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Overview of Data Communication And Networking

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Outline

- Data transmission networks
- Computer network architecture
- Types of services
- Benefits of computer network



Discussion Questions

1. List the types of data communication networks do you know.
2. What are the three fundamental characteristics that make a data communication systems effective?
3. Identify the five components of a data communication system.



Electrical Telegraph

- Using Morse code to transmit data

Morse code

Tic “•”

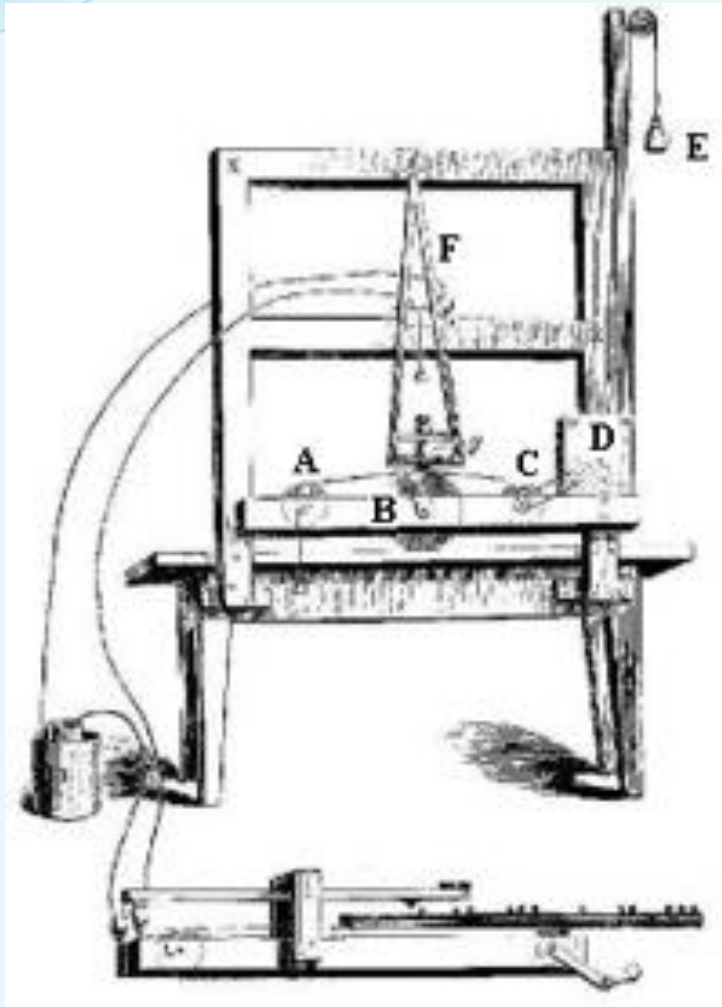
Te “-”

•— A	—••• B	—•—• C	— •• D	• E
••—• F	— —• G	•••• H	•• I	• — — — J
—•— K	•—•• L	— — — M	—• N	— — — — O
• — — • P	— — • — Q	• — • R	••• S	— T
••— U	•••— V	• — — W	—••— X	—•— — Y
		— — •• Z		



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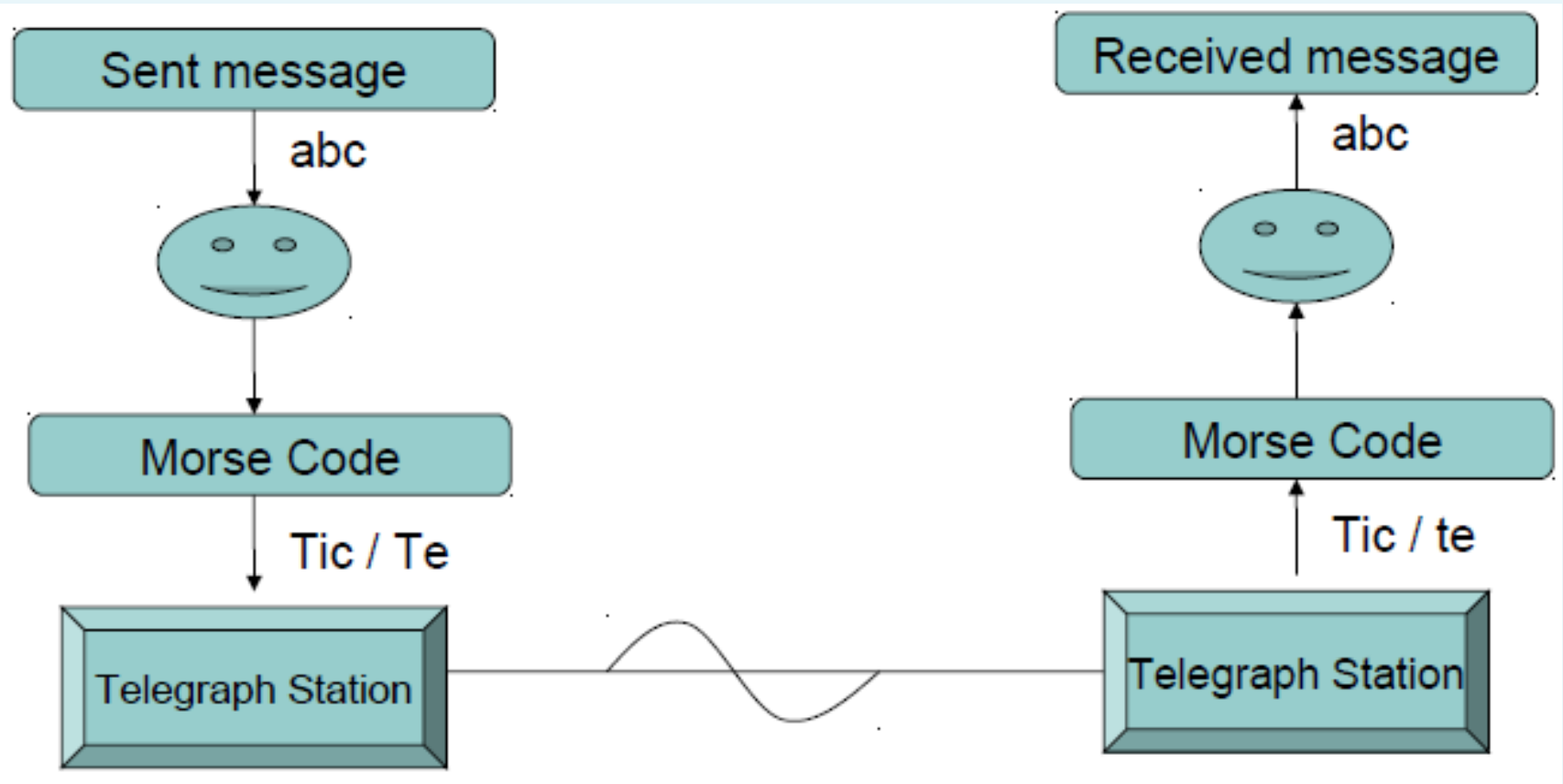
Electrical Telegraph





