CS4514
Computer Networks

Term B07

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), Wireless LANs (WLANs) and Wireless Sensor Networks (WSNs).
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 performance evaluation 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

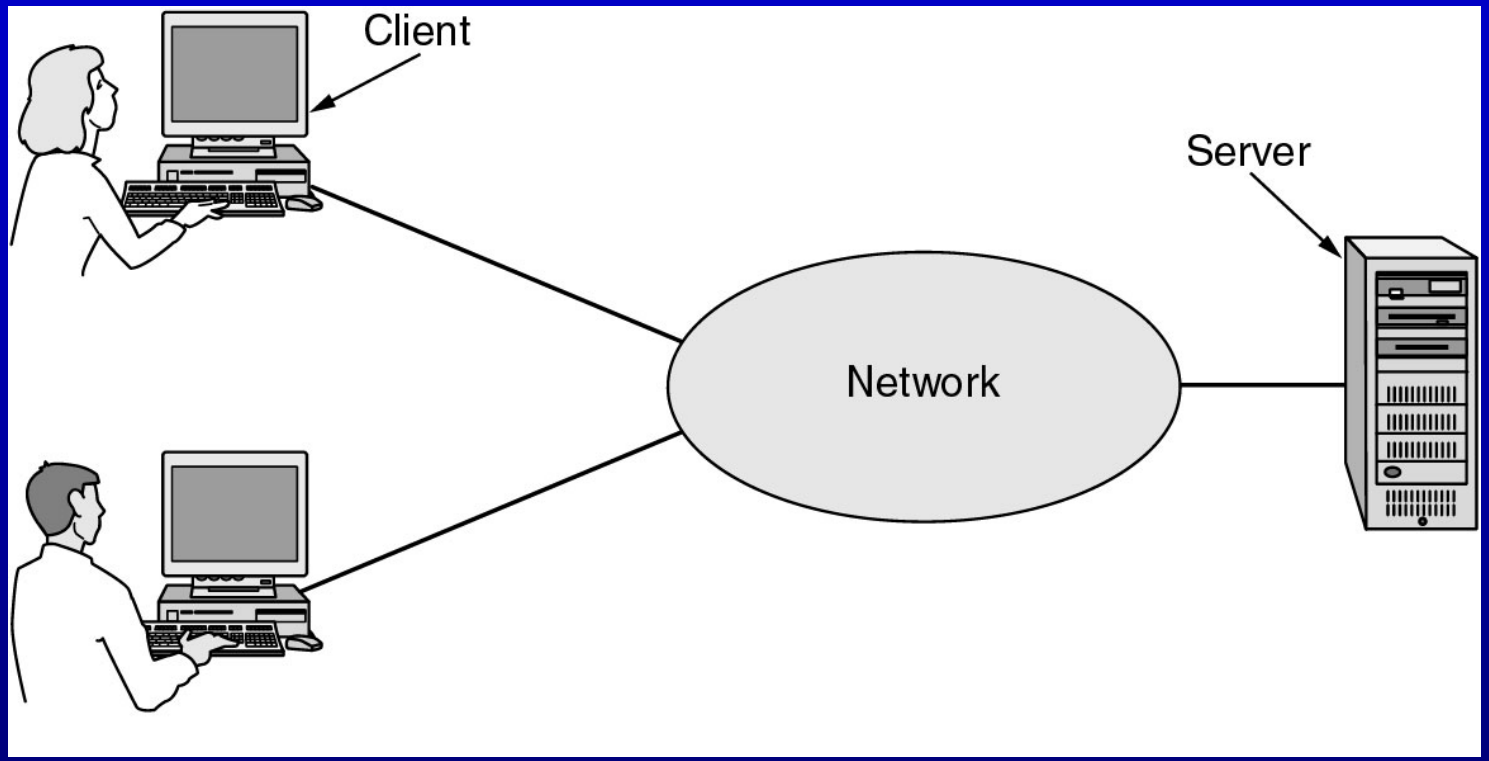


Figure 1.1 A network with two clients and one server.

Client-Server Model

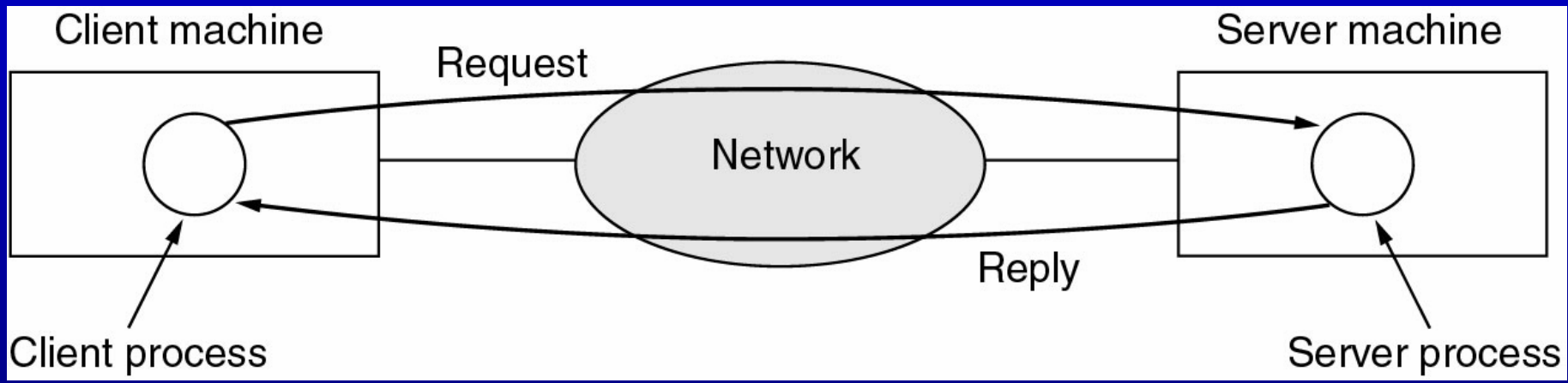


Figure 1-2. The client-server model involves requests and replies.

