Section – A
Computer Networks

OSI Reference Model

Outline of the talk

- **Formal Framework : Protocols**

- **Protocol hierarchy / Layered Architecture**

- **OSI Reference Model**
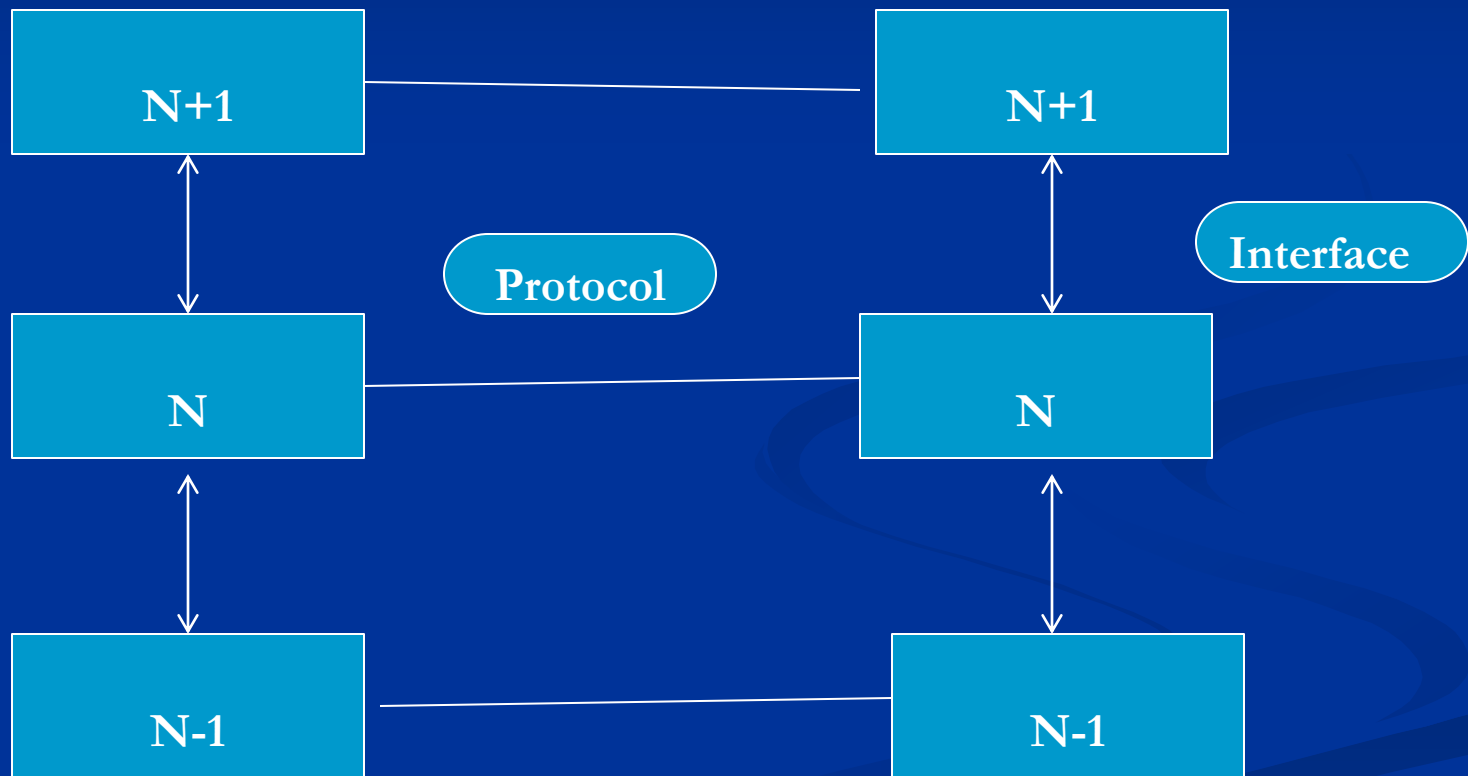
- **Peer level communication**

Formal Framework : Protocols

Formal Framework : Protocols

- **Building blocks of a network architecture.**
- **Each protocol object has two different interfaces.**
  - **Service interface: defines operations on this protocol.**
  - **Peer-to-peer interface: defines messages exchanged with peer.**

Protocol Hierarchy-I

Pls. note : Protocol hierarchy is also known as layered architecture.

