Computer Networking: A Top Down Approach

Chapter 1

Computer Networks and the Internet

CS-3001 Computer Networks

- **Instructor:** Salma Kulsoom
- **Classes:** Monday, Wednesday
- **Communication and announcements:** Everything on Slate
- **Counselling hours:** Monday 2:30 PM to 4:00 PM
- **Text book:** Computer Networking by James F. Kurose
- **Grading Policy;**
  - Assignments: 10%
  - Quies: 10%
  - Mids: 30%
  - Final:50%

Objectives

- Get into basics of networking
- Types of connections
- Circuit Switching
- Packet switching (Datagram and Virtual circuit)

Content

1. What is internet?
2. Internet nuts and bolts (Components of internet)
3. Edges and core of internet
4. Network protocols
5. Connection oriented and connectionless services
6. Point to point and multipoint connection
7. Circuit switching
8. Frequency division multiplexing
9. Time division multiplexing
10. Packet switching
11. Datagram
12. Virtual circuit switching
13. Practice questions

Computer Network

- **Computer Network:** Two or more devices that are connected with one another for the purpose of communicating data electronically.
- A cohesive architecture that allows a variety of equipment to transfer information in a near-seamless fashion.
- **Internet:** Global computer network where networks from around the world are connected through standard protocols.

Nuts and Bolts View of Internet

- Core components that formulates an internet.
- **Software:** Network applications, Protocols, Operating System
- **Hardware:**
  - End Systems -> Sender, Receiver, Host, Node, Client, Servers
  - Host
  - Communication link -> Chanel, media, medium, connection,
  - Switch
  - Hub
  - Router
  - Modem
  - Base station
  - Satellite Links
  - Repeaters

Nuts and Bolts of Internet

Router

Hub

Bridge

ISP

Base Station

Wireless Router

Switch

Wireless Bridge

Modem

Satellite Link

Edges and Core of Network

- Edges: End devices, clients, servers
- Core: Router, Gateways, Bridges, Switches

Internet Protocols

human protocols:

- "what' s the time?"
- "I have a question"
- introductions

… specific messages sent

… specific actions taken when messages received, or other events

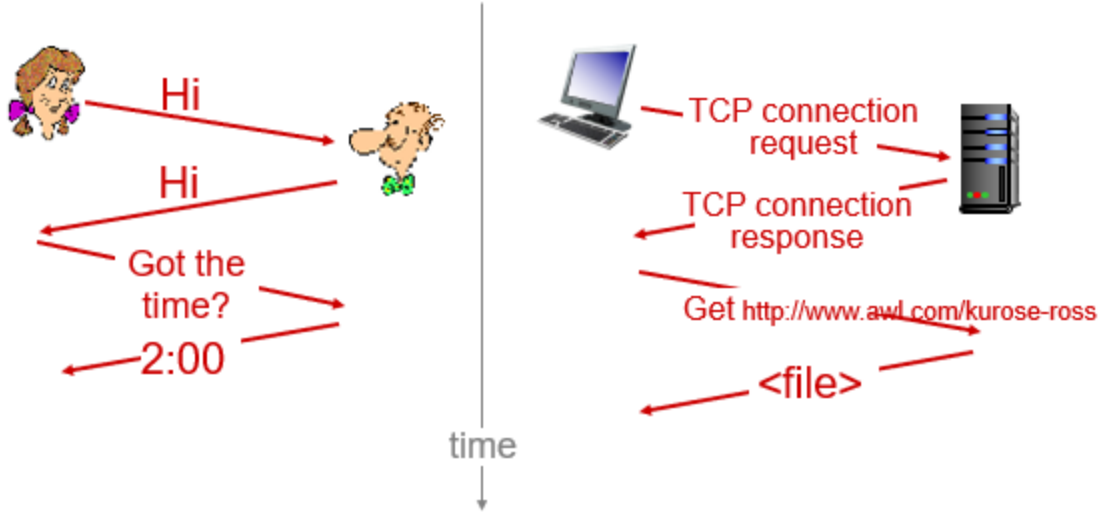
network protocols:

- machines rather than humans
- all communication activity in Internet governed by protocols

