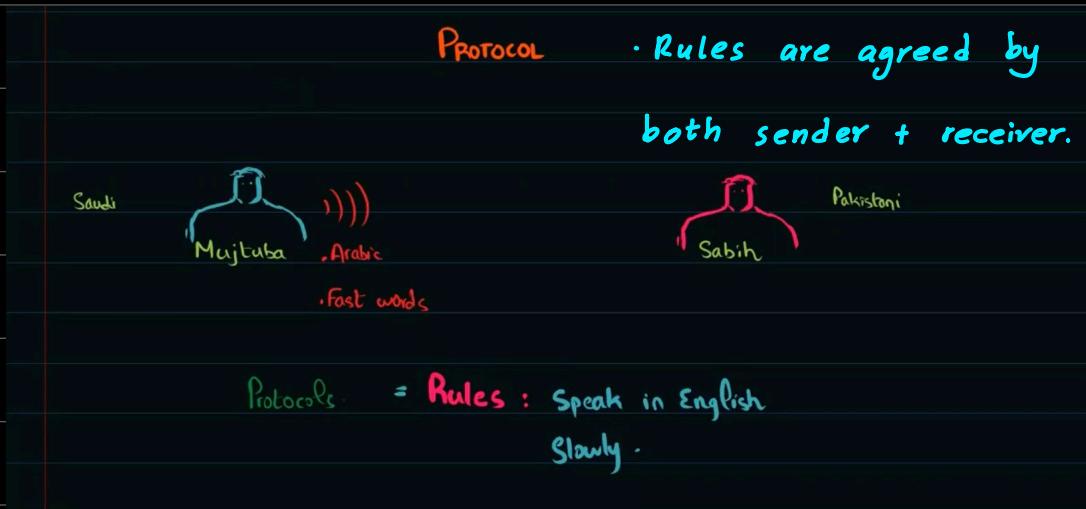


Communication And Network Technology



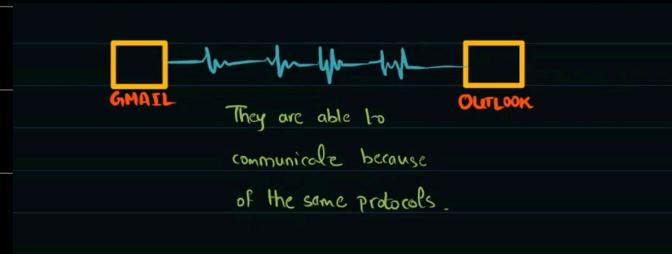
Q- What is protocol?

- A set of rules
- for successful transmission and receipt of data.

Q- Explain why protocols are essential for communication b/w computers?

- Provides a set of standards for transmission of data
- That basically gives accepted set of rules for transmitting and receiving data
- This enables communication b/w different platforms.

Types of Protocols with use

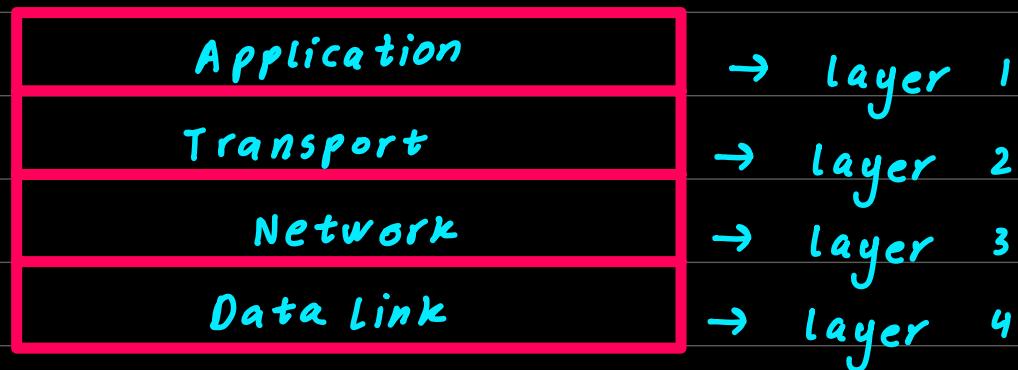


- POP 3/4 :
 - Post office Protocol
 - Downloads email from servers
- HTTP :
 - Hypertext transfer Protocol
 - Responsible for correct transfer of hypertext files (HTML)
- FTP :
 - File Transfer Protocol
 - Allows files to be transferred from one comp. to another
- SMTP :
 - Simple Mail Transfer Protocol
 - Responsible for sending emails
- IMAP :
 - Internet Message Access Protocol
 - Same Purpose as POP / receiving

