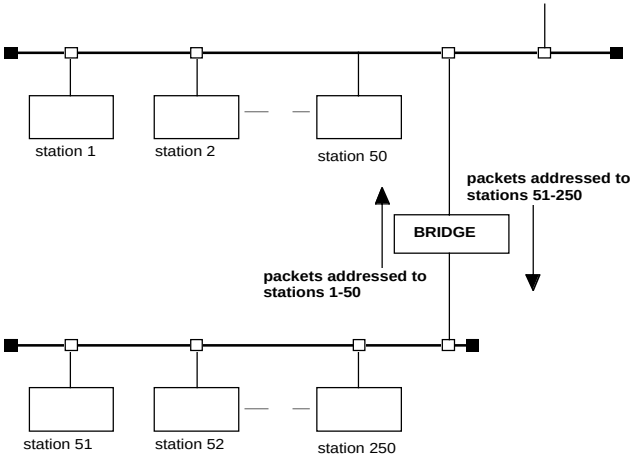
CS25110

Bridges

- Partition LAN to segregate load.
- Partition LAN to add reliability.
- Partition LAN to add security.
- Combine remote LAN segments into a single logical network.
- Combine separately developed and controlled LANs.

Bridges

- IEEE 802 LANs often include bridges
- repeater cleans and forwards *all* data, basically forwards electrical information
- bridge selectively forwards data, stores and forwards complete packets
- forwarding based on header information.
- bridges sometimes known as a 'MAC level relay'.



Bridge types

Two main types of bridges:

- **Source Routing Bridges**. Hosts discover the route to each other host and are very aware of the presence of multiple LANs coupled by bridges.

- **Transparent Bridges**. Bridge learns (or is told) the LAN on which each address exists. Hosts need not know anything about the location of other hosts and indeed are not even aware of the presence of the bridges.

Source Routing Bridges

- Bridges and LANs have numbers.
- Hosts “discover” routes to other hosts.
- Data is transmitted with routing attached
- Bridges obey the routing.

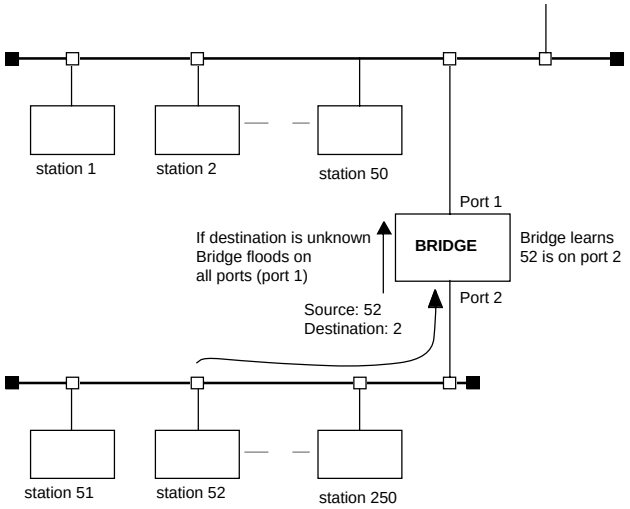
Transparent Bridges

frame forwarding:

- Frames which arrive are handled in one of 3 different ways:
- Same LAN. If destination address on same LAN as source address then discard packet.
- Different LAN. If destination address on different LAN to source address then forward packet.
- Unknown destination. If location of destination address is not known then ‘flood’.

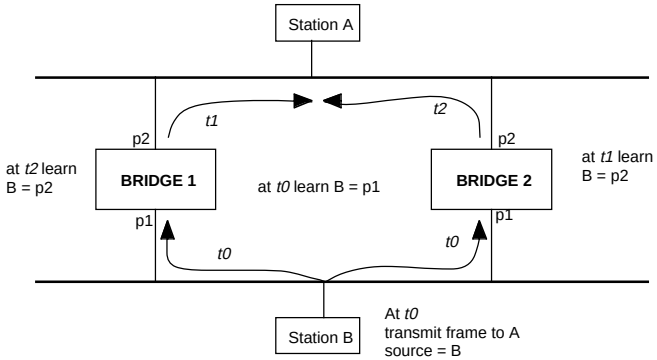
Address Learning:

Bridges can update their forwarding database when a frame arrives on a particular port, since they know that the originating address must be on the port that the packet arrived on.



