LAN Technology

Ethernet Protocols & Technology

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July 2010

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Outlines:

- Ethernet
- Mac Type
- OSI Model
- TCP/IP
- Ethernet IEEE 802.2 and 802.3
- LAB Activity : Network Cabling

What Is Ethernet?

• A local-area network (LAN) protocol developed by Xerox Corporation in cooperation with DEC and Intel in 1976
• Ethernet uses a bus or star topology and supports data transfer rates of 10/100/1000 Mbps
• The Ethernet specification served as the basis for the IEEE 802.3 standard, which specifies the physical and lower software layers
• Ethernet uses the CSMA/CD access method to handle simultaneous demands
• Ethernet defines the lower two layers of the OSI Reference Model

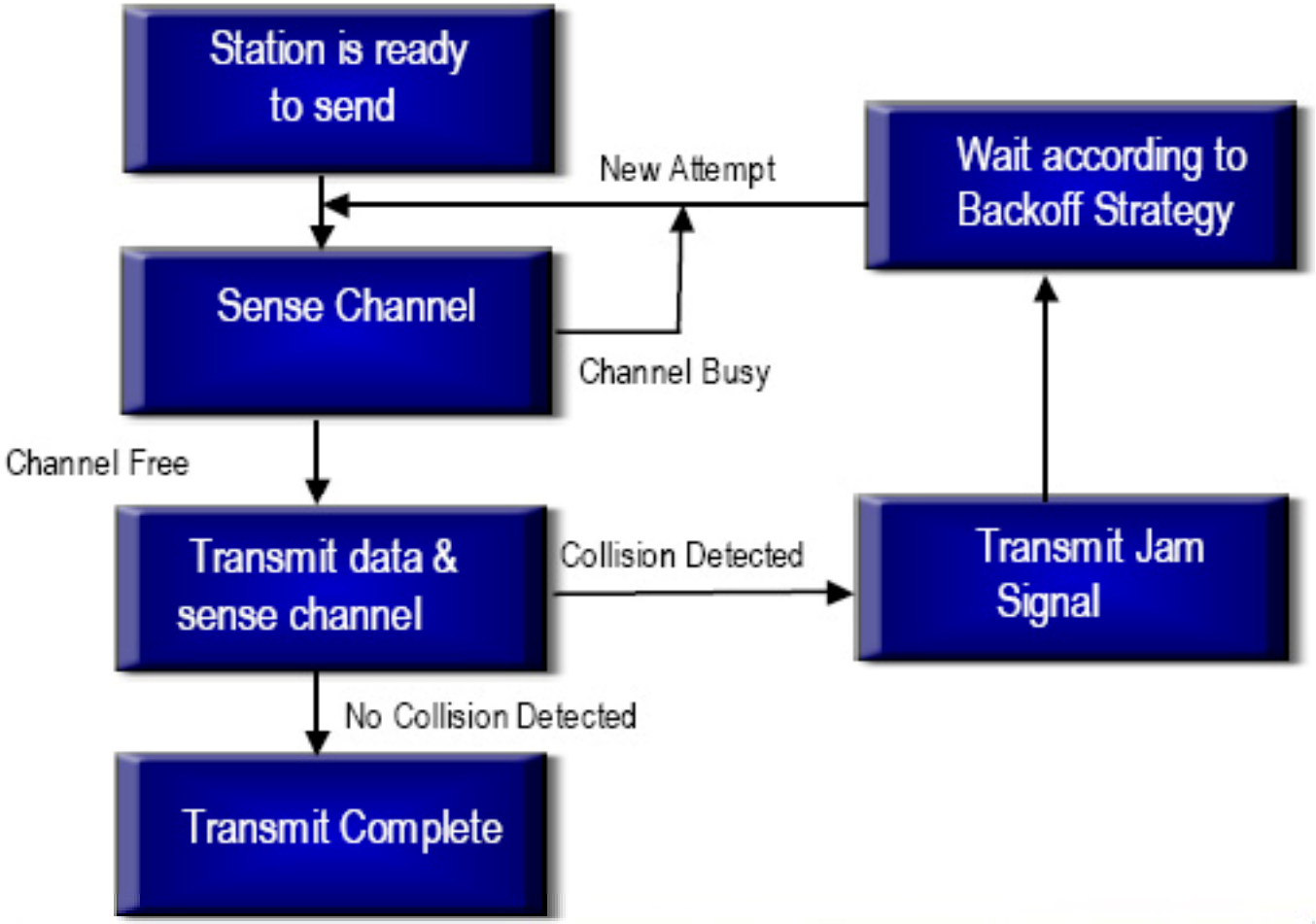
MAC Types

• There are two Media Access Control(MAC) protocols defined for Ethernet:
– Half-Duplex and Full-Duplex
• Half-Duplex is the traditional form of Ethernet that uses the CSMA/CD protocol
• Full-Duplex bypasses the CSMA/CD protocol
• Full-duplex mode allows two stations to simultaneously exchange data over a point to point link that provides independent transmit and receive paths

MAC Types (Half-Duplex)

- Refers to the transmission of data in just one direction at a time
- Half-Duplex Ethernet is the traditional form of Ethernet that uses the CSMA/CD
- Half duplex Ethernet assumes that all the "normal" rules of Ethernet are in effect on the local network

CSMA/CD Flow


Station is ready to send
New Attempt
Wait according to Backoff Strategy
Sense Channel
Channel Busy
Channel Free
Transmit data & sense channel
Collision Detected
Transmit Jam Signal
No Collision Detected
Transmit Complete

MAC Types (Full-Duplex)

• Based on the IEEE 802.3x standard, “Full-Duplex” MAC type bypasses the CSMA/CD protocol

• Full-duplex mode allows two stations to simultaneously exchange data over a point to point link

• The aggregate throughput of the link is effectively doubled
– A full-Duplex 100 Mb/s station provides 200 Mb/s of bandwidth

MAC Types (Full-Duplex)

• Full-Duplex operation is supported by:
– 10-Base-T, 10Base-FL, 100Base-TX, 100Base-FX, 100Base-T2, 1000Base-CX, 1000Base-SX, 1000Base-LS, and 1000Base-T.

• Full-Duplex operation is NOT supported by:
– 10Base5, 10Base2, 10Base-FP, 10Base-FB, and 100Base-T4.

• Full-Duplex operation is restricted to point to point links connecting
exactly two stations

