Data Link Layer, Part 4
Bridges

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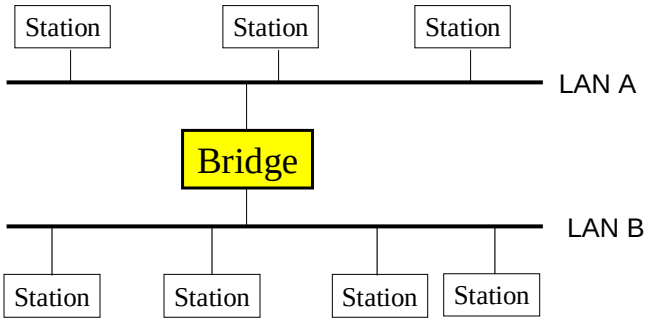
Introduction

- A bridge is a layer-2 device that connects LANs that may or may not be based on the same technology.
- A simple configuration:



Bridge Functions

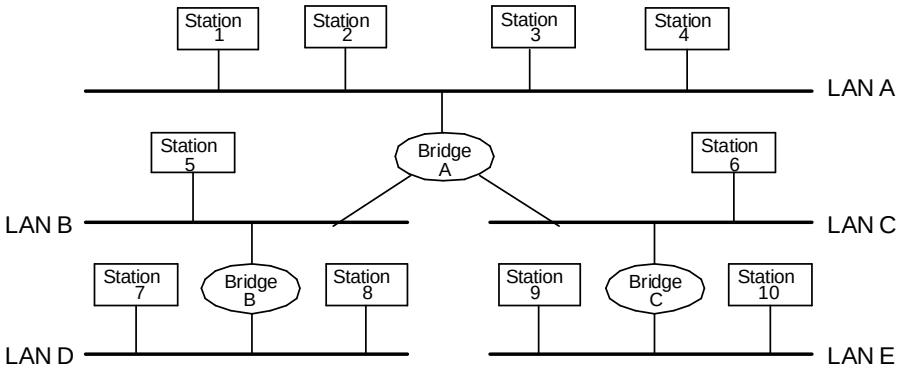
- Broadcast on LAN B everything it receives from LAN A.
- Broadcast on LAN A everything it receives from LAN B
- As a result, the network appears to all machines as a single LAN.

Reasons for Bridges

- overcomes the distance limitations of LANs
- connects LANs that use different technologies
- connects LANs built by different organizations

Nowadays we use Internet technologies to achieve these goals.

A More Sophisticated Configuration



Bridge Routing

- A sophisticated bridge can perform routing
  - decide whether or not to forward frame
  - if attached to more than two networks, must also decide which LAN, if any, to forward it on
- Methods:
  - fixed routing
  - **self learning**
  - source routing (not covered)

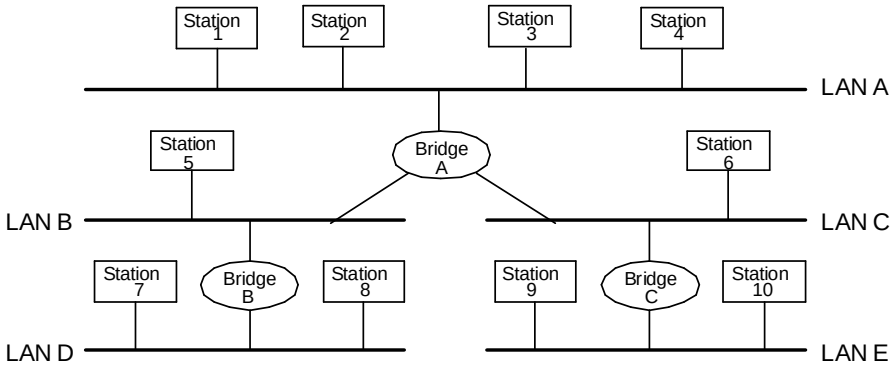
Self-Learning (Transparent) Bridges

- Bridges listens "promiscuously."
- For each packet received, the bridge
  - stores the source address in a cache along with the port the packet arrives on
  - If the destination address is broadcast (all 1's), forward the packet via all interfaces except the one from which the frame was received.

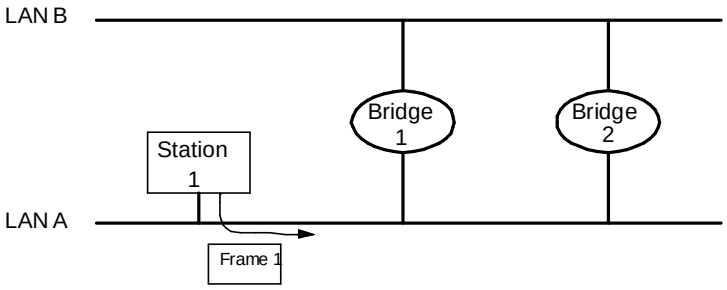
- For a regular dest address, looks for the destination in its cache
  - if not found, forward the packet via all interfaces except the one from which the frame was received
  - if found, forward the packet via the port indicated by the cache entry (if the port is the one via which the frame arrived, the frame is dropped)

Example

- Starting with empty caches at all switches, show the cache of Bridge A after Station 1 sends a frame to Station 4, Station 2 to Station 10, and Station 5 to Station 2.



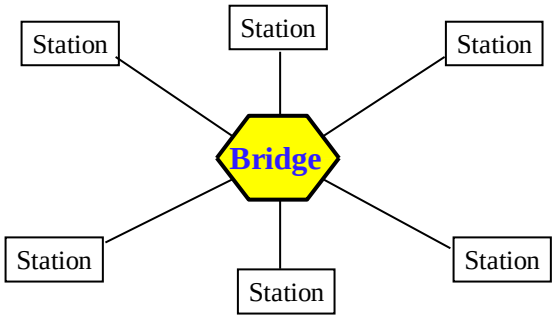
Problems with Parallel Bridges



- In general, this problem arises with any topology containing loops.
- Solution?
  1. avoid loops
  2. construct a spanning tree

Switched Ethernet

- Recall that the 10/100Base-T Ethernet standards use a star topology.



- Replace the hub by a bridge and we get ourselves a switched network, with dedicated bandwidth to each station.

Discussion

- Each switch-to-station segment forms an independent collision domain.
- Moreover, one line is used in each direction.
  - As such, there will be no collisions at all.
- Is this still Ethernet ?
  - **Yes**, in the sense that legacy Ethernet software and interface cards can still be used.
  - **No**, because the resultant network is based on switching, as opposed to broadcast and CSMA/CD.