onnectivity Devices

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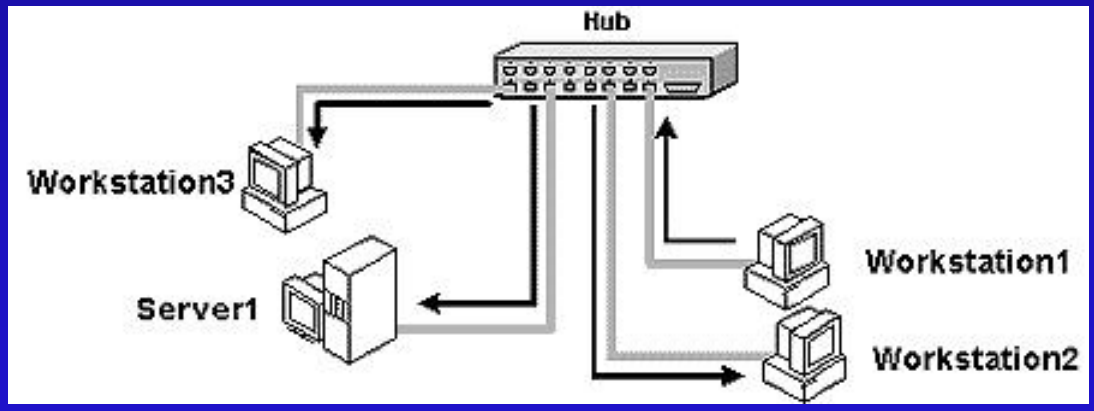
Connectivity Devices

- Hubs
- Repeaters
- Bridges
- Switches
- Routers

Hub

- **Hubs:** Also called wiring concentrators, provide a central attachment point for network cabling.

- Hubs come in three types:
  - Passive
  - Active
  - Intelligent



Passive Hubs

- Passive hubs do not;
  - Contain any electronic components
  - Process the data signal
- Passive hub combines the signals from different network cable segment.
- All devices attached to a passive hub receive all the packets that pass through the hub.

Active Hub

- Active hubs incorporate electronic components that can amplify and clean up the electronic signals that flow between devices on the network.
- Because active hubs function in part as repeaters, they are called multiport repeaters.