- Bit-torrent:
 - Bit torrent Protocol
 - Used for Peer-to-Peer file sharing



- It is a conceptual model for networking
- It consists of 4 layers



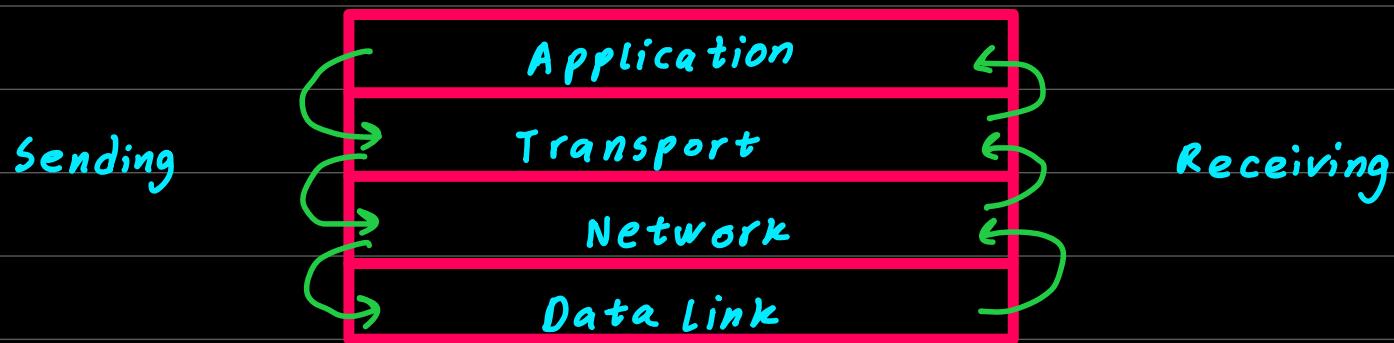
Q- How these layers are implemented

- By code / programming

Q- Describe TCP/IP Protocol Suite.

- A layered model with 4 layers
- Uses a set of protocols for transmission of data
- Application layer, Transport layer , Network layer, Data Link Layer

Flow of Data

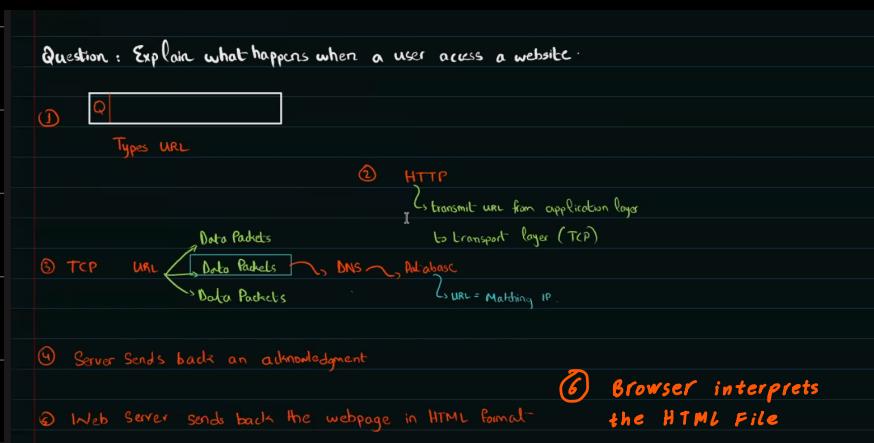


Application Layer

- Application layer sends data to transport layer
- It contains all programs that exchange data
- E.g: Web-browser

Protocols used In Application Layer

① HTTP



TCP/ IP Protocol

← Suite involved

② FTP

- File transfer protocol only transfer files over a network
- Similar to HTTP where HTTP only transfers HTML files while FTP transfers transfers other files only.