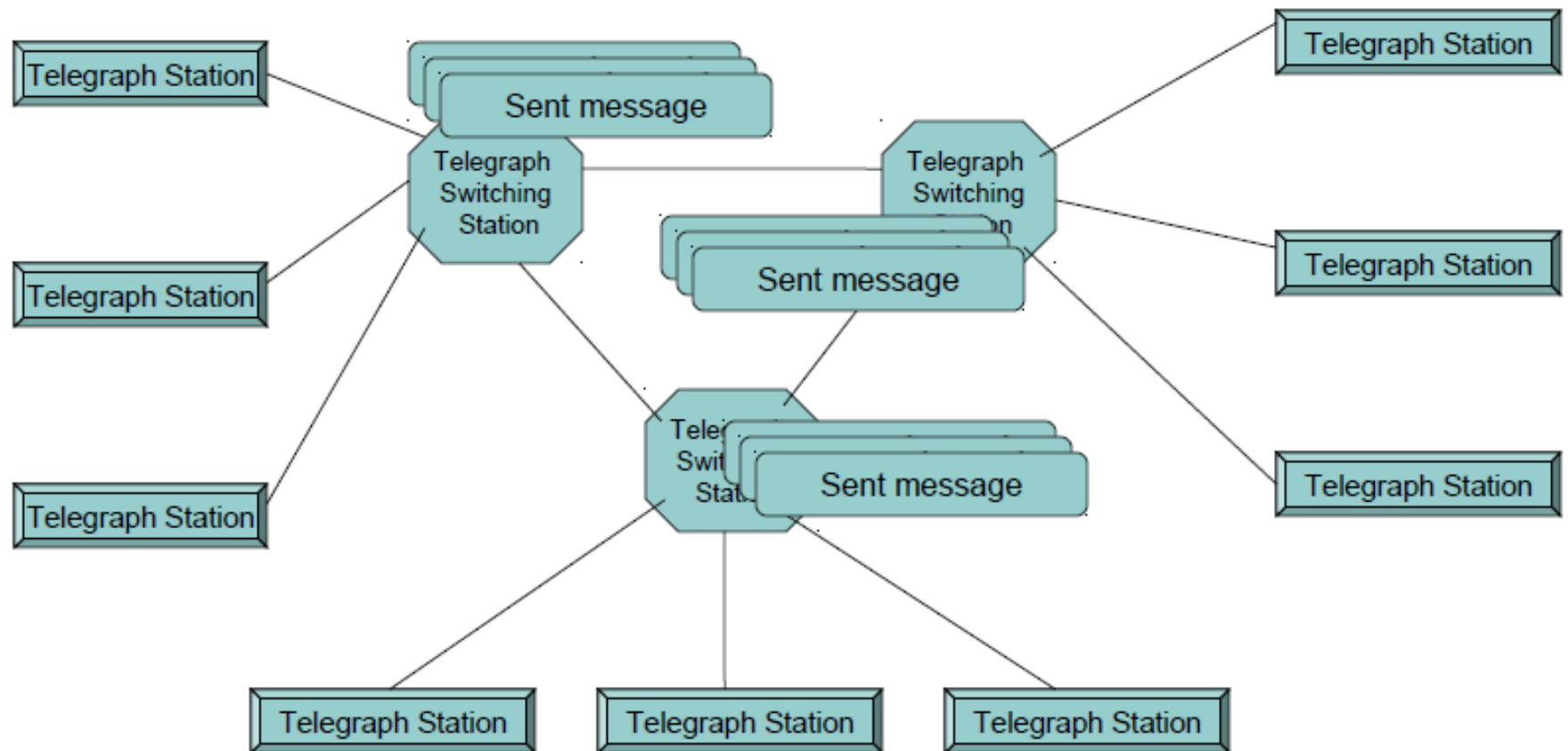
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Electrical Telegraph





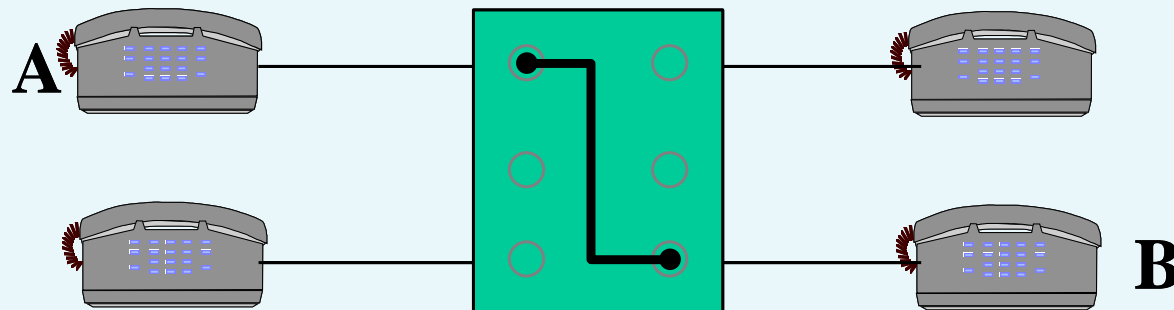
Electrical Telegraph





Telephone Network

- Transmit voice data
- Circuit switching / connection oriented network
- Establish a dedicated communication channel