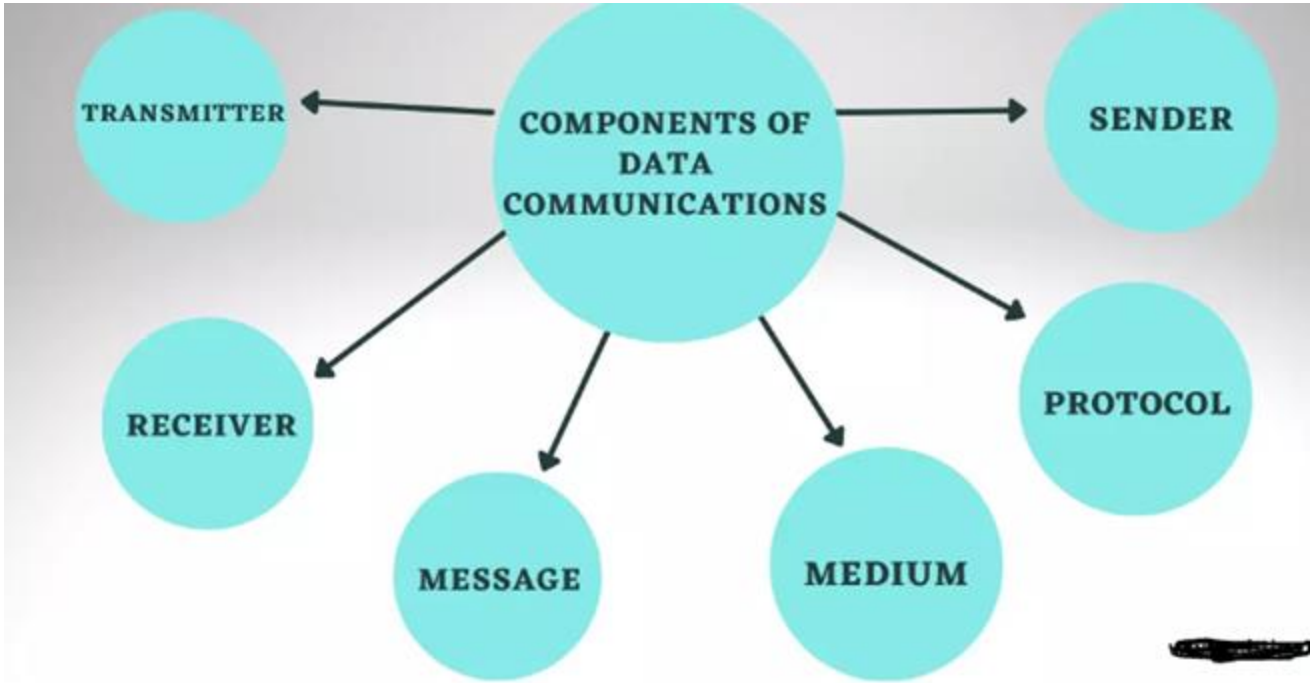
protocols define format, order of messages sent and received among network entities, and actions taken on message transmission, receipt

