



Network Protocol

Definition and terminology of Network Protocols

Computer Networks Protocols

Lecture One: Introduction

Description: General definition of Network terminology

وصف المحاضرة: تعاريف عامة لمصطلحات الشبكات.

- **What is the Network Architecture?**

A *set of layers and protocols* is called the network architecture.

- **The Protocol is form in Hierarchies سلم (layered) manners, WHY?**

Networks are organized as layers to *reduce design complexity*.

And Each layer offers services to the higher layers.

- **Each protocol provides services, what they are?**

Connection Oriented

Connectionless.

- **How do the adjacent layers communicate?**

Between adjacent layers is an interface.

Defines which primitives and services the lower layer will offer to the upper layer.

- **What is the Primitives?**

operations such as request, indicate, response, confirm.

- **Design Issues for the Layers (functions) الاسباب الرئيسية وراء تصميم الطبقات**

Mechanism for connection establishment

Rules for data transfer

Error control

Fast sender swamping a slow receiver

Routing in the case of multiple paths

Network Protocols بروتوكول الشبكات

- **What is the meaning of the Protocol:**

It is a format order of messages sent and received among the devices and action taken on msgs transmission receipt.

- **What are the Protocol process ماهي العمليات التي يقوم بها البرتوكول**

- The format or structure of the message
- The process by which networking devices share information about pathways with other networks
- How and when error and system messages are passed between devices
- The setup and termination of data transfer sessions

- **Layering in Networked Computing ماهي انواع انظمة الطبقات في شبكات الحاسوب**

- OSI Model (open system interconnection)
- TCP/IP Model

- **Why a layered model? لماذا استخدم نظام الطبقات?**

- Breaks down communication into smaller, simpler parts.
- Easier to teach communication process.
- Allows different hardware and software to work together.
- Reduces complexity

- **What is the OSI model?**

The Open Systems Interconnection is the model developed by the International Standards Organization. Study the OSI helps us understand how data gets from one user's computer to another.

It helps to provide an organized structure for hardware and software developers.

- **Why use a reference model? لماذا الحاجة الى نظام موحد**

- Serves as an outline of rules for how protocols can be used to allow communication between computers.
- Each layer has its own function and provides support to other layers.

OSI Model

OSI Model	Protocols
Application Layer	DNS, DHCP, FTP, HTTPS, IMAP, LDAP, NTP, POP3, RTP, RTSP, SSH, SIP, SMTP, SNMP, Telnet, TFTP
Presentation Layer	JPEG, MIDI, MPEG, PICT, TIFF
Session Layer	NetBIOS, NFS, PAP, SCP, SQL, ZIP
Transport Layer	TCP, UDP
Network Layer	ICMP, IGMP, IPsec, IPv4, IPv6, IPX, RIP
Data Link Layer	ARP, ATM, CDP, FDDI, Frame Relay, HDLC, MPLS, PPP, STP, Token Ring
Physical Layer	Bluetooth, Ethernet, DSL, ISDN, 802.11 Wi-Fi

Benefits(Advantage)	Negative Aspect (disadvantage)
<ul style="list-style-type: none"> • Interconnection of different systems (open) • Not limited to a single vendor solution 	<ul style="list-style-type: none"> • Systems might be less secure • Systems might be less stable

<u>Layer</u>	<u>Main Topics</u>
Physical Layer	<ul style="list-style-type: none"> • Transmission mediums (transmit bits over medium) • Encoding • Modulation • Repeaters • Hubs (multi-port repeater) • To provide mechanical and electrical specification
Data Link Layer	<ul style="list-style-type: none"> • Error detection and correction methods • Hop to hop delivery • Flow control • Frame format • IEEE LAN standards • Bridges & Switches (multi-port bridges) • physical addressing(MAC Address)
	<ul style="list-style-type: none"> • Inter-networking