FTP Features

- **Server:** It is the central computer and stores files that are to be downloaded
- **Command:** It makes sure that users can send instructions such as delete, copy and instructions are basically carried out on server.
- **Anonymous:** Allows user to access files and user does not need to identify themselves to the server.

③ SMTP

- used when sending mail
- Also known as Push Protocol
- Problem: Does not handle binary files
video, image, audio

Q- What if a video or image is attached?

- We will use MIME (Multipurpose internet mail extension)

④ POP_{3/4} AND IMAP

- Post office Internet Protocol is used when emails are to be downloaded or received from the email server.
- Both protocols are known as Pull protocols

Q- What is the difference between POP and IMAP?

- Synchronization across every platform in IMAP.
- In POP 3/4 email from the server is deleted when received and is stored on the recipient's HDD.
- In IMAP , email is not deleted from the server , so the email can be accessed from different devices

Transport Layer

- Data is broken into packets and are sent to network layer
- Uses TCP
- Ensures Packets arrive in sequence
- Without errors

Transmission Control Protocol

- It uses positive acknowledgement with Re-transmission.
- It automatically resends data packets if it has not received positive acknowledgement
- It is connection oriented → means a connection is required b/w both the devices => Host-to-Host transmission protocol.
- Re-transmits missing packets.
- Re-assemble packets in correct order.

Q- State the function of TCP part of TCP / IP Protocol Suite.

- Allows application to exchange data
- Establishes and maintains the connection until exchange of data is completed
- Determines how to break application data into packets.
- Add sequence / packet number to TCP header
- Sends packets to and accepts packets from network layer

- Manages flow control of data to avoid congestion.
- Acknowledges all packets that arrive
- Detects when a packet has not arrived at its destination.
- Handles re-transmission of dropped packets.
- Re-assembles packets in correct order

Network / Internet Layer

- Uses IP = Internet Protocol
- Identifies network and host

Q- State function of Internet Protocol

- Ensures correct routing of packets of data over the internet
- Takes a packet from the transport layer and add its own header which includes IP address of sender and receiver both.
- Encapsulates data into datagram
- Passes datagram to Link Layer for transmission on the LAN

Concept of Packets

Packet: Small group of bits

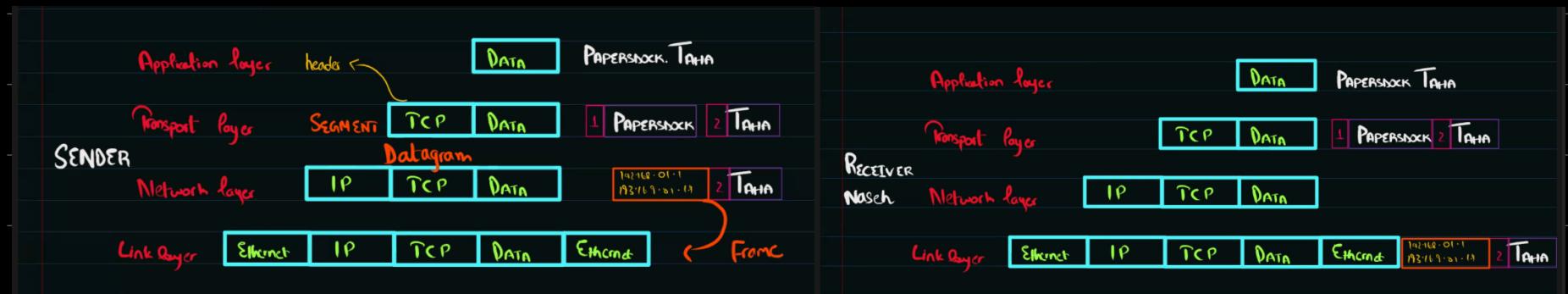
Header: Extra information about the data packet

Segment: Data packet with TCP header attached to it

Datagram: Segment with IP header attached to it

TCP header: Contains sequence number of the data packet

IP header: Contains sender's and receiver's IP address.



