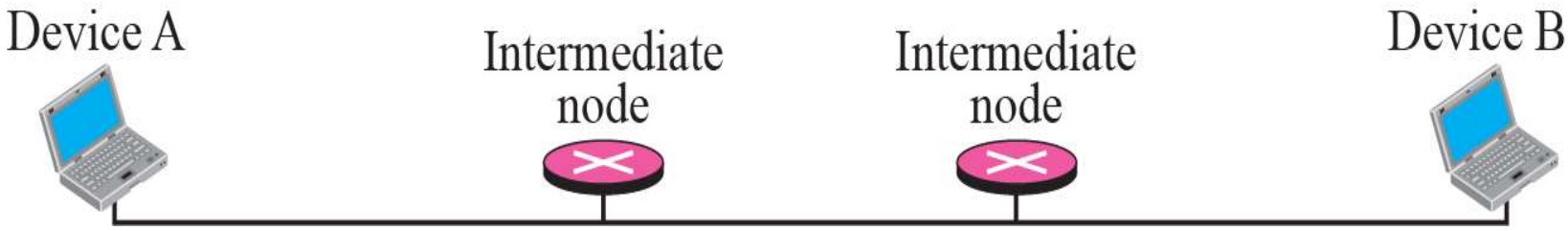
Computer Networks
MCA5151

The problem

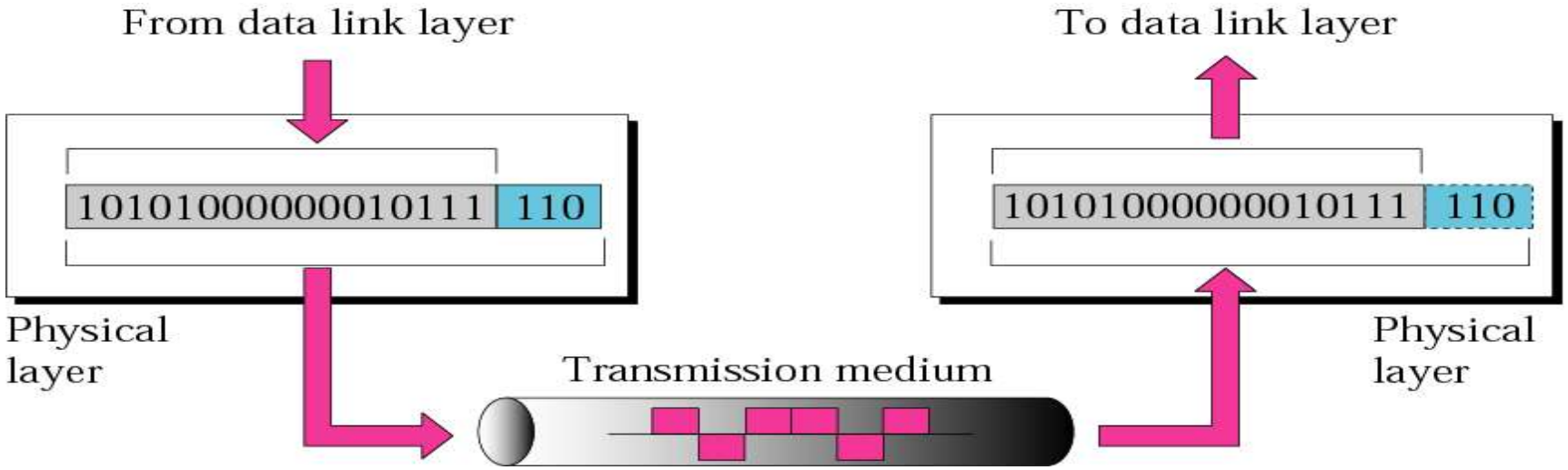
- Let us consider the problem of two computers hooked together & talk to each other.

A big file we want to send from A to B



1st Issue

- Physical Media (phone lines, cables)
- how to transmit bits ?
  - Bits to Analog signals
    - Signal encoding/ decoding techniques
      - Data rate, Duration or length of a bit

