COE 441 Project Grading

- ✍ Abstract: 2 points
- ✍ Progress report: 5 points
- ✍ Final report: 8 points

Ethernet Technologies

- ✍ 10-Mbps Ethernet:
  - » Developed by Xerox, DEC and Intel in 1980
  - » IEEE 802.3
- ✍ 100-Mbps Ethernet
  - » in 1995, IEEE adopted 802.3u Fast Ethernet standard
- ✍ Gigabit Ethernet

Ethernet Technologies (Cont.)

- ✍ Access methodology
  - » CSMA/CD
- ✍ 10-Mbps Ethernet
  - » minimum frame size = 64 bytes
  - » maximum cable length is 2.5 km
- ✍ As bit rate increases, the sender transmits the frame faster
- ✍ keeping the same frame size and cable length, then collision may not be detected
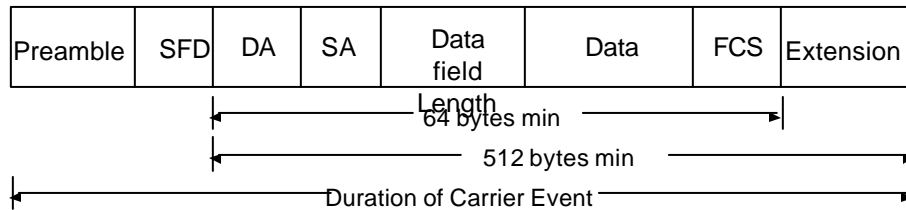
Ethernet Technologies (Cont.)

- ✍ Solutions:
  - » keep the maximum cable length and increase the *slot size* (i.e. therefore the minimum size)
  - » keep the slot size same and decrease the maximum cable length or both
- ✍ Fast Ethernet
  - » reduce the maximum cable length to 100 m
  - » keep the same *slot size*
- ✍ Gigabit Ethernet
  - » uses bigger slot size (512 bytes)
  - » to maintain compatibility with Ethernet, minimum frame size is not increased
  - » but the 'carrier event' is extended

Ethernet Technologies (Cont.)

- ✍ Carrier Extension
  - » to maintain 802.3 minimum and maximum frame sizes with meaningful cabling distances
  - » to be inter-operable with 802.3 networks
  - » minimum frame size is 64 bytes
  - » special symbols are added to complete 512 bytes
  - » FCS is calculated only on the original frame (without extension)

Preamble	SFD	DA	SA	Data field	Data	FCS	Extension

Length
64 bytes min

512 bytes min

Duration of Carrier Event

Ethernet Technologies (Cont.)