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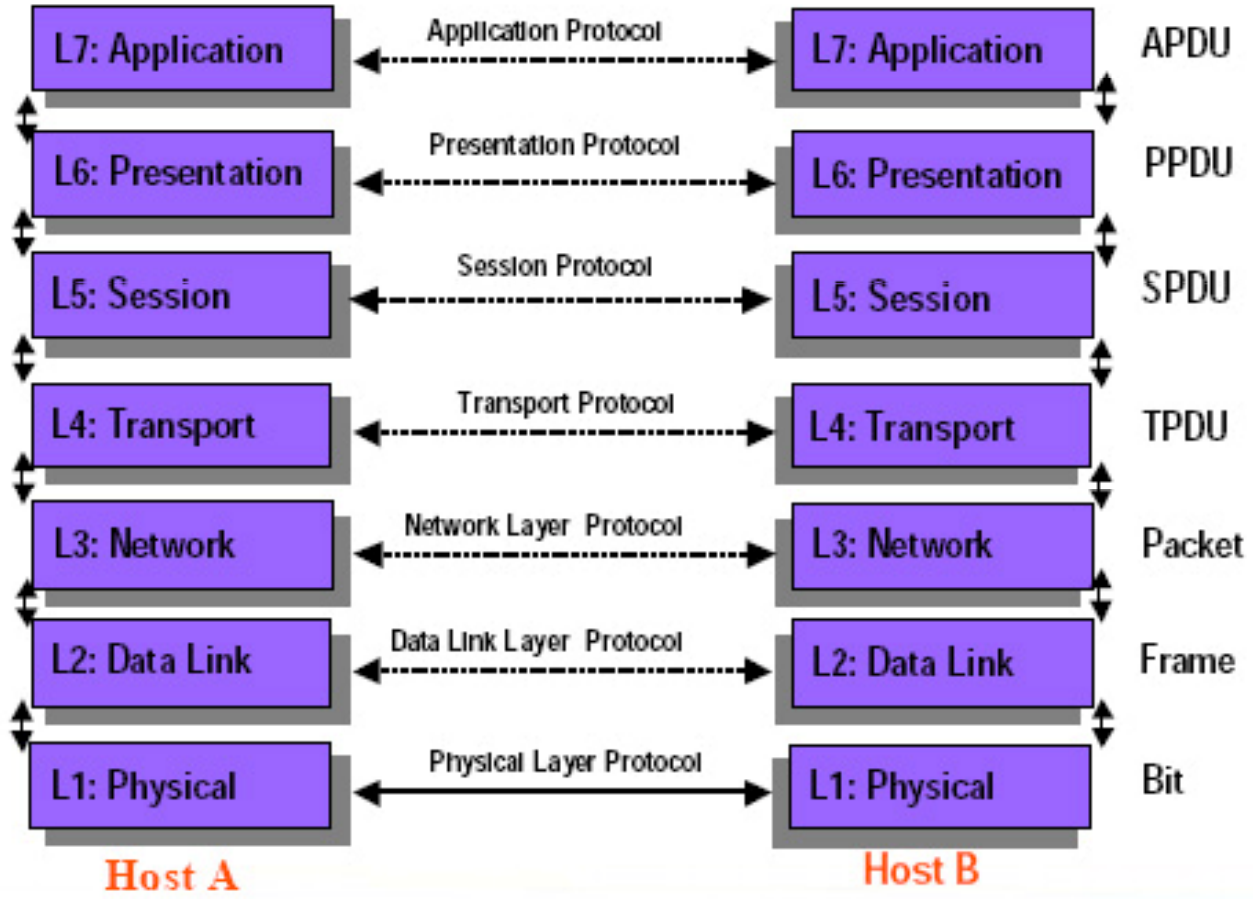