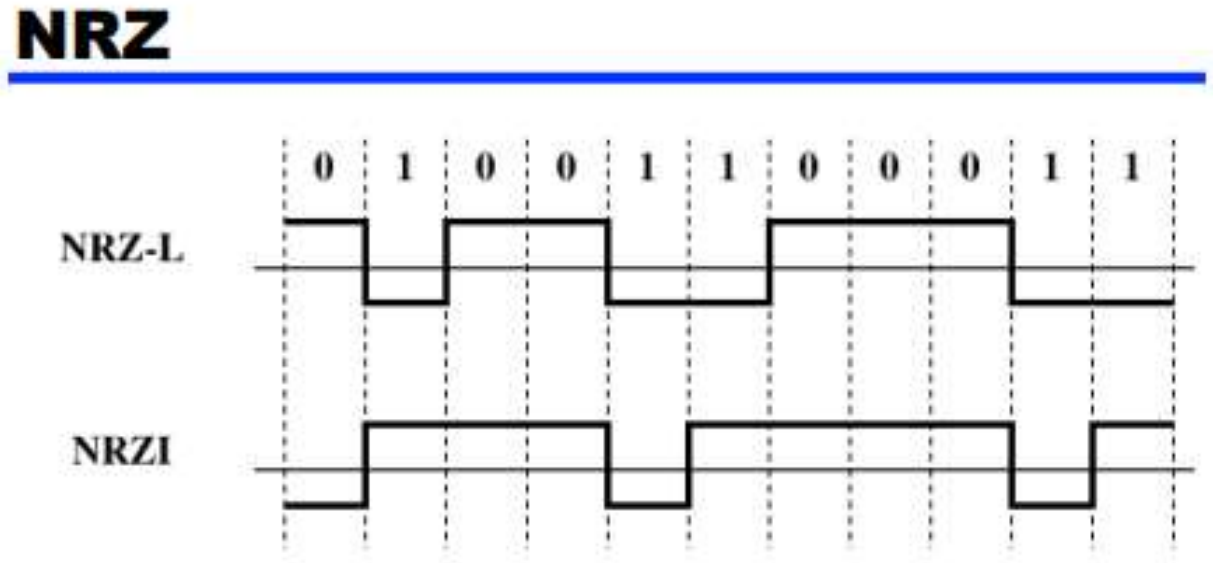


These functionalities are categorized as – Physical Layer functionalities

Signal encoding/ decoding

Nonreturn to Zero-Level (NRZ-L

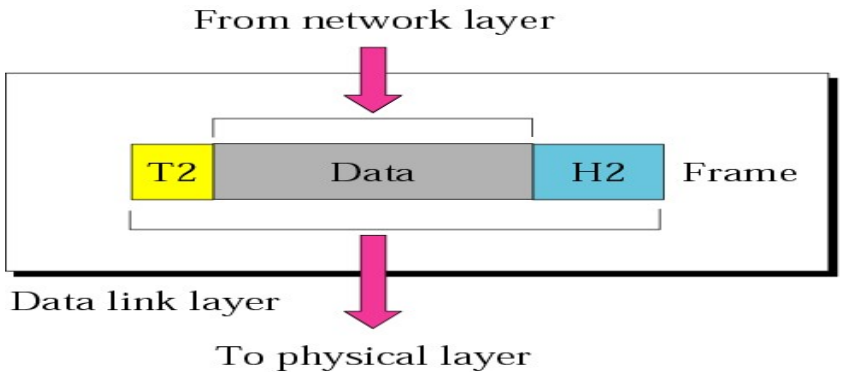
Nonreturn to Zero Inverted

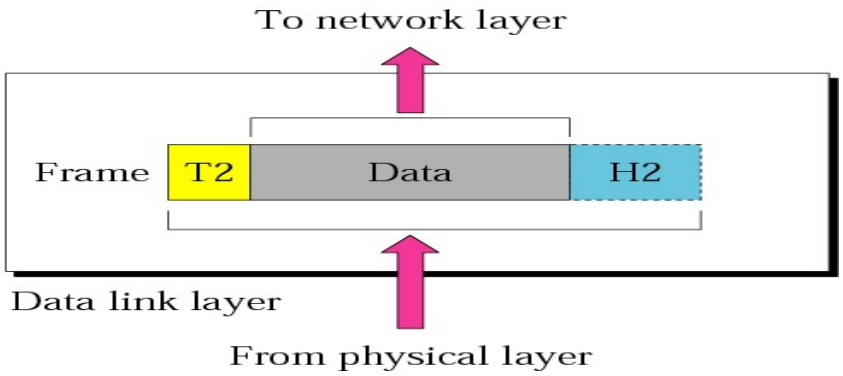


2nd Issue-

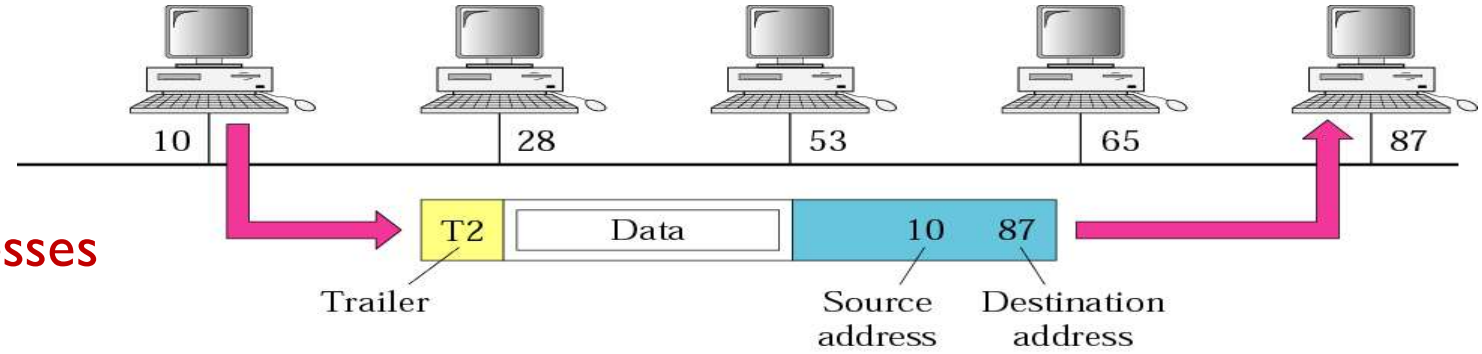
- Framing
  - Sending entire file as bit stream is not efficient.