Peer-to-Peer Applications

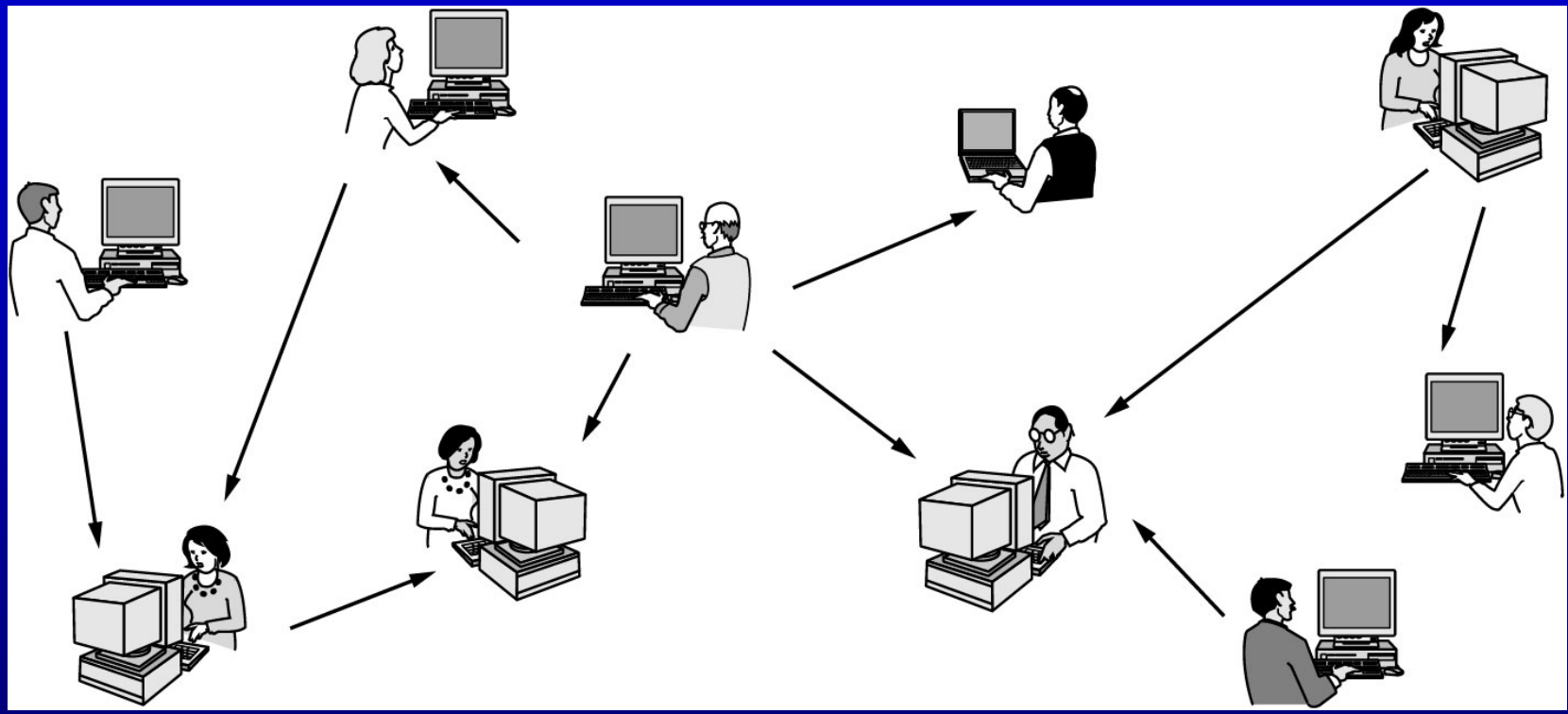
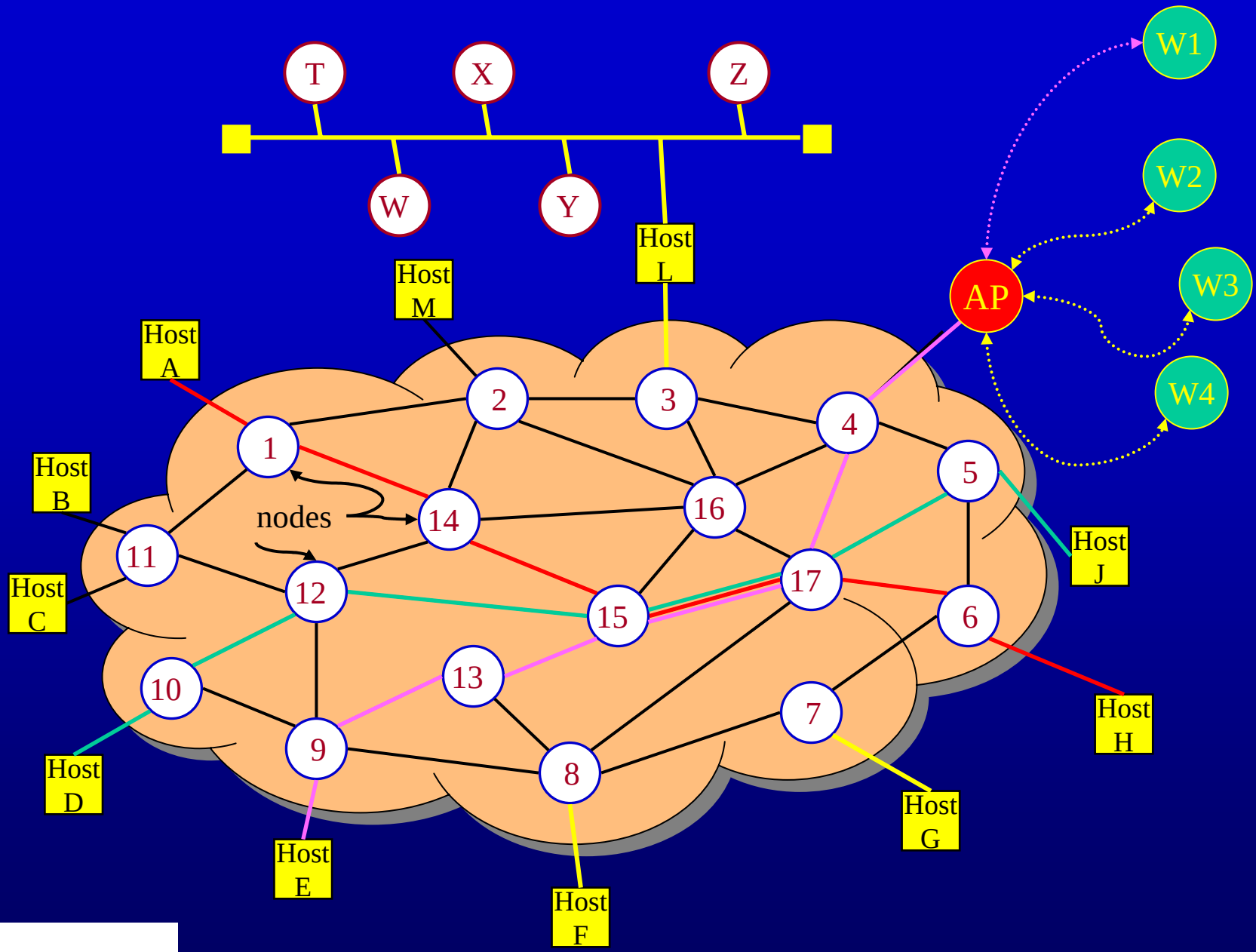


