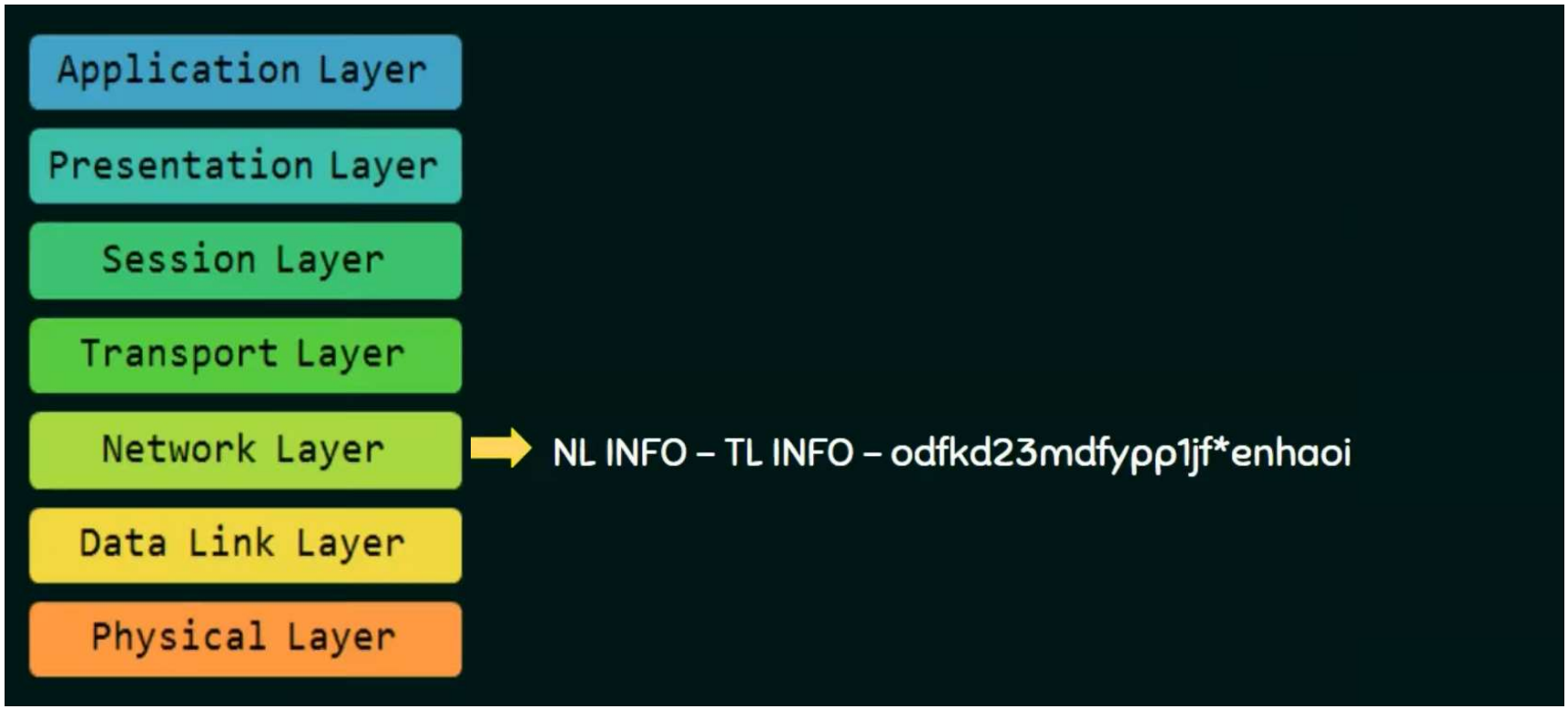
- Layers in OSI Reference Model



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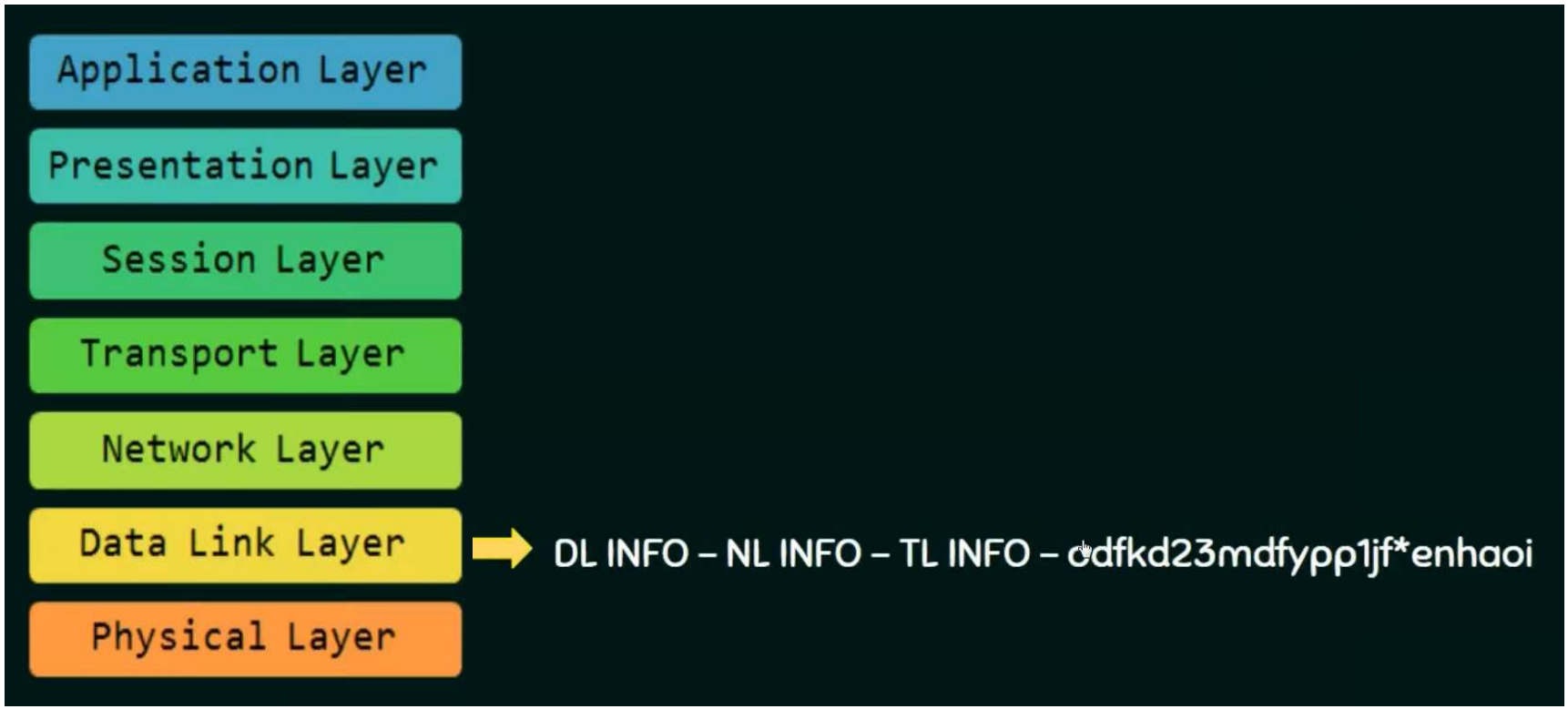
- Layers in OSI Reference Model



