Lecture 5
OSI Model

Topics Covered

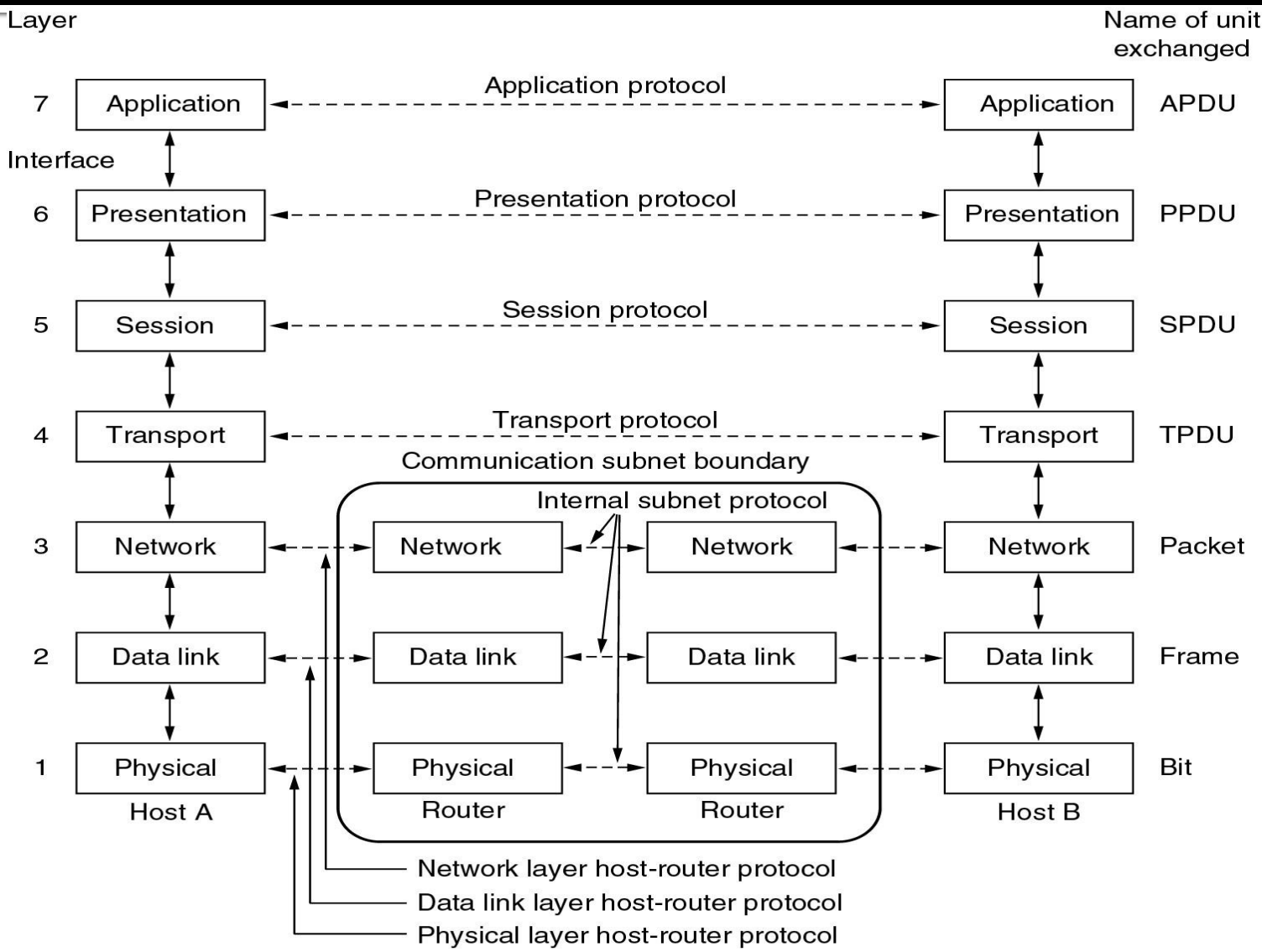
- OSI model
- Physical layer
- Data link layer
- Unacknowledged connectionless service
- Acknowledged connectionless service
- Checking the errors
- Flow control
- Physical addressing

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.

Reference Models: The OSI reference model



- Host X wants to send some data to host Y
- This message will be travelled via various intermediate nodes.
- These intermediate nodes as well as X and Y are concerned with the three lowest most OSI layers i.e. physical, dll, n/w
- The other four layers are used by the sender X and recipient Y only. Therefore they are known as **end-to-end layers**

Physical Layer

- The **physical layer is concerned with transmitting raw bits over a communication** channel.
- The design issues have to do with making sure that when one side sends a 1 bit, it is received by the other side as a 1 bit, not as a 0 bit.

- Source and destination nodes have to agree on a number of factors---
  - What voltage constitutes bit 1
  - What voltage constitutes bit 0

- Whether the communication is only one or both the directions
  - Simplex
  - Half duplex
  - Full duplex
- The design issues here largely deal with mechanical and electrical, specifications of the cables, connectors.

Physical layer takes into account following

- Signal Encoding
  - How are the bits 1 and 0 represented
- Medium
  - What is the medium used and what are its properties
- Bit synchronization
  - is the transmission asynchronous or synchronous
- Transmission type
  - Is the transmission serial or parallel
- Transmission mode
  - Simplex, half-duplex or full-duplex
- Topology
  - Star, bus, ring, mesh
- Interface
  - How closely linked devices are connected
- Bandwidth
- Signal type
  - Analog or digital

Physical Layer (contd…)

- **Protocols used:**
  RS 232C
  X.21

- **Physical Layer Devices:**
  Network Interface Card (NIC)
  Transceivers
  Repeaters
  Hubs

- **Limitation:** doesn't ensure the reliability of data.

