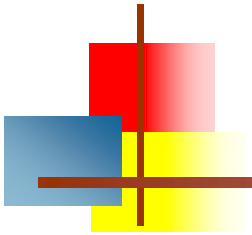
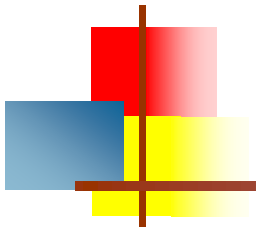


Introduction to Networks & Distributed Computing
CECS 327



Interconnection Devices

Interconnection Devices

Repeaters, Hubs, Bridges, Switches & Routers

for LANs, MANs & WANs

Interconnection Devices

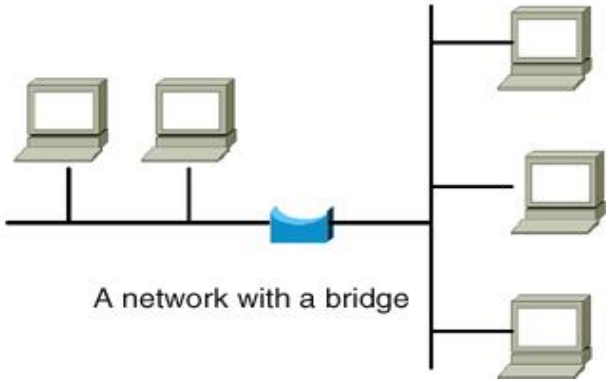
Bridges & Switches

A **bridge** is a network interconnection device (with only two interfaces) that forwards frames coming in from an interface to the outgoing interface corresponding to the MAC destination address in the frame.

A bridge:

- Is a hardware device.
- Connects two LAN segments.
- Forwards frames.
- Does not forward noise or collisions from the incoming connection.
- Learns addresses and filters frames based on those addresses.
- It's a data link layer device.

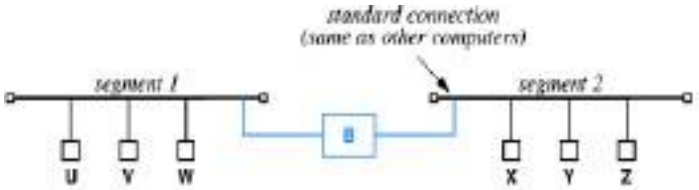
A **bridge** is used to connect two local-area networks (LANs) of the same type.



Interconnection Devices

More about Bridges:

- Bridge uses source address to learn location of computers
- Learning is completely automated



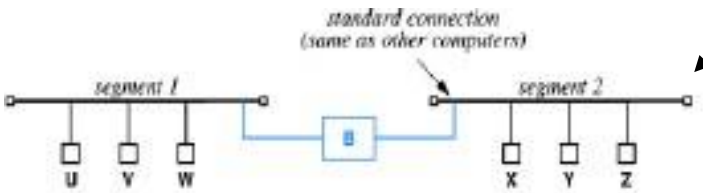
Event	Segment 1 List	Segment 2 List
Bridge boots	–	–
U sends to V	U	–
V sends to U	U, V	–
Z broadcasts	U, V	Z
Y sends to V	U, V	Z, Y
Y sends to X	U, V	Z, Y
X sends to W	U, V	Z, Y, X
W sends to Z	U, V, W	Z, Y, X

Interconnection Devices

More about Bridges:

- Bridge uses source address to learn location of computers
- Learning is completely automated

How many collisions are in here?



