

CS4514 Computer Networks

Term B05

Professor Bob Kinicki



Course Objectives

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 expose students to emerging technologies and their potential impact.



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 clarify network terminology.



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

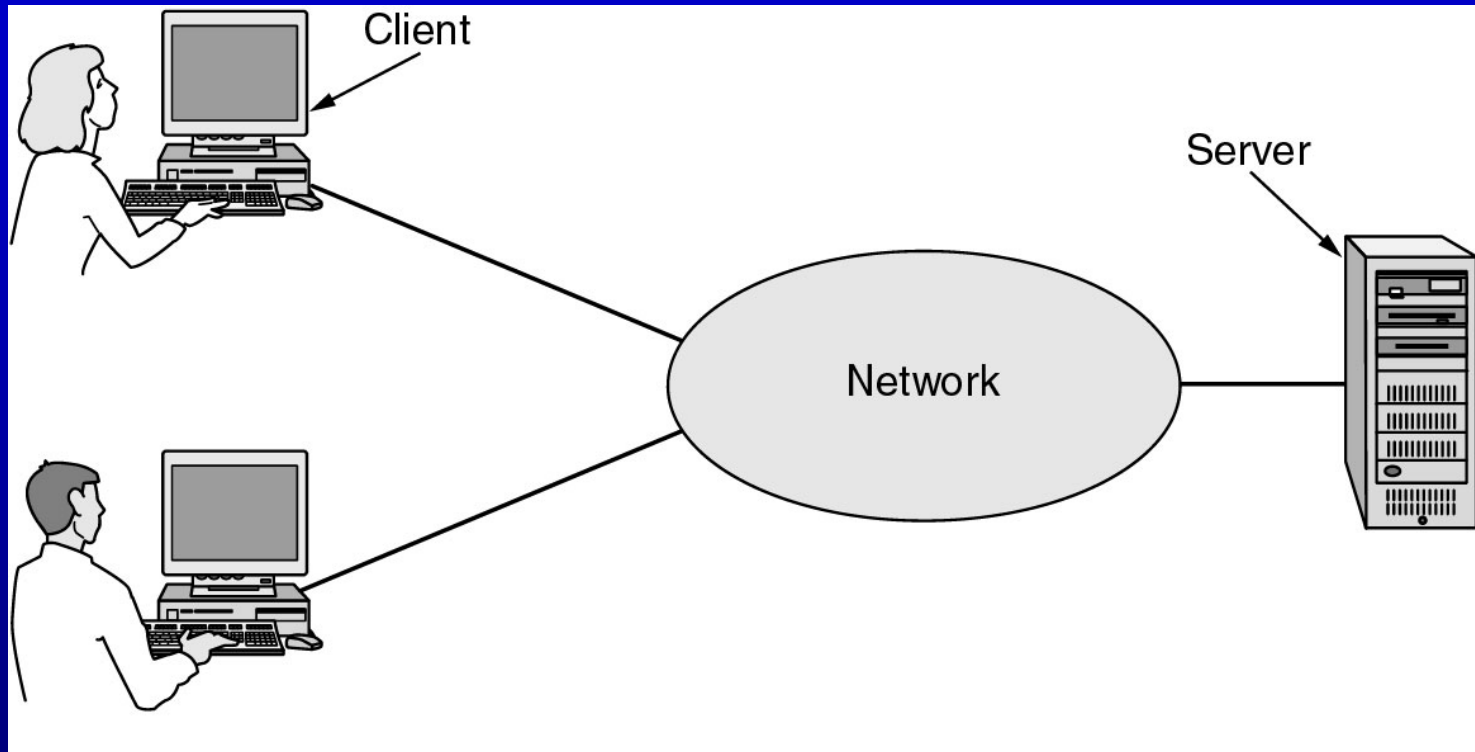


Figure 1.1 A network with two clients and one server.

Client-Server Model

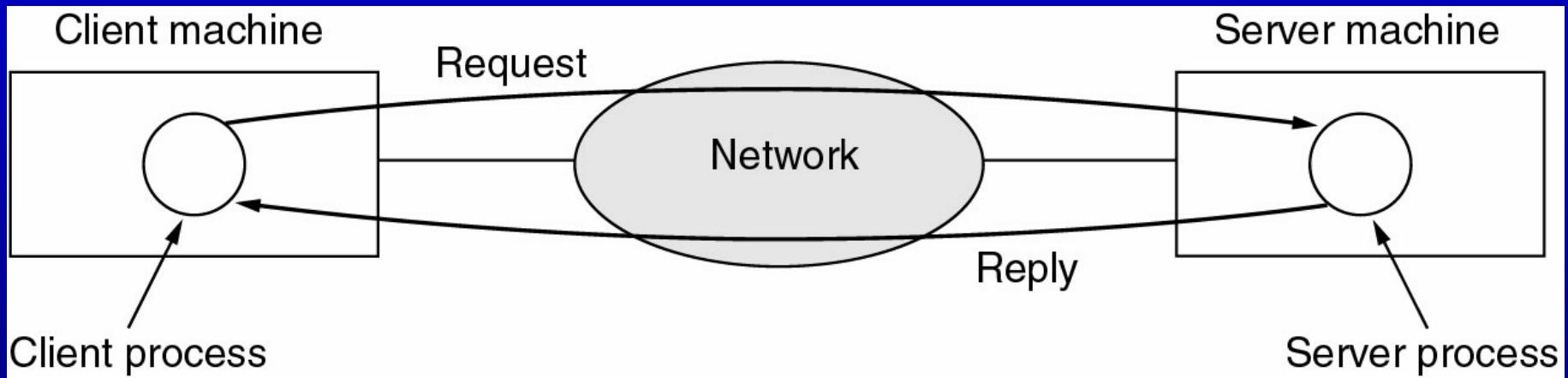


Figure 1-2. The client-server model involves requests and replies.

