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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
- Host-to-host, or transport layer
- 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



TCP/IP Network Access Layer

- Concerned with the exchange of data between an end system and the network to which it's attached
- Software used depends on type of network
 - Circuit switching
 - Packet switching (e.g., X.25)
 - LANs (e.g., Ethernet)
 - Others



T:TCP/IP Internet Layer

- Uses internet protocol (IP)
- Provides routing functions to allow data to traverse multiple interconnected networks
- Implemented in end systems *and* routers



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

- Commonly uses transmission control protocol (tcp)
- Provides reliability during data exchange
 - Completeness
 - Order

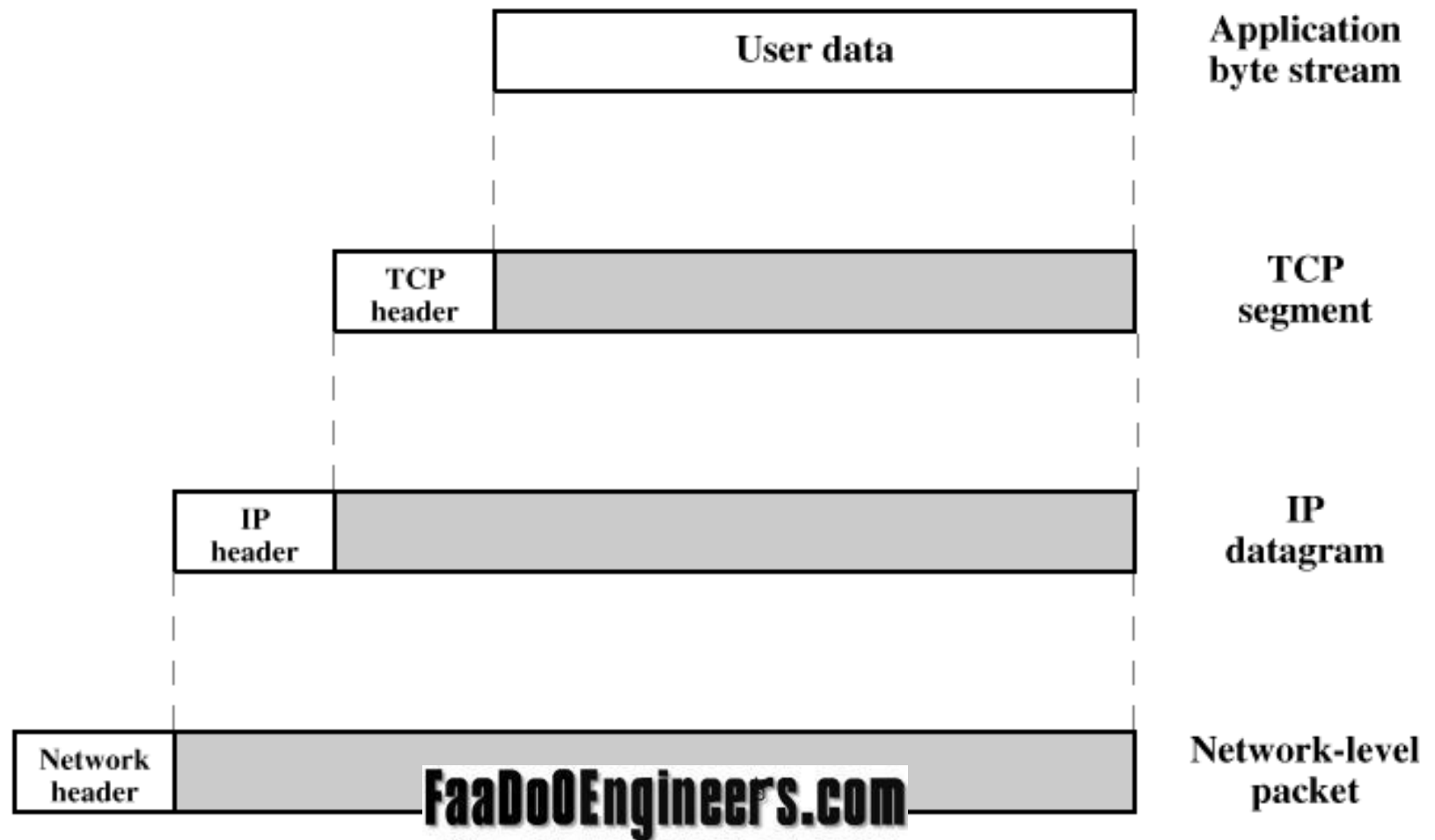


TCP/IP Application Layer

- Logic supports user applications
- Uses separate modules that are peculiar to each different type of application



Protocol Data Units (PDUs)





Common TCP/IP 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



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

OSI	TCP/IP
Application	Application
Presentation	
Session	
Transport	Transport (host-to-host)
Network	Internet
Data Link	Network Access



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



Elements of Standardization within OSI Framework

- Protocol Specification
 - Format of protocol data units (PDUs) exchanged
 - Semantics of all fields
 - Allowable sequence of PDUs
- Service Definition
 - Functional description that defines what services are provided, but not how the services are to be provided
- Addressing
 - Entities are referenced by means of a service access point (SAP)



Internetworking Terms

- Communication network – facility that provides a data transfer service among devices attached to the network
- 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



Internetworking Terms

- End System (ES) – device used to support end-user applications or services
- Intermediate System (IS) – device used to connect two networks
- 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



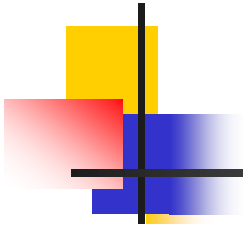
Functions of a Router

- 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



Network Differences Routers Must Accommodate

- Addressing schemes
 - Different schemes for assigning addresses
- Maximum packet sizes
 - Different maximum packet sizes requires segmentation
- Interfaces
 - Differing hardware and software interfaces
- Reliability
 - Network may provide unreliable service



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