CS4514
Computer Networks

Term B06

Professor Bob Kinicki

Course Objectives

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1. To develop an understanding of modern network architectures from a **design** and **performance** perspective.
2. To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
3. To clarify network terminology.

Course Objectives

4. To provide an opportunity to do network programming using **TCP/IP**.
5. To give the students experience working in programming teams.
6. To provide a WLAN measurement experience.
7. To expose students to 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 **distributed system** the collection of independent computers appears to its users as a single coherent system.

Client-Server Applications

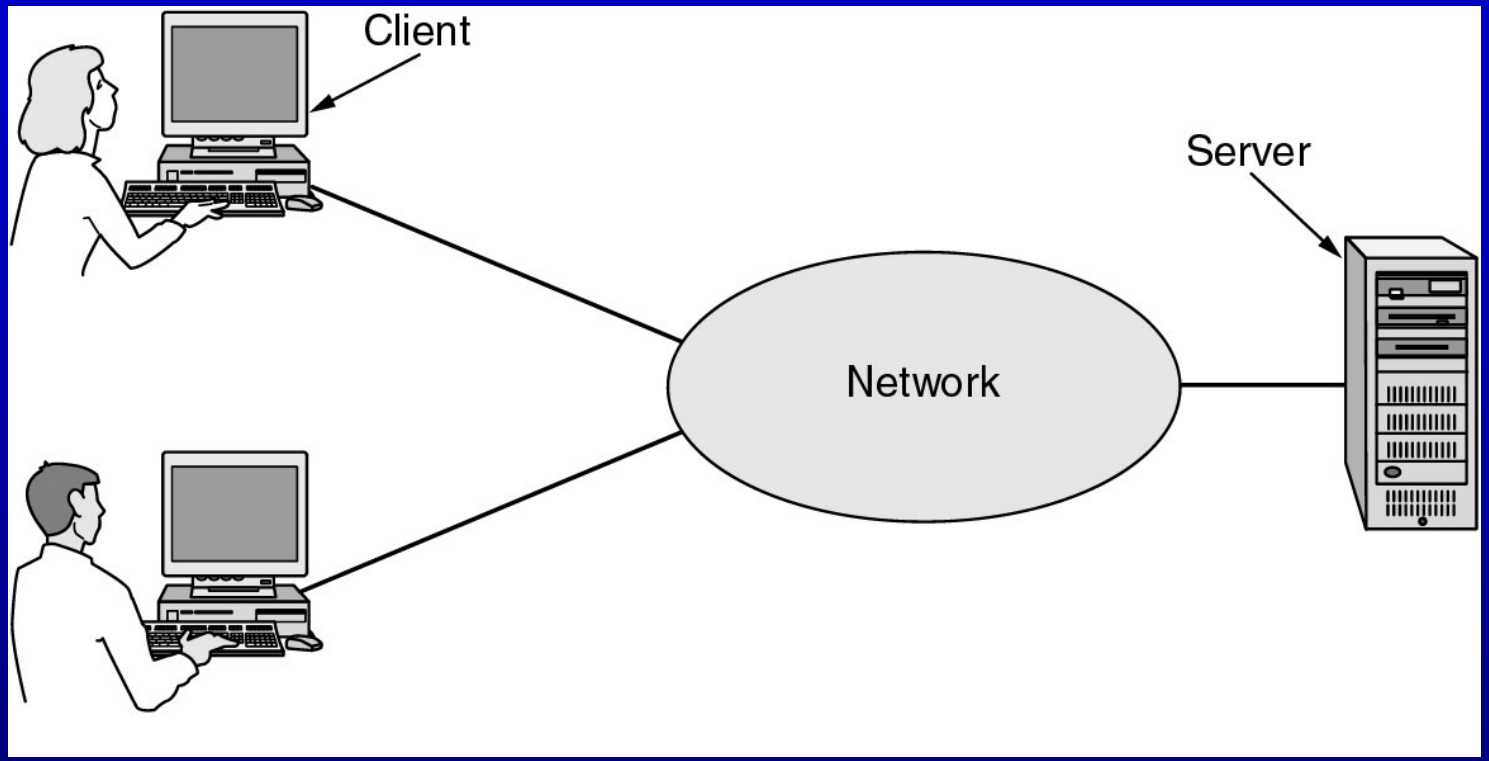


Figure 1.1 A network with two clients and one server.

Client-Server Model

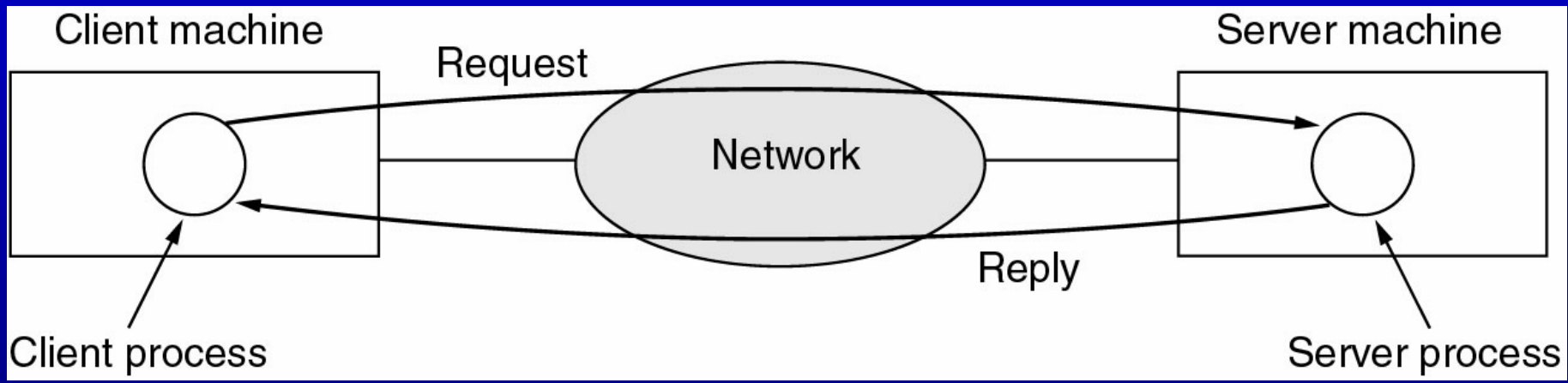


Figure 1-2. The client-server model involves requests and replies.