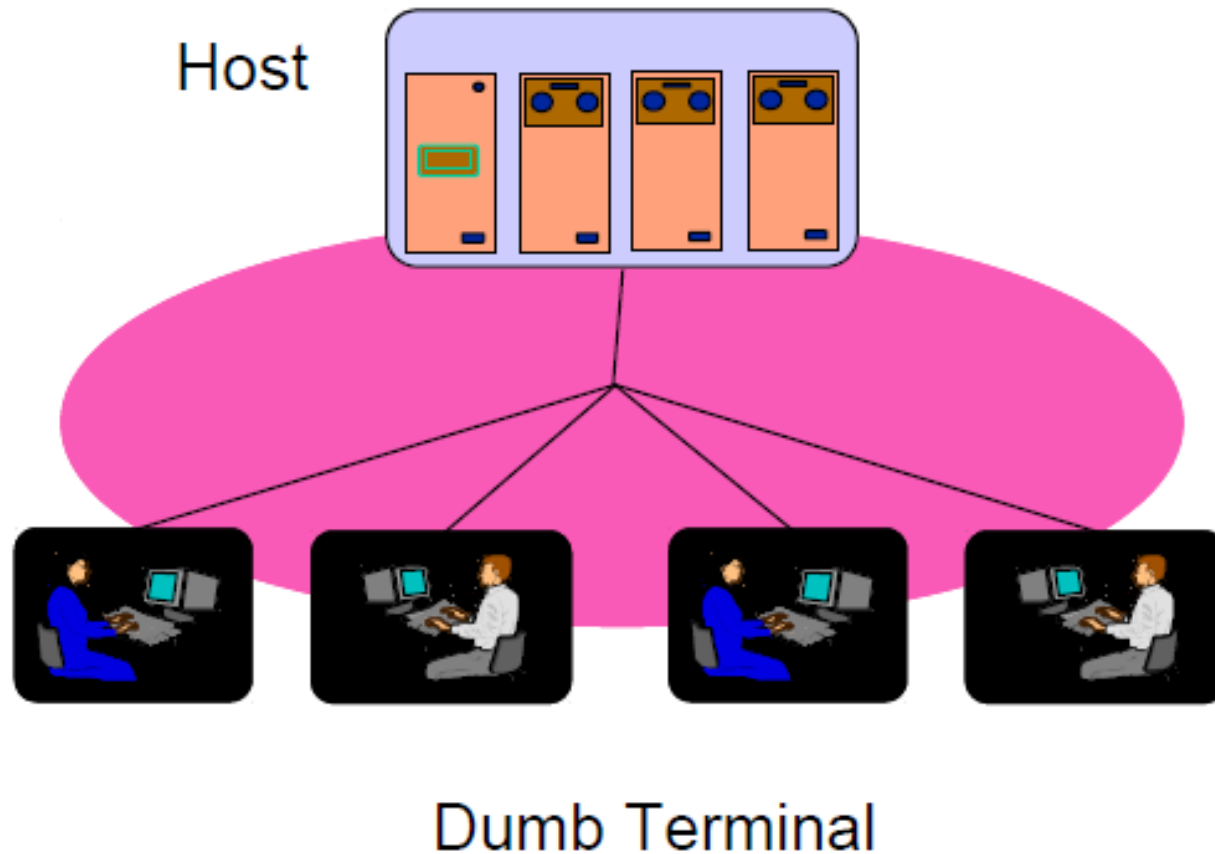




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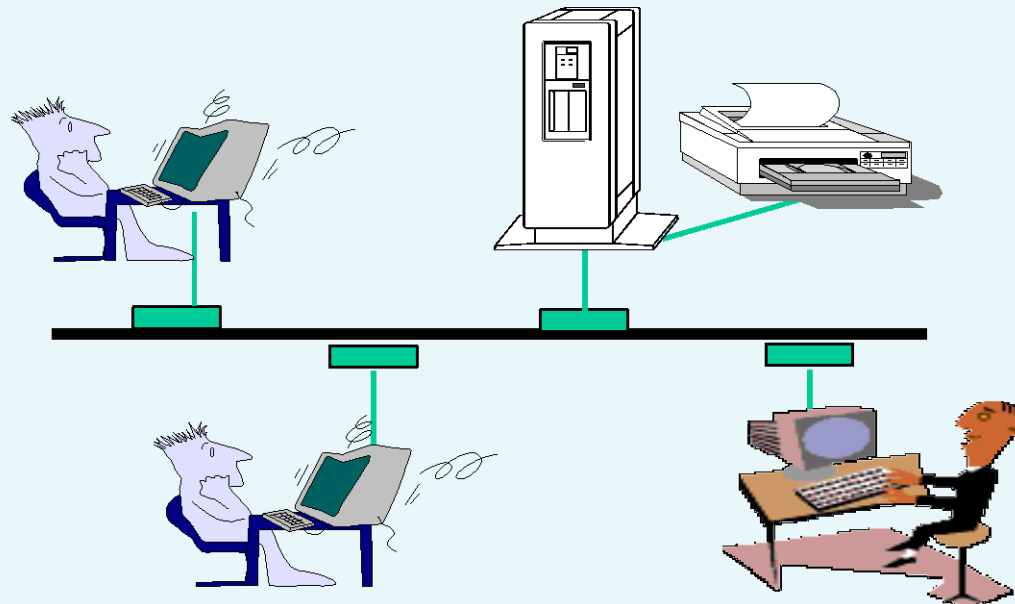
Terminal oriented communication network

- Mainframe network





- A group of two or more computer systems that are linked together through communication channels, according to a prototype, to facilitate communication and resource-sharing among a wide range of users.