Peer-to-Peer Applications

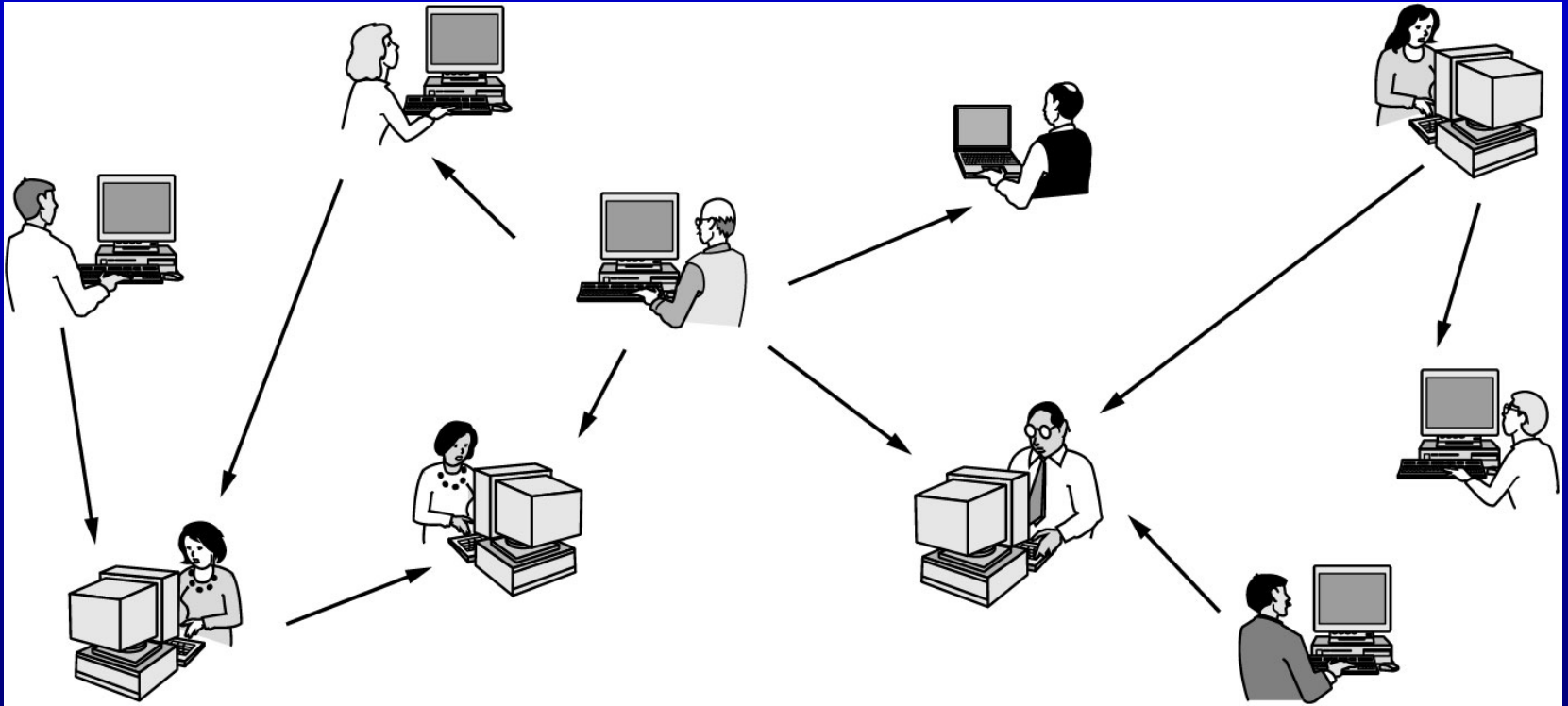
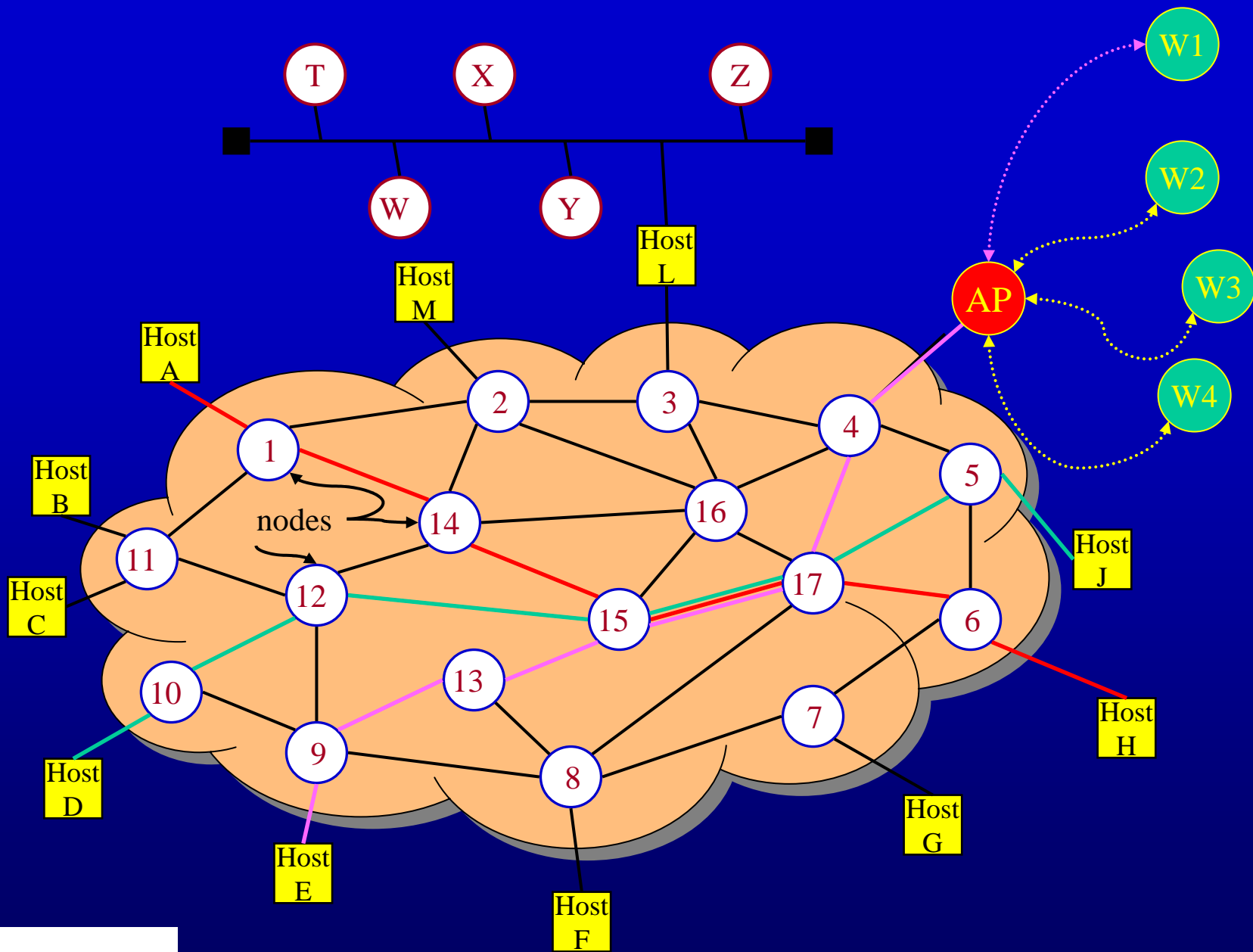


