Lecture-9 - TCP/IP & OSI Model

Vidyalekhan
DATE 27-09-24
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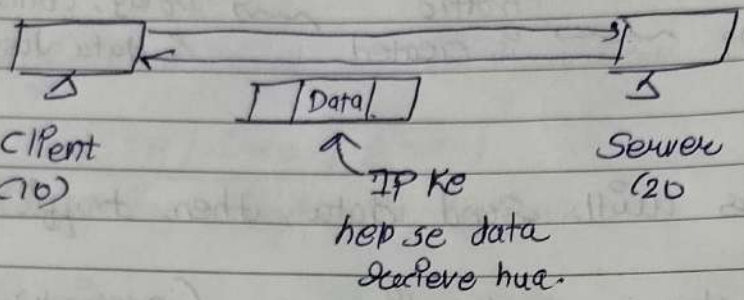
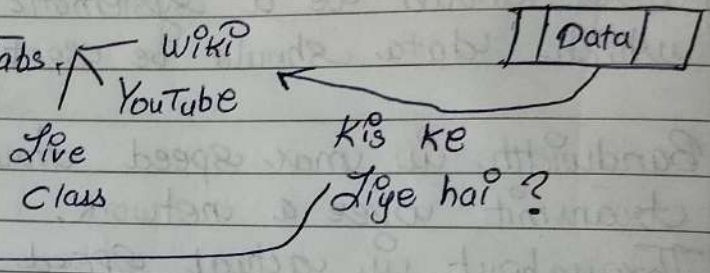
* Transport Layer

1) End-to End delivery / Port to Port delivery.



- You open many Tabs.



↳ Port Number
↓
For Wiki, port no.
For YouTube, Port no,
For Live, port no,

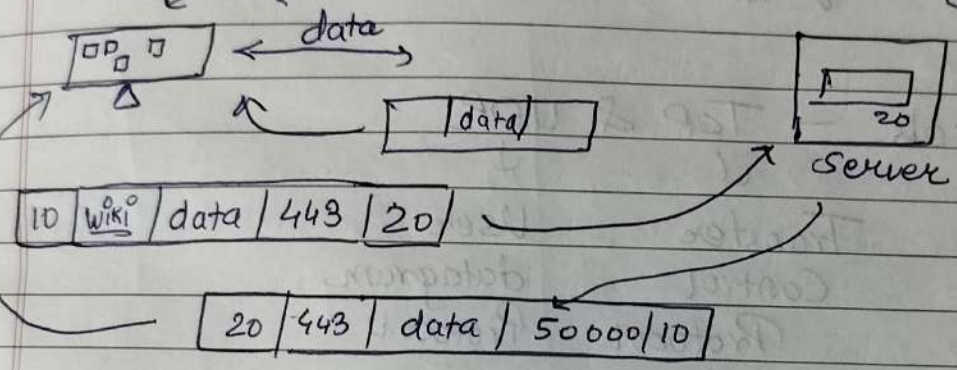
- Vo wale data mei port no bhi rehta hai.
- Port no. is of 16 bits.
↓
2^{16} port no
generated ⇒ 65536 → [0-65535]

Some port no are reserved.

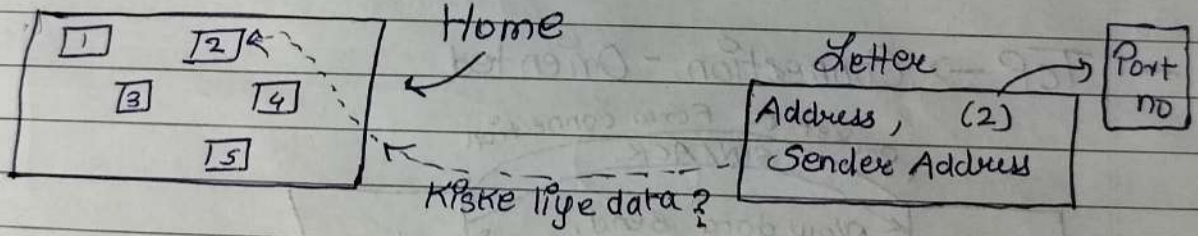
http : 40
https : 443
dns : 53
} Eg. of well known Ports,

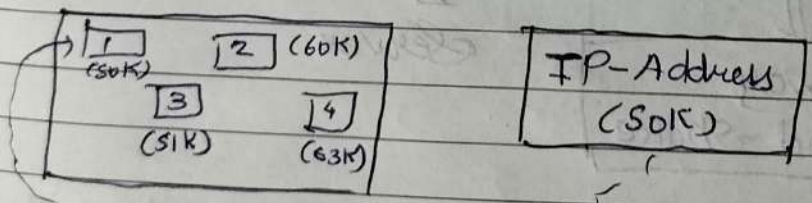
- Well Known Ports (0-1023): They are reserved for specific services and protocols.
- Registered Ports (1024-49151): These are assigned by Internet Assigned Numbers Authority (IANA) for specific purposes that are not standard.
- Dynamic / Private Ports (49152-65535): These are typically used for client side applications.

