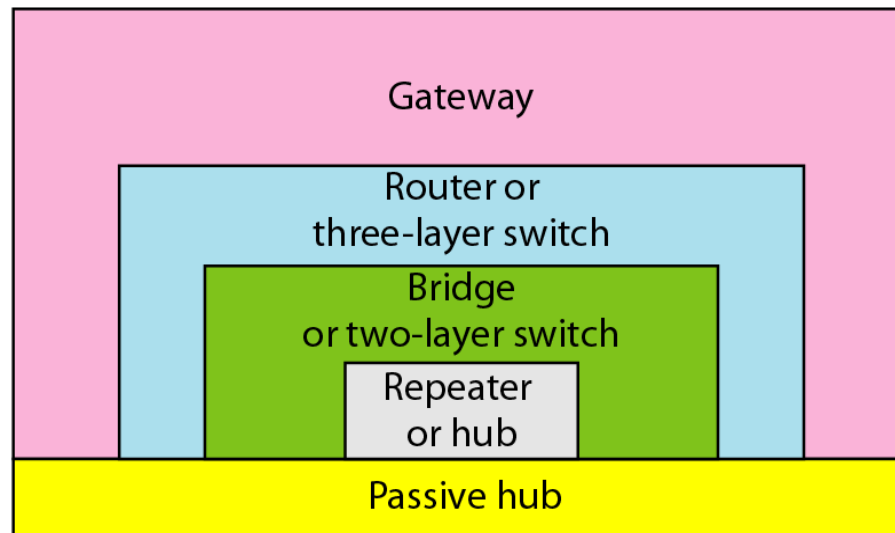




# Network Hardware Components

Application
Transport
Network
Data link
Physical



Application
Transport
Network
Data link
Physical

## ❑ Connectors

- ❖ Generally, the connectors are male-female type.

### Connector for Twisted Pair Cable:

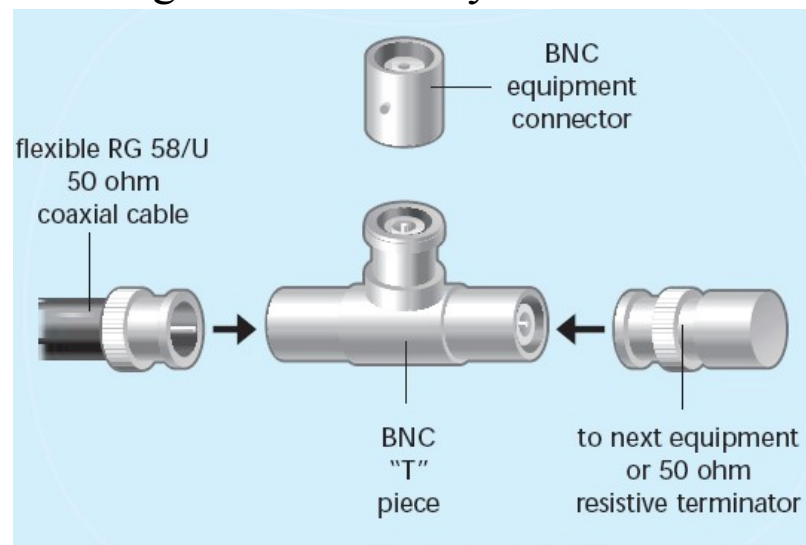
- Connect to networking devices such as network interface cards and switches using **RJ45 (Registered Jack)** connectors.
- One end must connect to a host, the other to a networking device such as a switch. You can only connect two computers together if you use a **crossover cable**, which uses different wiring.
- ❖ Consists of **four pairs** of copper wires **twisted** around each other. Twists are used because they reduce interference.
- ❖ Maximum length: 100 meters (328 feet).
- ❖ Maximum bandwidth: 1000 Mbps.





## Connector for Coaxial Cable:

- ❖ Hosts on an RG58 network require a network card with an RG58 adapter.
- ❖ To add the host to the network, the cable section must have an RG58 connector on both ends with a “T” piece fitted between them.
- ❖ Both ends of the segment should be terminated using a piece of equipment known as a **terminator**.
- ❖ A terminator stops signals on the network echoing back when they reach the end of the **segment**.
- ❖ Maximum bandwidth of 10 Mbps.
- ❖ Maximum segment length of 185 Meters (605 feet).
- ❖ Maximum of 30 hosts per segment.

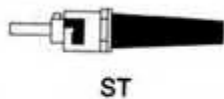


## Connector for Fiber optic cable:

There are many types of fiber optic cable connectors:

- ❖ **ST Connectors:** Slotted bayonet type connector with long ferrule. Common connector for **multimode fibers**.
- ❖ **FC Connectors:** Screw on type connector. Popular with **single mode fibers**.
- ❖ **SC Connectors:** Push/pull connector that can also be used with duplex fiber construction.
- ❖ **LC Connectors:** Much like the ST connector but with a ferrule that is half the size.
- ❖ **MT-RJ Connectors:** Connector configured for duplex fibers with both fibers in one ferrule.
- ❖ **MU Connectors:** Much like the SC connector but with a ferrule about half the size.