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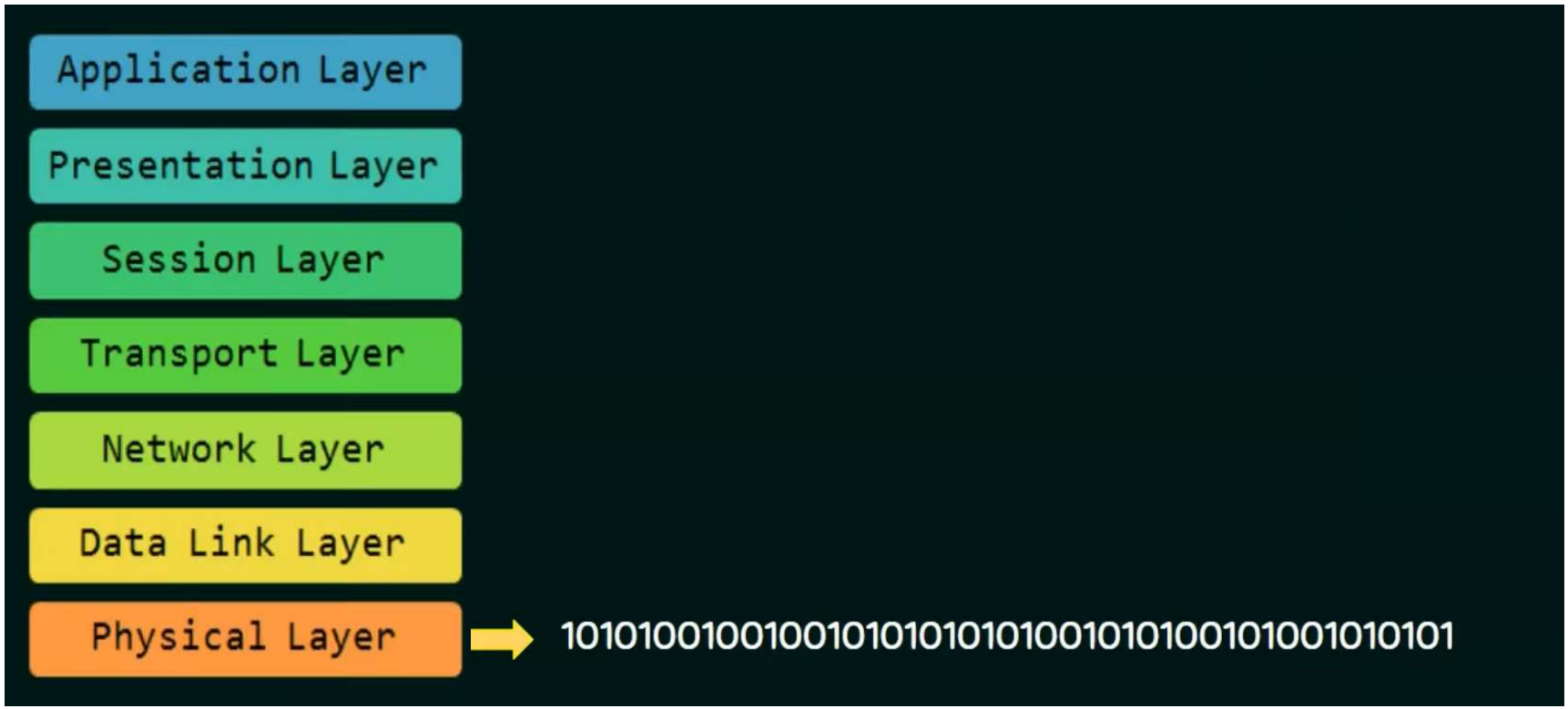
- Layers in OSI Reference Model