  - One method is –
    - Make packs of smaller size-'frames' and ship.
  - Physical media is not Nosie-free
    - Error detection and corrections.
- Sharing media
    - CSMA/CD, ALOHA , Token passing protocols
  - Physical address is used to deliver to immediate next device (Hop-to-Hop Delivery)

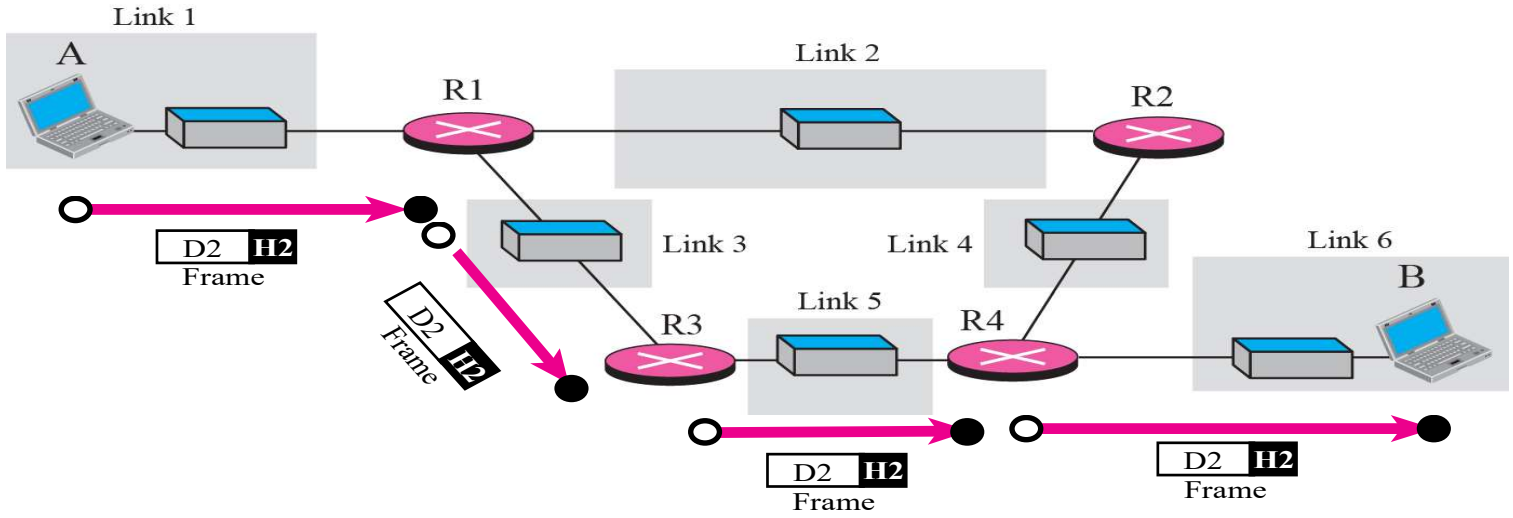
Immediate next device may be destination Computer or any other intermediate device