### Common Fiber Connectors



ST



SMA 906



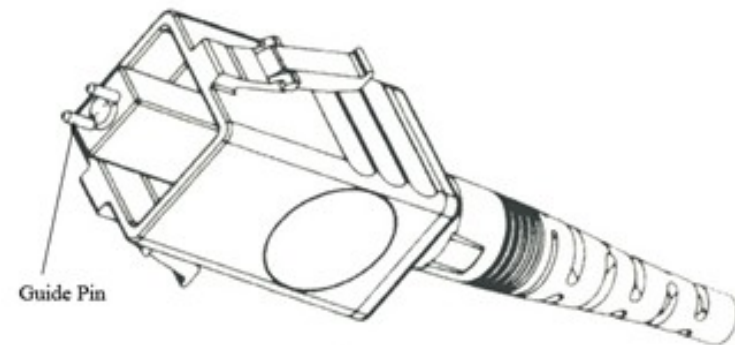
SMA 905



FC, FC/PC



SC



Guide Pin

**MT-RJ**



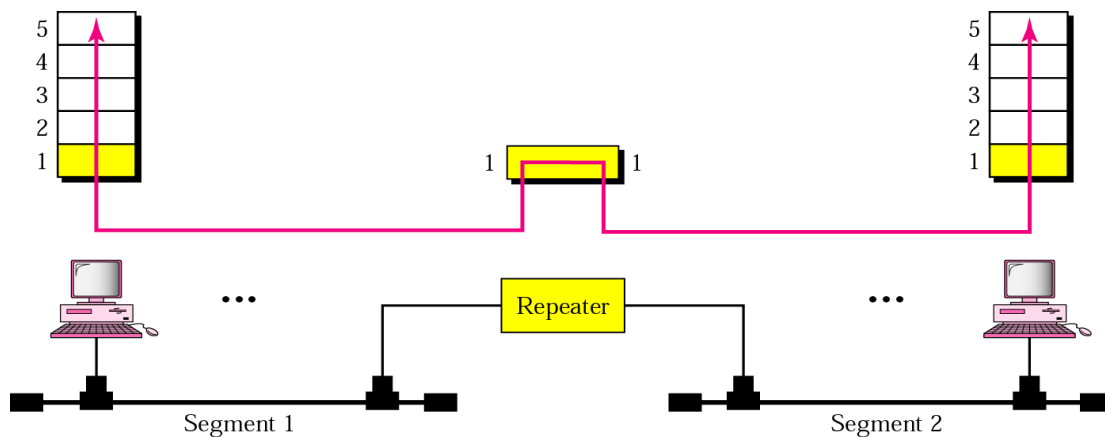
## ❑ Network Interface Card (NIC)

- ❖ Network Interface Card (NIC). Also known as Network Card or Ethernet Adapter. Transmits and receives signals to the LAN. Computers can not communicate on LAN without this device.
- ❖ Each Network Card has a Media Access Control (MAC) address. This is also known as the physical address or Ethernet address.
- ❖ MAC address is a unique 12 digit hexadecimal number that is hard coded into each network interface. The first half of a MAC address is the manufacturer's ID. The second half a serial number.

**00-04-AC    -F3-1C-D4**  
Manufacturer ID    Serial number

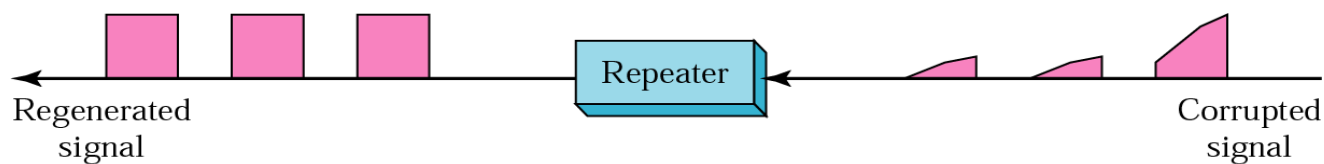


## ❑ Repeaters

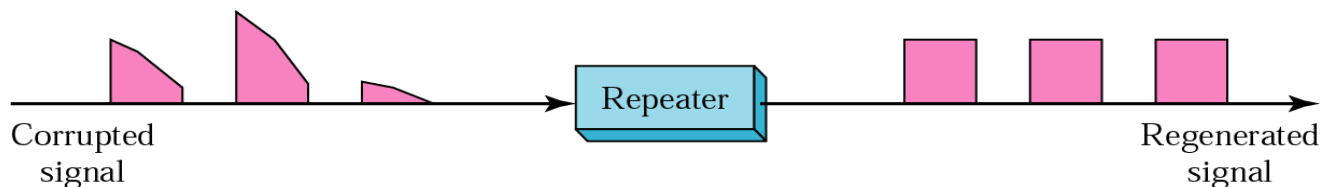


- ❖ A repeater connects two segments of a LAN.
- ❖ A repeater forwards every frame; it has no filtering capability.
- ❖ A repeater is a regenerator, not an amplifier.

### Function of a repeater



a. Right-to-left transmission.