Bridge Cycles

- The address learning works well if there are no alternative routes in the internetwork connections. i.e. a tree structure.
- However there often are and then bridges might cause loops.



bridges cannot now forward to station B

Bridge Cycles - solution

- Need protocol to avoid the problem.
- Result from graph theory states: For any connected graph (nodes and edges connecting pairs of nodes) there is a *spanning tree* of edges which maintains the connectivity but contains not closed loops.
- Each LAN represents a graph node and each bridge corresponds to an edge.

Spanning tree -Algorithm

- Bridges have numbers.
- Broadcast number every few seconds.
- One bridge becomes the *root bridge.*
- Bridges discover route to *root* via the *root port*.
- Routes might have costs.
- A *designated bridge* is determined for each LAN - minimum cost path to root.
- Only the designated bridge can forward to and from its LAN.
- Bridges communicate with a Bridge Protocol Data Unit (BPDU) consisting of:
  - the originating bridge number
  - the number of the bridge thought to be the root
  - the path cost to the root

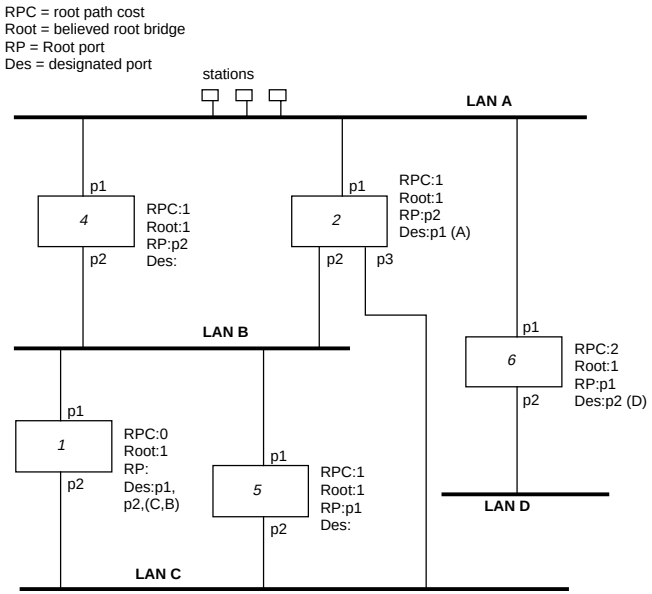
Spanning tree - Example

- Initially every bridge thinks it is the root - and it broadcasts a BPDU to assert this fact.
- If a bridge gets a BPDU indicating a 'superior' bridge exists it assigns its *root port* and path cost to root.
- If a bridge gets a BPDU from a bridge with a shorter *root path* it releases any claim to be the *designated* bridge for the segment.

- Hence the lowest numbered bridge becomes the root.
- Each LAN segment has one *designated* bridge

Bridge ports which are not root or designated ports are blocked.

Spanning tree example



Local and Remote Bridges

- Local Bridges - Connect two (or more) adjacent LANs. Throughput likely to be high. Hosts not likely to notice much performance degradation unless waiting for each packet to be acknowledged.

- Remote bridges - Connect two (or more) LANs which are widely separated. Bridge consists of two ‘half bridges’ connected by a WAN type link. Link typically 64Kbps or 2Mbps.

Managed Bridges

- Bridges often available in a *managed* form.
- Bridges are managed from a management station.
- Bridges can be loaded with forwarding tables.
- Bridges might only forward some types of packets.
- Bridges might only forward for specific source hosts.

Managed Bridges

- Managed bridges often provide feedback
- Traffic Load Reports. Loads on attached networks and proportions forwarded.
- Forwarding Problems. Problems experienced in the form of delays when trying to forward data.
- Network Errors and their types.

Managed Bridges

- Bridge to management station protocols required.
- Need agreed description of data objects.
- Need agreed value ranges for data types.
- Need to cope with multi manufacturer products.

100Mbit/s Ethernet

- Stations can utilise 100 Mbit/s via twisted pair. (100BASE-TX)
- Each host has its own connection to a fast Ether switch.
- The Switch forwards packets to the appropriate port.
- Switches can be connected to switches creating a ‘stacked’ hierarchy.
- Local workgroups operating via a single switch can improve performance.
- Flexible configurations - VLANs (virtual LANs) can be set up utilising several switches if required.

Example switch capabilities
Comp. Sci. Baystack 350T
Autosense switches

- 1.6 million packets / sec forwarding
- 16 autosense 100 / 10 Mbit / s ports
- IEEE 802.1D Spanning Tree Protocol
- SNMP agent support
- Remote monitoring
  - Statistics
  - History
  - Alarms
  - Events
- Upgradeable firmware in non-volatile flash memory.
- 8000 address memory
- default 300 sec ageing of addresses