Introduction

Network Definitions and Classification

- Preliminary definitions and network terminology
- Sample application paradigms
- Classifying networks by transmission technology
- Classifying networks by size (or scale)
- Classifying networks by topology

Preliminary Definitions

computer network :: [Tanenbaum] a collection of "autonomous" computers interconnected by a single technology.

[LG&W] *communications network ::a set of equipment and facilities that provide a service.*

[PD] {low level definition} A network can consist of two or more computers directly connected by some physical medium such as coaxial cable or an optical fiber. Wireless connectivity needs to be included in this definition.
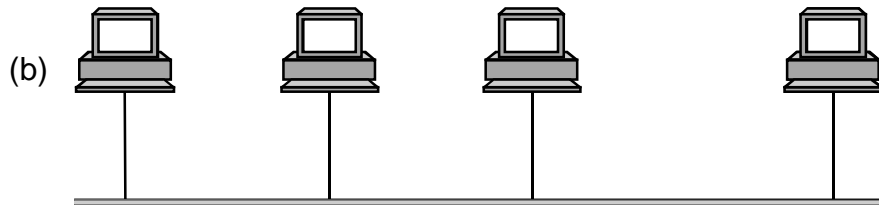
Network Building Blocks

- Nodes and Hosts: computers, routers, switches
- Links: coaxial cable, optical fiber, wireless communication
  - point-to-point   (a)
  - multiple access   (b)

Preliminary Definitions

In a <u>distributed system</u> the collection of independent computers appears to its users as a single coherent system.

Namely, the distinctions lie in the transparency in assigning tasks to computers.
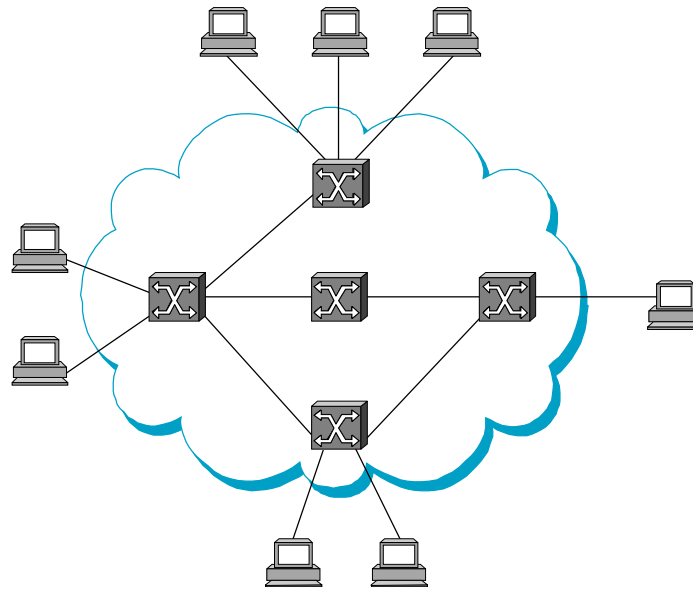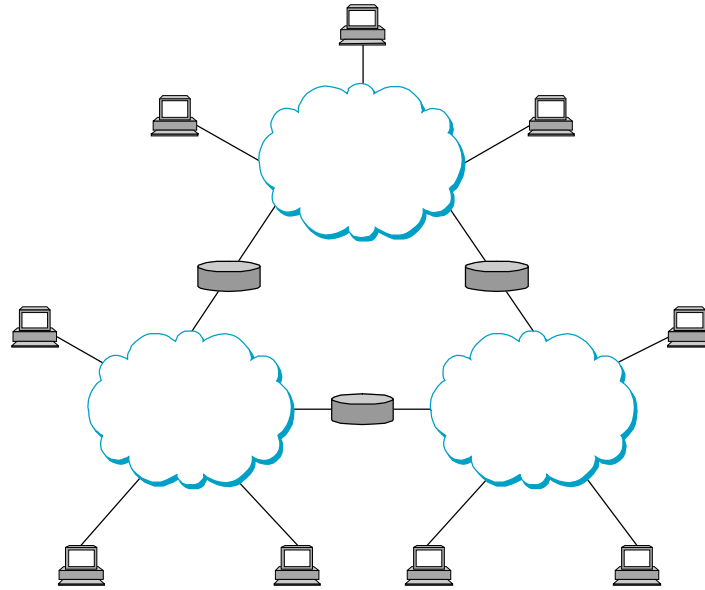
Switched Networks