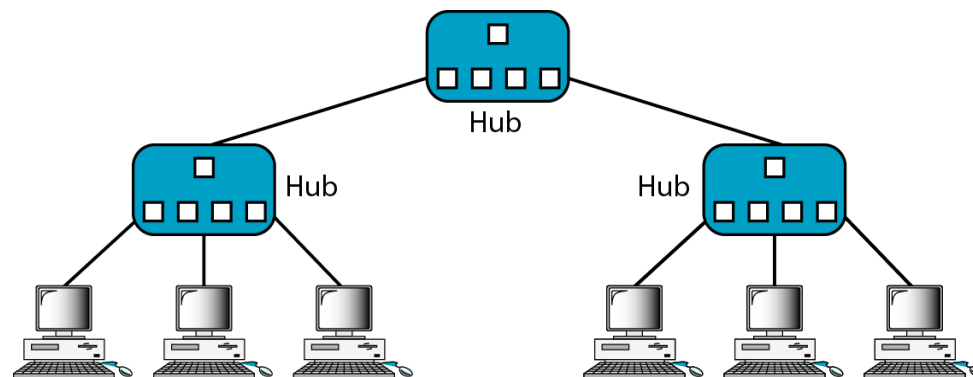


b. Left-to-right transmission.



## ❑ Hub

- ❖ As an active hubs regenerate signals, it increases the distance that can be spanned by the LAN (up to 100 meters per segment).
- ❖ Hubs can also be connected locally to a maximum of two other hubs, thereby increasing the number of devices that can be attached to the LAN.
- ❖ **Active hubs** are usually used for regeneration and amplification of signals.
- ❖ **Intelligent hub** perform some network management and intelligent path selection.



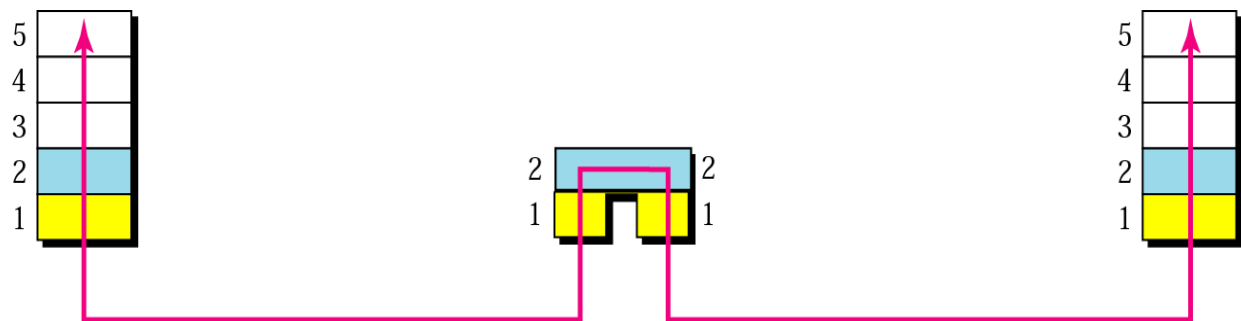
## Disadvantages

- ❖ Bandwidth is shared by all hosts i.e. 10Mbps shared by 25 ports/users.
- ❖ Can create bottlenecks when used with switches.
- ❖ Have no layer 3 switching capability.



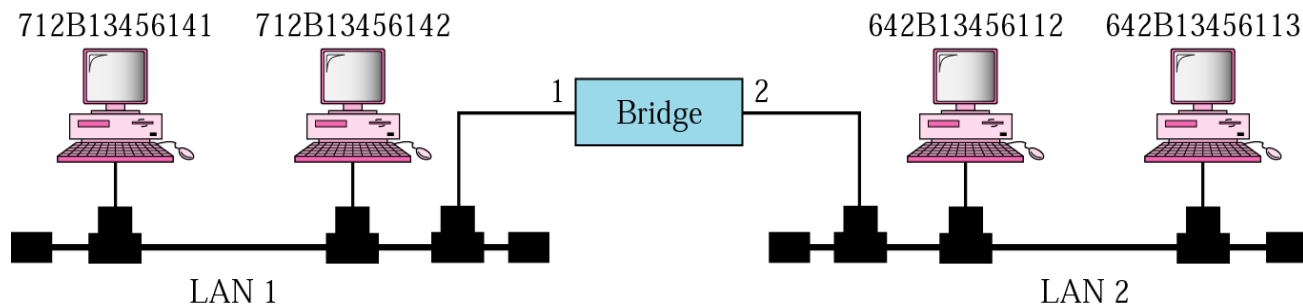
## ❑ Bridge

- ❖ Frame filtering and forwarding . A bridge has a table that maps addresses to ports.
- ❖ Learning the address
- ❖ Routing

