Chapter

ISO-OSI Reference Model and IEEE Standards

Chapter Objectives

- Discuss the most popular ISO-OSI 7-layer communication reference model
- Explain the reference model and standards relevant to network communications
- Describe the different IEEE standards that apply to different types of networks

Module 1

An Overview of ISO and its

7-Layer OSI Model

Models and Standards in Communication

- Communication
  - Established standards
  - Standards are known as protocols
- Implementation
  - A framework is helpful in the design of hardware and software for communication
  - ISO-OSI Model serves this purpose
  - ISO-OSI supersedes the TCP/IP model

ISO and OSI Defined

- ISO
  - International Standards Organization
- OSI
  - Open Systems Interconnect

OSI Model Background

- Introduced in 1978 and revised in 1984
- Formulates the communication process into structured layers
- There are seven layers in the model, hence the name the 7-Layer model
- The model acts as a frame of reference in the design of communications and networking products

The Layered Approach to Communication

7. Application

6. Presentation

5. Session

4. Transport

3. Network

2. Data Link

1. Physical

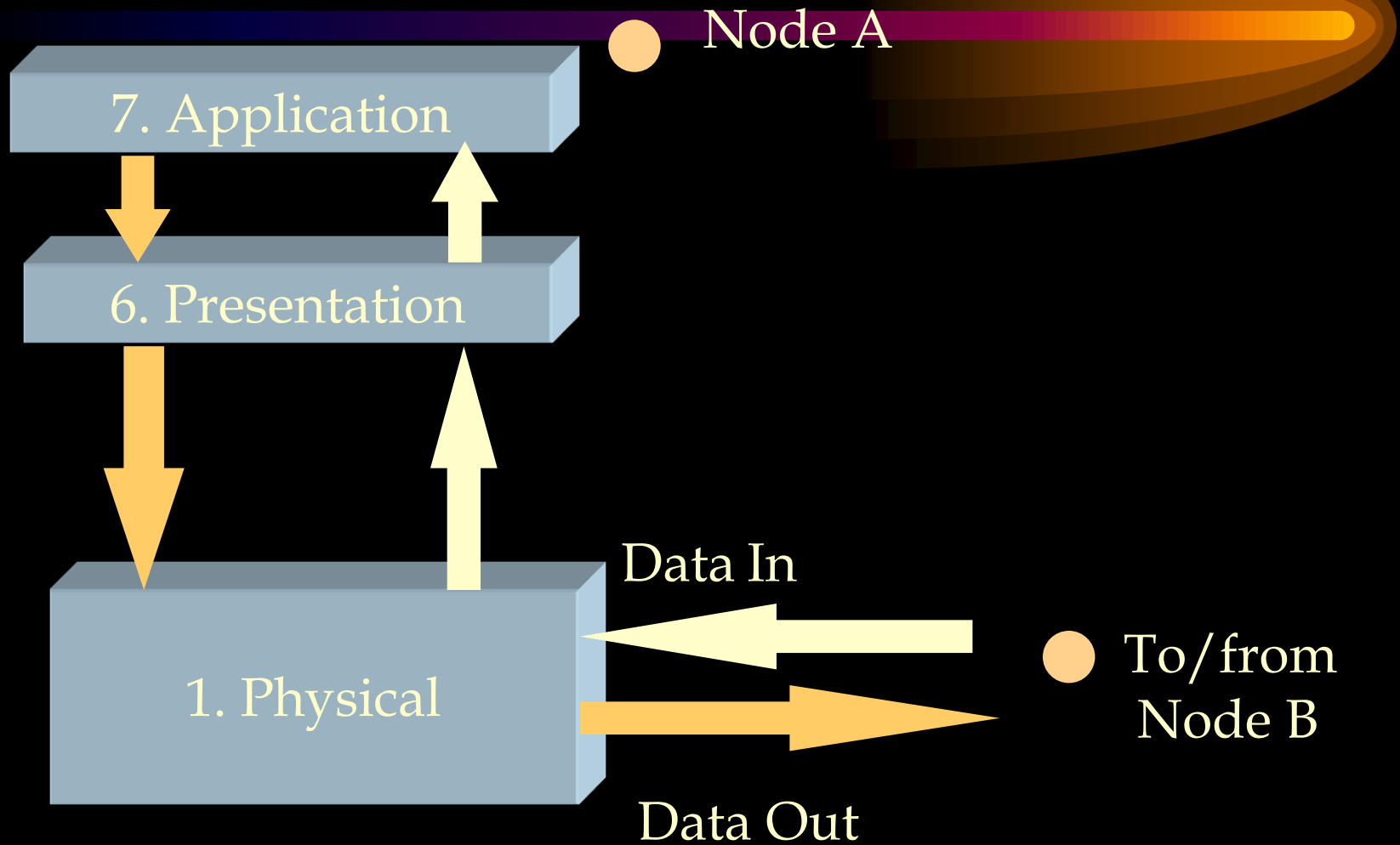# *Division of Layers*

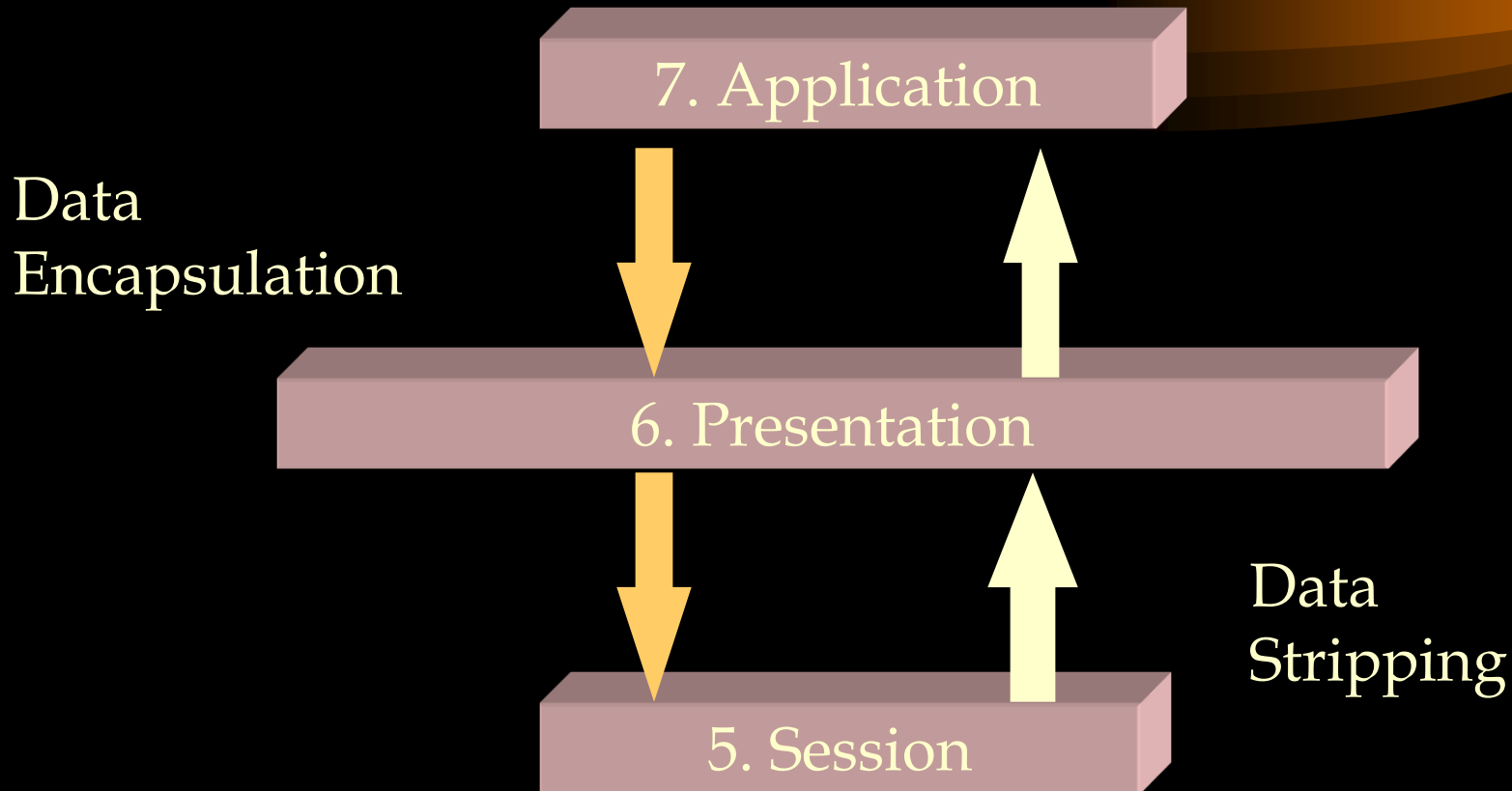| Layers	Division
7. Application	
6. Presentation	Upper Layers
5. Session	
4. Transport	← Middle Layer
3. Network	
2. Data Link	Lower Layers
1. Physical	

