Networks Fundamentals

Chapter 1

Network Fundamentals

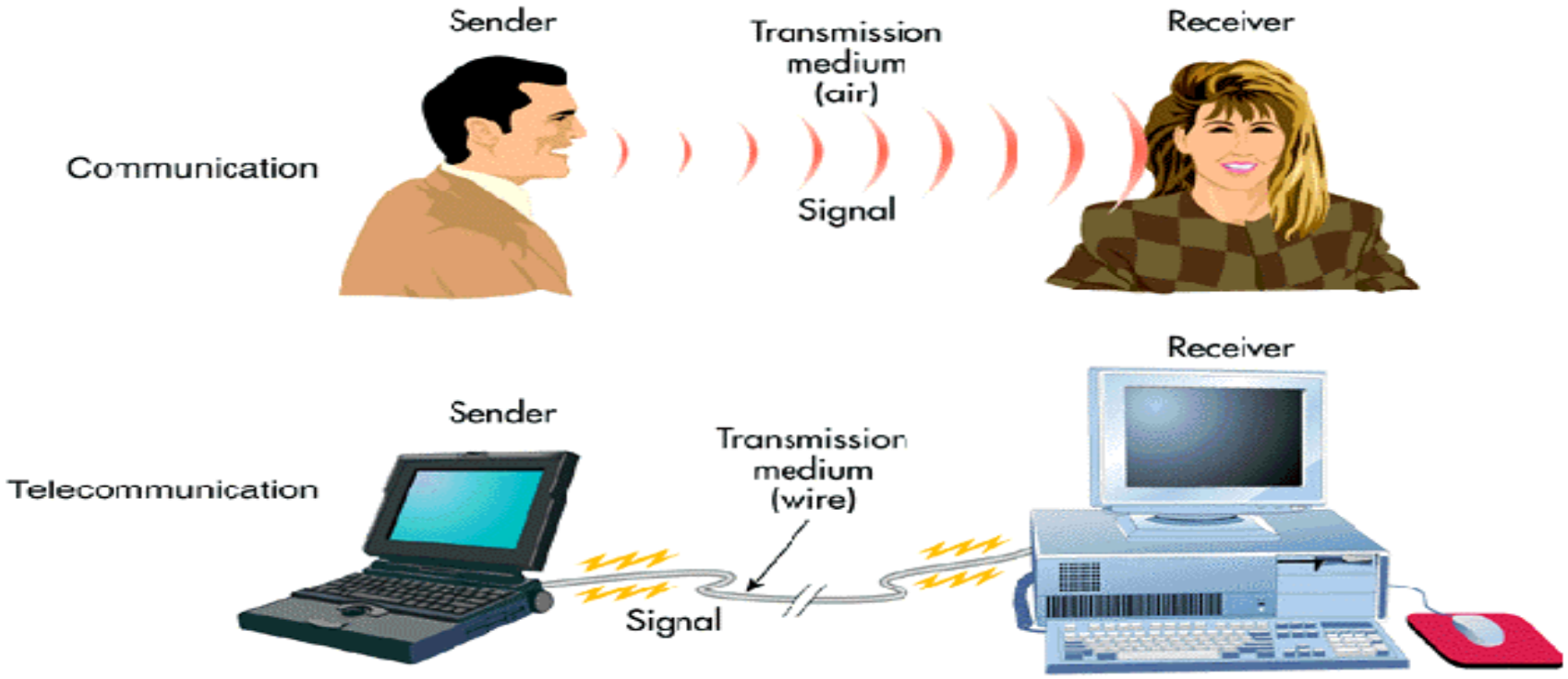
Introduction

Telecommunications

- **Telecommunications**
  - The electronic transmission of signals for communications, including such means as:
    - Telephone
    - Radio
    - Television
- **Telecommunication medium**
  - Anything that carries an electronic signal and interfaces between a sending device and a receiving device.

Communications and Telecommunications

- In human speech, the sender transmits a signal through the transmission medium of the air.
- In telecommunications, the sender transmits a signal through the transmission medium of a cable



Computer Network

- Communication is almost as important to us as our reliance on air, water, food, and shelter. In today's world, through the use of networks, we are connected like never before.
- **A computer network** is two or more computers connected together so they can communicate with one another.
- Two computers are interconnected if they can exchange information among them.
- These interconnected computers are called Computer networks