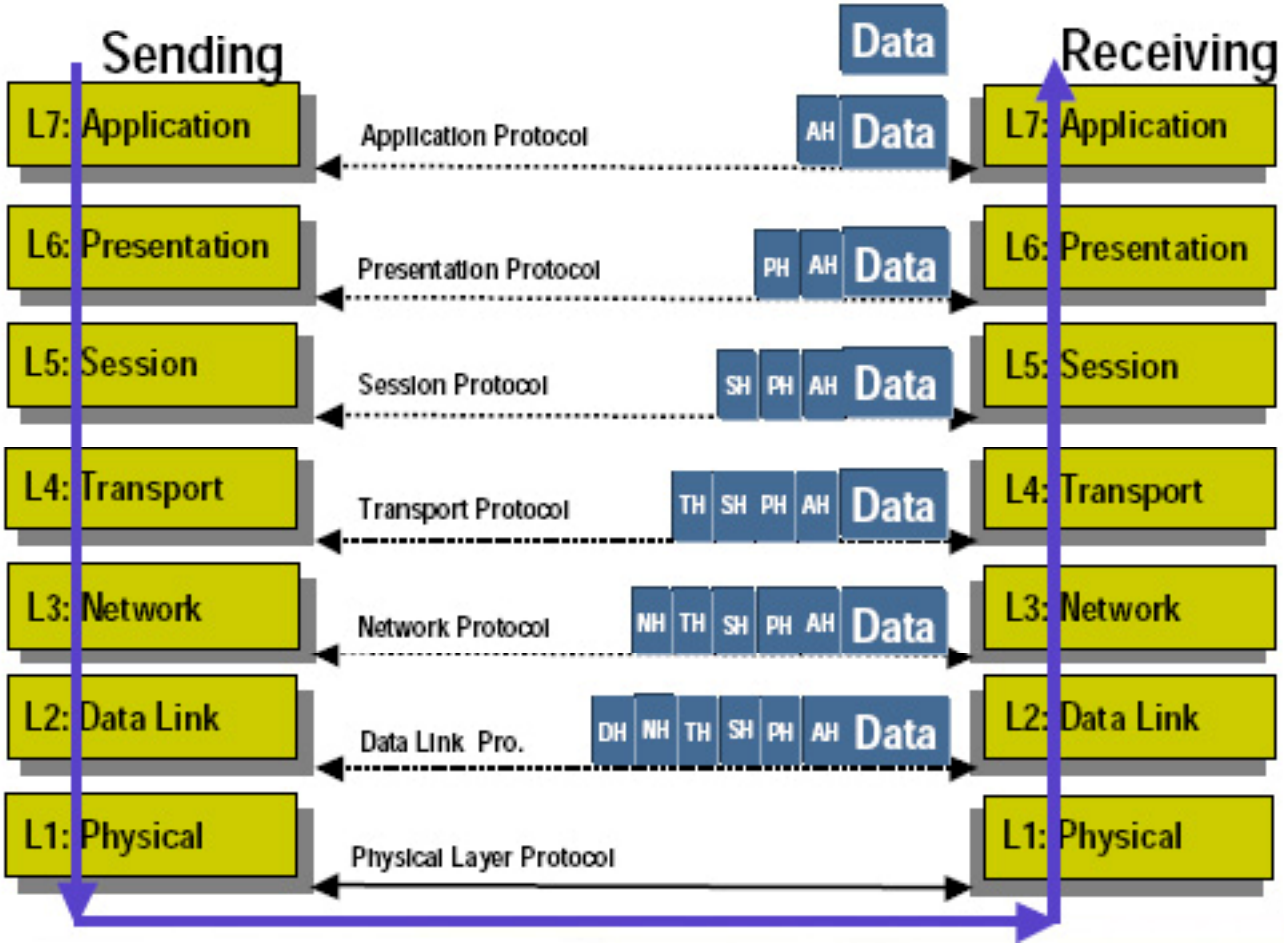
The OSI Reference Model