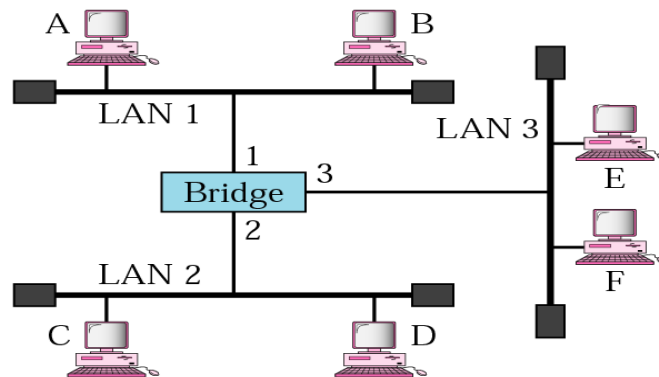


Address	Port
712B13456141	1
712B13456142	1
642B13456112	2
642B13456113	2

Bridge Table







Address	Port

a. Original

Address	Port
A	1

b. After A sends a frame to D

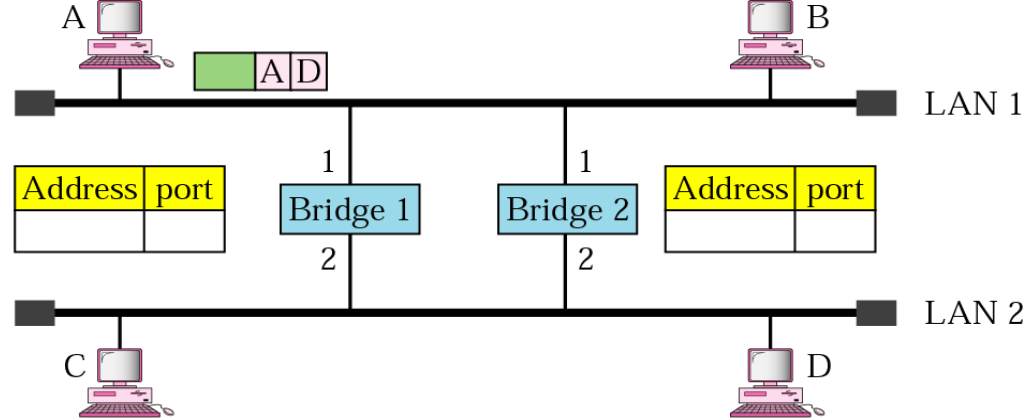
Address	Port
A	1
E	3

c. After E sends a frame to A

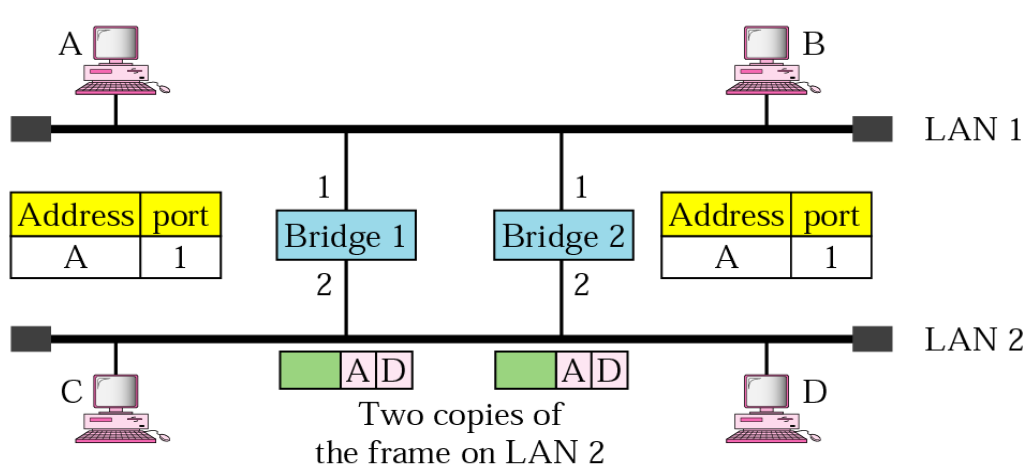
Address	Port
A	1
E	3
B	1

d. After B sends a frame to C

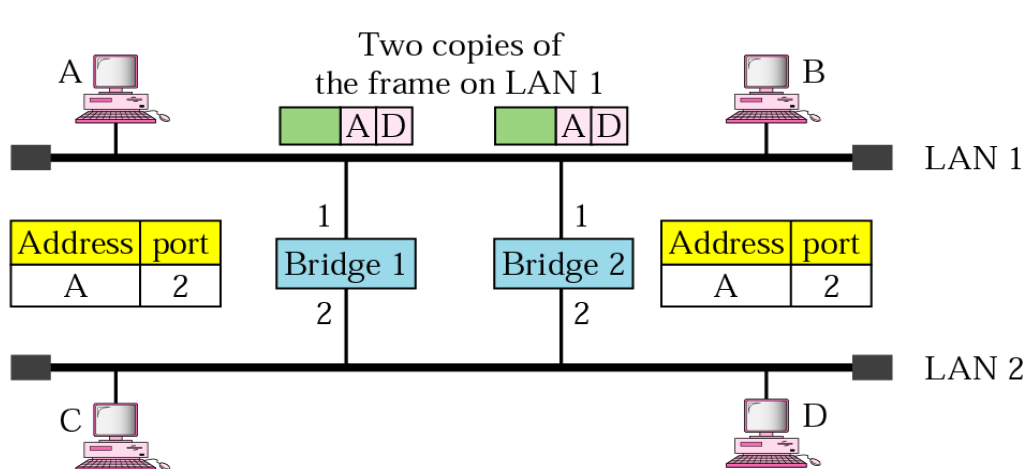
a. Station A sends a frame to station D