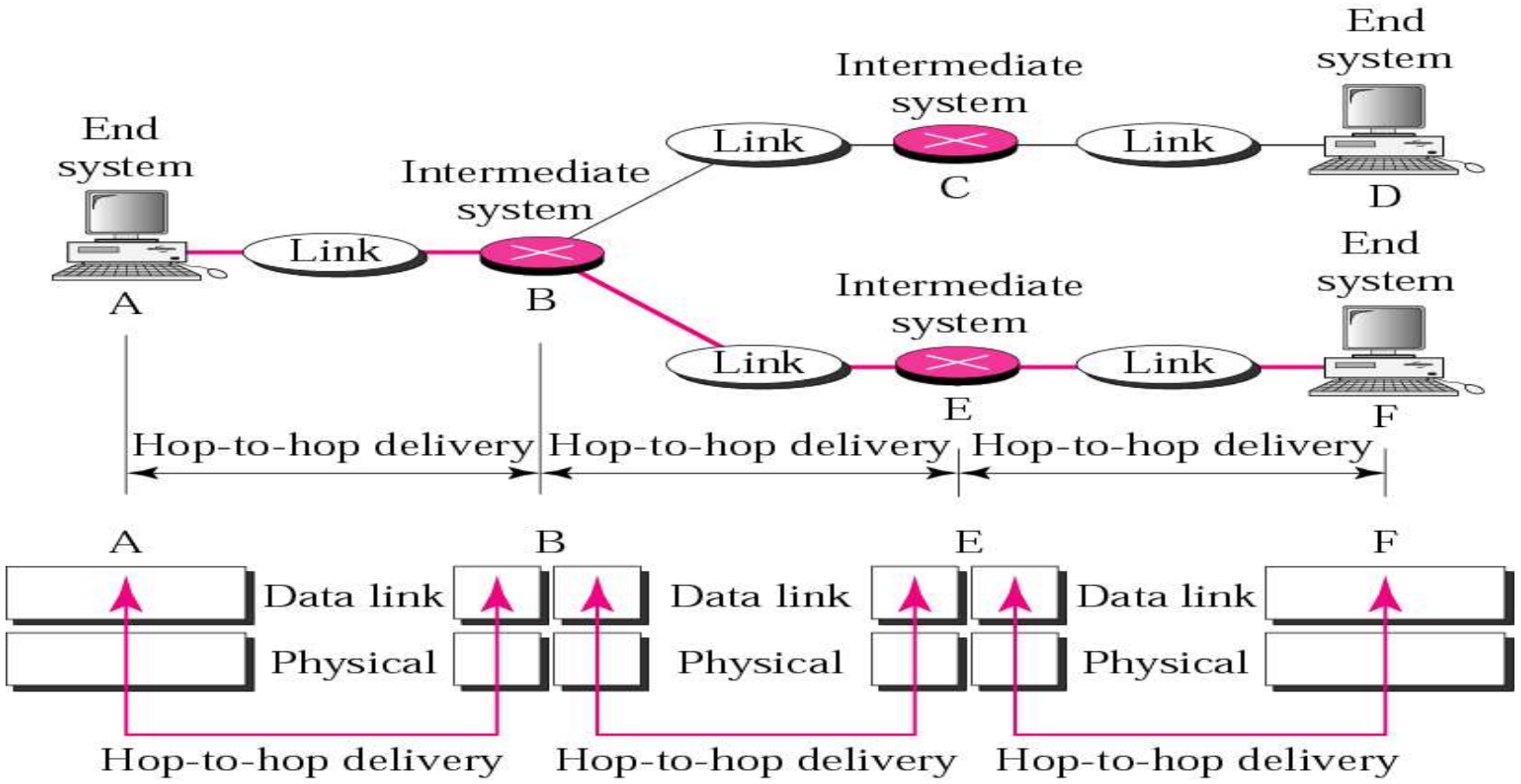
Physical Addresses





These functionalities are categorized as – Data Link Layer functionalities

Now we need 2 layers functionalities



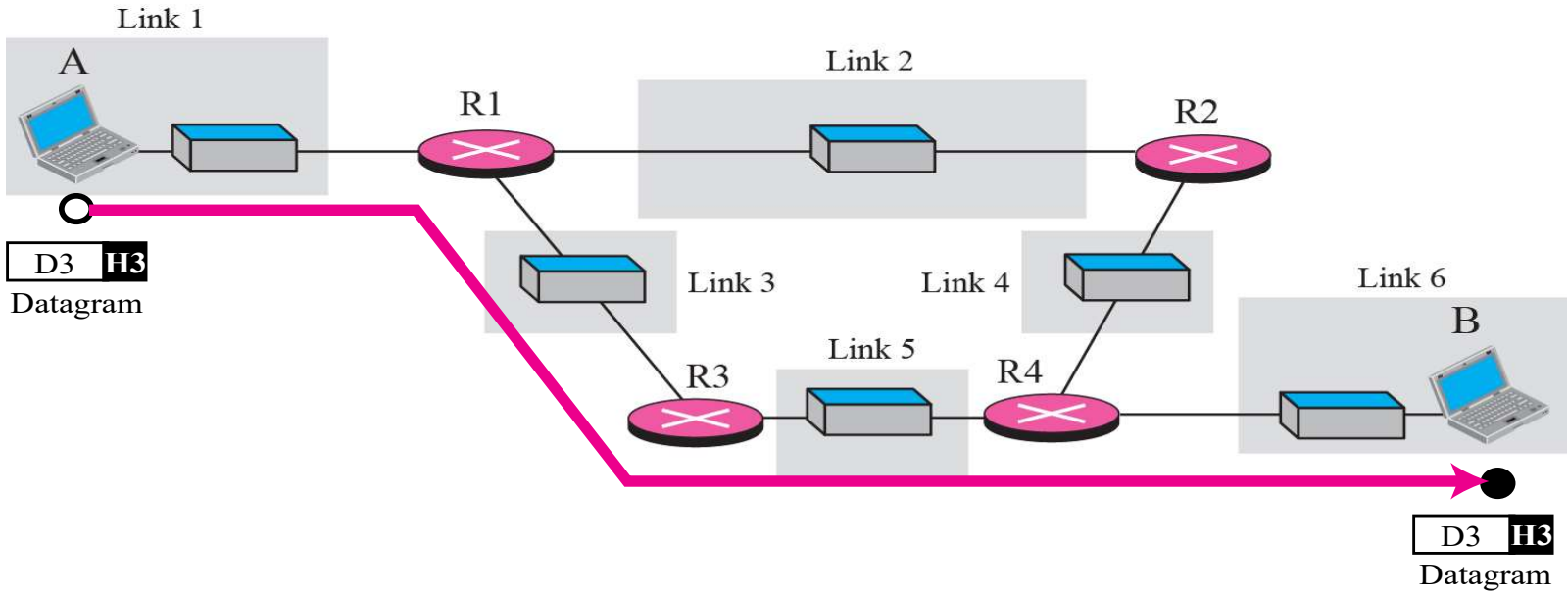
Syllabus:

Media Access sub layer(MAC) and LANS:

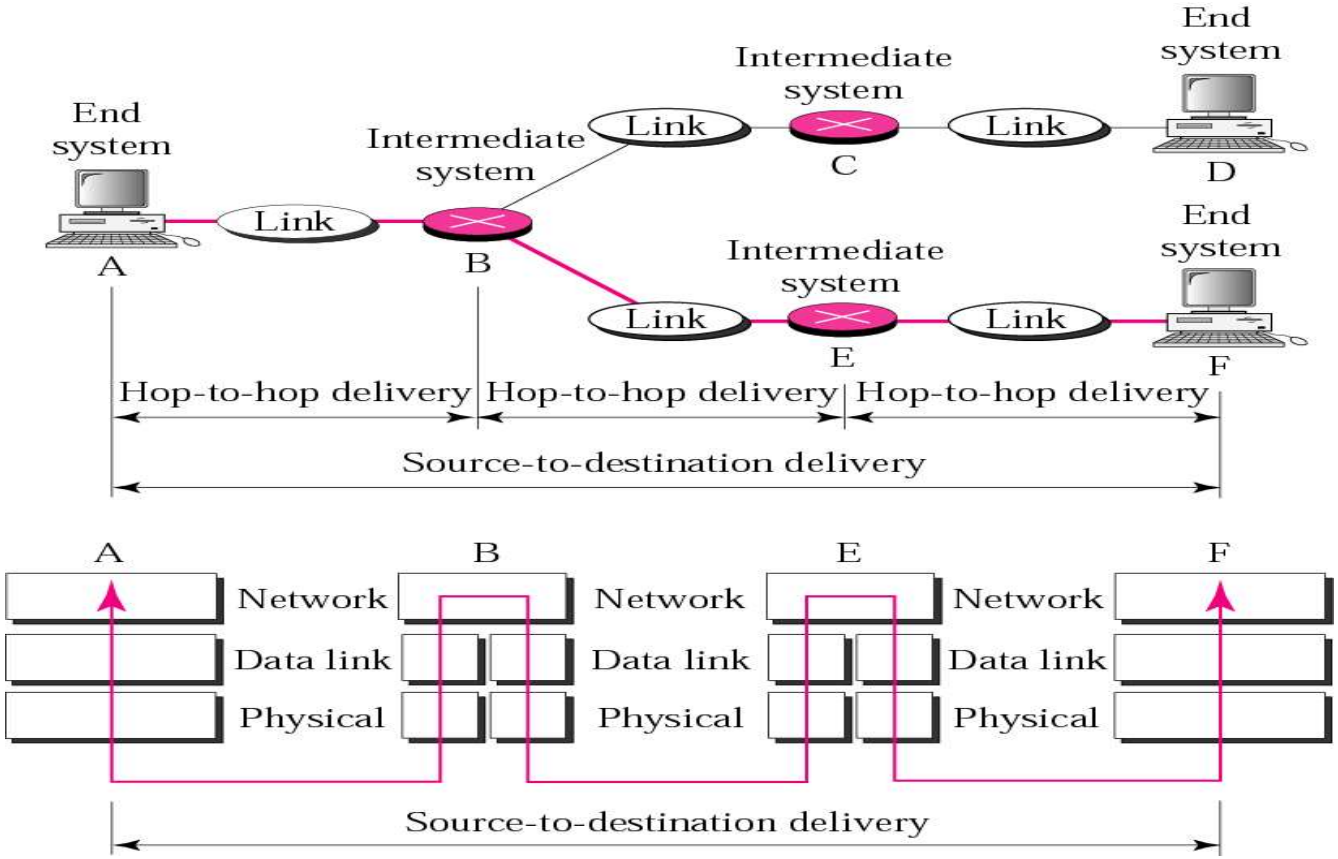
Approaches to sharing transmission Medium, Random Access Protocols, CSMA/CD (Token Passing protocols), IEEE LAN standards, Bridges, Switches and Routers.