Data Transmission



What is TCP/IP?

• TCP/IP = Transmission Control Protocol/Internet Protocol

• Is the basic communication language or protocol of the Internet

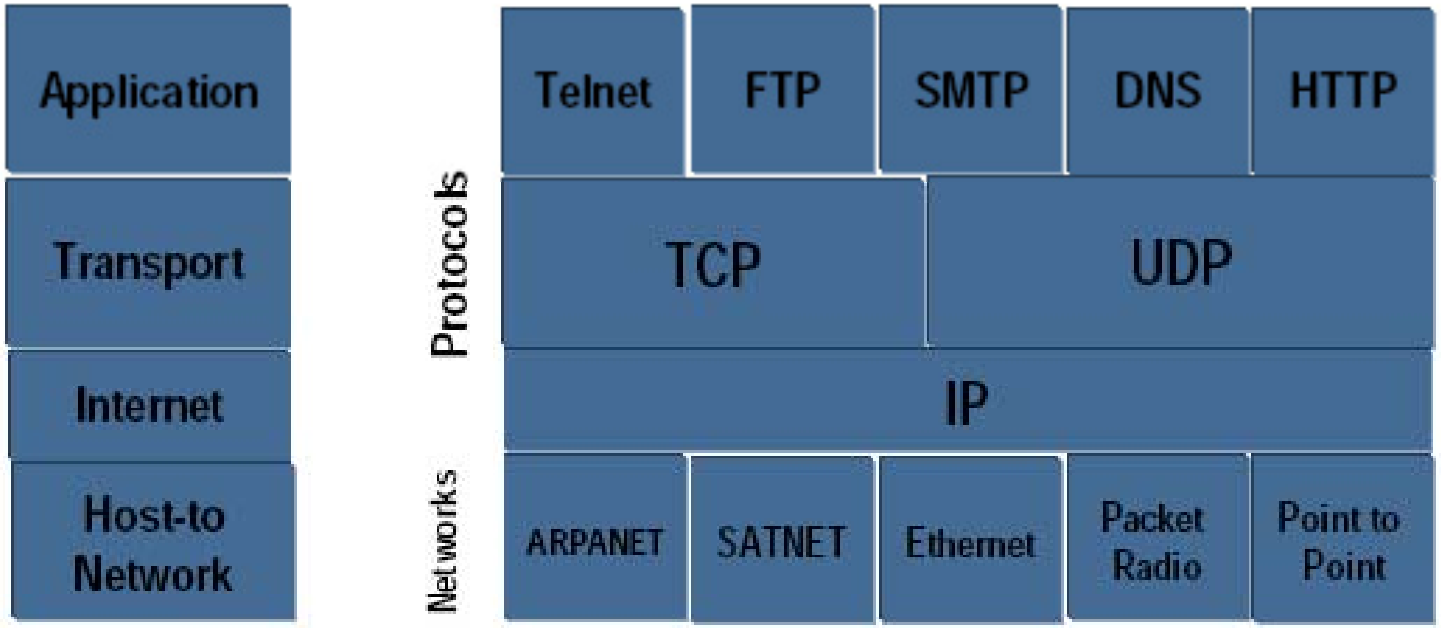
• It can also be used as a communications protocol in the private networks (intranets and in extranets)