Peer-to-Peer Applications

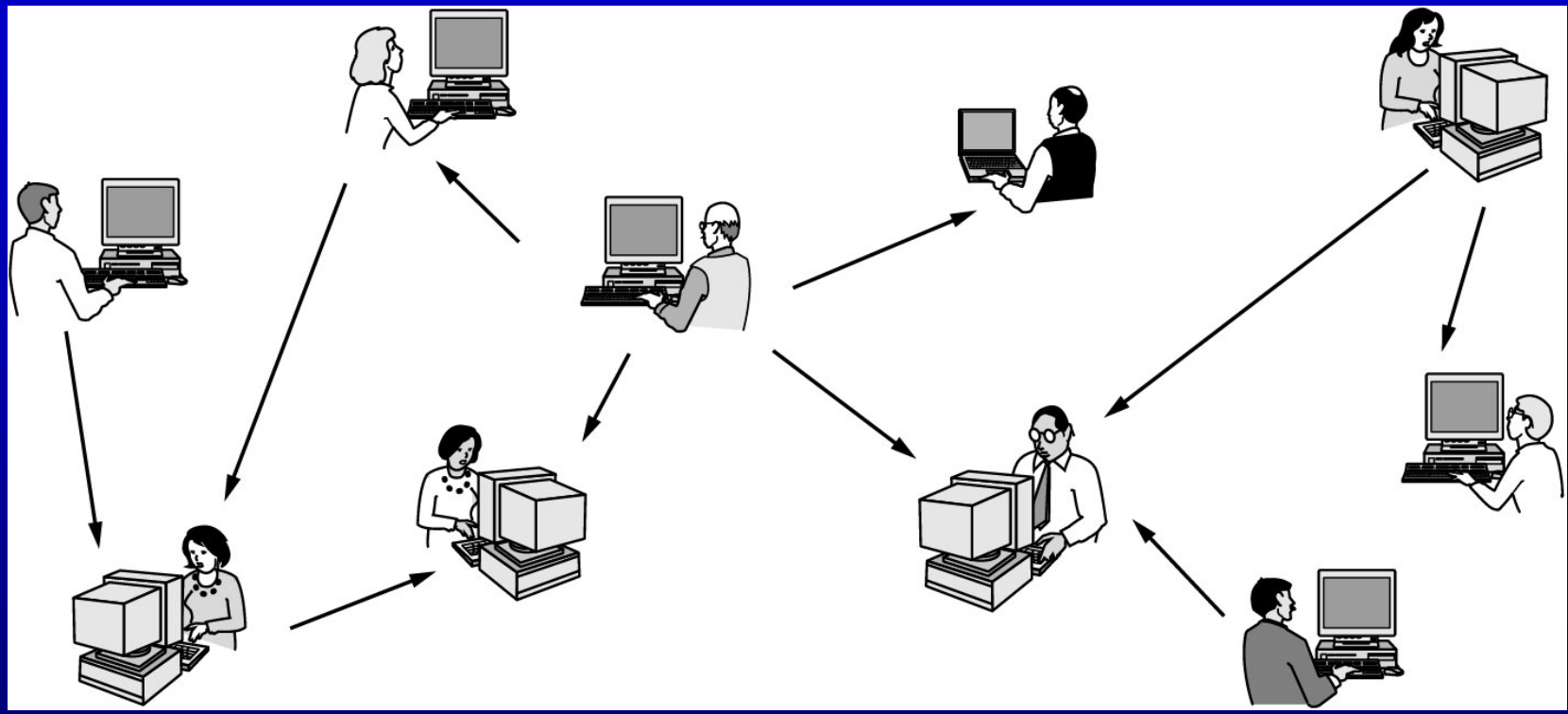
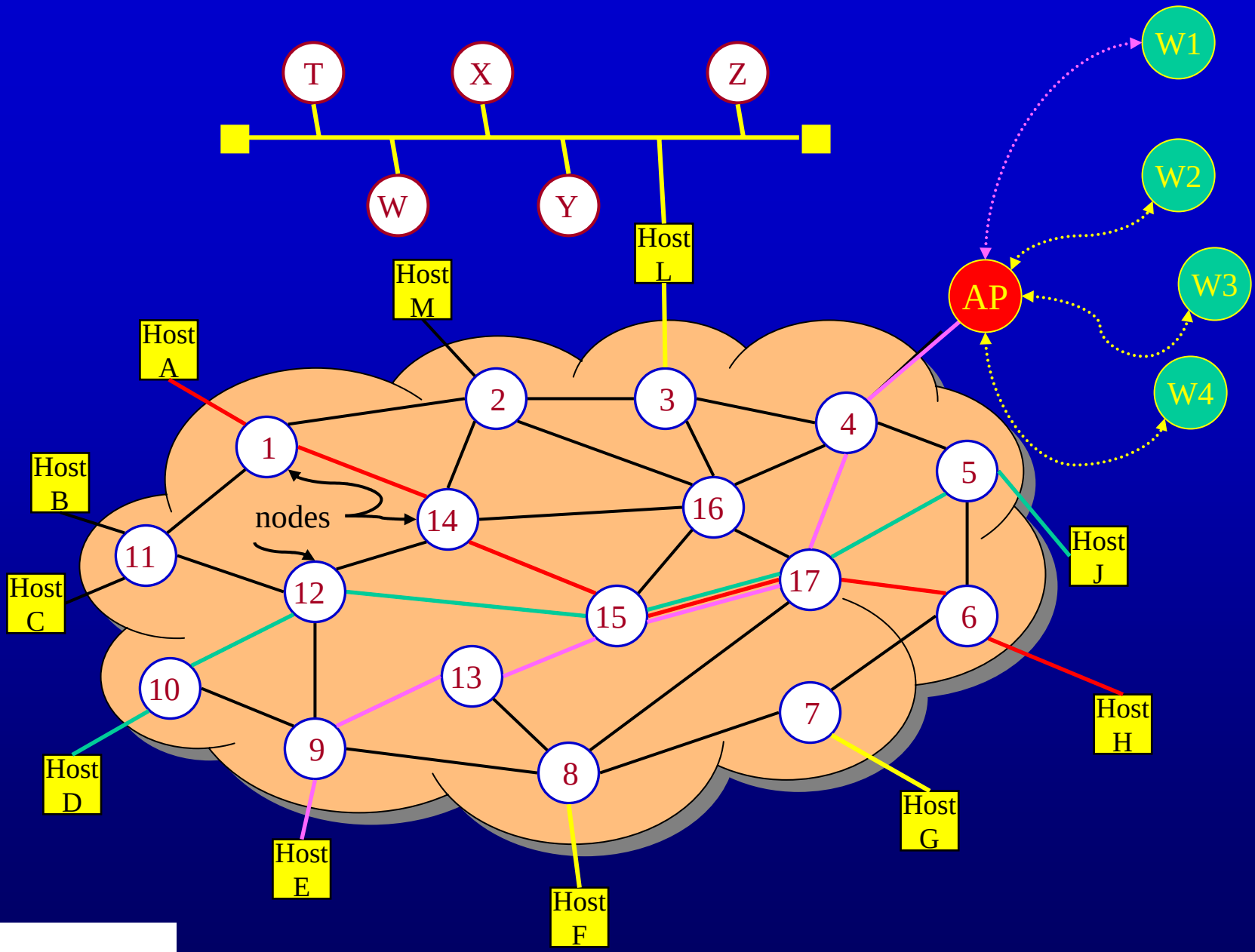


