



TCP/IP

"computer networks"

2021

what is it?

- TCP/IP is a suite of protocols, also known as the Internet protocol suite or Internet.
- Although elements of TCP/IP exist in OSI.
- It was originally developed for the US Department of Defense (DoD), funded by Defense Advanced Research Project Agency (DARPA) network.

The Department of Defense (DoD) developed its own protocol standard and communication architecture.

The motivation is the need for

- ① Military standard communication protocol.
- ② communication architecture.

In general terms two technical requirements must be met

- ① End-systems (ES = computer terminals) must share a common

DoD through the Defense Communication Agency (DCA) has issued a set of military standard protocols.

- MIL-STD-1777 :- Internet Protocol (IP) :- Provides a connectionless services for end systems to communicate across one or more nets
- MIL-STD-1778 :- Transmission Control Protocol (TCP) :- A reliable end-to-end data transfer service. (same as The Iso transport layer)
- MIL-STD-1780 :- File Transfer Protocol (FTP) :- A simple protocol to transfer ASCII, EBCDIC, and binary files
- MIL-STD-1781 :- Simple Mail Transfer Protocol (SMTP) :- A simple ~~document~~ electronic mail (e-mail)
- MIL-STD-1782 :- Telnet (Telecommunication network) :-

DoD Architecture & Protocols

- Processor layer
- Host-to-Host layer
- Internet layer
- Network Access layer

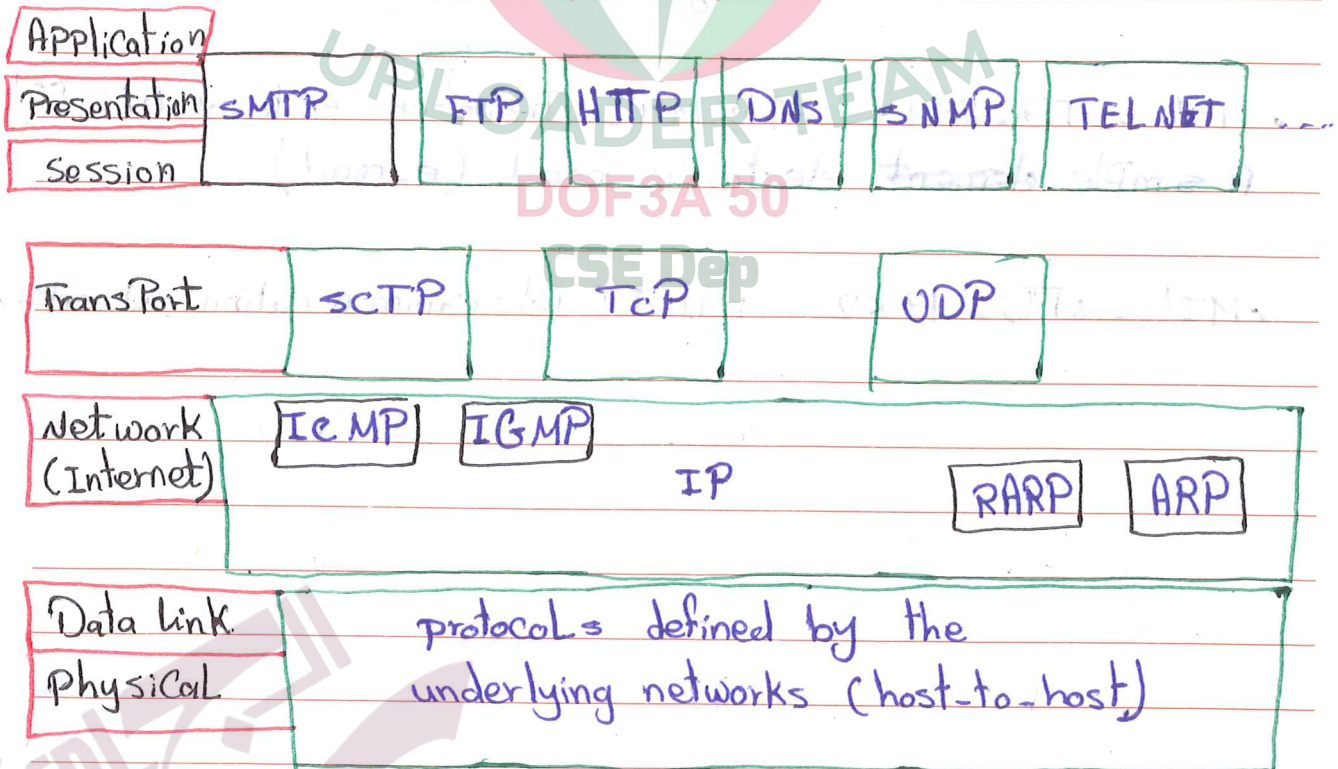
Process (App)
TelNET FTP SMTP

Host-to-Host
TCP UDP

Internet IP

Network Access
Ethernet ARP FDDI

OSI RM and DoD Architecture



check

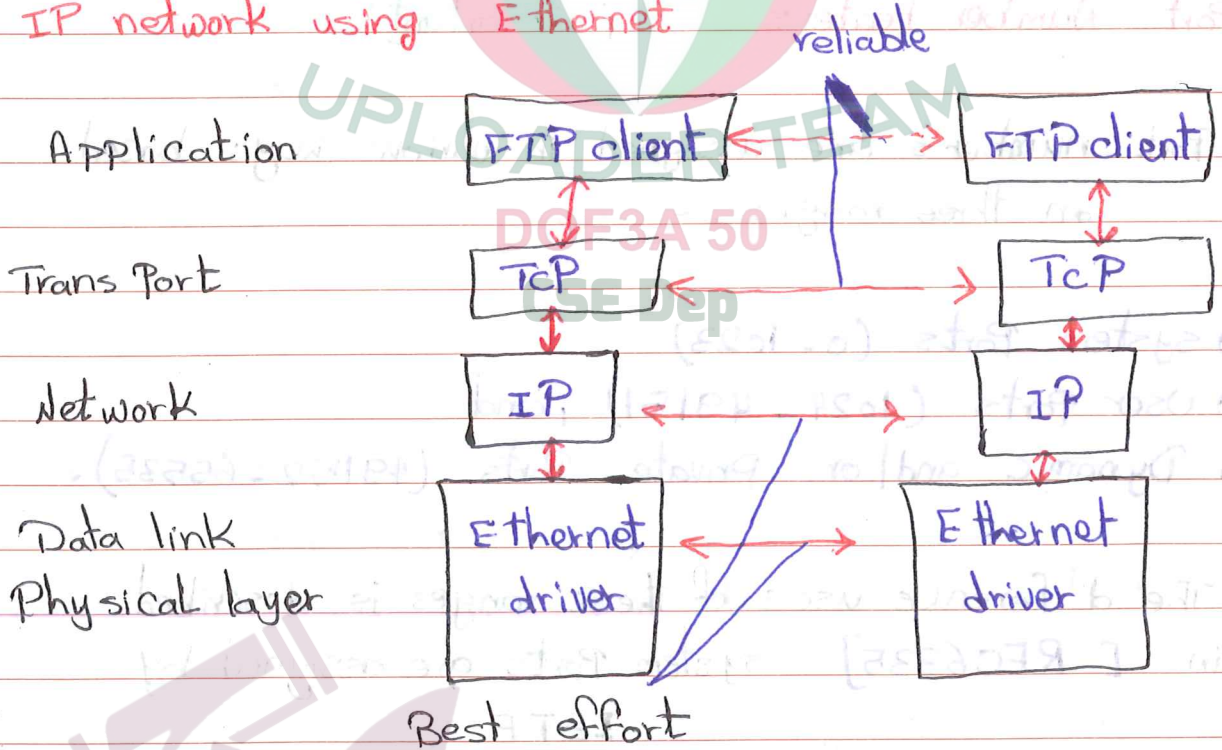
IETF \Rightarrow RFC (Request For Comment)

optionally

TCP (Transmission Control Protocol)

- TCP is a connection-oriented **reliable** protocol
- It provides a reliable transport service between Pairs of processes executing on **End system (Es)** using the network layer services provided by **IP Protocol**
- The Internet Protocol suite consists of a set of protocols that provide a variety of networking services.