Figure 1.3 In a peer-to-peer system there are no fixed clients and servers.

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.



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	
100 m	Building	
1 km	Campus	Local area network
10 km	City	
100 km	Country	Metropolitan area network
1000 km	Continent	
10,000 km	Planet	Wide area network
		The Internet

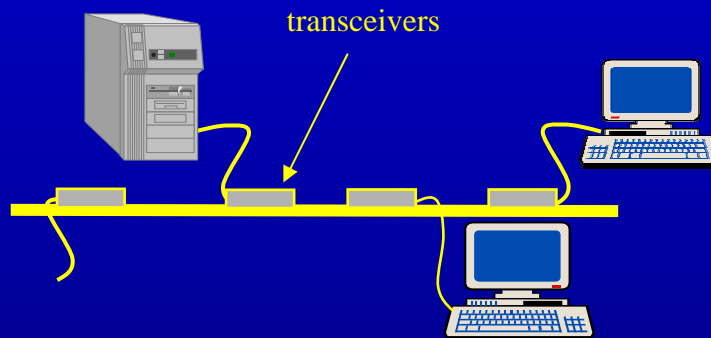
Figure 1-6. Classification of interconnected processors by scale.

Network Classification by Size

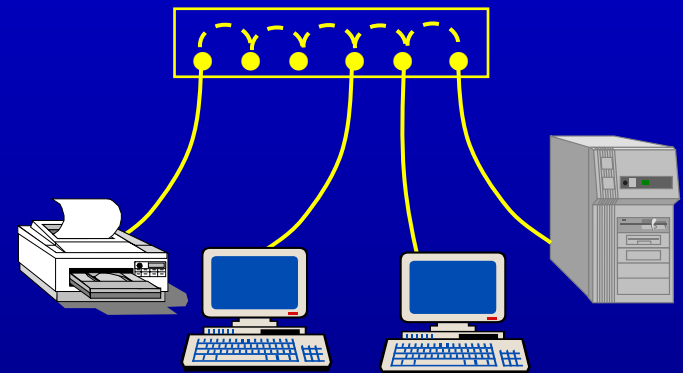
- LANs {Local Area Networks}
 - Wired LANs: typically physically broadcast at the MAC layer (e.g., Ethernet, Token Ring)
 - Wireless LANs
- MANs {Metropolitan Area Networks}
 - campus networks connecting LANs logically or physically.
 - often have a backbone (e.g., FDDI and ATM)