• TCP/IP is a two-layered program

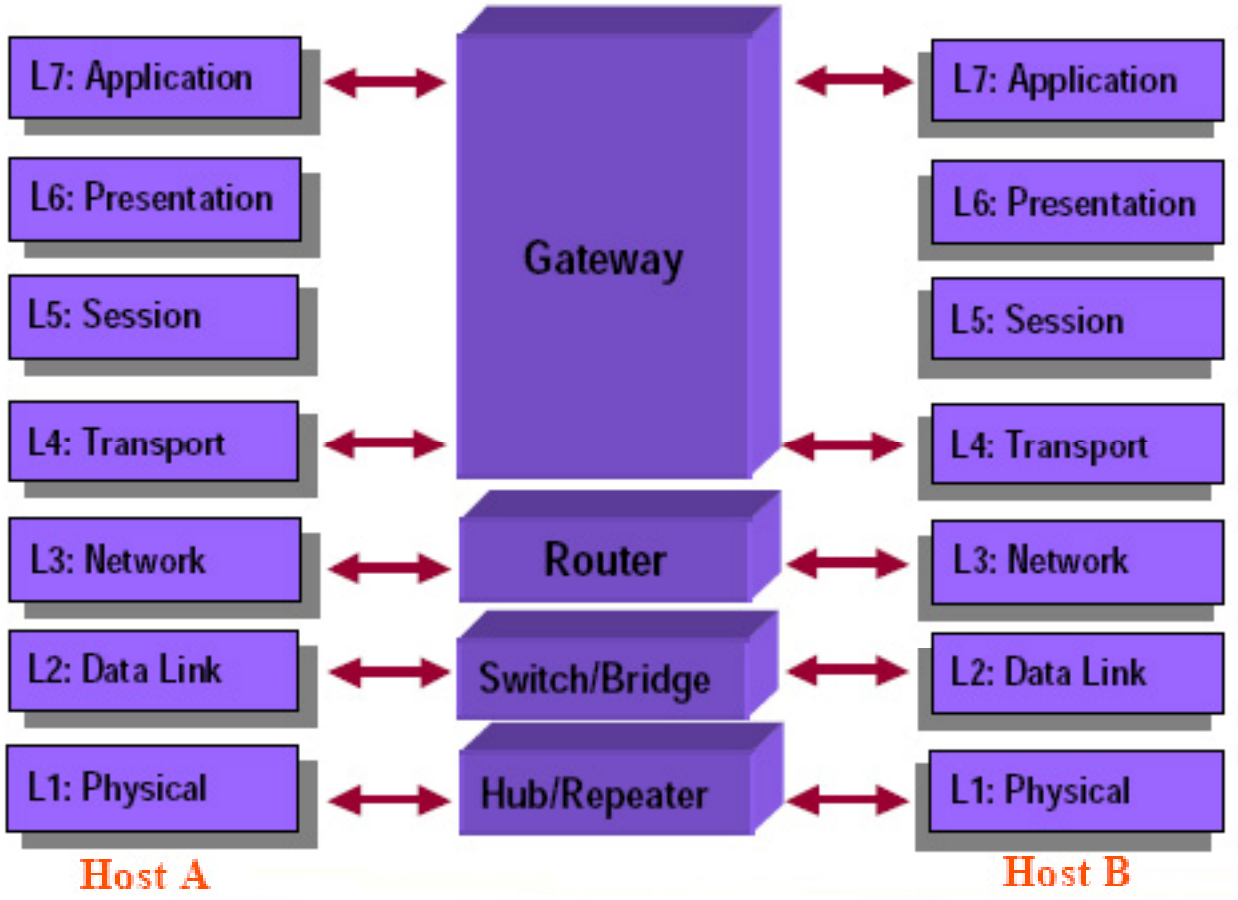
– Transmission Control Protocol - Manages the assembling of a message or file into smaller packets