Figure 1.3 In a peer-to-peer system there are no fixed clients and servers.

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.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17
nodes

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).

unicast :: a communication involving a single sender and a single receiver.

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

Network Classification by Size

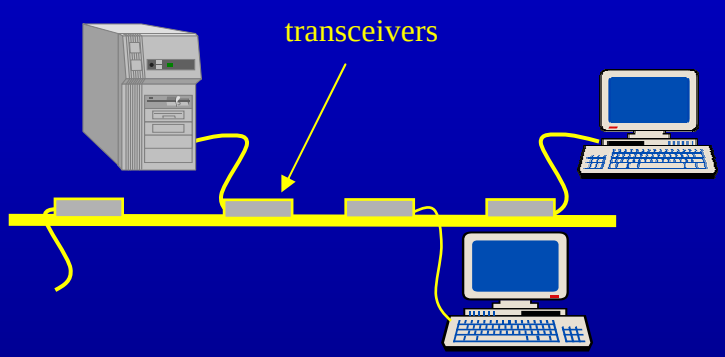
Interprocessor distance	Processors located in same	Example
1 m	Square meter	Personal area network
10 m	Room	Local area network
100 m	Building	
1 km	Campus	
10 km	City	Metropolitan area network
100 km	Country	Wide area network
1000 km	Continent	
10,000 km	Planet	The Internet