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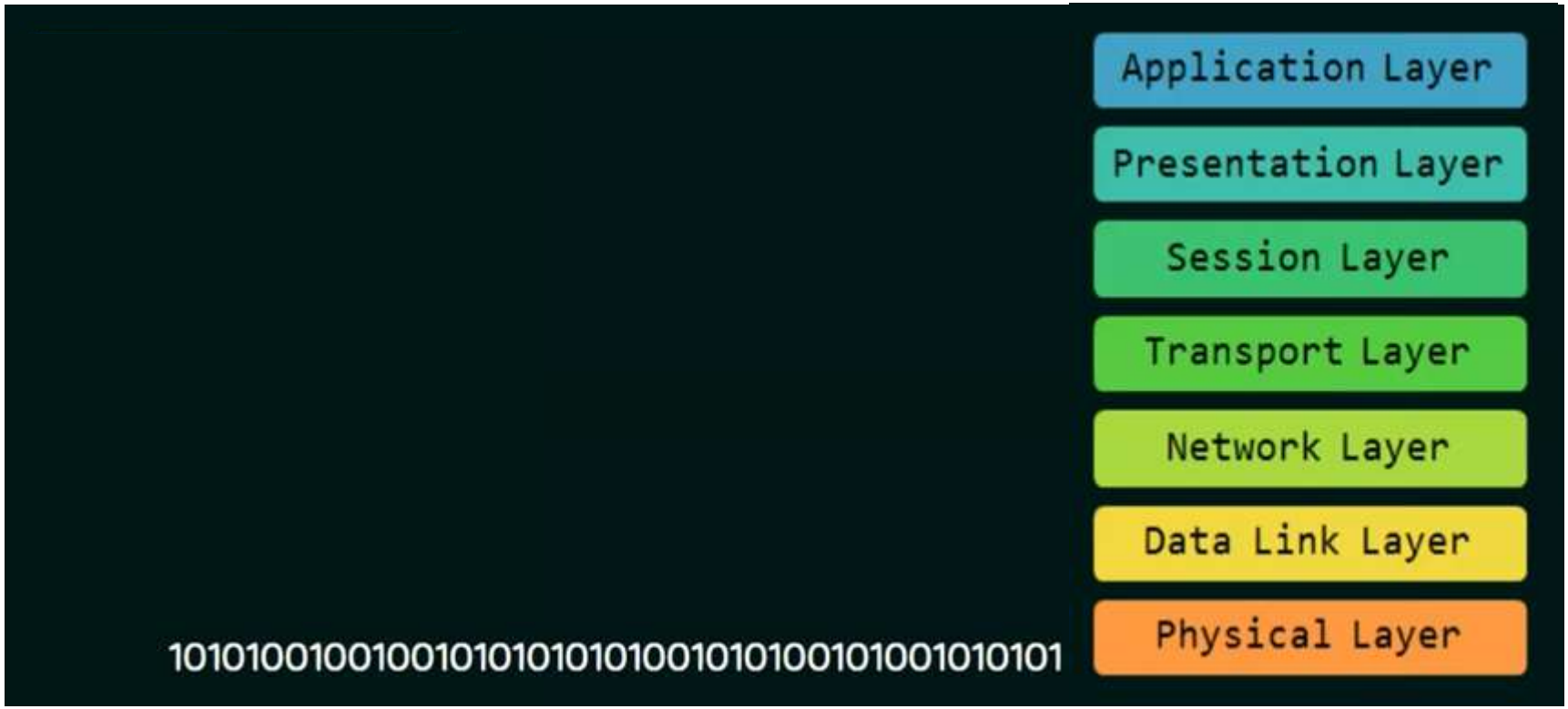
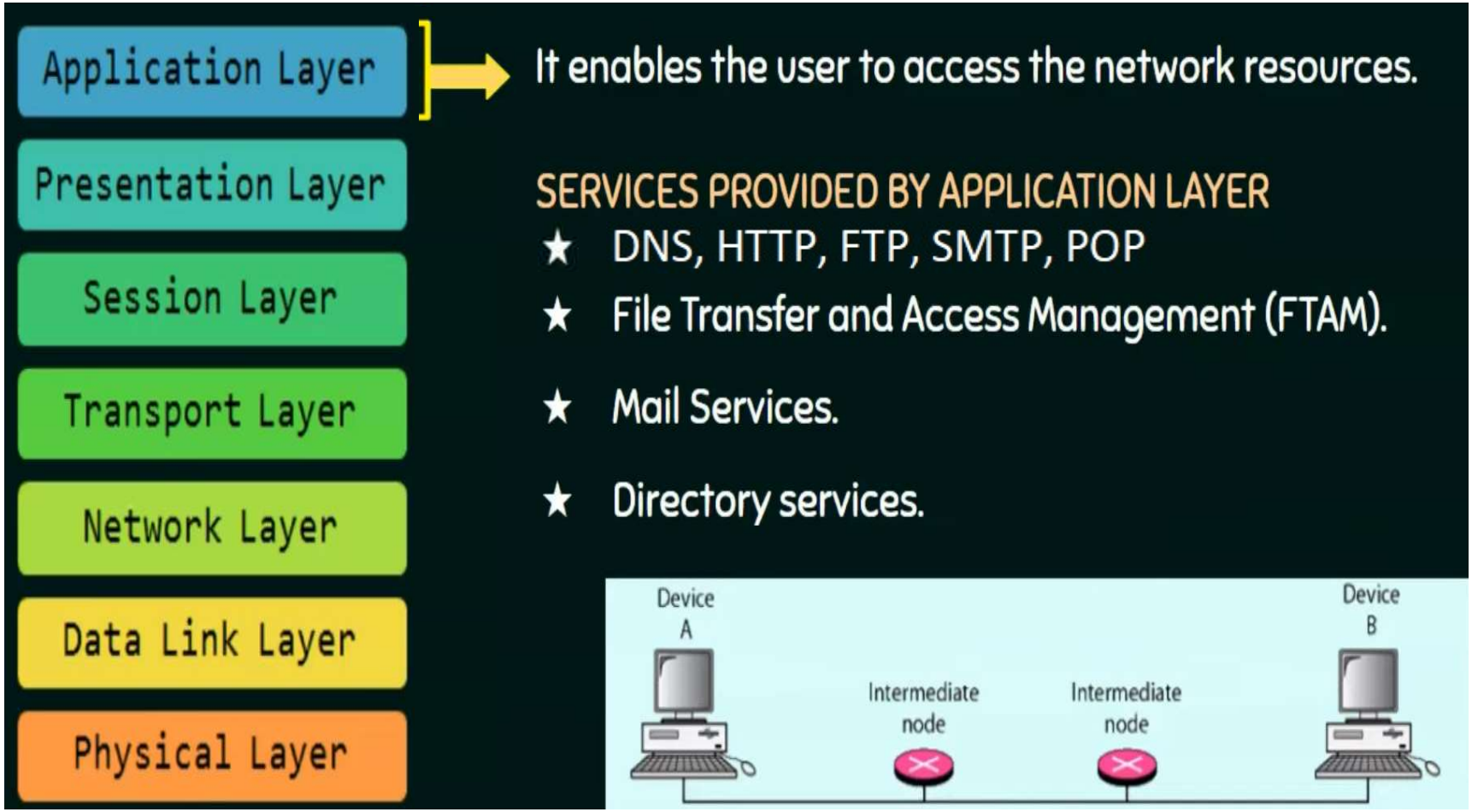
- Layers in OSI Reference Model



