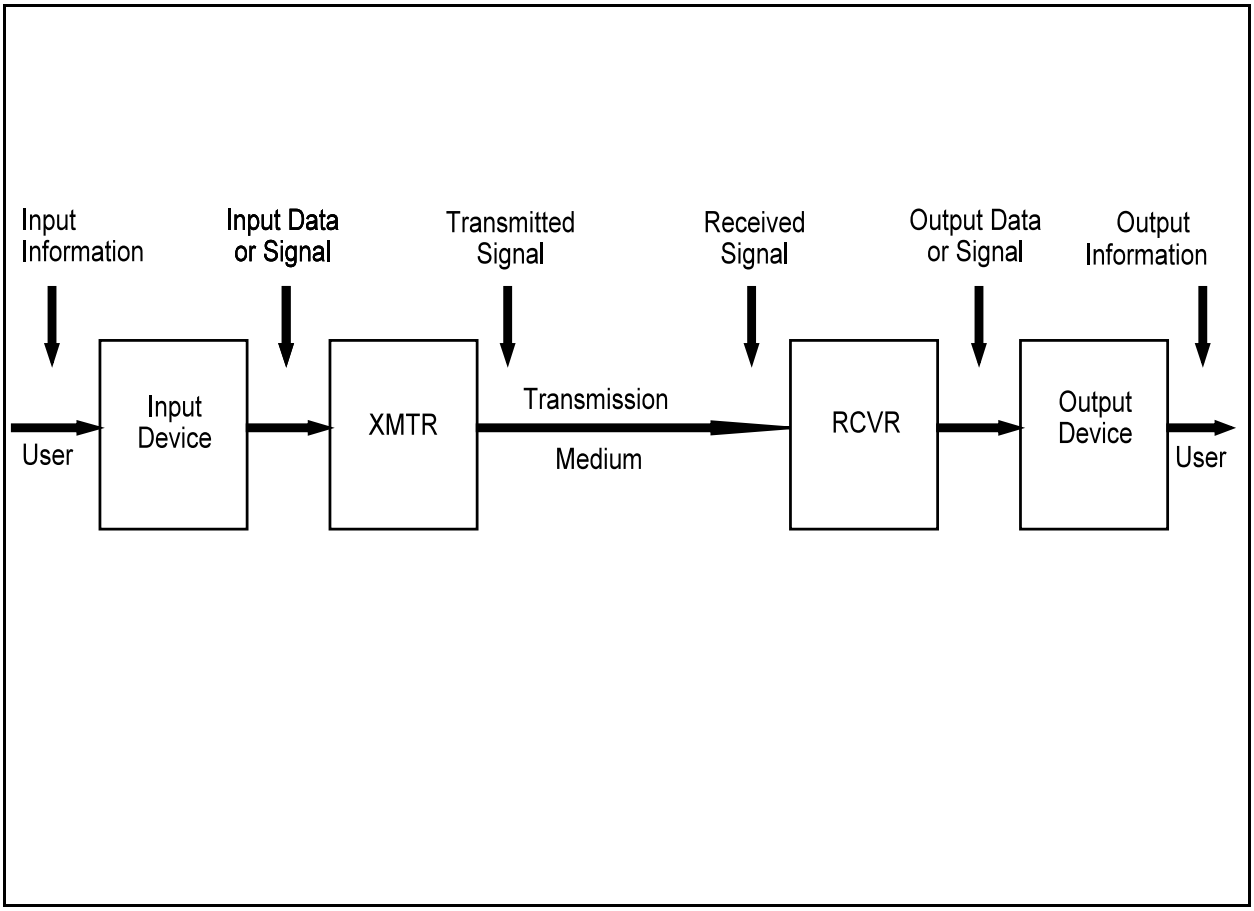
Introduction

The fundamental purpose of data communications is to exchange information between user's computers, terminals and applications programs.



