Chapter 2

Network Models

2-1 LAYERED TASKS

- A network model is a layered architecture
  - Task broken into subtasks
  - Implemented separately in layers in stack
  - Functions need in both systems
  - Peer layers communicate

- Protocol:
  - A set of rules that governs data communication
  - It represents an agreement between the communicating devices

Topics discussed in this section:

Sender, Receiver, and Carrier

Hierarchy (services)

2-2 THE OSI MODEL

Established in 1947, the International Standards Organization (ISO) is a multinational body dedicated to worldwide agreement on international standards.

An ISO is the Open Systems Interconnection (OSI) model is the standard that covers all aspects of network communications from ISO. It was first introduced in the late 1970s.

ISO is the organization.
OSI is the model.

Topics discussed in this section:

Layered Architecture
Peer-to-Peer Processes
Encapsulation

Layered Architecture

Layers

Layer 7. Application

Layer 6. Presentation

Layer 5. Session

Layer 4. Transport

Layer 3. Network

Layer 2. Data Link

Layer 1. Physical

Layered Architecture

- A layered model
- Each layer performs a subset of the required communication functions
- Each layer relies on the next lower layer to perform more primitive functions
- Each layer provides services to the next higher layer
- Changes in one layer should not require changes in other layers
- The processes on each machine at a given layer are called peer-to-peer process

PEER – TO – PEER PROCESS

- Communication must move downward through the layers on the sending device, over the communication channel, and upward to the receiving device
- Each layer in the sending device adds its own information to the message it receives from the layer just above it and passes the whole package to the layer just below it
- At the receiving device, the message is unwrapped layer by layer, with each process receiving and removing the data meant for it

PEER – TO – PEER PROCESS

- The passing of the data and network information down through the layers of the sending device and backup through the layers of the receiving device is made possible by *interface* between each pair of adjacent layers
- Interface defines what information and services a layer must provide for the layer above it.

2-3 LAYERS IN THE OSI MODEL

Topics discussed in this section:

1. **Physical Layer**
2. **Data Link Layer**
3. **Network Layer**
4. **Transport Layer**
5. **Session Layer**
6. **Presentation Layer**
7. **Application Layer**

1. Physical Layer

The physical layer is responsible for movements of individual bits from one hop (node) to the next.

- Function
  - Physical characteristics of interfaces and media
  - Representation of bits
  - Data rate
  - Synchronization of bits
  - Line configuration (point-to-point or multipoint)
  - Physical topology (mesh, star, ring or bus)
  - Transmission mode (simplex, half-duplex or duplex)

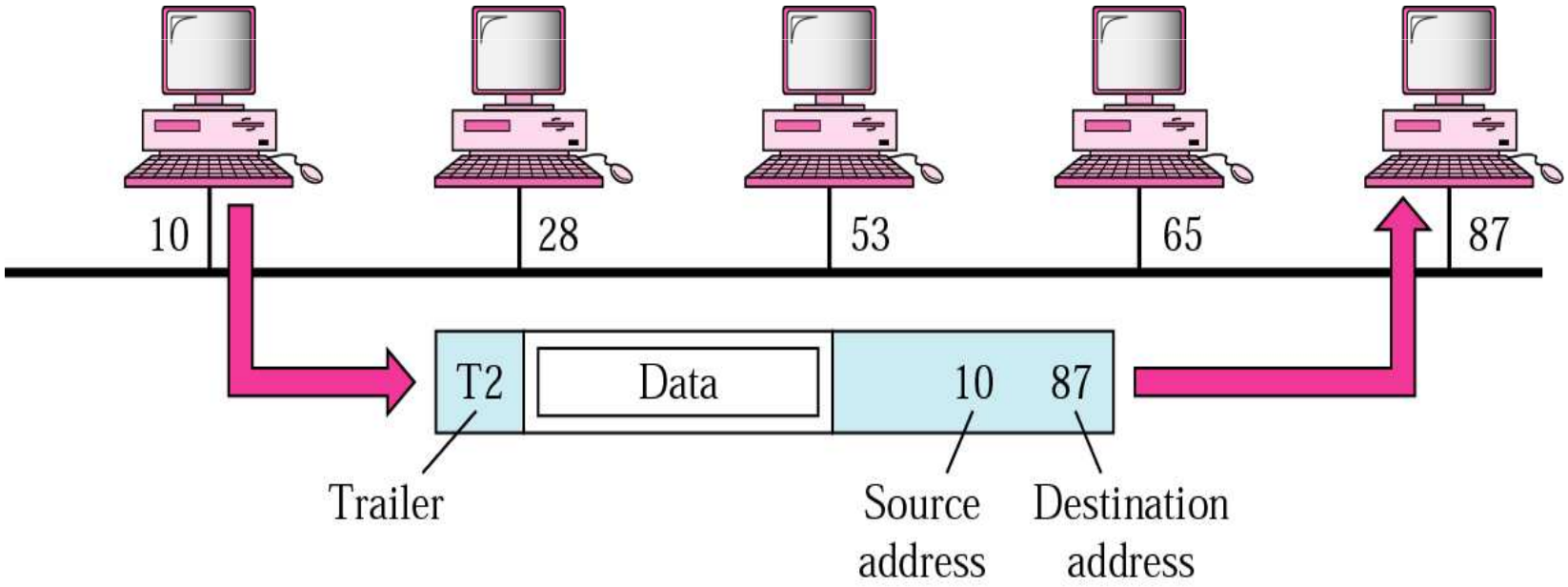
2. Data Link Layer

The data link layer is responsible for moving frames from one hop (node) to the next.