Wired LANs



Ethernet bus



Ethernet hub

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Networks*

Figure 1.17

Wireless LANs

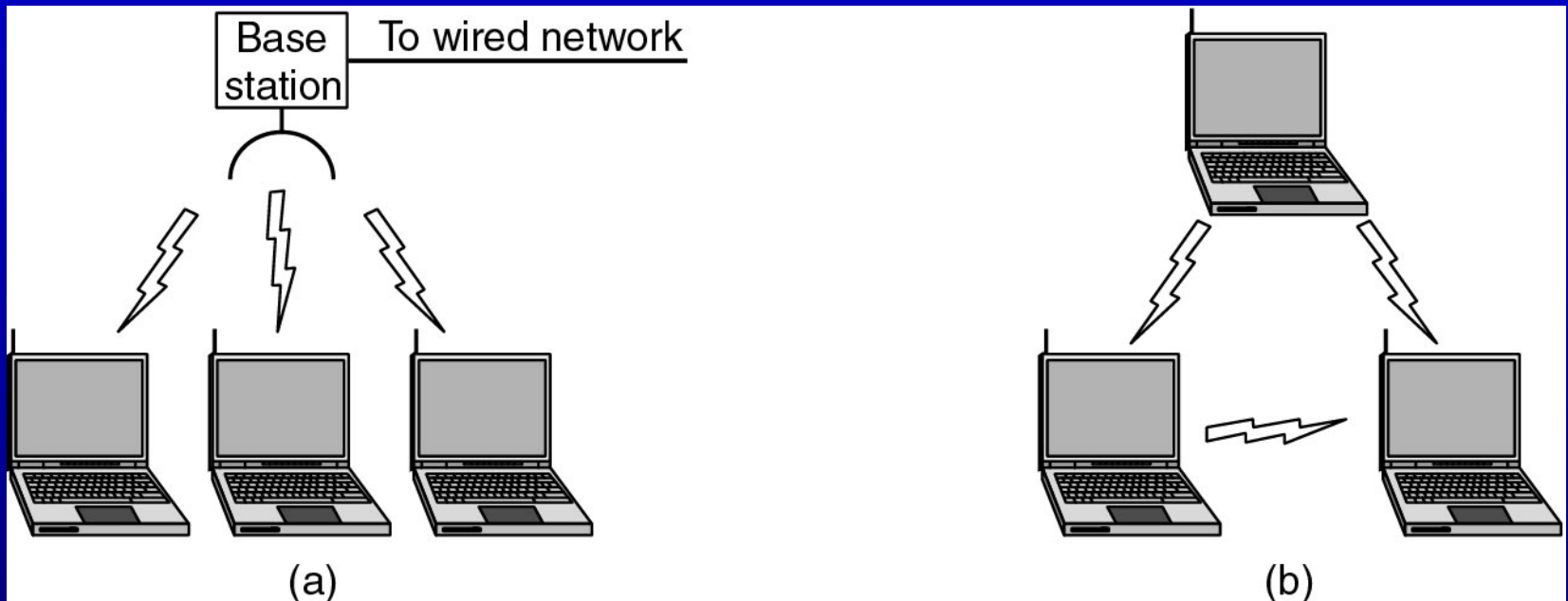


Figure 1-35. (a) Wireless networking with a base station. (b) Ad hoc networking.

Metropolitan Area Networks

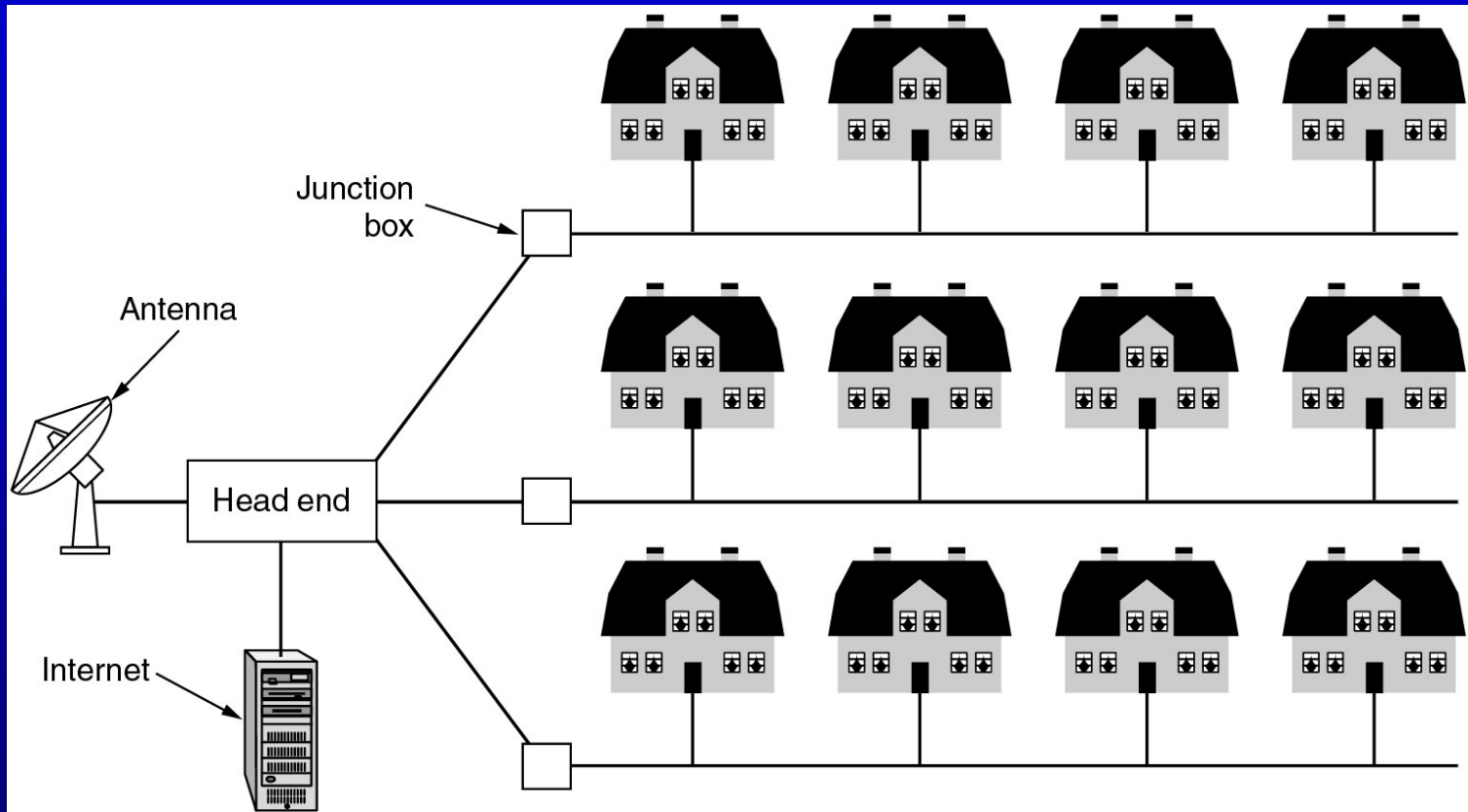
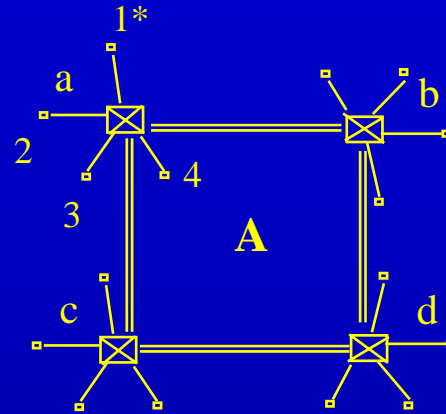