Data Link Layer

- Communication Circuits make errors occasionally
- DLL specific functions are:
  - Providing a well defined service interface to the network layer
  - Dealing with transmission errors
  - Regulating the flow of data so that the receivers are not swamped by the fast senders

- To accomplish these goals DLL takes the packets from the network layer and encapsulates them into frames for transmission
- Each frame contains a frame header, a payload for holding the packet and a trailer

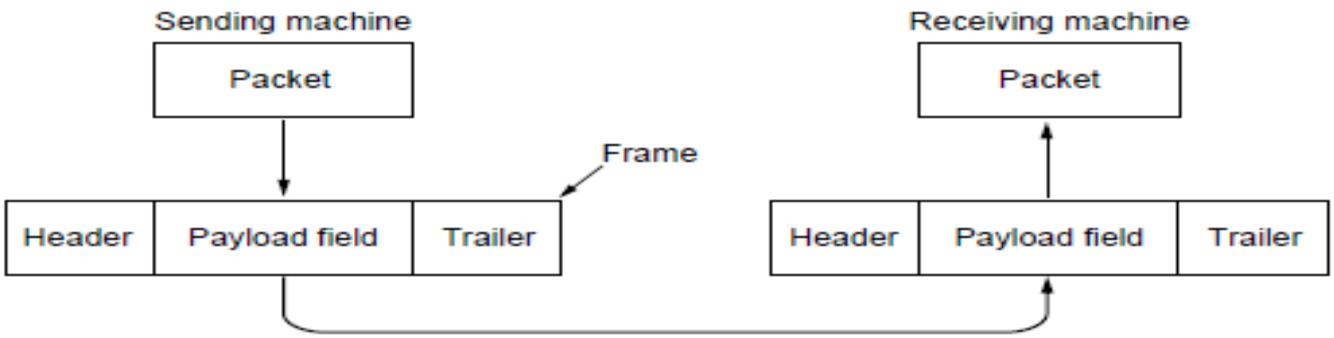


Fig. 3-1. Relationship between packets and frames.

Data Link Layer--contd

- **Protocols used:** HDLC

DLL is responsible for:

- Logical (MAC) addressing
- Logical link control processing
- Creating logical topologies
- Controlling media access

DLL Devices:

- Bridges
- Switches

Services provided

1. Unacknowledged Connectionless Service
2. Acknowledged Connectionless Service
3. Acknowledged Connection oriented Service

Unacknowledged Connectionless Service

- Source machine sends independent frames to the destination m/c without having the destination m/c acknowledge them
- No logical connection is estd or released.
- If the frame is lost no attempt is made to detect the loss or recover from it in the DLL

Acknowledged Connectionless Service

- No connection is estd but each frame sent is individually acknowledged.
- In this way sender knows whether a frame has arrived correctly
- If not arrived within a specified time interval it can be sent again.
- Trouble with this strategy is frame have a strict maximum length imposed by the h/w and n/w layer.
- If packets can be broken into say 10 frames and 20% frames are lost ---- 2 frames are lost
- SO it may take a long time for a packet to get through
- BUT for unreliable wireless channels it is well worth the cost

Acknowledged Connection oriented Service

- SRc and Destn establishes the connection before any data is transferred
- Each frame is sent over connection is numbered and DLL guarantees that each frame is received and that too received exactly once and all frames are received in the order

Example

- A Wan subnet consisting of routers connected by point-to-point leased telephone lines.
- When a frame arrives at a router, the h/w checks it for errors then passes the frame to DLL s/w (which might be embedded in a chip on the network interface board)
- The DLL s/w checks to see id this is the frame expected, and if so, gives the packets contained in the payload field to the routing s/w.
- The routing s/w then chooses the appropriate outgoing line and passes the packets down to the DLL s/w which then transmits it

CHECKING THE ERRORS

- FRAMING IS DONE TO BREAK THE BIT STREAM UP INTO DISCRETE FRAMES AND COMPUTE THE CHECKSUM FOR EACH FRAME.
- WHEN FRAME ARRIVES AT THE DESTINATION THE CHECKSUM IS RECOMPUTED.
- IF THE CHECKSUM IS DIFFERENT THAT MEANS AN ERROR HAS OCCURRED AND TAKE STEPS TO DEAL WITH IT.

FLOW CONTROL

- FEEDBACK BASED FLOW CONTROL
  - Receiver sends back the information to the sender giving it permission to send more data
- RATE BASED FLOW CONTROL
  - The protocol has built in mechanism that limits the rate at which sender may transmits data without using feedback from the receiver

Physical Addressing

- DLL layer adds header to the frame to define the sender and receiver of the frame.

- ****
- If the frame is intended for a system outside the sender's network, the receiver address is the address of the device that connects the network to the next one

PHYSICAL ADDRESS

- It is the address of the node as defined by its LAN or WAN
- Size and format of these address depends on the network
- Generally it the address imprinted on the network interface card (NIC)

LOGICAL ADDRESS

- It is the address for universal communication that are independent of the underlying physical networks
- Physical n/ws are not adequate for internetworks
- Universal addressing system is needed in which each host is identified uniquely, regardless of the underlying physical network
- Logical address of the internet is 32 bit IP address