Simplified Communications System Block Diagram

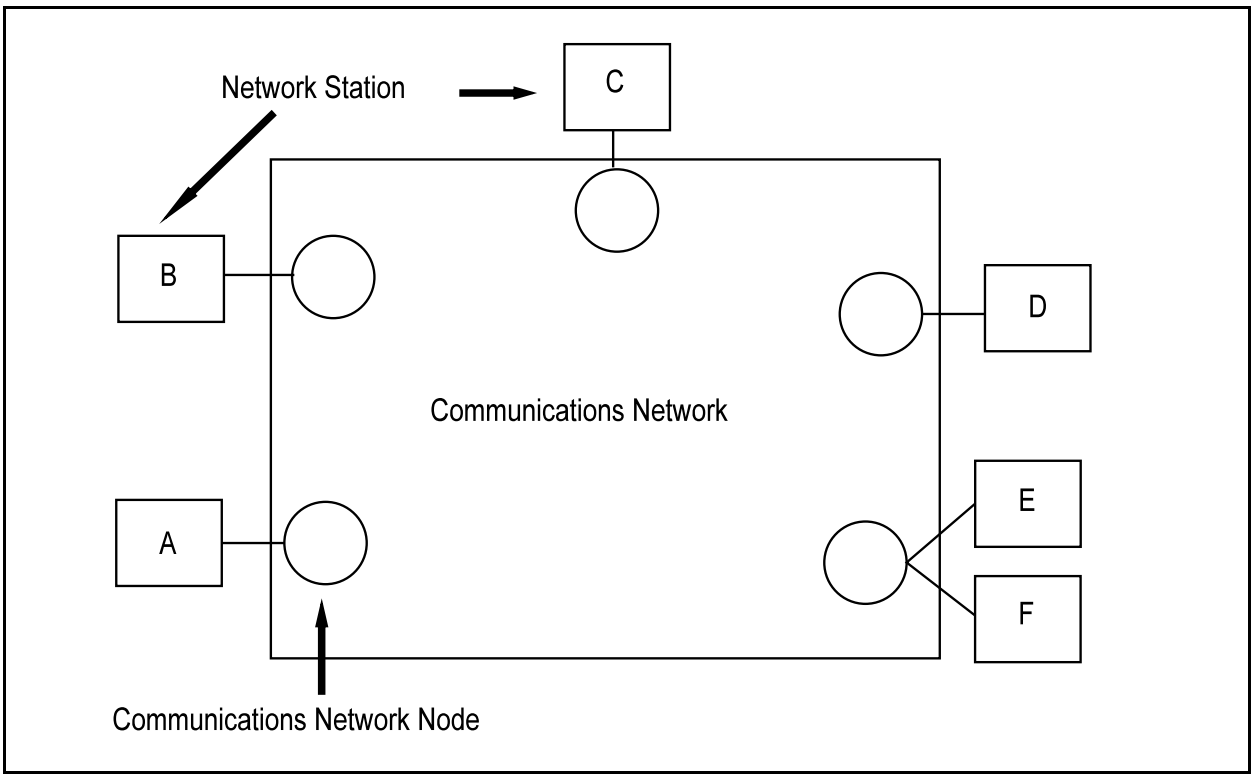
Data Communications Networking

! In its simplest form data communications takes place between two devices that are directly connected by some form of point-to-point transmission medium.

! Often it is impractical for two devices to be directly connected:

a) The devices are far apart,
b) There is a large set of devices to be interconnected.

