1. COMPUTER COMMUNICATION AND THE INTERNET

1.1 INTERNET

→ Internet is a computer network that interconnects thousands of computing devices around the world.

→ PC's, workstations etc are called as end points / end systems, are connected together by a network of switches and communication links.

→ End systems access the Internet through ISPs

→ All components of the Internet → end systems, packet switches etc run protocols that control the sending and recieving of information (TCP/IP)

Internet can be viewed as an infrastructure that provides various facilities / applications

→ Internet applications are classified as distributed applica's as they involve multiple systems exchanging data with each other

→ End systems attached to the internet provide an API specifying how a program can request the Internet to deliver data to the specified destination.

PROTOCOLS

→ All activity on the Internet that involves 2 or more communicating entities is governed by a protocol

* A protocol defines the format and the order of messages exchanged between two or more communicating entities, as well as other actions taken on the transmission and / or receipt of a message or other event

1.1 NETWORK EDGE

→ Applications and end systems are considered edge systems

→ Network edge → Hosts and clients
Access Networks → Wired / wireless communication links
Network core → Interconnected Routers / ISPs

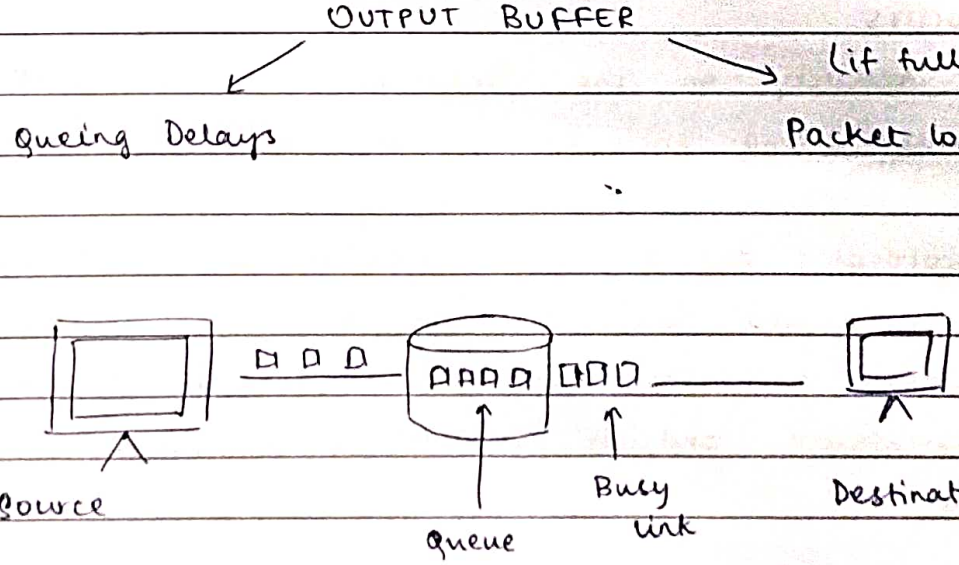
PACKET SWITCHING

→ To send a message from a source to a destination end system, the source breaks long messages into smaller chunks known as packets

→ Each packet travels through various communication links and packet switches.

→ Most packets use store and forward transmission, meaning that the switch must recieve the entire packet before transmitting the next bit.

→ Each packet switch has multiple links attached to it For each, it has an output buffer. If a packet is to be transmitted but the link is full, it waits in the output butter.



FORWARDING TABLES & ROUTING PROTOCOLS

→ Every End system has an IP address

→ When a packet is sent from the source, the destination packet is specified in the packet header.

→ The router has a forwarding table, that routes the packet to the destination address.

→ There may be multiple routes for a packet but the routing protocol selects the best path.

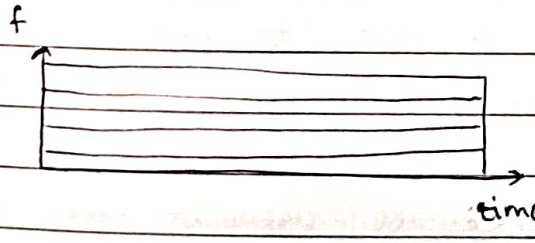
CIRCUIT SWITCHING

→ In circuit switched networks, the resources needed along a path to provide for communication between the end systems are reserved for the duration of the communication session.