Network Layer	<ul style="list-style-type: none"> • Controls the operation of the subnet. • Routing algorithms(Routing packets from source to destination) • Internet Protocol (IP) addressing (Logical addressing) • Routers
Transport Layer	<ul style="list-style-type: none"> • Connection-oriented and connectionless services • Provide reliable process to process message delivery & error recovery • Transmission Control Protocol (TCP) • User Datagram Protocol (UDP) • Provides additional Quality of Service. • Port address • End-to-end flow control.
Session Layer	<ul style="list-style-type: none"> • Allows users on different machines to establish sessions (dialogue) between them. • managing dialogue control. • Token management. • Synchronization.
Presentation Layer	<ul style="list-style-type: none"> • Concerned with the syntax and semantics of the information. • Preserves the meaning of the information. • Data compression. • Data encryption.
Application Layer	<ul style="list-style-type: none"> • Provides protocols that are commonly needed. • To allow access to network resource • (FTP), (HTTP), (SMTP), (SNMP),(NFS),(Telnet)

SERVICES

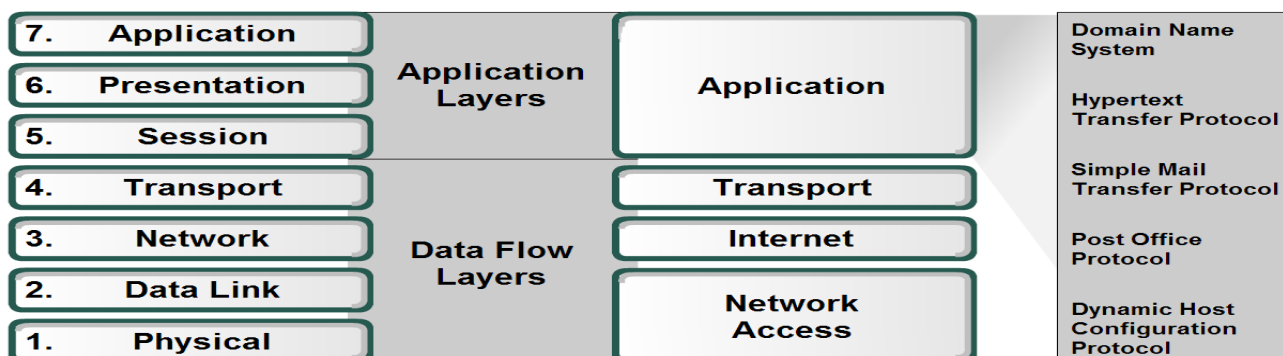
Connection-Oriented	Connectionless
before data is sent, the service from the sending computer must establish a connection with the receiving computer.	data can be sent at any time by the service from the sending computer.

OSI(Open System Interconnection)	TCP/IP(Transmission Control Protocol / Internet Protocol)
1. OSI provides layer functioning and also defines functions of all the layers.	1. TCP/IP model is more based on protocols and protocols are not flexible with other layers.
2. OSI model has a separate presentation layer	2. TCP/IP does not have a separate presentation layer
3. OSI is a general model.	3. TCP/IP model cannot be used in any other application.
4. Network layer of OSI model provide both connection oriented and connectionless service.	4. The Network layer in TCP/IP model provides connectionless service.
5. OSI model has a problem of fitting the protocols in the model	5. TCP/IP model does not fit any protocol
6. Protocols are hidden in OSI model and are easily replaced as the technology changes.	6. In TCP/IP replacing protocol is not easy.
7. OSI model defines services, interfaces and protocols very clearly and makes clear distinction between them.	7. In TCP/IP it is not clearly separated its services, interfaces and protocols.
8. It has 7 layers	8. It has 4 layers