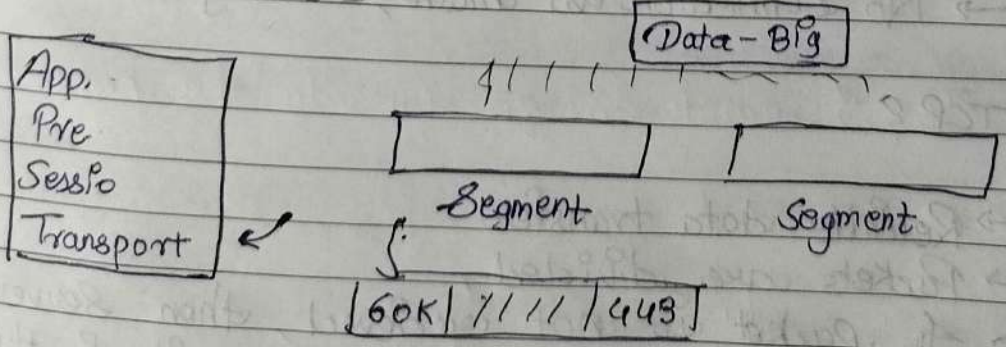
Transport Layer → Port to Port delivery.



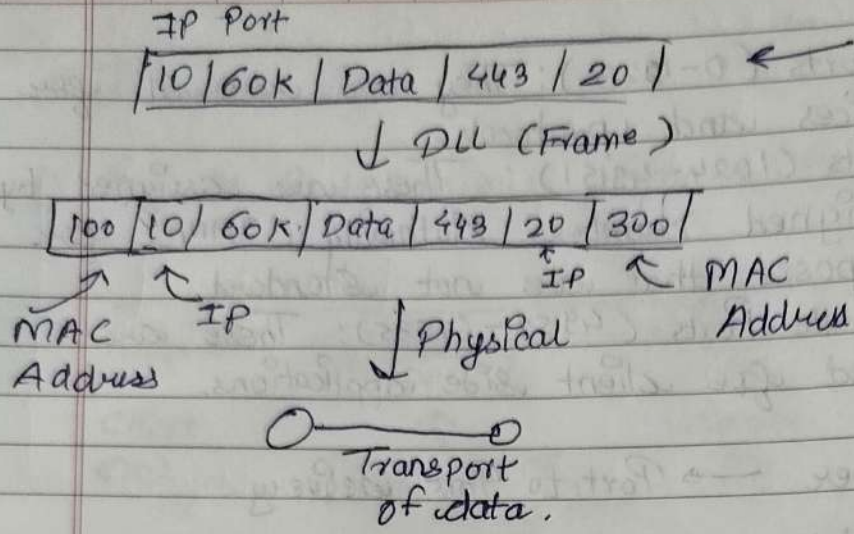
Eg







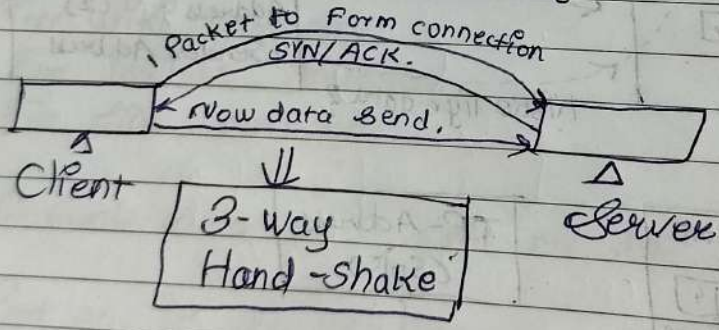
- Network layer adds IP Address. Segment name changes to Packet.



* Protocols — TCP & UDP.