Functions of OSI Layers



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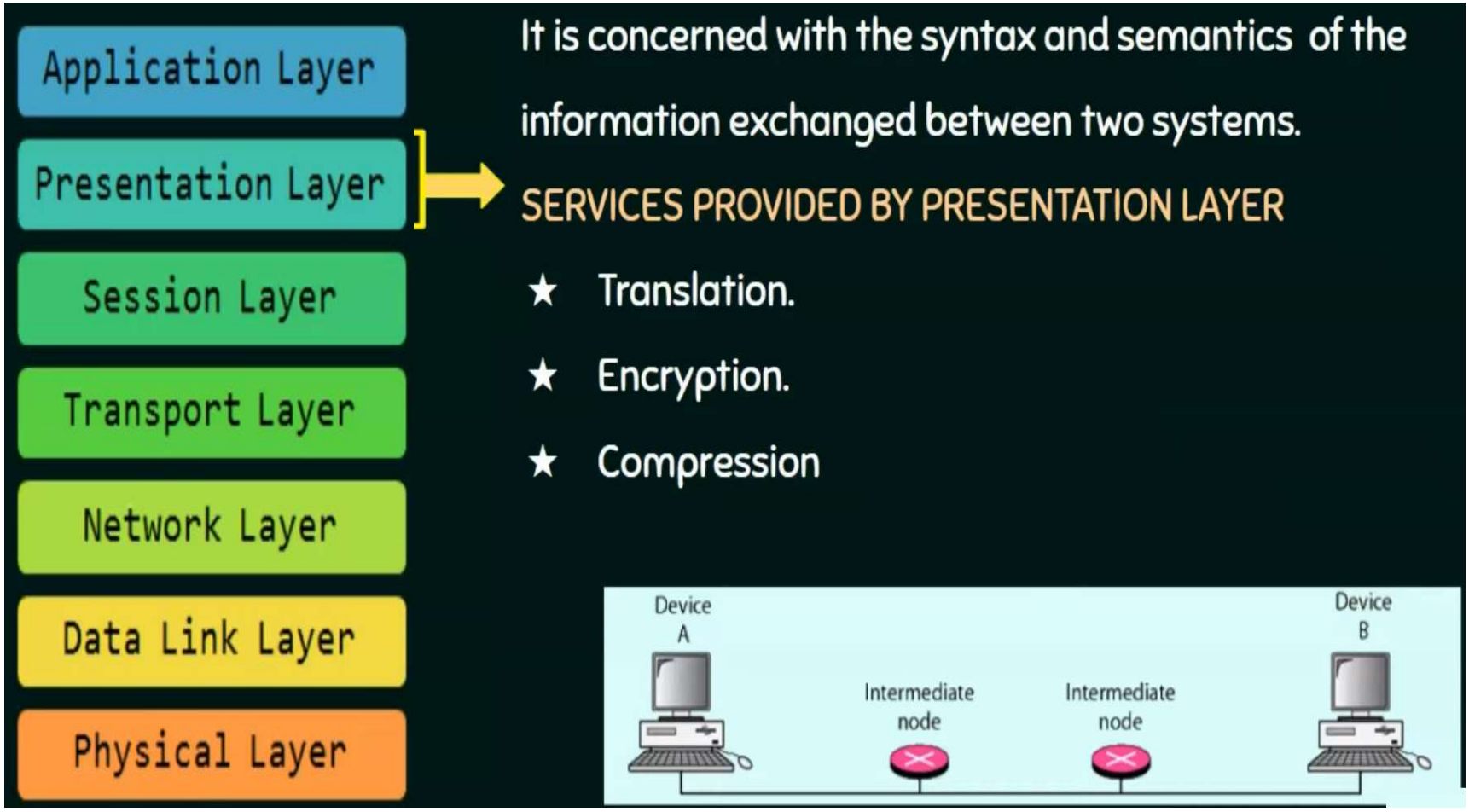