Figure 1.3 In a peer-to-peer system there are no fixed clients and servers.

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.


T
X
Z
W
Y
Host L
Host M
Host A
W1
W2
W3
W4
AP
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
nodes
Host B
Host C
Host D
Host E
Host F
Host G
Host H
Host J

Classifying Networks by Transmission Technology

broadcast :: a single communications channel shared by all machines (addresses) on the network. *Broadcast can be both 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 made via *links* between pairs of nodes.

Network Classification by Size

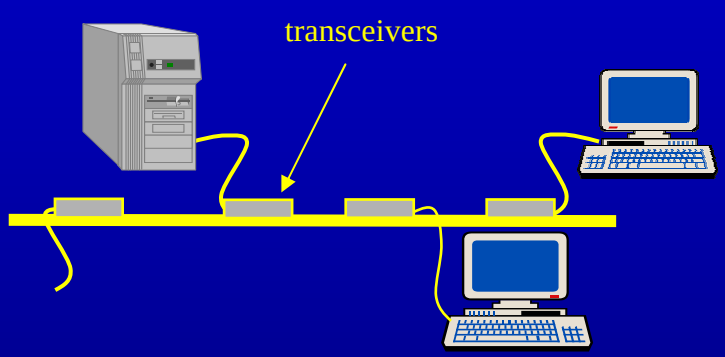
Interprocessor distance	Processors located in same	Example
1 m	Square meter	Personal area network
10 m	Room	Local area network
100 m	Building	
1 km	Campus	
10 km	City	Metropolitan area network
100 km	Country	Wide area network
1000 km	Continent	
10,000 km	Planet	The Internet

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

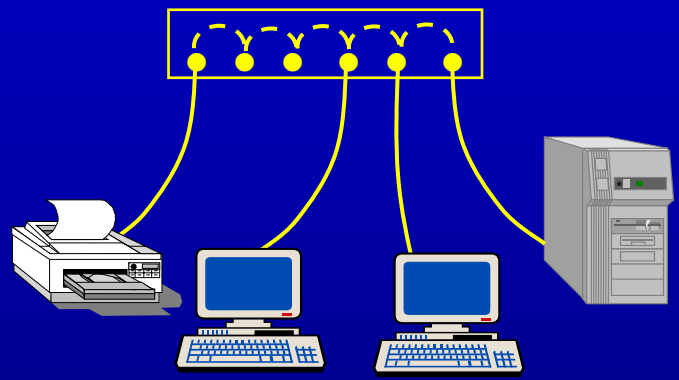
Network Classification by Size

- **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 backbone (e.g., FDDI and ATM)

Wired LANs



Ethernet bus



Ethernet hub

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Figure 1.17

Wireless LANs (WLANs)