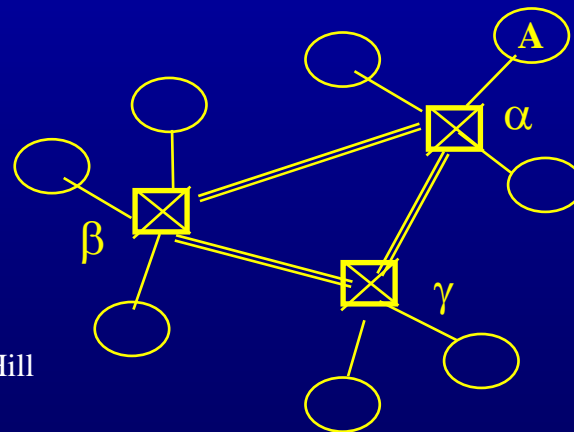
Figure 1-8. A metropolitan area network based on cable TV.

MAN



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

Hierarchical Network Topology



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

Metropolitan network **A** is part of regional subnetwork α .

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Figure 1.8

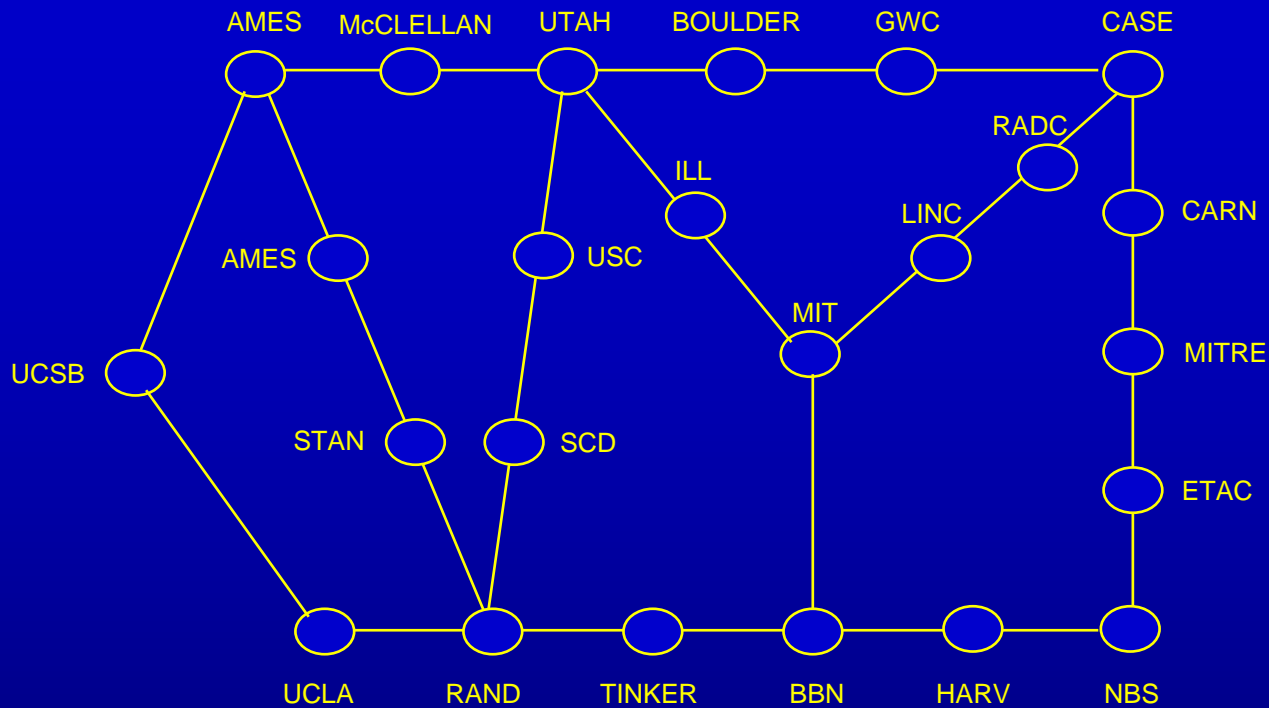
Networks: Introduction



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)