3rd Issue

- How to reach destination Computer ?
  - Because, in reality, there may be many intermediate devices & link technologies between Sender and Receive.
    - Support for Heterogeneous Link Technology -MTU, fragmentation
    - Need for Logical Address. –IPv4, IPv6
    - Routing –OSPF, RIP, BGP protocols



- Extra Functionalities needed now are-
  - Logical Addressing & Routing



These functionalities are categorized as – Network Layer functionalities

Now we need 3 layers functionalities- Network Layer

Source to Destination –means Communication from Computer A to D is achieved ; B ,C E are intermediate devices(Routers)

Syllabus:

Network Layer:
Internal Organization of NL.

IP addressing:
Decimal Notation, Classes, Special Addresses, Unicast multicast and broadcast addresses, applying for IP address, Private networks.

Subnetting and Supernetting:
Subnetting, Masking, Variable length subnetting, supernetting.

Delivery Forwarding, and Routing of IP Packets:
Connection – oriented v/s connectionless services. Direct Vs. Indirect Delivery, Forwarding, Routing methods, Static Vs. Dynamic routing, Routing module and Routing table design.

Syllabus:

Internet Protocol (IP): Datagram, Fragmentation, Options, Checksum & IP Design.

ARP and RARP: ARP, ARP design & RARP.

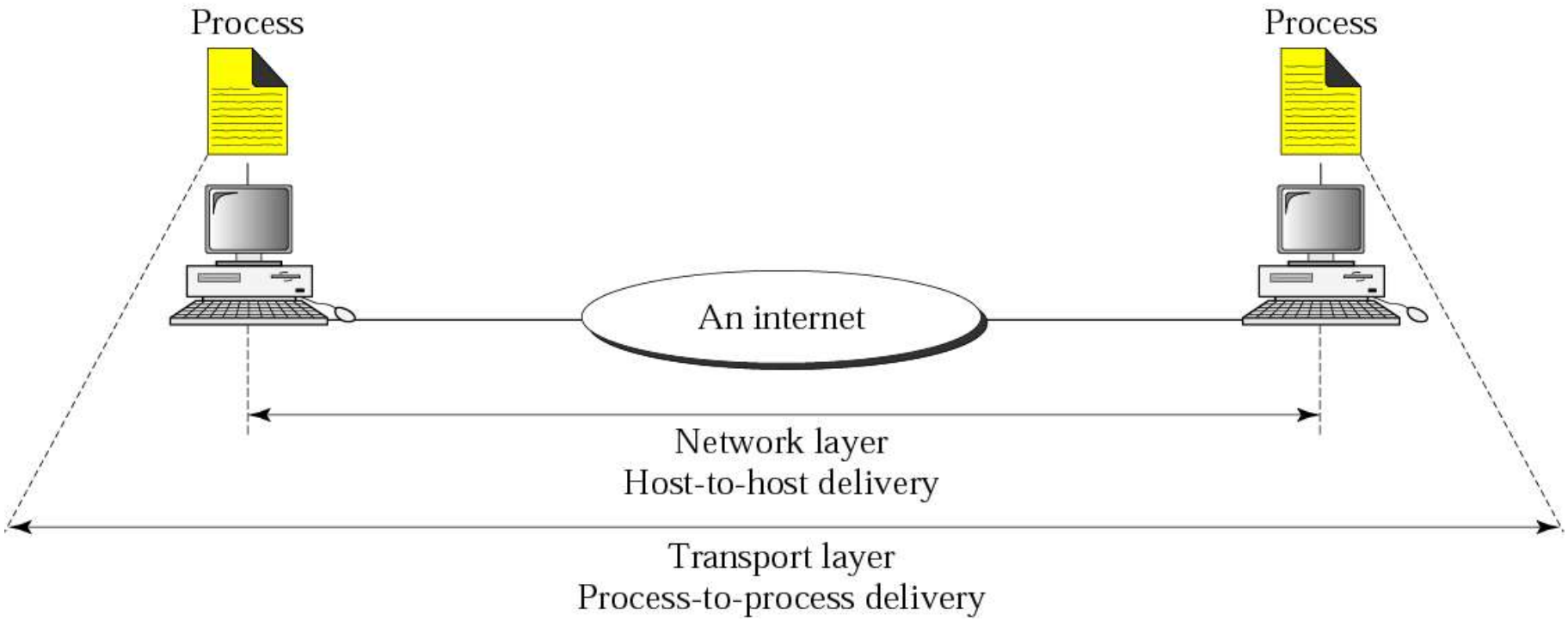
Internet Control Message Protocol (ICMP):
Types of messages, message format, error reporting, query, Checksum& ICMP Design.

