

Internetworking

(September 13, 2016)

Learning Objectives

2

- Understand reasons for internetworking
- Describe types of LANs based on access methods
- Distinguish between internetworking devices

Internetworking ?

3

- Connecting separate networks using internetworking devices (bridges, routers, hubs, switches, etc.)
- Reasons for internetworking:
 - LAN performance decrease due to growth => Break & Interconnect
 - Need to access resources available on another network
 - Need to share software & hardware between networks
- Will focus on
 - Interconnecting LANs to LANs
 - Interconnecting LANs to WANs



Different kinds of LANs

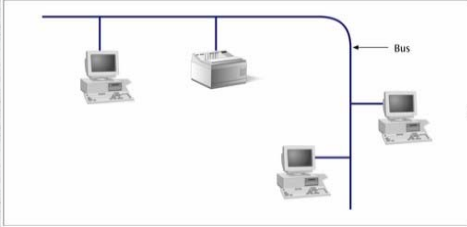
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- In terms of their topology (logical design -How data moves around the network from station to station):
 - Bus topology
 - Star-Bus topology ★
 - Ring topology

Bus topology

5

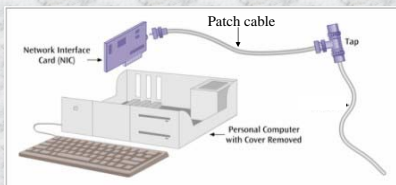
Usually, use a linear coaxial cable (called a BUS) that multiple devices or workstations tap into.



Bus topology

6

- Connecting to the BUS cable requires:
 - a patch cable, and
 - a simple device called a Tap (a passive device).



Star-Bus topology

7



- Most popular topology for LANs
- Looks physically like a star, but acts logically like a bus
- Star design built around a central collection device called Hub or Switch. All workstations attach to hub/Switch

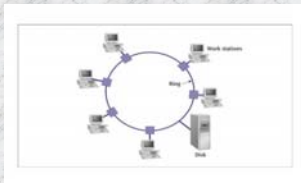


Ring topology

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- Circular connection of workstations
- One channel of information
- Information flows in one direction around the ring

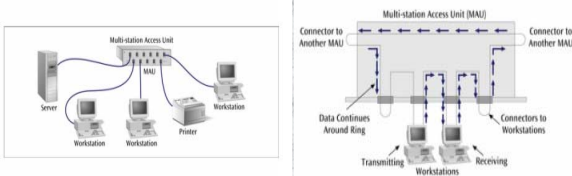


Ring topology

9



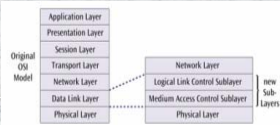
- Implemented using a (physical) star design.
- Star design built around a central collection point called a MAU (Multistation Access Unit)
- MAU passes the signal around in a ring fashion (logical ring)



Media Access Control Protocols used in LANs

10

- Ethernet or CSMA/CD ★
 - Most common form of LAN today.
 - Star-Bus is most common topology
 - Many standards (10Base2, 100BaseT, 1000BaseT, etc.)
- Token Ring ★
 - For LAN that use Ring topology
 - Offered at speeds of 4, 16 Mbps.
 - More expensive components than CSMA/CD
 - Losing ground quickly to CSMA/CD.



Why Ethernet and Token ring?

11

- Created to answer two questions:
 - How to identify sending & receiving computers in LANs?
 - Which computer should send? At what time?
- Ethernet answer:
 - Adding Sender's & Receiver's MAC address to packets
 - Implement a rule known as CSMA/CD
- Token ring answer:
 - Adding Sender's & Receiver's MAC address to packets
 - Implement a *Token passing* method:
 - a single token circulates in the ring.
 - Only the computer that gets the token will send.

Carrier Sense Multiple Access / Collision Detection
- All computers ("carriers") listen ("sense") for traffic on the LAN
- If no traffic, computer that wishes to transmit may transmit
- If collision occurs, computers must wait a random amount of time
- The computer with smallest random number send again first.