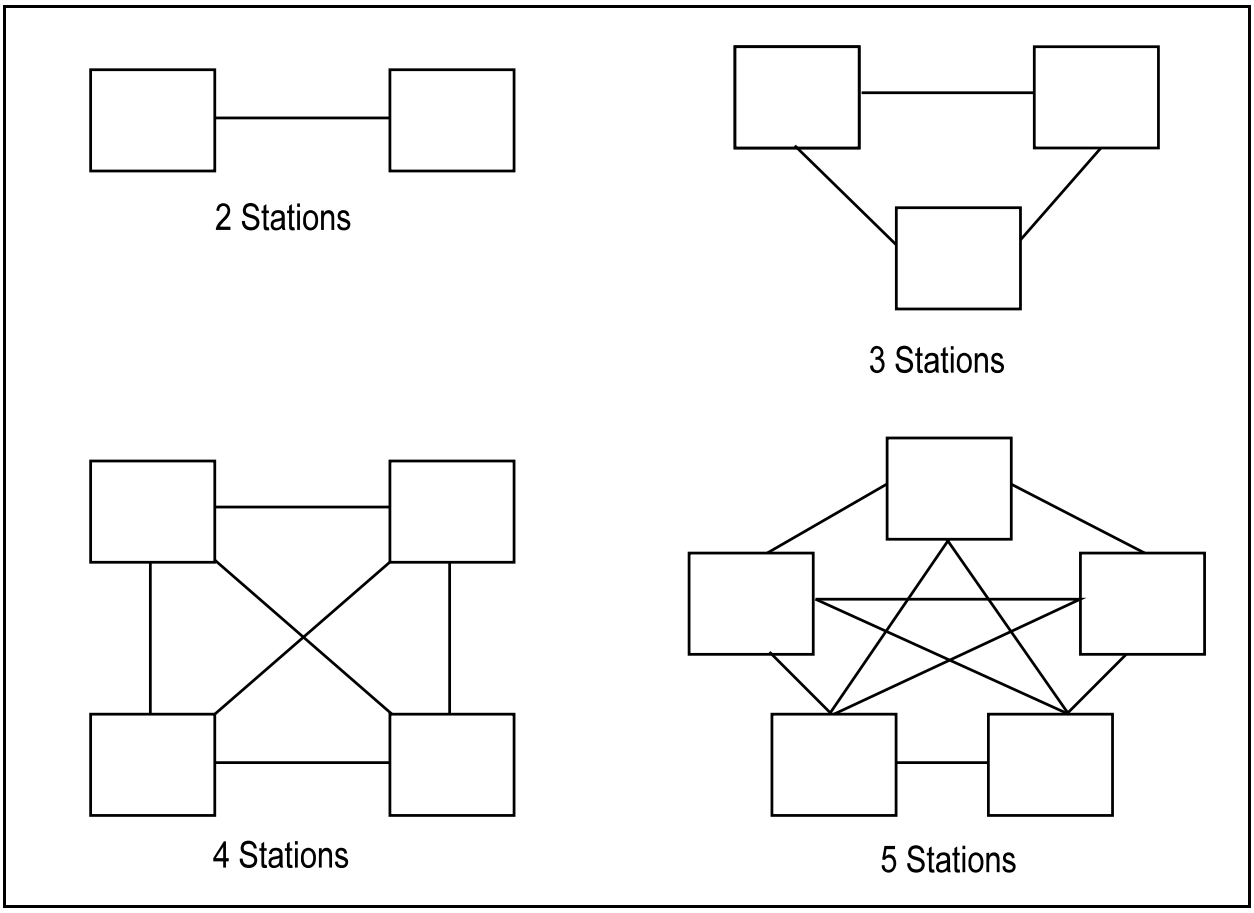
! The solution is to connect each device to a COMMUNICATIONS NETWORK.