Event	Segment 1 List	Segment 2 List
Bridge boots	–	–
U sends to V	U	–
V sends to U	U, V	–
Z broadcasts	U, V	Z
Y sends to V	U, V	Z, Y
Y sends to X	U, V	Z, Y
X sends to W	U, V	Z, Y, X
W sends to Z	U, V, W	Z, Y, X

Interconnection Devices - Switch

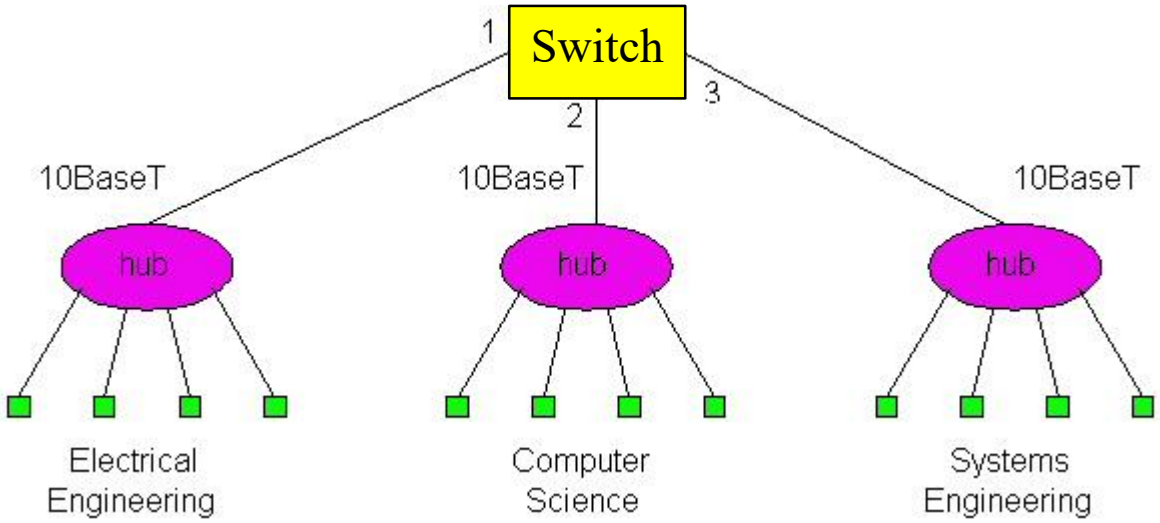
A **switch** is a network interconnection device (with multiple interfaces) that accepts a frame from an interface and forwards the frame to the interface corresponding to the MAC destination address in the frame.

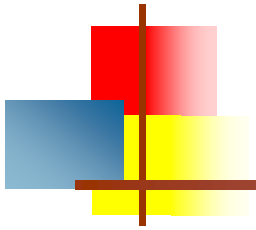
A **switch**:

- Is physically similar to a hub.
- Is logically similar to a bridge.
- It's a data link layer device.
- Operates on frames and it's able to understands MAC addresses.
- Only forwards frames when necessary.
- Is able to isolates collision domains since it buffers frames (Max Throughput)
- allow separate pairs of computers to communicate at the same time.
- Can be used in heavily loaded networks to isolate data flow and improve performance.

Switches are the Layer 2 Ethernet device of choice.

Interconnection Devices - Switch





Interconnection Devices - Switch

Switch: frame filtering, forwarding:

- Switch filter frames
  - same-LAN -segment frames not forwarded onto other LAN segments.
- forwarding:
  - how to know on which LAN segment to forward frame?
  - Switch learn which hosts can be reached through which interfaces (maintain forwarding tables).
  - when frame received, switch “learns” location of sender: incoming LAN segment
  - records sender location in forwarding table
- Forwarding table entry:
  - (Node LAN Address, Switch Interface, Time Stamp)
  - stale entries in Forwarding Table dropped (TTL can be 60 minutes)

Interconnection Devices - Switch

Switch procedure(in_MAC, in_port,out_MAC, out_port)