Figure 1.3

internet

Figure 1.4 Interconnection of networks

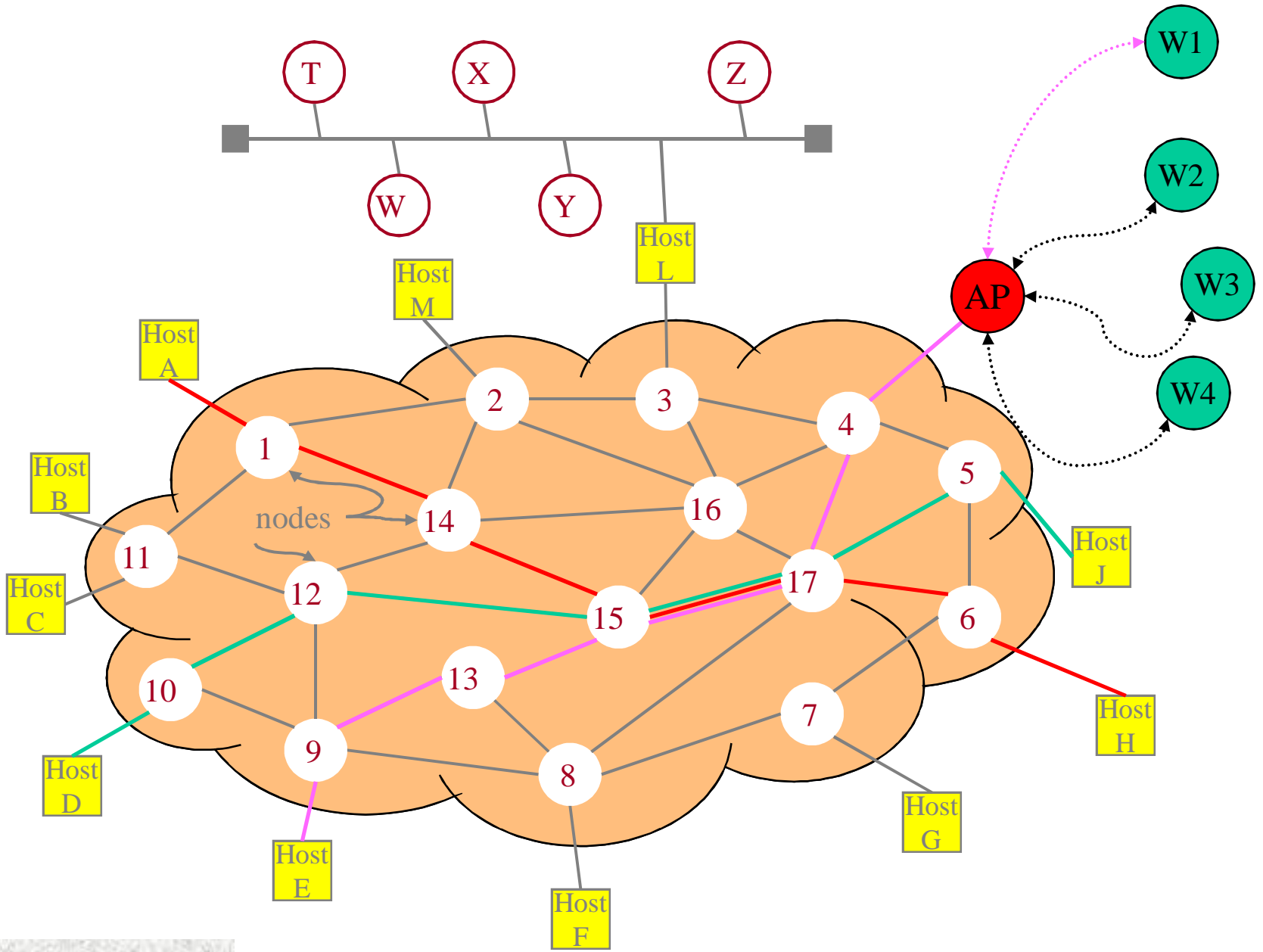# Network

P&D recursive definition::

i. two or more nodes connected by a link.

or

ii. two or more networks connected by a node {an internet}.

nodes

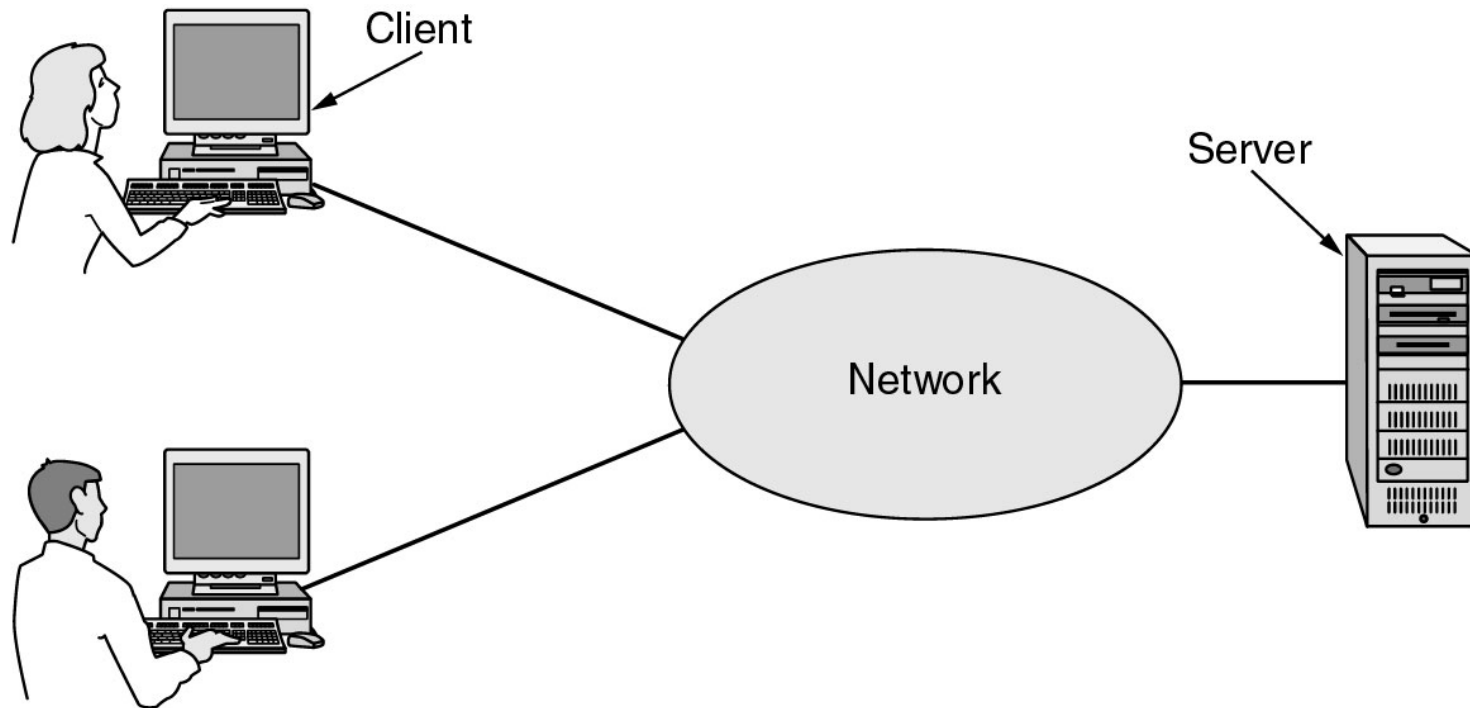# Sample Application Paradigms

Client-Server Applications

Figure 1.1 A network with two clients and one server.
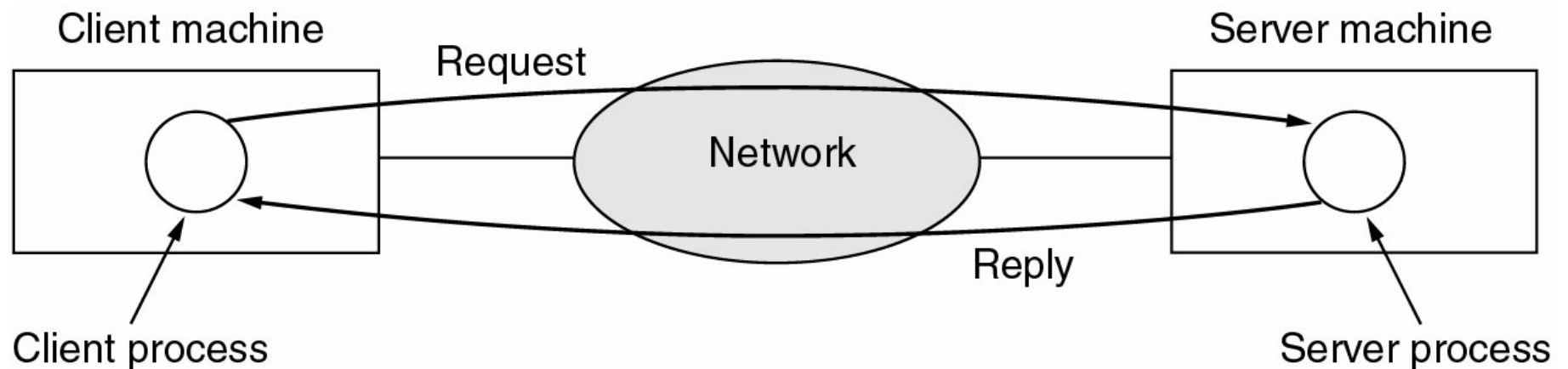
Client-Server Model