Intelligent Hubs

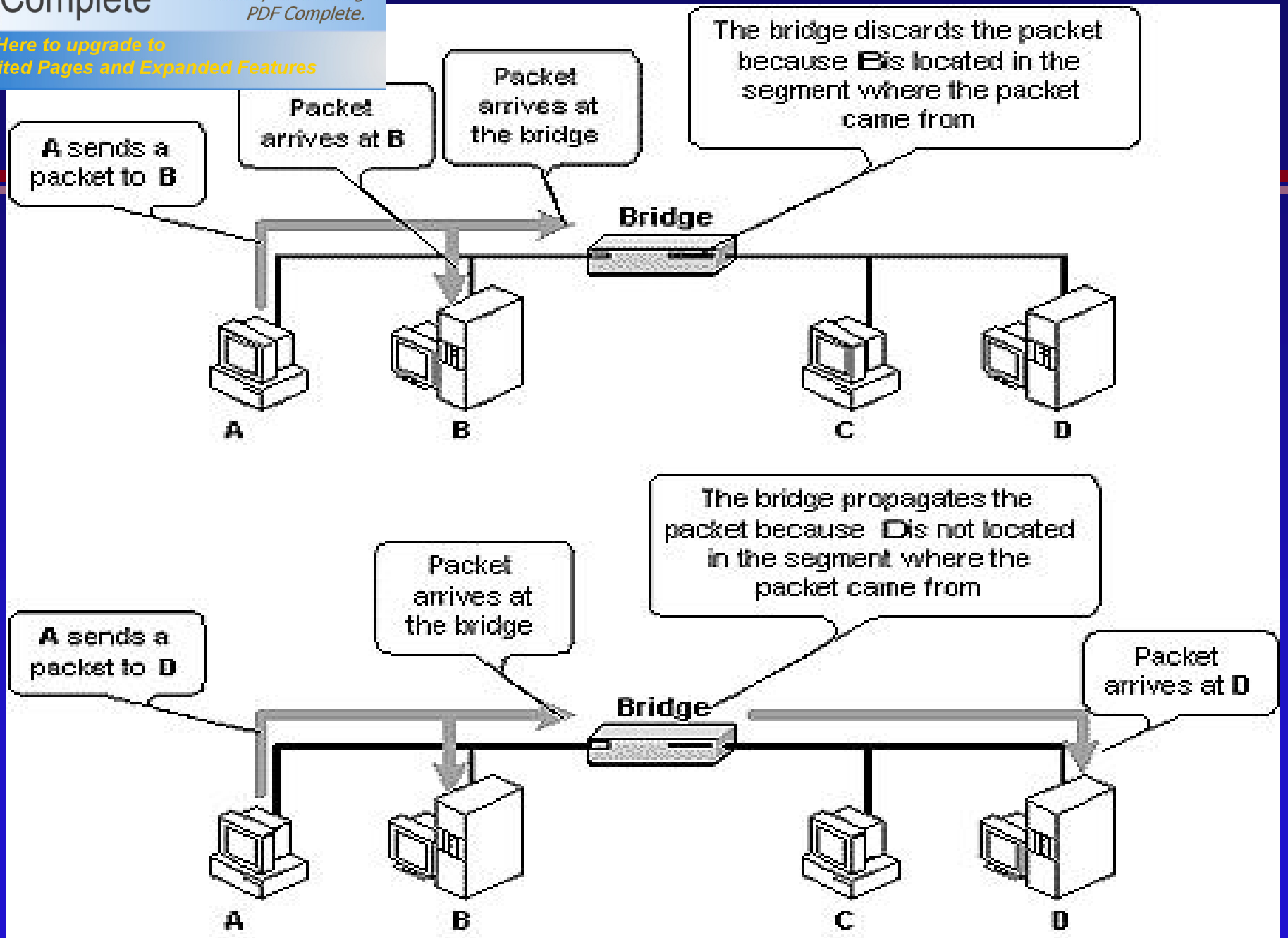
- Intelligent hubs are enhanced active hubs.
- Several functions can add intelligence to a hub:
  - Hub management: support of network management protocols that enable the hub to send packets to a central network console. These protocols enable the console to control the hub.
  - Switching hubs: includes circuitry that very quickly routes signals between ports on the hub.

Repeaters

- Connect two cable segments by boosting and regenerating the signal
- Function at the Physical layer of the OSI model
- Cause very small delays in propagating the packets
- Pass incoming traffic to all connected ports—they do not perform data filtering
- Cannot connect segments with different media access control methods
- Have limits in cascading (the number you can connect serially)
- Can increase network reliability

Bridges

- Operate at the Data Link layer of the OSI model
- Have higher processing overhead than repeaters
- Segment networks into collision domains
- Propagate broadcast messages
- Can connect segments with different media access control methods
- Make intelligent decisions based on a bridging table
- Can improve network performance by isolating intra-segment network traffic
- May overflow during excessive network traffic



Type of Bridging

several of the types of bridging that exist in the industry today:

- Transparent bridging
- Source-route bridging
- Translational bridging
- Source-route transparent bridging

Type of Bridging (Cont'd)

- Transparent bridging is found primarily in Ethernet environments.
- Source-route bridging occurs primarily in Token Ring environments.
- Translational bridging provides translation between formats and transit principles of different media types (usually Ethernet and Token Ring).
- Source-route transparent bridging combines the algorithms of transparent bridging and source-route bridging to enable communication in mixed Ethernet/Token Ring environments.