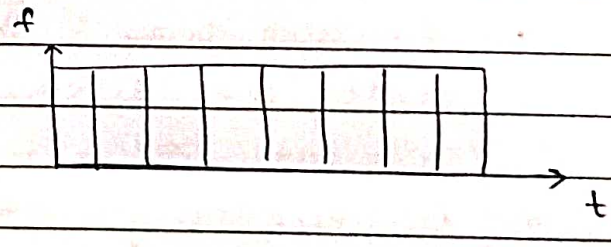
→ When two hosts wish to communicate, the network establishes a dedicated end to end connection between the hosts.

FDM vs TDM

F.D.M



T.D.M



→ The overall frequency is shared

→ Works with analog

→ Less efficient, High conflict

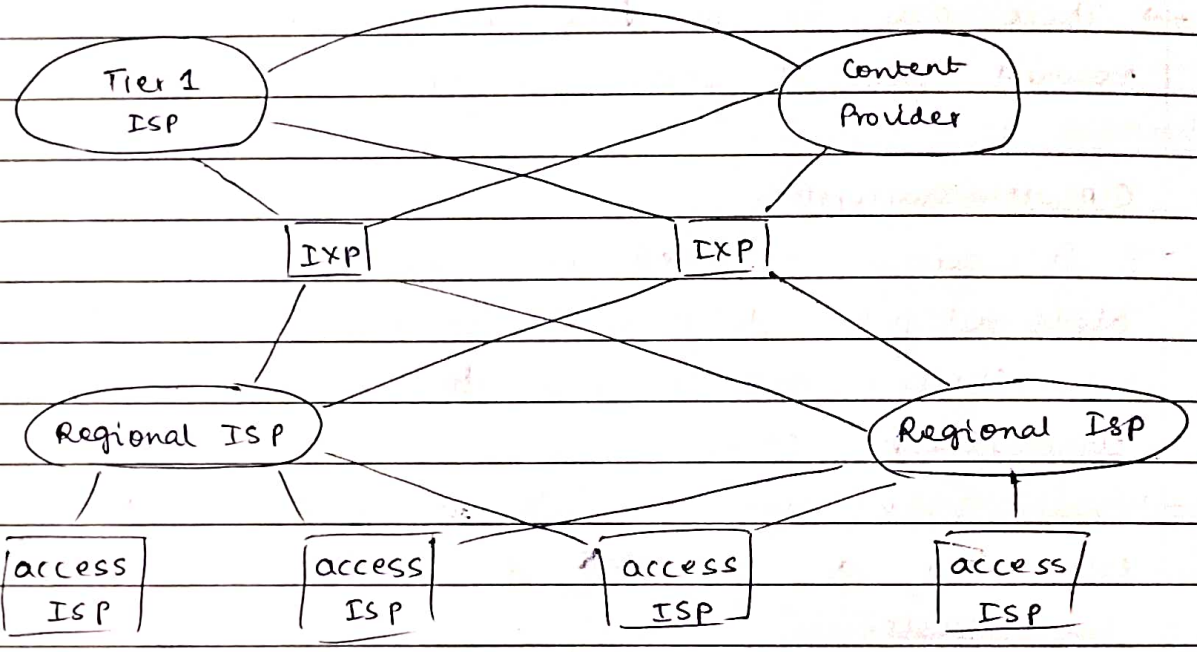
→ The overall timescale is shared

→ Works with digital

→ More efficient, less conflict

* Packets switching is better than circuit switching for bursty data. However it may lead to congestion and must be managed as it can lead to packet delay and loss due to overflow.