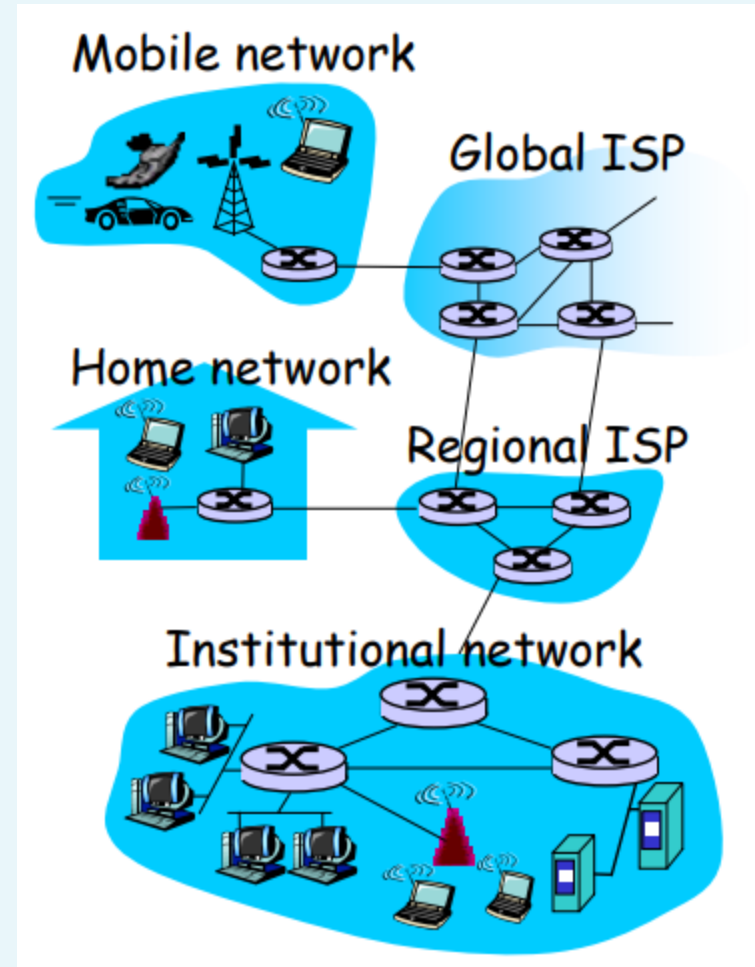


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Computer network components

Three components:

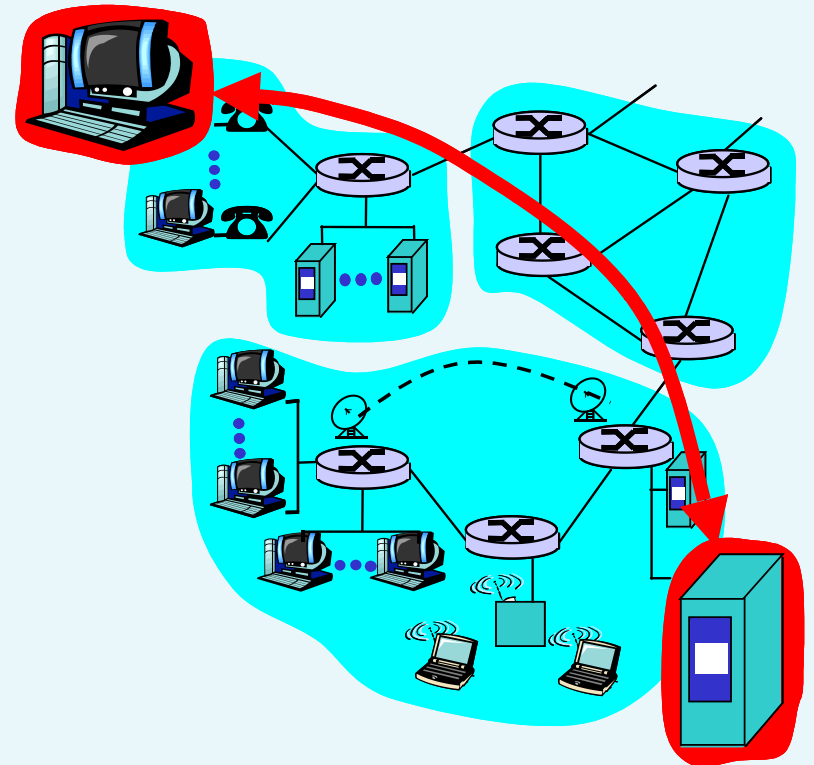
- Network Edge
- Network Core
- Access Network





Network edge

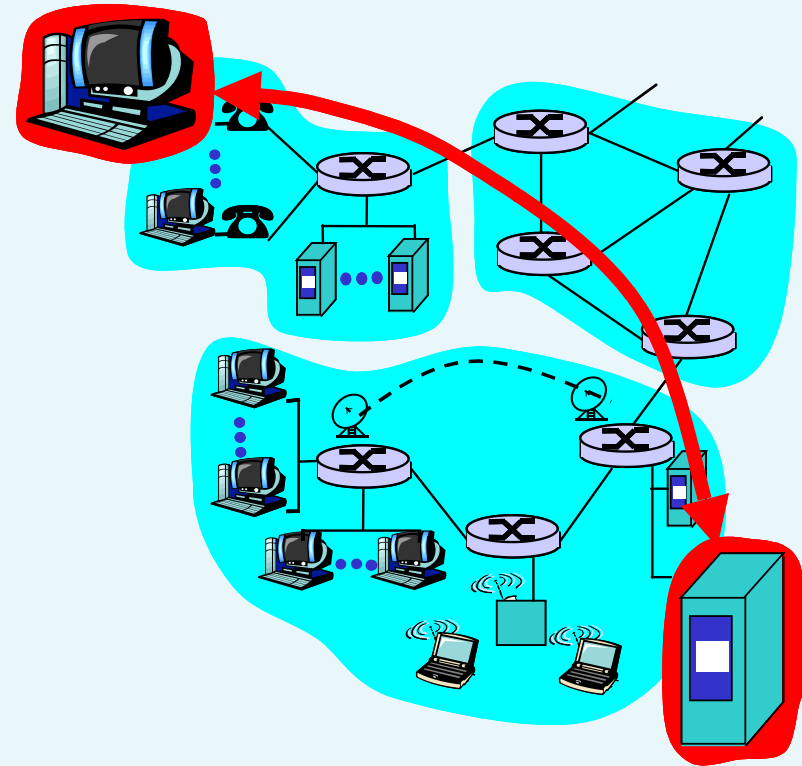
- Applications and hosts
- End systems (hosts):
 - run application programs
 - e.g. Web, email
 - at “edge of network”