Set Forwarding table **(in_MAC)** to **in_port** /*learning*/

lookup in filtering table **(out_MAC)** receive **out_port**

if (out_port not exist) /* no entry found for destination */

then flood; */* forward on all but the interface on which the frame arrived*/*

if (in_port = out_port) /*destination is on LAN on which frame was received */

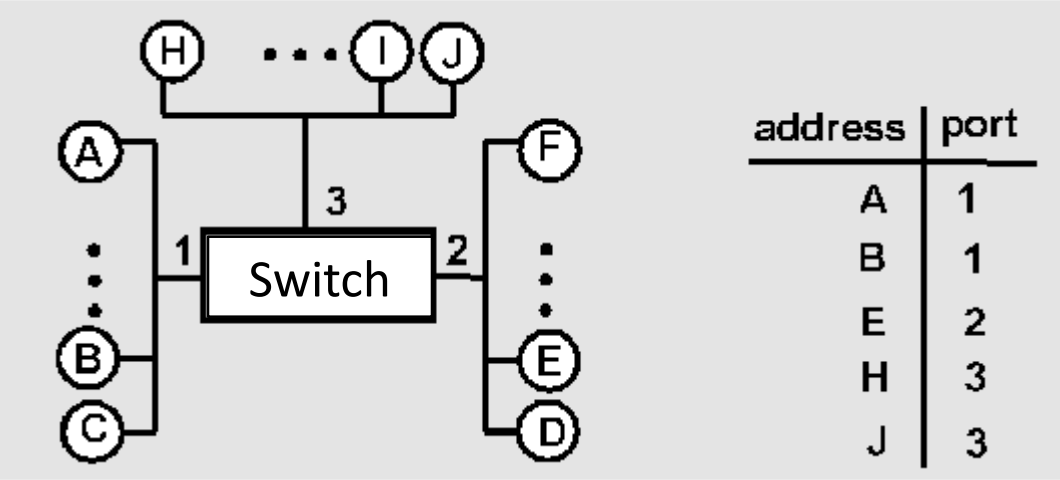
then drop the frame

Otherwise (out_port is exist) /*entry found for destination */

then forward the frame on the indicated interface

Interconnection Devices - Switch

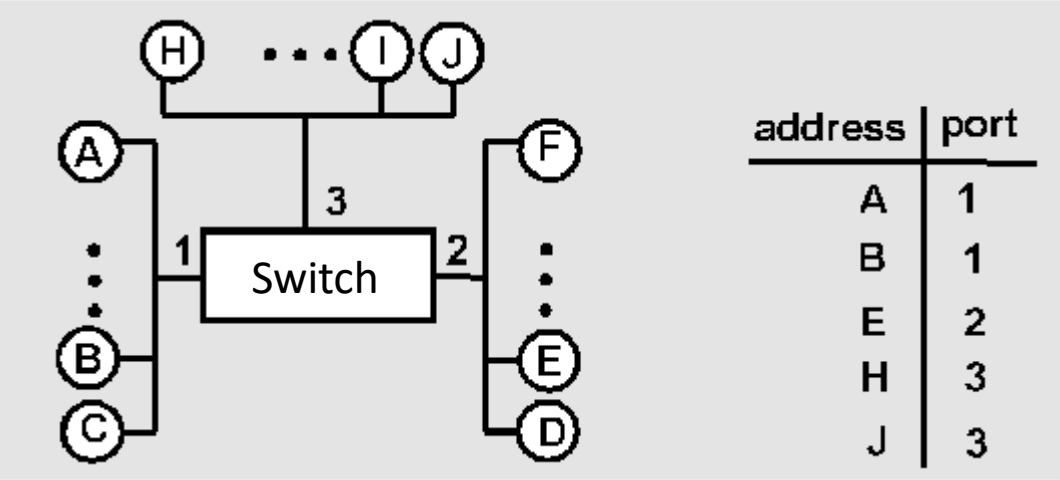
Switch Learning example:



What a switch should do if C wants to sends message to D an

Interconnection Devices - Switch

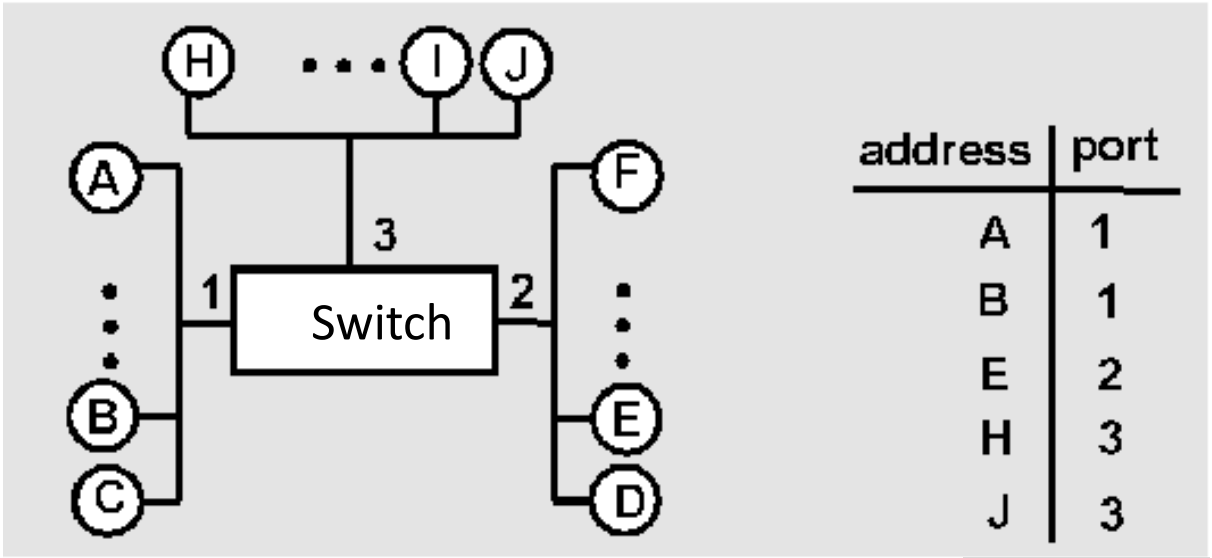
Switch Learning example:



address	port
A	1
B	1
E	2
H	3
J	3

- C sends frame, switch has no info about D, so floods to both LANs
  - Switch notes that C is on port 1
  - frame ignored on upper LAN
  - frame received by D

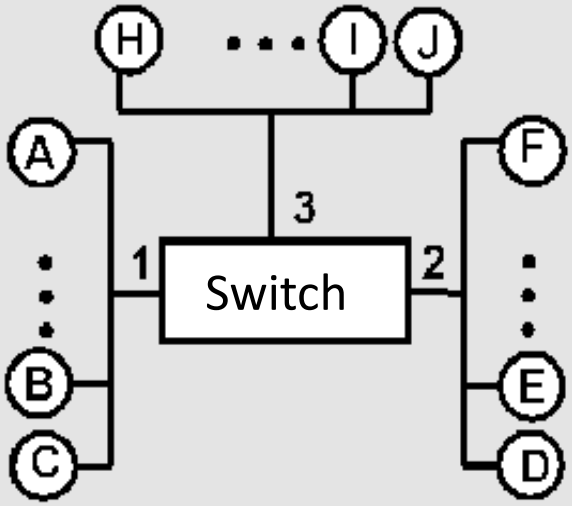
Interconnection Devices - Switch



address	port
A	1
B	1
E	2
H	3
J	3
C	1

- D generates reply to C, sends
  - Switch sees frame from D
  - Switch notes that D is on interface 2
  - Switch knows C on interface 1, so *selectively* forwards frame out via interface 1