The Function of a Layer

- Each layer deals with one aspect of networking
  - Layer 1 deals with the communication media
- Each layer communicates with the adjacent layers
  - In both directions
  - Ex: Network layer communicates with:
    - Transport layer
    - Data Link layer
- Each layer formats the data packet
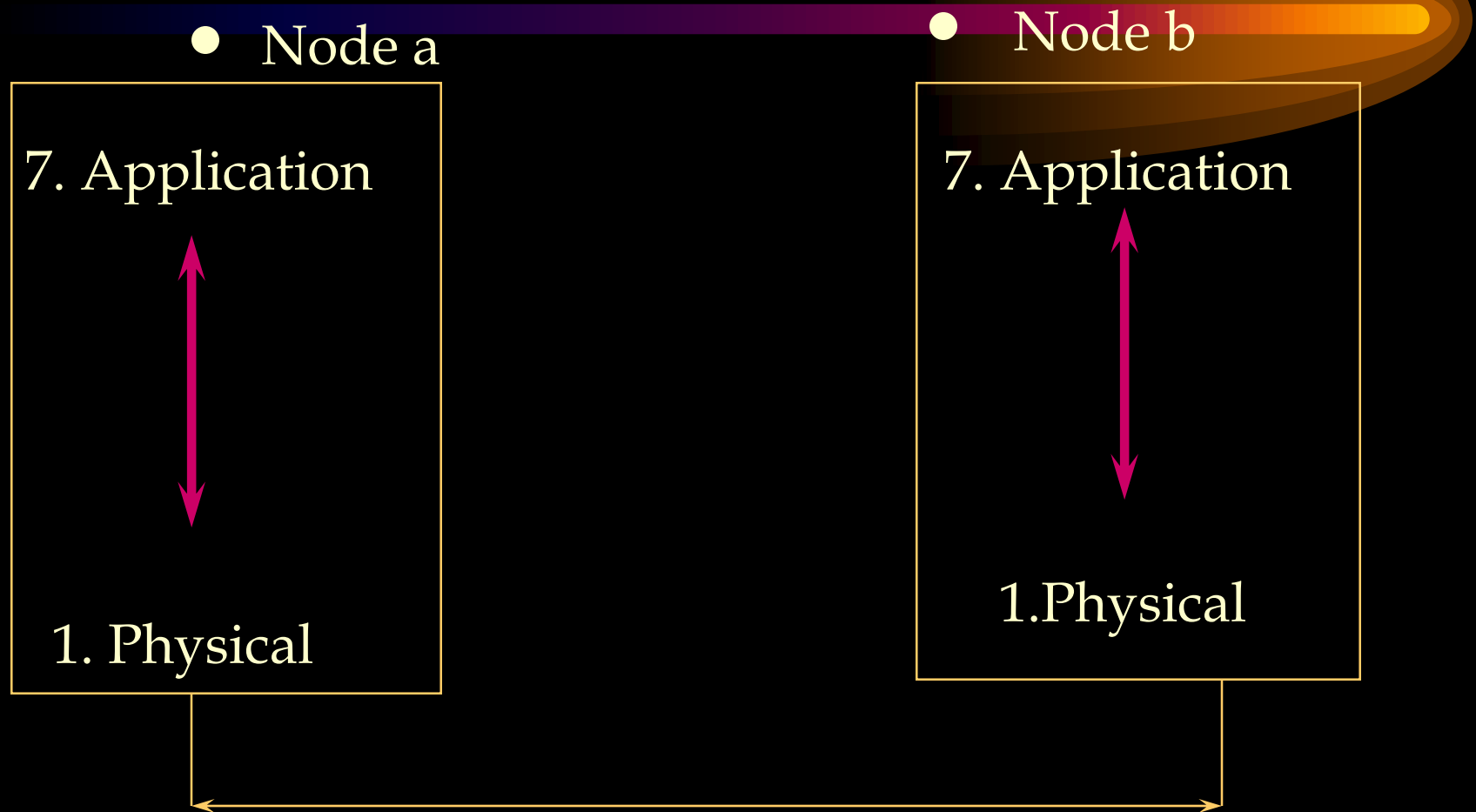 - Ex: Adds or deletes addresses