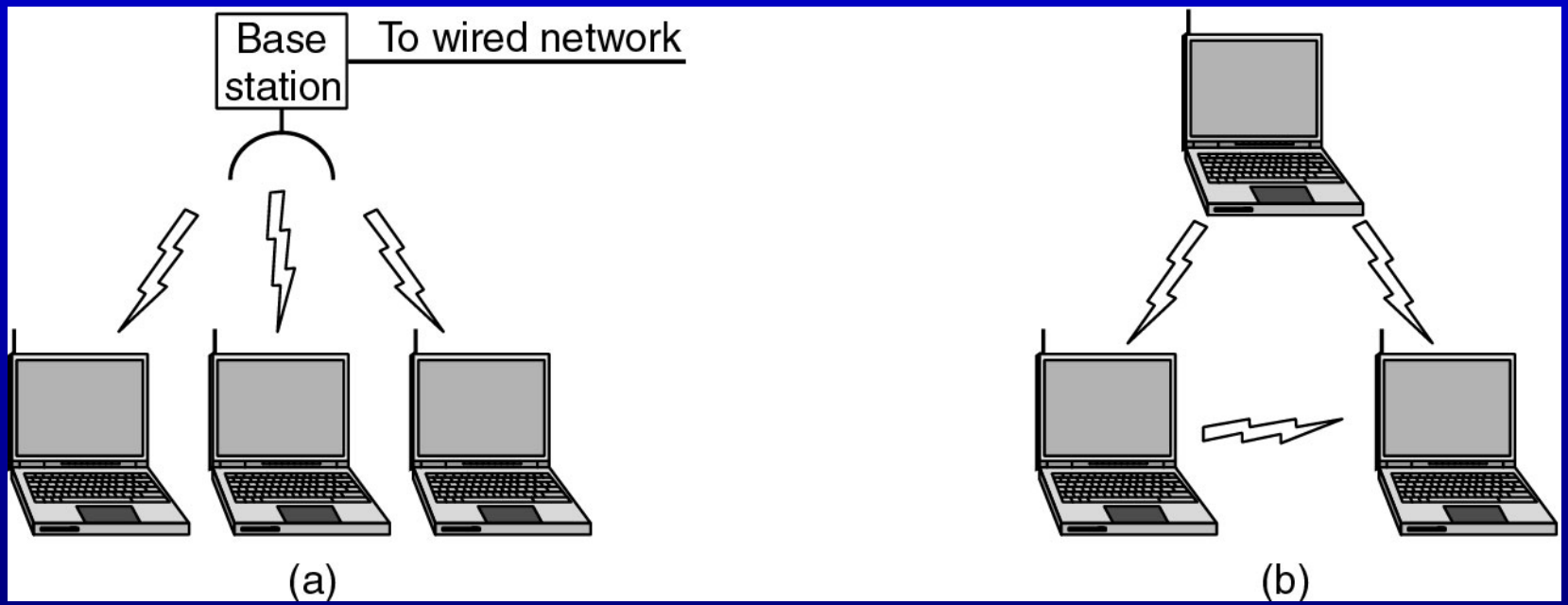


Figure 1-35. (a) Wireless networking with a base station. (b) Ad hoc networking.

Metropolitan Area Networks

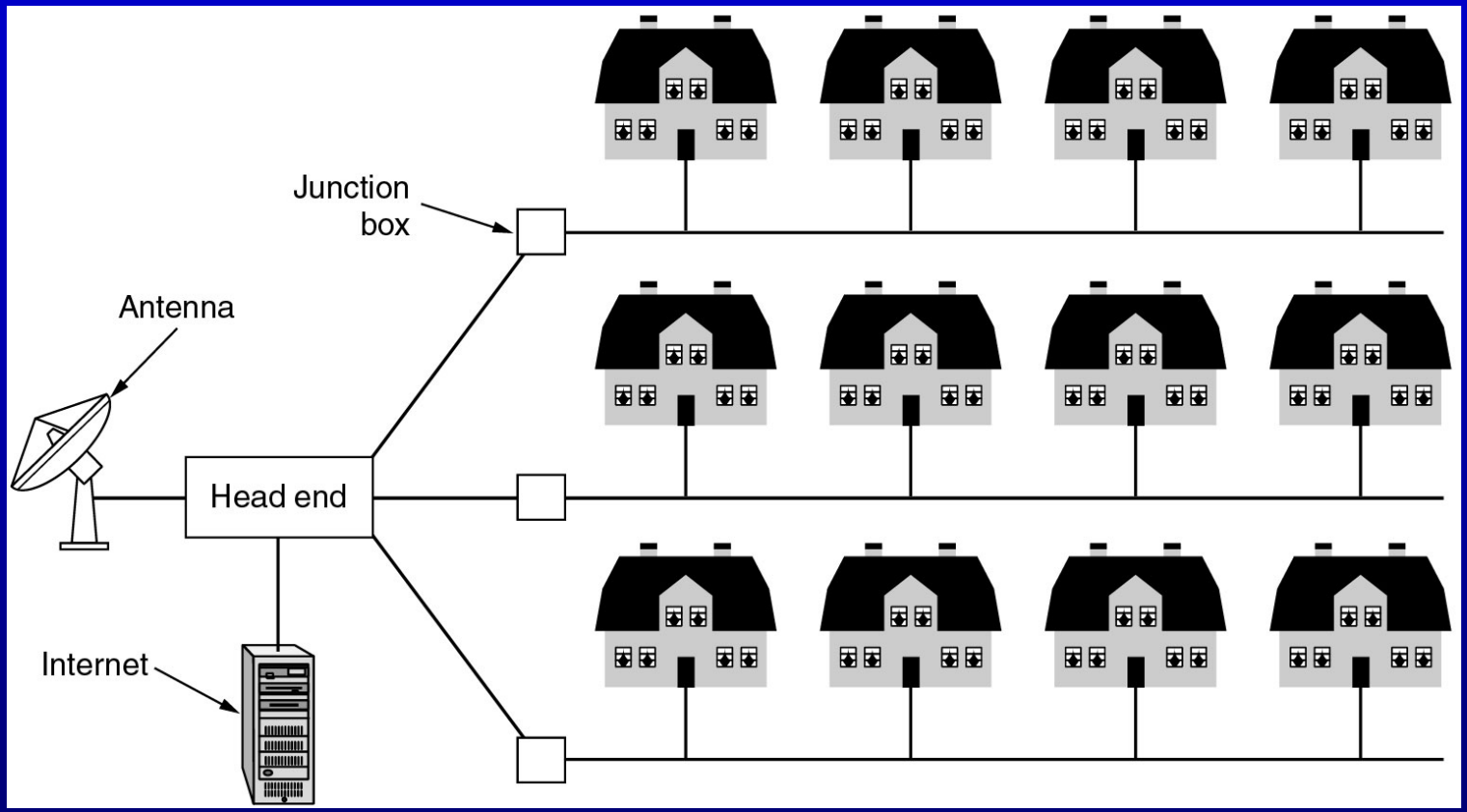
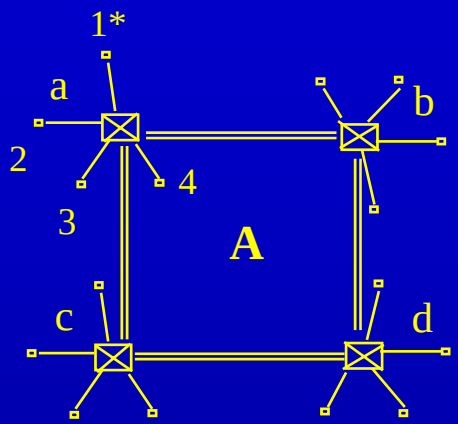