- Function
  - Framing
  - Physical addressing
  - Flow control
  - Error control
  - Access control

Example 1

In following figure a node with physical address 10 sends a frame to a node with physical address 87. The two nodes are connected within the same network. At the data link level this frame contains physical addresses in the header. These are the only addresses needed. The rest of the header contains other information needed at this level at the receiver side. The trailer usually contains extra bits needed for error detection



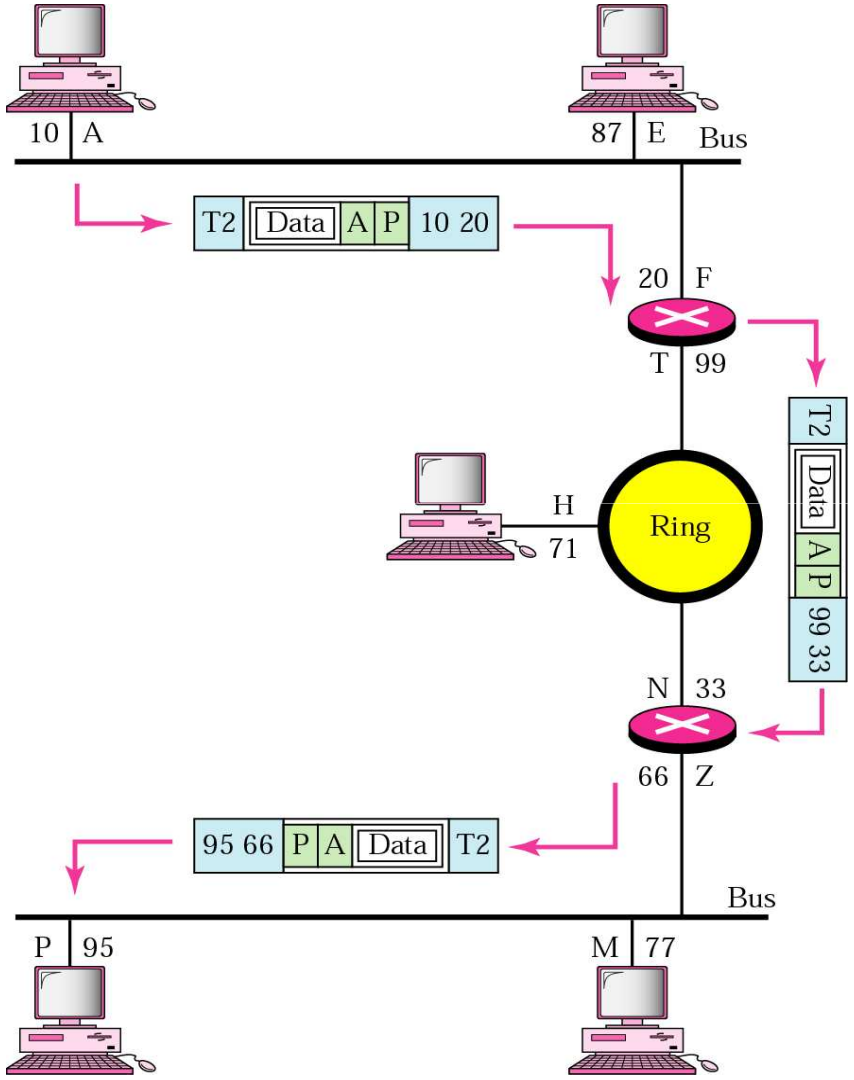
3. Network Layer

The network layer is responsible for the delivery of individual packets from the source host to the destination host.

- Source-to-destination delivery
- Responsible from the delivery of packets from the original source to the final destination
- Functions
  - Logical addressing
  - routing

Example 2

We want to send data from a node with network address A and physical address 10, located on one LAN, to a node with a network address P and physical address 95, located on another LAN. Because the two devices are located on different networks, we cannot use physical addresses only; the physical addresses only have local influence. What we need here are universal addresses that can pass through the LAN boundaries. The network addresses have this characteristic.