Role of Layers

Node A

7. Application

6. Presentation

1. Physical

Data In

Data Out

To/from
Node B

Communication Between Layers

Data
Encapsulation

7. Application

6. Presentation

Data
Stripping

5. Session

The Role of Layers in Point-to-point Communication

● Node a   ● Node b

7. Application

7. Application

1. Physical

1.Physical

Virtual Communication Between Layers

7. Application		7. Application
3. Network		3. Network
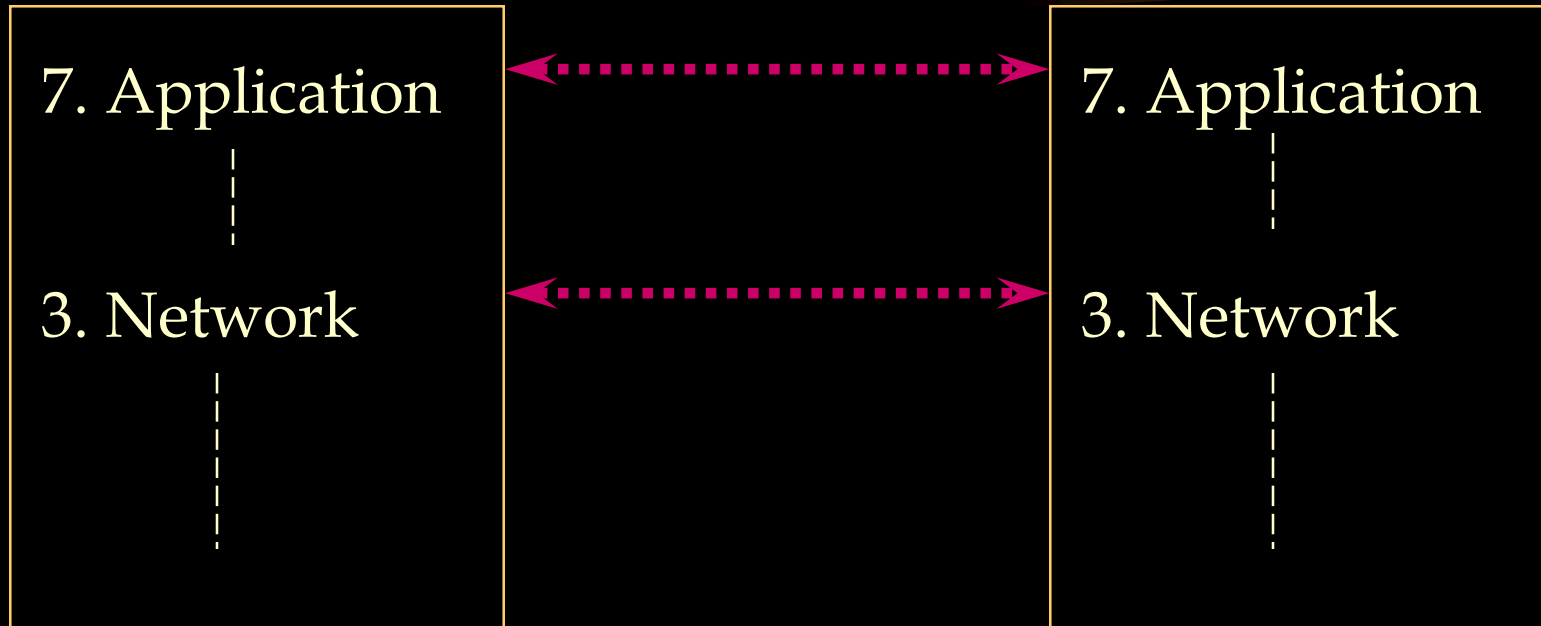
End of Module 1

Module 2

The ISO Upper Layers

Module Objectives

- Application Layer
- Presentation Layer
- Session Layer
- Transport Layer
- Network Layer

7. Application Layer

- Purpose
  - User application to network service interface

- Examples
  - File request from server
  - E-mail services
  - etc.

Application Layer Function

- General network access
- Flow control
- Error recovery

6. Presentation Layer

- Purpose
  - Formats data for exchange between points of communication
    - Ex: Between nodes in a network
- Example:
  - Redirector software
    - Formats for transmission to the server

Presentation Layer Function

- Protocol conversion
- Data translation
- Encryption
- Character set conversion
- Expansion of graphics command