OSI Model

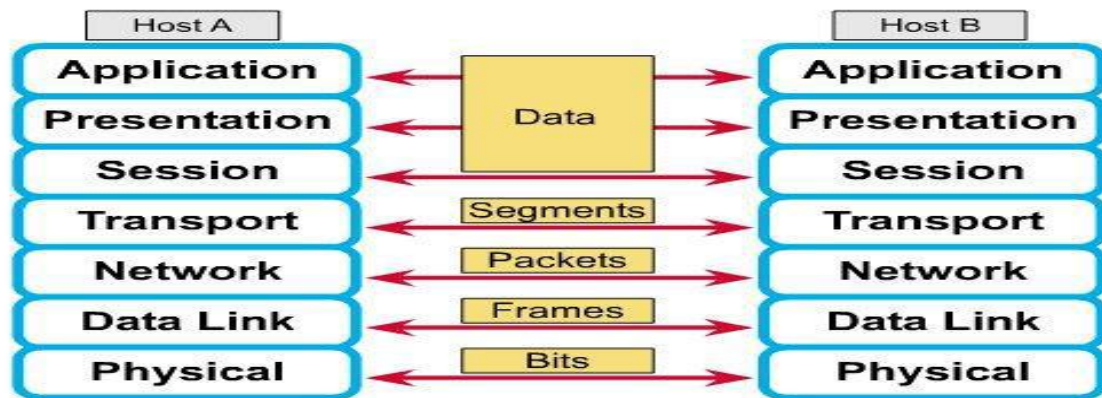
TCP/IP Model



Data Encapsulation

- Each layer contains a **Protocol Data Unit (PDU)**
 - PDU's are used for **peer-to-peer contact** between corresponding layers.

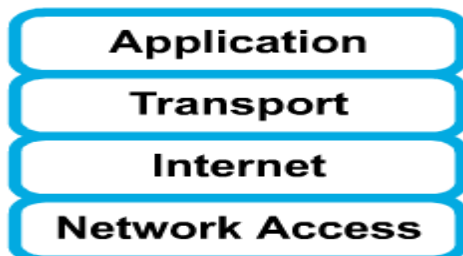
The Layer	Shape of data (PDU)
top three layers	Data
Transport layer	Segment
Network layer	packets
Data Link layer	frames
Physical layer	bits



4 layers of the TCP/IP model

- Layer 4: Application
- Layer 3: Transport
- Layer 2: Internet
- Layer 1: Network access

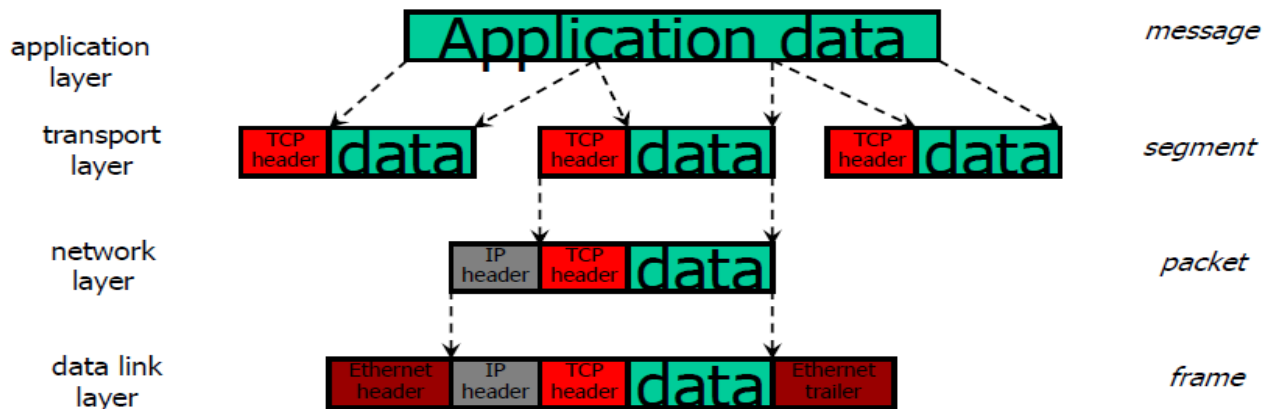
It is important to note that some of the layers in the TCP/IP model have the same name as layers in the OSI model. Do not confuse the layers of the two models.