Bridge Learning Process

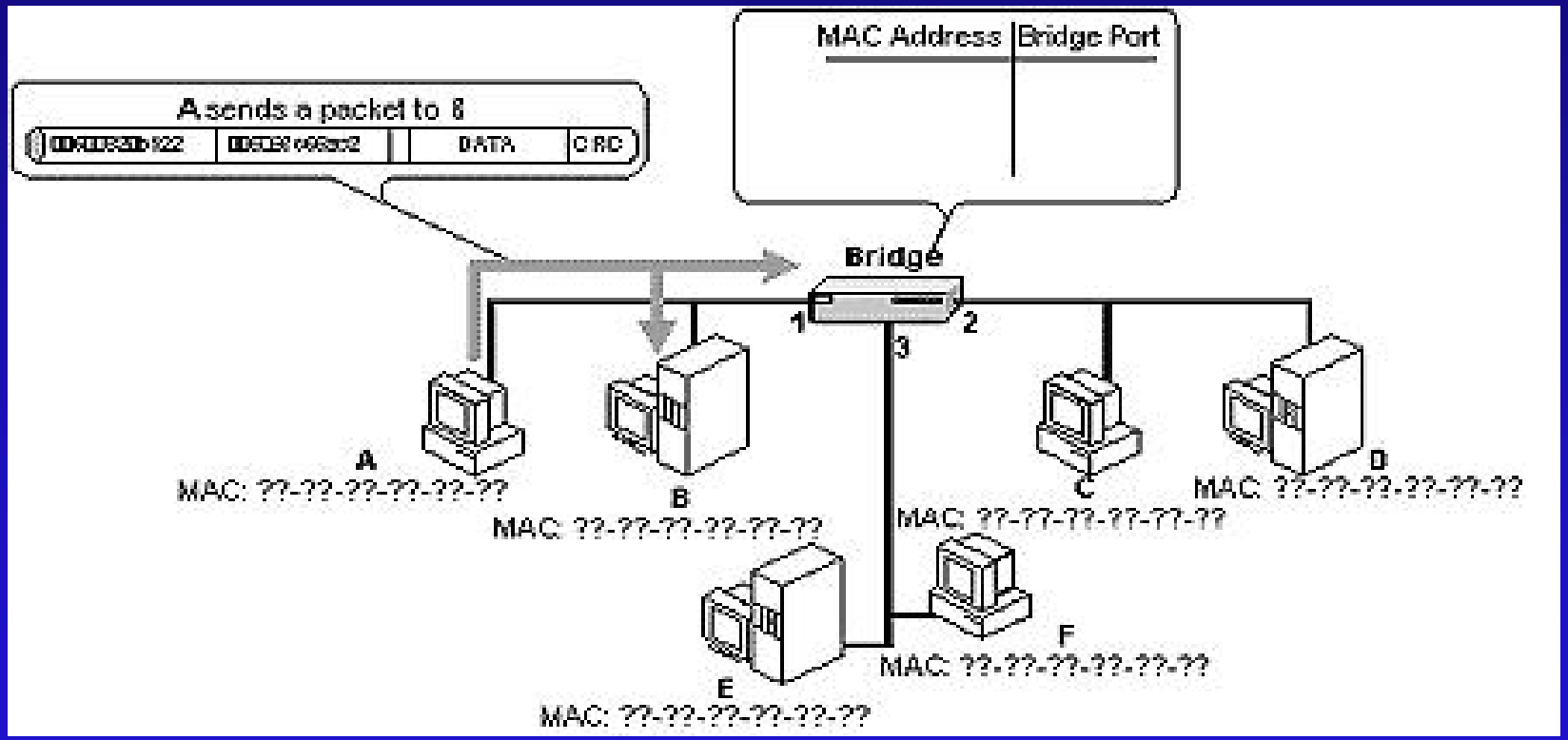


Figure 1: Initially the Bridge Table is Empty

ge Learning Process (Cont'd)