Redirector Example

F:/PUR/ORDER

C:/CORRES/USDA

REDIRECTOR

TO SERVER

TO LOCAL
DISK
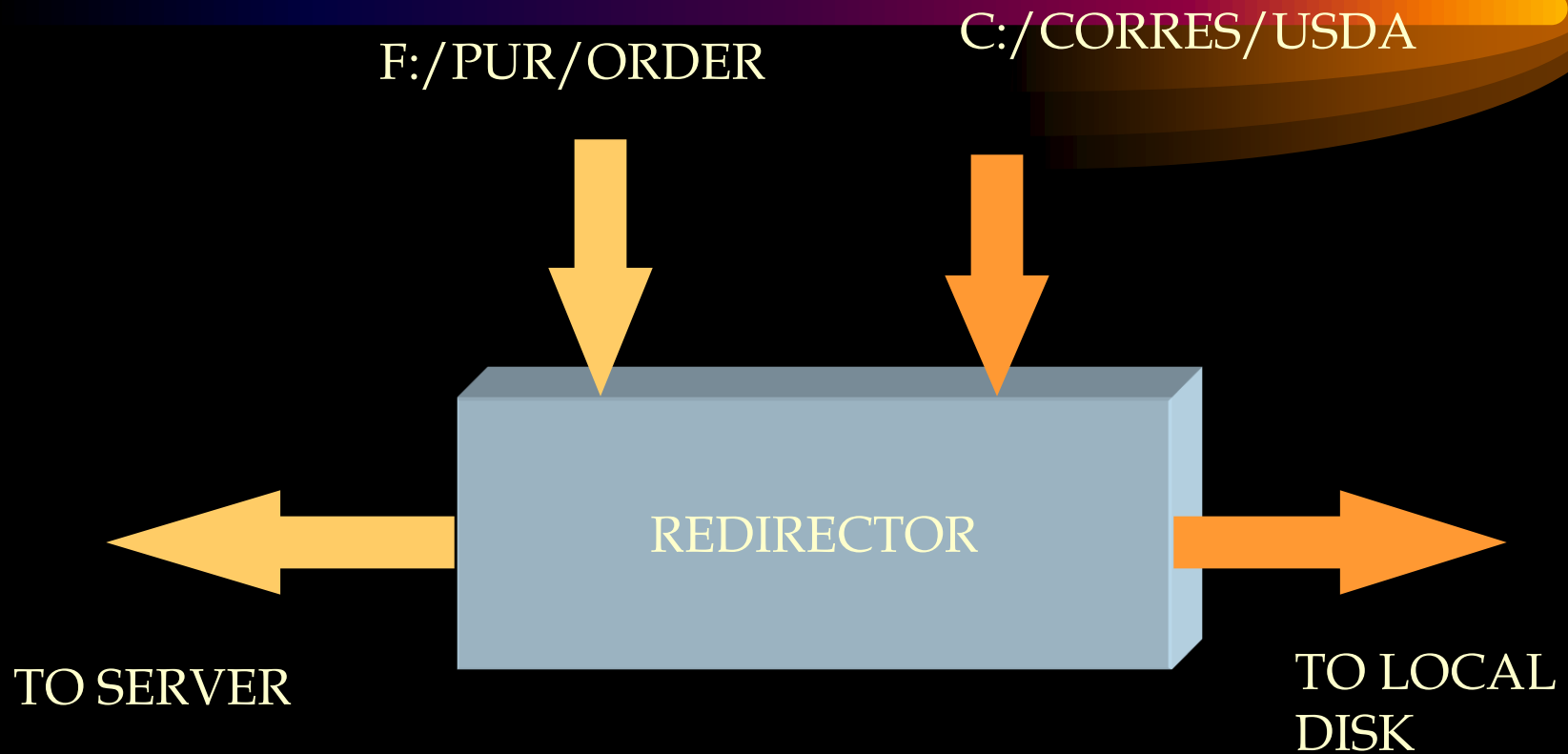
- Purpose
  - Oversee a communication session
    - Establish
    - Maintain
    - Terminate
- Example

Session Layer Function

- Performs name recognition and related security

- Synchronization between sender and receiver

- Assignment of time for transmission
  - Start time
  - End time etc.

- Purpose
  - Repackage proper and efficient delivery of packages
    - Error free
    - In sequence
    - Without duplication
- Example

Transport Layer Function

- For sending data
  - Repackage the message to fit into packets
    - Split long messages
    - Assemble small messages
- On receiving data
  - Perform the reverse
  - Send an acknowledgment to the sender
- Solve packet problems
  - During transmission and reception

3. Network Layer

- Purpose
  - Addressing and routing the packets
- Example application at the router
  - If the packet size is large, splits into small packets

Network Layer Function

- Address messages
- Address translation from logical to physical
  - Ex: nganesa ----------> 102.13.345.25
- Routing of data
  - Based on priority
  - Best path at the time of transmission
- Congestion control

End of Module 2

Module 3

The ISO Lower Layers

2. Data Link Layer

- Purpose
  - Manages the flow of data over the physical media

- Responsible for error-free transmission over the physical media

- Assures error-free data submission to the Network Layer

Data Link Layer Function

- Point of origin
  - Packages data for transmission over physical line
- Receiving end
  - Packages data for submission to the network layer
- Deals with network transmission protocols
  - IEEE 802. protocols

Data Link Layer Subdivision

- Improvement to ISO Model
- Logical Link Control (LLC) sub-layer
  - Manages service access points (logical link)
  - Error and flow control
- Media Access Control (MAC) sub-layer
  - Applies directly to network card communication
  - Access control

Logical Link Control

Media Access Control

- Network Interface Card driver

NETWORK SOFTWARE		NETWORK CARD

NIC Driver facilitates data transfer

- Purpose
  - Deals with the transmission of 0s and 1s over the physical media
    - Translation of bits into signals
- Example
  - Pulse duration determination
  - Transmission synchronization
  - etc.

Physical Layer Function

- Encode bits into signals
  - Carry data from the h higher layers
- Define the interface to the card
  - Electrical
  - Mechanical
  - Functional
  - Example: Pin count on the connector