Interconnection via a Communications Network

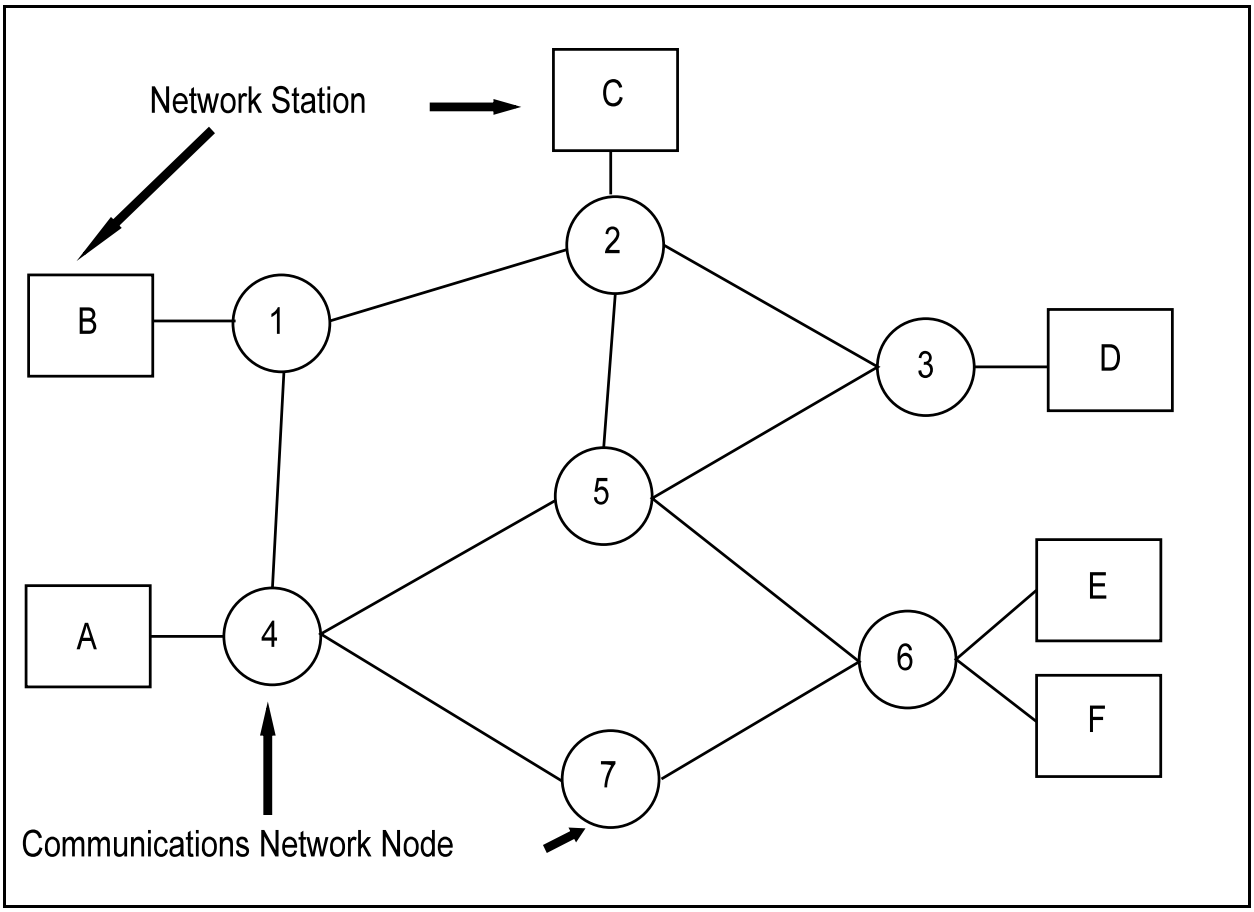
Station Interconnection

The Problem with the Fully Connected Topology



Switched Communications Networks

Communications between stations is accomplished via transmission and switching.



A Generic Switched Communications Network

! Common Switching Methods:
- Circuit Switching
- Message Switching
- Packet Switching

Switching Methods

1. Circuit Switching:

! Prior to the start of data transmission, an end-to-end (station-to-station) physical path must be established.

! During data transmission, all channels in the path are used simultaneously.

! The entire path remains dedicated to the pair of communicating stations until circuit release.

! Three phased operation:
- Circuit Establishment (Allocation of Resources)
- Data Transfer (Use of Resources)
- Circuit Termination (Deallocation of Resources)

2. Message Switching:

! A MESSAGE represents a logical unit of information that one station wishes to send to another station.

! No dedicated path is established prior to data transfer. Instead, the message will travel over one channel at a time.

! A message travels (hops) through the network from node-to-node, in a store-and-forward fashion, until it reaches its final destination.

