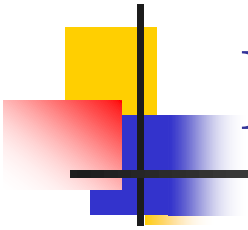
Protocols and the TCP/IP Suite

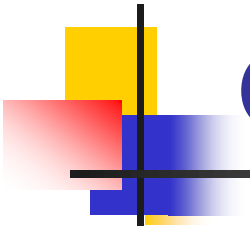
Chapter 4



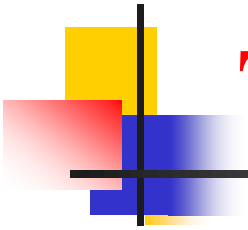
Key Features of a Protocol

- Syntax
  - Concerns the format of the data blocks
- Semantics
  - Includes control information for coordination and error handling
- Timing
  - Includes speed matching and sequencing

Agents Involved in Communication

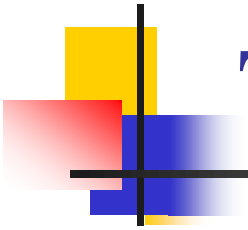


- Applications
  - Exchange data between computers (e.g., electronic mail)
- Computers
  - Connected to networks
- Networks
  - Transfers data from one computer to another



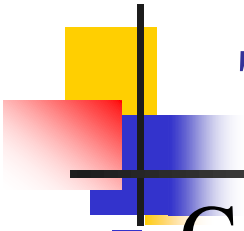
TCP/IP Layers

- Physical layer
- Network access layer
- Internet layer (IP)
- Host-to-host, or transport layer (TCP)
- Application layer



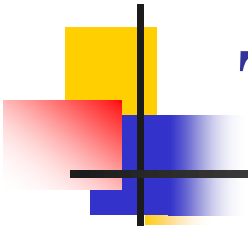
TCP/IP Physical Layer

- Covers the physical interface between a data transmission device and a transmission medium or network
- Physical layer specifies:
  - Characteristics of the transmission medium
  - The nature of the signals
  - The data rate
  - Other related matters (modulation, encoding, ..)



TCP/IP Network Access Layer

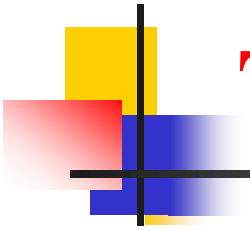
- Concerned with the exchange/access of data between an end system and the network to which it's attached
- Routing within the same network
- Other services like priorities
- Not concerned about the type of transmission medium
- Protocol used depends on type of network:
  - Circuit switching
  - Packet switching (e.g., ATM)
  - LANs (e.g., Ethernet)
  - Others



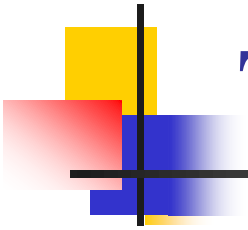
TCP/IP Internet Layer

- Uses internet protocol (IP)
- Provides routing functions to allow data to traverse multiple interconnected networks
- Not concerned about the type of the network
- Implemented in end systems *and* routers
- IPv4, IPv6