Protocol Hierarchy-II

- Most Networks are organized as a series of layers.

- The task of each layer is to give some service to upper layer

- Any Layer maintains a virtual connection with the corresponding layer in a peer

Protocol Hierarchy-III

- **There is a peer to peer protocol running between any two corresponding and communicating layers.**

- **The interface between the layers in the node is well defined.**

- **The implementation of each layer in each node is transparent to other nodes.**

Protocol Hierarchy-IV

- The protocols between peer layers can be changed if the peers all agree. However it need not be referred to other layers.

- The Service definitions tells what the layer does nothing else.

- The interface tells the process above it how to access it. It specifies what the parameters are and what results to expect.

Protocol Hierarchy-V

- **OSI Reference Model**

- **TCP/IP Reference Model**

- **ATM Reference Model**

- **Other protocol stacks exist and new ones are possible. However the extent to which a particular model is universally accepted is the key to its success.**

OSI Reference Model

- **Application Layer**

- **Presentation Layer**

- **Session Layer**

- **Transport Layer**

- **Network Layer**

- **Data Link Layer**

- **Physical Layer**

Peer Level Communication

- **Message sent from one application to another application on different hosts.**

  - travels down the layers of the sending machine.

  - each layer adds a header to be used by it's corresponding peer level.

  - bottom layer (physical) sends the message to the receiving machine.

Peer level Communication

- **Sending Message (continued)**

    - received on receiving side.

    - passed up through each layer.

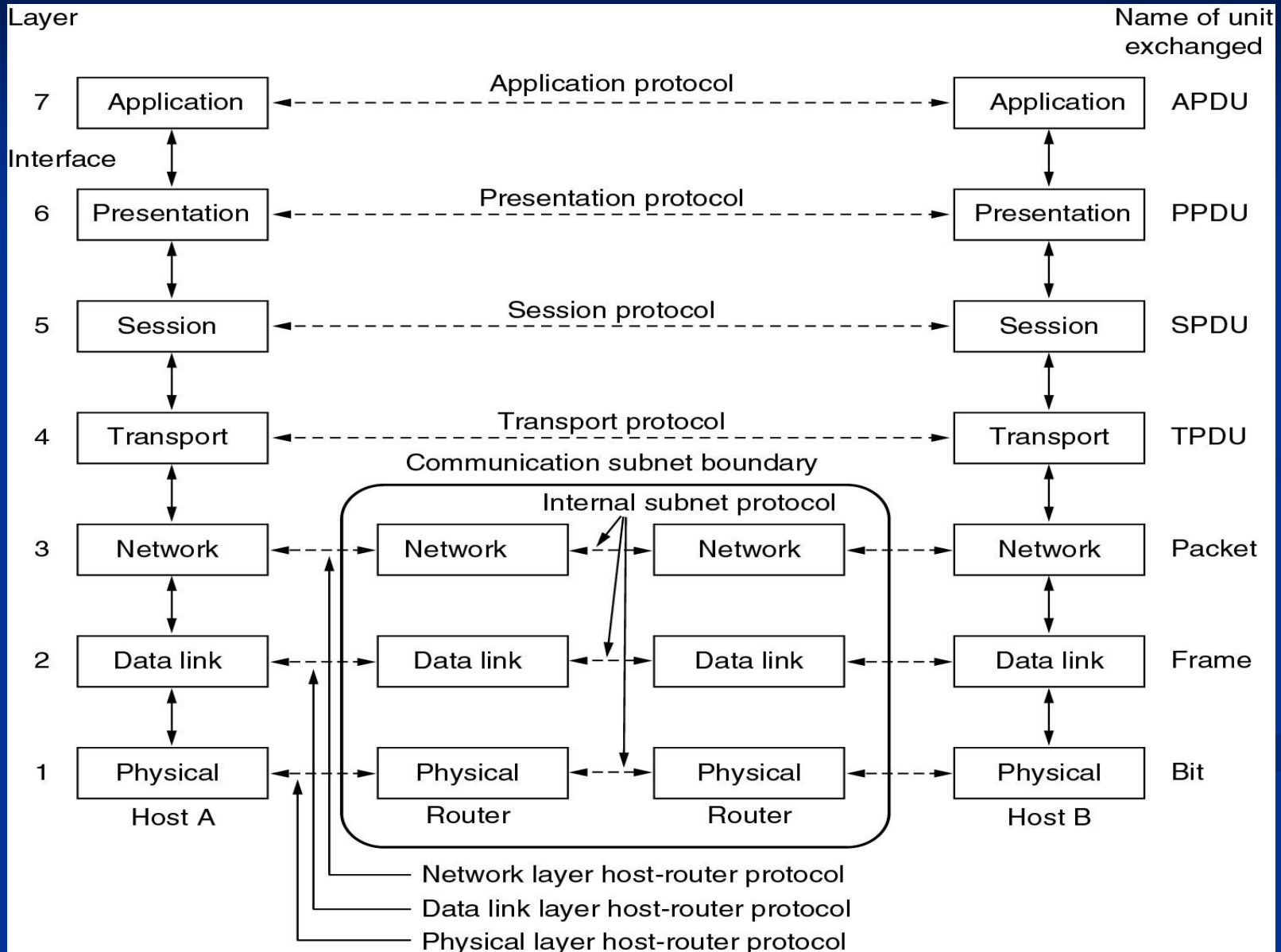   - each layer reads the corresponding header.