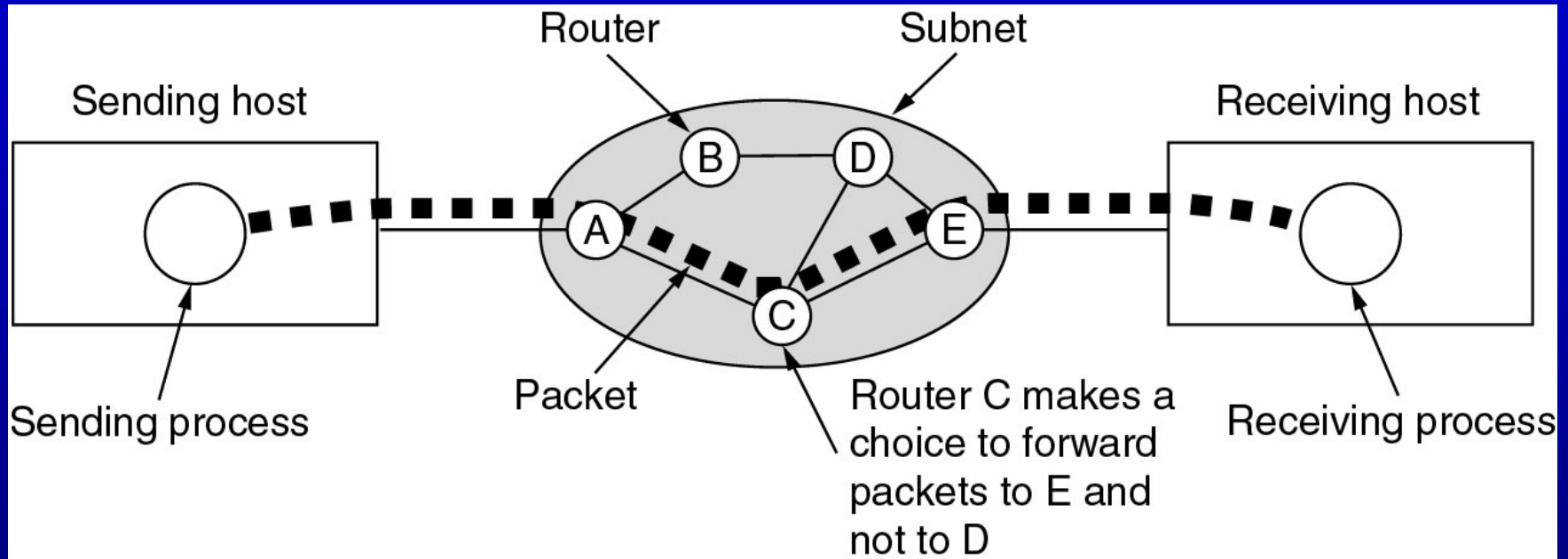
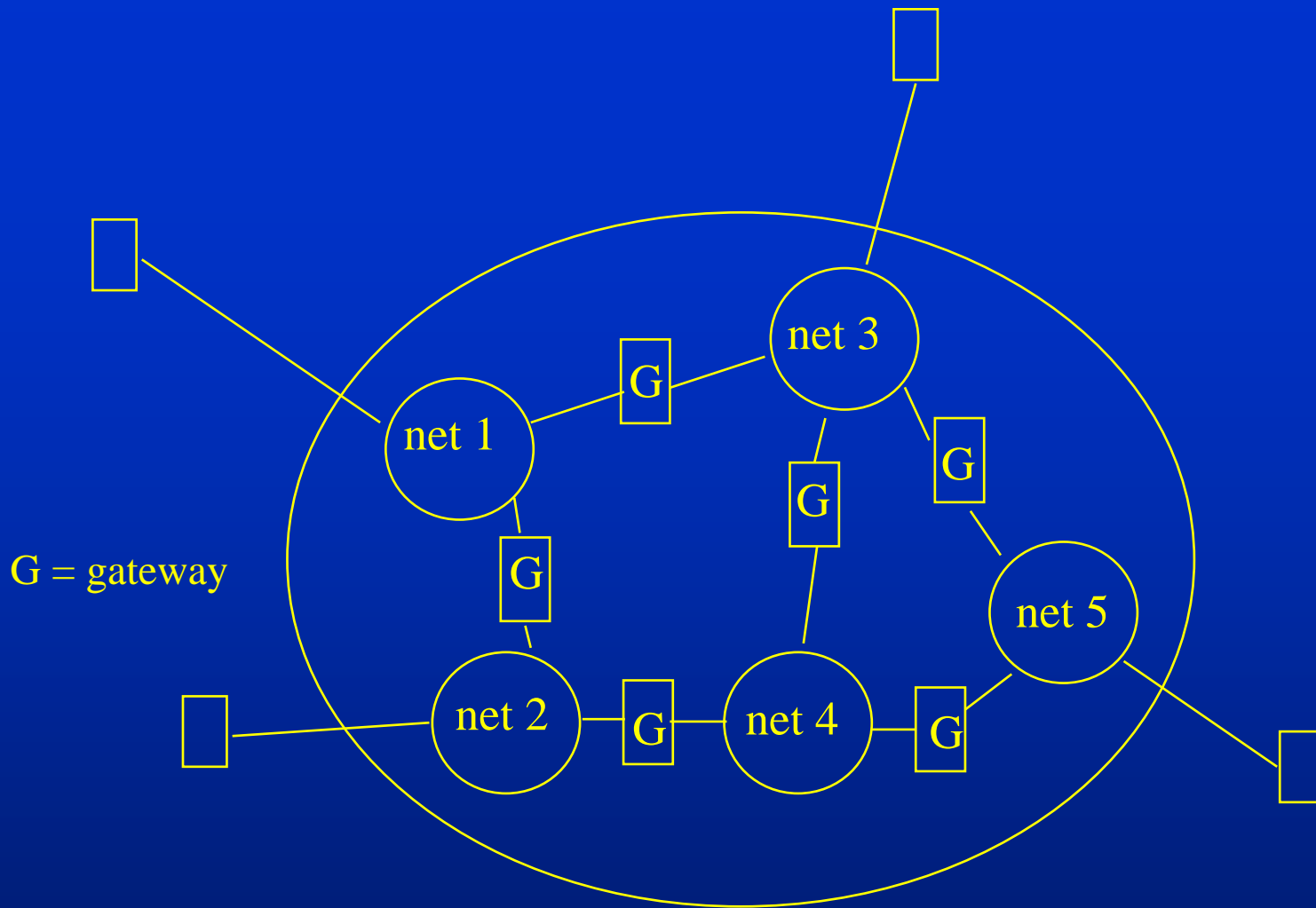


Figure 1-10. A stream of packets from sender to receiver.