Lower Layers Application Areas

- Special significance to network card design
- Applies to general LAN hardware design
  - Exceptions
    - Routers etc.
- 802. standards
  - Centered around the lower layers
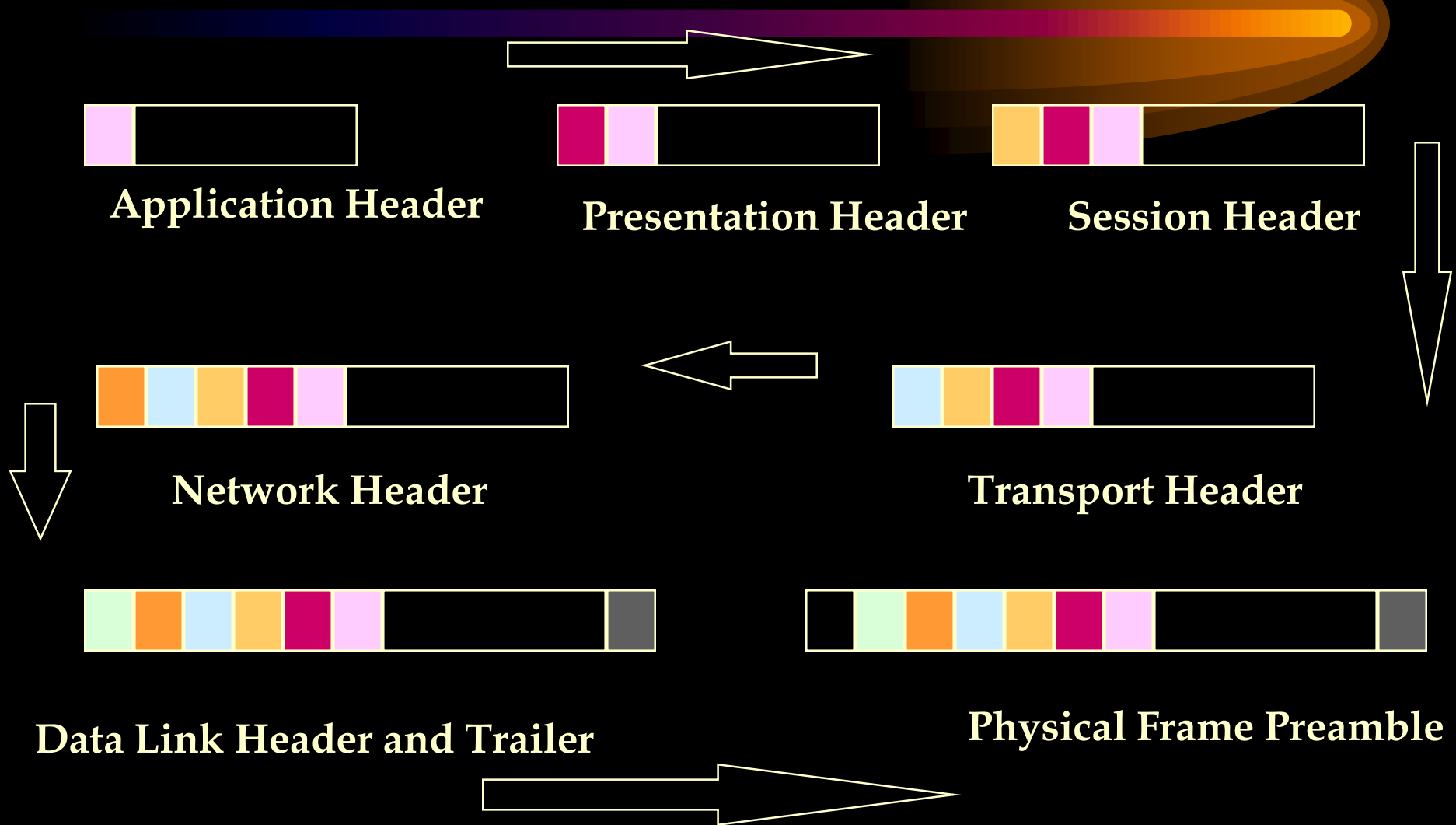 - Applies to networks

End of Module 3

Module 4

Summary of ISO-OSI Functional Layers

Layer Operations

- At each layer, additional information is added to the data packet

- An example would be information related to the IP protocol that is added at Layer 3

Formatting of Data Through the Layers

Application Header

Presentation Header

Session Header

Network Header

Transport Header

Data Link Header and Trailer

Physical Frame Preamble

Packet : General Format

Header

Trailer

	Data	

A general concept of packets serves as a prerequisite to the understanding of the ISO-OSI model.

Some Header Information Added at Various Layers

- Packet arrival information
- Receiver's address
- Sender's address
- Synchronization character

- Actual data
- May contain error correction code
  - Performed on individual characters of the data
  - Example: Parity
- Size may vary
  - Depending on the protocol
  - Example
    - 802.3 specifies range of data packet length

# *Some Trailer Information Added at Various Layers*

- Error correction code
  - Character oriented
  - VRC (Parity Checking)
- Packet oriented error correction codes
  - LRC
  - CRC

- Used widely

- Sophisticated
  - Polynomial of deferent degrees are used for error correction
  - Example: Degrees 16, 32 etc.