Computer Network

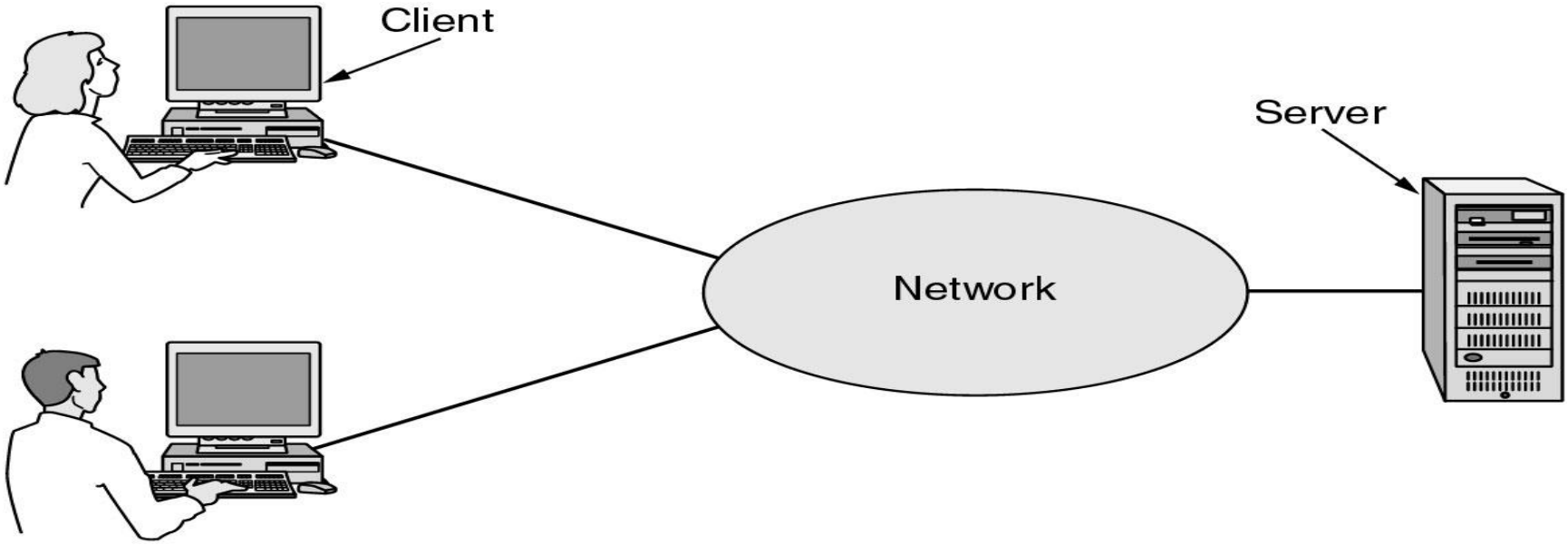
- Today, a single mainframe computer is not serving all the computation needs, but a large number of interconnected computers will do.
- Computers networks vary in their size, communication media and speed of data transmission.
- Uses of Computer Networks
  - Business Applications
  - Home Applications
  - Mobile Users

Benefits and uses of computer networks

- **Business applications:** companies that have large number of computers can benefit from computer networks as follows:
  - •Hardware sharing: like printers, hard drives and scanners.
  - •Send files from one computer to another quite easily
  - •Connectivity and Communication: Networks connect computers and the users within a building or work group can be connected into local area networks (LANs); users in distant locations can be interconnected into larger wide area networks (WANs).
  - •Run programs that installed on central computers (servers) but are not installed on any other user's computer.
  - •Internal e-mail services
  - •E-commerce.