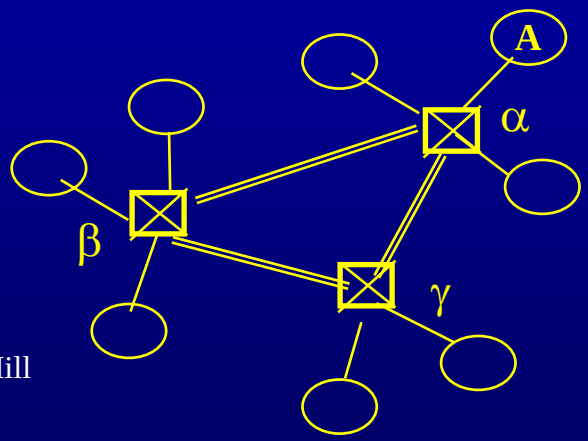
Figure 1-8. A metropolitan area network based on cable TV.

MAN



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

Hierarchical Network Topology



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

Metropolitan network A is part of regional subnetwork α.

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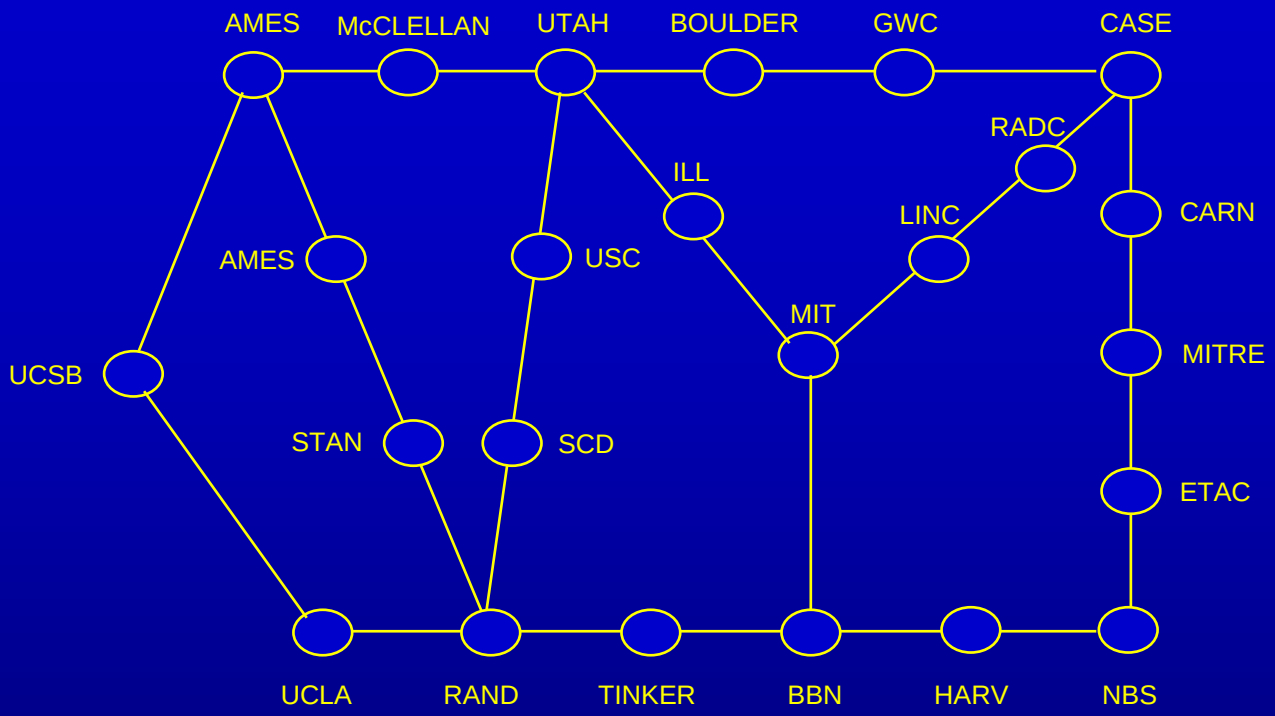
Figure 1.8

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

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Figure 1.16

Wide Area Networks (WANs)