TCP/IP Host-to-Host, or Transport Layer



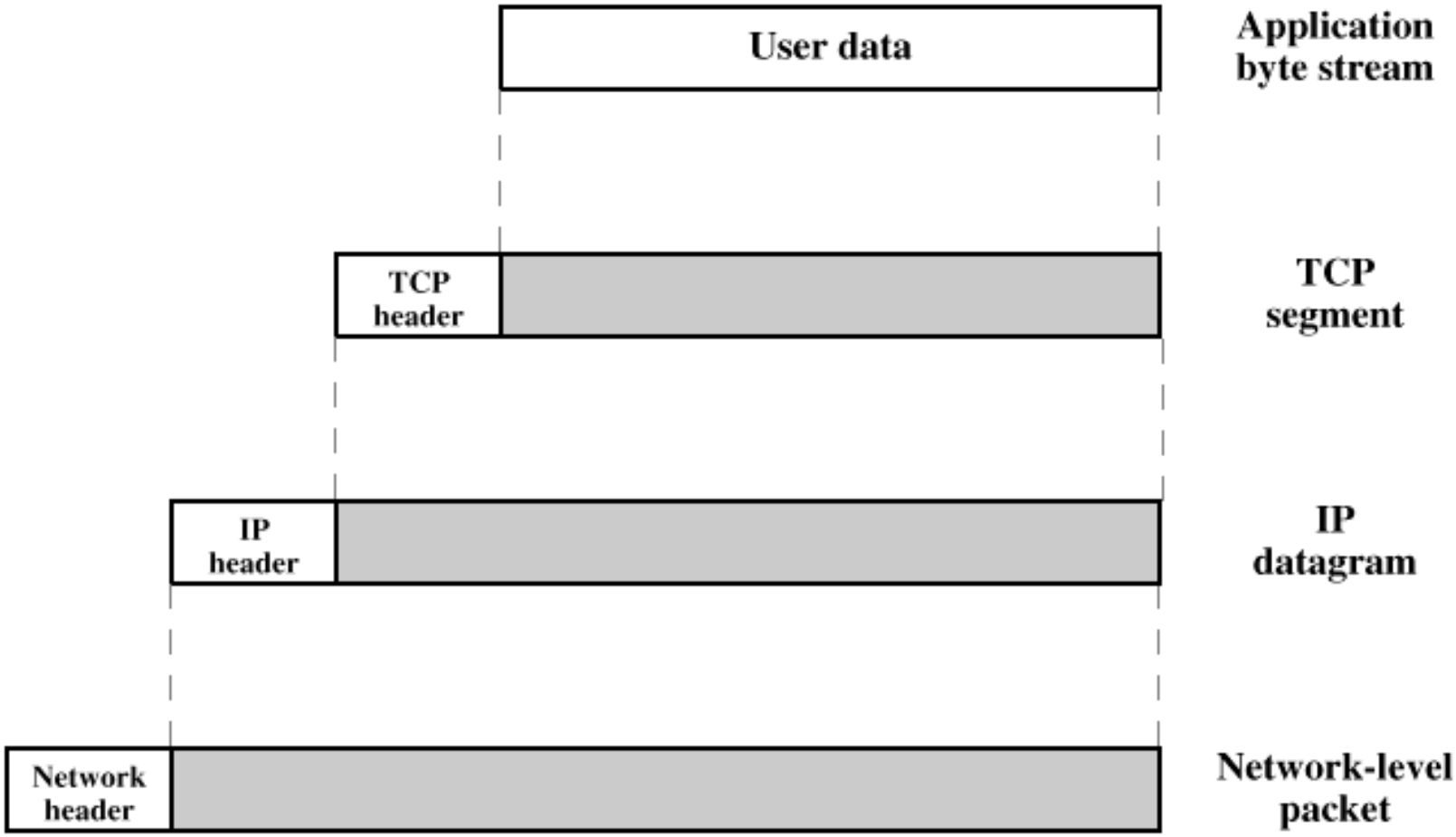
- Commonly uses transmission control protocol (TCP)
- Provides reliability during data exchange:
  - Completeness/ correctness
  - Ordering/ sequencing



TCP/IP Application Layer

- Logic supports user applications:
- Simple mail transfer protocol (SMTP)
  - Provides a basic electronic mail facility
- File Transfer Protocol (FTP)
  - Allows files to be sent from one system to another
- TELNET
  - Provides a remote logon capability

Protocol Data Units (PDUs)