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

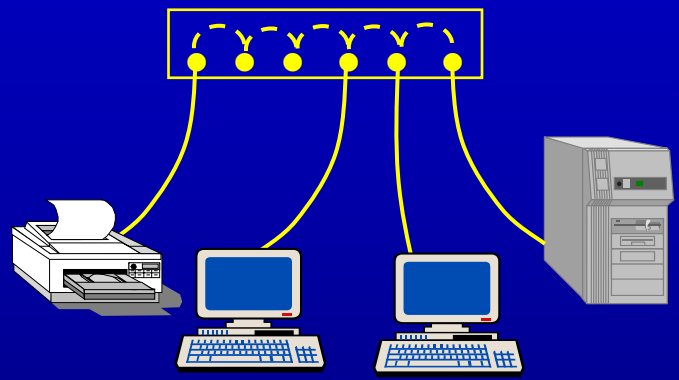
Network Classification by Size

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

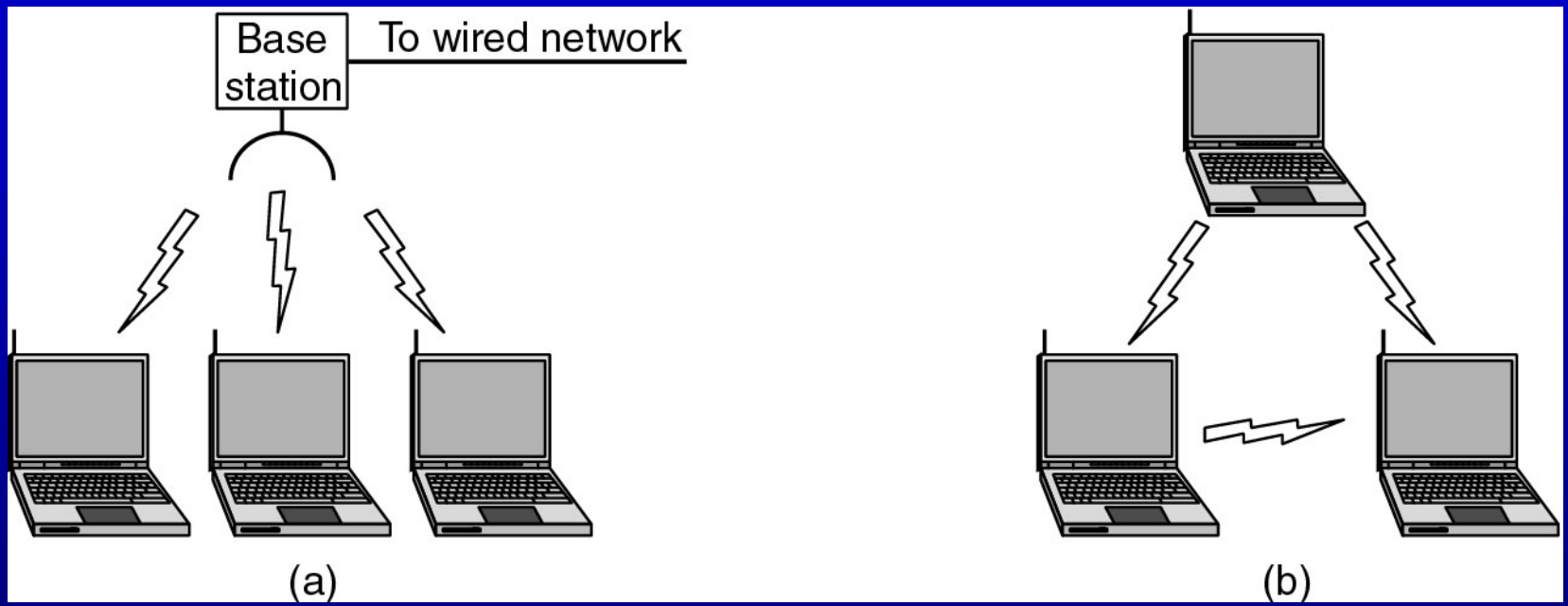


Figure 1-35. (a) Wireless networking with a base station. (b) Ad hoc networking.

Metropolitan Area Networks

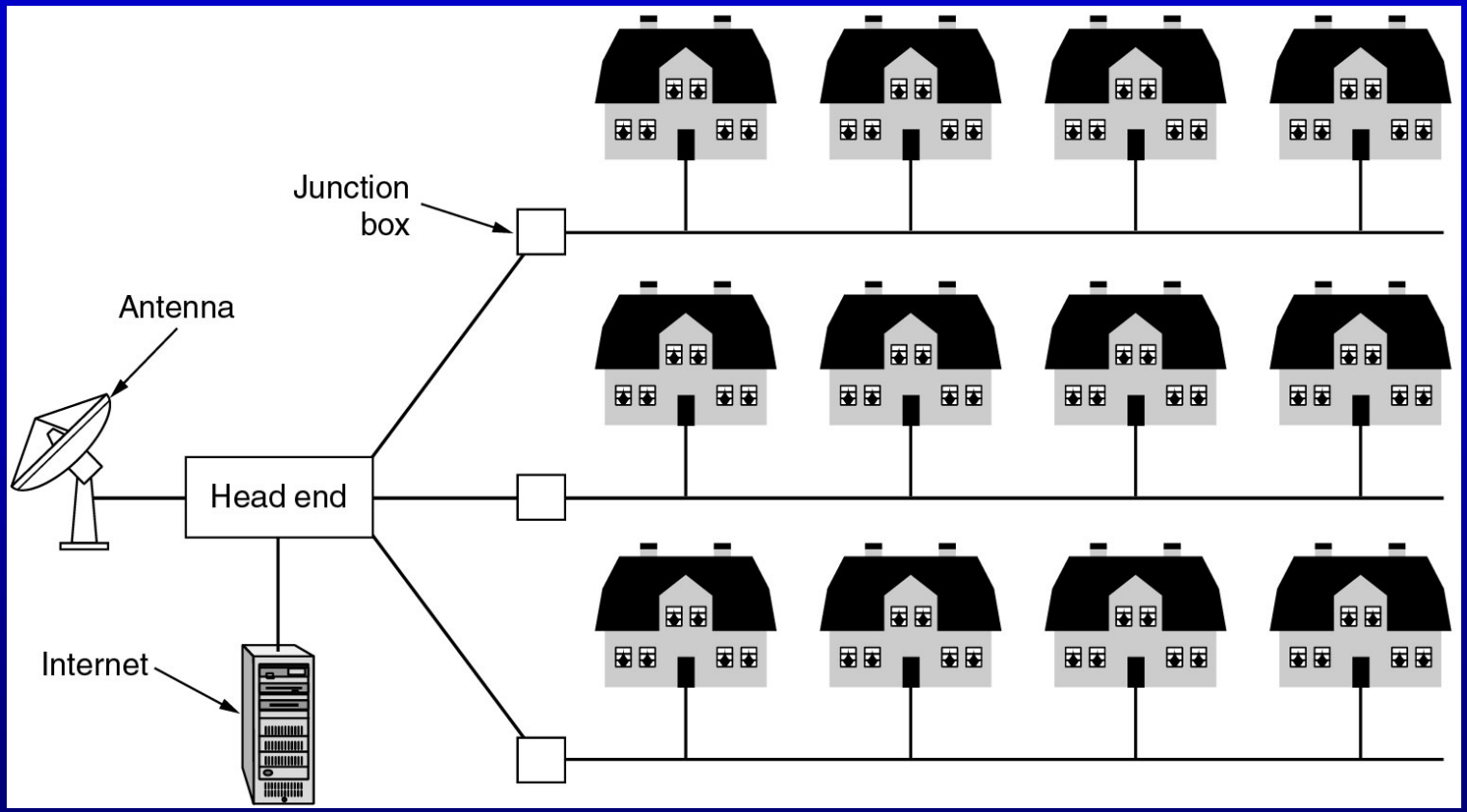
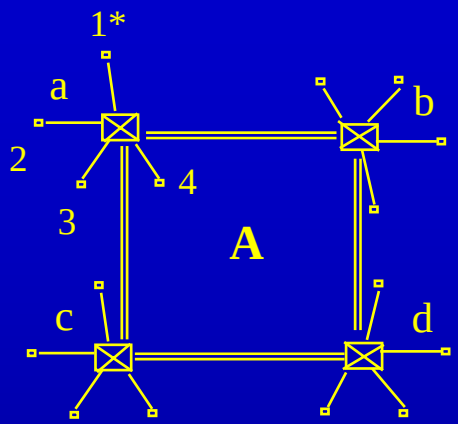