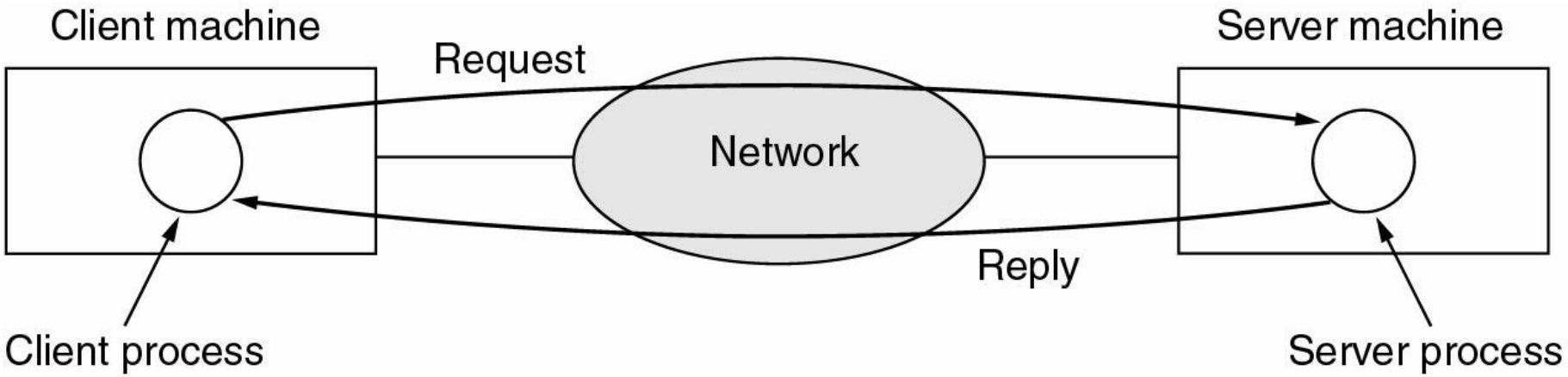
Business Applications of Networks

- **Clients**
  - A computer provides a user with access to a network. End user personal computers or networked computers
- **Servers**
  - A computer or system that provides resources, data, services, or programs to other computers, used to manage the networks



A network with two clients and one server.

Business Applications of Networks



The client-server model involves requests and replies.

Benefits and uses of computer networks

- **Data Security and Management:**

- Computer networks allow the administrators to manage the company's critical data. Instead of having this data spread over a large number of small computers data can be centralized on shared servers.

- This makes it easy for everyone to find the data, backup data on regular basis, and allows for the implementation of security measures to control who can read or change critical information.

Home Network Applications

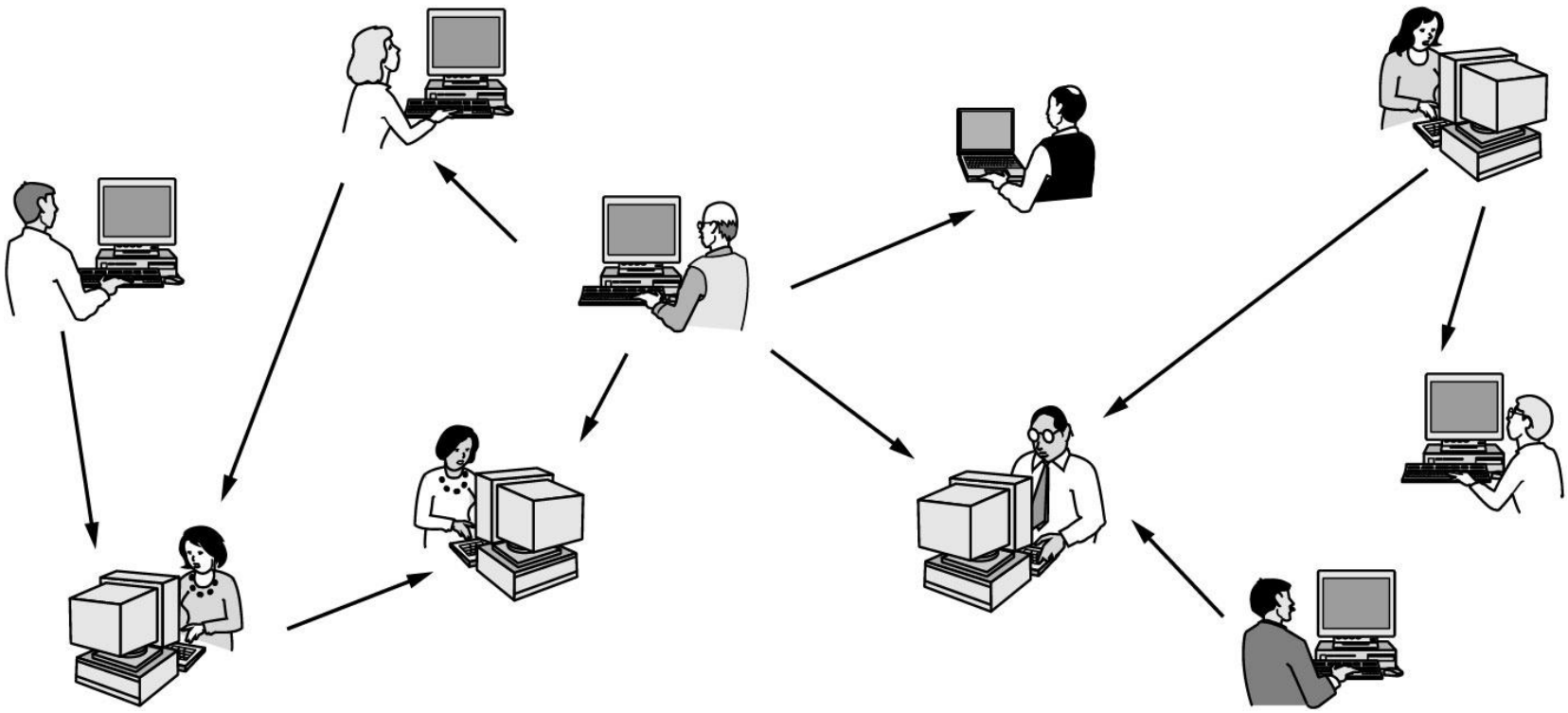
- Access to remote information
- Person-to-person communication
- Interactive entertainment
- Electronic commerce

Home Network Applications

- Home applications:

- Sharing resources like printers, scanners
- share a single Internet connection on all the home PCs.
- Interactive entertainment : e.g. Video on demand on the internet.
- Peer to peer communication to share music
- Connecting home appliances together.