3. Packet Switching:

- Messages are decomposed into smaller units of data called PACKETS and then sent out packet-by-packet.

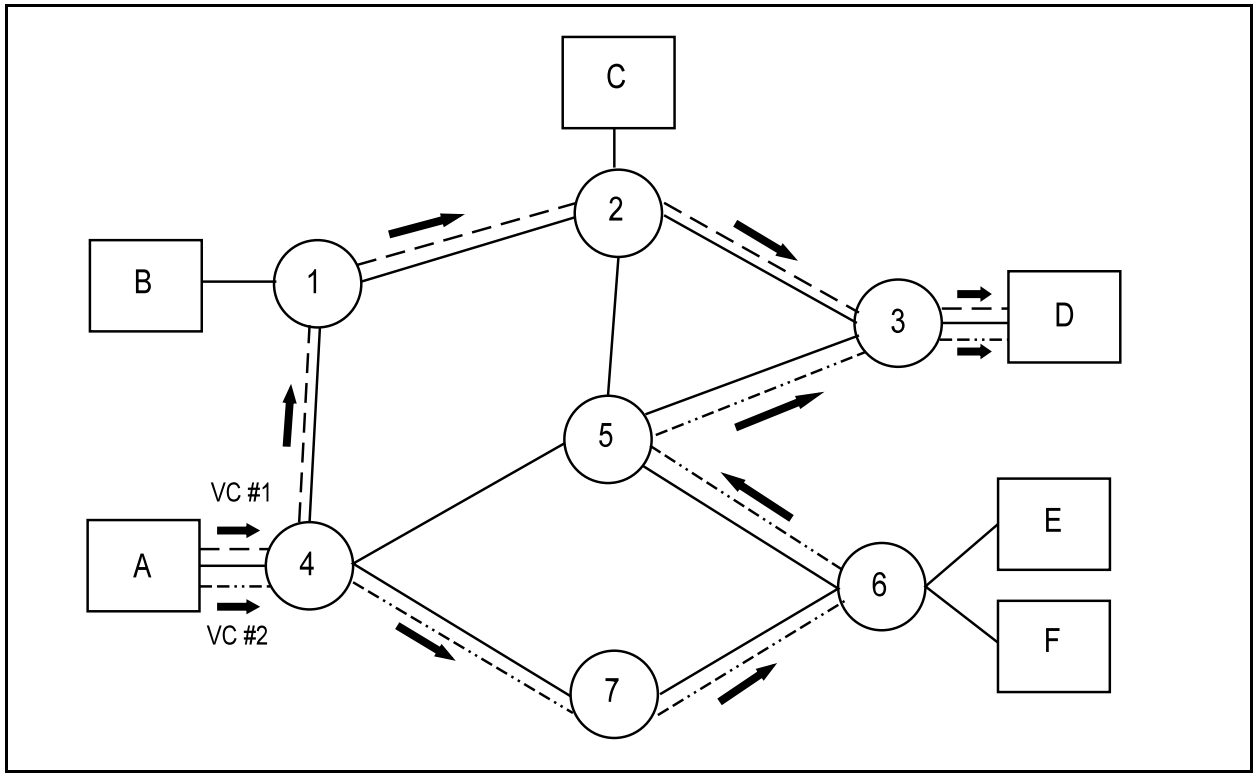
- Many packets of the same message can be in transit at the same time.

- Reassembly of the original message is required at the destination.