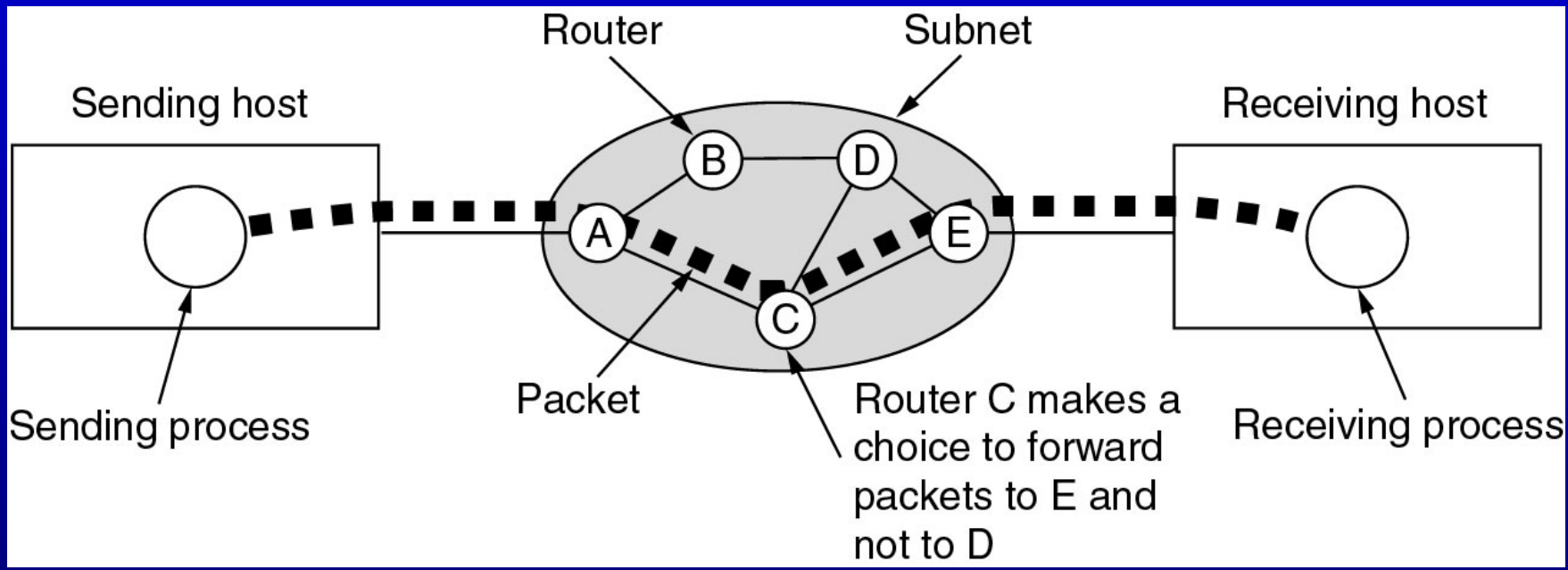
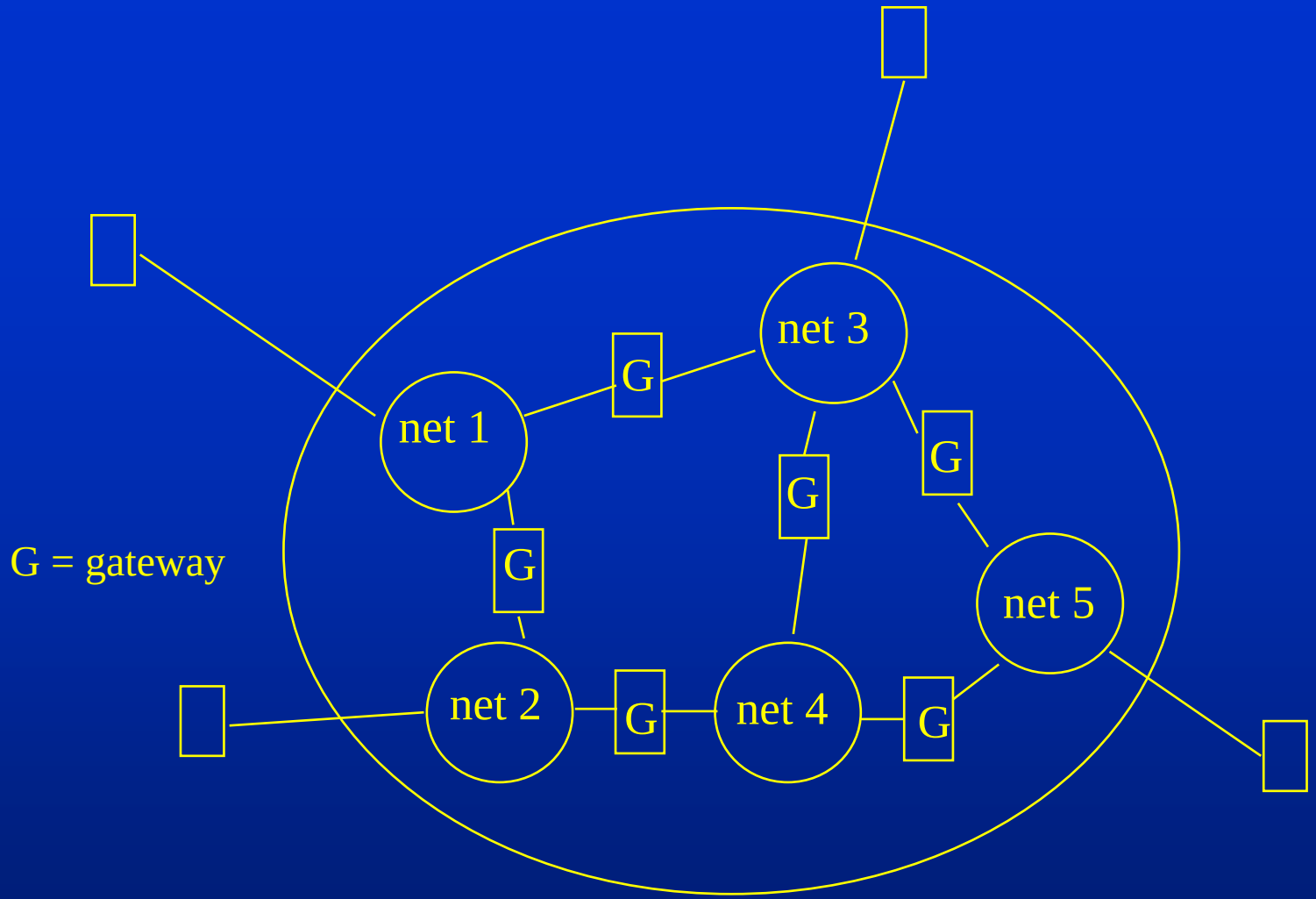


Figure 1-10.A stream of packets from sender to receiver.