Internetworking

12

- Need to connect Networks using different protocols
 - e.g.: Ethernet LANs and Token Ring LANs
 - e.g.: LANs (Ethernet or Token Ring) and WANs
- Need to connect Networks using same protocols
- Need to break a LAN into segments to relieve traffic congestion

Internetworking

13

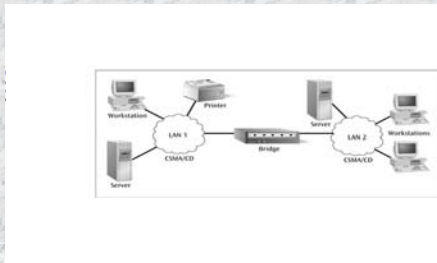
- Categories of devices used to interconnect networks:
 - Bridges
 - Routers
 - Hubs
 - Switches



Bridges

14

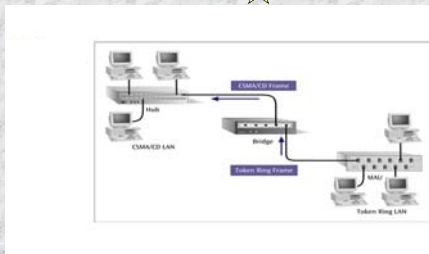
- A bridge can be used to connect two similar LANs, such as two CSMA/CD LANs or two Token ring LANs



Bridges

15

- A bridge can also be used to connect a CSMA/CD LAN and a Token Ring LAN



How Bridges operate ?

16

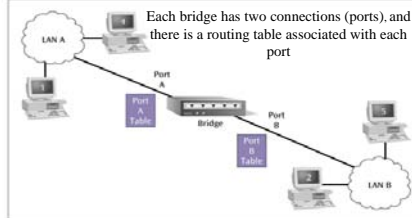
- The answer depends on the type of bridge.
- Three basic types:
 - Transparent Bridges
 - Source-routing Bridges ★
 - Remote Bridges

Transparent Bridges

17

- A transparent bridge is found with CSMA/CD LANs (Filtering & Forwarding functions).

Figure 7-10
A bridge interconnecting two CSMA/CD networks has two internal port tables



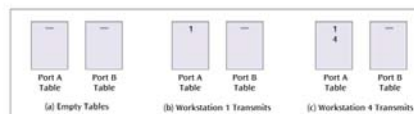
The transparent bridge observes all traffic and builds routing tables from this observation (This observation is called **Backward learning**)

A transparent Bridge

18

- Observes each frame that arrives at a port
- Extracts the source address from the frame
- Places that address in the port's routing table.

Figure 7-10
Two internal port tables and their new entries



Recap: Transparent Bridges ★★

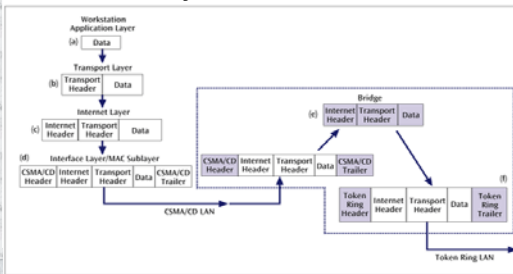
19

- A transparent bridge observes all traffic and builds routing tables from this observation.
- This observation is called **Backward learning**.
- Each bridge has two connections (ports) and there is a routing table associated with each port.
- A bridge observes each frame that arrives at a port, extracts the source address from the frame, and places that address in the port's routing table.

Transparent Bridges

20

- A transparent bridge can connect a CSMA/CD to a Token Ring LAN
 - Convert one frame format to another
 - Forward frames
 - Filtering



Summary Questions

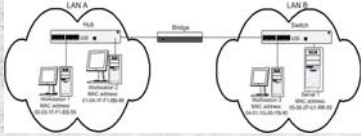
21

1. Name the two most known Medium Access Control protocols found in LANs. How they differ?
2. (a) What are the primary reasons for internetworking two or more networks? (b) What are the basic functions of a bridge?
3. How does a Transparent bridge operate?
4. Exercise # 34 on page 244 of book.

Summary Questions

22

- Consider the local area network shown below



Suppose that the only traffic generated on the network since it has been physically set up is as follow:

- Workstation 1 has sent a message to workstation 3
- Workstation 2 has sent a message to Server 1
- Server 1 has sent a message to workstation 3

What would be the content of the bridging tables?

Port A Table

Port B Table

Summary Questions (Cont)

23

- Now, suppose that Workstation 1 sends another message. This time the message is sent to Workstation 2. What would happen? (Circle all correct answers)
 - The hub will send a copy of the message to the bridge
 - The bridge will forward the message to the switch
 - The switch will discard the received message
 - The bridge will check its Port A bridging table and will discard the received message.

Ethernet

24

- Uses CSMA/CD access method for data transmission on a network
- CSMA/CD* :
 - 1) All computers ("carriers") listen ("sense") for traffic on the LAN
 - 2) If no traffic, computer that wishes to transmit may transmit
 - 3) If collision occurs, computers must wait a random amount of time
 - 4) The computer with smallest random number send again first.

* Carrier Sense Multiple Access with Collision Detection