Packet Switching Alternatives

A. Virtual Circuit Packet Switching:

- ! A LOGICAL CONNECTION (virtual circuit) is established between communicating stations prior to the transmission of data packets.
- ! The logical connection establishes the route over which all data packets will travel between stations.
- ! Packet delivery across the virtual circuit will be in sequential order.
- ! Connection-Oriented Operation:
  - Connection Establishment Phase
  - Data Transfer Phase
  - Connection Termination Phase



Virtual Circuit Packet Switching

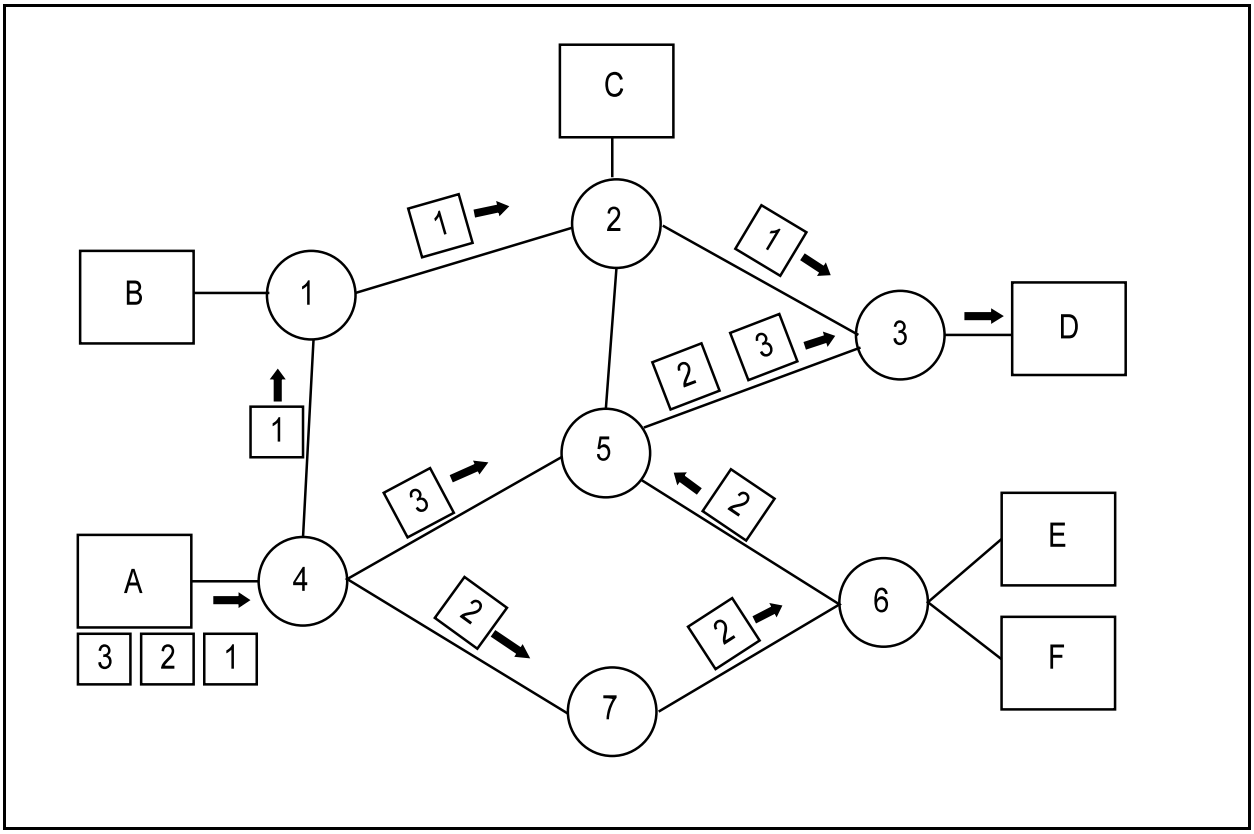
B. Datagram Packet Switching:

! Each data packet is treated independently from one another.

! Each packet finds its own route through the network.

! Packets may arrive at the destination out of sequential order.

! Connectionless Operation:
- Data Transfer Phase



Datagram Packet Switching

General Comparison of Switching Methods

Circuit Switching:

- Good for long, continuous transmissions.
- Good for time-constrained communications.

Packet Switching:

- Good for data transmission that is BURSTY in nature.
- Provides fast service to small users even in the presence of large ones.