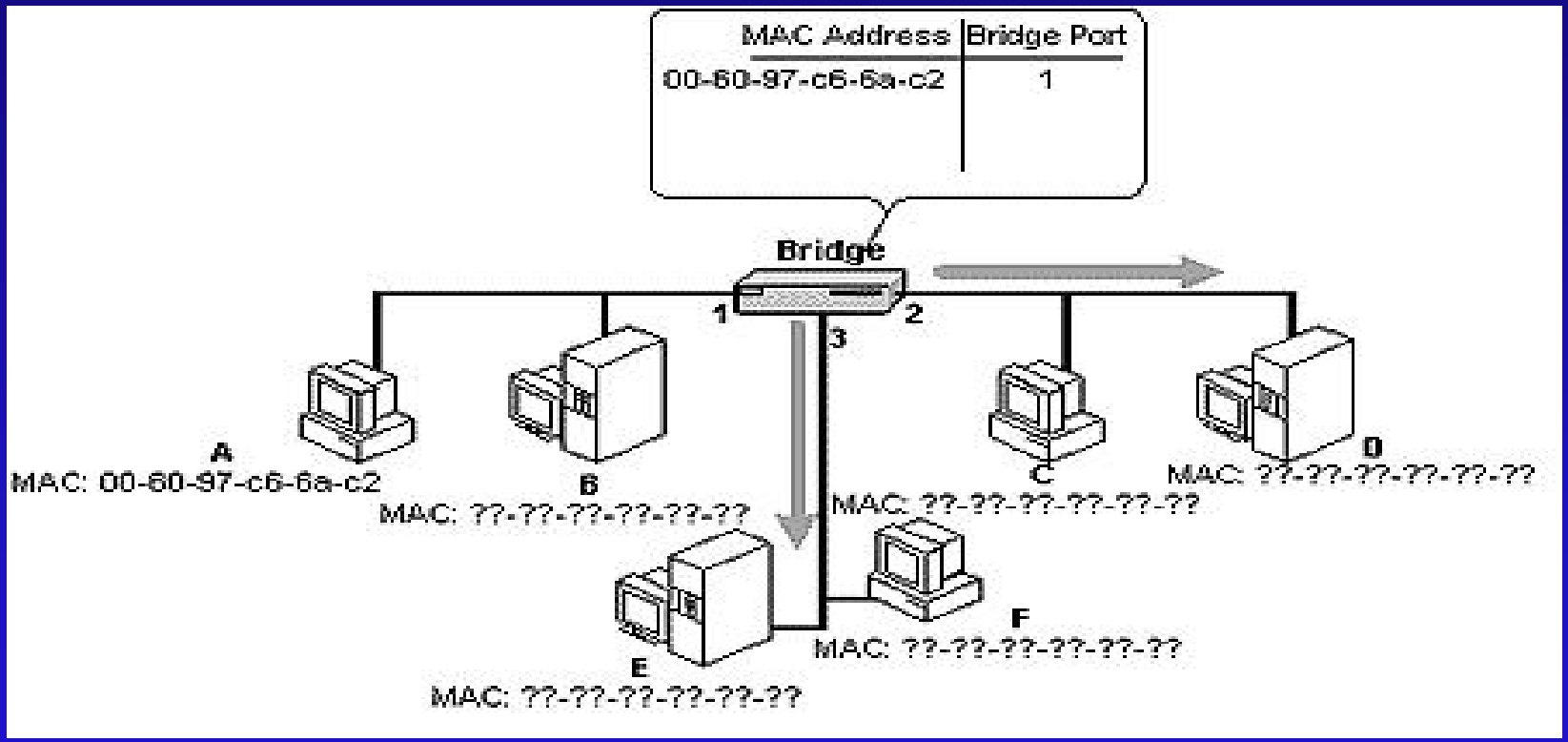


Figure 2: The Bridge Propagates a Packet with an Unknown Destination MAC Address to all Other Ports

e Learning Process (Cont'd)