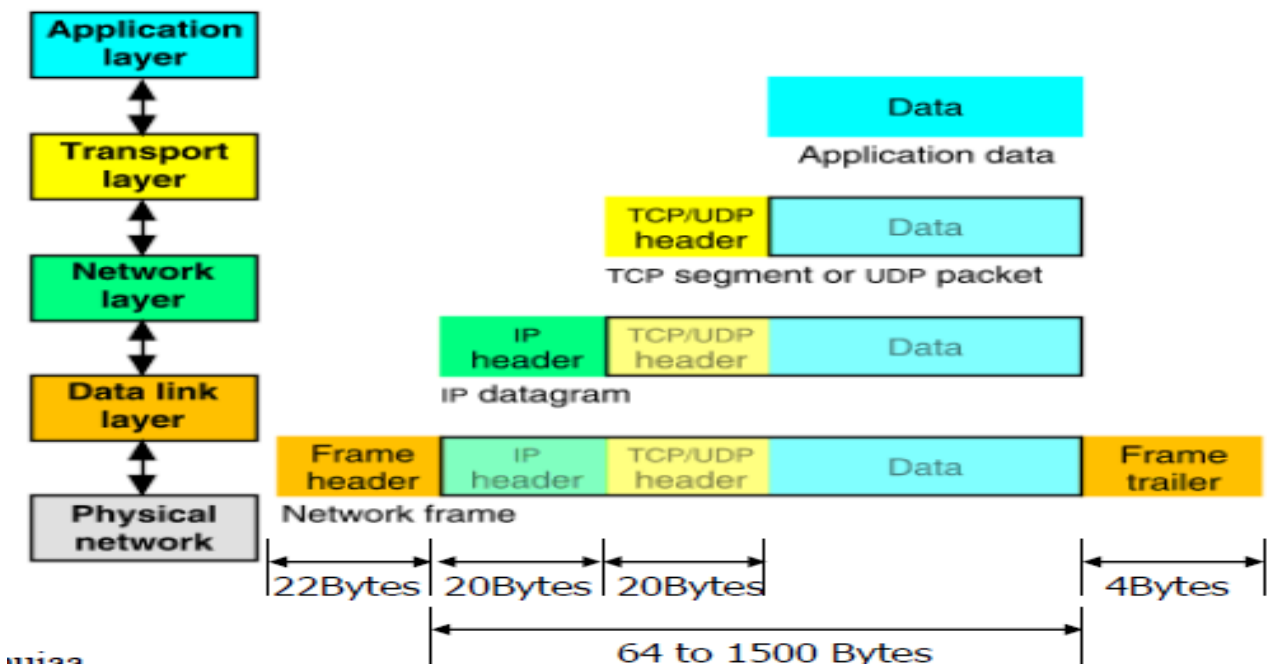
Data Encapsulation In TCP/IP

- Outgoing data is packaged and identified for **delivery** to the layers.
- PDU – Packet Data Unit – the “envelop” information attached to a packet at a particular TCP/IP protocol e.g. header and trailer
- Header (Identifies the protocol in use, the sender and intended recipient)
- Trailer (or packet trailer) (Provides data integrity checks for the payload)