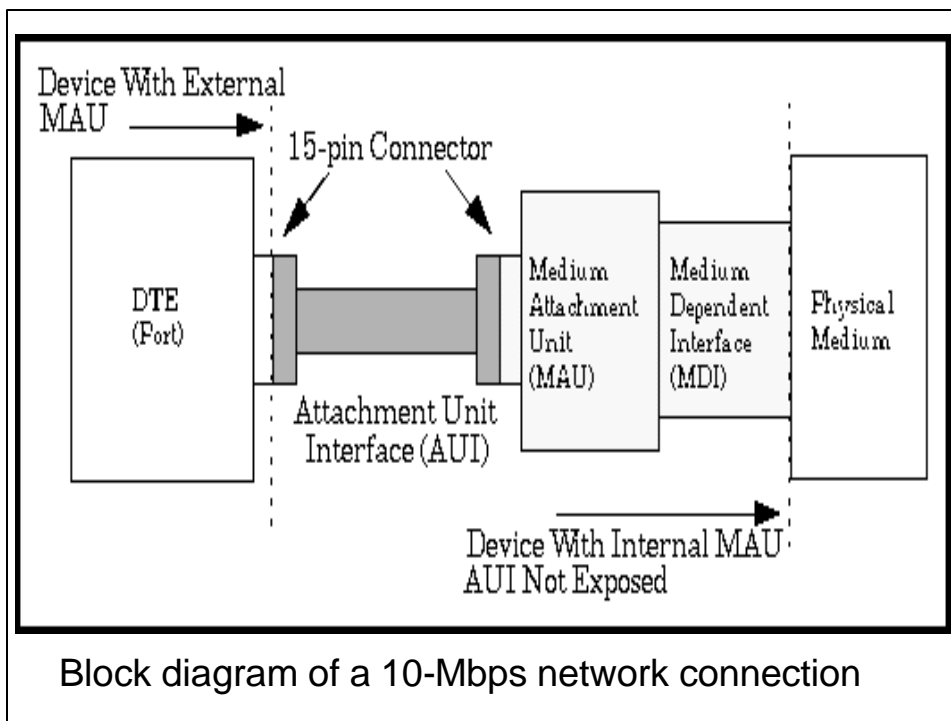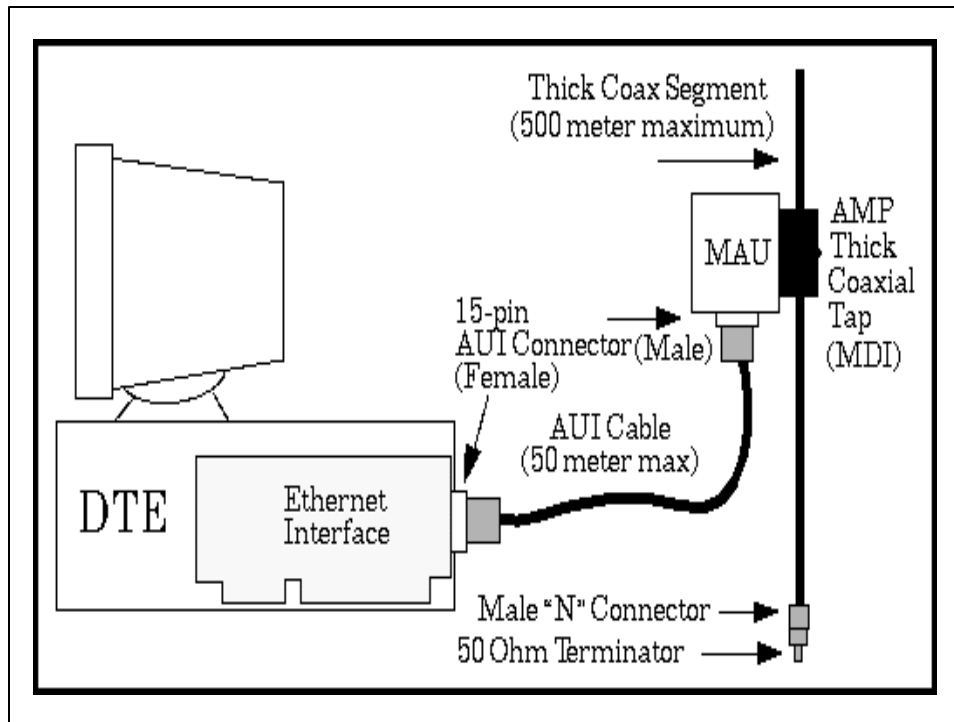| Parameter	10-Mbps	100 Mbps	1Gbps
SlotTime	512-bit time	512-bit time	4096-bit time
interFrameGap	9.6 ?sec	0.96 ?sec	0.096 ?ses
attemptLimit	16	16	16
backoffLimit	10	10	10
jamSize	32 bits	32 bits	32 bits
MaxFrame Size	1518 bytes	1518 bytes	1518 bytes
MinFrameSize	64 bytes	64 bytes	64 bytes
Burstlimit	N/A	N/A	8192 bytes

Ethernet Technologies (Cont.)

? Medium Access Unit:
» Medium attachment unit (MAU)
– Transmit signals on the medium
– Receive signals from the medium
– recognize the presence of a signal on the medium
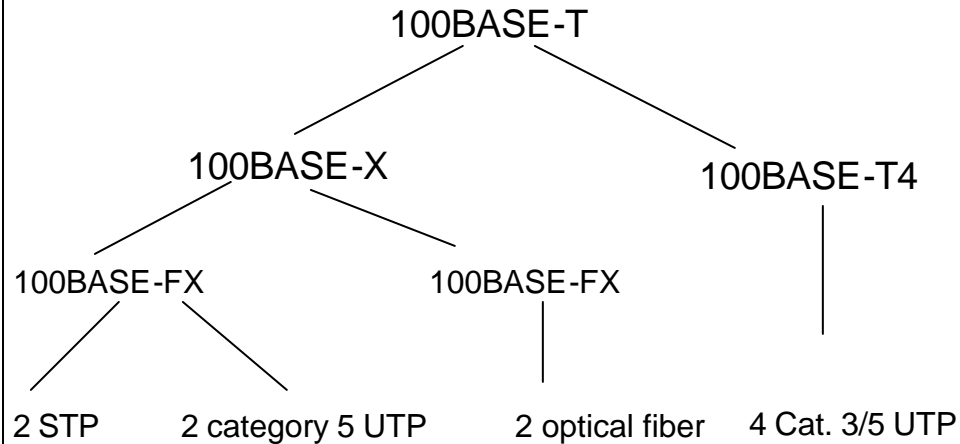– Recognize a collision
» Attachment unit interface (AUI)

Block diagram of a 10-Mbps network connection

10 Mbps Ethernet Cabling

✍ 10BASE5

<data rate in Mbps> <signaling method> <maximum segment length in hundreds of meters>