Home Network Applications



In peer-to-peer system there are no fixed clients and servers.

Home Network Applications

- Some forms of e-commerce.

Tag	Full name	Example
B2C	Business-to-consumer	Ordering books on-line
B2B	Business-to-business	Car manufacturer ordering tires from supplier
G2C	Government-to-consumer	Government distributing tax forms electronically
C2C	Consumer-to-consumer	Auctioning second-hand products on-line
P2P	Peer-to-peer	File sharing

Transmission Technology

- Computer networks differ by their size and transmission technology.
- There are two types of transmission technology:
  1. **Broadcast links**
  2. **Point-to-point links.**

- Broadcast links have a single transmission channel that is shared by all the computers on the network.

Transmission Technology

- Broadcast links :
  - If the destination of the sent messages is all the existing computers on the network this known as a broadcasting.
  - If the destination of the sent messages is a specific computers this known as a multicasting.

- Point-to-point link:
  - The messages are sent from one sending computer to one receiving computer.

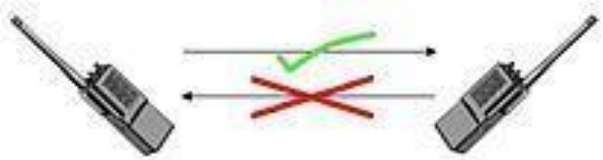
Broadcast Networks

- Classification of interconnected processors by scale.

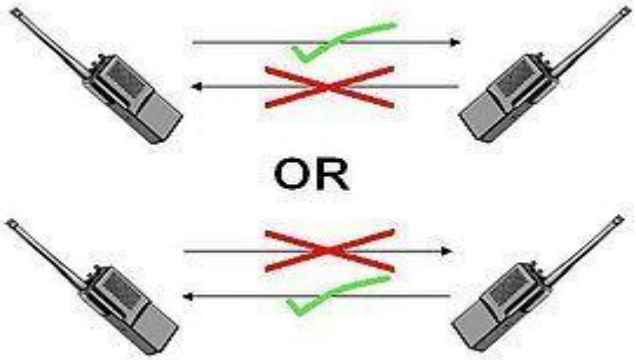
Interprocessor distance	Processors located in same	Example
1 m	Square meter	Personal area network
10 m	Room	Local area network
100 m	Building	
1 km	Campus	
10 km	City	Metropolitan area network
100 km	Country	Wide area network
1000 km	Continent	
10,000 km	Planet	The Internet

Transmission Modes

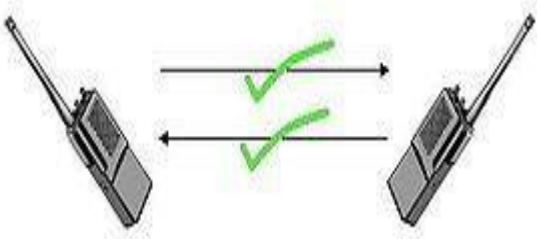
- Transmission Modes:
  - Simplex
    - Sends information in one direction only.



  - Half Duplex:
    - Uses only one wire pair.
    - Collision might occur.



  - Full Duplex:
    - Uses two pairs of wire.
    - No collision.
    - Transmitted data is sent on a different wires than the received data.
    - Full duplex is faster than half duplex.



