INTERNETWORKING DEVICES

Internetworking Devices

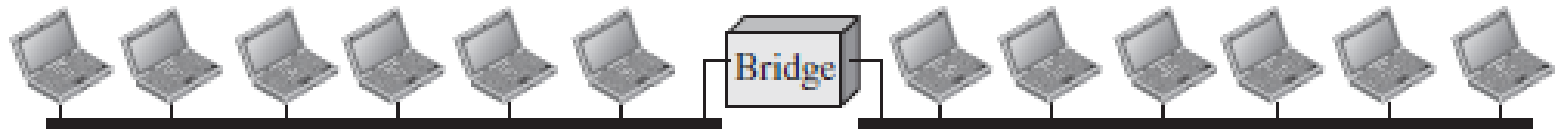|	
Application layer	Application gateway
Transport layer	Transport gateway
Network layer	Router
Data link layer	Bridge, switch
Physical layer	Repeater, hub

Hubs
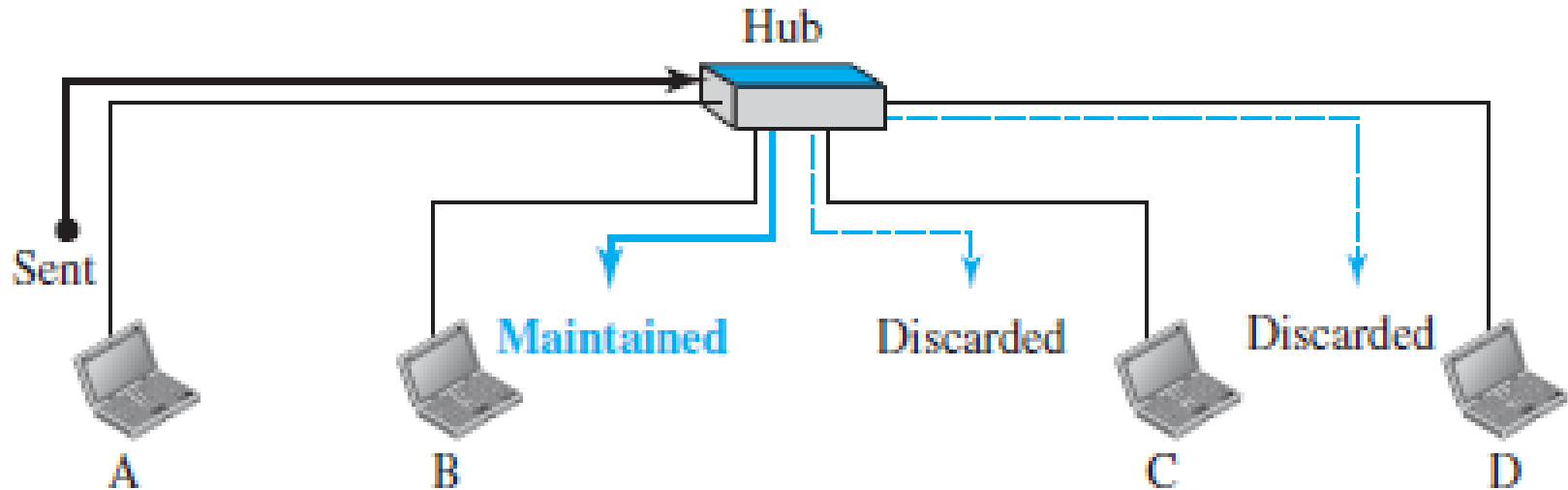
A Hub or a Repeater has no filtering capability as it is working in the physical layer
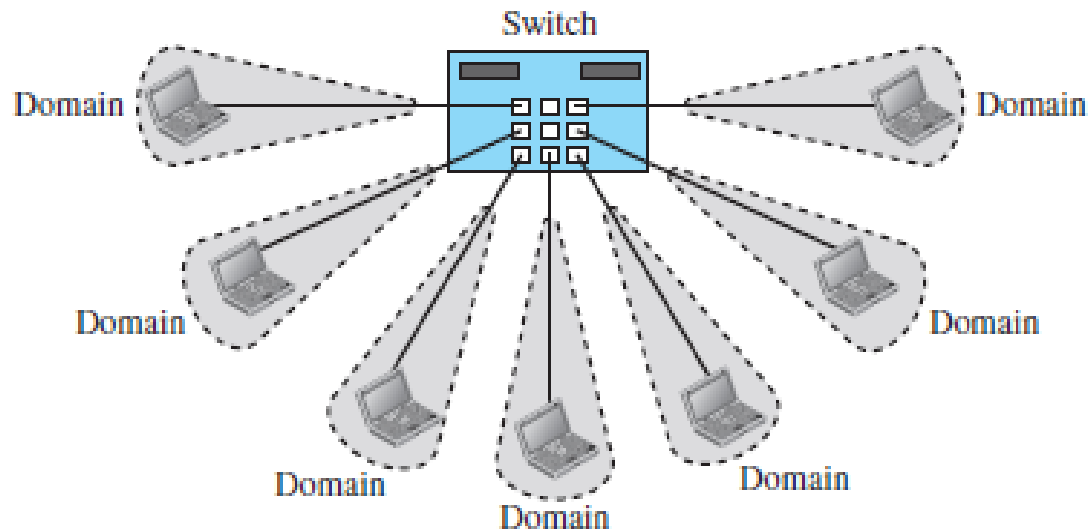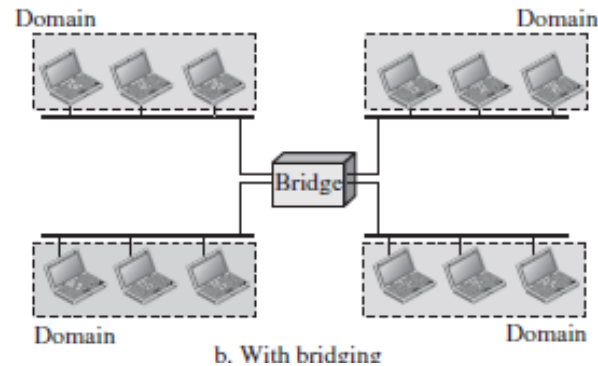
Bridges

