

CS4254

Computer Network Architecture and Programming

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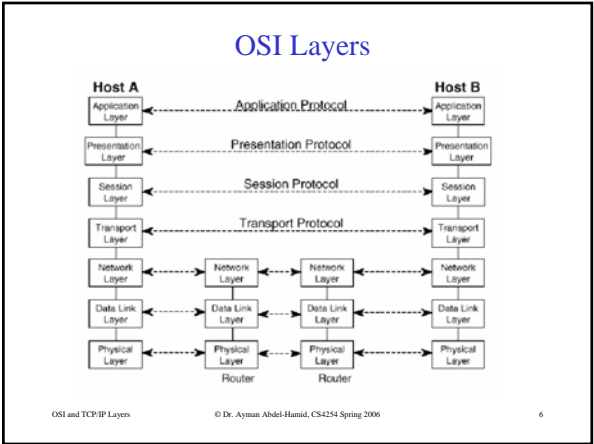
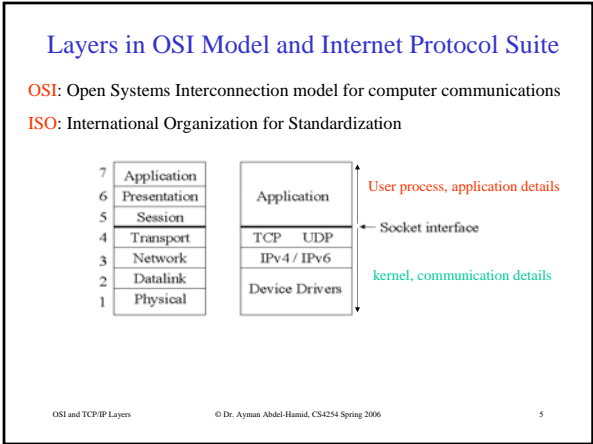
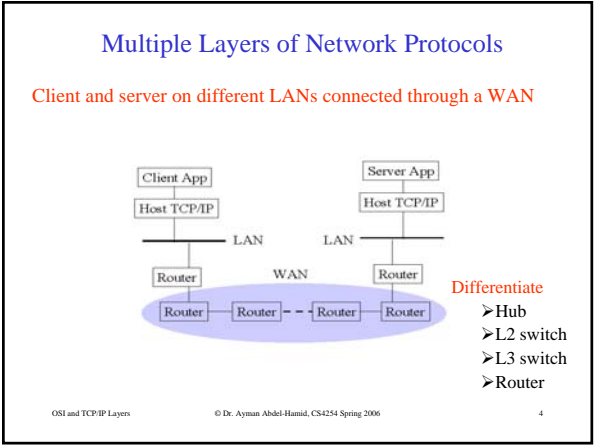
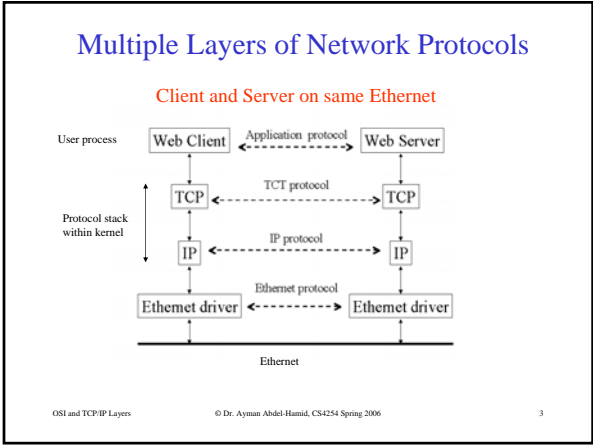
OSI and TCP/IP Layers

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Outline

- OSI Layering Architecture
- TCP/IP Layers

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Physical Layer 1/2

•Functions

- Transmission of a raw bit stream
- Forms the physical interface between devices

•Issues

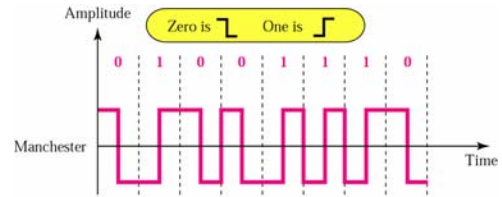
- Which modulation technique (bits to pulse (analog signal))?
- Which Line Coding technique (bits to digital signal?)
- How long will a bit last? (*bit interval vs bit rate*)
- Bit- serial or parallel transmission?
- Half- or Full- duplex transmission?
- How many pins does the network connector have?
- How is a connection set up or torn down?