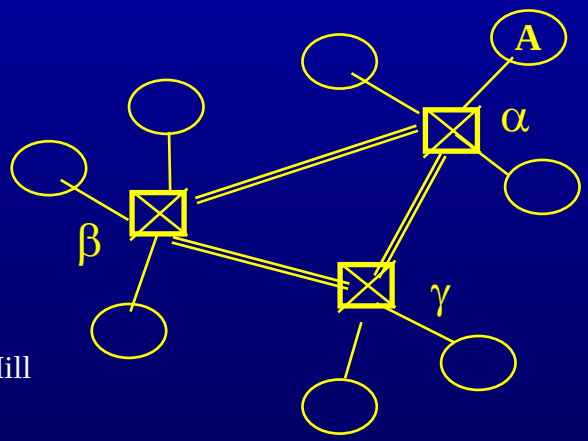
Figure 1-8. A metropolitan area network based on cable TV.

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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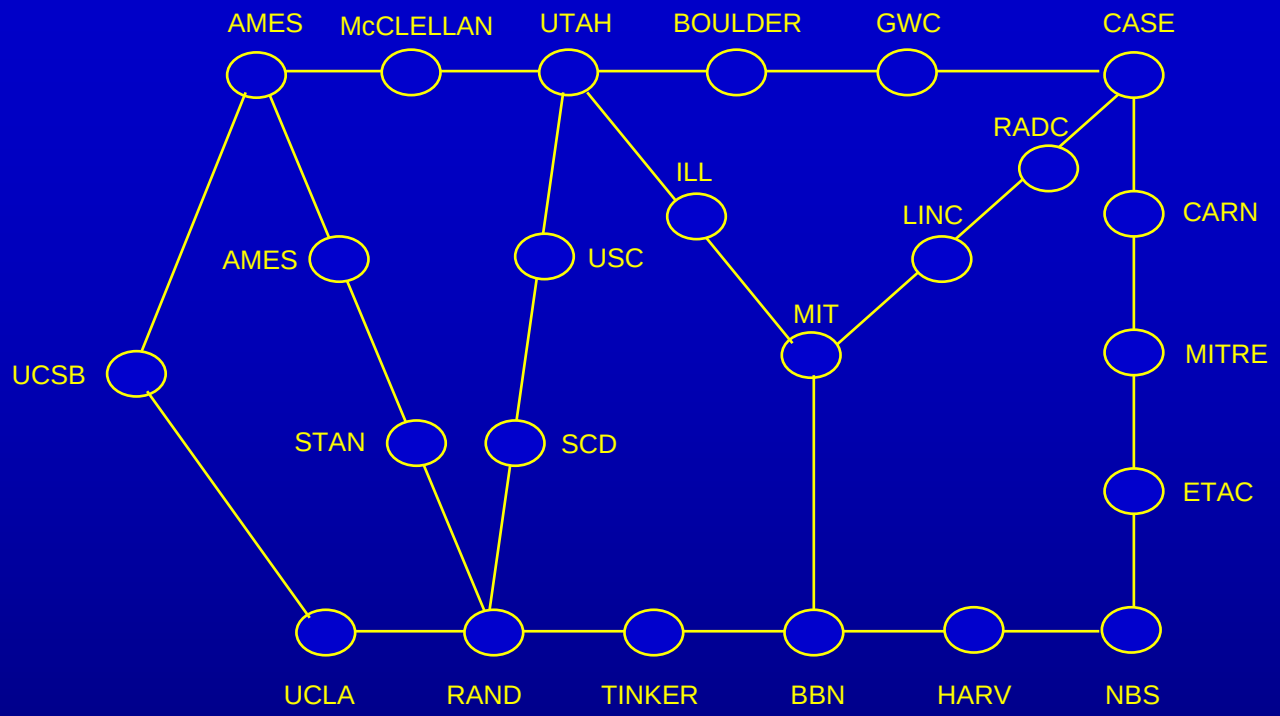
Figure 1.8

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)