– Internet Protocol- Handles the address part of each packet so that it gets to the right destination

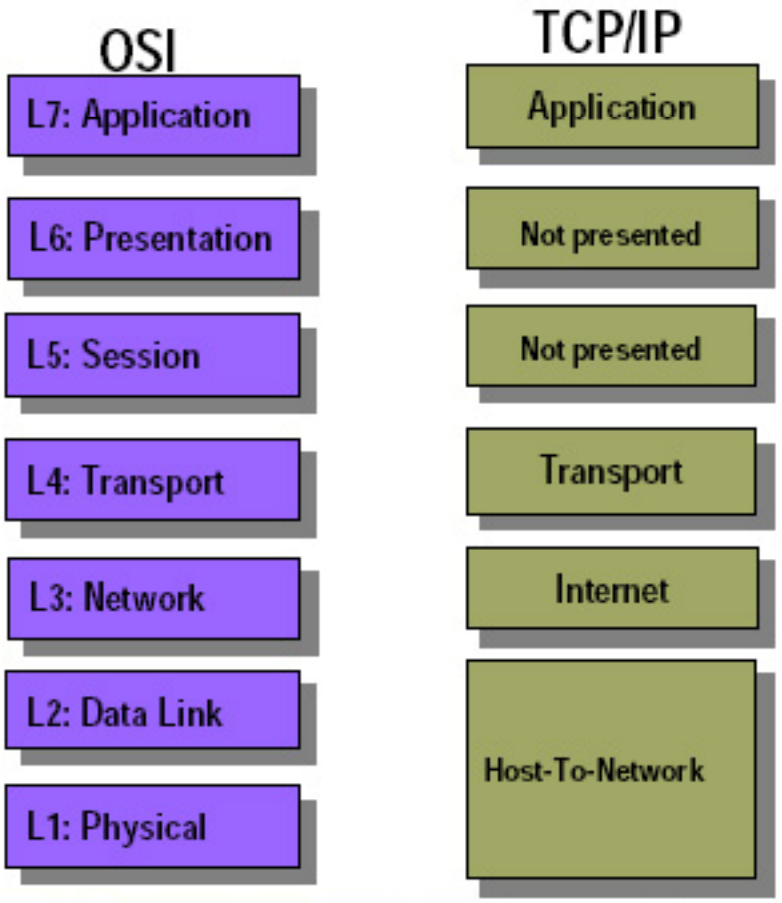
What is TCP/IP Reference Model?