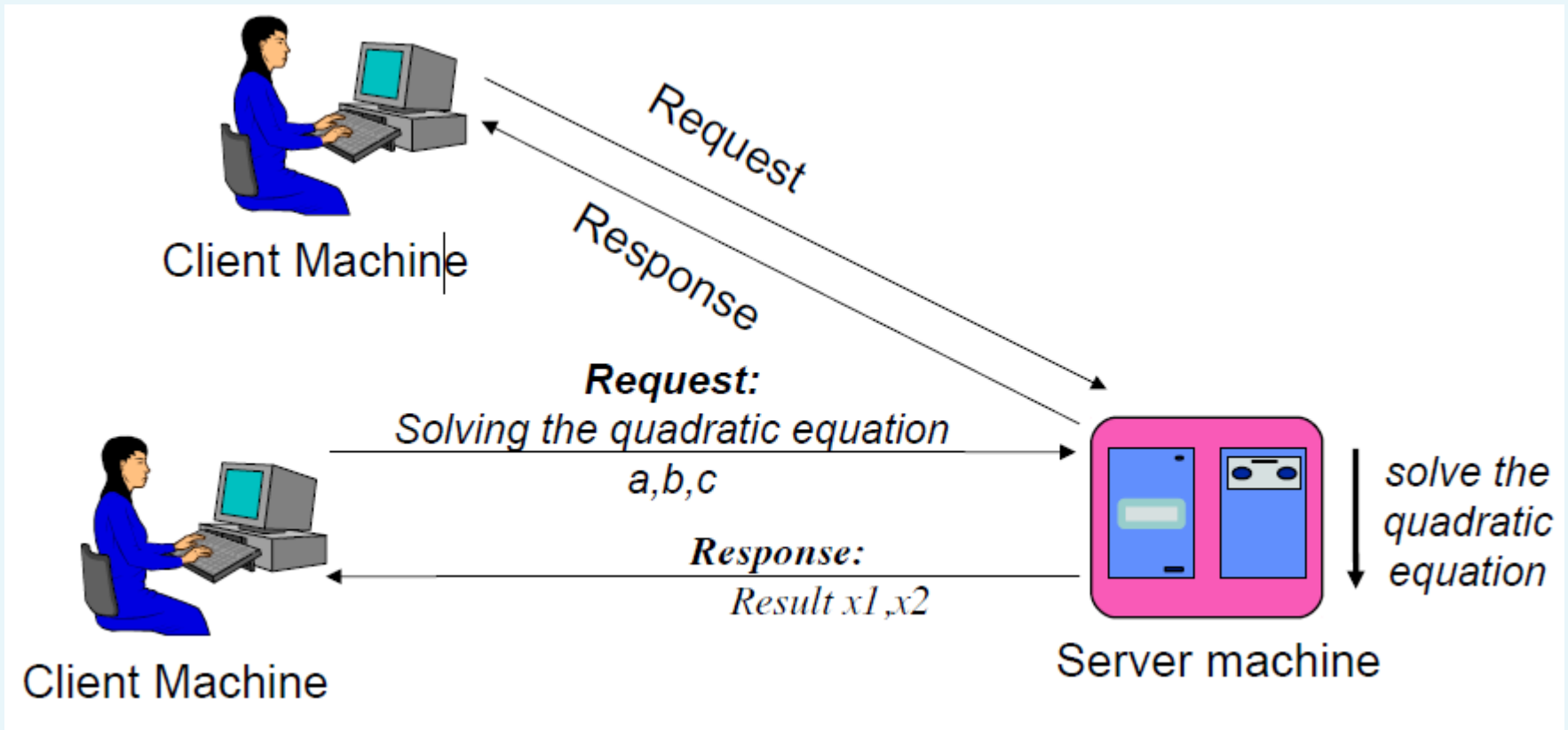
Network edge

- **client/server model:**
 - client host requests, receives service from always-on server
 - e.g. Web browser/ server; email client/server