TCP Providing reliable data transfer to FTP over an IP network using Ethernet



TCP Features

- An end-to-end connection
- The most common application such as HTTP (web services) and FTP (File Transfer Protocol) use **Ports** that are "well known" so clients can connect to them to access a particular service without having to query on what port that service is running
- For example :- web browsers automatically connect with **Port 80**, FTP uses **Port 21**, and Gopher use **Port 70**, etc.

⇒ Port Number Features (Important)

- Port numbers are assigned in various ways based on three ranges:-

- ① system ports (0-1023)
- ② user ports (1024-49151), and
- ③ Dynamic and/or Private Ports (49152-65535).

- The difference uses of these ranges is described in **[RFC6335]**. system ports are assigned by

IETF

"TCP Header structure"

source Port

Destination Port

sequence number

Acknowledgment number

offset

Reserved

(urgent)
U

A

P

R

S

F

window

(Acknowledgment)

(Push)

(Reset)

(Finish)

checksum

urgent Pointer

option + Padding

Data

TCP Header structure

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A Typical TCP session.

- A connection is established via a three-way handshake, as described next →
- This handshake helps define the start of a new TCP connection.
- Host A (The sender) sends a TCP segment to host B with the SYN flag set to 1 and the ACK flag set to 0

Host B returns a segment to Host A in which both the syn and Ack flags are set to 1. Host A can now acknowledge to Host B that it received its Ack, it sends a segment in which $\text{Ack} = L$ and $\text{syn} = 0$.

After data is transmitted the session is terminated. Host A sends a $\text{FIN} = 1$ to Host B. Host B then responds 'A'.

Three ways Handshake

- ① $\text{syn} = 1$ & $\text{Ack} = 0$ — For connection request
- ② $\text{syn} = 1$ & $\text{Ack} = 1$ — For connection accept
- ③ $\text{syn} = 0$ & $\text{Ack} = 1$ — Acknowledge of Ack

TCP uses flow controls, sliding windows, and various other mechanisms to manage sessions.

Internet Protocol (IP)

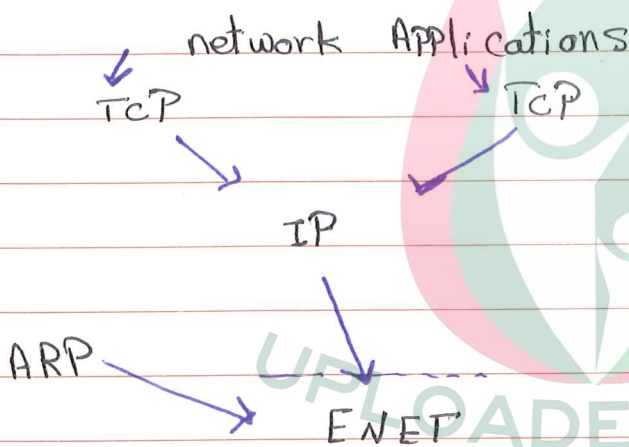
have 5 classes

class A to E Address formats.

Address in TCP/IP

- Physical Addresses → Data link + physical layer
- logical → network layer
- Port → Transport layer
- specific → Application layer

Flow of Data Basic TCP/IP Network node.



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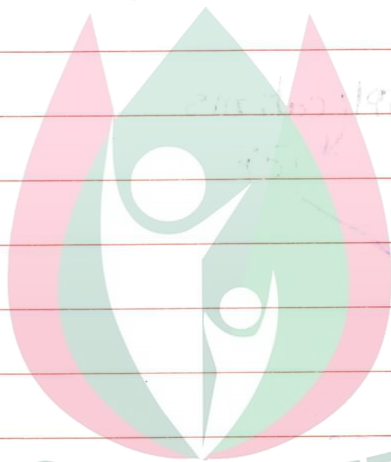
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Ethernet cable.

The TCP module, UDP module, and the Ethernet driver are n -to-1 multiplexers. They are also 1-to- n de-multiplexers. According to the type field in the protocol.

* Internet Protocol Route Table

- Direct Routing → one IP network.
- Indirect Routing → Three IP network, one Internet.



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