Sender TCP divide
IP add

Receiver TCP assemble
IP remove

Q- Describe the purpose of packet header

- To store data about packet
- And its routing information to ensure that it reaches its destination
- To ensure that messages can be properly reconstructed.

Q- What does TCP protocol header might contain?

- Source Port number
- Sequence Number of Packet

Q- What does IP protocol header might contain?

- IP address of sender
- IP address of receiver
- IP version

Q- What does an IP data packet might contain?

- Message data
- Size of Packet

- sequence number
- protocols used
- source IP address
- Destination IP address
- IP version

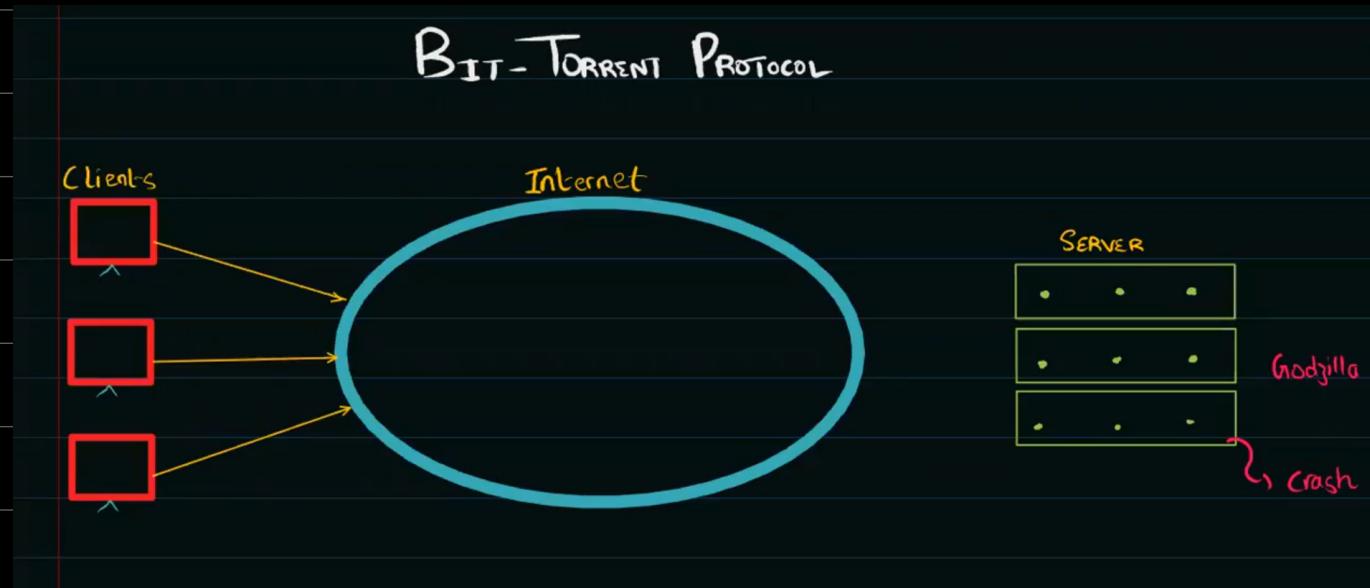
Link Layer

- The protocols in this layer provides the means for the system to deliver data to other devices

Examples

- Ethernet protocol
- WIFI Protocol
- Bluetooth Protocol

Bit - Torrent Protocol



In client-server relationship, user sends request to the internet which forwards the request to the server. Server sends back the data to the internet which forwards the data to the user.

In case if number of requests to the server increase, server might crash, that's why we use peer-to-peer file sharing.

Concept of Bit-torrent

Q- What does seed 16236 means?

- 16236 people contain 100% of data
- Peer computer
- that has 100% of the file and is uploading downloaded content.

Q- What is the function of swarm?