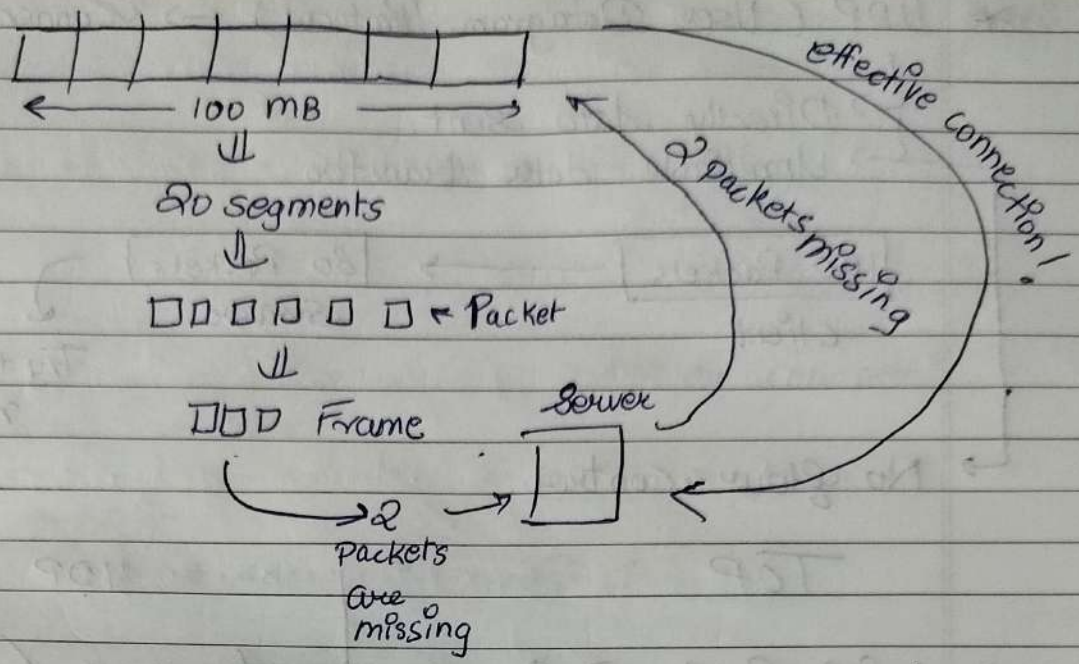
TCP	UDP
Transfer Control Protocol	User datagram Protocol

- TCP → Connection-Oriented

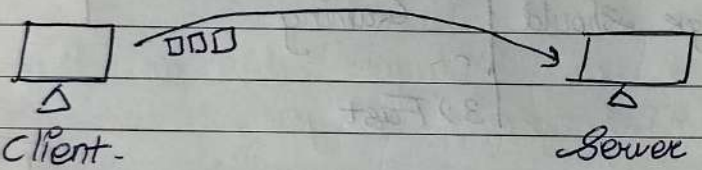


- UDP → No connection is made, directly data send.

* Why TCP?
  - → Reliable data transfer
  - → Packets are divided,
  - → If packet is not recieved, then Server is sending message to client about it & then client can re-send data.



2) Flow control

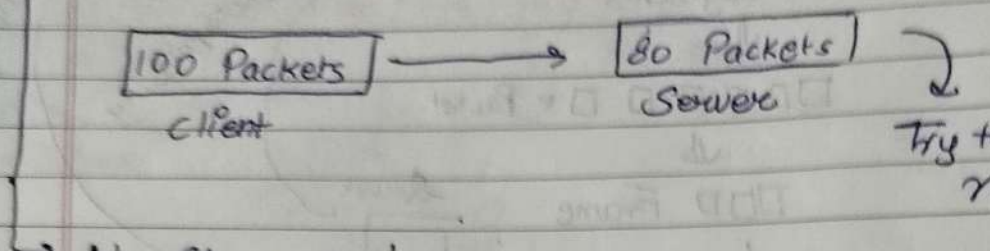


- The control of packet is done on a end-to-end basis.
- Server should be able to handle data, so the flow of packets are controlled.
- How will server know the length of packets?
  ↳ During 3-way handshake, the length of packet are discussed.

3) Error checking

- From client to server, errors are checked.