Figure 1-2. The client-server model involves requests and replies.
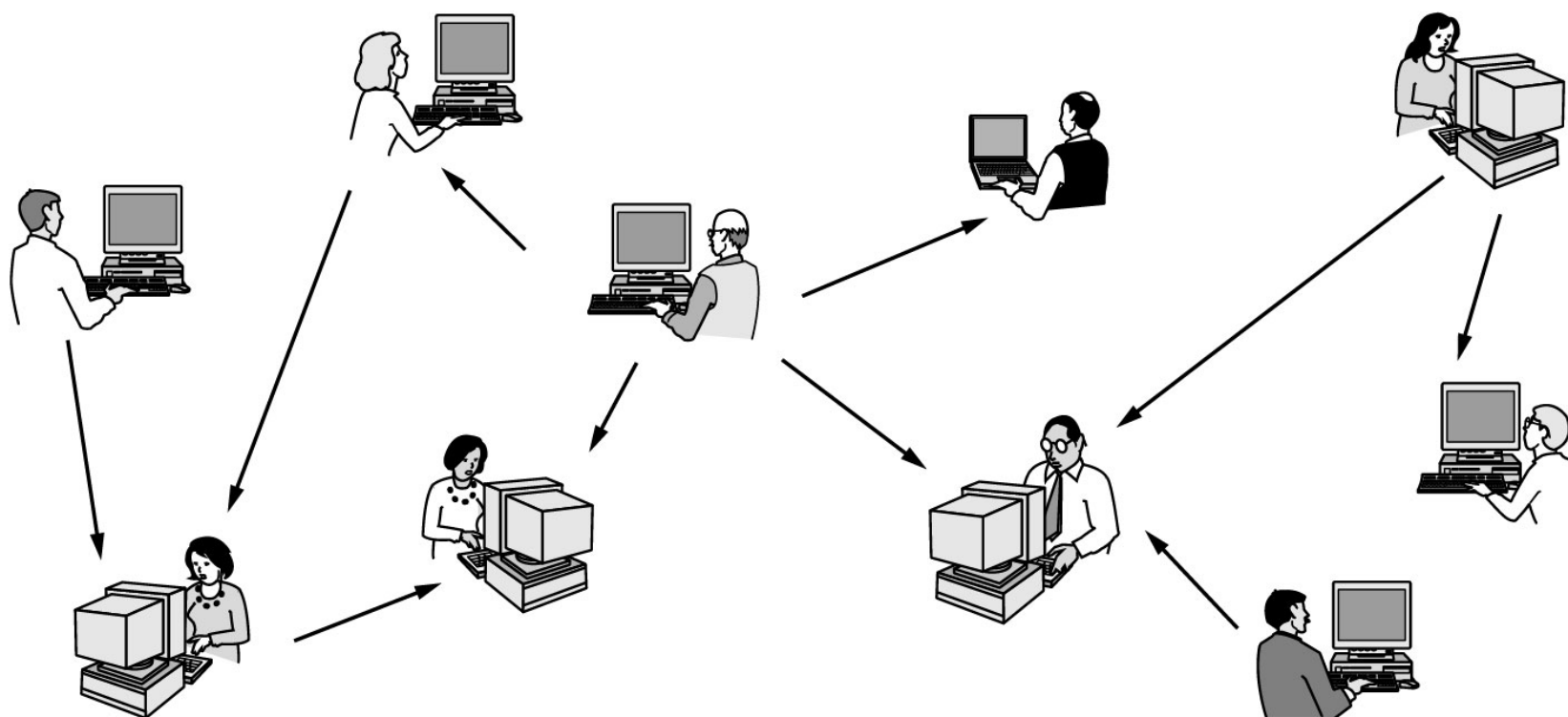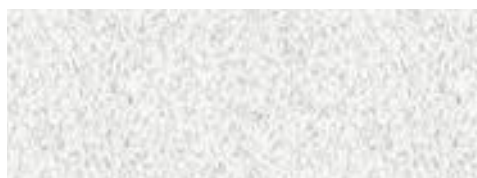
Peer-to-Peer Applications

Figure 1.3 In a peer-to-peer system there are no fixed clients and servers.

Mobile Network Users

Wireless	Mobile	Applications
No	No	Desktop computers in offices
No	Yes	A notebook computer used in a hotel room
Yes	No	Networks in older, unwired buildings
Yes	Yes	Portable office; PDA for store inventory

Figure 1-5. Combinations of wireless networks and mobile computing.

Classifying Networks by Transmission Technology

broadcast :: a single communications channel shared by all machines (addresses) on the network.

Broadcast can be either a logical or a physical concept (e.g. Media Access Control (MAC) sublayer) .

multicast :: communications to a specified group.

This requires a group address (e.g. – multimedia multicast).

point-to-point :: connections are made via *links* between pairs of nodes.

Network Classification by Size

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

Figure 1-6. Classification of interconnected processors by scale.

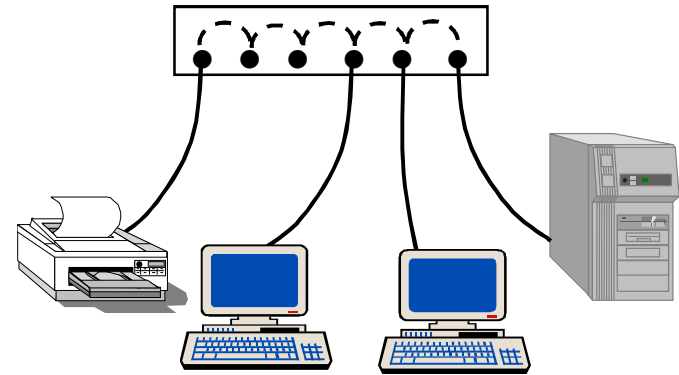# Network Classification by Size

- ## LANs {Local Area Networks}
  - Wired LANs: typically physically broadcast at the MAC layer (e.g., Ethernet, Token Ring)
  - Wireless LANs