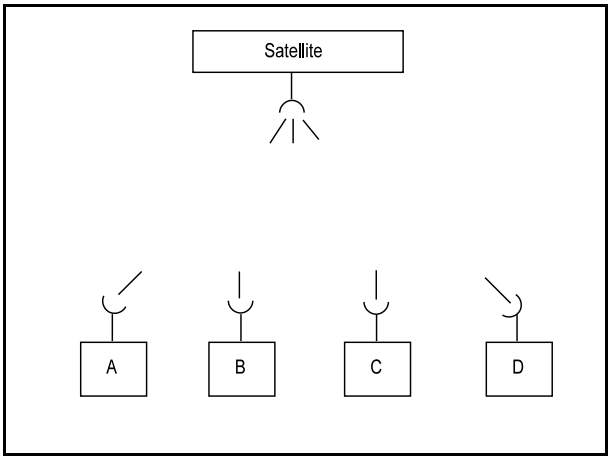
Broadcast Communications Networks

A transmission from one station can be received by all other station within the network.

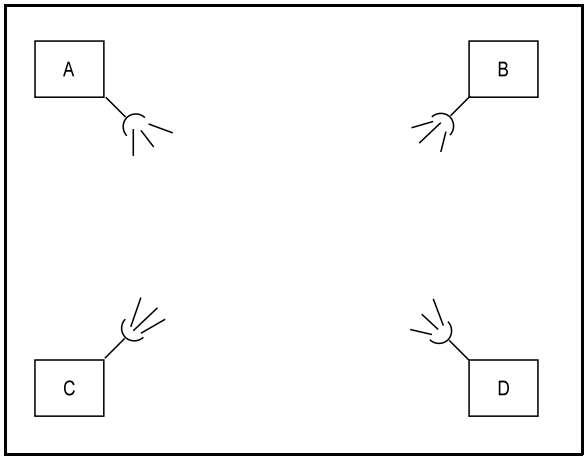
Sample Networks:

- Satellite Networks
- Radio Networks
- Local Area Networks

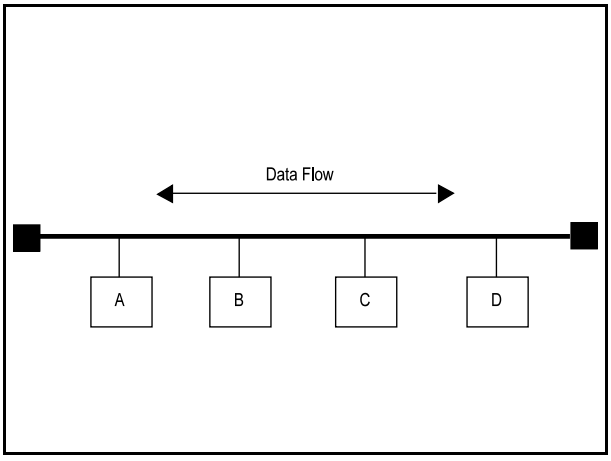
Sample Broadcast Network Topologies



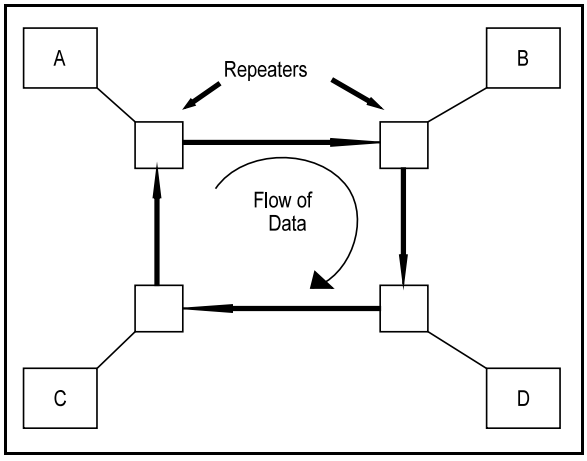
Satellite Network Topology



Radio Network Topology



Bus Topology



Ring Topology

! Common Access Methods:
- Contention (e.g., CSMA/CD, etc.)
- Reservation
- Token Passing