CS4514 Computer Networks

Term C04

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Course Objectives

1. To develop an understanding of modern network architectures from a <u>design</u> and <u>performance</u> perspective.

2. To introduce the student to the major concepts involved in wide-area networks (WANs) and local area networks (LANs).

Course Objectives

3. To expose students to current technologies.

4. To provide an opportunity to do network programming using TCP/IP.

5. To clarify network terminology.

6. To get a sense of emerging technologies and their potential impact.

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.*

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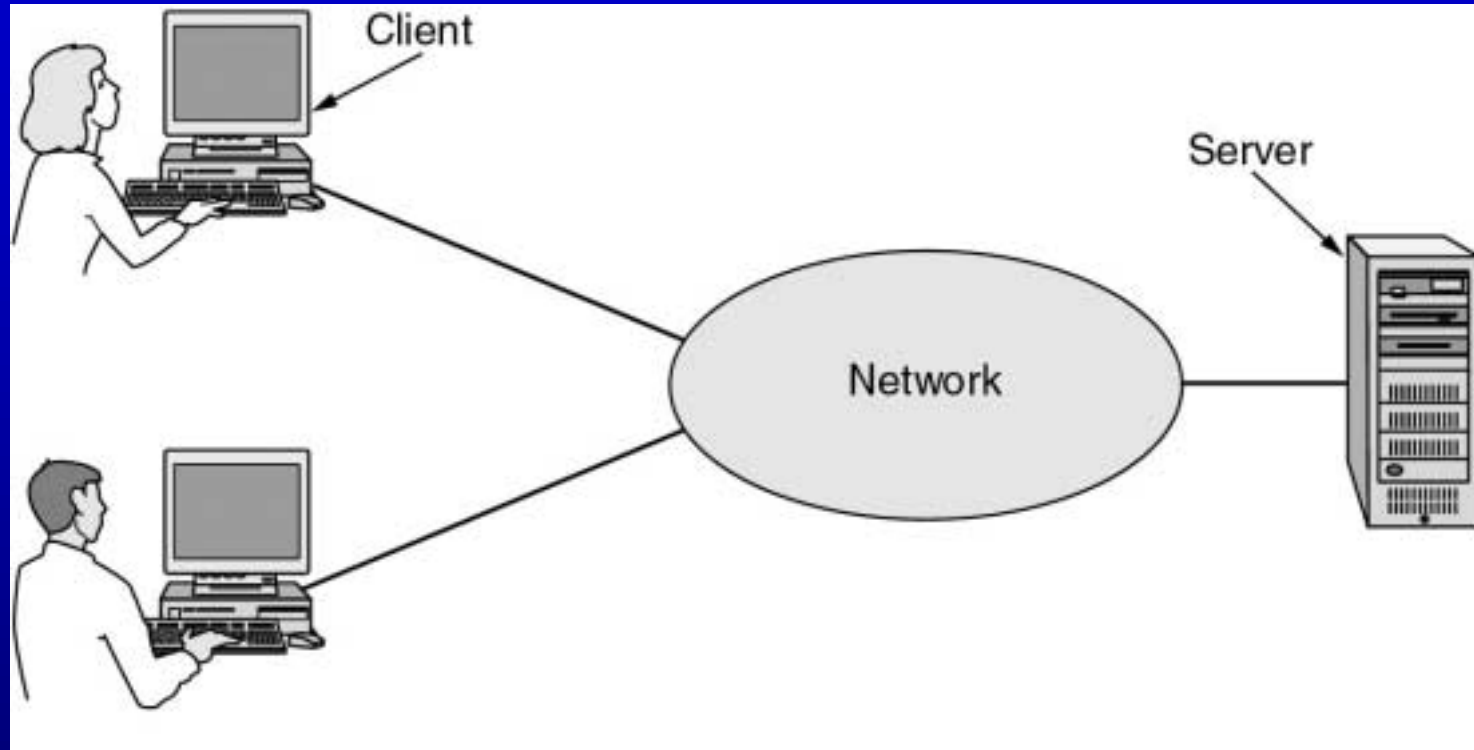
Client-Server Applications

Figure 1.1 A network with two clients and one server.