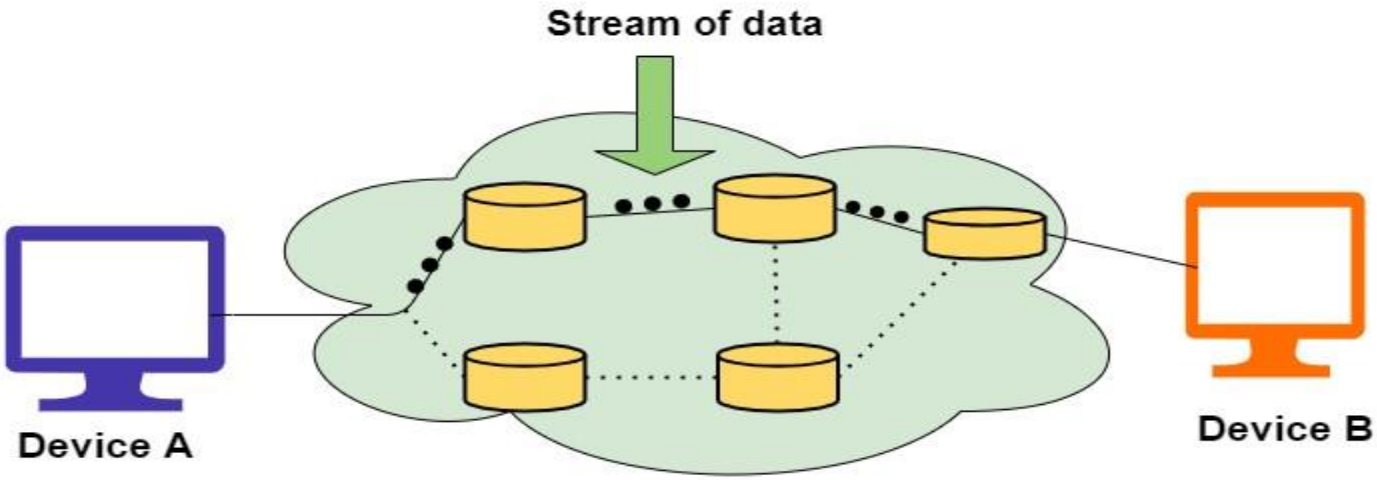
Data communication

- Data communication is a telecommunication network to send and receive data between two or more computers over the same or different network.

- There are two ways to establish a connection before sending data from one device to another:
  - **Connection-Oriented**
  - **Connectionless Service**.

Connection-Oriented Services

- Connection-oriented service involves the creation and termination of the connection for sending the data between two or more devices.
- Used to create an end to end connection between the sender and the receiver before transmitting the data over the same or different networks.



Connection-Oriented Services

Advantages

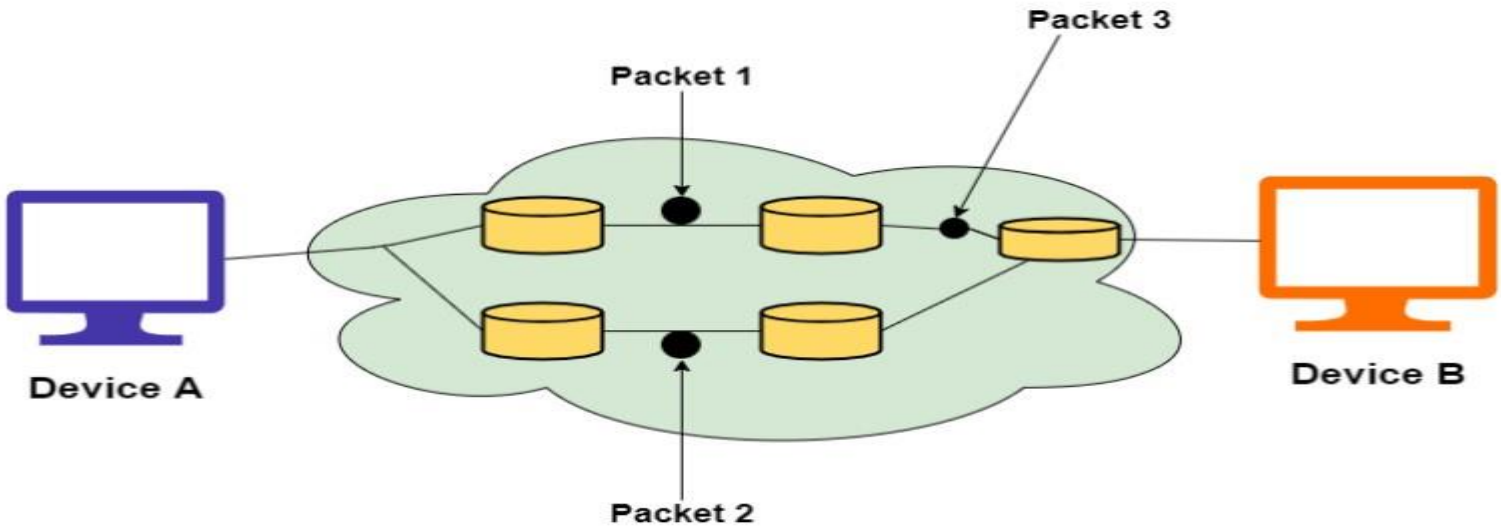
- Connection-Oriented Services are reliable.
- There is no duplication of data packets.
- There are no chances of Congestion.
- These are Suitable for long connections.
- Sequencing of data packets is guaranteed.