- All the connected peer computers
- That have all or part of the file to be uploaded / downloaded
- They share a torrent (file)

Q- Who is tracker?

- Central Server
- that stores details of other computers that have all / part of file to be downloaded
- Store IP addresses of other peers in swarm allowing them to connect

Q- Who are leechers?

- Peers who download much more data
- And upload less data
- negative impact on network

* Trackers have leecher's ip address until they stop downloading.

Q- Explain how data is exchanged using bit-torrent?

- Torrent file is made available
- File shared is split into pieces
- Bit-torrent client software is made available to other peers which allows them to work as seeds or leeches
- A peer can act as a seed and a peer downloading file can get different pieces from other seeds simultaneously
- Once a peer has a piece of a file it can become a seed for the parts downloaded and leaches download much more than they upload.
- Tracker keeps record of all the peers and the parts of the file they have and can pause and re-start the swarm or create a new one at any time.
- Peer-to-Peer network model is used for file sharing.

Email Communication

Q- Which protocols are used in email communication?

POP: . Post Office Protocol

- Downloading Email

SMTP: · Simple Mail Transfer Protocol

- Sending email

IMAP: · Internet Message Access Protocol

- Downloading Email

HTTP: · Hyper Text Transfer Protocol

- Accessing Email using a browser

Packet Switching Vs Circuit Switching

- dedicated

Qasim

Circuit Switching

Ali



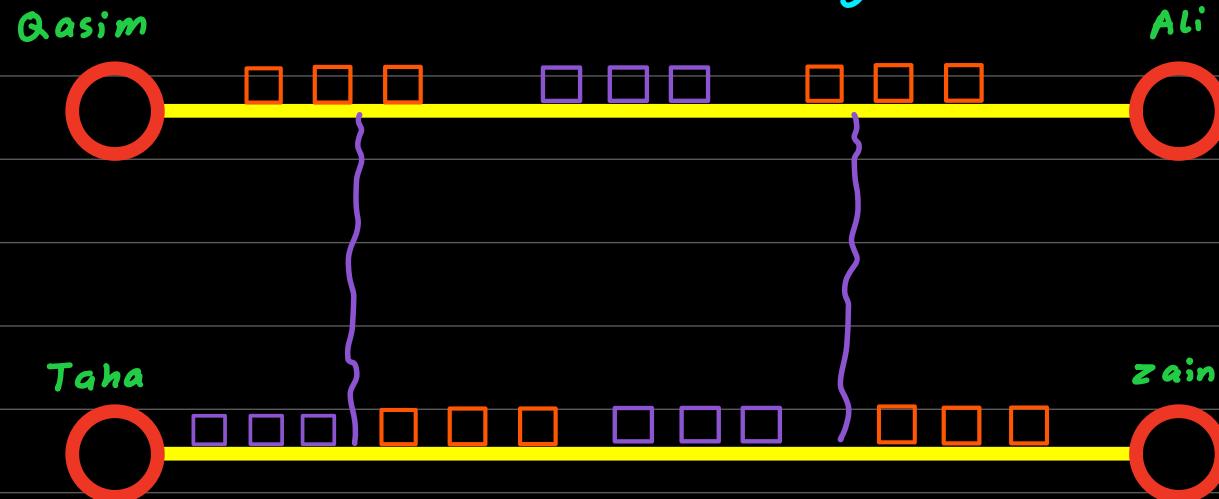
- limited

dedicated lines. Taha



IF 3rd person wants to join he/she would have to wait until the already going-on communication stops

Packet Switching



□ = Qasim Packet

□ = Taha Packet

Bandwidth: Maximum rate of data transfer

Q- Describe Circuit switching

- A circuit is established at the start of communication.
- Between Sender and receiver
- This lasts for the call / data transfer
- Then the link that makes up the circuit is removed.

Q- Describe Packet switching.

- A circuit does not have to be established at the start of the communication
- The data to be sent is divided into packets
- That can travel along different routes → least congested and shortest route
- From node to node device/router
- Packets are reassembled in the correct order at the receiver's end.
- Must wait until the last packet is received to put the data back together.

