

## - How Network works

A network is a conduit that connects two or more computers or other devices.

## Types of Network

LAN: Any group of computers on a single, geographically limited network.

[Wired LAN: Switch]

[Wireless LAN: Access Point]

WAN : A network that connects LAN over large geographic distances

## - Open System Interconnection (OSI) Reference Model

↳ 7 Layers:

1. Physical
2. Data Link
3. Network
4. Transport
5. Sessions
6. Presentation
7. Application

Sending.

Data  
moves  
down  
the  
stack

↑ receiver.

de-encapsulation:  
removing header / + encapsulation of  
data: Header. of data

### Network Protocol

Protocol: A formal set of rules or procedures computers must understand, accept, and use to be able to communicate over a network.

Eg TCP, UDP, SNMP, SMTP, IMAP,  
HTTP, FTP.

## TCP/IP Reference Model

- 4 Layer Model
- Defines specific protocols at each layer.
- Based on OSI
- TCP / IP : Transmission Control Protocol / Internet Protocol.

TCP / IP Model : Protocol suite

- Applications
- Transport
- Internet

## • Network Access

### - 5 - Layer Model

↳ Same as TCP / IP but

Network Access broken down to  
Physical & Data Link.

### - Application Layer

- Data is first processed according to one of the many Application Layer protocols, such as SMTP

(eg) sending an email from outlook

- SMTP: Simple Mail transport  
Protocol

- Application Layer protocols

specify details such as how data should be encoded, compressed, or encrypted and how sessions should be managed.

### Examples of Application Layer

- HTTP: HyperText Transfer Protocol is a communication protocol for the transfer of information on the Internet and World Wide Web
- FTP: File Transfer protocol is a network protocol used to transfer data from one computer to another through a network, such as over the Internet

• DNS : The Domain Name System associates various information with domain names;

Translating websites: www.example.com

→ To IP address: 208.77.188.161

⇒ Network equipment needs to know these IP addresses to deliver information.

• SMTP : Simple Mail Transfer Protocol is the most popular protocol for sending electronic mail on the Internet

Application Layer  $\Rightarrow$  Transport Layer

Transport Layer

- Specifies which Application Layer protocol should be used to process the data on receiving computer

- Each Application Layer protocol is assigned a unique numerical identifier, called port (software\*), which is used to identify the protocol.

### Examples:

- HTTP : Port 80
- DNS : Port 53
- SMTP : Port 25

Source Port Number	Destination Port Number	Data
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Uniquely identifies  
the connection on the  
sending side

- Reliability of Transport Layer.
    - ↳ 2 Transport Layer protocols:
- ① UDP: User Datagram Protocol
  - ② TCP : Transmission Control Protocol

UDP :

→ A simple and fast  
↳ Does not know if receiving  
computer actually received data.

- commonly used for short messages, and time-sensitive data.

(29)

- DNS

- Online gaming

- Voice over IP (VoIP)

- Streaming video,

## TCP

- A robust protocol providing delivery notification, error checking and recovery procedures

- The receiving computer tells the sending computer when the data was received.

C Equivalent to sending a letter by registered mail with return receipt.

⑧

- HTTP
- SMTP
- FTP

→ TCP accepts data from Application Layer protocol and cuts the data into smaller pieces called **segments**

Sending data:

- TCP uses sequence numbers to put segments back together in the correct order:
- The receiver uses the sequence numbers to tell the

sending side when segments have been received

(just like the return receipt in postal analogy)

→ If it didn't receive the token the protocol resend.

Transport Layer  $\Rightarrow$  Network Layer

Network Layer

- The Network Layer receives data segments from the Transport Layer and adds a header to create a packet  $\hookrightarrow$  contains a destination and

source IP address, Layer 3 addresses).

- The Network layer identifies the upper layer Transport Layer protocol that is being used.
- Each Transport layer protocol is assigned a unique identifier or IP protocol number:

(eg)

- UDP = IP protocol number: 17
- TCP = IP protocol number: 6

Network Layer  $\Rightarrow$  Data Link Layer

Data Link Layer

- The data Link Layer receives packets and adds its own header to each packet to create a frame.

- The header usually includes another address, referred to as a Layer 2 address, a physical address or a MAC address

• MAC address: Media Access Control

- Layer 2 header typically also includes an indication as which Layer 3 protocol is in the data portion of the frame.

④ Also performs a data integrity

check

↳ This check is done by adding a checksum in the trailer at the end of a frame.

→ Finally, Layer 2 converts the data into binary for digital communications  
(# ETHERNET)

Data Link Layer  $\Rightarrow$  Physical layer

- Physical Layer

- Layer 1 converts bits into electrical signals and send them across the physical medium.

which can be a wire, a fiber-optic cable, or even a wireless environment

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Receiving Computer

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Network Addressing

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