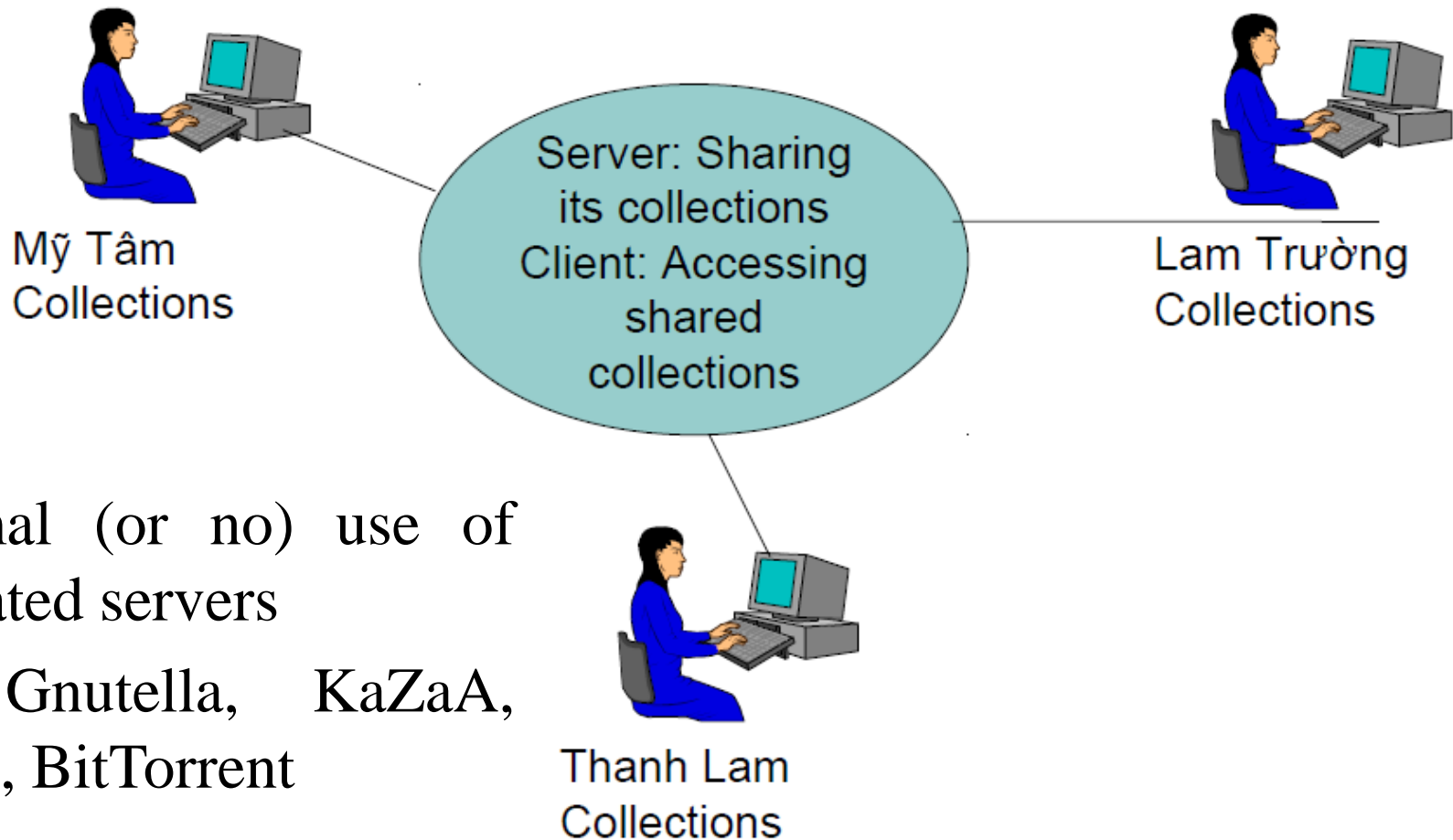


Client – Server model





Peer-to-Peer Model

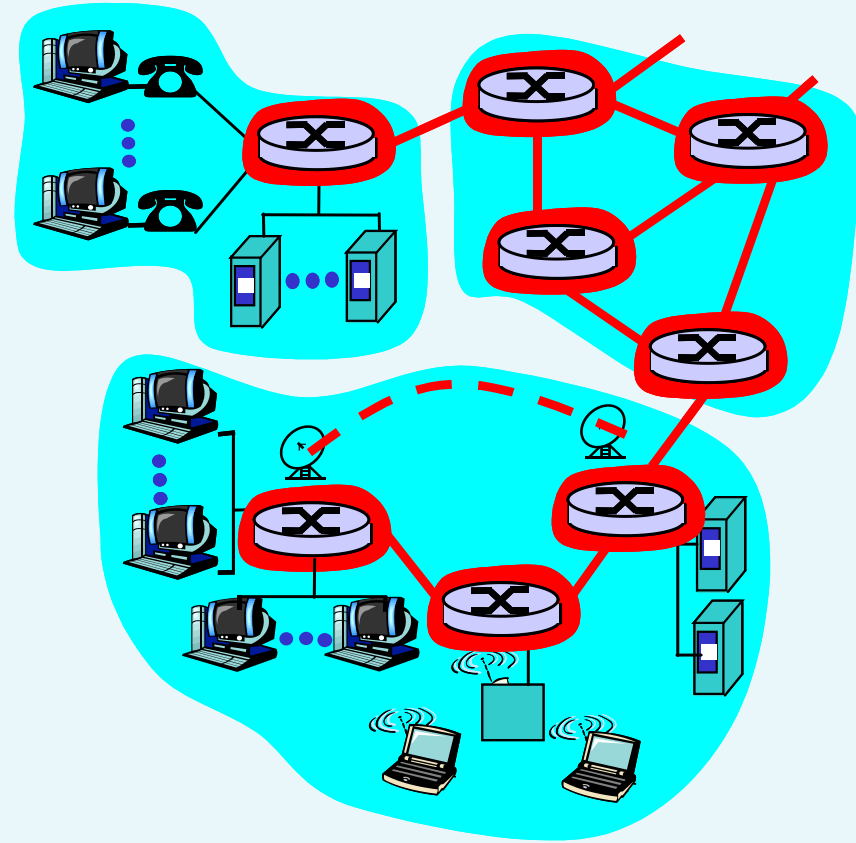


- minimal (or no) use of dedicated servers
- e.g. Gnutella, KaZaA, Skype, BitTorrent