- CRC-32 is a more stringent error checking procedure than CRC-16

Some of the Major Components of the Data Packet

Receiver's Address

Control Data

Data

Start/synch Information

Sender's Address

Error Correction Protocol
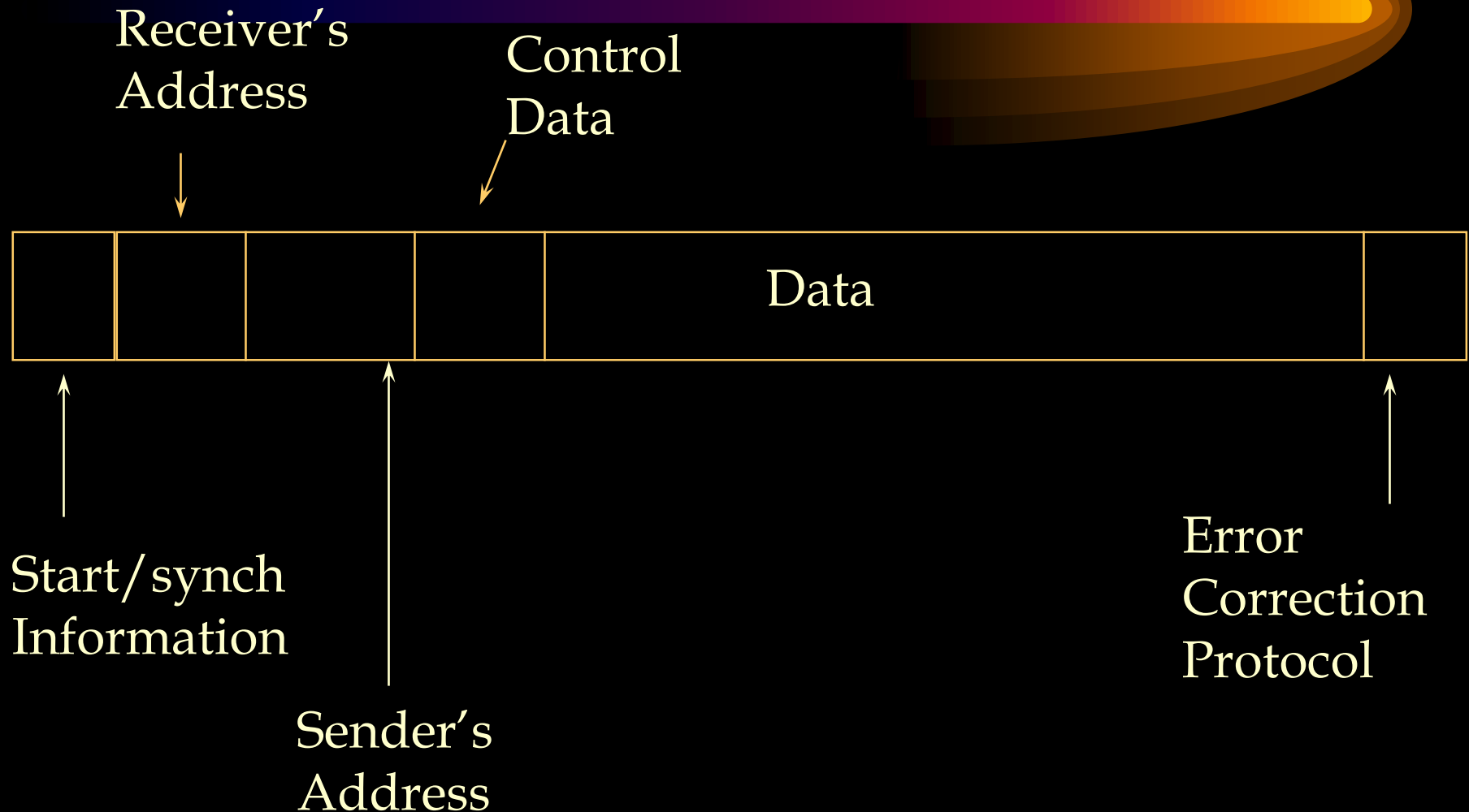
Standardizing Packet Formatting

- Packets must conform to a standard in order for the nodes in a network to be able to communicate with one another

- The International Standards Organization (ISO) has provided a reference model

- Standards are established for operations at each layer of the ISO/OSI model in the form of protocols

End of Module 4

Module 5

The IEEE 802 Group and the Standards

IEEE Background

- Institution of Electrical and Electronic Engineers (IEEE)
  - A professional non-profit organization
- Project group 802
  - Responsible for setting standards relating to the physical link of the network

IEEE 802 Focus

- OSI Reference
  - Data Link layer
  - Physical layer
- Areas
  - Network cards and cables
  - Network electronic/optical/ wireless communication standard as they apply to the lower two layers mentioned above
  - WAN connectivity

Upper Layer Focus

- IETF
- W3C
- ISO/IEC
- The above agencies focus on setting standards on higher level protocol
  - TCP, IP etc.