a. Without bridging

b. With bridging

Switches Vs Bridges

a. Without bridging

b. With bridging

Switches Vs Bridges

Sl no	Switch	Bridge
1	Many ports	2 to 4 ports
2	Buffering	No buffering
3	Error checking	No error checking
4	Connecting Nodes	Connecting Networks
5	Hardware based switching	Software based bridging

Hub Vs Bridges

ETHERNET

Ethernet evolution

Standard Ethernet	Fast Ethernet	Gigabit Ethernet	10 Gigabit Ethernet
10 Mbps	100 Mbps	1 Gbps	10 Gbps

ETHERNET FRAME FORMAT

Minimum payload length: 46 bytes
Maximum payload length: 1500 bytes

Preamble: 56 bits of alternating 1s and 0s
SFD: Start frame delimiter, flag (10101011)

Preamble	S F D	Destination address	Source address	Type	Data and padding	CRC
7 bytes	1 byte	6 bytes	6 bytes	2 bytes		4 bytes

Physical-layer header

Minimum frame length: 512 bits or 64 bytes
Maximum frame length: 12,144 bits or 1518 bytes
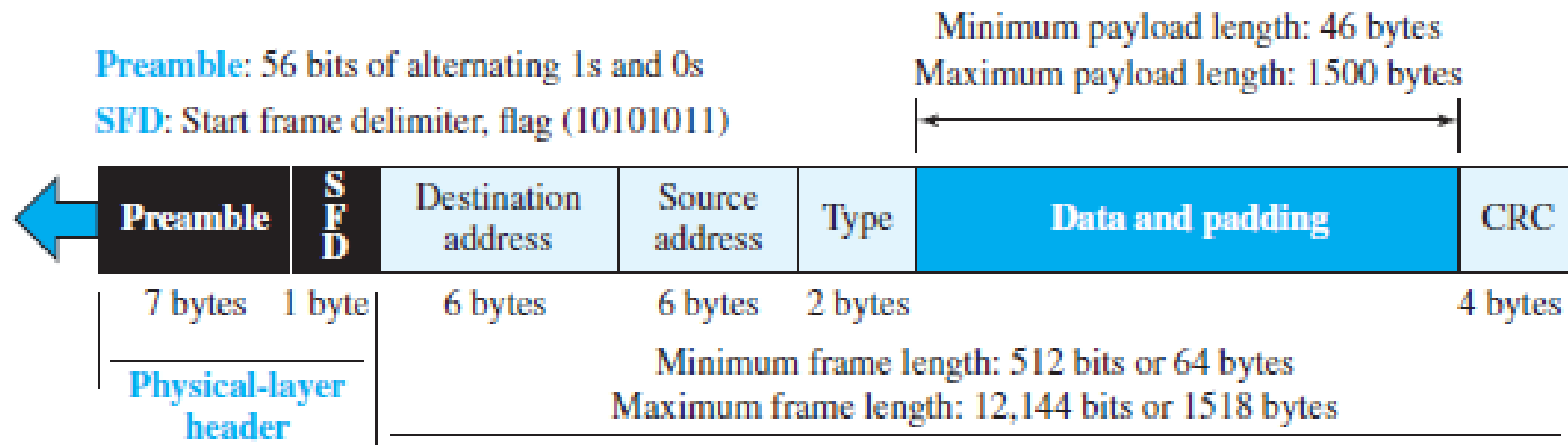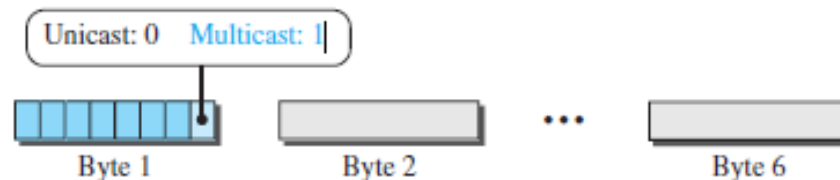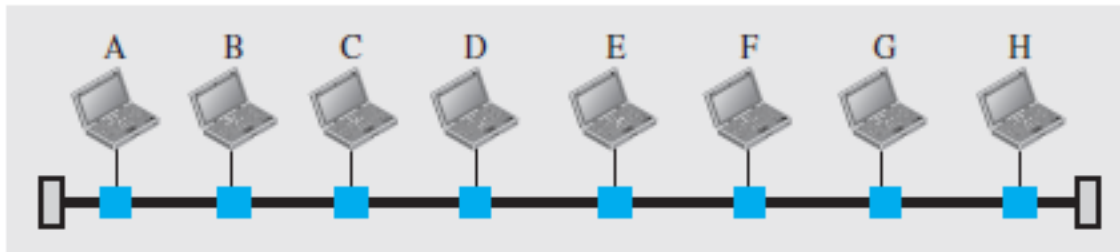
Preamble – for synchronization
Type- indicates the upper layer protocol(IP,ARP etc)

If the least significant
bit of the first byte in a destination
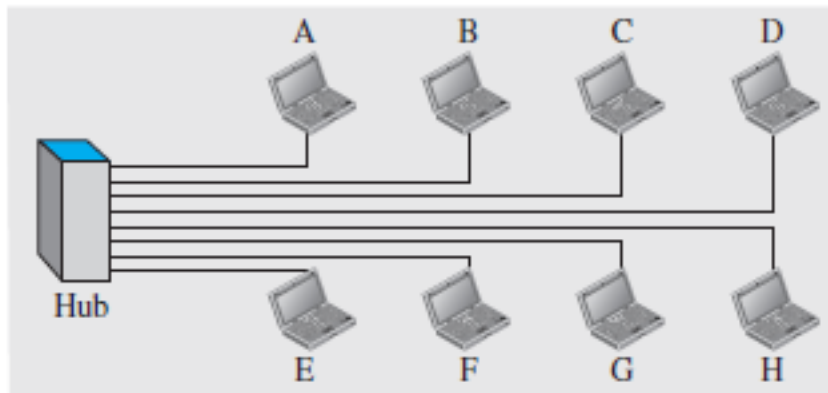address is 0, the address is unicast;
otherwise, it is multicast.
Broadcast- all 48bits are one

Unicast: 0   Multicast: 1

Byte 1   Byte 2   • • •   Byte 6

Ethernet Implementation

a. A LAN with a bus topology using a coaxial cable

b. A LAN with a star topology using a hub

Legend

A host (of any type)
A hub
A cable tap
A cable end
Coaxial cable
Twisted pair cable
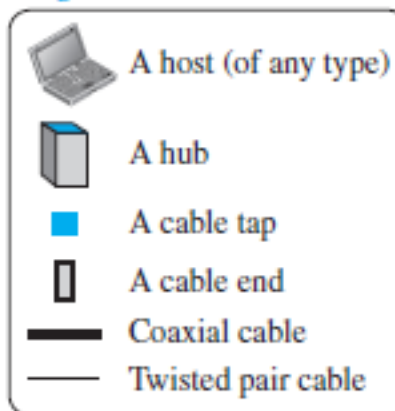
STANDARD ETHERNET TYPES