- ## MANs {Metropolitan Area Networks}
  - campus networks connecting LANs logically or physically.
  - often have a <u>backbone</u> (e.g., FDDI and ATM)
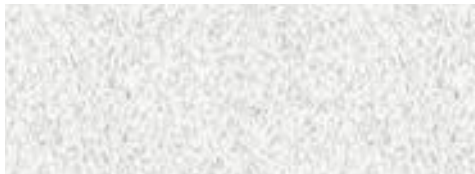
Wired LANs

transceivers
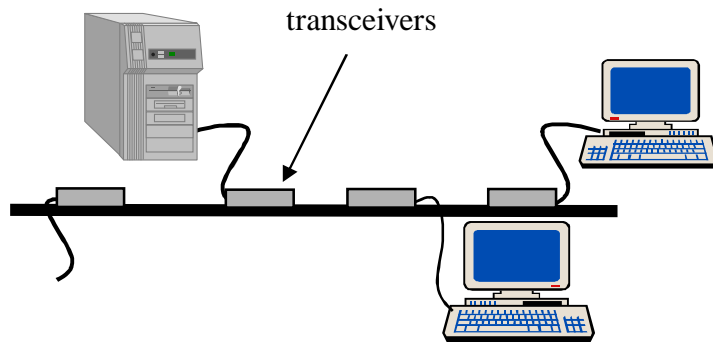
Ethernet bus

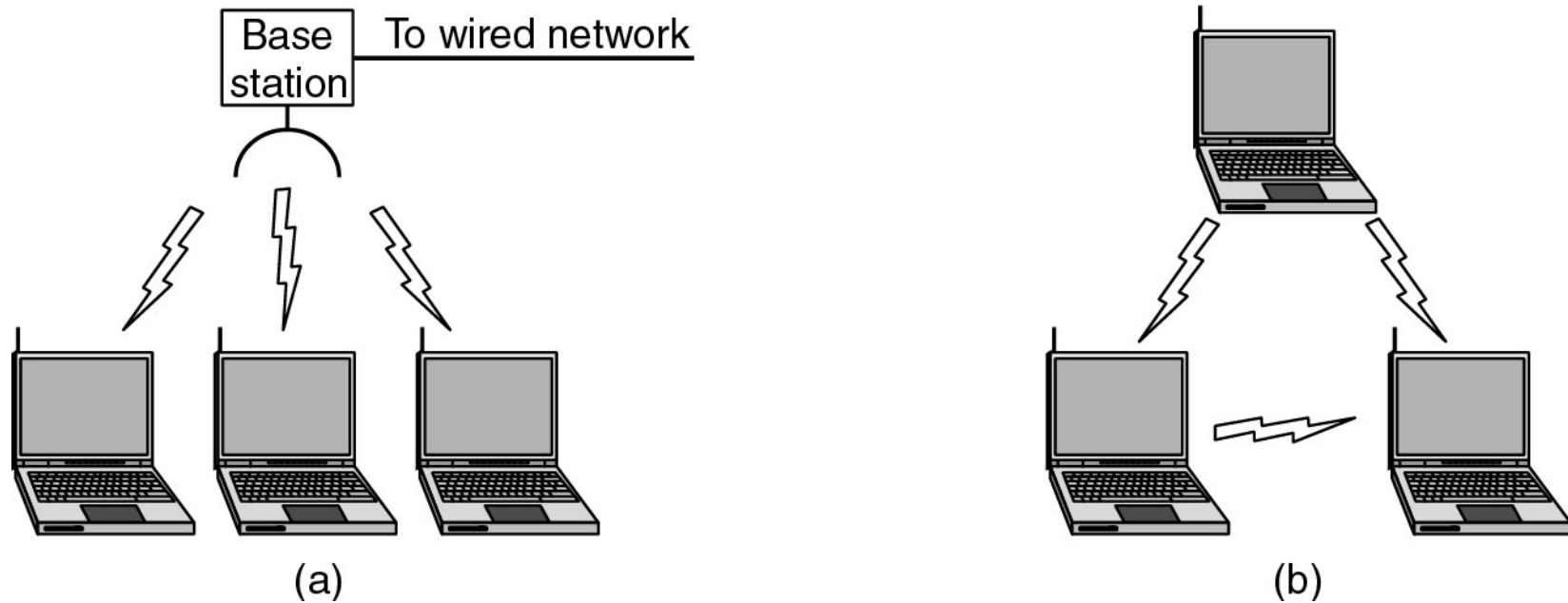Ethernet hub

Wireless LANs

Figure 1-35. (a) Wireless networking with a base station. (b) Ad hoc networking.
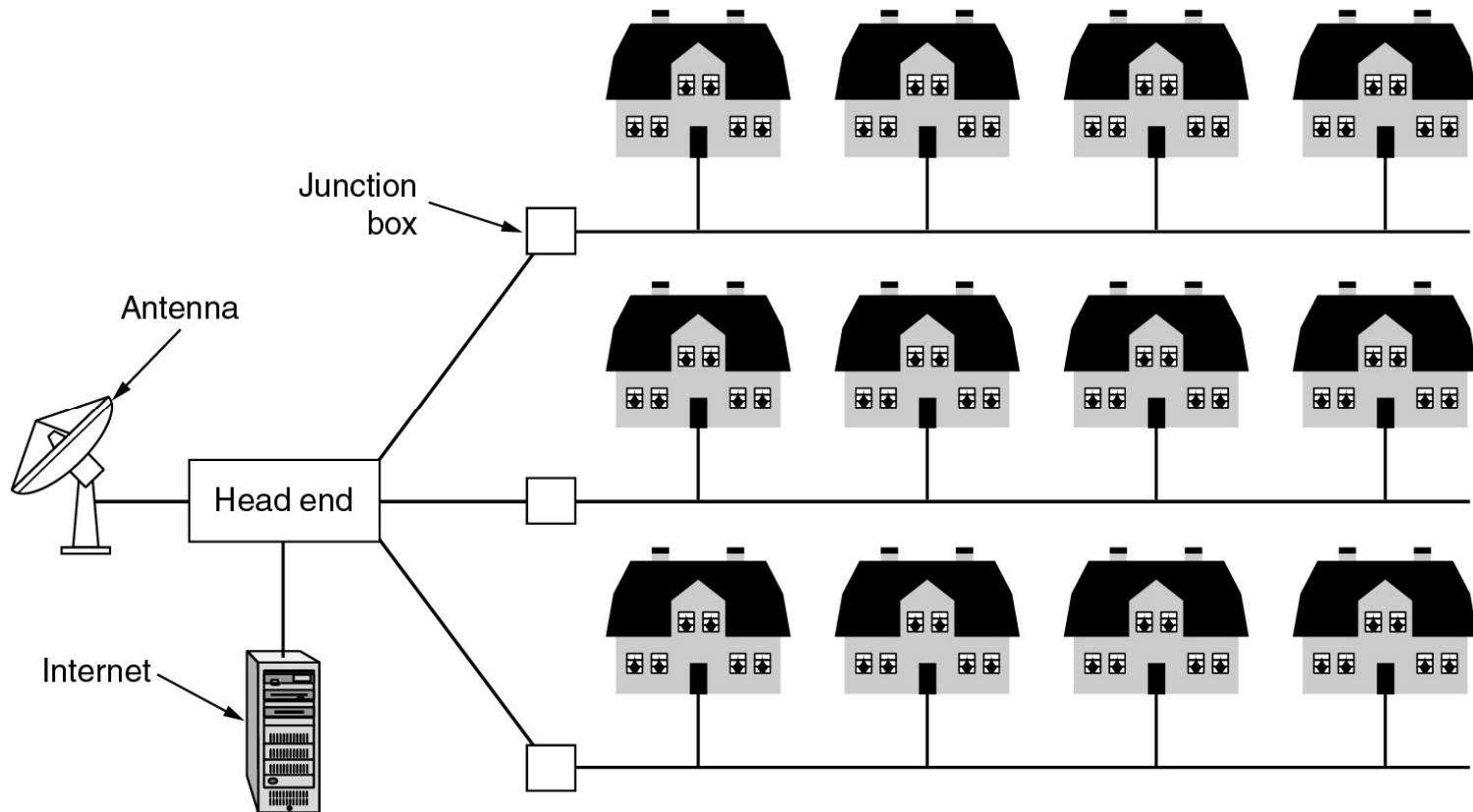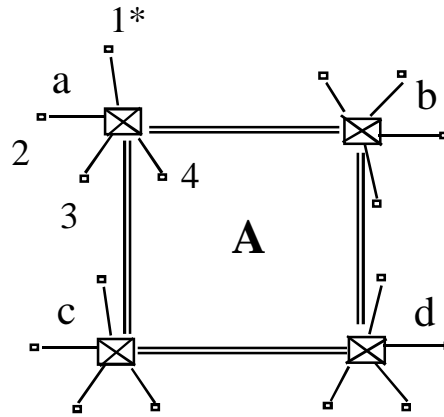
Metropolitan Area Networks

