The University Of Alabama in Huntsville Computer Science

cs570

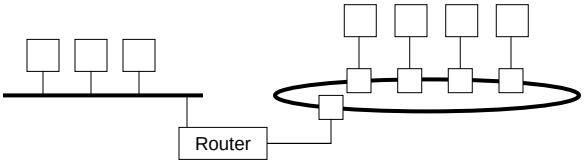
Lecture 7: Extending LANs

The University Of Alabama in Huntsville Computer Science

Interconnecting LANS

cs570

- Individual networks (LANS) have distance limits. How do we interconnect them to span large areas?
  - Option: Connect them at L3

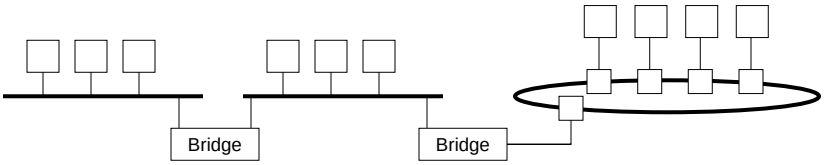


  - But going to L3 means we have to run L3 code as well as L2 – greater overhead

G. W. Cox -- Fall 2007

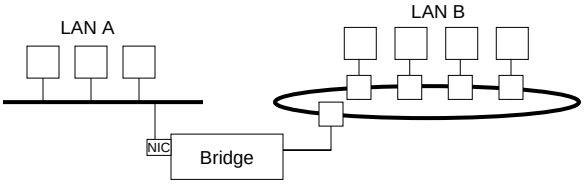
Bridging

- Another option: for compatible networks (e.g, 802-series), there are L2 devices to interconnect them



A bridge is a node with an interface on multiple LANs. It accepts traffic on one LAN and copies it to the others.
Generally, LANs must be identical or compatible (e.g, both 802-family)

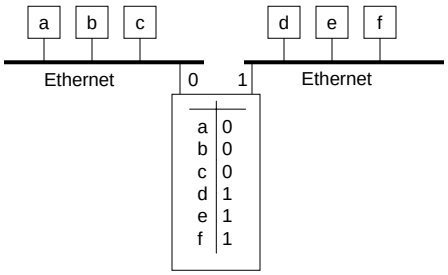
A basic bridge



- Bridge interfaces are in promiscuous mode on both LANs (so they receive all frames on both LANs).
- Any frames on LAN A are copied to LAN B and vice-versa.
- A problem:
  - Imagine hundreds of LANs connected through these simple bridges. Every frame everywhere is copied to every LAN (even if the destination is on the sender's LAN). The system will quickly bog down.

A smart bridge

Give the bridge a list that specifies which interface to use for a particular destination MAC address



A problem: Who builds the table? How do we keep it up to date?

A learning bridge

The learning bridge starts out as a simple bridge, then "learns" which interface to use by observing where frames come from.

When a frame arrives at interface A:
  If the frame's destination address is in the table,
    THEN
      {read the destination interface from the table
       if the interface in the table is not A, copy the frame to the indicated interface}
    ELSE
      {copy the frame's source address into the table with A as the interface
       copy the frame to all other interfaces}

EVERY ONCE IN A WHILE:
  Clear the table

A problem with smart bridges

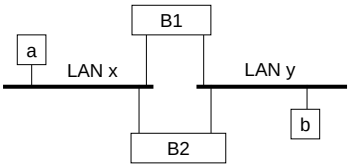
Loops can form as LANs are connected -- when loops are present, bridges may forward data endlessly

Example:

assume the tables are empty at the start

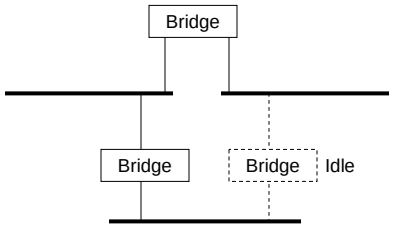
1. a sends a frame to b
2. Say B1 gets the frame first. It doesn't know where b is, so it forwards the frame to LAN y
3. On LAN y, both b and B2 get the frame. Now B2 thinks a is on LAN y and updates its table accordingly.
4. B2 doesn't know where b is, so it sends the frame to LAN x.
5. B1 sees the frame for the second time, but doesn't know it's the same frame. It doesn't know where b is, so it forwards the frame to LAN y.

STEPS 2-5 WILL REPEAT FOREVER.



Fixing the loop problem

The key is to idle enough bridges in the system to break all loops. This means we need to find a spanning tree for the network.



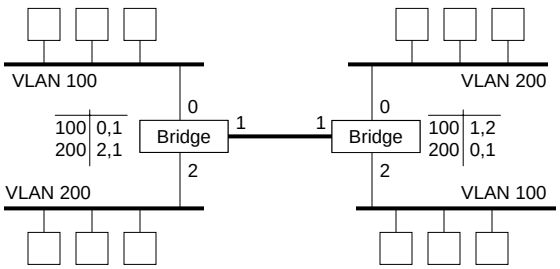
Ideally, we'd like each bridge to be able to determine for itself if it should be running or idle. Conventional spanning tree algorithms assume you know the entire graph, which a bridge would not. Perlman's algorithm is a distributed spanning tree algorithm that will do the job (see text for the algorithm).

Some additional challenges in extended LANs

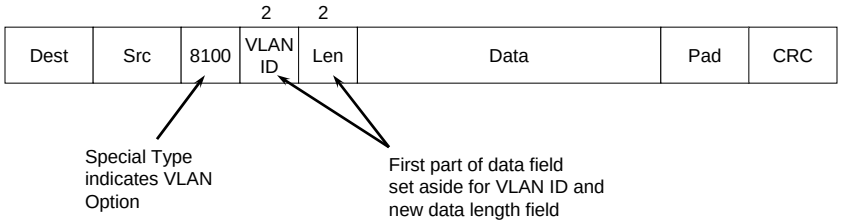
- Privacy: it's useful to be connected to other departments, but do we want them to get all of our messages?
- Broadcast/multicast: we want to be able to do broadcasting and multicasting, but do we really mean for our broadcasts to go to every address everywhere?

Virtual LANs (VLANs)

VLANs are partitions set up over a set of connected LANs. Traffic is not copied between VLANs.



802 support for VLANs



Special Type indicates VLAN Option

First part of data field set aside for VLAN ID and new data length field