internet - a network of networks

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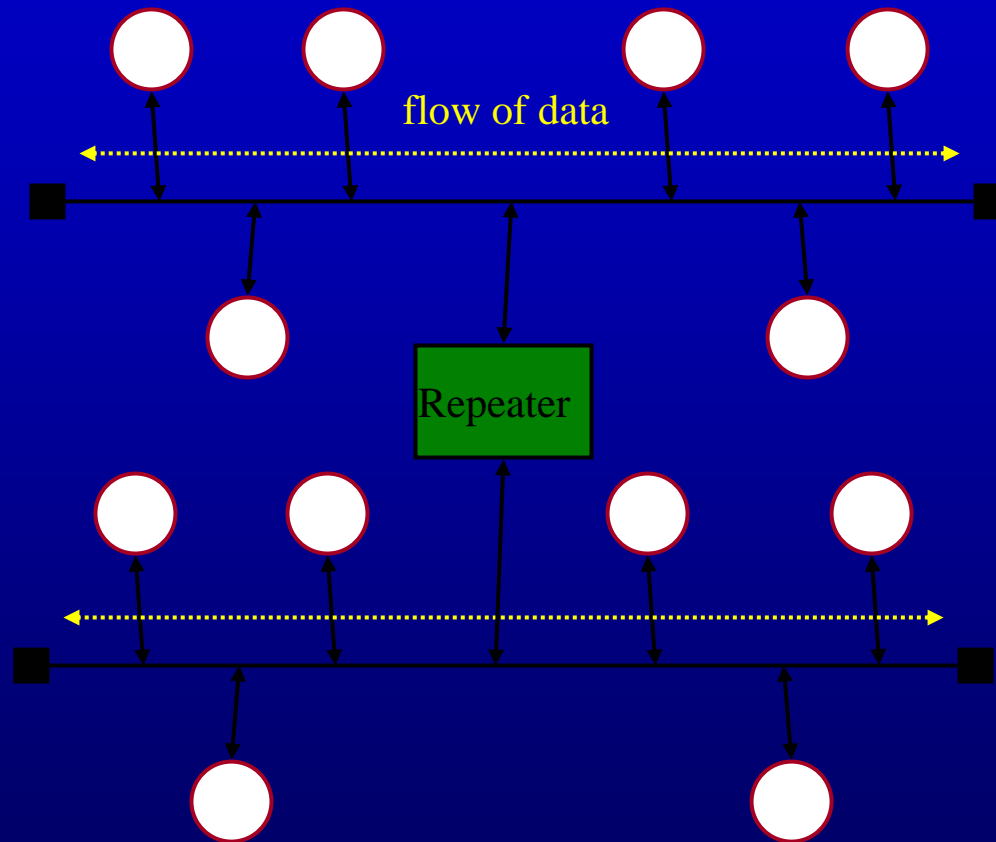
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Figure 1.18



Network Classification by Topology

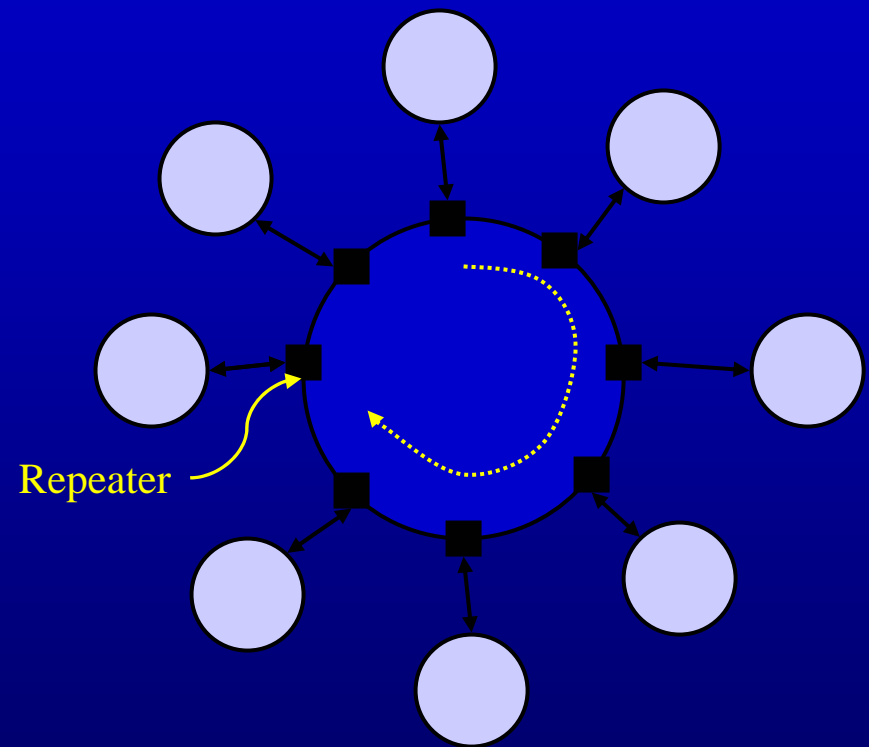
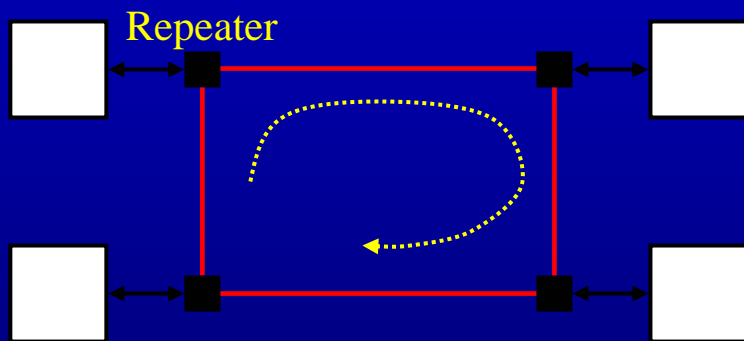
Bus