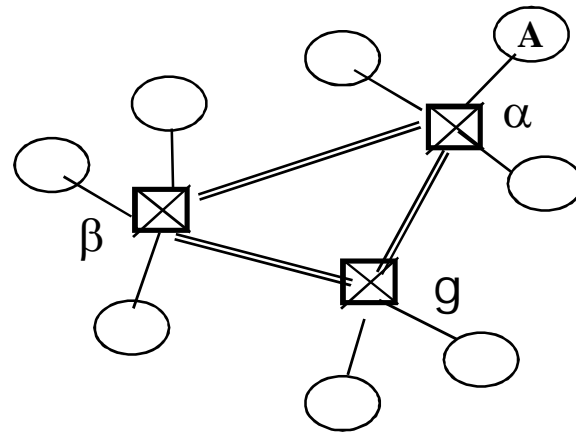Figure 1-8. A metropolitan area network based on cable TV.

MAN

Metropolitan network **A** consists of access subnetworks a, b, c, d.

Hierarchical Network Topology

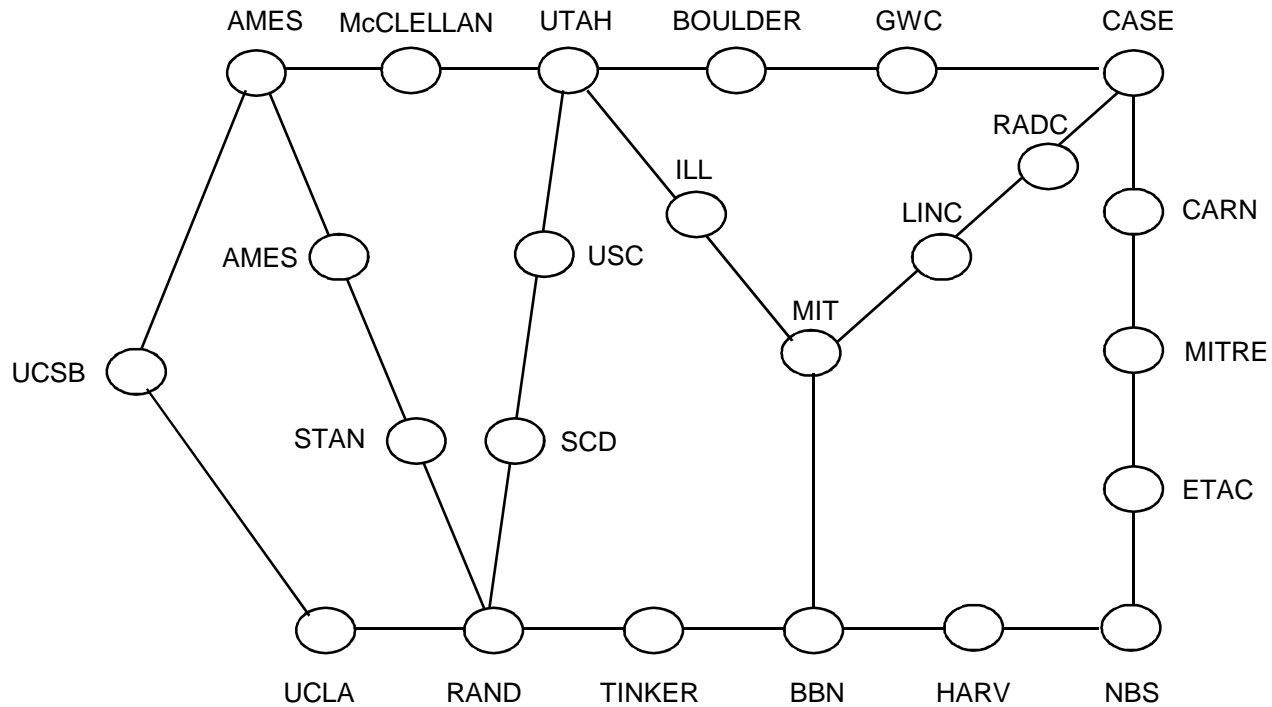National network consists of regional subnetworks a, b, g

Metropolitan network A is part of regional subnetwork α.

Figure 1.8

Computer Networks: Introduction   **21**

Network Classification by Size

- WANs {Wide Area Networks}

    – ARPANET → Internet

    – usually hierarchical with a backbone.

    – Enterprise Networks, Autonomous Systems (ASs)

    – VPNs (Virtual Private Networks).