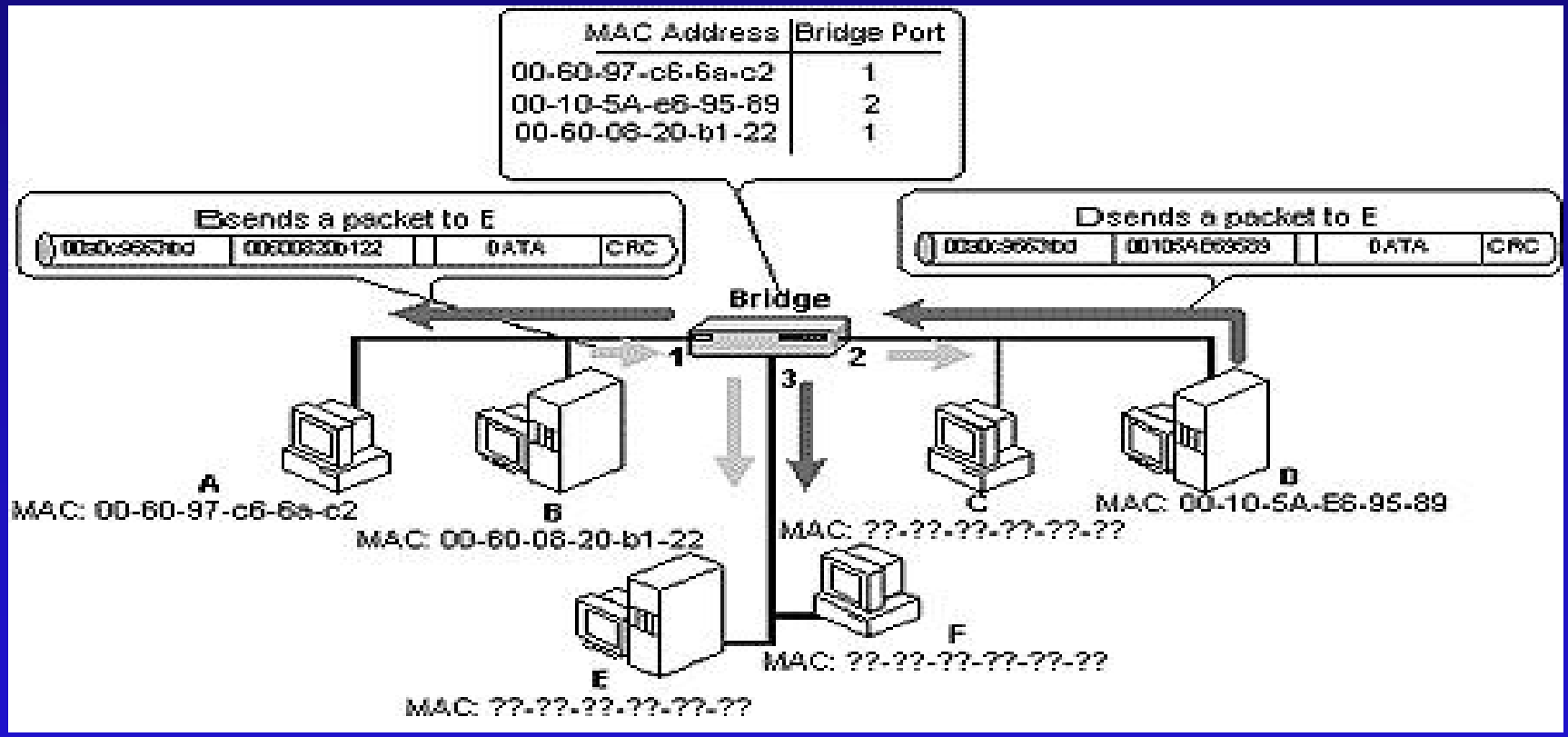


Figure 3: Bridge is learning About the Network Structure Automatically

ge Learning Process (Cont'd)