*Bidirectional flow
assumes baseband cable*

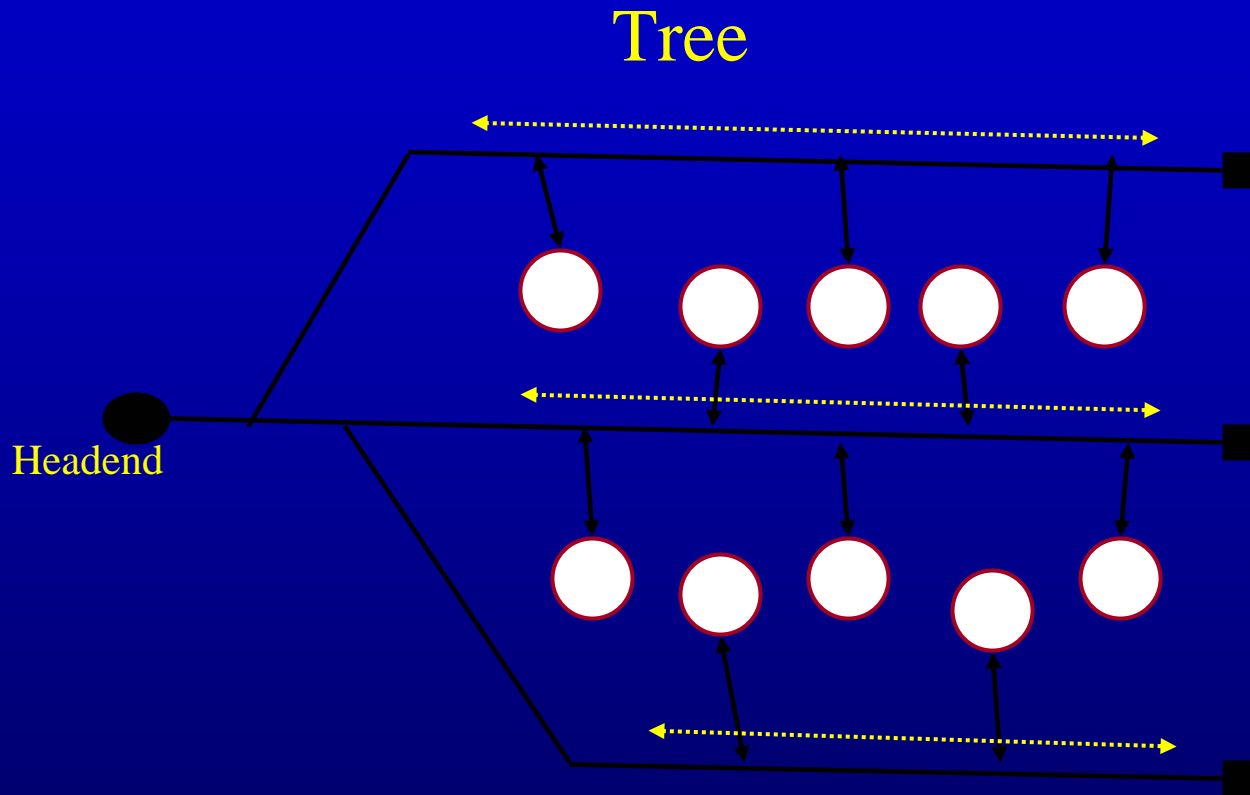
Network Classification by Topology

Ring



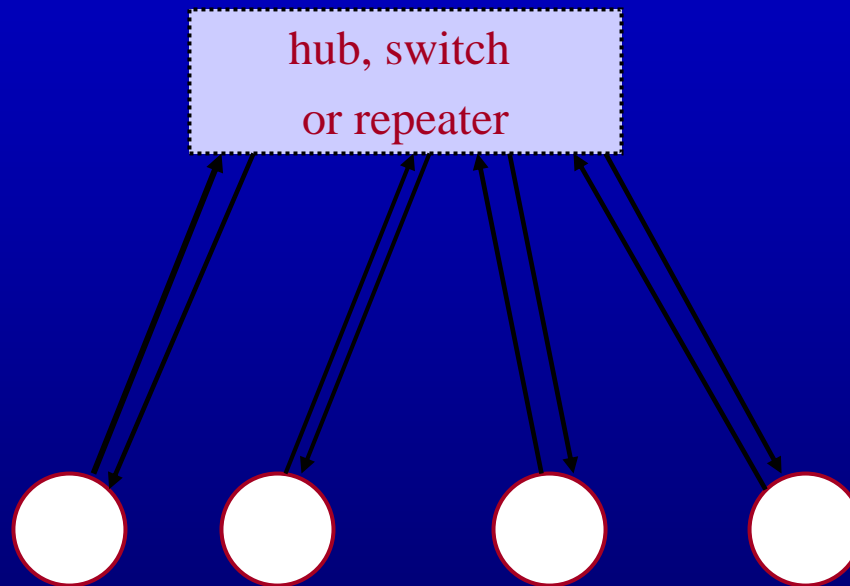
Note - a ring implies unidirectional flow

Network Classification by Topology



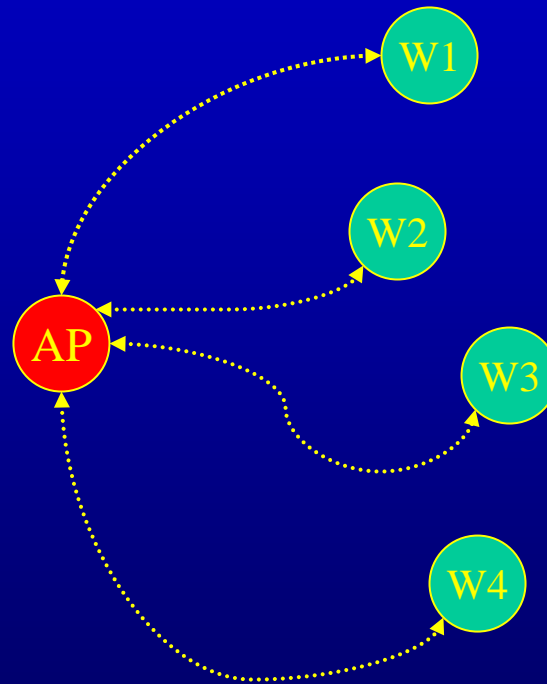
Network Classification by Topology

Star



Network Classification by Topology

Star



Wireless Infrastructure