ARPAnet circa 1972

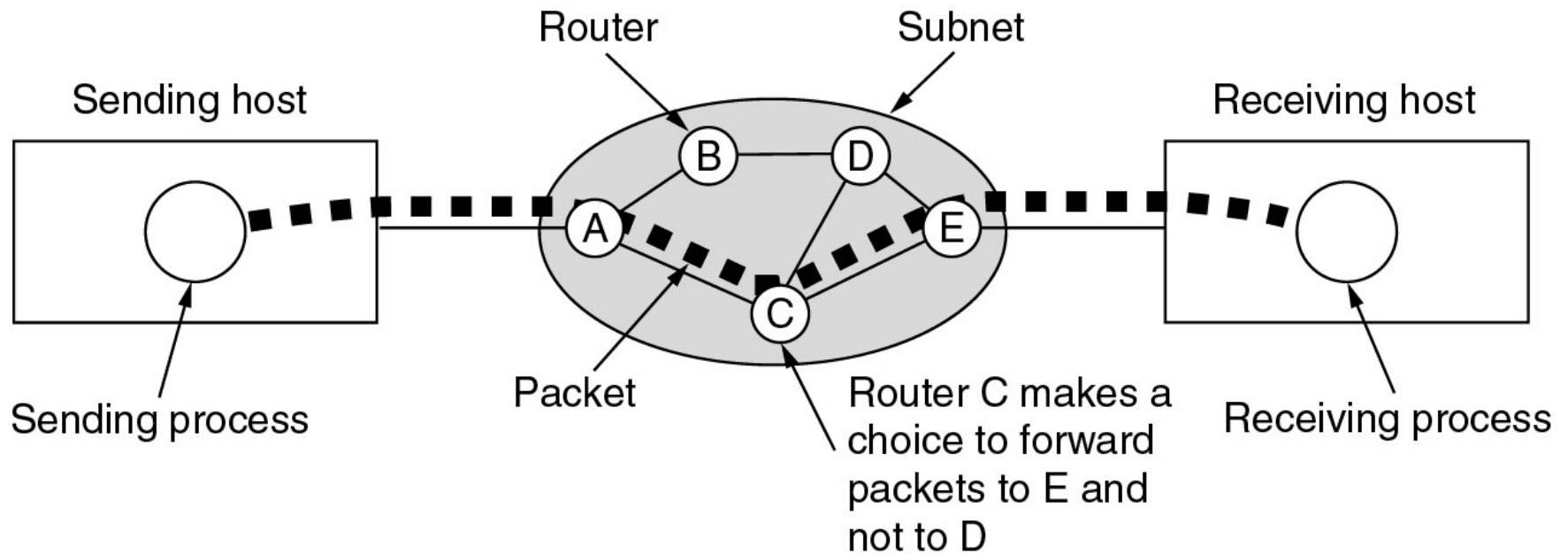*a point-to-point network*

Figure 1.16

Computer Networks: Introduction   **23**

Wide Area Networks (WANs)

Router   Subnet

Sending host   Receiving host

Sending process   Packet   Router C makes a   Receiving process
                             choice to forward
                             packets to E and
                             not to D

Figure 1-10.A stream of packets from sender to receiver.

G = gateway

internet - a network of networks

Figure 1.18

Computer Networks: Introduction   25
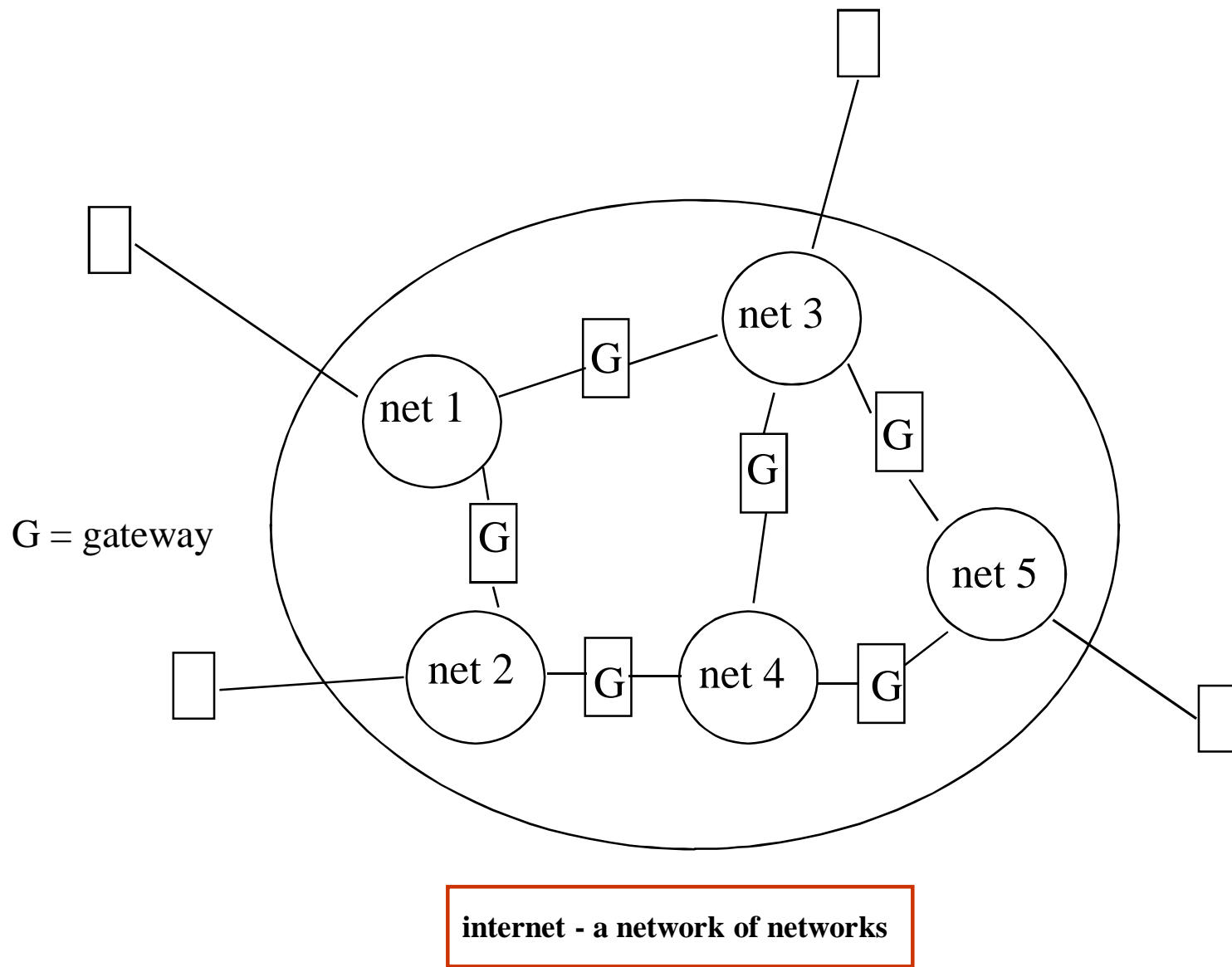
Network Classification by Topology