Interconnection Devices - Switch

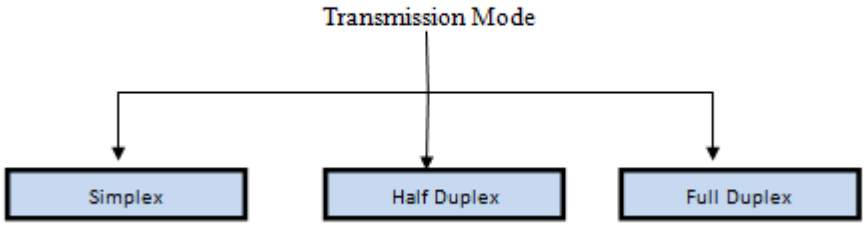


address	port
A	1
B	1
E	2
H	3
J	3
C	1
D	2

Transmission Modes in Computer Networks

Transmission mode refers to the mechanism of transferring of data between two devices connected over a network. It is also called Communication Mode. These modes direct the direction of flow of information. There are three types of transmission modes. They are:

1. Simplex Mode
2. Half duplex Mode
3. Full duplex Mode



Transmission Modes in Computer Networks

Simplex Mood

In this type of transmission mode, data can be sent only in one direction i.e. communication is unidirectional. We cannot send a message back to the sender. Unidirectional communication is done in Simplex Systems where we just need to send a command/signal, and do not expect any response back.

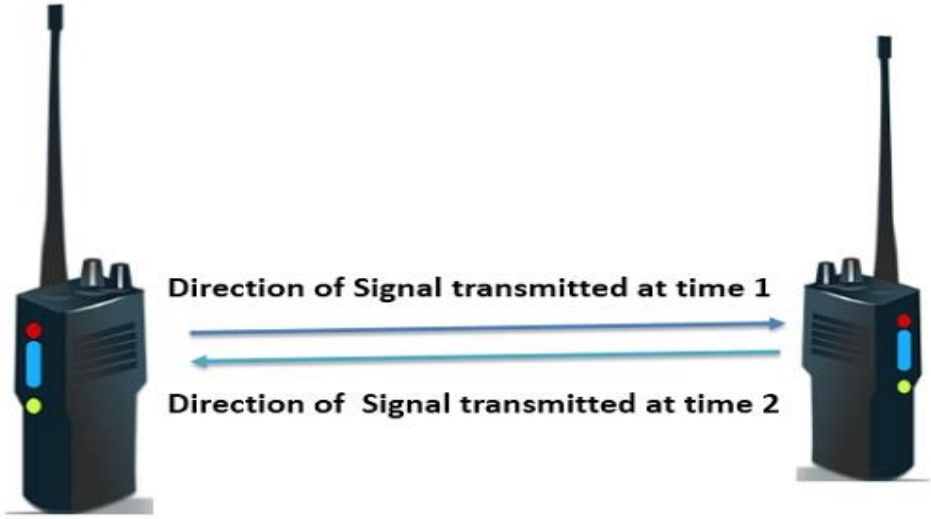
- The common infrared remote control a prime example of a simplex system, where the IR remote controller transmits signals but never receives any in return.

Transmission Modes in Computer Networks

Half Duplex Mode

Half-duplex data transmission means that data can be transmitted in both directions on a signal carrier, but not at the same time.

- For example, on a local area network using a technology that has half-duplex transmission, one workstation can send data on the line and then immediately receive data on the line from the same direction in which data was just transmitted. Hence half-duplex transmission implies a bidirectional line (one that can carry data in both directions) but data can be sent in only one direction at a time.
- Example of half duplex is a walkie- talkie in which message is sent one at a time but messages are sent in both the directions.