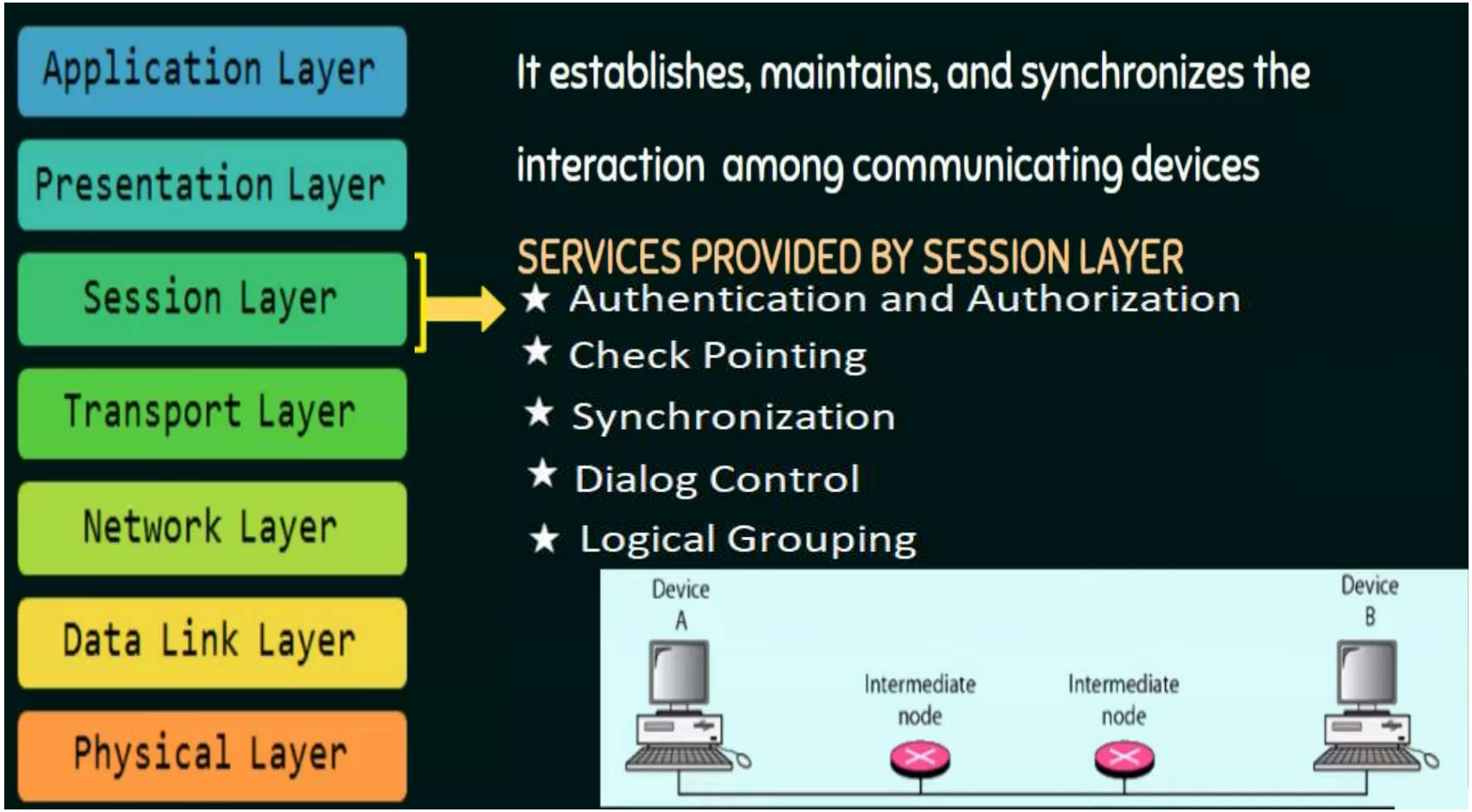
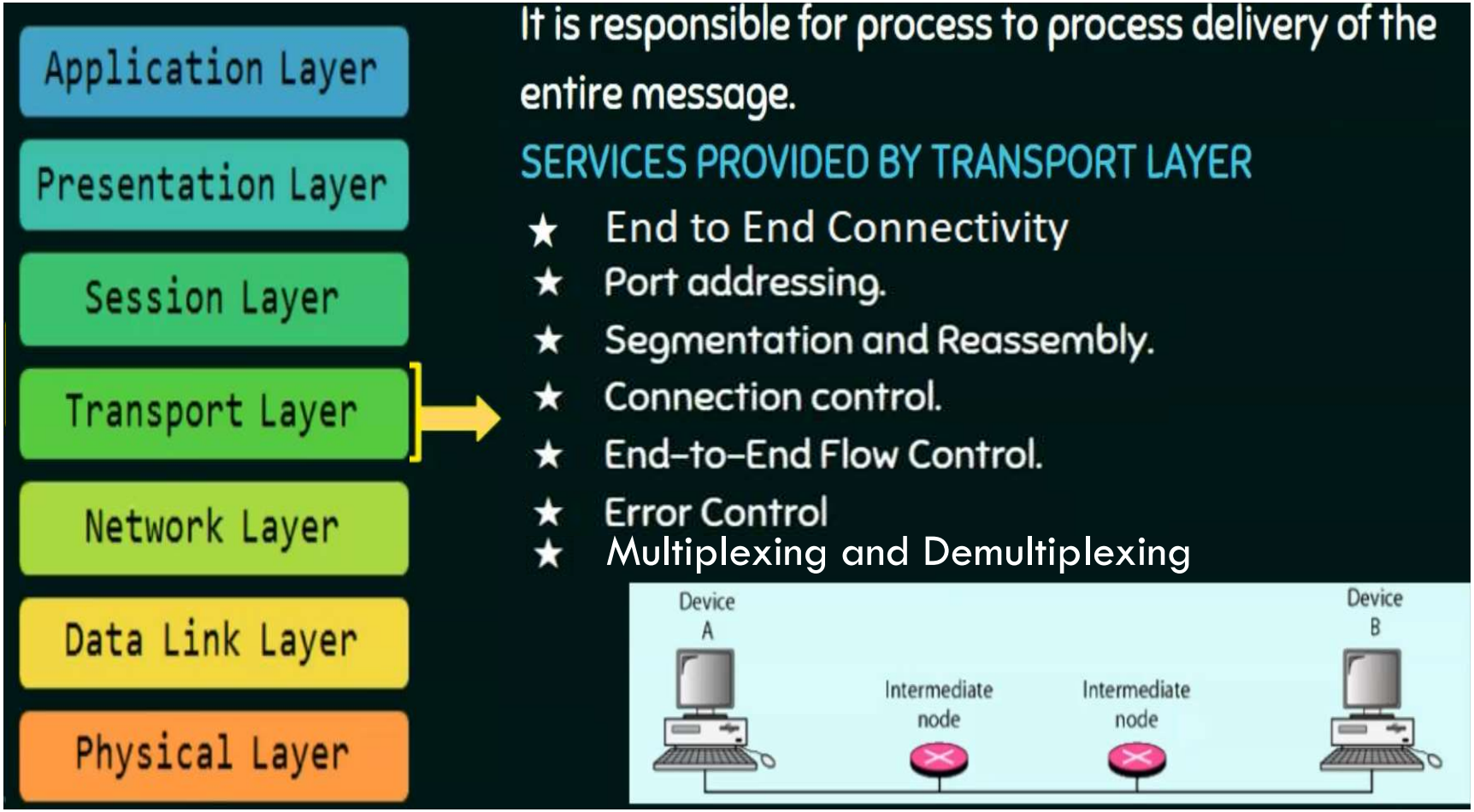