Bus

flow of data
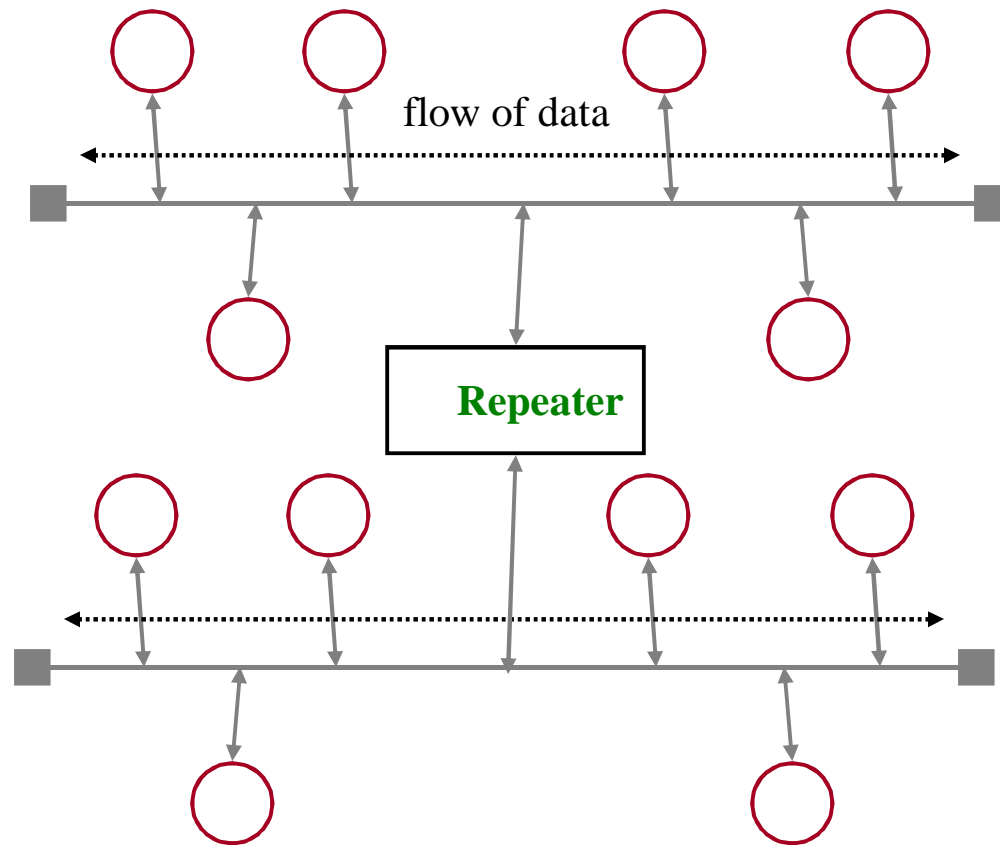
Bidirectional flow

assumes baseband cable

Repeater

Network Classification by Topology
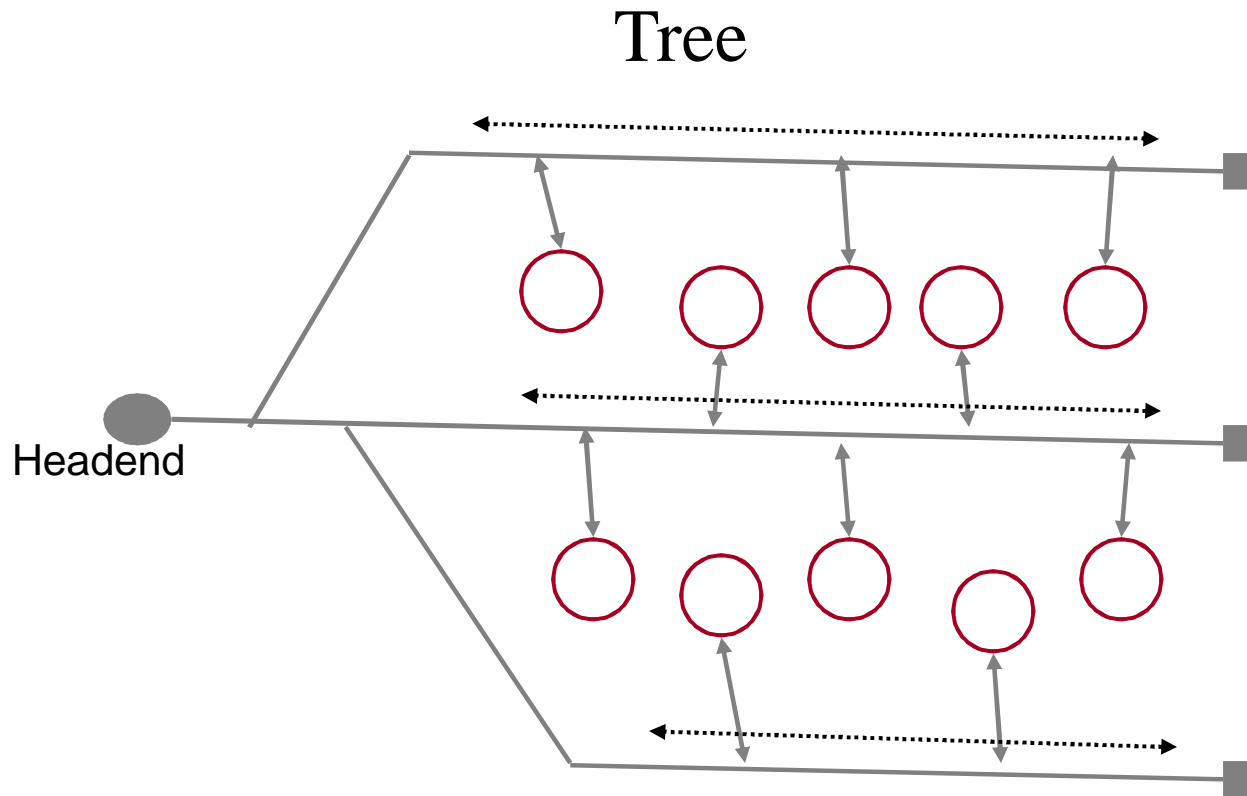
Ring

Repeater

Repeater
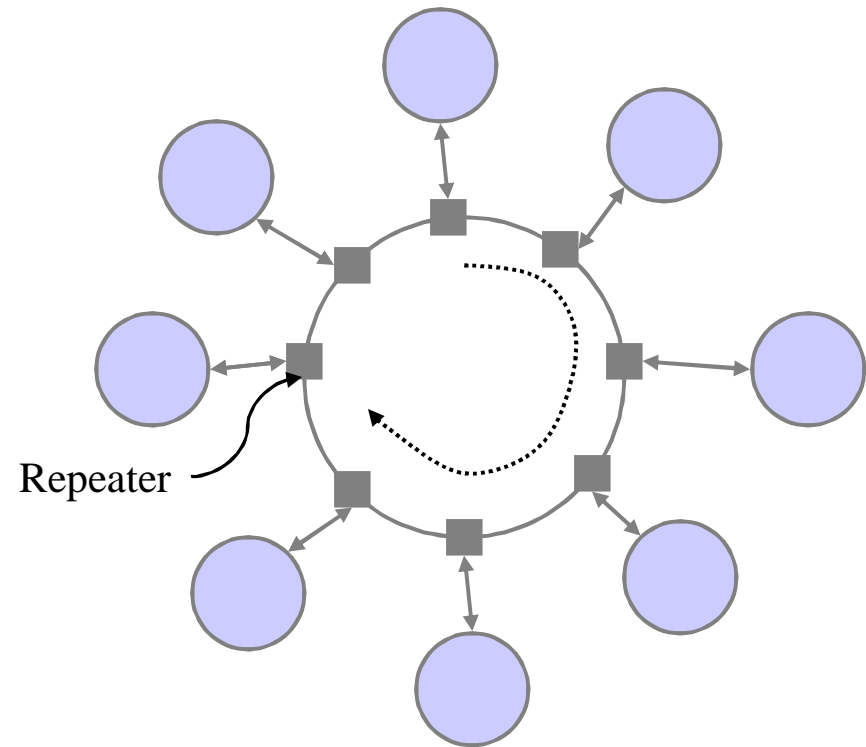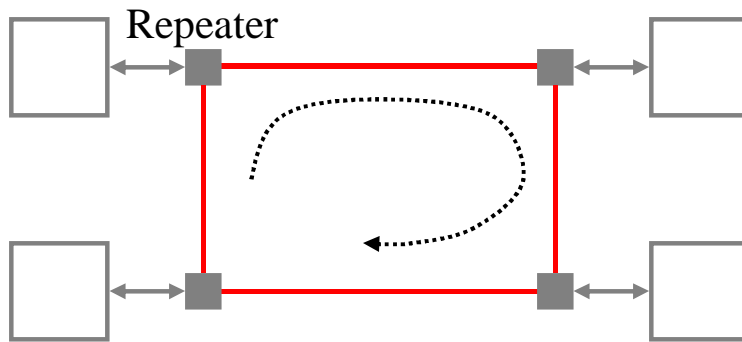