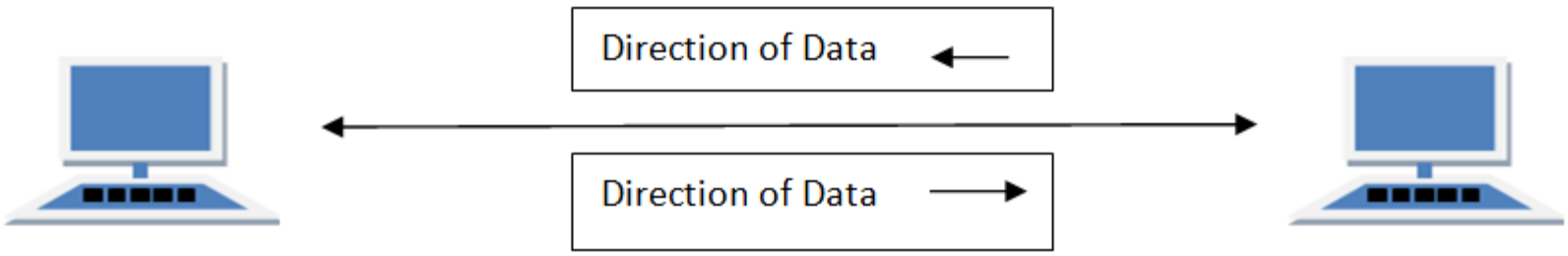


Transmission Modes in Computer Networks

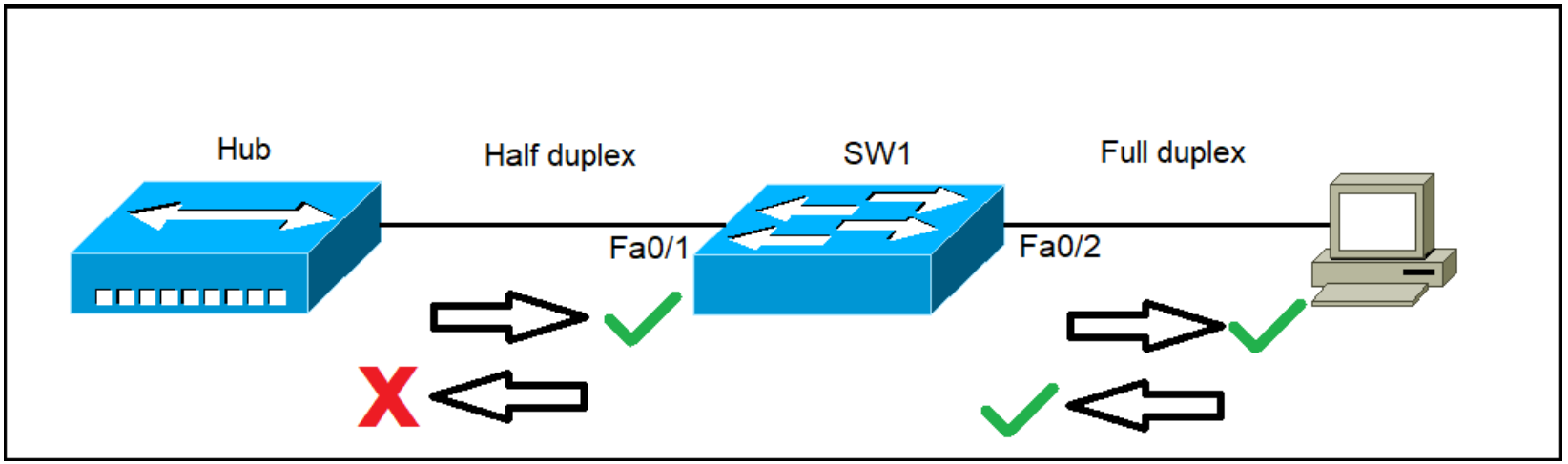
Full Duplex Mode

In full duplex system we can send data in both the directions as it is bidirectional at the same time in other words, data can be sent in both directions simultaneously.

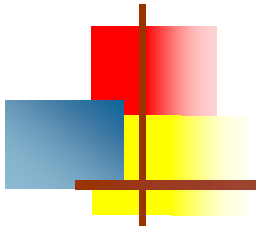
- Example of Full Duplex is a Telephone Network in which there is communication between two persons by a telephone line, using which both can talk and listen at the same time.



Transmission Modes in Computer Networks



Hub is Half Duplex
Switch is full Duplex



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- Computer Networks, Fifth Edition: A Systems Approach (The Morgan Kaufmann Series in Networking).
- Computer Networks and Internets (5th Edition)
- Some slides by Dr. Tracy Bradley Maples