Network Core

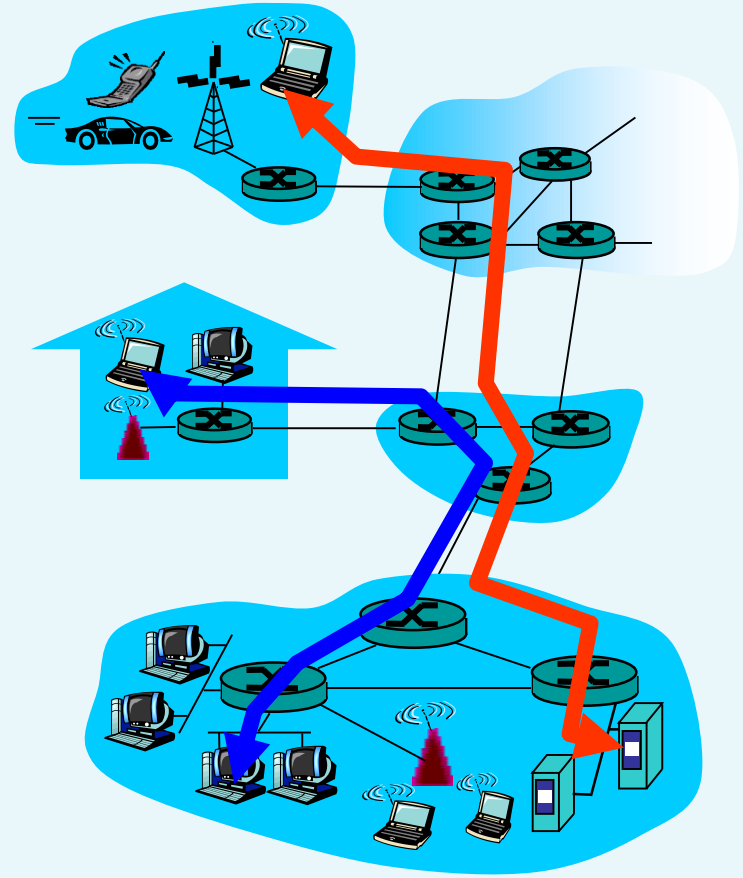
- Network of Routers
- Ensuring the exchange data between remote hosts
- **Two switching techniques:**
 - Circuit switching
 - Packet switching





Circuit switching network

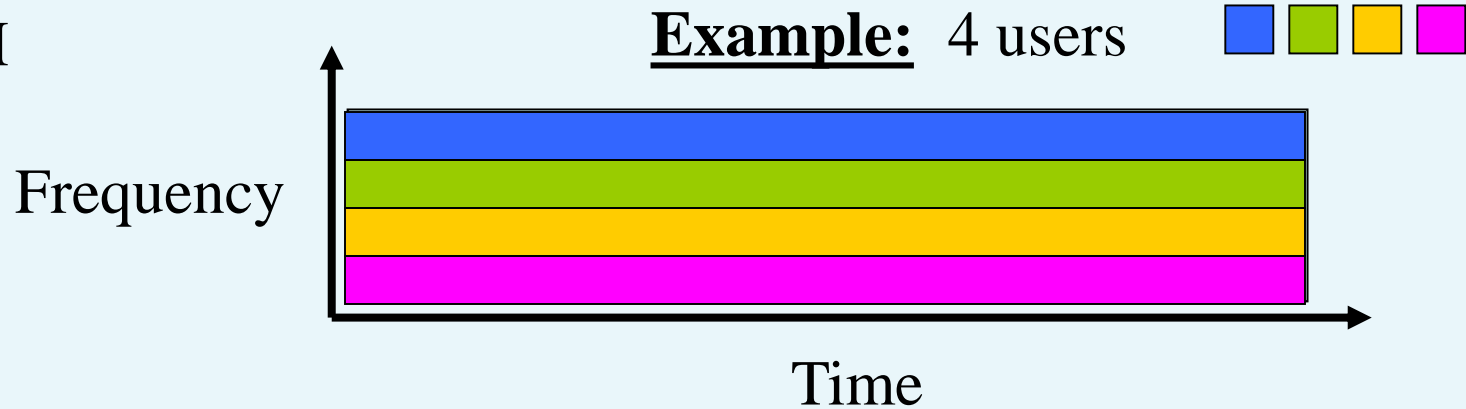
- Need to set up an end-to-end path before any data being sent
- **Popular techniques:**
 - FDMA-Frequency Division Multiple Access
 - TDMA- Time Division Multiple Access