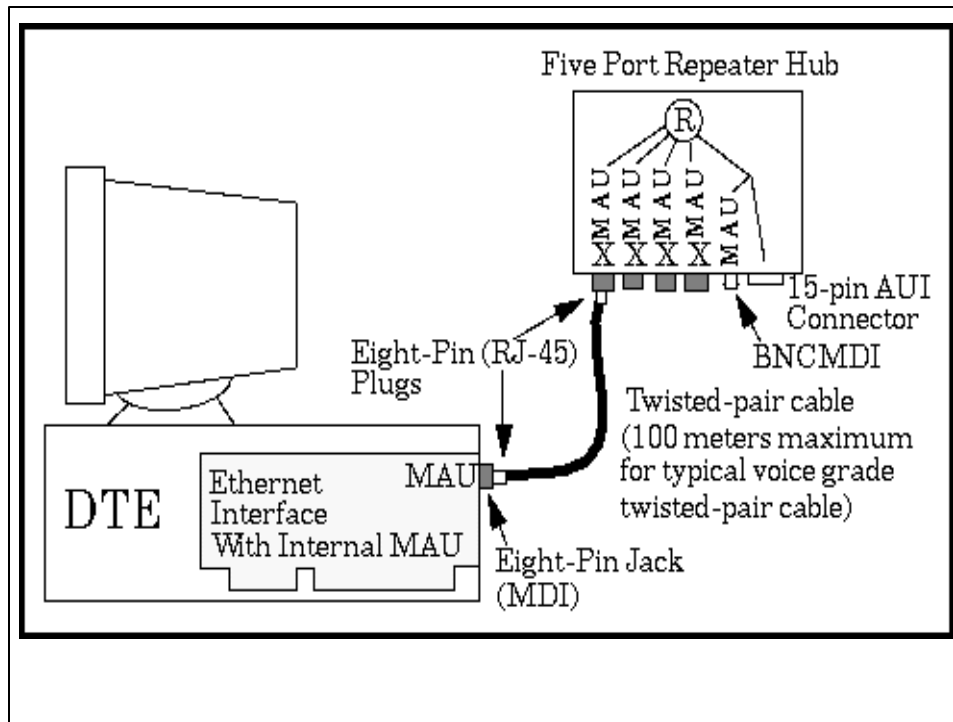| Name	cable	Max. segment	Nodes /seg	signaling	advantages
10Base5	Thick coax	500m	100	Baseband (Mancheste)	Good for backbone
10Base2	Thin coax	200m	30	Baseband (Mancheste)	Cheapest system
10Base-T	Twisted pair	100m	1024	Baseband (Mancheste)	Easy maintenance
10Base-F	Fiber optics	2000m	1024	Baseband (Mancheste)	Best between buildings

100 Mbps Ethernet Cabling

✍ 100BASE-T

    <data rate in Mbps> <signaling method>

```
                        100BASE-T
                       /         \
            100BASE-X             100BASE-T4
           /         \                  |
    100BASE-FX      100BASE-FX          |
      /     \            |              |
 2 STP   2 category 5 UTP  2 optical fiber  4 Cat. 3/5 UTP
```

1000 Mbps Ethernet Cabling

✍ 10BASE5

    <data rate in Mbps> <signaling method> <maximum segment length in hundreds of meters>

Name	cable	Max. segment	Nodes /seg	signaling	advantages
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Five Port Repeater Hub

DTE

Ethernet Interface With Internal MAU

MAU

Eight-Pin (RJ-45) Plugs

Eight-Pin Jack (MDI)

15-pin AUI Connector

BNCMDI

Twisted-pair cable (100 meters maximum for typical voice grade twisted-pair cable)

Ethernet Design Issues

- ✍ A repeater is transparent to the MAC level
  - » Does no buffering
  - » Does not isolate one segment from another
  - » Constitute a single *Collision Domain*
- ✍ Using STAR-wiring, each link is considered a segment

Token Bus   (IEEE 802.4)

- ✎ Disadvantages of IEEE 802.3 CSMA/CD:
  - » a station may wait arbitrarily long to send a frame due to its probabilistic nature.
  - » frames do not have priorities
  - » Minimum frame size requirement
- ✎ Physically, the token bus is a linear cable onto which stations are attached. Logically, stations are organized into a ring.
- ✎ A special control frame called token is transmitted from one station to the logically next, with each station knowing the address of the station to its ``left'' and ``right''.
- ✎ Token bus defines four priority classes: 0, 2, 4, and 6 for traffic, with 0 the lowest and 6 the highest.

TOKEN RING

- ✎ IEEE 802.5 Medium Access Protocol
- ✎ The token ring technique is based on the use of a small frame, called a token that circulates.
  - » A station wishing to transmit must wait until it detects a token passing by.
  - » It then seizes the token by changing one bit in the token which transforms it from a token into a start-of-frame sequence for a data frame.
  - » The station then appends and transmits the remainder of the fields needed to construct a data frame.

TOKEN RING (cont)

- ⚞ The transmitting station will insert a new token on the ring when both of the following conditions have been met:
  - » The station has completed transmission of its frame.
  - » The leading edge of the transmitted frame has returned (after a complete circulation of the ring) to the station. (This condition ensures that only one data frame at a time may be on the ring, thereby simplifying error-recovery procedures).

TOKEN RING (cont)

  - » Once the new token has been inserted on the ring, the next station downstream with data to send will be able to seize the token and transmit.
- ⚞ Note that under lightly loaded conditions, there is some inefficiency with token ring because a station must wait for the token to come around before transmitting.
- ⚞ The principal disadvantage of token ring is the requirement for token maintenance.
  - » Loss of token prevents further utilization of the ring.
  - » One station must be selected as a monitor.