Application Layer
Presentation Layer
Session Layer
Transport Layer
Network Layer
Data Link Layer
Physical Layer
It is concerned with the syntax and semantics of the information exchanged between two systems.
SERVICES PROVIDED BY PRESENTATION LAYER
★ Translation.
★ Encryption.
★ Compression
Device A
Intermediate node
Intermediate node
Device B

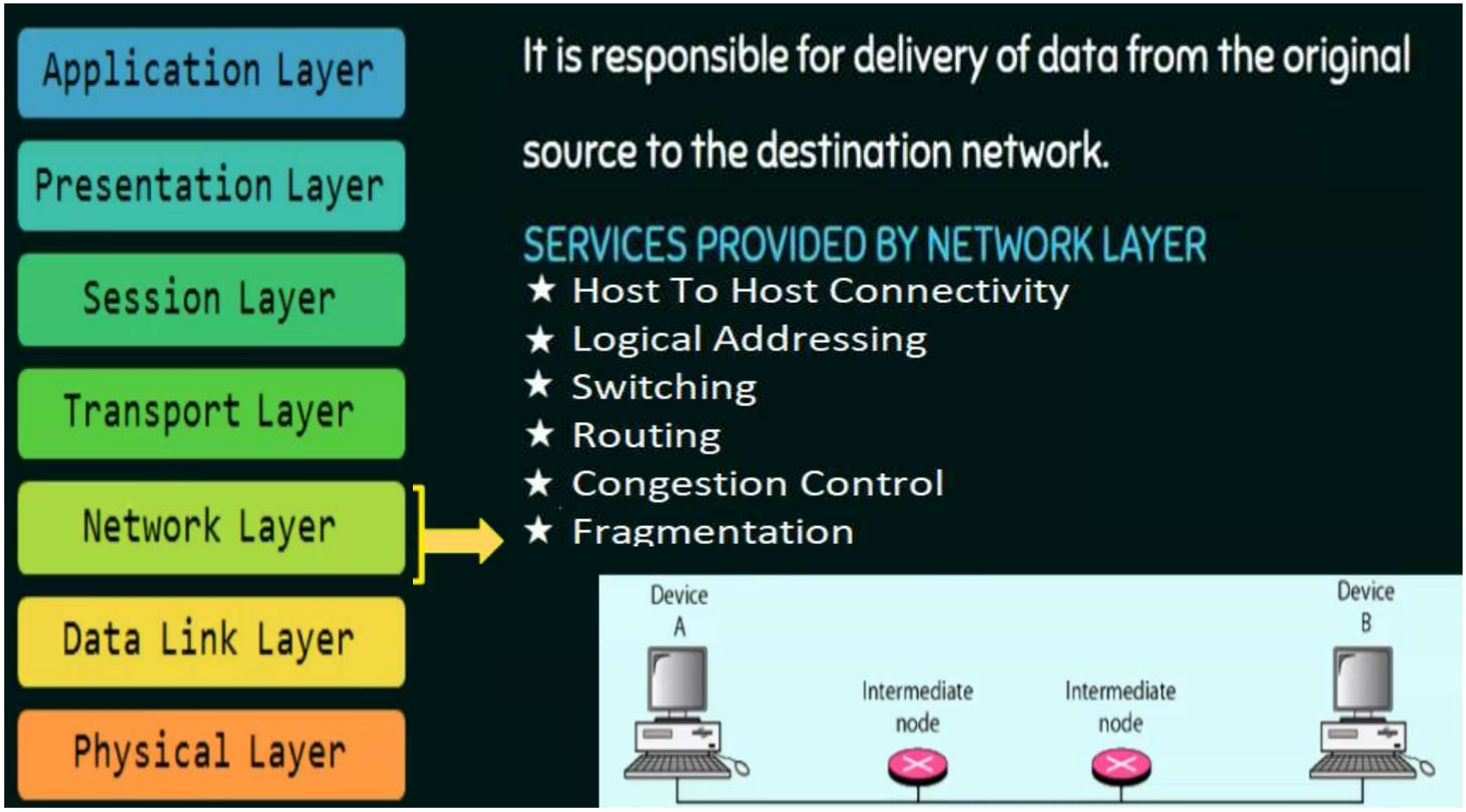
Cont…


Application Layer
Presentation Layer
Session Layer
Transport Layer
Network Layer
Data Link Layer
Physical Layer
It establishes, maintains, and synchronizes the interaction among communicating devices
SERVICES PROVIDED BY SESSION LAYER