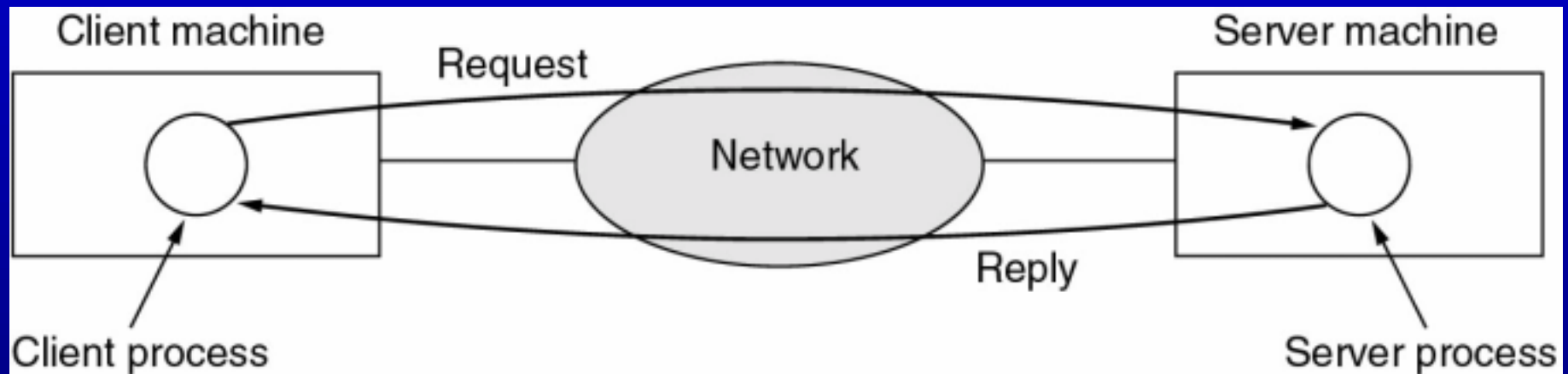# Client-Server Model

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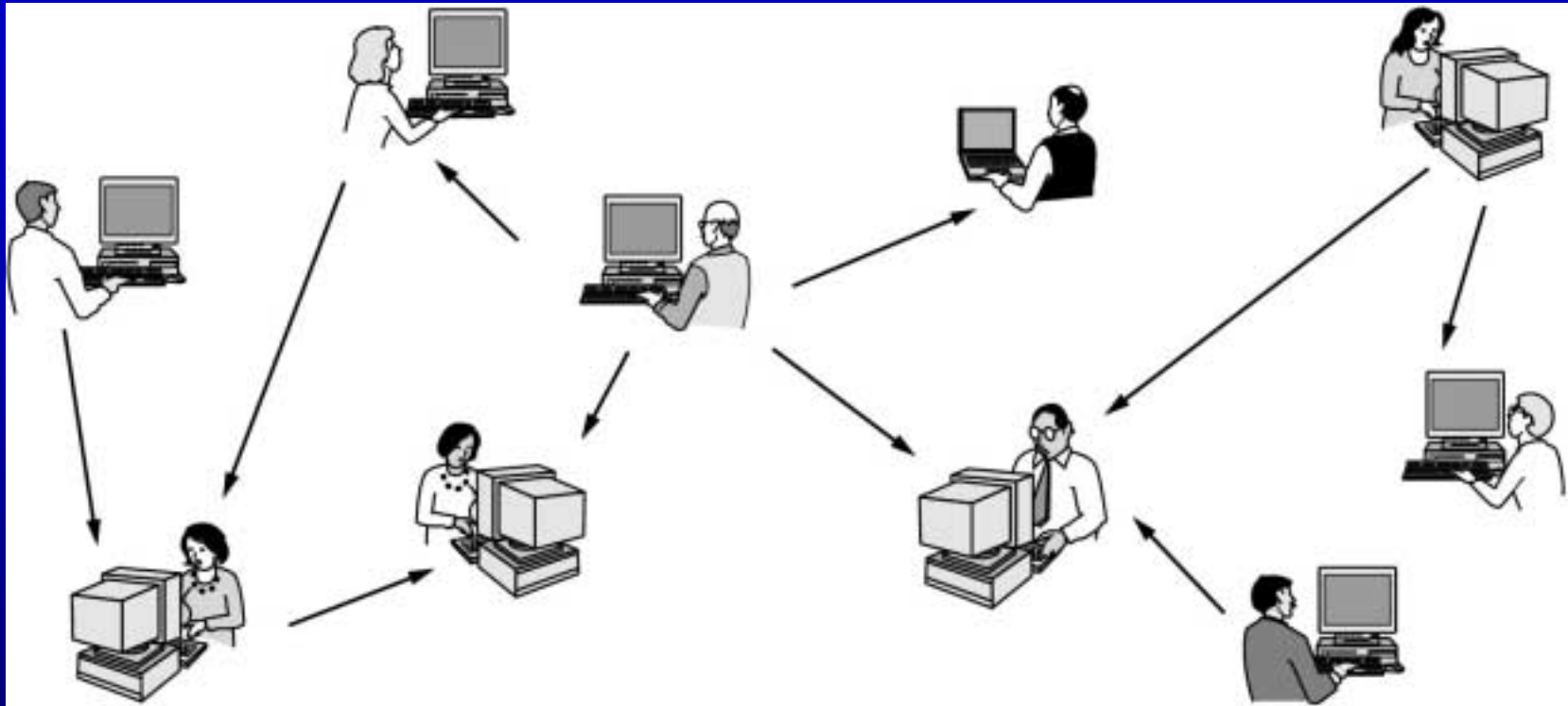
Peer-to-Peer Applications

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.

Networks: Introduction

9

nodes
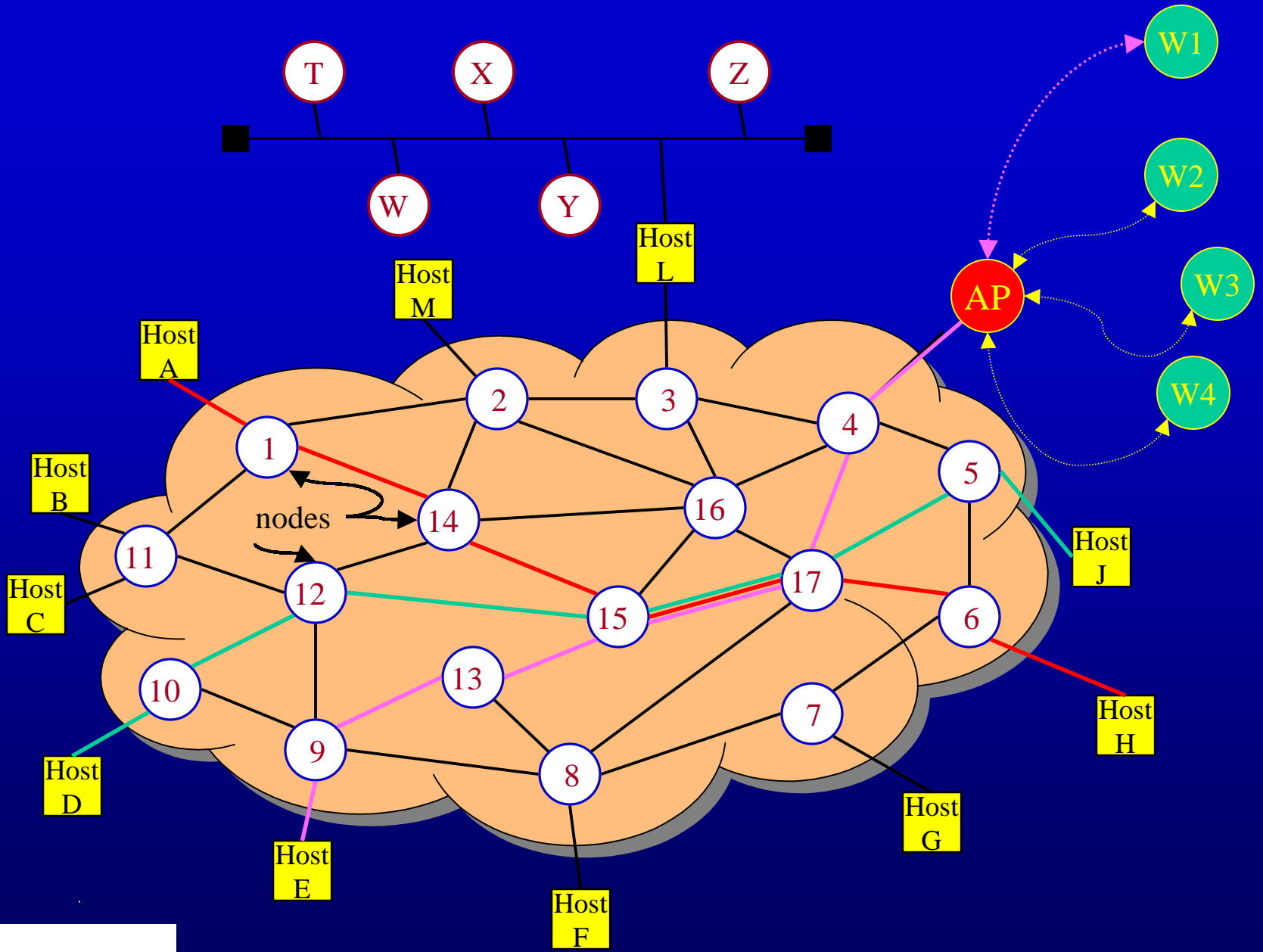
Classifying Networks by Transmission Technology