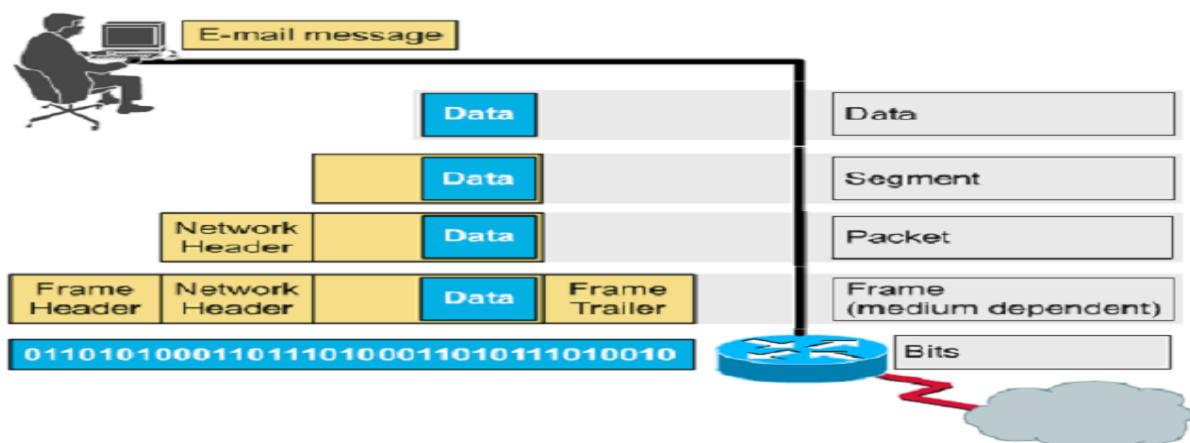
Data Formats



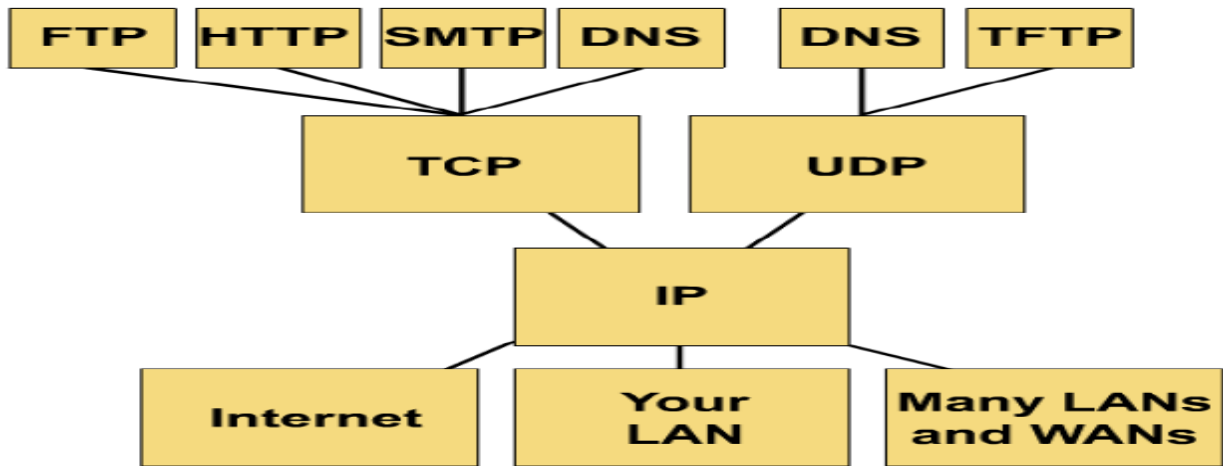
Encapsulation (TCP/IP)



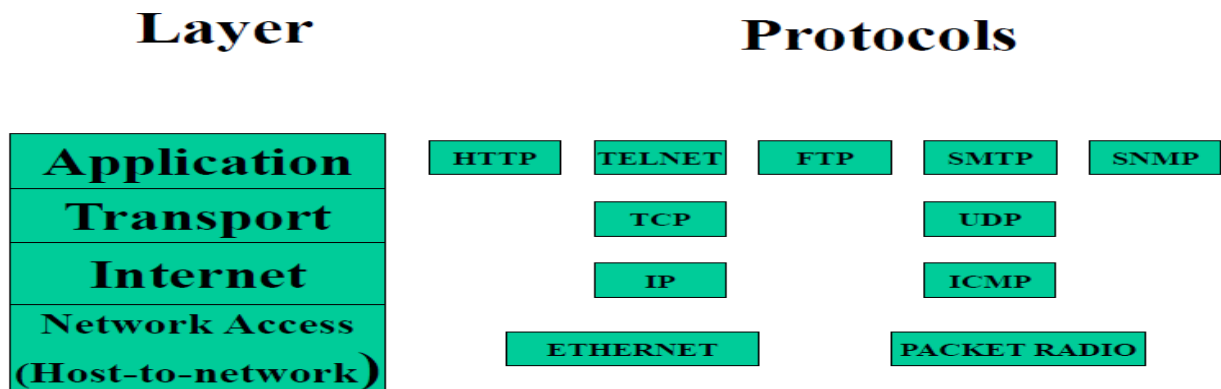
Encapsulation example: E-mail



What is the TCP/IP protocol stack?



TCP/IP Reference Model



What is a socket ?

- An interface between application and network(each application create socket)
- Socket (Protocol family, type-of-communication, specific- protocol);
- The socket *type* dictates the style of communication

reliable vs. best effort

connection-oriented vs. connectionless

Q/Explain the delivery of data in Layered model?

Type of delivery	Layer	Shape of data	Type of addressing
End to End process	Transport	Segment	Port (socket)
Source To Destination	Network	Packet	Logical (IP)
Node to Node	Data Link	Frame	Physical(MAC)