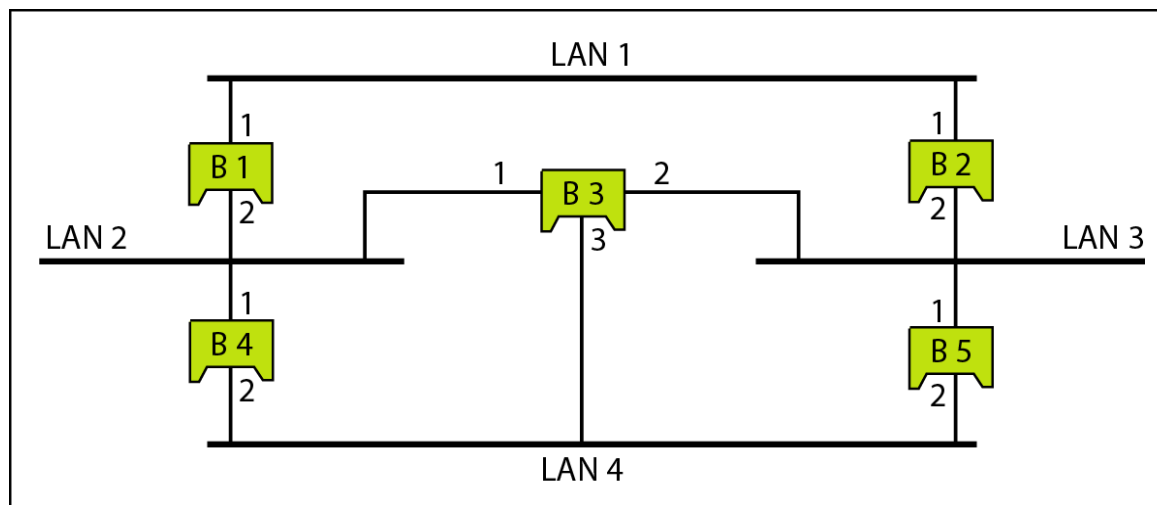
b. Both bridges forward the frame and improve tables



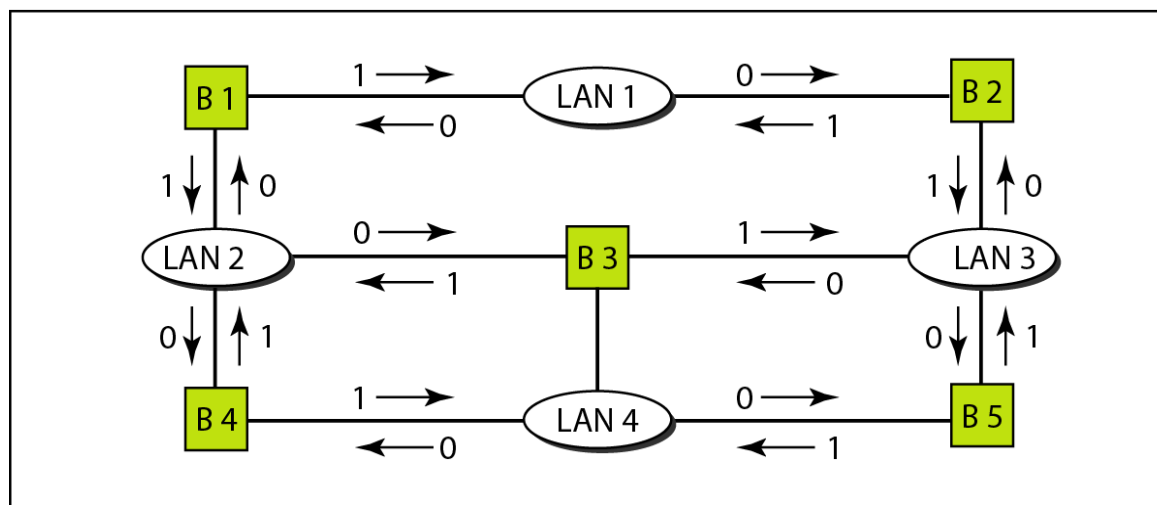
c. Both bridges forward the frame and improve tables



# What happens if you have a loop of bridges/switches in your LAN?



a. Actual system



b. Graph representation with cost assigned to each arc



## Applying spanning tree

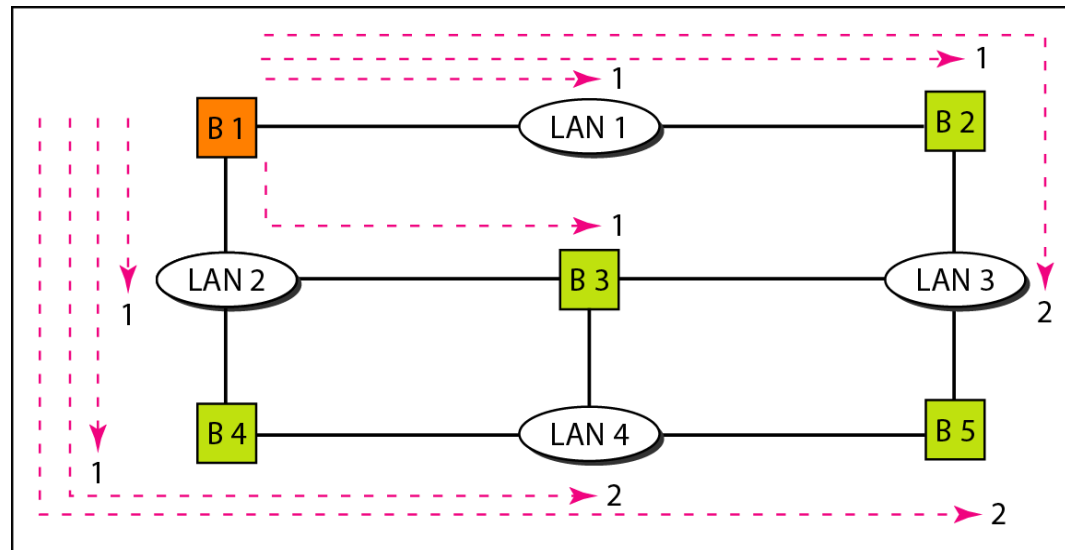
**Step 1:** Every bridge has an ID. Select the bridge with smallest ID. This is the *root bridge*.