Disadvantages

- This allocation of resources is mandatory before communication.
- The speed of connection is slower.

Connectionless Services

- Connectionless service is used in the network system to transfer data from one end to another end without creating any connection.
- So it does not require establishing a connection before sending the data from the sender to the receiver.
- It is not a reliable network service because it does not guarantee the transfer of data packets to the receiver, and data packets can be received in any order to the receiver.



Connectionless Services

Advantages

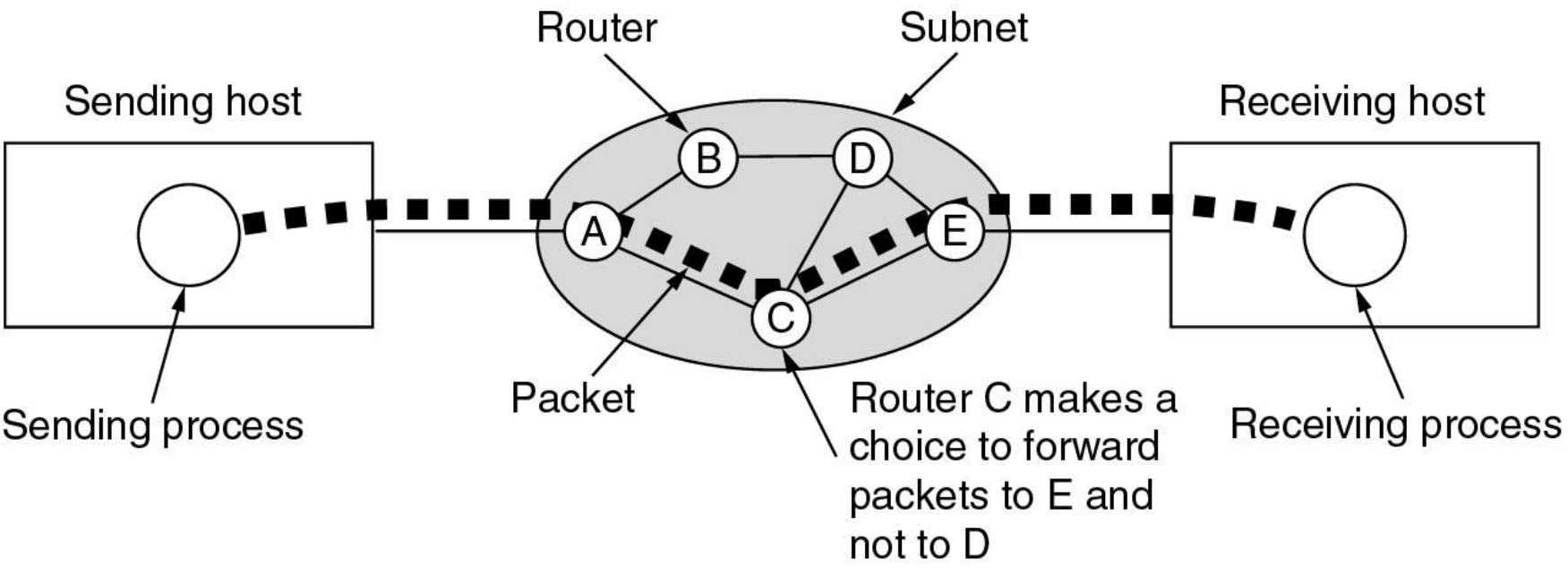
- There are usually low overheads.
- Connectionless services help to broadcast or multicast messages to multiple recipients.

Disadvantages

- These are susceptible to congestion in the network.
- It is not reliable as there is the possibility of a loss of data packets, wrong delivery of packets or duplication is high.

Data communication

- A stream of packets from sender to receiver.