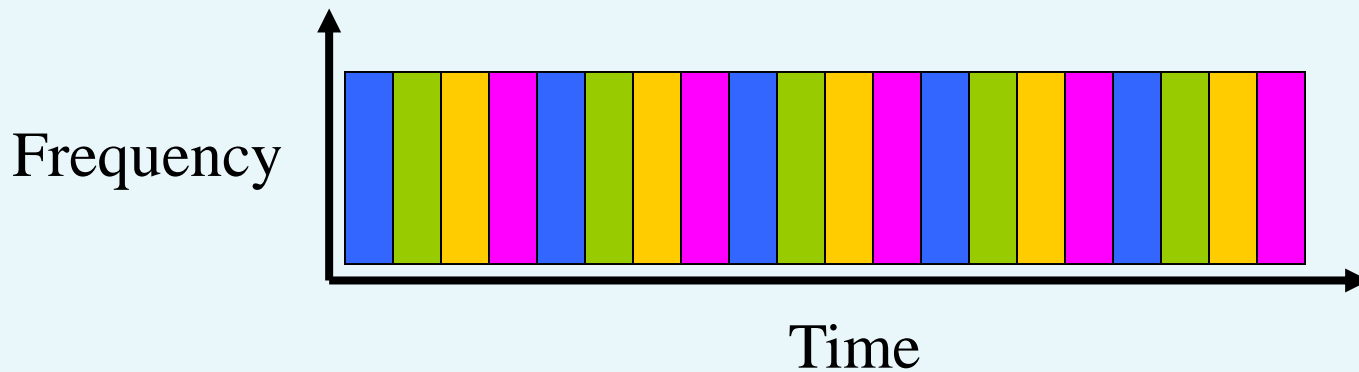


Circuit Switching: FDM and TDM

FDM

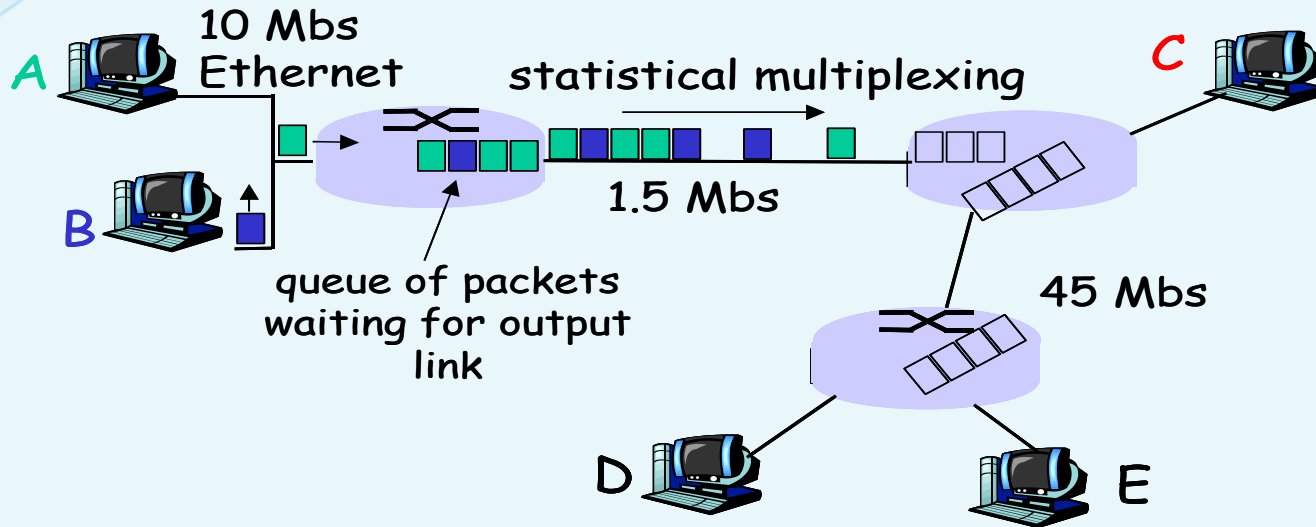


TDM





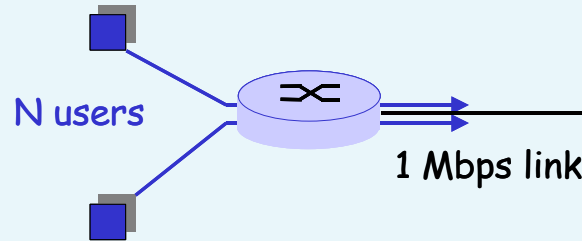
Packet Passing Network



- Each end-end data stream divided into packets
- User A, B packets share network resources
- Each packet uses full link bandwidth
- Resources used as needed
- Store-and-forward



Circuit switching vs Packet Switching



Assume:

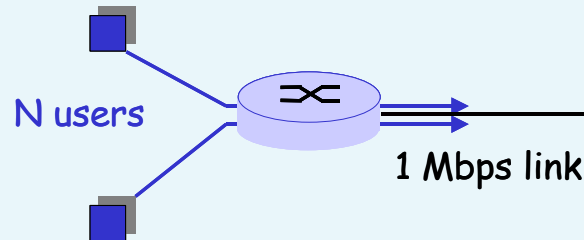
- Link: 1 Mbits
- Assign 100Kbps channel for each “active” user
- User “active time”: 10%.

Then:

- circuit-switching: maximum of 10 users
- packet switching: maximum of 35 users, (Possibility of having more than 10 “active” concurrently is less than 0.004)



Circuit switching vs Packet Switching

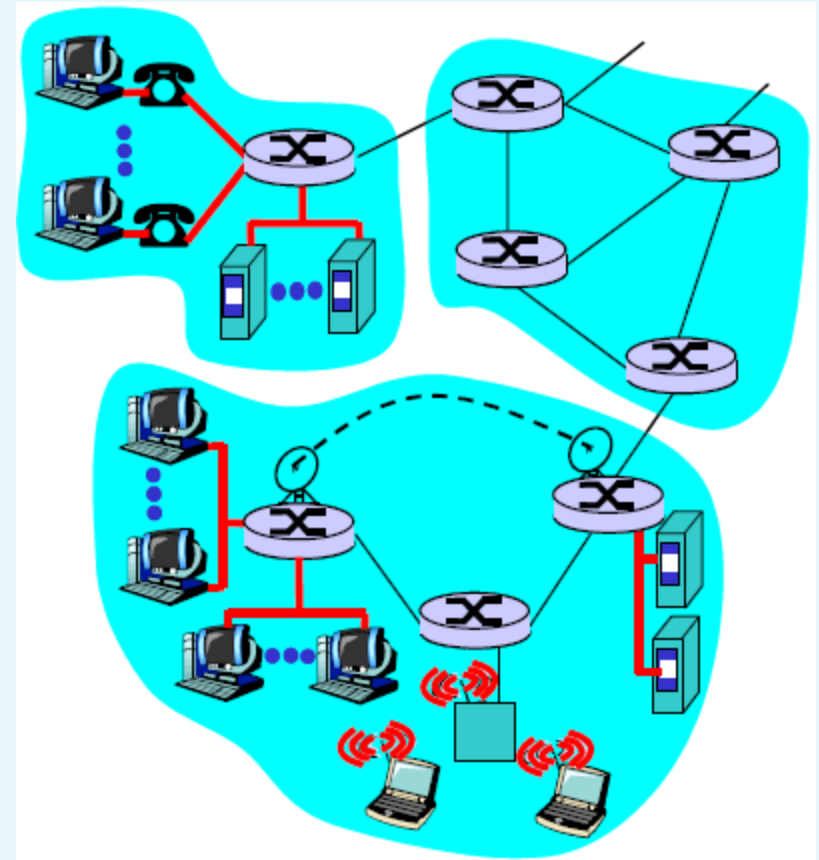


Packet switching networks:

- Suitable for high traffic network thanks to a mechanism of sharing resources
- Need a mechanism for congestion control and data loss
- Lack of quality assurance mechanism for certain kinds of application: videos, audio, ..

Access Network

- Connect end systems to
- How to connect end systems to edge router
- Example:
 - Telephone network
 - ADSL network
 - Local area networks.
 - Wireless LAN





Benefits of computer networks

- Sharing resources such as hardware, softwares and data.
- Enhance reliability of computer systems
- Enhance working efficiency
- Reduce investment cost
- Enhance security for data Facilitate new methods of working: remote working, group-ware, virtual offices, ...



Exercise

1. How long does it take to send a file of 640,000 bits from host A to host B over a circuit-switched network? If
 - All links are 1.536 Mbps
 - Each link uses TDM with 24 slots/sec
 - 500 msec to establish end-to-end circuit