1.1 NETWORK OF NETWORKS



1.2 DELAY LOSS

1. Processing Delay : The time required to examine a packet header and determine where ~~it~~ to direct ~~it~~ it.

2. Queueing Delay : If a packet is stuck in the buffer queue, it is called queuing delay

3. Transmission Delay : It is the amount of time required to push all of the packet bits into the link

4. Propagation Delay : The time required to propagate from one end of the link to another is propagation delay.

propagation delay depends on the medium.

End to end delay → Total delay from source to destination.

Throughput → Rate at which bits are sent from sender to reciever
- Average
- Instantaneous

1.3 PROTOCOL LAYERS

→ The network hardware and software is divided into layers to provide structure to the protocols

Application
Presentation
Session
Transport
Network
Link
Physical

Application
Transport
Network
Link
Physical

Internet protocol

OSI - Reference Model

1. Application layer → Network applications and their protocols reside here. An application layer protocol is distributed over multiple end systems with the application in one end system using the protocol to exchange packets of information referred to as message.

2. Transport layer → This layer transports the application layer message between 2 endpoints TCP & UDP are the two protocols in this layer.

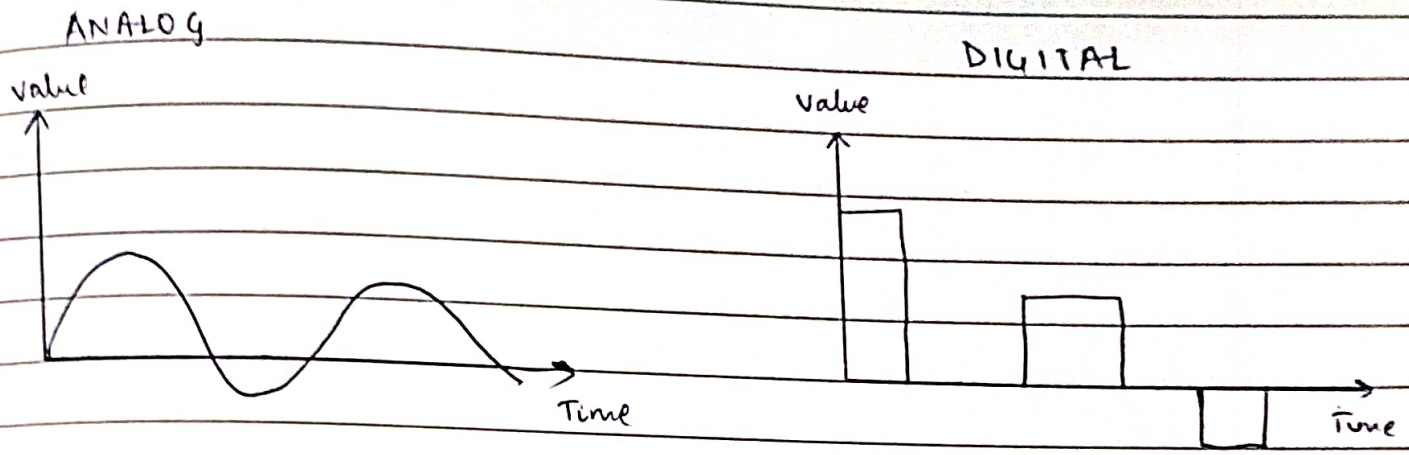
3. Network Layer → The network layer is responsible for moving the network level packets known as datagram from one host to another. This layer includes the IP protocol

4. Link layer → This layer routes the datagram through a series of routers. The services at this layer depend on the protocols. ~~depend~~ These link layer packets are called frames.

5. Physical Layer → This layer performs the task of moving the individual bits within the frame from one node to another. The protocols of this layer are dependent on the ~~layer~~ medium of transmission

ENCAPSULATION

1.4 DATA AND SIGNALS



Analog Signals → Wavelength, Bandwidth, frequency

Digital Signals

1. Bit Rate → No of bits sent in 1 second
2. Bit length → Distance that one bit occupies on the medium

Transmission Impairment

Attenuation
- ↳ Loss of energy
- ↳ Compensated by Amplifiers

Distortion
- ↳ Signal changes form or shape
- ↳ Causes change in phase

Noise
- ↳ External extra signals not originally present constitute the noise.