Internet Protocol

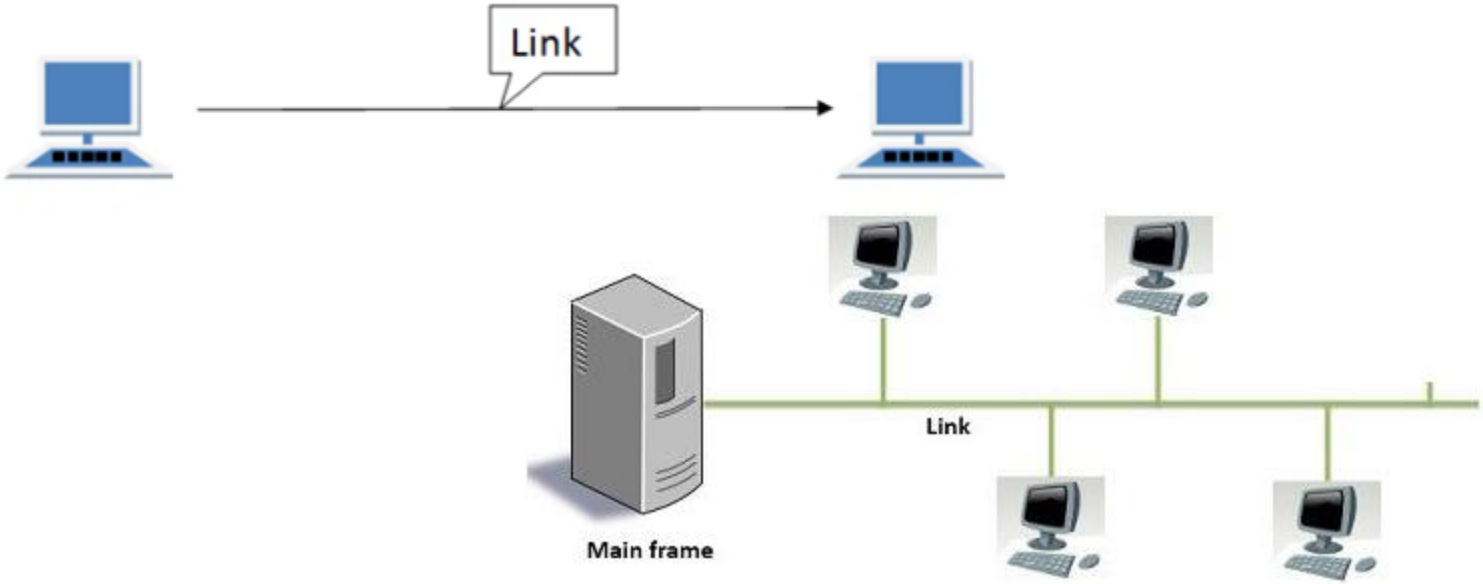
a human protocol and a computer network protocol:



Components of Data Communication

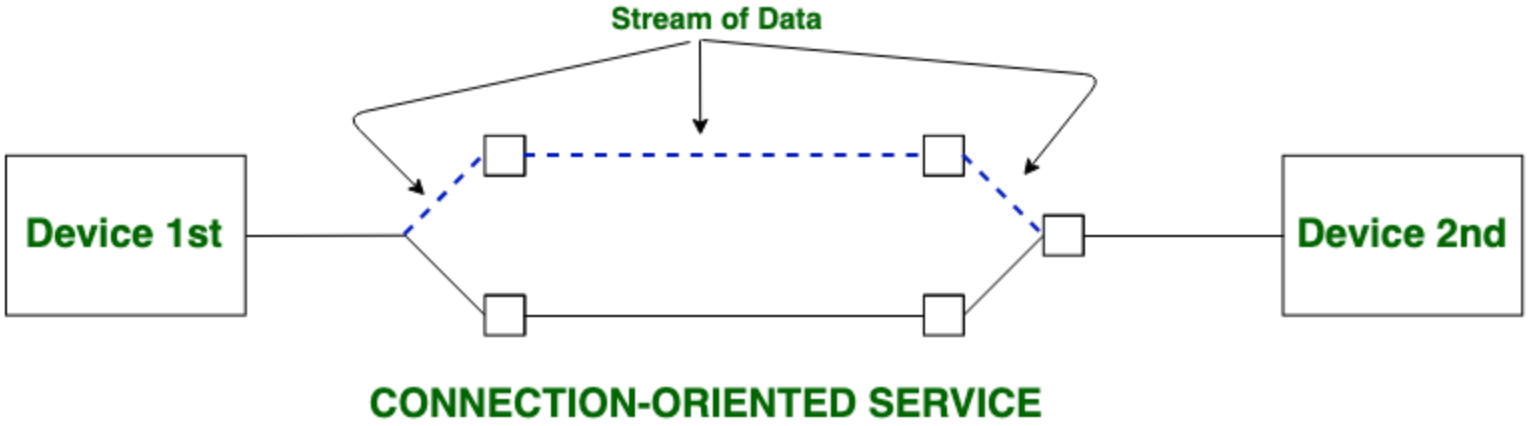


Point to Point Vs Multipoint

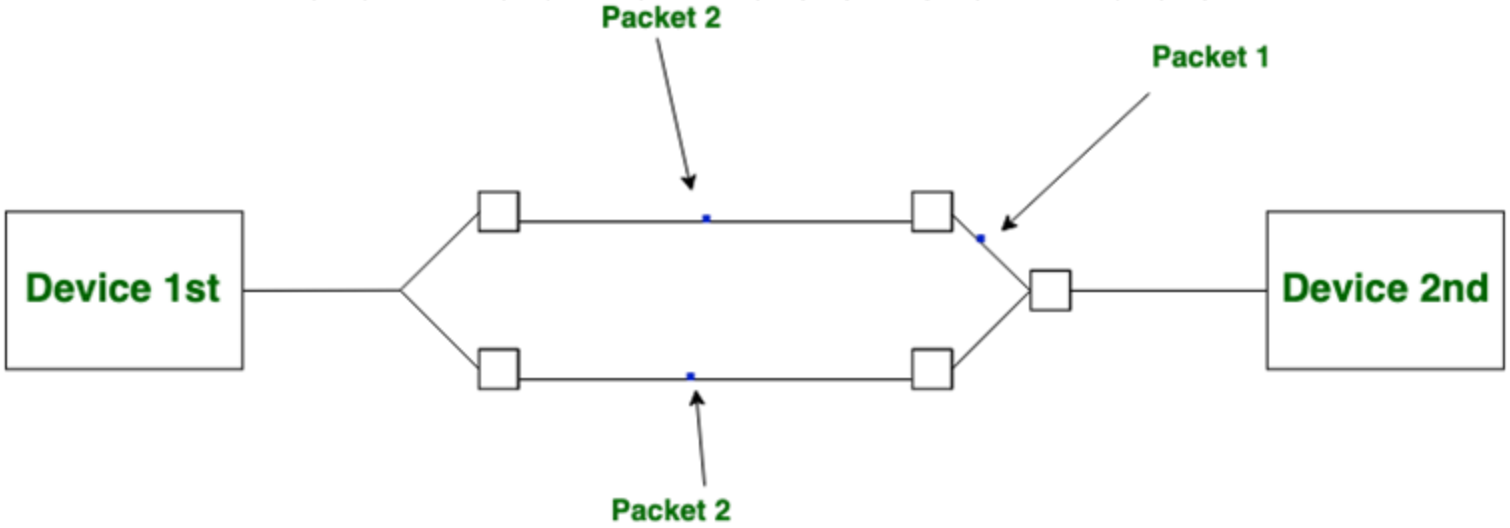


Connection Oriented Services

- Works on basis of Hand-shaking protocol

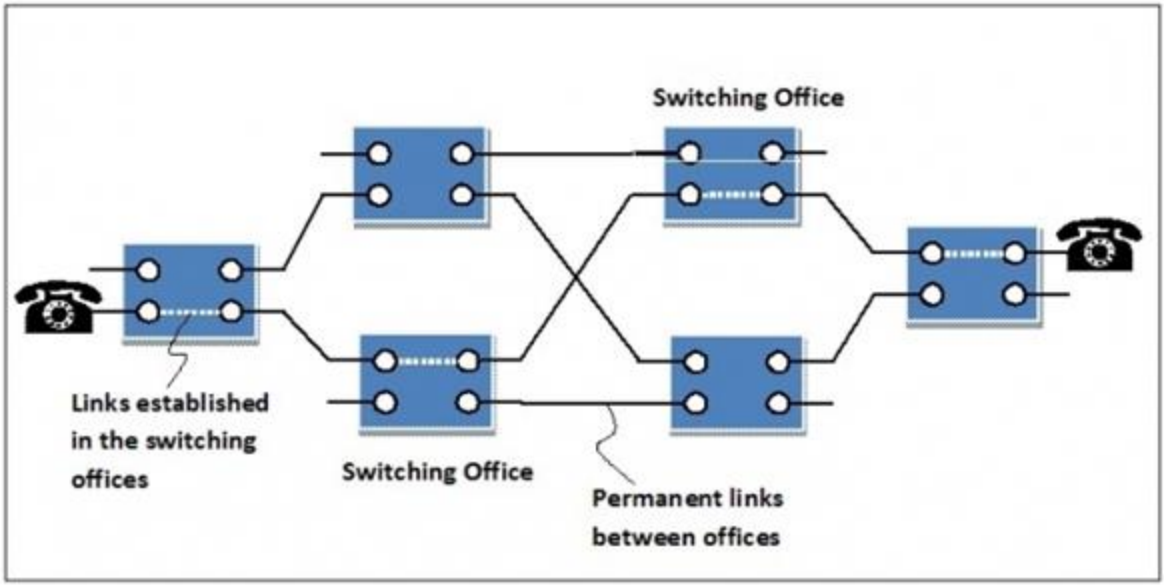


Connectionless Services



CONNECTIONIESS SERVICE

Circuit Switching



Setup time= Time required for establishing setup

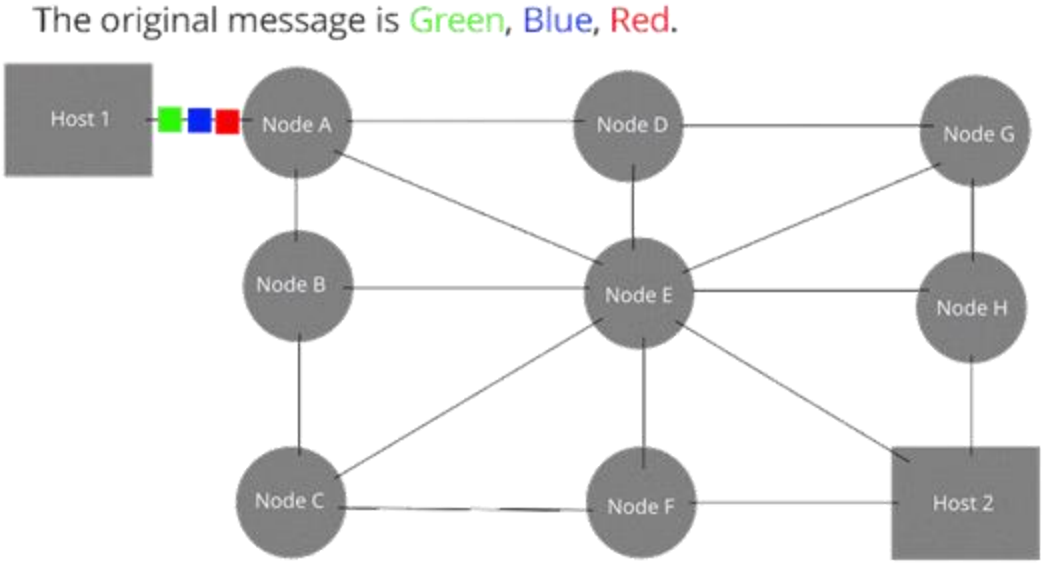
Transmission time= Number of bits in message/ Bandwidth

Propagation delay= Distance/ Speed

Teardown time= Time required for releasing resources

Total Transmission Time= Setup time + Transmission time + Propagation delay + Teardown Time