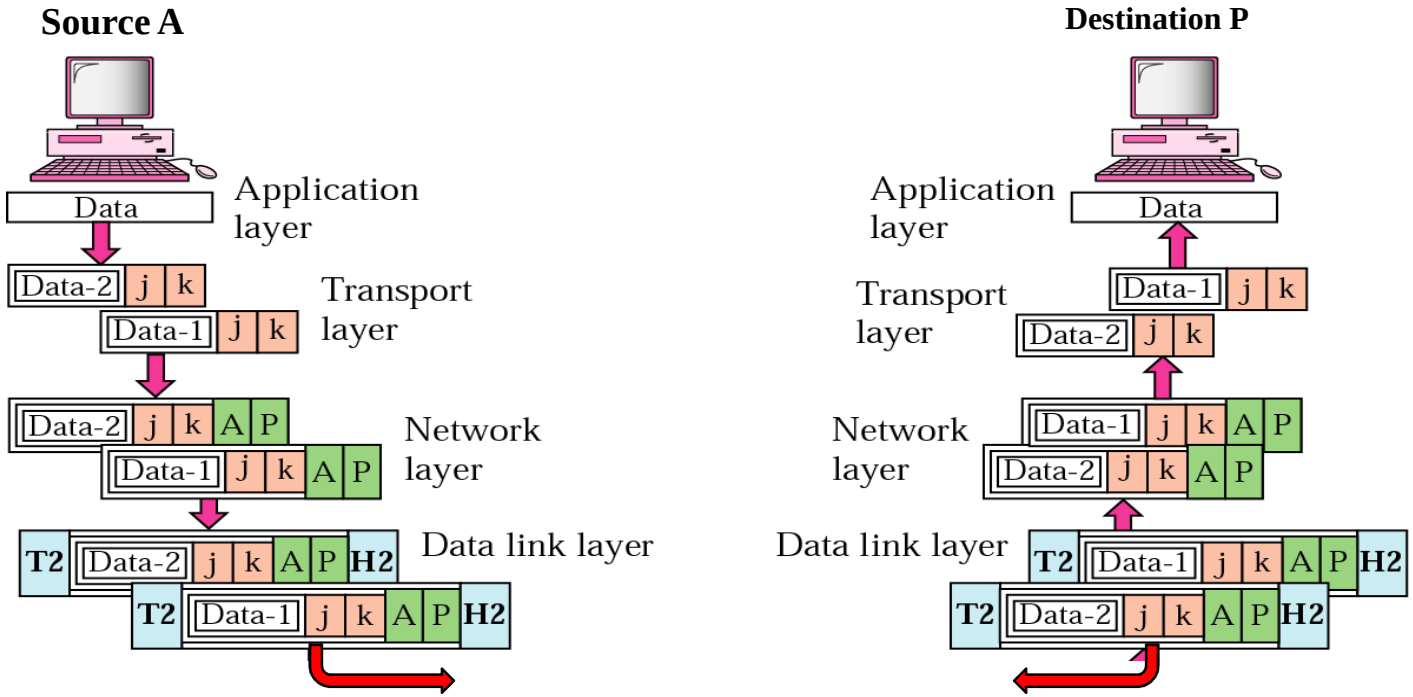
4. Transport Layer

The transport layer is responsible for the delivery of a message from one process to another.

- Process-to- process delivery
- Functions
  - Port addressing
  - Segmentation and reassembly
  - Connection control (Connection-oriented or connection-less)
  - Flow control
  - Error control

Example 3

Following Figure shows an example of transport layer communication. Data coming from the upper layers have port addresses j and k (j is the address of the sending process, and k is the address of the receiving process). Since the data size is larger than the network layer can handle, the data are split into two packets, each packet retaining the port addresses (j and k). Then in the network layer, network addresses (A and P) are added to each packet.



5. Session Layer

The session layer is responsible for dialog control and synchronization.

- **It establishes, maintains and synchronize the interaction between communicating system**
- **Function**
  - **Dialog control**
  - **Synchronization (checkpoints)**

6. Presentation Layer

The presentation layer is responsible for translation, compression, and encryption.

- **Concerned with the syntax and semantics of the information exchanged between two system**
- **Functions**
  - **Translation** (EBCDIC-coded text file → ASCII-coded file)
  - **Encryption and Decryption**
  - **Compression**

7. Application Layer

The application layer is responsible for providing services to the user.

- Functions
  - Network virtual terminal (Remote log-in)
  - File transfer and access
  - Mail services
  - Directory services (Distributed Database)
  - Accessing the World Wide Web

Figure 2.15 *Summary of layers*

OSI Model			
	Data unit	**Layer**	**Function**
User support layers	Data	7. Application	Network process to application
		6. Presentation	Data representation and encryption
		5. Session	Inter-host communication
User⇔ Network	Segment	4. Transport	End-to-end connections and reliability
Network support layers	Packet	3. Network	Path determination and logical addressing
	Frame	2. Data Link	Physical addressing
	Bit	1. Physical	Media, signal and binary transmission