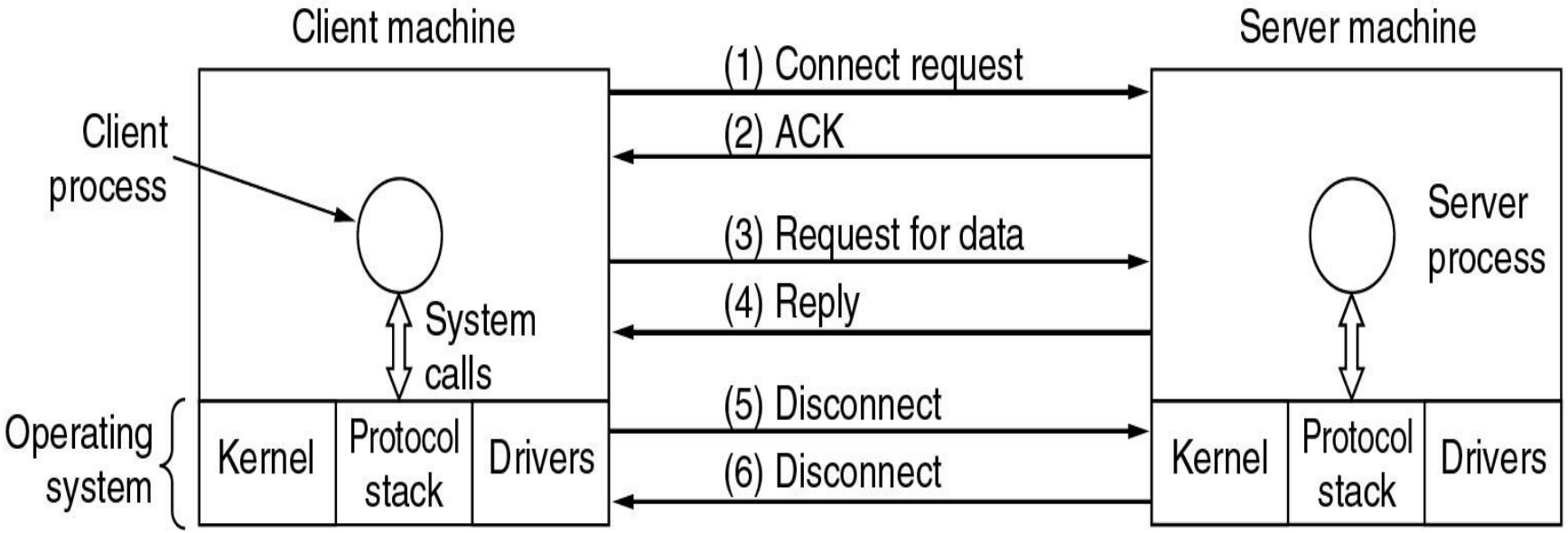
Service Primitives

- Five service primitives for implementing a simple connection-oriented service.

Primitive	Meaning
LISTEN	Block waiting for an incoming connection
CONNECT	Establish a connection with a waiting peer
RECEIVE	Block waiting for an incoming message
SEND	Send a message to the peer
DISCONNECT	Terminate a connection

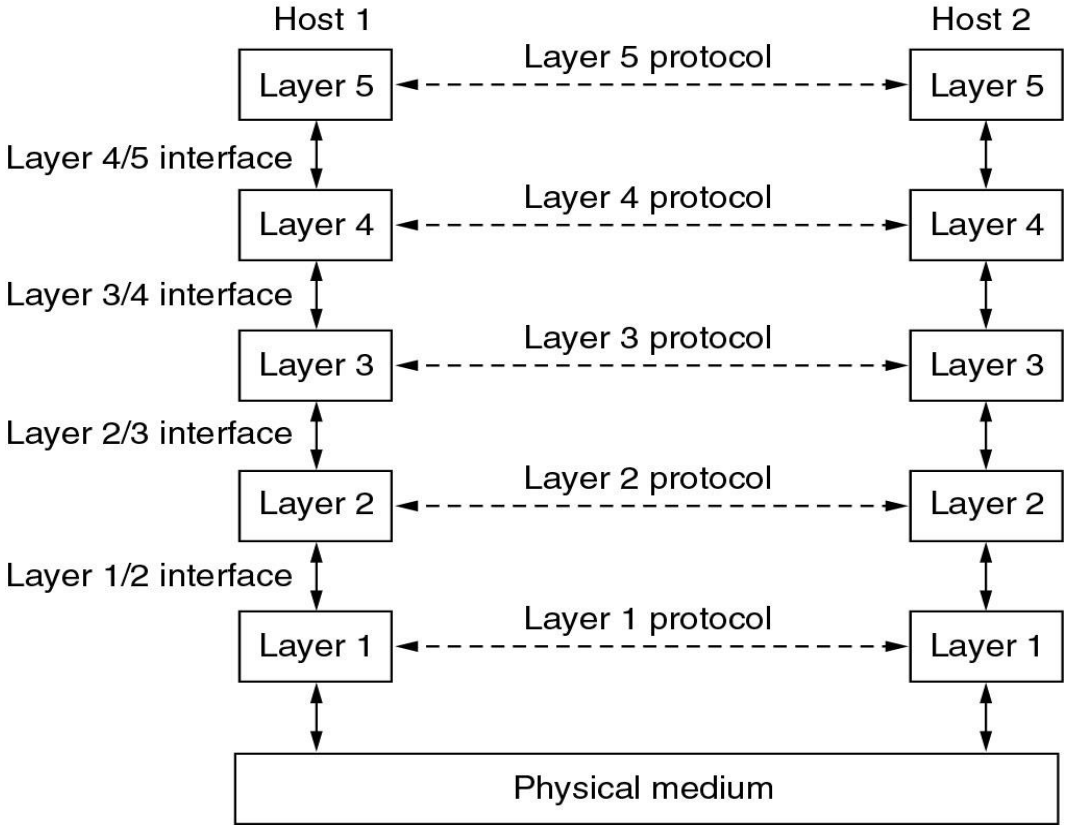
Service Primitives

- Packets sent in a simple client-server interaction on a connection-oriented network.