broadcast :: a single communications channel shared by all machines (addresses) on the network. *Broadcast can be both a* <u>*logical*</u> *or a* <u>*physical*</u> *concept (e.g. Media Access Control (MAC) sublayer) .*

multicast :: communications to a <u>specified</u> group. *This requires a group address* (e.g. – multimedia multicast).

point-to-point :: connections 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
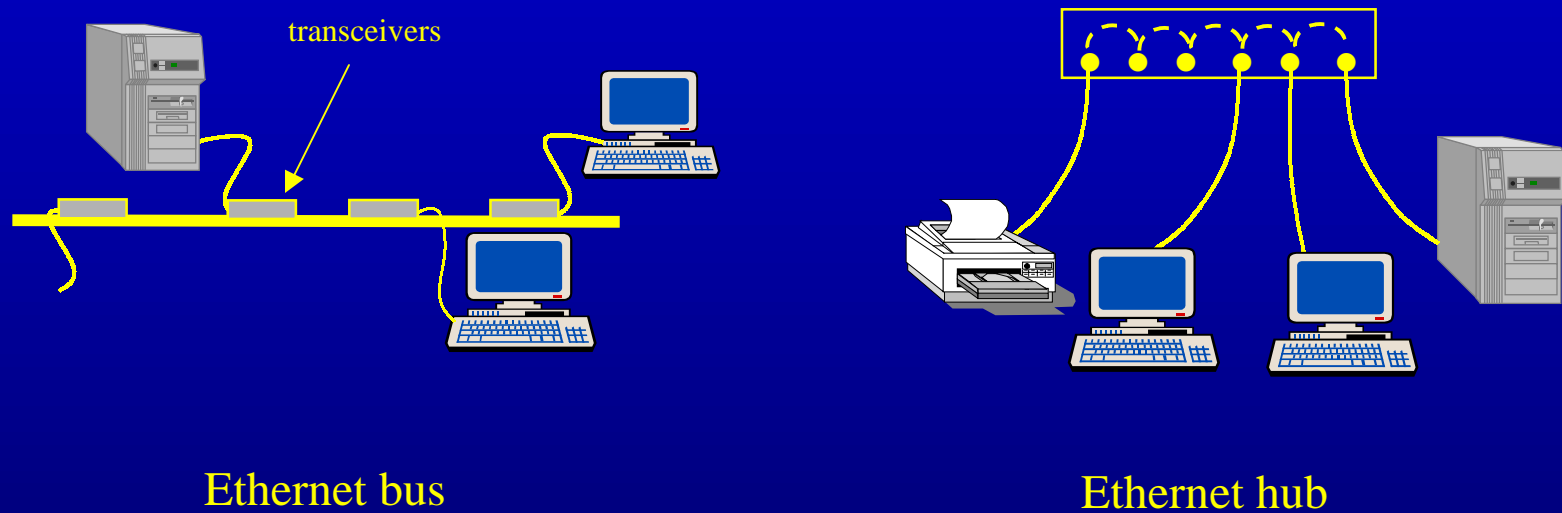
Ethernet bus