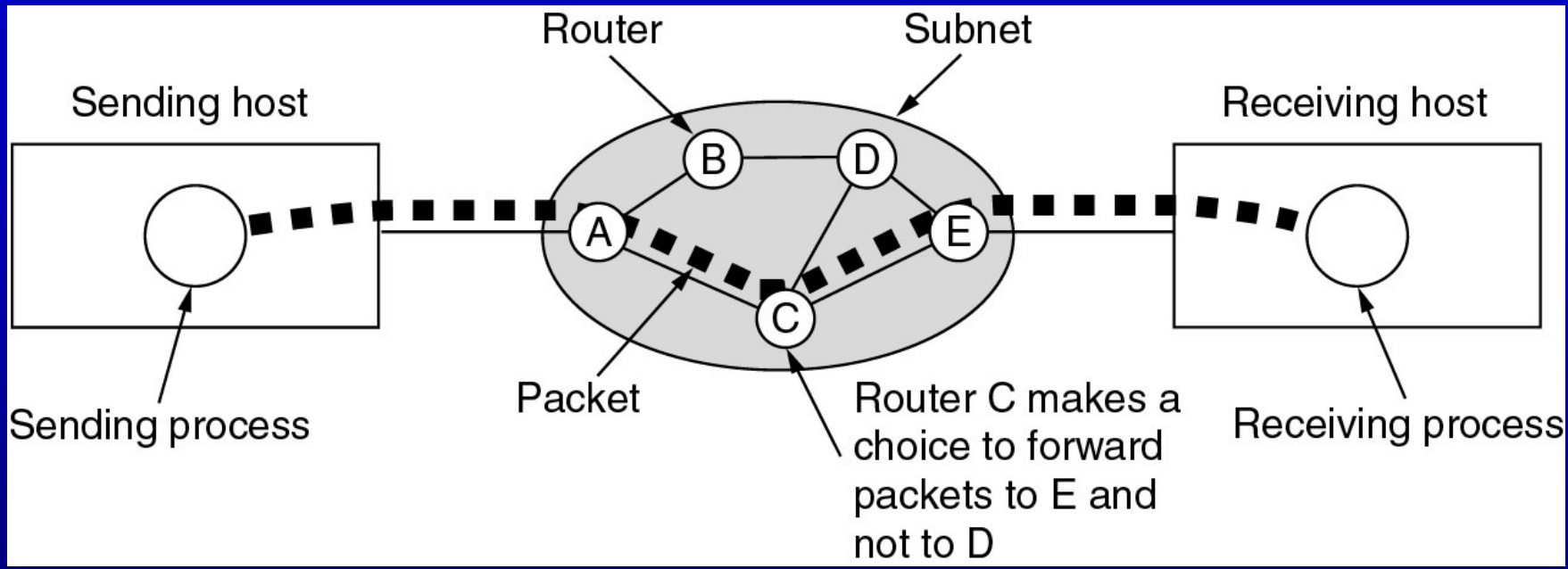
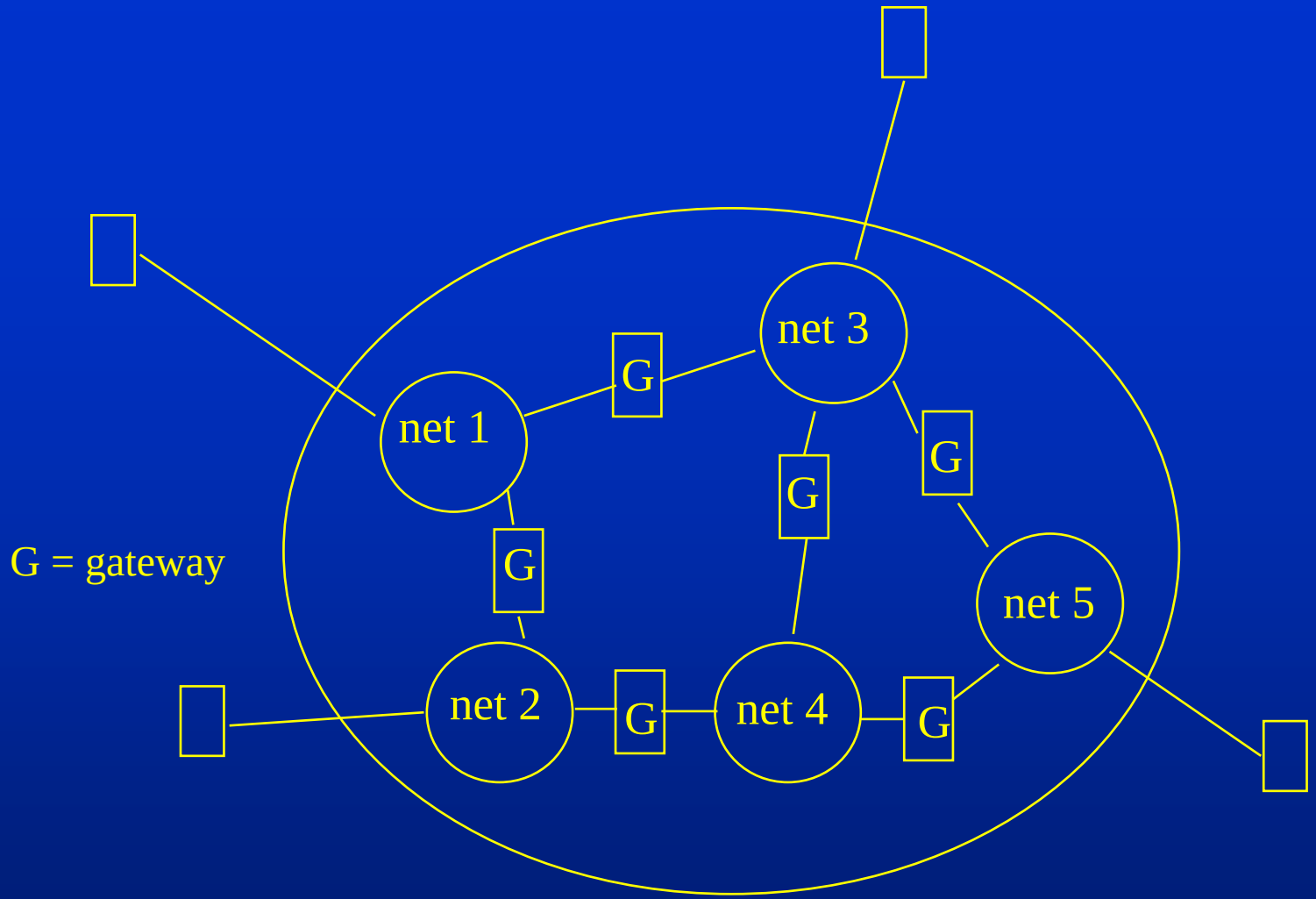


Figure 1-10.A stream of packets from sender to receiver.