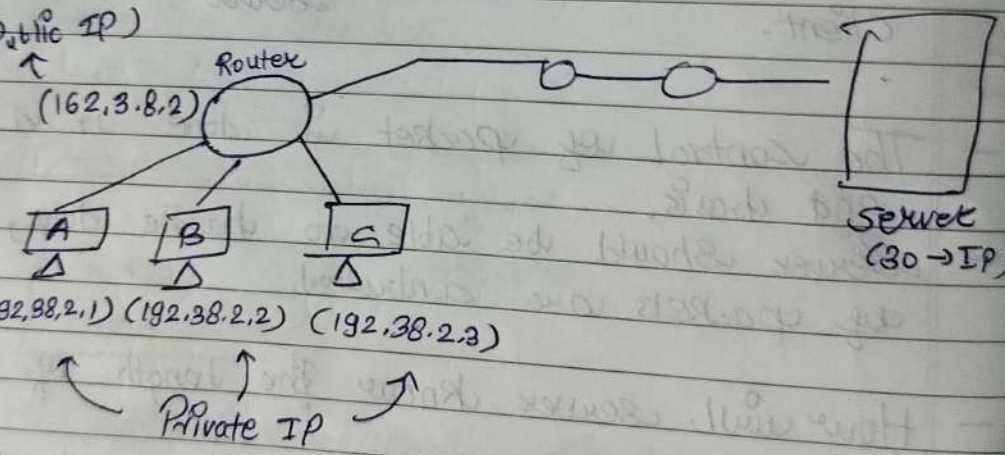
* UDP (User Datagram Protocol) → Connection-less.
  - → Directly data sent.
  - → Unreliable data transfer.



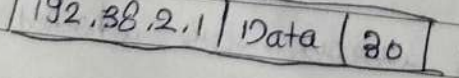
  - → No flow control.

TCP	UDP
1) Wiki-Pedia ⇒ Everything should be seen.	1) Live Stream
2) Insta ⇒ Full Page should be seen	2) Online Gaming
3) Slow	3) Fast

Audio, Video Quality may low, but data will be sent



* What if I want to go outside the network?
  - A to Server



request send to router.

- Now, router will change from private to public IP Address

| 192.3.8.2 | Data | 30 |

↓

Now, server with data can reply.

- Now, what if multiple devices want to connect with server.

↓

NAT
(Network Address Translation)

| 192.38.2.1 | 50K | Data | 80 | 30 |

Port no.
IP

→ Now, router will change IP address of A.

| 162.3.8.2 | 50K | Data | 80 | 30 | → (1)

- Now, B device also wants to connect at same time.

| 192.38.2.2 | 50K | Data | 80 | 30 |

↓

Sended to Router

↓

Router changes to Public IP.

↓

| 162.3.8.2 | 50K | Data | 80 | 30 | → (2)

↓

Now, Server replied both.

↓

How Router will decide betⁿ A and B?

↓

NAT ⇝ Takes help of Port Number

- Now, NAT will store IP & Port no. & router will allocate unique no.

| [redacted] | 162.3.8.2 | 62K | Data | 80 | 30 |

50K got replaced

- Then how will 'B' device get identified.

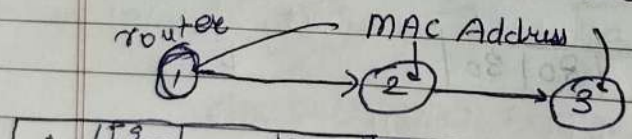
| 162.3.8.2 | 57K | Data | 80 | 30 |

Now, router can send to A & B based on 'A' & 'B's number (57K & 62K).

- Router can work on 3 layers, but in this case, router can go transport layer.

* MAC Address kyu nahi diya ?

↳ Adds in data-link layer.



| 1 | IP | Data | D.IP | 2 |

Now on 2 address

| 2 | IP | Data | DIP | 3 |

- MAC Address keeps changing, it can't be stored anywhere.

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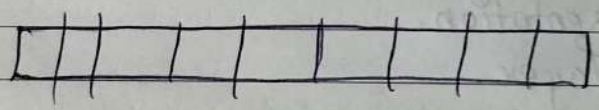
5 Session Layer

- Creating Session
- Authentication → LOGIN
  PASSWORD
- Authorization → LOGIN ✓
  ↓
  Kis chiz ko
  Access kar sakta
  ↓
  Bank Balance ko
  Change nahi
  Kar sakta

- Check-Point



- I was downloading 10 GB file, 8 GB ho gya par 2 GB baki reh gya because of issue.
  ↳ Directly 2 GB hi download karo, 10 GB wapas nahi karna padega