★ Authentication and Authorization
★ Check Pointing
★ Synchronization
★ Dialog Control
★ Logical Grouping
Device A
Intermediate node
Intermediate node
Device B

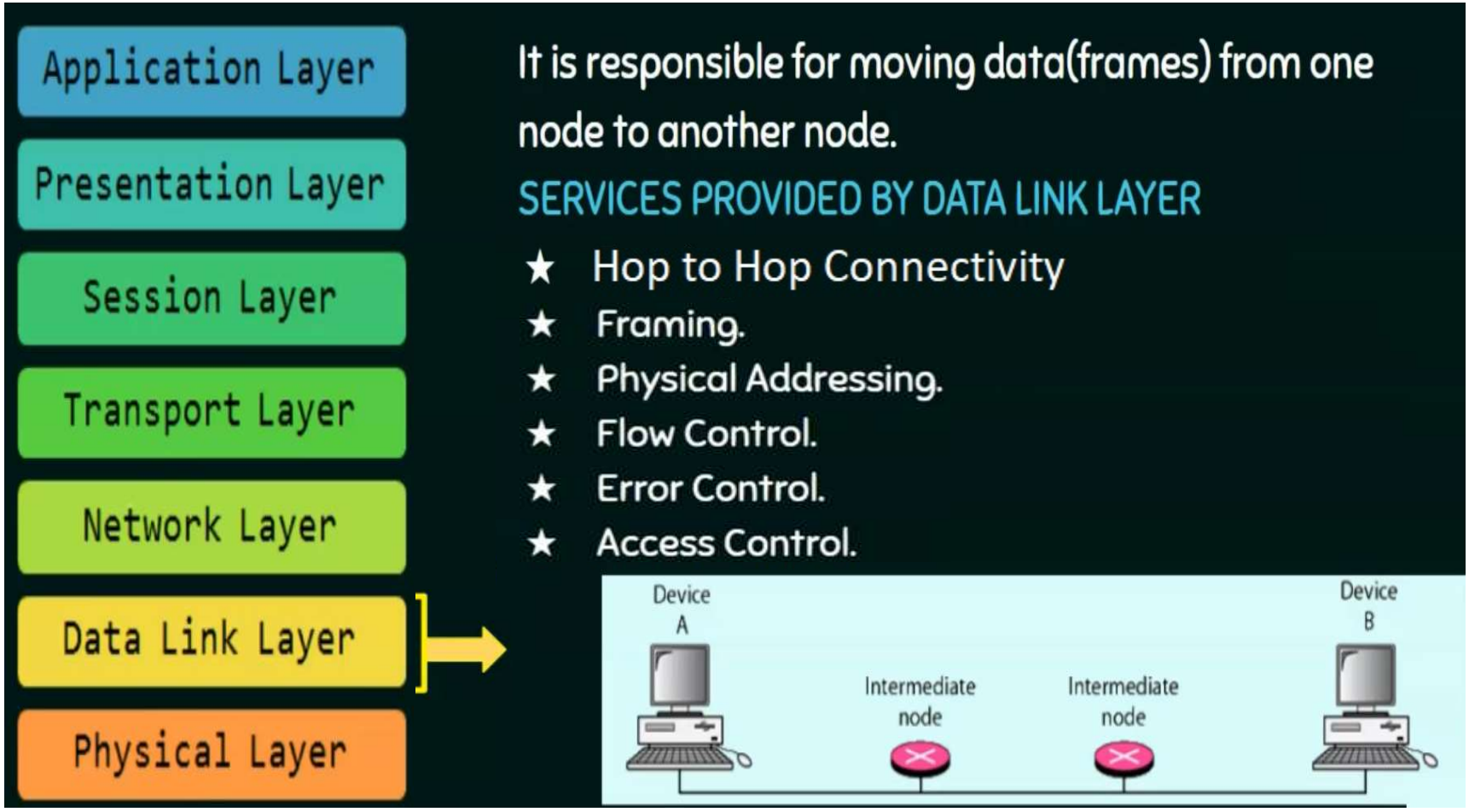
Cont…


Application Layer
Presentation Layer
Session Layer
Transport Layer
Network Layer
Data Link Layer
Physical Layer
It is responsible for process to process delivery of the entire message.
SERVICES PROVIDED BY TRANSPORT LAYER
★ End to End Connectivity
★ Port addressing.
★ Segmentation and Reassembly.
★ Connection control.
★ End-to-End Flow Control.
★ Error Control
★ Multiplexing and Demultiplexing
Device A
Intermediate node
Intermediate node
Device B