internet - a network of networks

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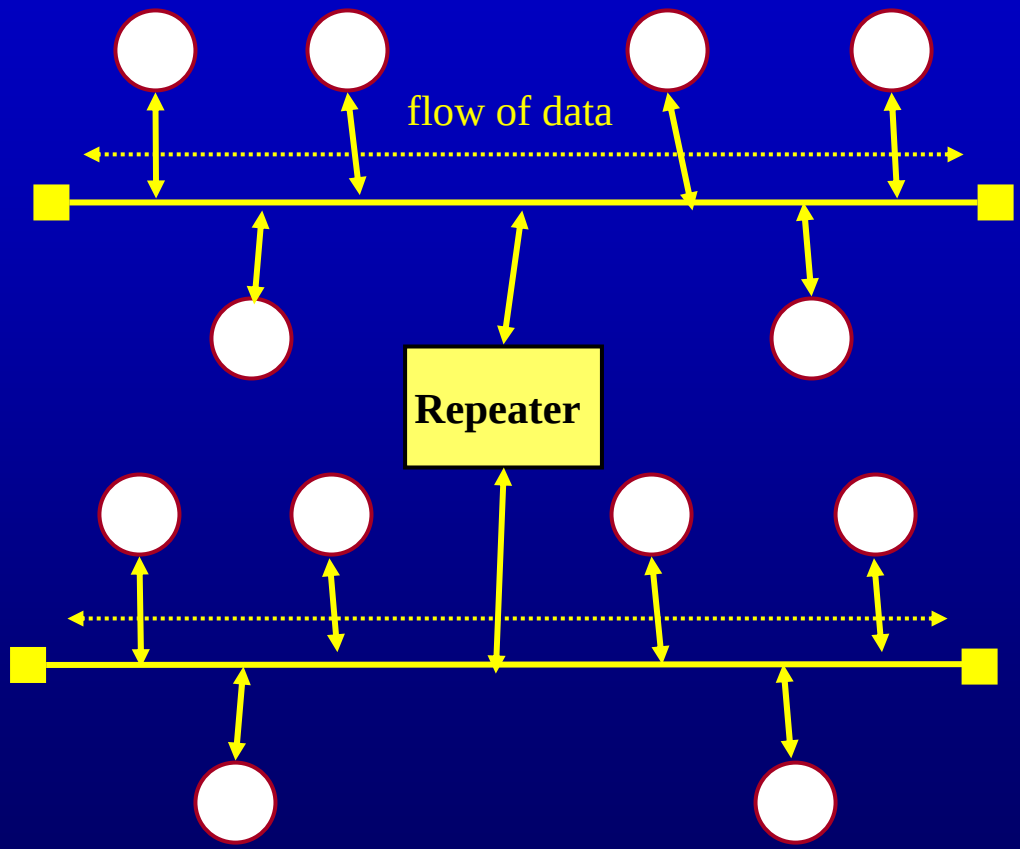
Figure 1.18