IEEE 802 Committees And Responsibilities

- 802.1
  - Internetworking
- 802.2
  - Logical Link Control (LLC)
- 802.3
  - CSMA/CD
- 802.4
  - Token Bus LAN

# IEEE 802 Committees and Responsibilities (Cont.)

- 802.5
  - Token Ring LAN
- 802.6
  - Metropolitan Area Network
- 802.7
  - Broadband Technical Advisory Group
- 802.8
  - Fiber-Optic Technical Advisory Group

IEEE 802 (Cont.)

- 802.9
  - Integrated Voice/Data Networks
- 802.10
  - Network Security
- 802.11
  - Wireless Networks
- 802.12
  - Demand Priority Access LANs
  - Ex: 100BaseVG-AnyLAN

OSI Sub-Layer Reference to IEEE 802 Standards

Logical Link Control (LLC)

802.2

802.1 for both.

Media Access Control (MAC)

802.3
802.4
802.5
802.12
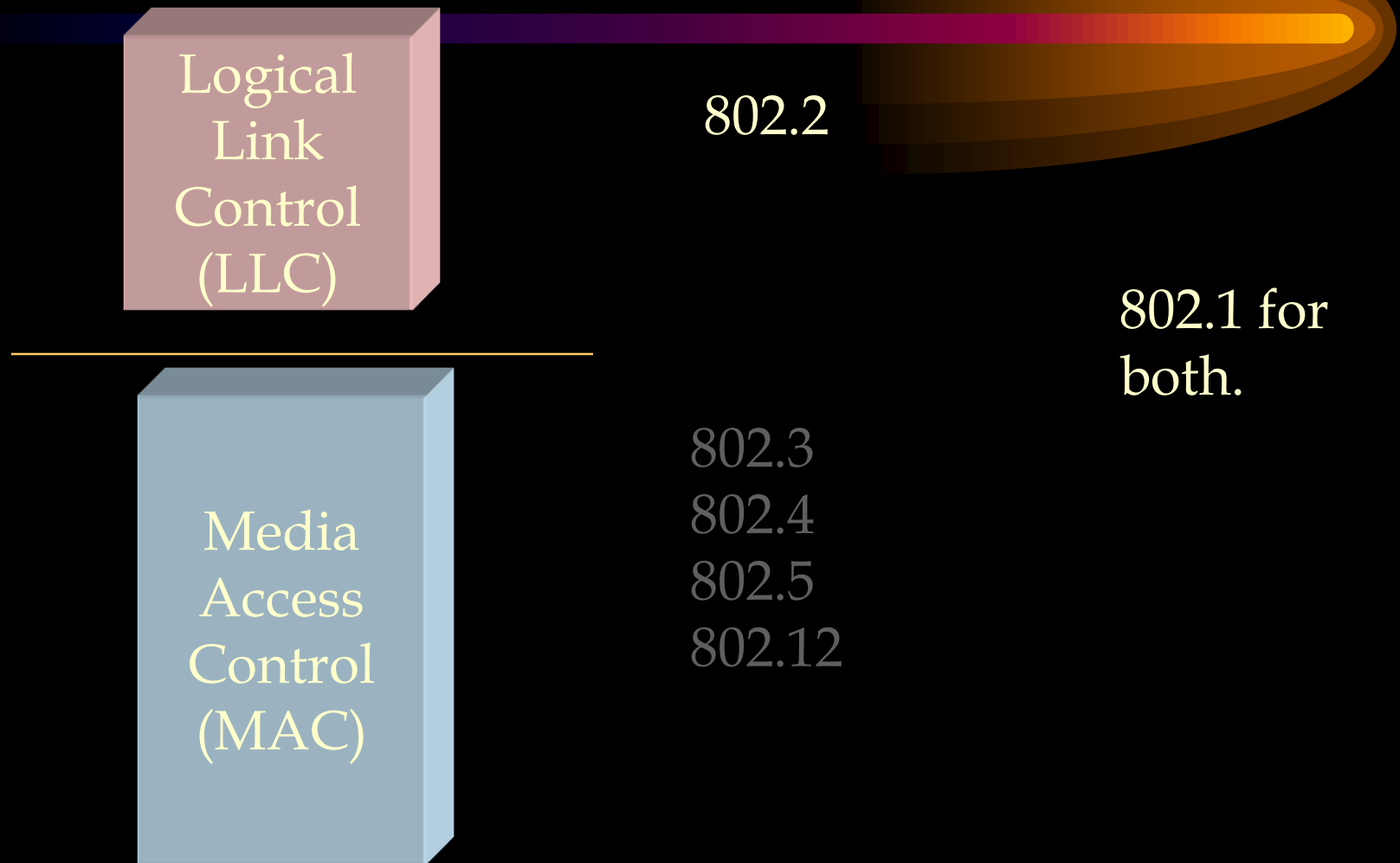
End of Module 5

END OF MODULE

END OF CHAPTER