Note - *a ring implies <u>unidirectional flow</u>*

Network Classification by Topology

Tree

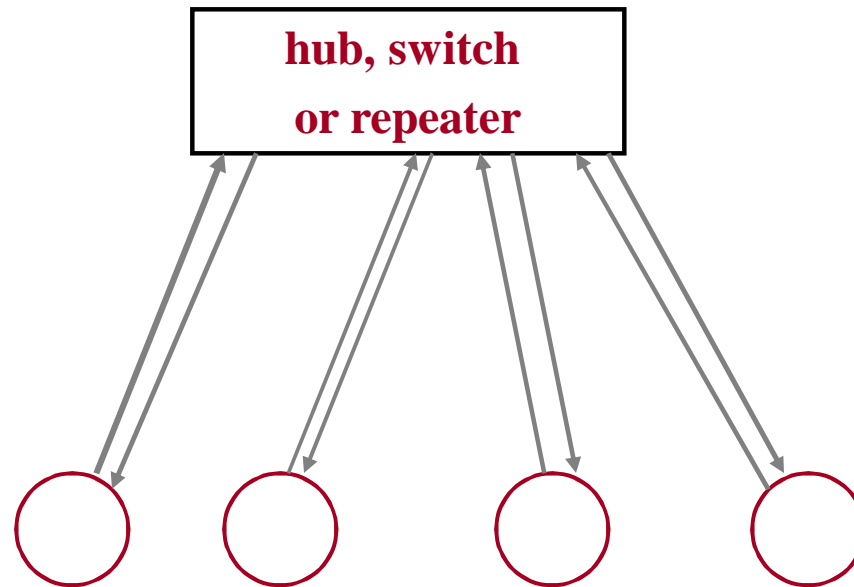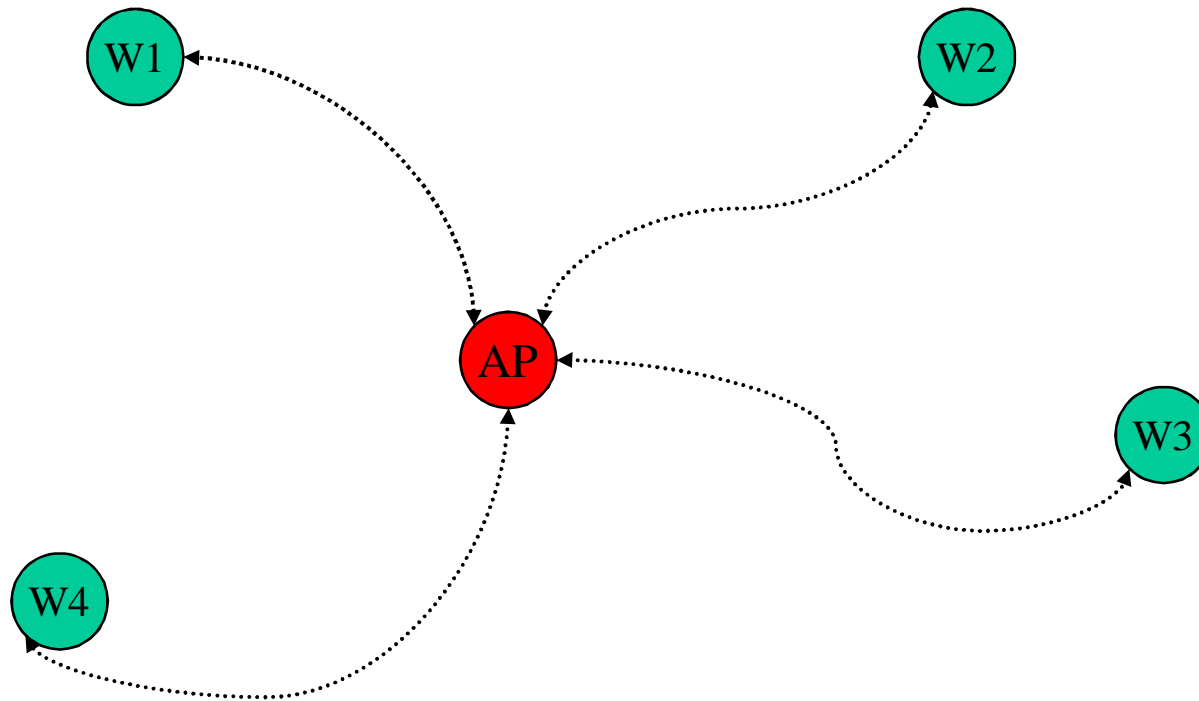Headend

Network Classification by Topology

Star

Network Classification by Topology

Star

Wireless Infrastructure