**Step 2:** Mark one port of each bridge (except root bridge) as the *root port*. Root port is the port with least-cost path from the bridge to the root bridge (marked with 1 star).

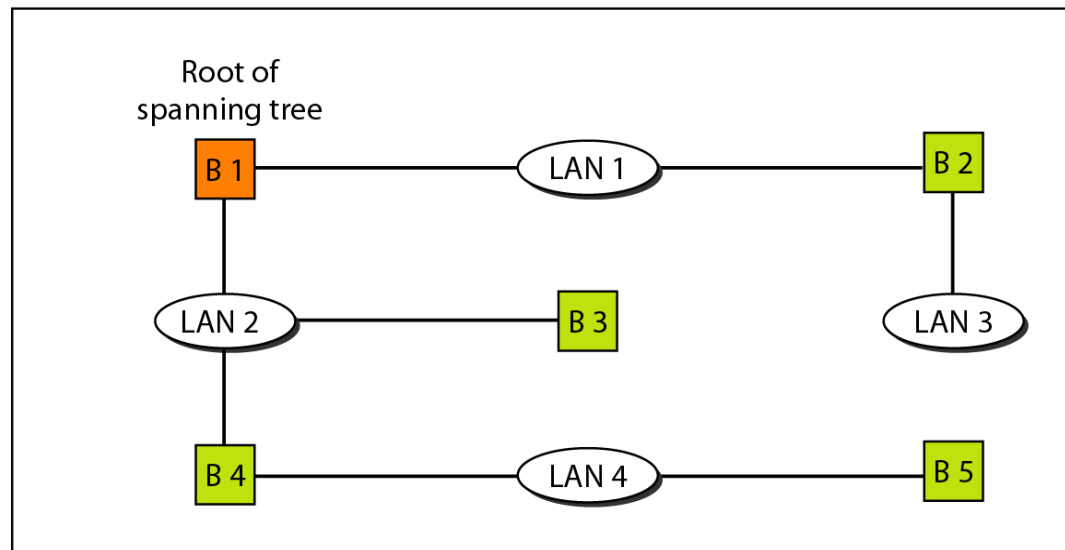
**Step 3:** For each LAN, choose a *designated bridge*. A designated bridge has the least-cost path between the LAN and root bridge (the arrows). Mark the corresponding port that connects the LAN to its designated bridge the *designated port* (two stars).

**Step 4:** Mark the root port and designated port as *forwarding ports*, the others as *blocking ports* (every port with 1 or 2 stars keep, ports with no stars drop).

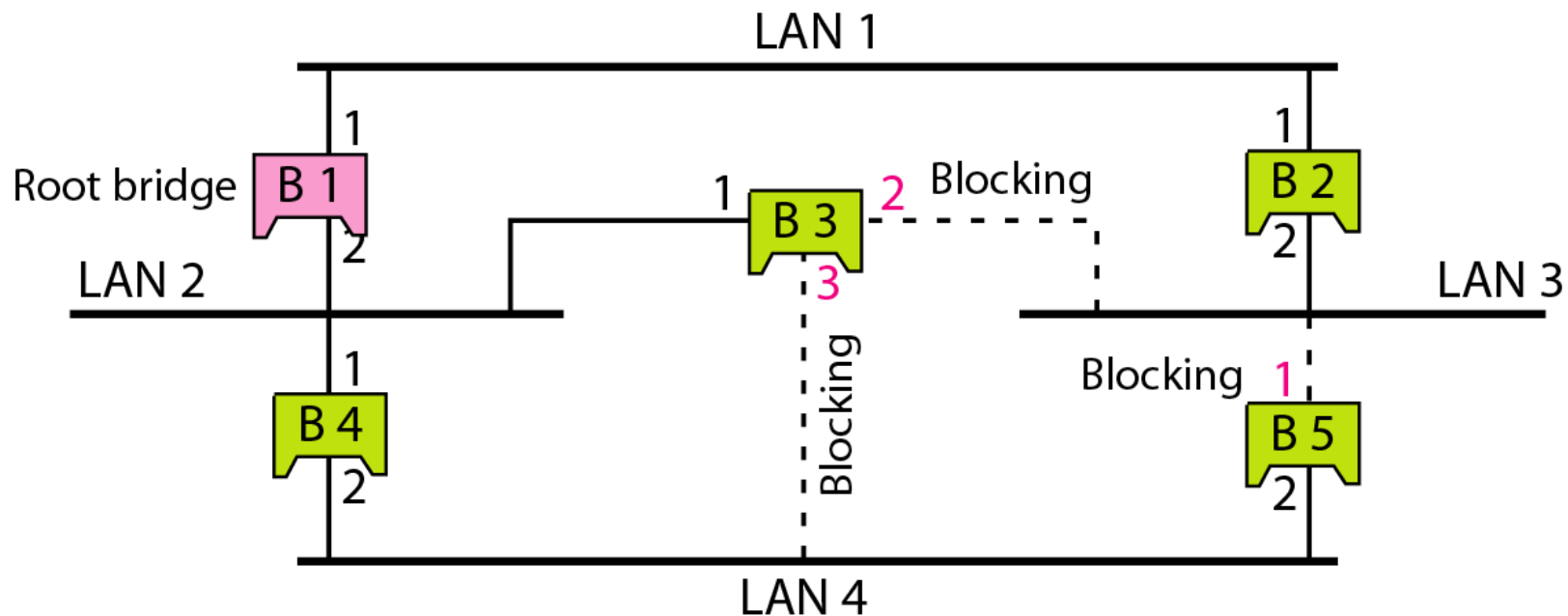
**Note** - there is only 1 path between any two bridges.