Network Hierarchies

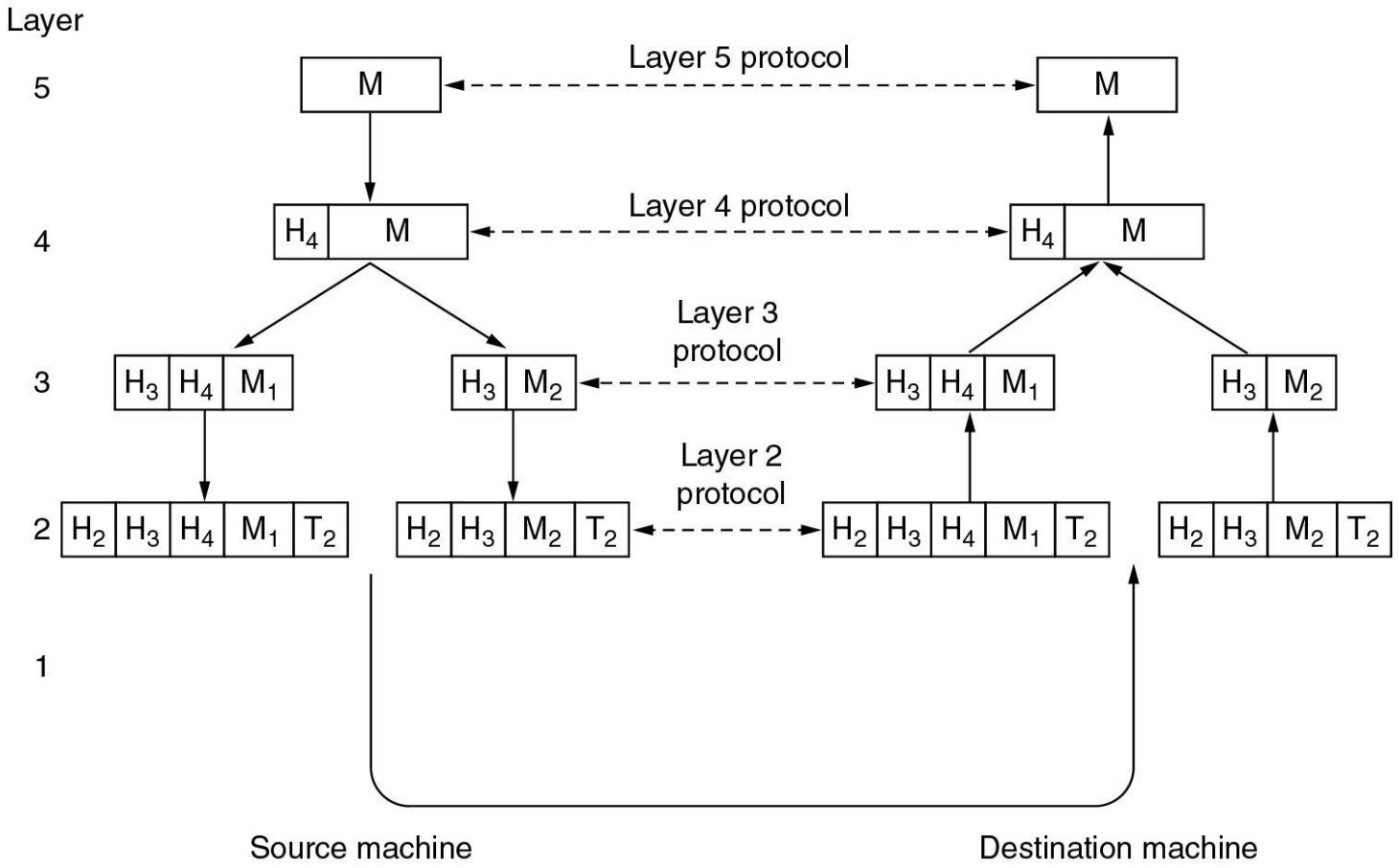
- Networks are designed into layers to reduce complexity.



Layers, protocols, and interfaces.

Network Hierarchies

- Example information flow supporting virtual communication in layer 5.



Q&A