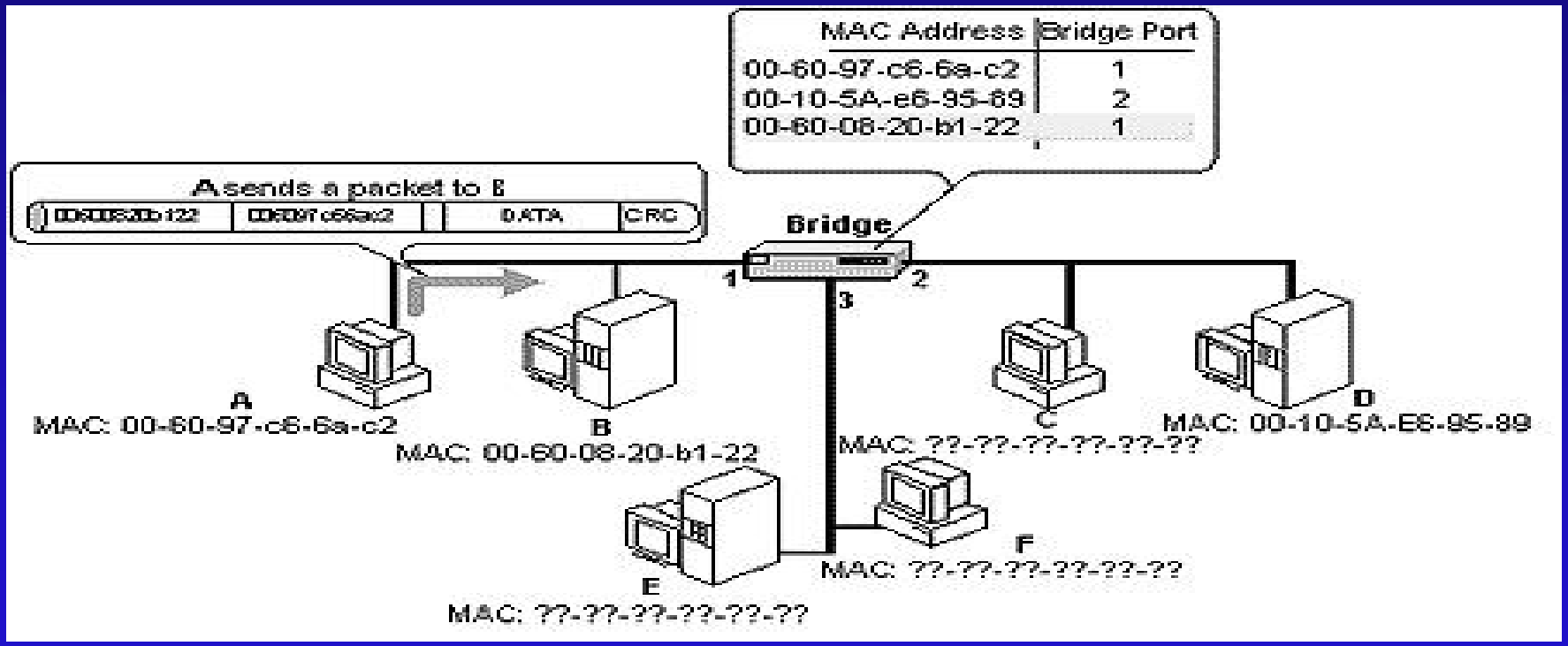


Figure 4: Bridge Performs Packet Filtering when it knows the Destination MAC Address

Switches

- Operates at the Data Link layer of the OSI model
- Functions very similarly to a bridge, but has higher performance because of parallel processing
- Has a higher processing overhead than a repeater
- Segments networks into collision domains
- Propagates broadcast messages
- Can connect segments with different media access control methods and speeds
- Is transparent to end devices—meaning they require no special configuration to be aware of the switch
- Improves network performance by implementing micro-segmentation
- May support full duplex on some or all of its ports
- May overflow because of the funnel effect

Switching algorithms

- Each port of a switch is serviced by a dedicated Ethernet Packet Processor (EPP). EPPs are usually of Reduced Instruction Set Computer (RISC) or Application Specific Integrated Circuit (ASIC) architecture.

- Each switch has a system module that coordinates the work of all EPPs. To transfer data between ports, the switching matrix, or simply, the matrix is used.

Switching algorithms (Cont'd)