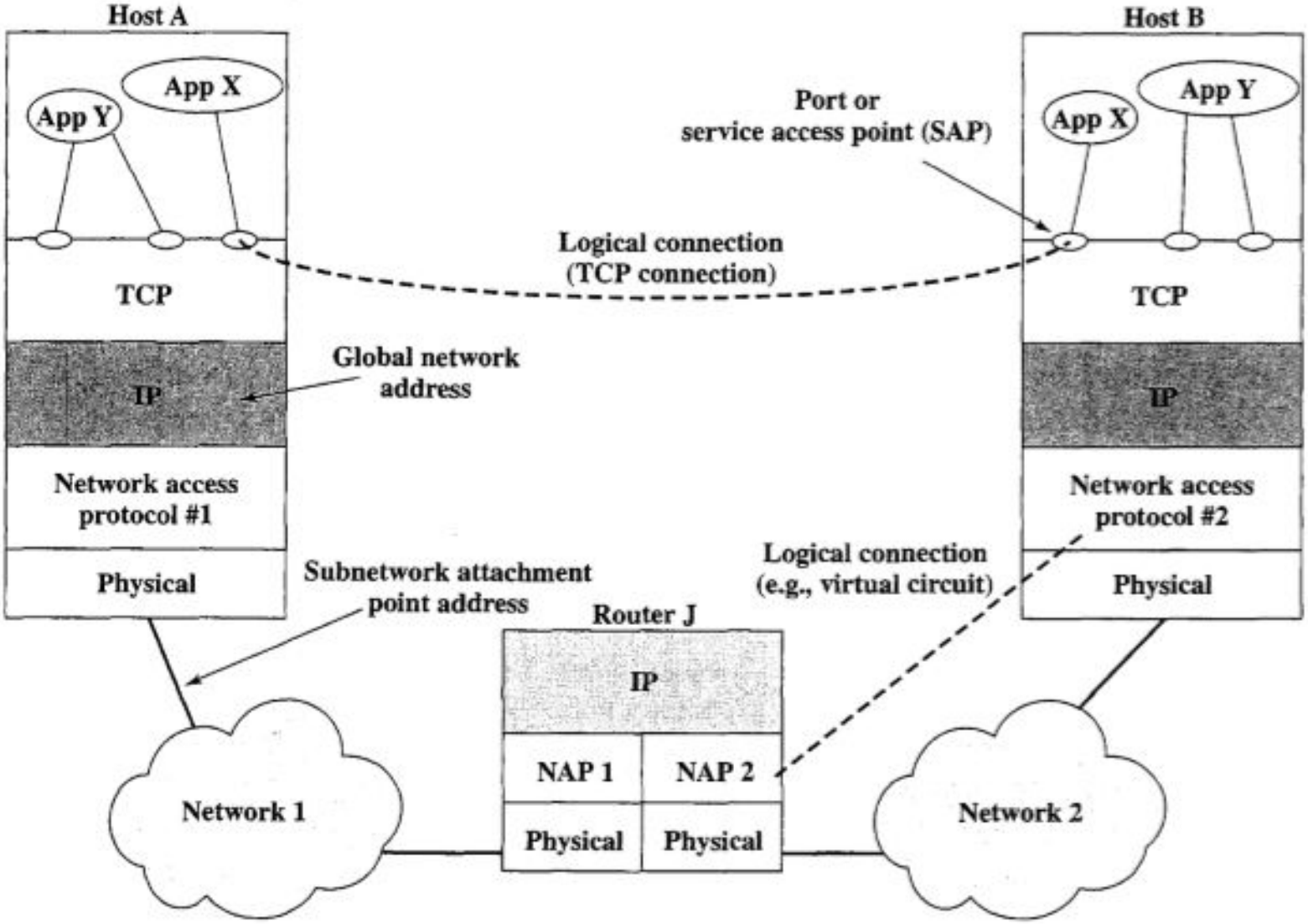
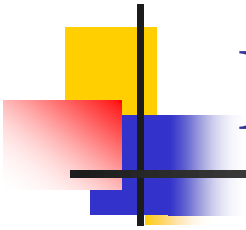
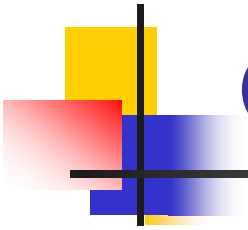


Figure 4.1 TCP/IP Concepts



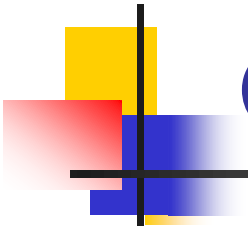
Layers of the OSI Model

- Application
- Presentation
- Session
- Transport
- Network
- Data link
- Physical



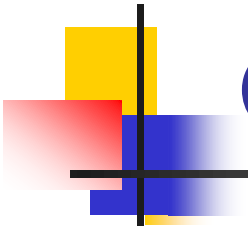
OSI Application Layer

- Provides access to the OSI environment for users
- Provides distributed information services



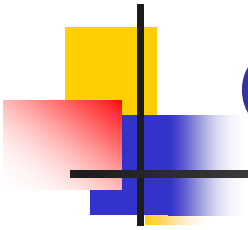
OSI Presentation Layer

- Provides independence to the application processes from differences in data representation (syntax)



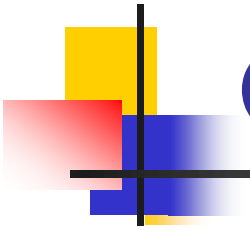
OSI Session Layer

- Provides the control structure for communication between applications
- Establishes, manages, and terminates connections (sessions) between cooperating applications



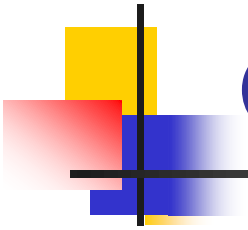
OSI Transport Layer

- Provides reliable, transparent transfer of data between end points
- Provides end-to-end error recovery and flow control