Ethernet hub

Leon-Garcia & Widjaja: *Communication Networks*

Figure 1.17

Networks: Introduction

14

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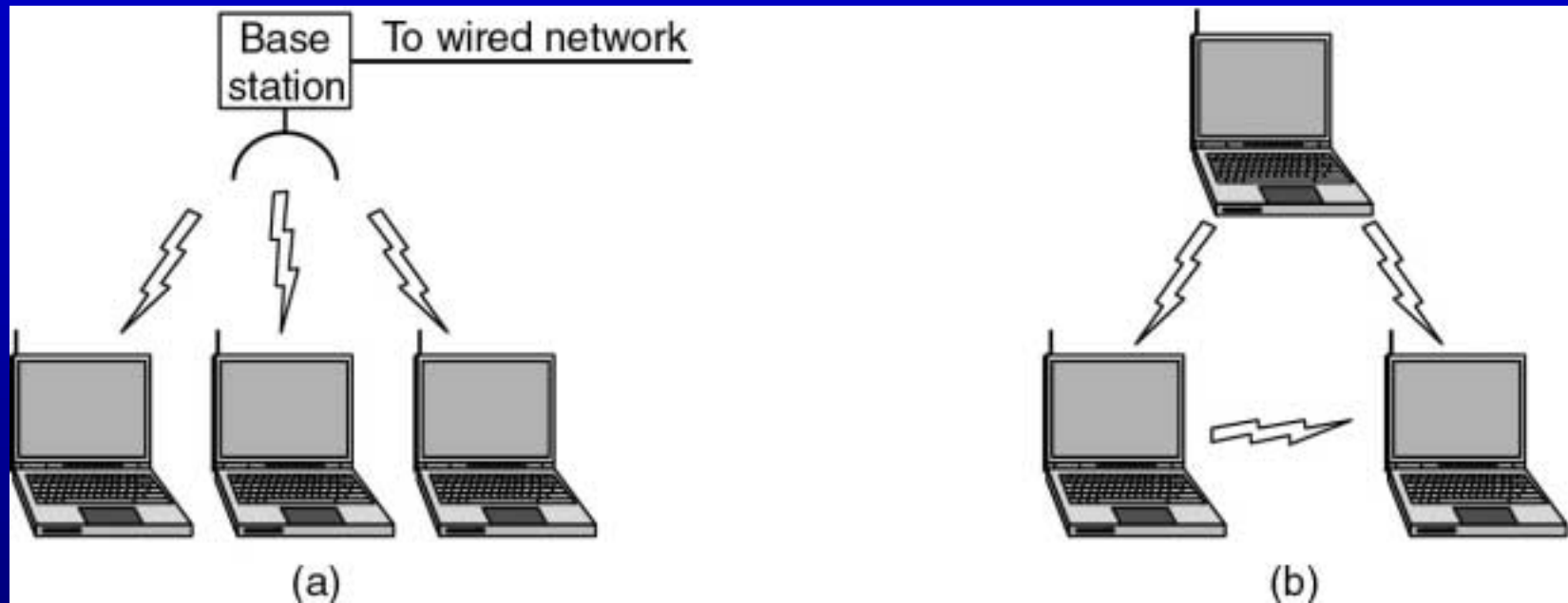
Figure 1-35. (a) Wireless networking with a base station. (b) Ad hoc networking.

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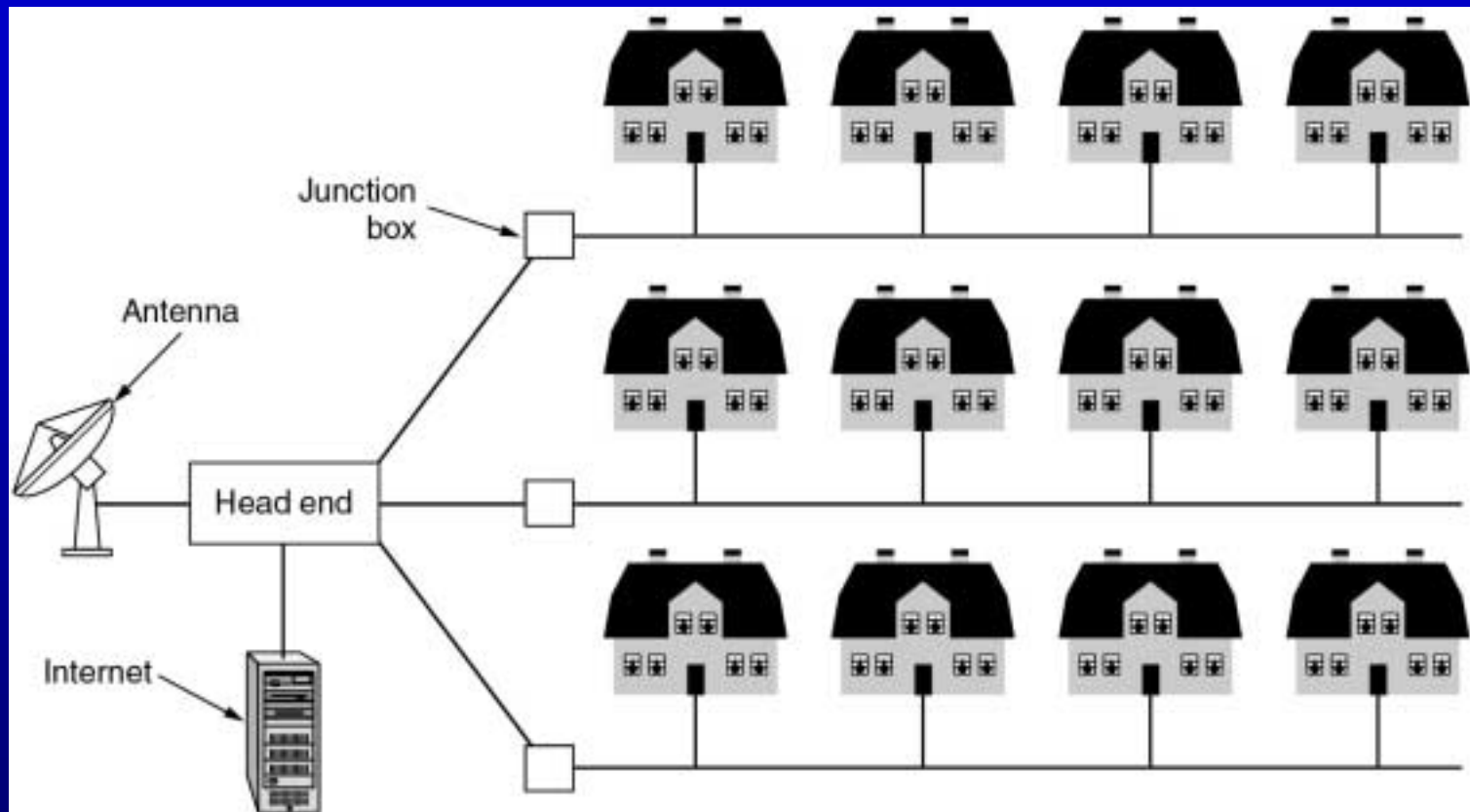
Figure 1-8. A metropolitan area network based on cable TV.