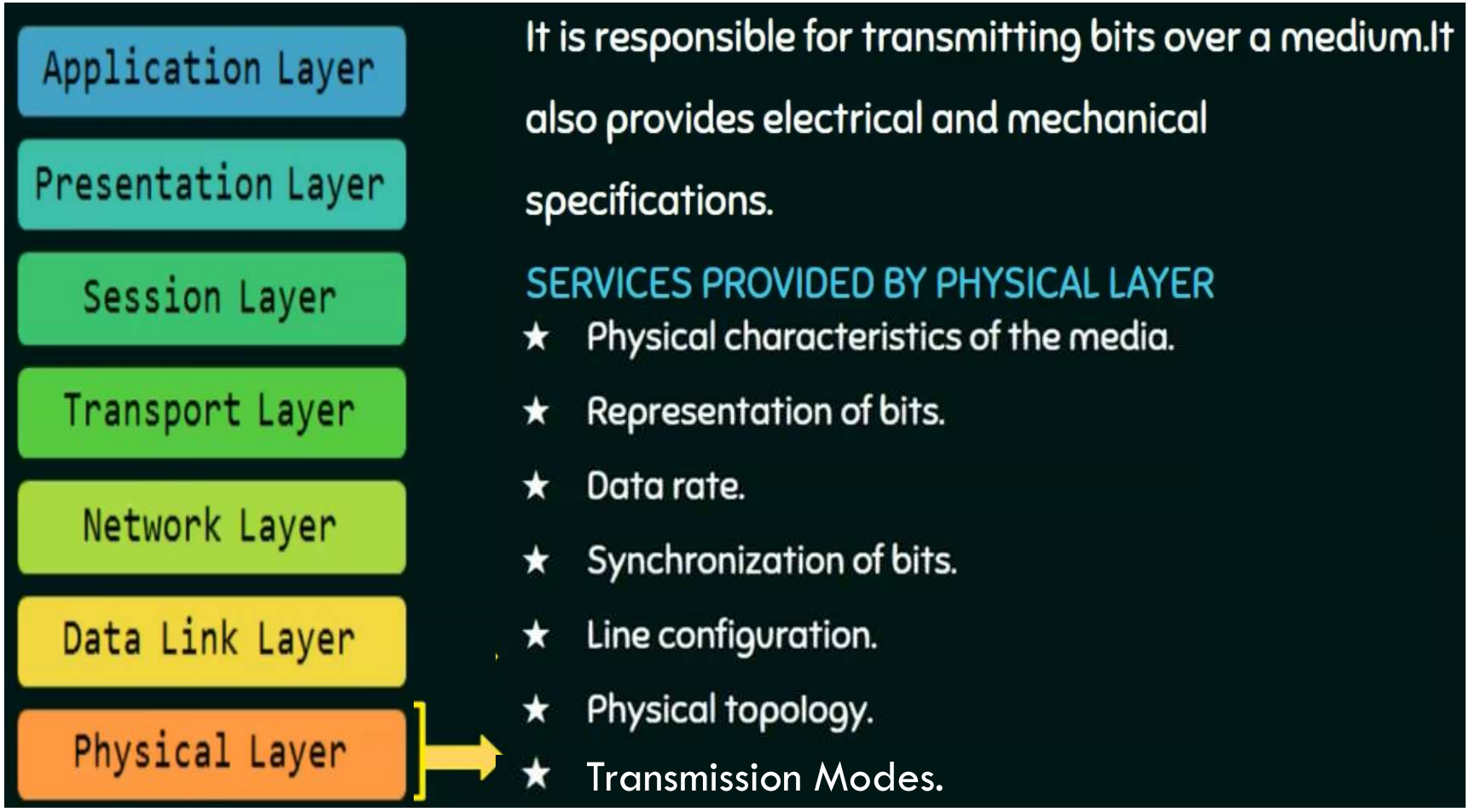
Cont…


Application Layer
Presentation Layer
Session Layer
Transport Layer
Network Layer
Data Link Layer
Physical Layer
It is responsible for delivery of data from the original source to the destination network.
SERVICES PROVIDED BY NETWORK LAYER
★ Host To Host Connectivity
★ Logical Addressing
★ Switching
★ Routing
★ Congestion Control
★ Fragmentation
Device A
Intermediate node
Intermediate node
Device B

Cont…


Application Layer
Presentation Layer
Session Layer
Transport Layer
Network Layer
Data Link Layer
Physical Layer
It is responsible for moving data(frames) from one node to another node.
SERVICES PROVIDED BY DATA LINK LAYER
★ Hop to Hop Connectivity
★ Framing.
★ Physical Addressing.
★ Flow Control.
★ Error Control.
★ Access Control.
Device A
Intermediate node
Intermediate node
Device B

Cont…


Application Layer
Presentation Layer
Session Layer
Transport Layer
Network Layer
Data Link Layer
Physical Layer
It is responsible for transmitting bits over a medium.It also provides electrical and mechanical specifications.
SERVICES PROVIDED BY PHYSICAL LAYER
★ Physical characteristics of the media.
★ Representation of bits.
★ Data rate.
★ Synchronization of bits.
★ Line configuration.
★ Physical topology.
★ Transmission Modes.