Standard Ethernet chose CSMA/CD with 1-persistent method

Implementation	Medium	Medium Length	Encoding
10Base5	Thick coax	500 m	Manchester
10Base2	Thin coax	185 m	Manchester
10Base-T	2 UTP	100 m	Manchester
10Base-F	2 Fiber	2000 m	Manchester

10 Mbps data   10 Mbps data

Manchester encoder   Manchester decoder

Station

Media
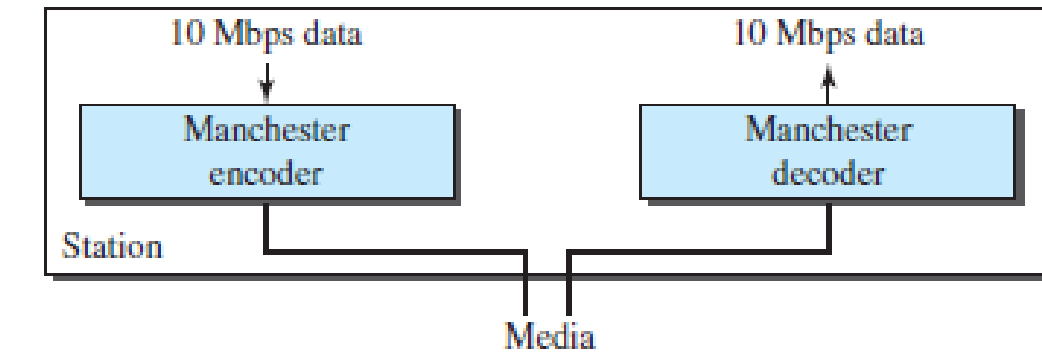
ETHERNET TYPES

Switched Ethernet
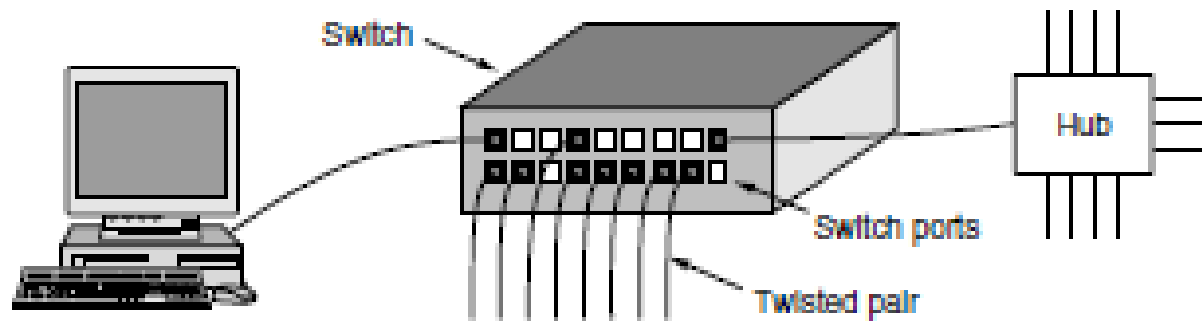
Most LAN interfaces have a **promiscuous mode**, in which *all* frames are given to each computer, not just those addressed to it.

Fast Ethernet

- Normal Ethernet 10Mbps

- Fast Ethernet permits 100 Mbps

- Supports half duplex as well as full duplex

- Autonegotiation

Gigabit Ethernet

- unacknowledged datagram service with both unicast and broadcast
- Uses point to point links

Name	Cable	Max. segment	Advantages
1000Base-SX	Fiber optics	550 m	Multimode fiber (50, 62.5 microns)
1000Base-LX	Fiber optics	5000 m	Single (10 μ) or multimode (50, 62.5 μ)
1000Base-CX	2 Pairs of STP	25 m	Shielded twisted pair
1000Base-T	4 Pairs of UTP	100 m	Standard category 5 UTP

10-Gigabit Ethernet

Ethernet bandwidth- 10Gbps

Name	Cable	Max. segment	Advantages
10GBase-SR	Fiber optics	Up to 300 m	Multimode fiber (0.85μ)
10GBase-LR	Fiber optics	10 km	Single-mode fiber (1.3μ)
10GBase-ER	Fiber optics	40 km	Single-mode fiber (1.5μ)
10GBase-CX4	4 Pairs of twinax	15 m	Twinaxial copper
10GBase-T	4 Pairs of UTP	100 m	Category 6a UTP