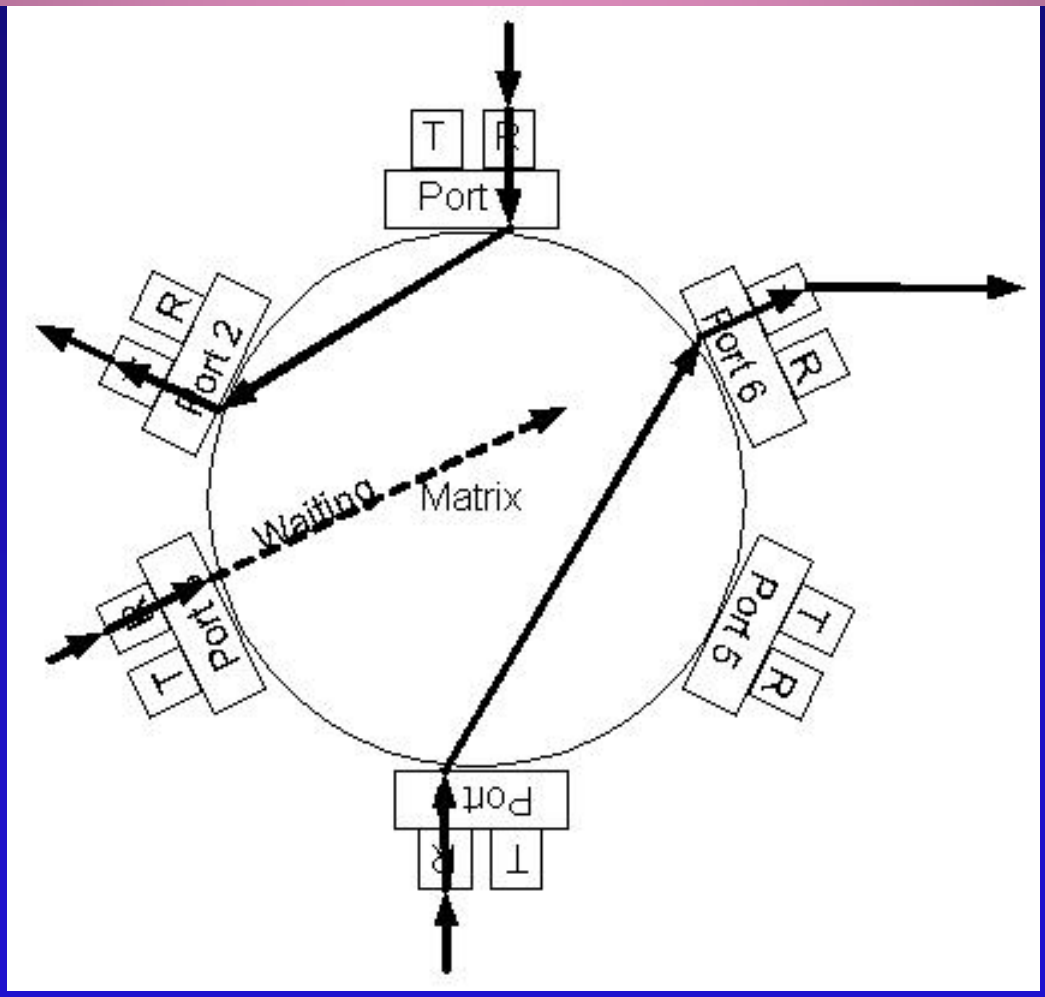


Figure 1: Switching Operation is done by the Matrix.

Types of Switches

- There are two main types of switches and they use different methods to process frames:
  - **A Store-and-Forward:The entire incoming frame is captured, an address lookup occurs to resolve the outgoing port, a Cyclic Redundancy Check (CRC) is performed on the Frame Check Sequence (FCS) to validate the frame, and the frame is sent to the proper port.**
  - **Cut-Through:A cut-through switch will reduce the amount of introduced time latency because the switch begins transmitting the frame to the receiving port as soon as the destination address is decoded (usually within the first 20-30 bytes of the frame).**

Performance Considerations

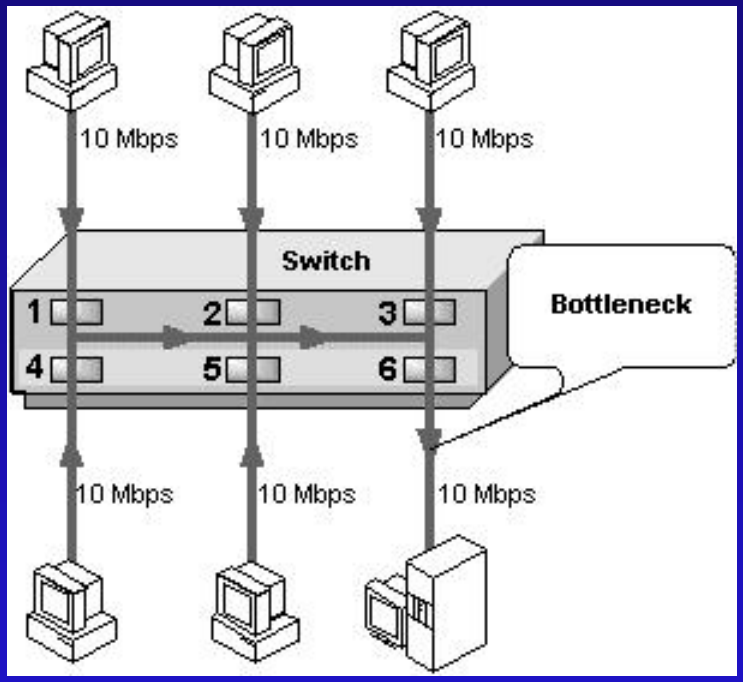


Figure 2: Funneling.