MAN

1*

a

b

2

4

3

A

c

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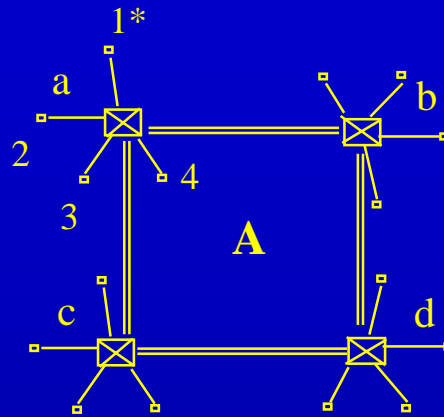
Metropolitan network **A** consists of access subnetworks a, b, c, d.

Hierarchical Network Topology

A

α

β

γ
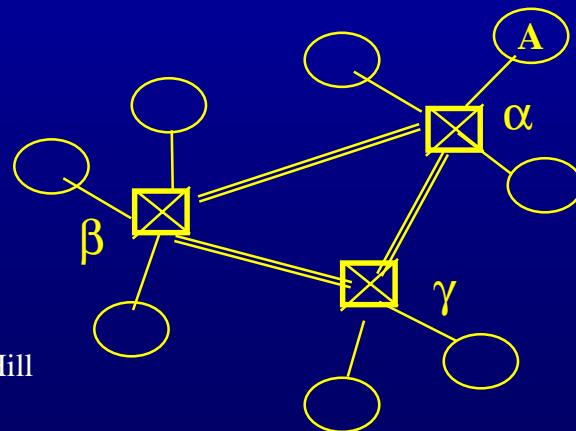
National network consists of regional subnetworks α, β, γ.

Metropolitan network A is part of regional subnetwork α.

Leon-Garcia & Widjaja: *Communication Networks*

Networks: Introduction

Figure 1.8

Network Classification by Size

- WANs {Wide Area Networks}
  - *also referred to as "point-to-point" networks.*
  - ARPANET Internet
  - usually hierarchical with a backbone.
  - Enterprise Networks, Autonomous Systems
  - VPNs (Virtual Private Networks).
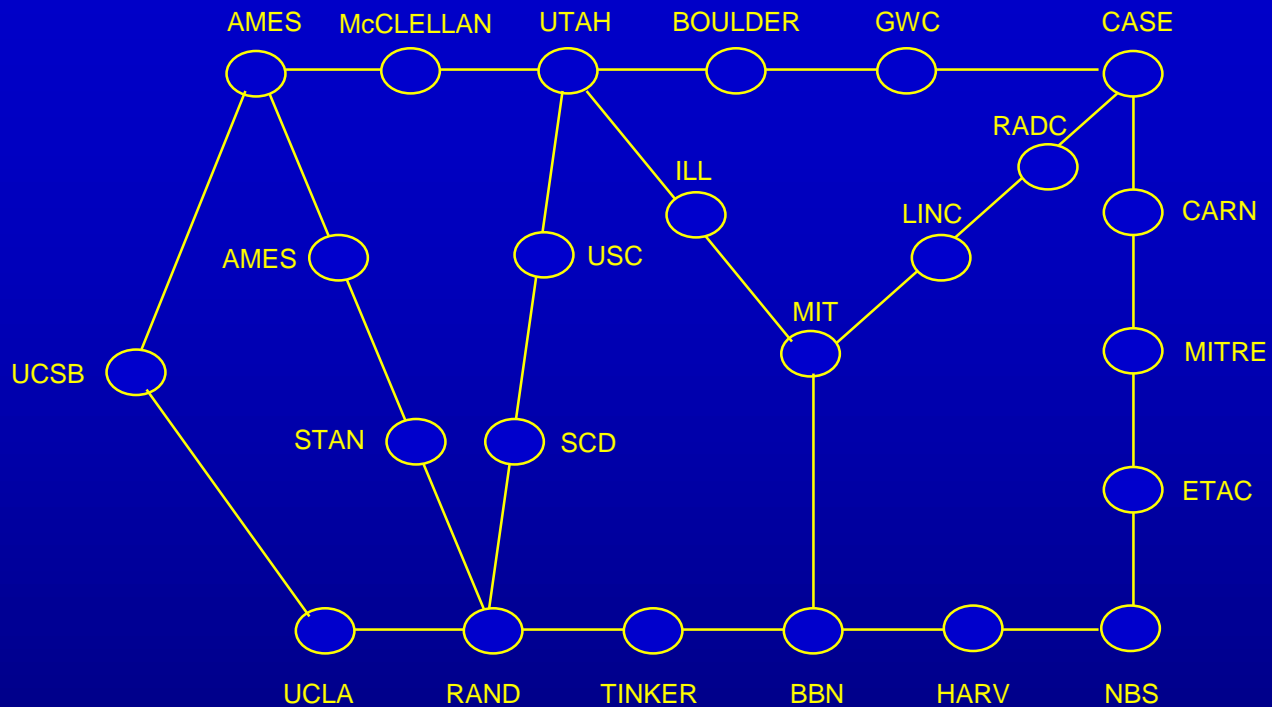
ARPAnet circa 1972