Peer Level Communication
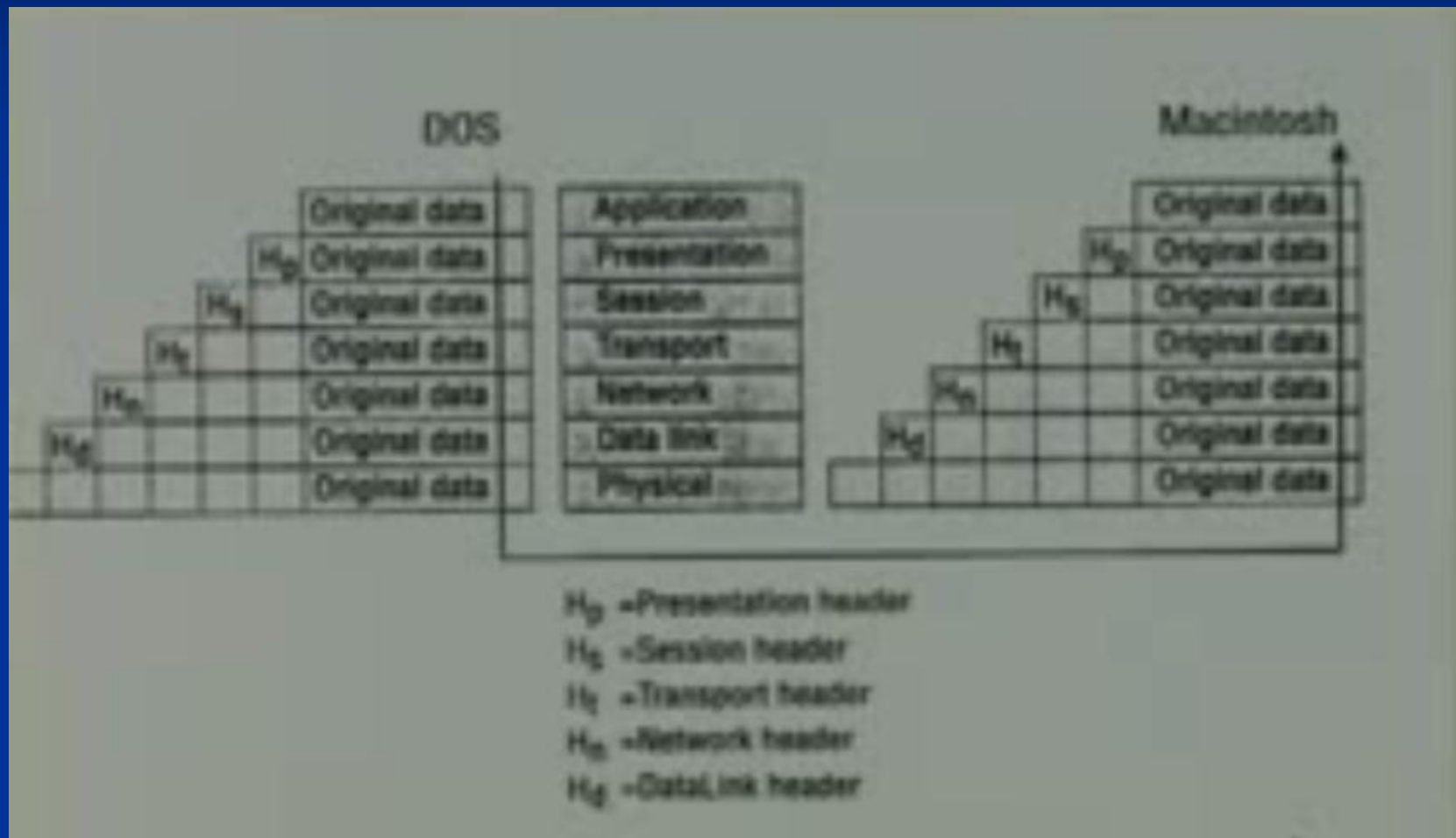
OSI Model

- The model is called the **ISO OSI (Open Systems Interconnection) Reference Model because it deals with connecting open systems—that is, systems** that are open for communication with other systems.

- The OSI model has seven layers.

OSI Reference Models

The OSI reference model.

OSI Model: 7 Protocol Layers

- Physical →how to transmit bits.
- Data link → how to transmit frames.
- Network → how to route packets to the node
- Transport → how to send packets to the application
- Session → manage connections
- Presentation → encode/decode msgs, security
- Application → everything else !

Application Layer

- **The application layer contains a variety of protocols which are used by various application, Examples are FTP, TELNET, SMTP, HTTP etc.**

- **The application layer usually requires a reliable/cheap connection to its peer, Examples of peers are nodes giving some service to its clients.**

Presentation Layer

- **Handles the format of the data.**
    - protocol conversion.
    - data translation (ASCII)
    - Compression
    - Encryption

Session Layer

- Allows applications on different computers to share a connection.

- Provides for checkpoints (if a connection is lost only the required info is resent

- Dialog control who can transmit

The Transport Layer

- **The basic function of the transport layer is to accept data from the layer above, split it into smaller units if necessary, pass these to the network layer, and ensure that the pieces all arrive correctly and in the right order at the other end. This should also be done in a cheap and efficient manner and isolate the upper layers from change in technology.**

Types of Transport Services

- Error free point to point channel that delivers messages or bytes in the order in which they were sent.

- Transport of isolated messages with no guarantee of the order of delivery.

- Broadcasting of messages to multiple destinations.

Network Layer – I

- It decides on what route to take locally so that the intended message ultimately reaches the destination.

- It controls broadcasting by essentially segregating (or separate out) the different "Networks"

- It handles technological mismatches including restriction about message sizes.

Network layer II

- Congestion control is done in this layer.

- Billing information may be generated in this layer.

- It handles different policies pertaining to different networks.

- In broadcast networks, its functionality is minimal.

The Data Link Layer

- Make the physical layer appear like a channel that is free of transmission errors.

- Handle rate mismatch between sender and receiver.

- Control access of channels which are broadcast in nature.

Physical Layer

- **This transmits raw bits over a communication channel.**

- **Physical issues like voltages, attenuation and noise levels, light intensity, ports and pins, modulating techniques are described in this layer.**