Network Classification by Topology

Bus

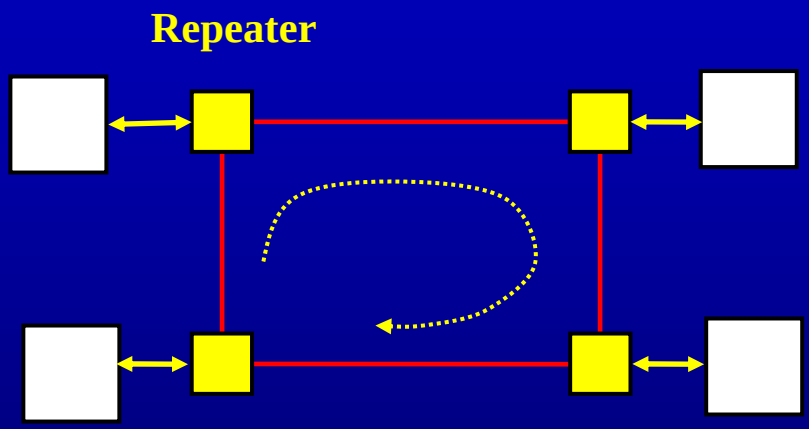


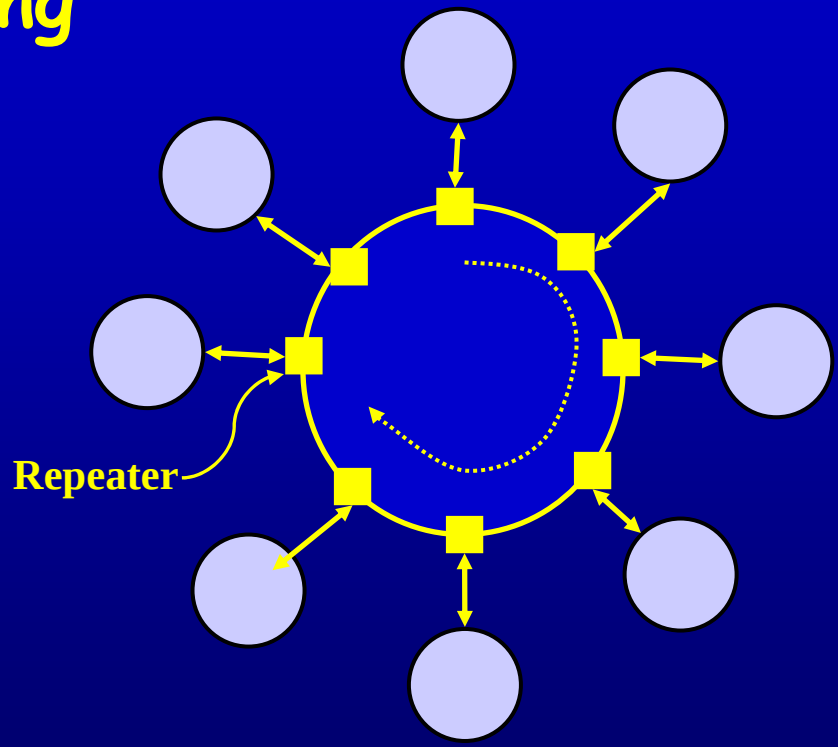
Bidirectional flow

assumes baseband cable

Network Classification by Topology

Ring

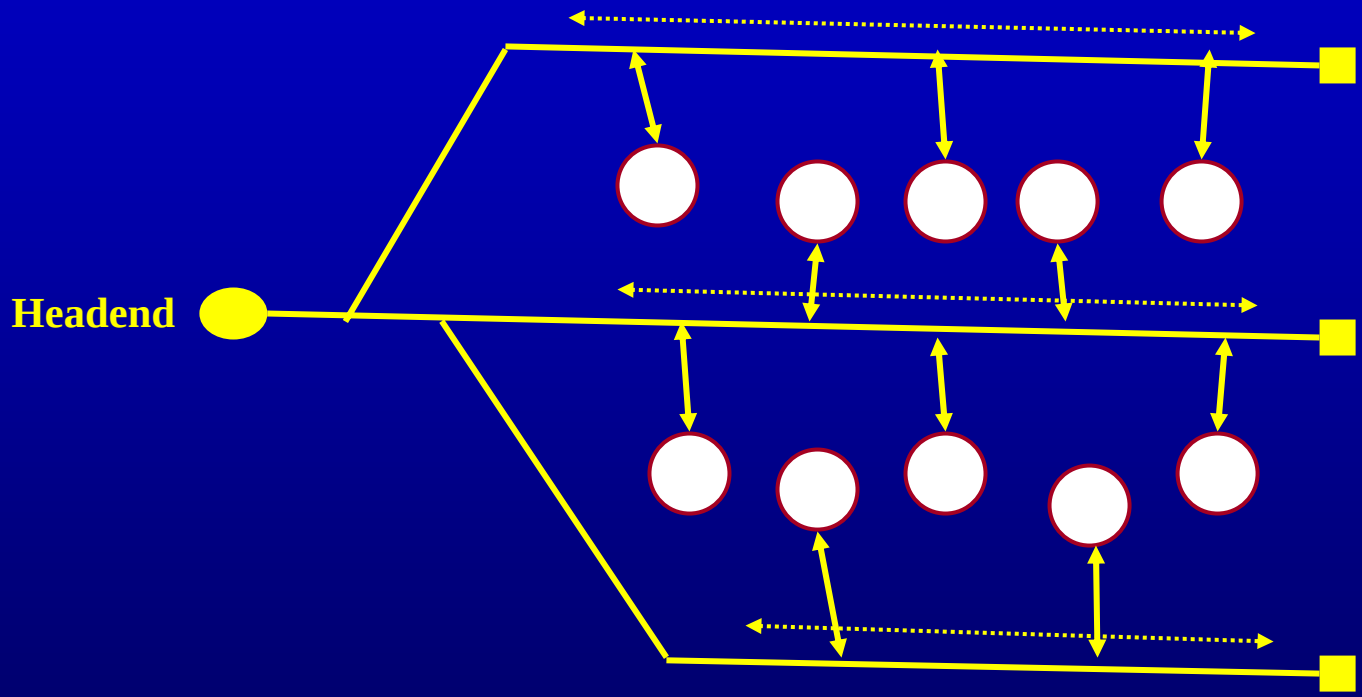




Note - *a ring implies <u>unidirectional</u> flow*

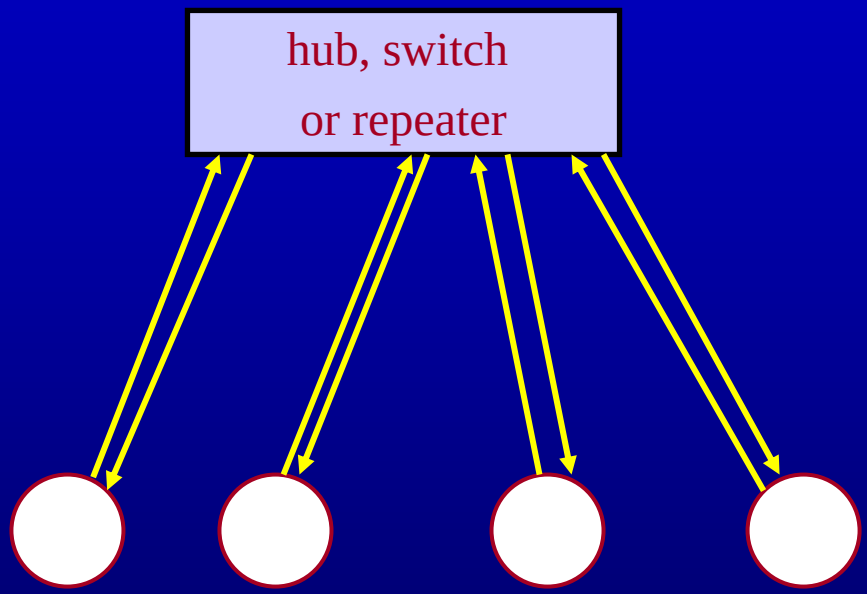
Network Classification by Topology

Tree



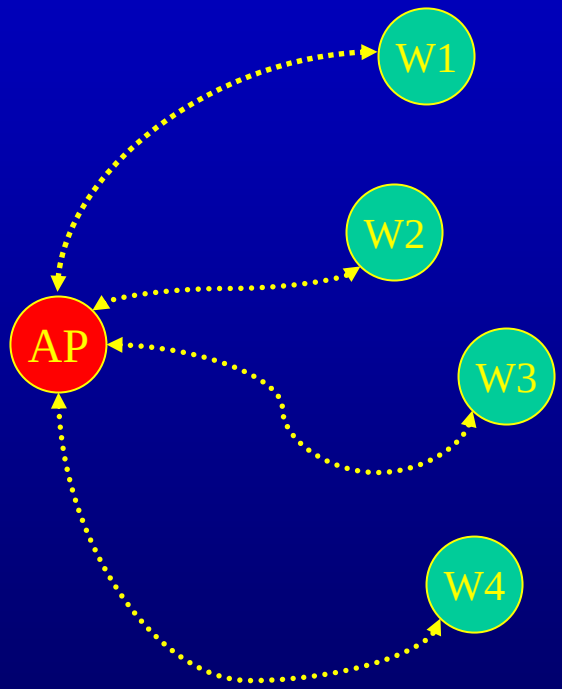
Network Classification by Topology

Star



Network Classification by Topology

Star



Wireless Infrastructure