Internet Group Management Protocol (IGMP):
Multicasting, IGMP, Encapsulation, Multicast backbone & IGMP design.

Introduction to Routing Protocols:
Interior and Exterior routing, RIP, RIP Version 2, OSPF & BGP.

4th Issue

- How to Deliver to destination Process ?



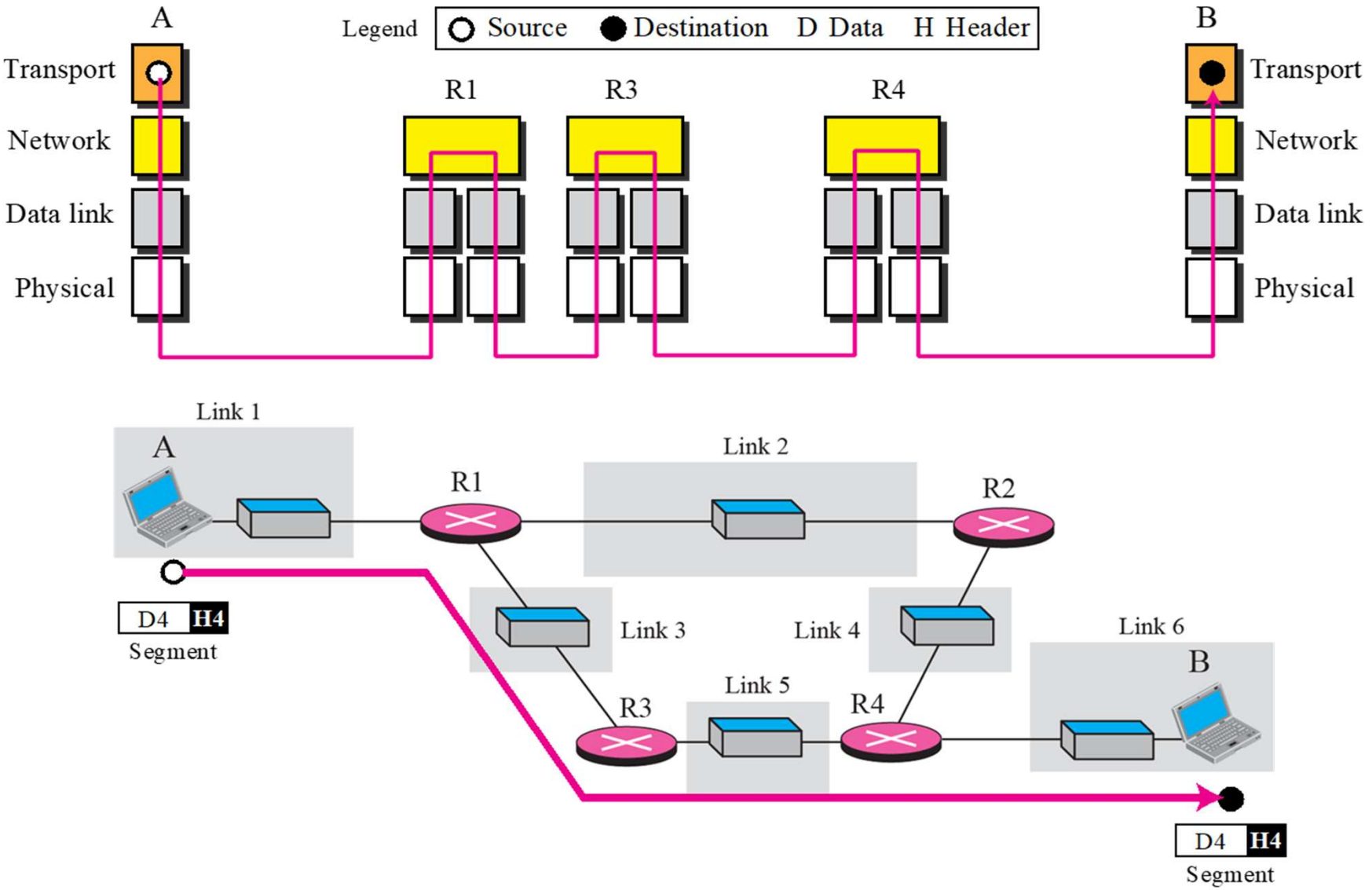
Main functionalities Required are-

Process-to-Process delivery

Flow Control

Error Control

Reassembly



Now we need 4 layers functionalities

Syllabus:

User Datagram Protocol (UDP) :

Process-To-Process Communication, User datagram, UDP operation, Uses of UDP.

Transmission Control Protocol (TCP) :

TCP services, A TCP connection, Flow control, Error Control, Congestion control, TCP Timer.

