Chapter 15

Connecting LANs, Backbone Networks, and Virtual LANs
In this section, we divide connecting devices into five different categories based on the layer in which they operate in a network.

**Topics discussed in this section:**
- Passive Hubs
- Active Hubs
- Bridges
- Two-Layer Switches
- Routers
- Three-Layer Switches
- Gateways
Figure 15.1 *Five categories of connecting devices*

- Application
- Transport
- Network
- Data link
- Physical

- Gateway
  - Router or three-layer switch
  - Bridge or two-layer switch
  - Repeater or hub

- Passive hub
Figure 15.2  A repeater connecting two segments of a LAN
A repeater connects segments of a LAN.
A repeater forwards every frame; it has no filtering capability.
A repeater is a regenerator, not an amplifier.
Figure 15.3  *Function of a repeater*

a. Right-to-left transmission.

b. Left-to-right transmission.
Figure 15.4 A hierarchy of hubs
A bridge has a table used in filtering decisions.
Figure 15.5 *A bridge connecting two LANs*

<table>
<thead>
<tr>
<th>Address</th>
<th>Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>71:2B:13:45:61:41</td>
<td>1</td>
</tr>
<tr>
<td>71:2B:13:45:61:42</td>
<td>1</td>
</tr>
<tr>
<td>64:2B:13:45:61:12</td>
<td>2</td>
</tr>
<tr>
<td>64:2B:13:45:61:13</td>
<td>2</td>
</tr>
</tbody>
</table>

**Bridge Table**


A bridge does not change the physical (MAC) addresses in a frame.
Figure 15.6  A learning bridge and the process of learning
**Figure 15.7 Loop problem in a learning bridge**

a. Station A sends a frame to station D

b. Both bridges forward the frame

c. Both bridges forward the frame

d. Both bridges forward the frame
Figure 15.8  *A system of connected LANs and its graph representation*

![Diagram of LANs and their graph representation](image)

a. Actual system

b. Graph representation with cost assigned to each arc
Figure 15.9  Finding the shortest paths and the spanning tree in a system of bridges

a. Shortest paths

b. Spanning tree
Figure 15.10  *Forwarding and blocking ports after using spanning tree algorithm*

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).
Figure 15.11  *Routers connecting independent LANs and WANs*
A backbone network allows several LANs to be connected. In a backbone network, no station is directly connected to the backbone; the stations are part of a LAN, and the backbone connects the LANs.

**Topics discussed in this section:**
- Bus Backbone
- Star Backbone
- Connecting Remote LANs
Note

In a bus backbone, the topology of the backbone is a bus.
Figure 15.12  *Bus backbone*
Note

In a star backbone, the topology of the backbone is a star; the backbone is just one switch.
Figure 15.13  *Star backbone*
Figure 15.14  Connecting remote LANs with bridges
A point-to-point link acts as a LAN in a remote backbone connected by remote bridges.

Note
We can roughly define a virtual local area network (VLAN) as a local area network configured by software, not by physical wiring.

Topics discussed in this section:
- Membership
- Configuration
- Communication between Switches
- IEEE Standard
- Advantages
Figure 15.15  *A switch connecting three LANs*
Figure 15.16 A switch using VLAN software
Figure 15.17  Two switches in a backbone using VLAN software
VLANs create broadcast domains.