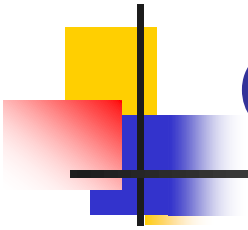
OSI Network Layer

- Provides upper layers with independence from the data transmission and switching technologies used to connect systems
- Responsible for establishing, maintaining, and terminating connections



OSI Data link Layer

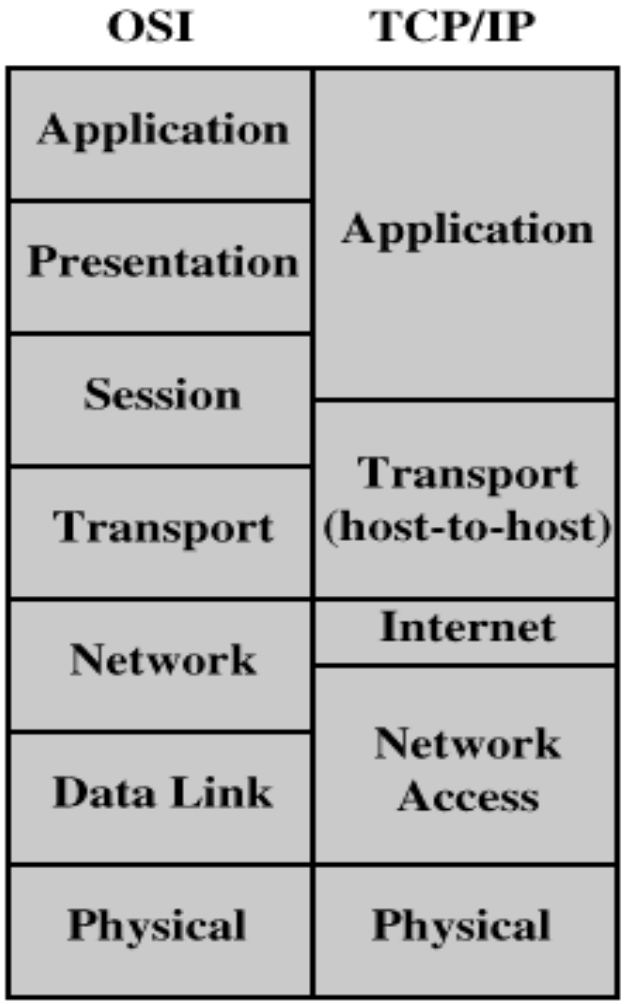
- Provides for the reliable transfer of information across the physical link
- Sends blocks (frames) with the necessary synchronization, error control, and flow control

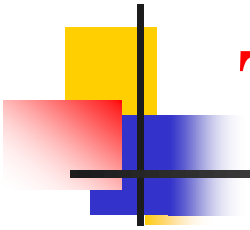


OSI Physical Layer

- Concerned with transmission of unstructured bit stream over physical medium
- Deals with accessing the physical medium:
  - Mechanical characteristics
  - Electrical characteristics
  - Functional characteristics
  - Procedural characteristics

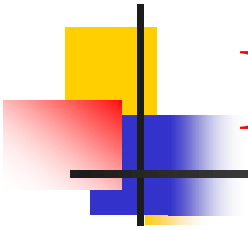
Comparison of OSI and TCP/IP





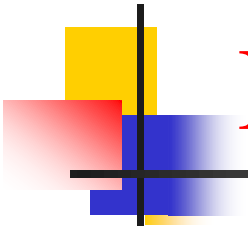
TCP/IP Architecture Dominance

- TCP/IP protocols matured quicker than similar OSI protocols
  - When the need for interoperability across networks was recognized, only TCP/IP was available and ready to go
- OSI model is unnecessarily complex
  - Accomplishes in seven layers what TCP/IP does with fewer layers



Internetworking Terms

- Internet – collection of communication networks, interconnected by bridges/routers
- Intranet – internet used by an organization for internal purposes
  - Provides key Internet applications
  - Can exist as an isolated, self-contained internet
- Bridge – an IS used to connect two LANs that use similar LAN protocols
- Router - an IS used to connect two networks that may or may not be similar



Functions of a Router

- Provide a link between networks
- Provide for the routing and delivery of data between processes on end systems attached to different networks
- Provide these functions in such a way as not to require modifications of the networking architecture of any of the attached subnetworks