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Physical Layer 2/2



Line Coding Example: Manchester Encoding

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Data Link Layer 1/2

•Functions

- Provides *reliable transfer* of information between *two adjacent nodes* (*physical link is a raw transmission facility*)
- Creates frames (manageable data units) from bits and vice versa
- Physical addressing (identify frame sender and/or receiver)
- Provides frame- level error control (normally through a trailer added at end of frame)
- Provides flow control
- Access Control (through a MAC sub layer)

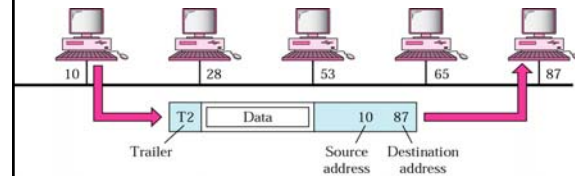
•In **summary**, the data link layer provides the network layer with what appears to be an error- free link for packets

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Data Link Layer 2/2



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Network Layer 1/2

•Functions

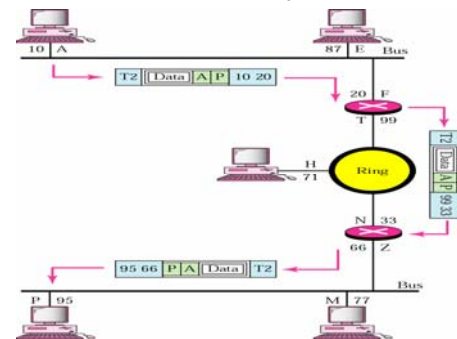
- Source-to-destination delivery of packets across multiple networks
- Logical addressing
- Responsible for routing decisions
 - ✓Dynamic routing
 - ✓Fixed routing
- Performs congestion control
 - In the Internet model, the network layer does not perform congestion control
 - Congestion control at the network layer is a current area of research

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Network Layer 2/2



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Transport Layer

•Functions

- Process-to-process delivery of entire message
- Port addressing
- Connection control
- Provides reliable end-to-end communication
- Perform end-to-end flow control
- Perform packet retransmission when packets are lost by the network
- In the Internet model, the transport layer also offers congestion control.

Session Layer

•Functions

- Network dialog controller
 - ✓ Establish, maintain, and synchronize interaction between communicating entities
- May perform synchronization between several communicating applications
- Groups several user- level connections into a single "session"

Presentation Layer

•Functions

- Concerned with syntax and semantics of information exchanged between 2 systems
- Performs specific functions that are requested regularly by applications
 - ✓ Encryption
 - ✓ Compression
 - ✓ Translation
 - ASCII to Unicode, Unicode to ASCII
 - LSB- first representations to MSB- first representations

Application Layer

•Functions

- Application layer protocols are application-dependent
- Implements communication between two applications of the same type
- Examples
 - ✓ FTP
 - ✓ HTTP
 - ✓ SMTP (email)

OSI Layering Problems

- Seven layers not widely accepted
- Standardized before implemented
- Top three layers fuzzy
- Internet or TCP/ IP layering widespread

Internet Design Principles

•Scale

- Protocols should work in networks of all sizes and distances

•Incremental deployment

- New protocols need to be deployed gradually

•Heterogeneity

- Different technologies, autonomous organizations

•End-to-end argument [[End-to-end Arguments in System Design](#)]

- Networking functions should be delegated to the edges; application knows best
- "A function can only be completely and correctly implemented with the knowledge and help of the applications standing at the communication end points"