Q- Why company uses Circuit switching for voice calls?

- A dedicated channel / Not sharing channel
- Can use all bandwidth
- Two-way real time conversation
- No delay, as no switching → No switching of routes
- Data arrives in order as it is sent.

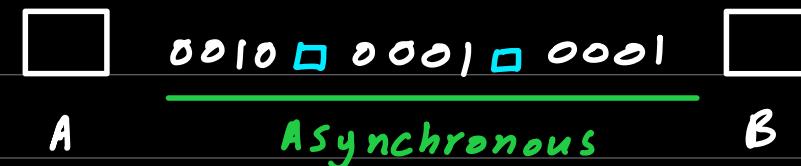
Q- Why company uses Packet Switching to send and receive other data?

- Communication is Asynchronous
- Allows for error checking (can't be checked in circuit switching)
- Real-time transmission is not required
- Smaller amount of data are sent (than voice calls) therefore dedicated lines or higher bandwidth is not required.
- Does not matter if data arrives out of order.

* Consider Packet switching if not mentioned in question



• Data has no gaps



• Data has gaps, forming packets

- Benefits and drawbacks of packet switching

Benefits:

- Packets can be re-routed if there are problems
- Packets can take the least congested route
- Transmission error can be detected
- missing / corrupt packets can be resent.

Drawbacks:

- Packets can be dropped / delayed
- Real-time conversation is not possible

- Benefits and drawbacks of circuit switching

Benefits:

- The person communicating can see each other in real time
- Better synchronisation / full bandwidth available

Drawbacks:

- Bandwidth / channel not available to other users
- Extra time to set up circuit at start of conversation.
- Alternative route not available without restarting the conversation
- Less secure as easier to intercept data if only one channel used.
- Failure in single route used means failure of transmission.

Scenario Based Questions

(a) A large video file is shared

Method: Packet Switching

Description: • File is divided into packets and necessary data is added to packet e.g: Header

- Which are sent independantly of each other.
- and do not need to take the same route.
- Packets are reassembled at the destination
- Missing / corrupt packets can be resent.

(b) Person A and B want to have a video conversation

Method: Circuit switching

Description: • The circuit can easily be set up for the duration of the conversation

- set up before communication starts

Q- Describe what happens when the LAN transmit data from computer X to computer Y using circuit switching?

- Computer X sends a connection request to computer Y.
- If computer Y is busy then computer X waits and then resends the connection request to computer Y.
- If available, computer X sets up path between nodes.
- Computer X sends the data
- Computer Y sends the receipt signal.
- The sender signals node to deallocate resources.

Q- Describe the steps that take place when the e-mail message is sent and received on LAN by packet switching?

- Message is split into packets
- Each packet is of a fixed size
- Each packet is given a header
- Including destination IP, sequence number

- Packets are forwarded from one LAN to another
- Packets may take different routes
- Missing packets are requested to be re-sent
- Packets are re-assembled into order at destination

Q- State two problems that could arise if video conferencing were to use packet switching.

- Picture and sound not synchronized // real-time conversation not possible
- Interruption, data can be delayed by other computing traffic.

Routing Table

- Contains information which allows the packet to be forwarded along the shortest route
- Router examines packet header and compares it with routing table.
- The table supplies the router with instructions to send the packet to the next available router

Table includes:

- Number of hops
- MAC address of next router // gateway // next hop
- Routing metrics → For calculation of the best route
- NetworkID
- interface (indicates which locally available interface is responsible for reaching the gateway)
- Net mask

Hops

- Packets can be kept forwarding between routers without reaching their destination. and clogs up routes.
- A hop number is added to packet header
- Each packet is allowed to hop/forward a number of times
- Hop number is decreased by 1 when the packet reaches a router. If hop number reaches 0, router deletes the packet

Checksum

- Each packet contains error checking techniques i.e: Checksum or parity checking
- Steps of checksum
- Packets are re-sent if error
- Packet priority is sometimes also added