Total transmission time is also called total delay.

Packet Switching



Total Transmission Time= n(Transmission time) + Propagation delay

n= number of routers

Transmission time= Number of bits in message/ Bandwidth

Propagation delay= Distance/ Speed

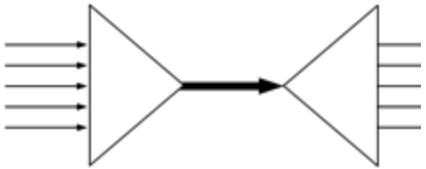
Teardown time= Time required for releasing resources

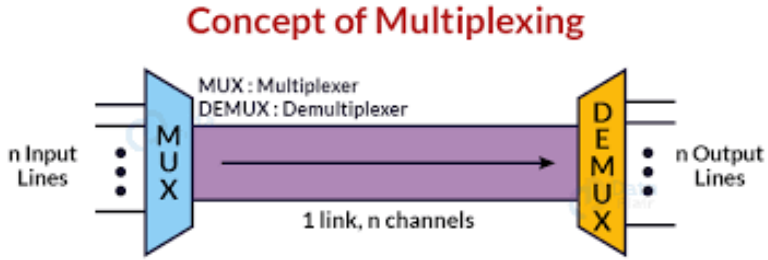
Total transmission delay also includes queuing delay and processing delay at each hop (hop is a point or a router from where packets are transmitted to next node.) If they are not mentioned, then ignore them.