a point-to-point network

Leon-Garcia & Widjaja: *Communication Networks*

Figure 1.16

Networks: Introduction

Wide Area Networks (WANs)
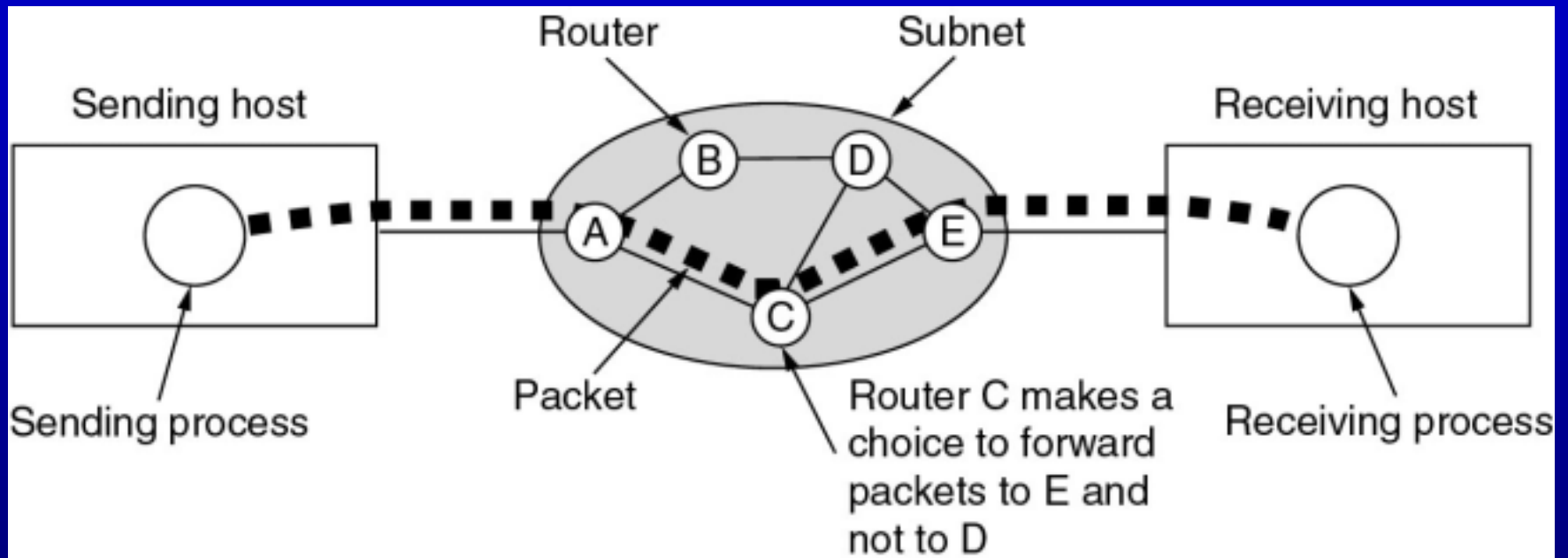
Figure 1-10.A stream of packets from sender to receiver.
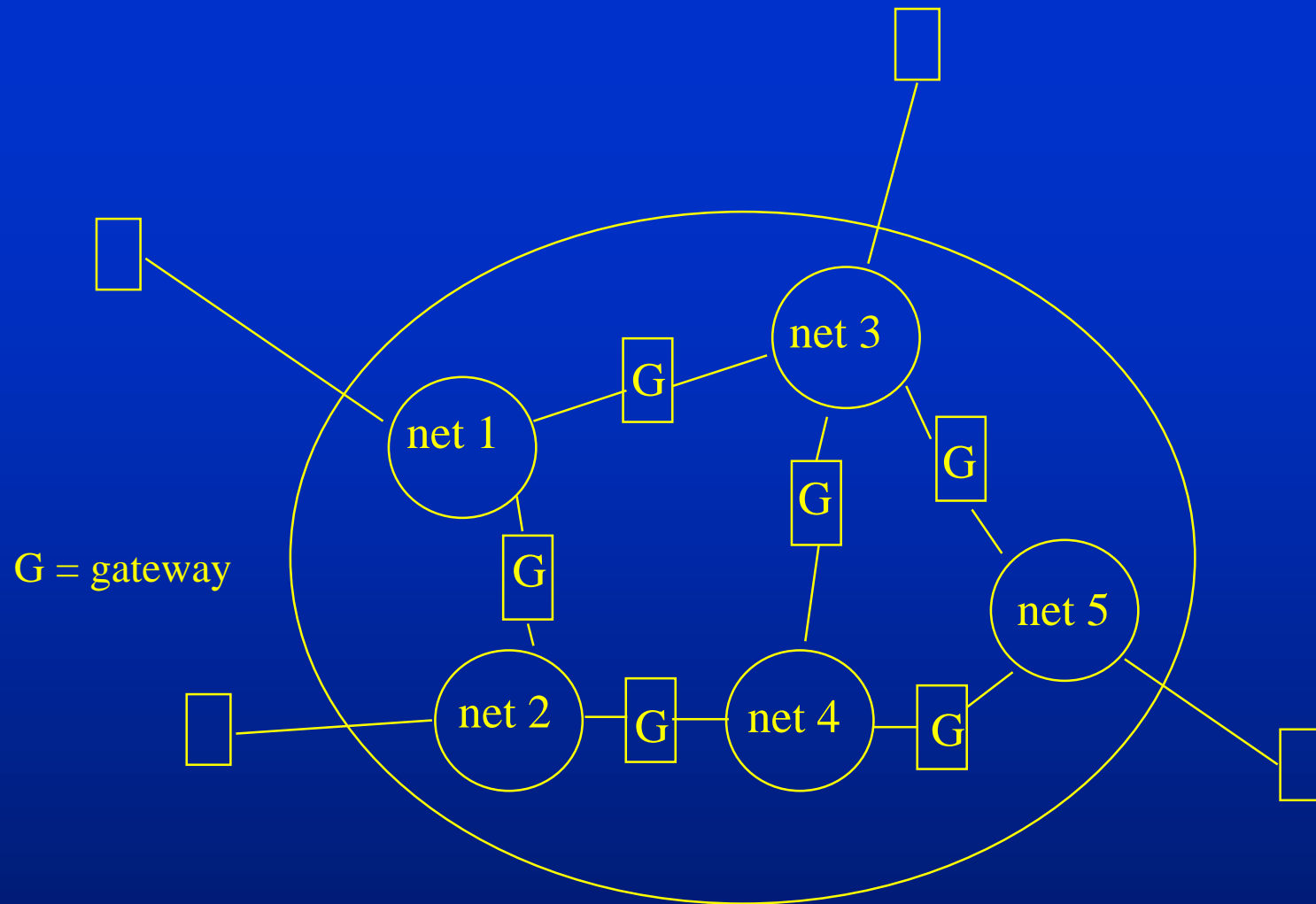
internet - a network of networks