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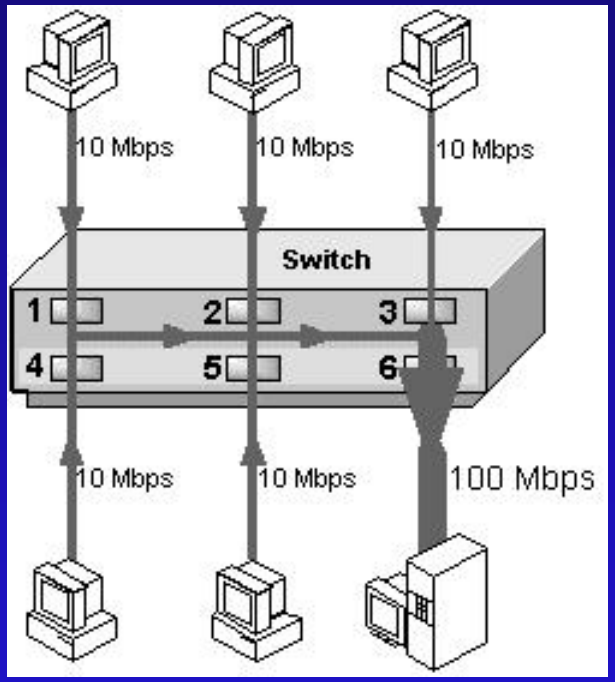

Figure 3: Upgrading the Link to the server to solve the Funneling Problem.

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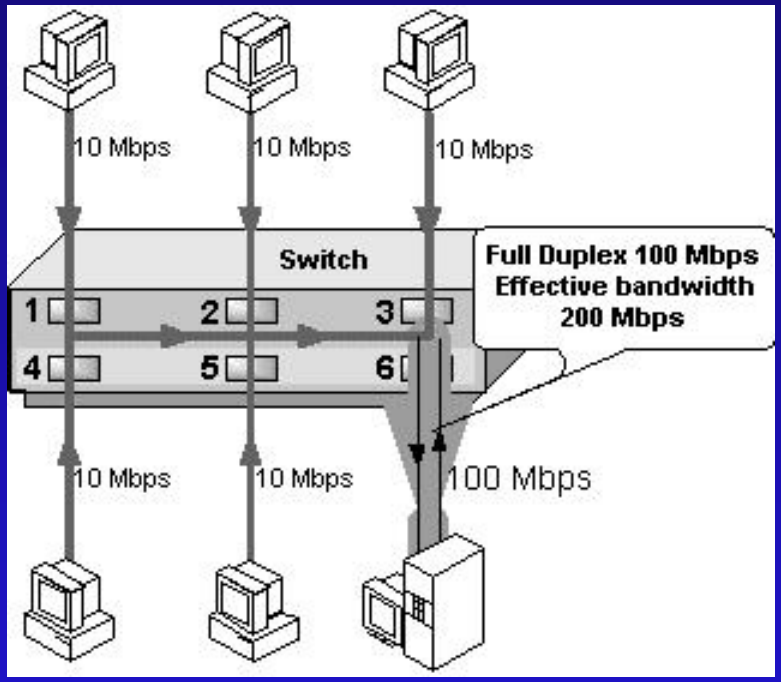

Figure 4: Full Duplex Links Double the Effective Bandwidth

Routers

- Operates at the Network layer of the OSI model
- Has higher processing overhead than bridges or switches
- Can make intelligent decisions about how to reach the remote computer more efficiently
- Does not propagate broadcast messages: Segments networks into broadcast domains
- Can connect segments with different media access control methods and speeds
- Works only with routable protocols (for example IPX and IP)
- Must be configured by the administrator before functioning
- End nodes must be specifically configured to use the router

Routing Table

- the routing table has more information on how to reach the destination and usually has the associated cost value associated with a particular path. The following listing shows a fragment of a routing table for an IP router:

Destination	Netmask	Gateway	Interface	Metric
207.22.36.0	255.255.255.0	195.209.225.1	195.209.225.50	1
207.22.36.0	255.255.255.0	195.209.225.10	195.209.225.50	2
194.0.0.0	255.0.0.0	193.11.17.44	193.11.117.1	8