Multiplexing in Circuit Switching

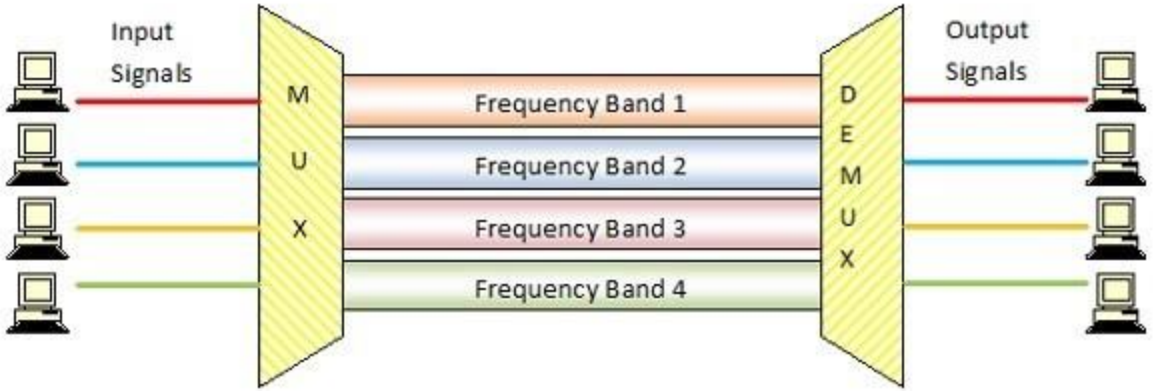
Multiplexing: Combining multiple analog or digital signals into one composite signal that is transported over a communication medium.

Demultiplexing: Converting a single signal with multiple streams into separate signals in order to transform it back into their original form.





Frequency Division Multiplexing

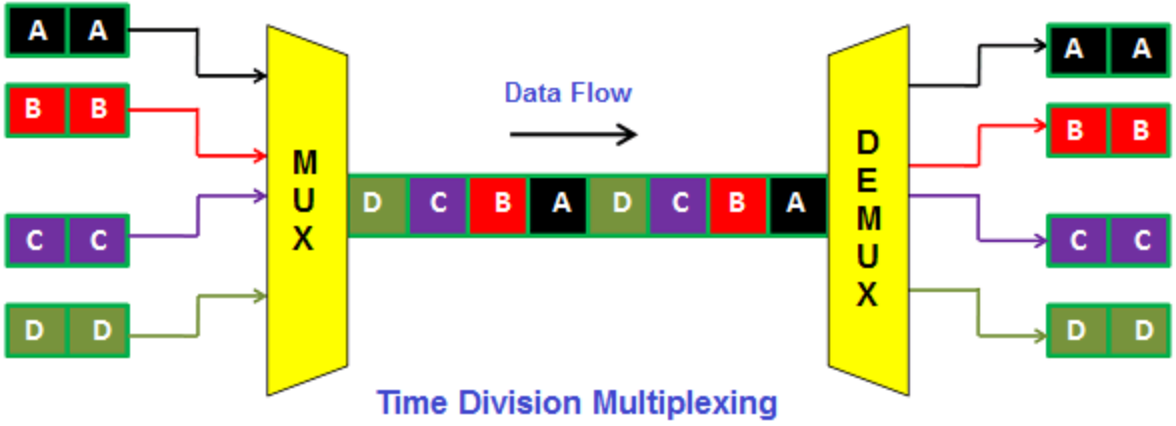


Total Transmission Time= Setup time + Transmission time + Propagation delay + Teardown Time

Since bandwidth is divided among slots:

Bandwidth per slot= total bandwidth/ number of slots

Time Division Multiplexing



Total Transmission Time= Setup time + Transmission time + Propagation delay + Teardown Time

Since bandwidth is divided among slots:

Bandwidth per slot= Total bandwidth/ (number of frames * bits in each frame)

Datagram Packet

- Pure packet switching
- No reservation of packets
- No order of packets
- Packets randomly choose any path
- Headers associated with each packet
- Frequent packet loss
- More efficient

Virtual Packet Switching

Connection less, do not work on hand-shaking principle

Less efficient

More wastage of resources

Global header only with first packet

Less overhead

Less dealy

Practice Exercises

- Mentioned in the self study material

To be continued..