Leon-Garcia & Widjaja: *Communication Networks*

Networks: Introduction

Figure 1.18

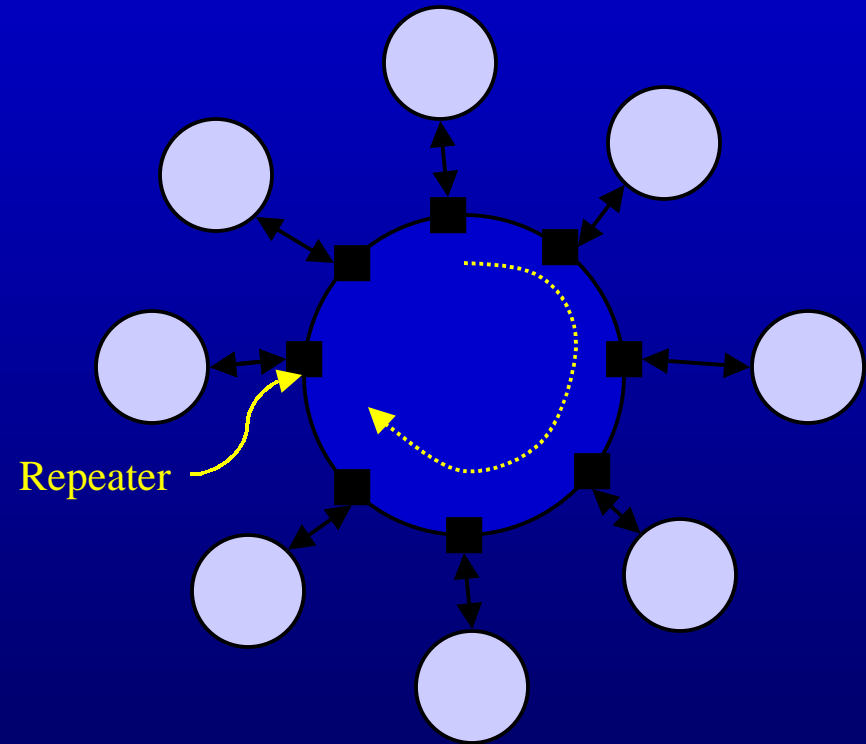# Network Classification by Topology
Bus

flow of data
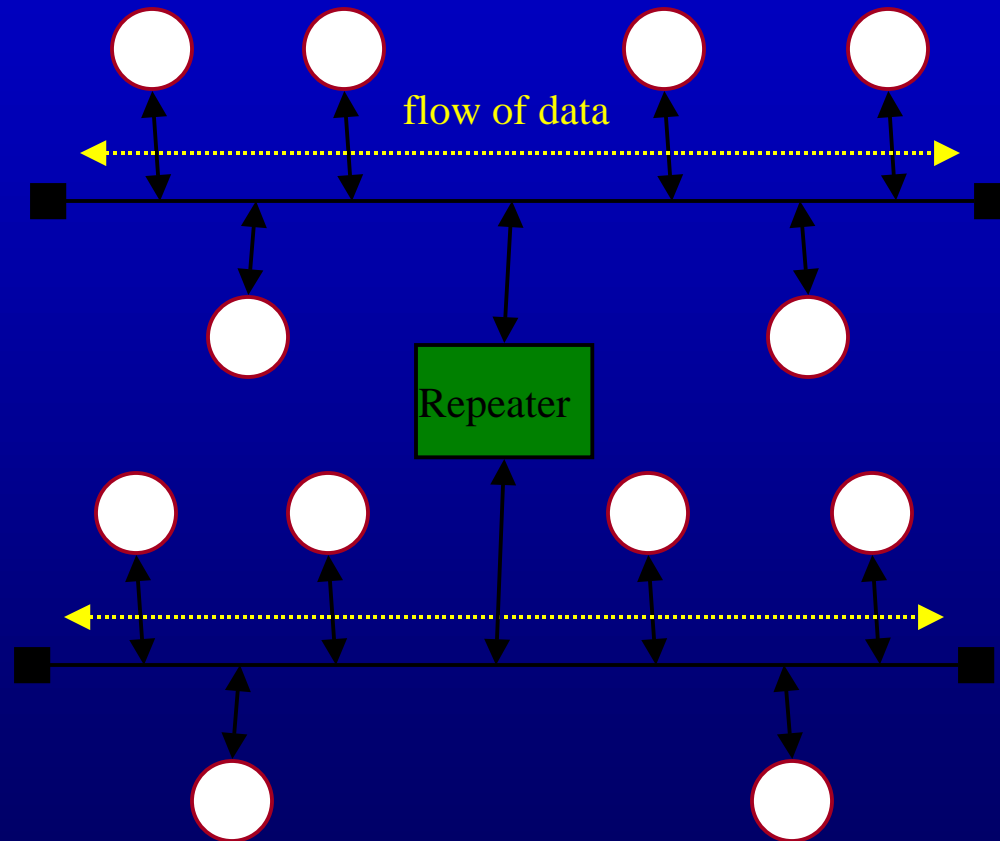
Bidirectional flow
 assumes baseband cable

Repeater

Network Classification by Topology

Ring

Repeater

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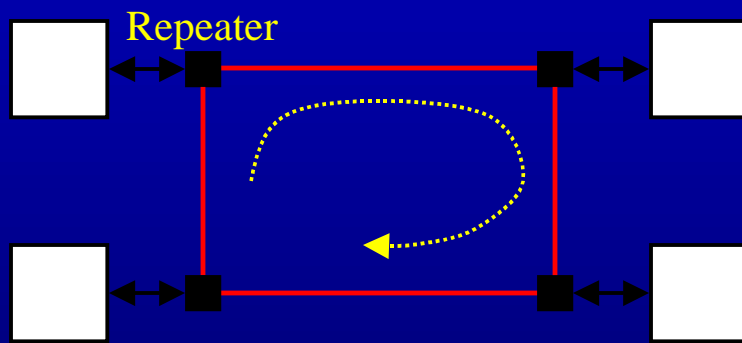
Note - *a ring implies <u>unidirectional</u> flow*