a. Shortest paths



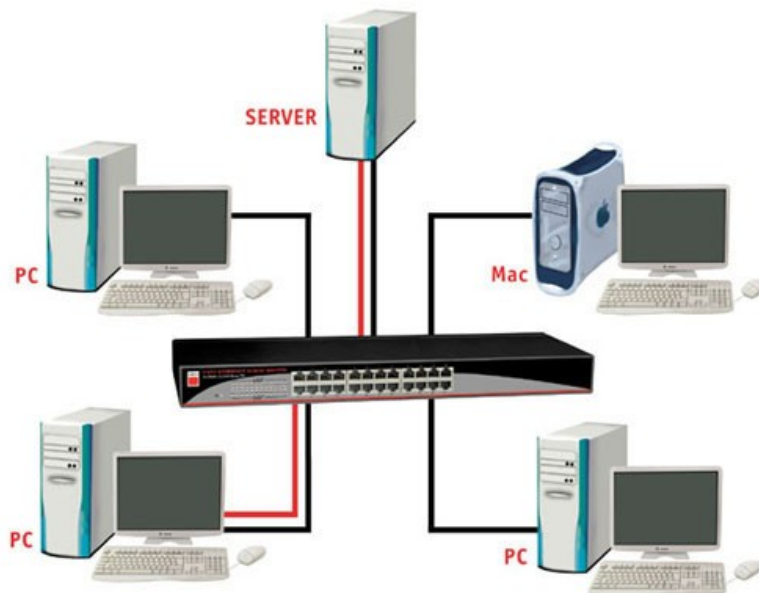
b. Spanning tree



Ports 2 and 3 of bridge B3 are blocking ports (no frame is sent out of these ports).  
Port 1 of bridge B5 is also a blocking port (no frame is sent out of this port).