Interconnection Devices



OSI & TCP/IP

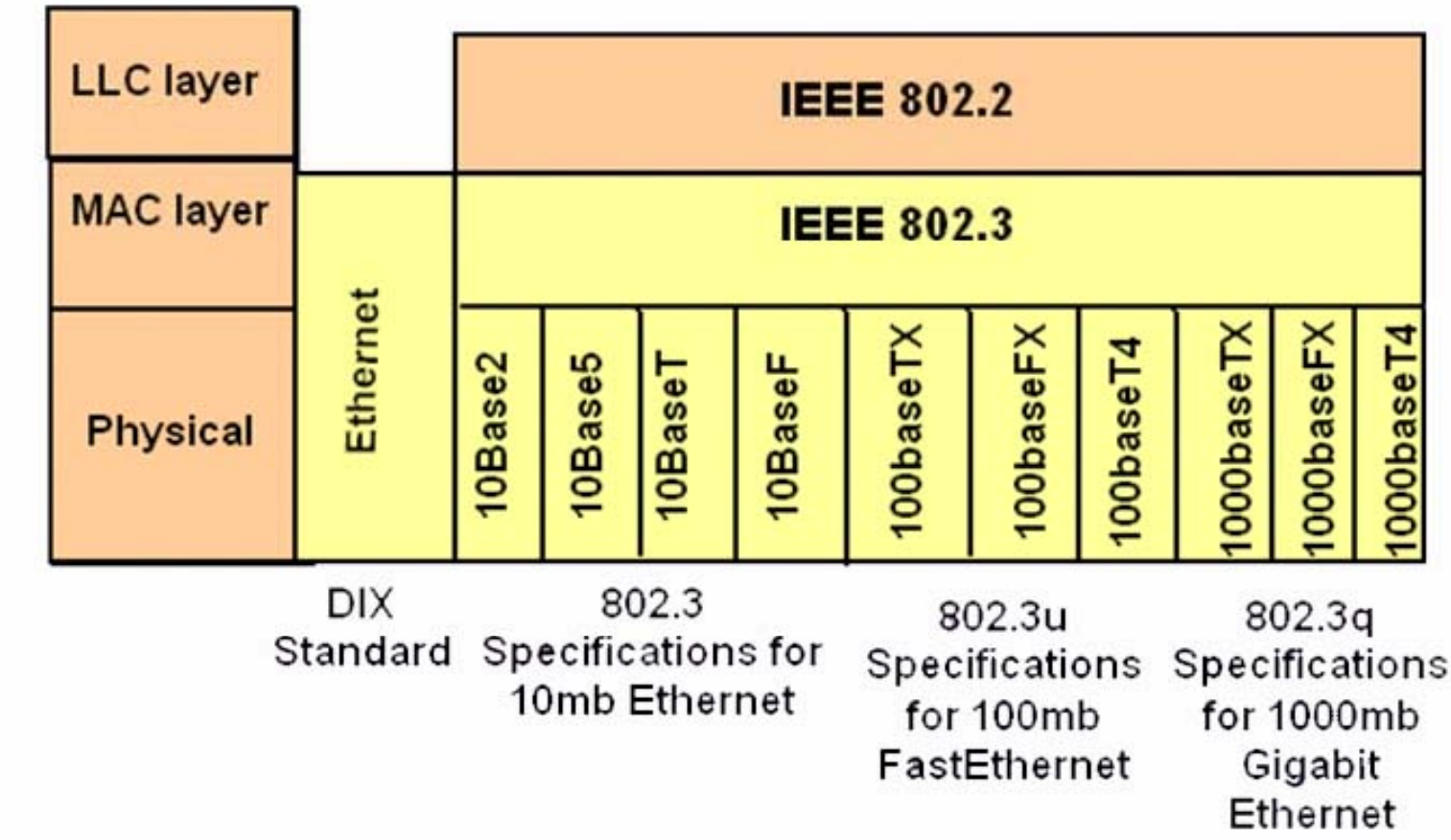

OSI
L7: Application
L6: Presentation
L5: Session
L4: Transport
L3: Network
L2: Data Link
L1: Physical
TCP/IP
Application
Not presented
Not presented
Transport
Internet
Host-To-Network

The OSI Reference Model

Ethernet LAN Specifications

- IEEE - 802.3
- IEEE – 802.3u – Fast Ethernet
- IEEE – 802.3z – Gigabit Ethernet over Fiber
- IEEE - 802.3ab – Gigabit Ethernet over UTP
- IEEE – 802.3ae – 10 Gigabit Ethernet over Fiber
- IEEE – 802.3ak – 10 Gigabits Ethernet over UTP

IEEE 802.2 and 802.3



10 Base 5

- Transmission Rate:10 Mb/s(full-duplex not supported)
- Cable Type: A single "thick" (10mm) coaxial cable with

50 + 2 ohms impedance

- Max. Segment Length: 500 meters (1640 feet)
- Max. TX Cable Length: 50 meters (164 feet)
- Max. # of TX / Segment: 100
- Connector Technology: N-type coaxial connectors,

barrel connectors, & terminators

- Signal Encoding: Manchester encoding

10 Base 2

- Transmission Rate:10 Mb/s(full-duplex not supported)
- Cable Type: A single "thin" (5mm) coaxial cable with 50 ± 2 ohms impedance
- Max. Segment Length:185 meters (606.9 feet)
- Max. Spacing Between Stations: 0.5 meters (164 feet)
- Max. # of TX / Segment: 30
- Connector Technology: BNC Tee coaxial connectors, barrel connectors, & terminators
- Signal Encoding: Manchester encoding

10 Base T

- Transmission Rate: 10 Mb/s (20 Mb/s in optional full duplex mode)
- Cable Type: Two pairs of Category 3 or better

unshielded twisted pair (UTP) cabling

– 100-ohm impedance rating

- Max. Segment Length:100 meters (328 feet)
- Max. # of TX / Segment: 2
- Connector Technology: RJ-45 style modular jack
- Signal Encoding: Manchester encoding