Network Classification by Topology
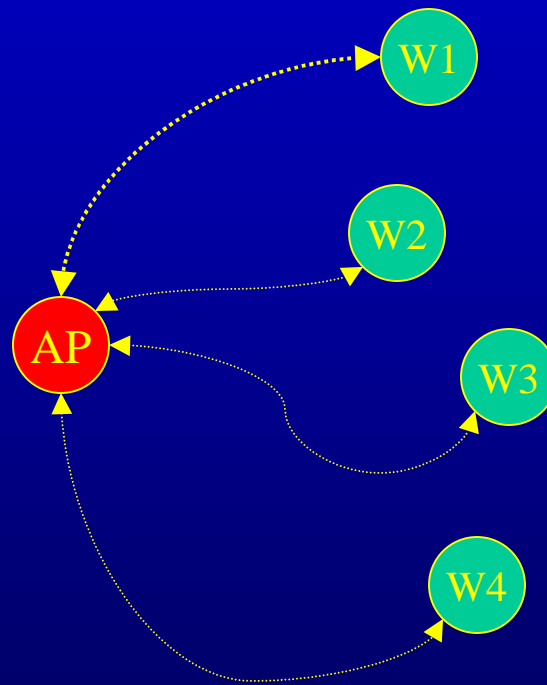
Tree

Headend
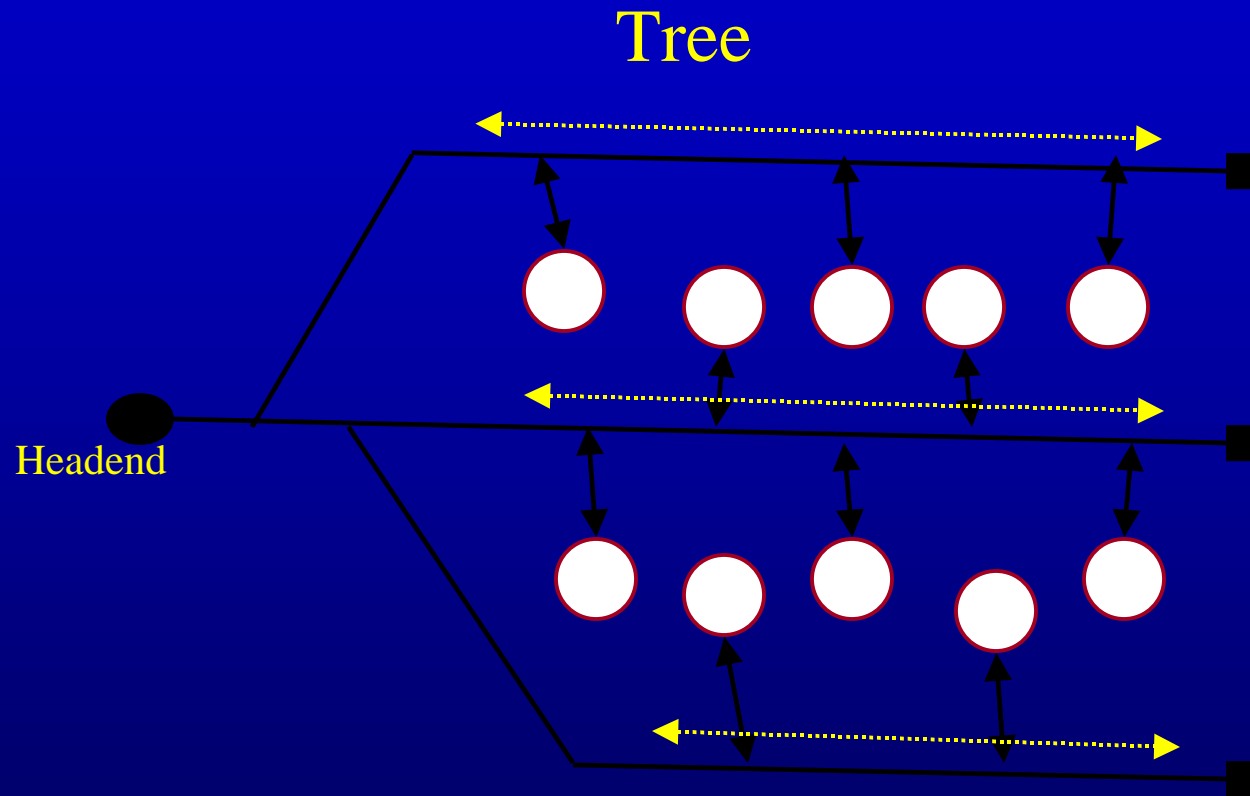
Network Classification by Topology
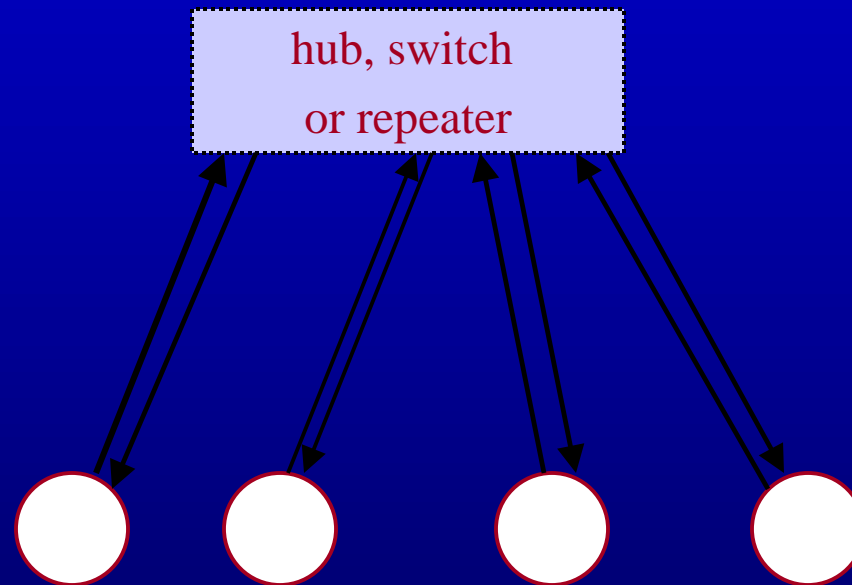
Star

Network Classification by Topology

Star

Wireless Infrastructure