internet - a network of networks

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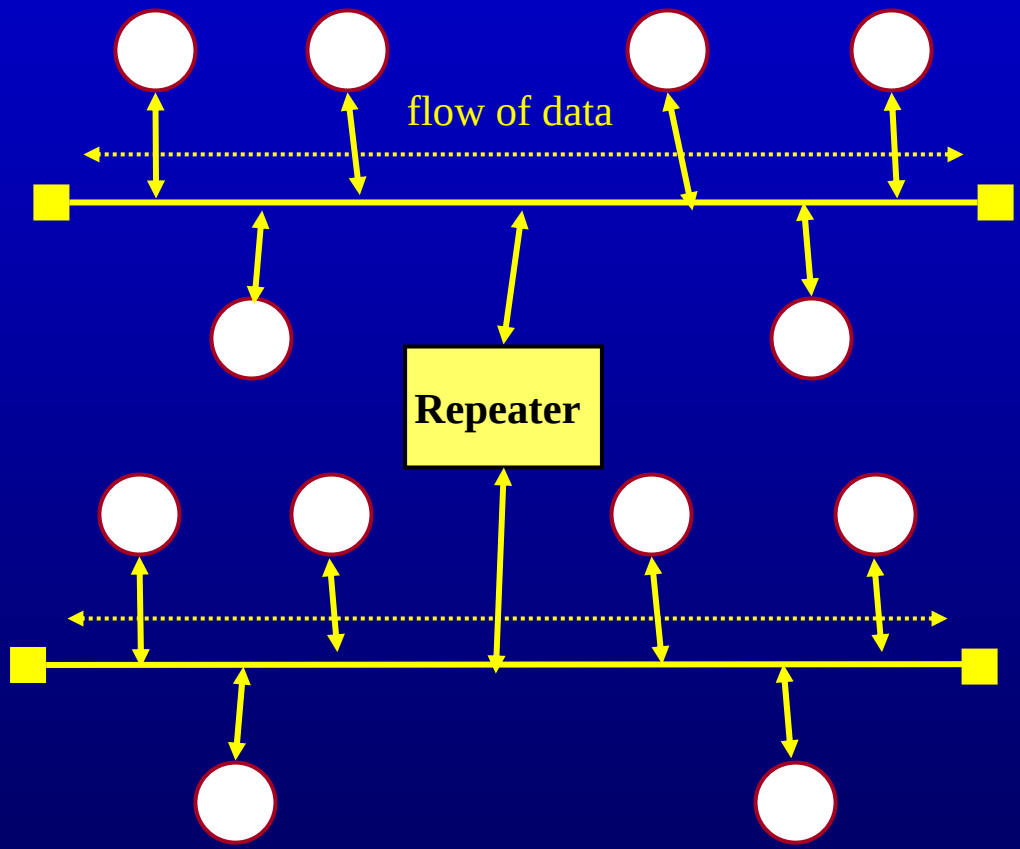
Figure 1.18