10Broad36

- Transmission Rate: 10 Mb/s (full-duplex not supported)
- Cable Type: Single 75-ohm CATV broadband cable
- Max. Segment Length: 1800 meters (5905 feet)
- Maximum Total Span: 3600 meters (11811 feet)
- Signal Encoding: Modulated radio frequency (RF)

10Base-FL

- Transmission Rate : 10 Mb/s (20 Mb/s in optional full duplex

mode)

- Cable Type: Two multi-mode fiber optic cables, typically

62.5/125 fiber, 850 nanometer light wavelength

- Max. Segment Length: 2000 meters (6561 feet)
- Max. # of TX per Segment: 2
- Connector Technology : ST connector (BFOC/2.5)
- Signal Encoding: Manchester encoding

100BaseTX

- Transmission Rate: 100 Mb/s (200 Mb/s in optional full duplex

mode)

- Cable Type: Two pairs of Category 5 unshielded twisted

pair (UTP) cabling, 100-ohm impedance rating

- Max. Segment Length: 100 meters (328 feet)
- Max. # of TX per Segment: 2
- Connector Technology: RJ-45 style modular jack (8-pins)

for UTP cabling

- Signal Encoding: 4B/5B

100BaseFX

- Transmission Rate:100 Mb/s (200 Mb/s in FD mode)
- Cable Type: Two multi-mode optical fibers (MMF),1300 nanometer light wavelength
- Max. Segment Length: 412 meters (Half-Duplex), 2000 meters (Full-Duplex)
- Max. # of TX/ Segment: 2
- Connector Technology: Duplex SC connector preferred, ST and FDDI MIC connectors also permitted
- Signal Encoding: 4B/5B

100BaseT4

- Transmission Rate:100 Mb/s(full-duplex not supported)
- Cable Type: Four pairs of Category 3 or better unshielded twisted pair (UTP) cabling ,100-ohm impedance rating
- Max. Segment Length: 100 meters (328 feet)
- Max. # of TX/ Segment: 2
- Connector Technology: RJ-45 style modular jack
- Signal Encoding: 8B6T

100BaseT2

- Transmission Rate: 100 Mb/s (200 Mb/s in optional full duplex mode)
- Cable Type: Two pairs of Category 3 unshielded twisted

pair (UTP) cabling, 100-ohm impedance rating

- Max. Segment Length: 100 meters (328 feet)
- Max. # of TX/ Segment: 2
- Connector Technology: RJ-45 style modular jack (8-pins)
- Signal Encoding: PAM5x5

100BaseLX

- Transmission Rate: 1000 Mb/s (2000 Mb/s in FD mode)
- Cable Types:
  - Two 62.5/125 or 50/125 multi-mode optical fibers (MMF)
  - Two 10 micron single mode optical fibers (SMF)
- Maximum Segment Length:
  - Half-Duplex MMF & SMF: 316 meters (1036 ft)
  - Full-Duplex MMF: 550 meters (1804 ft)
  - Full-Duplex SMF: 5000 meters (16,404 ft)
- Connector Technology: Duplex SC connector
- Signal Encoding: 8B/10B

1000BaseSX

- Transmission Rate:1000 Mb/s (2000 Mb/s in FD mode)
- Cable Types: Two 62.5/125 or 50/125 multi-mode optical fibers,

770 to 860 nanometer light wavelength

- Maximum Segment Length:

– Half-Duplex 62.5/125: 275 meters (902 ft)

– Half-Duplex 50/125: 316 meters (1036 ft)

– Full-Duplex 62.5/125: 275 meters (902 ft)

– Full-Duplex 50/125: 550 meters (1804 ft)

- Max. # of TX/ Segment: 2
- Signal Encoding: 8B/10B

1000BaseT

- Transmission Rate:1000 Mb/s (2000 Mb/s in FD mode)
- Cable Types:4-pairs of Category 5 or better cabling

– 100-ohm impedance rating

- Max. Segment Length: 100 meters (328 ft)
- Max. # of TX/ Segment: 2
- Connector Technology: 8-Pin RJ-45 connector
- Signal Encoding: PAM5

LAB:

1. Ethernet cabling connections
2. Interconnection Devices

Questions