5th Issue

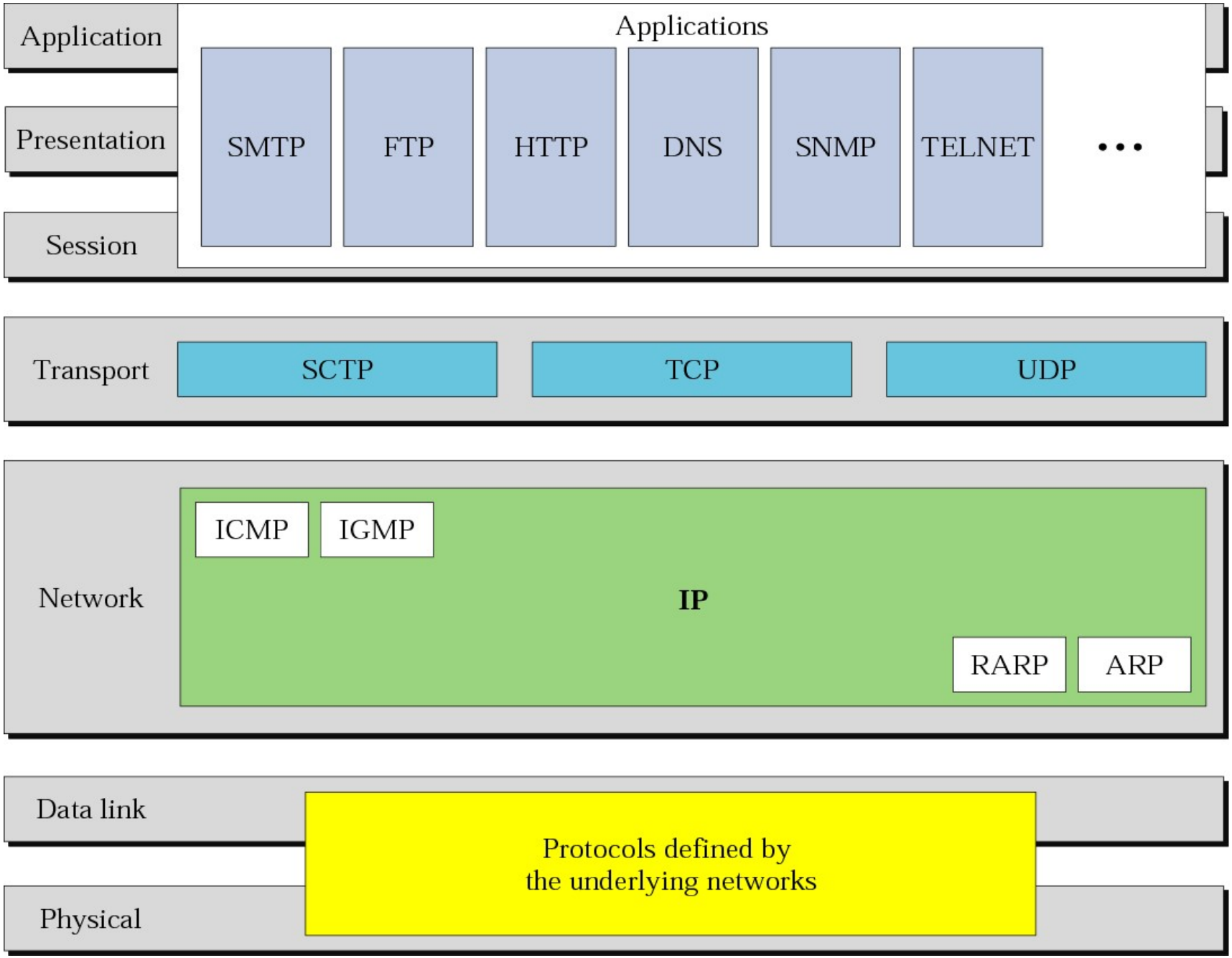
The session layer is the network dialog controller. It establishes, maintains, and synchronizes the interaction between communicating systems.

6th Issue

The presentation layer is concerned with the Translation, Encryption/Decryption , Compression/Decompression of the information exchanged between two systems.

7th Issue

- The application layer provides the interfaces and services to access the network


Application
Applications
Presentation
SMTP
FTP
HTTP
DNS
SNMP
TELNET
• • •
Session
Transport
SCTP
TCP
UDP
Network
ICMP
IGMP
IP
RARP
ARP
Data link
Protocols defined by
the underlying networks
Physical

Text Books

- Behroua A. Forouzan – "TCP/IP PROTOCOL SUITE", Tata McGraw Hill, Third Edition, 2010
- Behroua A. Forouzan – "Data Communication and Networking", Tata McGraw Hill, Fourth Edition, 2007
- Tannenbaum, A.S. – "COMPUTER NETWORKS", Prentice Hall of India [EE Edition], 4th edition, 2003.
- Alberto Leon- Garcia – "Communication Networks", Tata McGraw Hill, 2nd edition, 2004