Network Classification by Topology

Bus

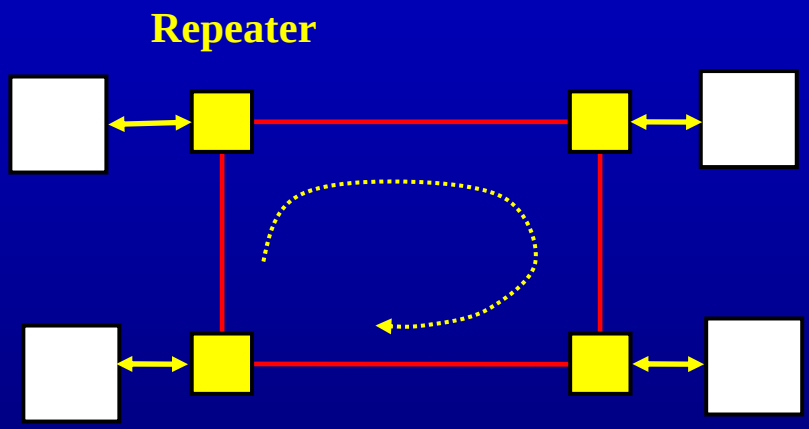


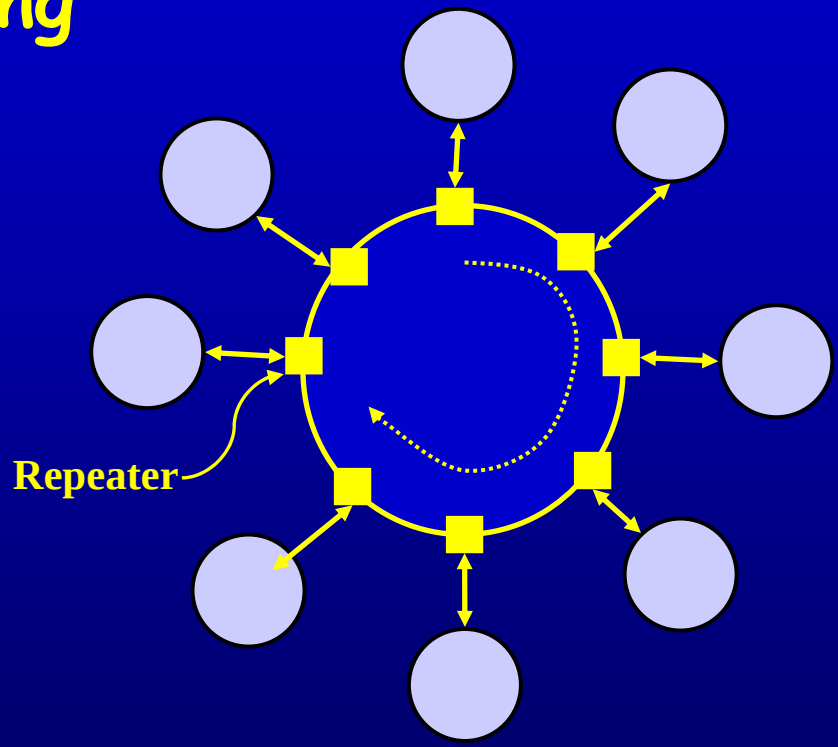
Bidirectional flow

assumes baseband cable

Network Classification by Topology

Ring

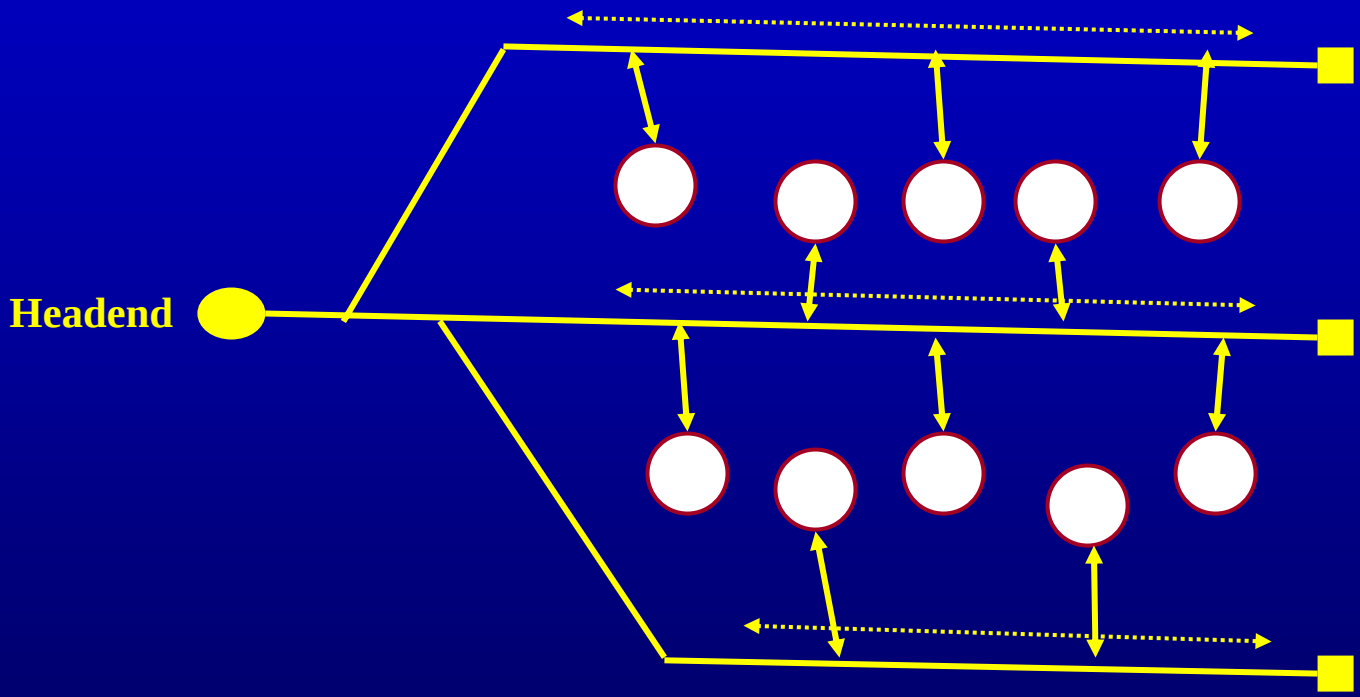




Note - ***a ring implies <u>unidirectional</u> flow***

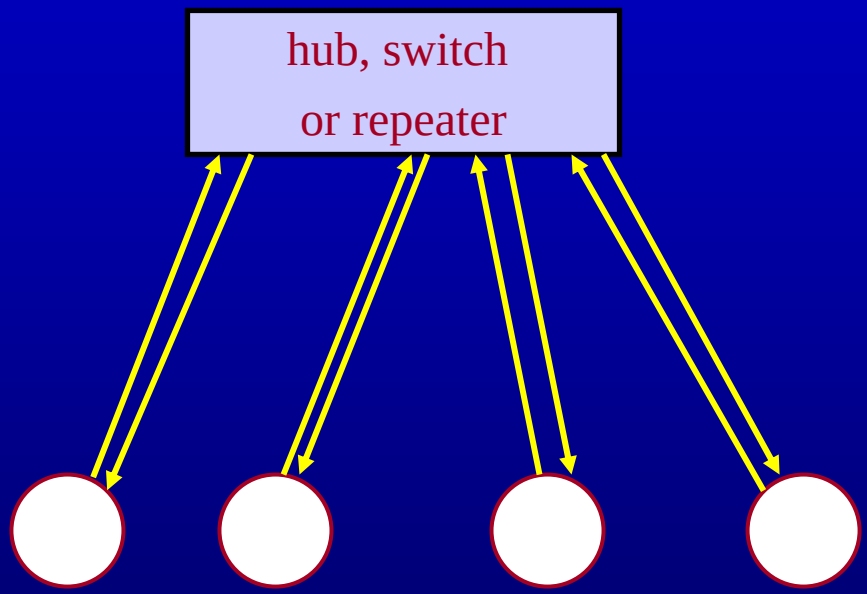
Network Classification by Topology

Tree



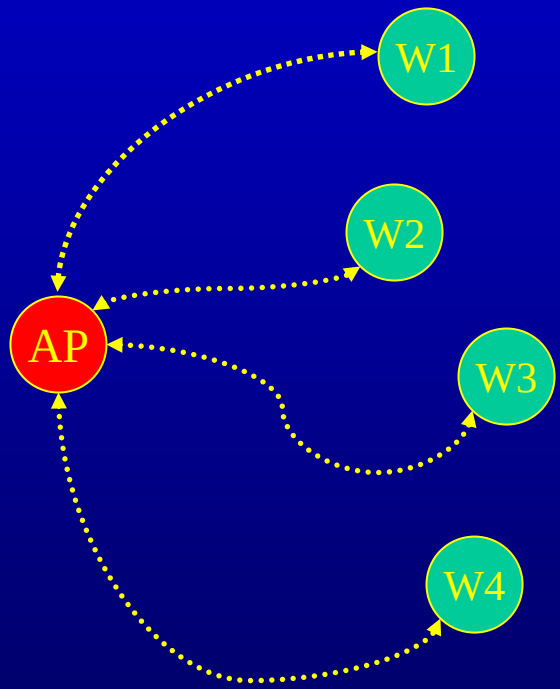
Network Classification by Topology

Star



Network Classification by Topology

Star



Wireless Infrastructure