- YouTube Account Hack
  ↓
  Store Cookies
  ↓
  Session ID theft
  ↓
  //

6 Presentation Layer

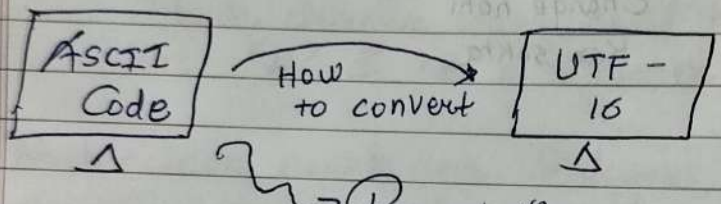
- Encrypt / Decryption

ABC → CDE

- Data compression → 10mB ko 6mB bana diya.

DSA Algorithm

- Data Translation



7 Application Layer

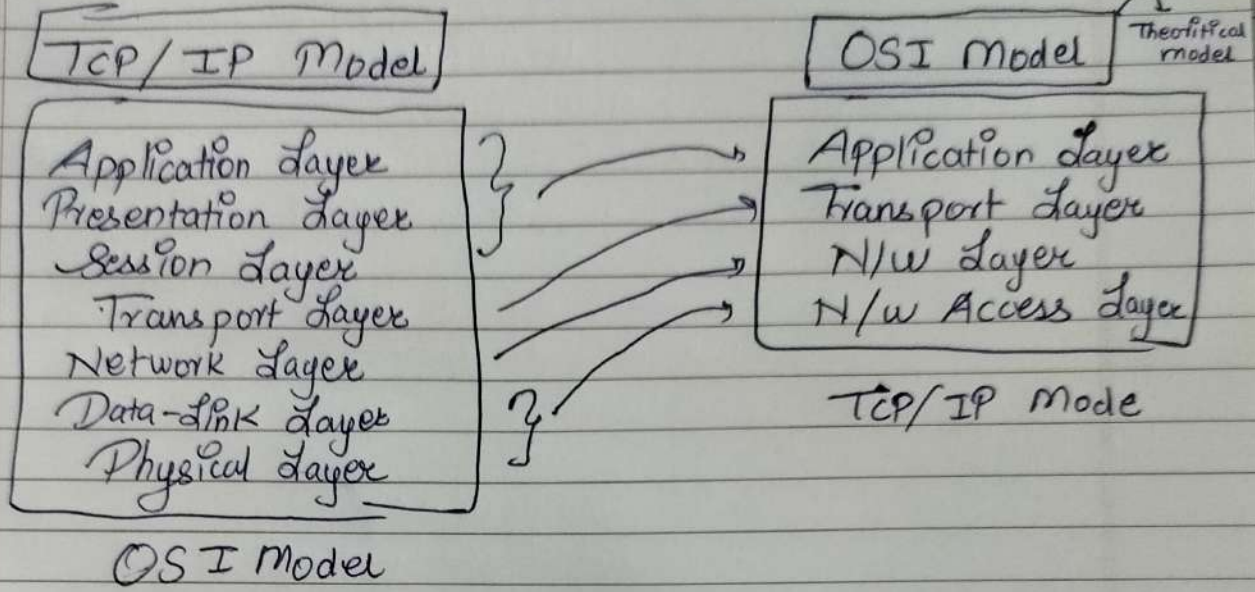
- Provide network interface.
  - Google ki website khol diya.
- Interaction with websites.

HTTP, FTP, SMTP, HTTPS

- HTTP → Hyper Text Transfer Protocol.
- FTP → File Transfer Protocol
- SMTP → Simple mail Transfer Protocol
- HTTPS → Security

→ Gmail etc.

- N/w Transparency → User ko sirf UI se matlab hai. Internal working kisiko pata nahi chala.



Features	TCP	UDP
Connection	Connection - Oriented (3-way handshake)	Connection - less (no-handshake)
Reliability	Reliable	Unreliable
Ordering	Ensures packet order	No-ordering of packets.
Error Checking	Error checking with retransmission	Basic error checking (but no correction)
Flow & Congestion Control	Yes (adjusts based on n/w conditions)	No flow or congestion control
Speed	Slower due to overhead	Faster due to less overhead
Common Use	Web browsing, email, File-Transfer.	Streaming, Gaming, DNS, VoIP.
Data Segmentation	Breaks data into segments	Sends data as independent datagrams.
Data Size	Supports larger data packets	Typically, used for small, quick data packets.