## ❑ Switch

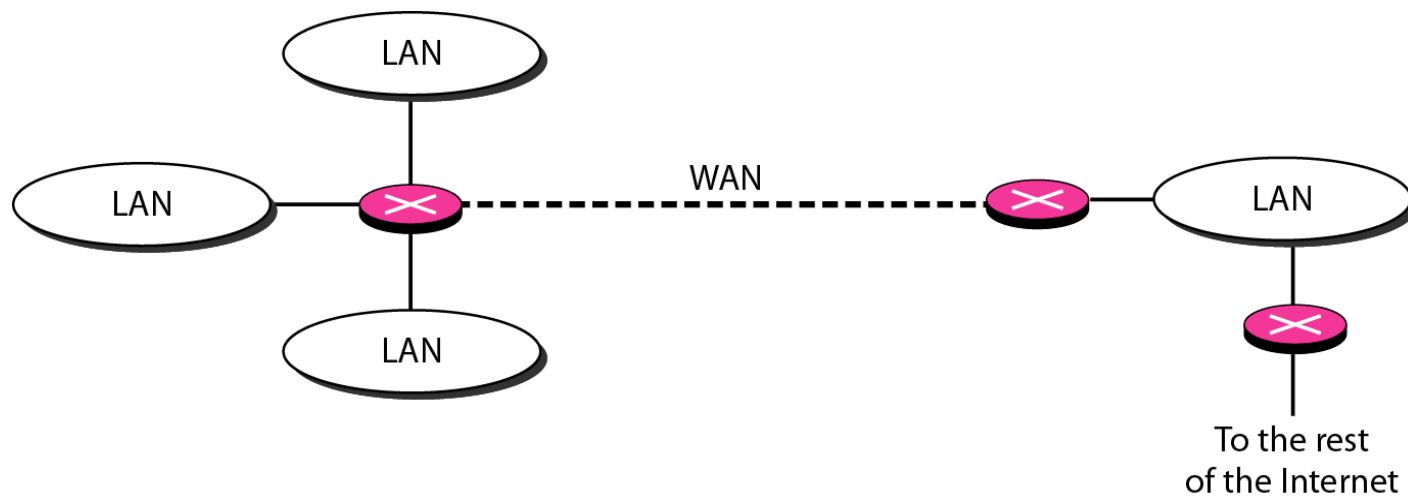
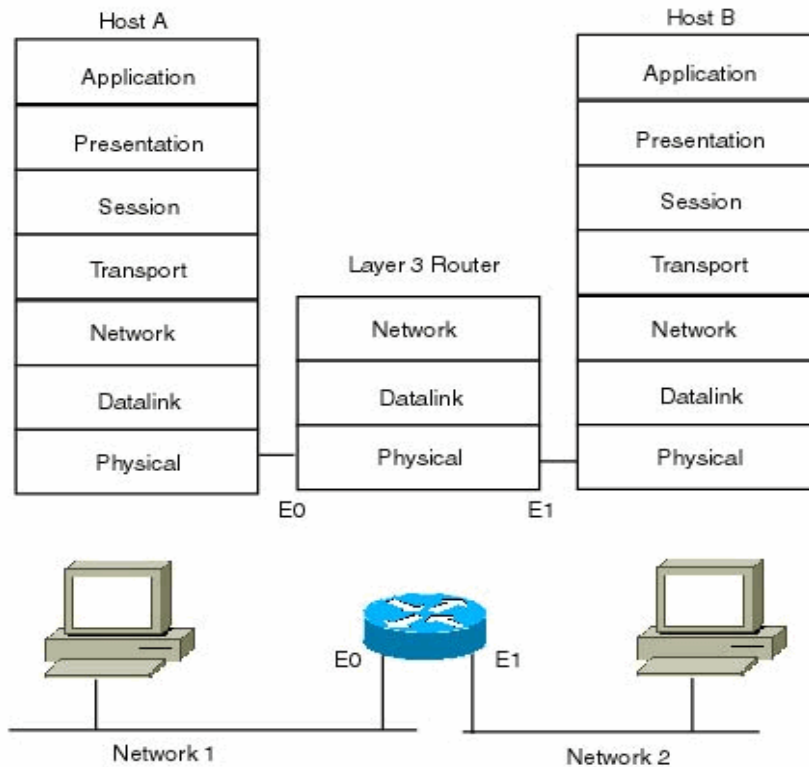
- A switch is a multi-port bridge.
- It stores MAC addresses in an internal lookup table.
- Temporary switched paths are created between the frame's source destination.
- Some Switches have limited layer 3 IP routing capabilities.
- Switches can be configured to use VLANs.
- Switches support spanning tree protocol to create resilient networks.



*The packet of data from the server  
is sent only to the destination workstation  
connected to the relevant port*



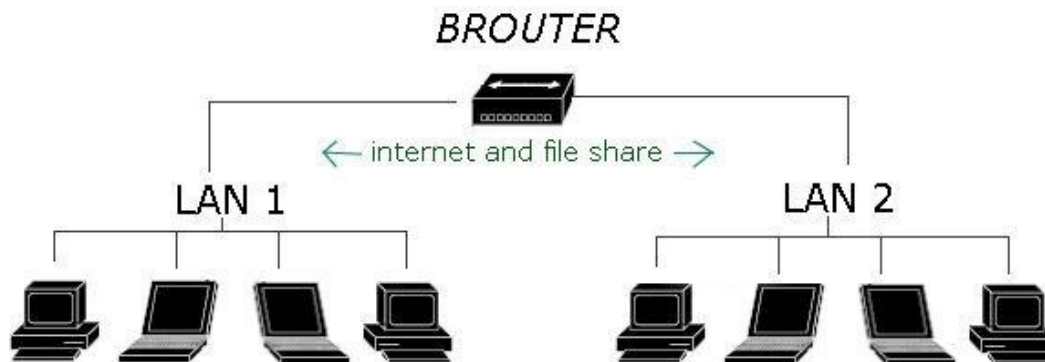
## Router





## ❑ **Router : [ Bridge+router ]**

- Router is the device which is used as both a bridge and router, It is combination of network bridge and a router.
- Router routes some different protocols/IP and also connect them together in the form of bridge.
- In short it is used as LAN and Internet source at the same time.
- Using router we can share files to other computers connected on same router.



<b>Hub</b>	<b>Switch</b>
It is a broadcast device	It is a point to point device
It operates at physical layer	It operates at data link layer
It is not an intelligent device	It is an intelligent device
It can not be used as a repeater	It can be used as a repeater
Not very costly	costly

<b>Router</b>	<b>Bridge</b>
Network layer	Data link layer
Connect two or more network	Regeneration, check MAC address
Types: Distance vector, Link state	Transparent, Routing
Uses hardware and software	Uses tables relating the addresses and ports
Connecting networks	Connecting computers



Hub	Switch	Bridge
Broadcast	Point to point	Both
Physical	Data link	Both
Not intelligent	Intelligent	Highly intelligent
Simply broadcast the incoming packet	Uses switching table to find correct destination	Filtering, forwarding and blocking of frames
Low cost	Expensive	Very expensive