

Chapter 5

Bridges

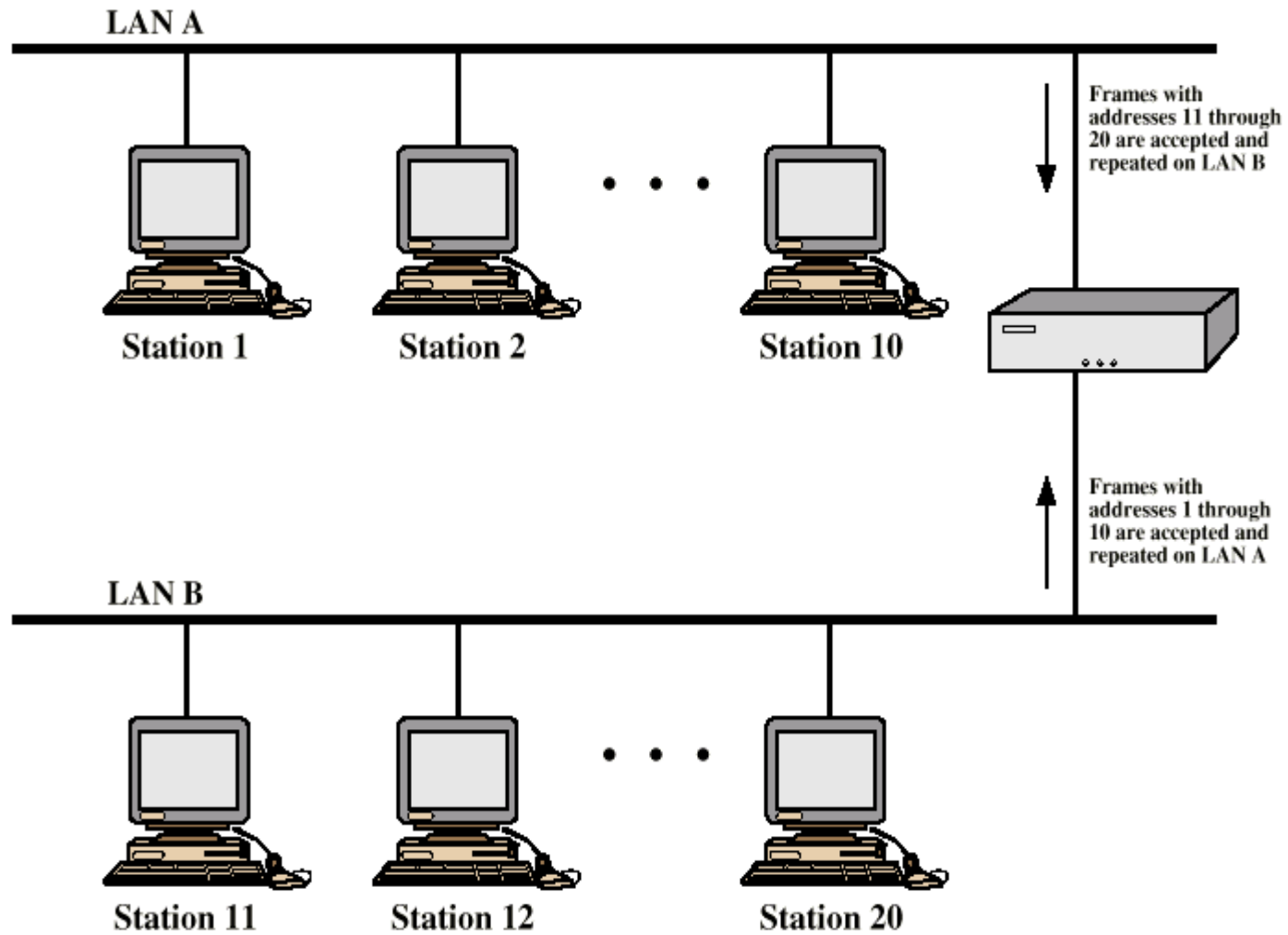
Bridges

- Ability to expand beyond single LAN
- Provide interconnection to other LANs/WANs
- Use Bridge or router
- Bridge is simpler
 - Connects similar LANs
 - Identical protocols for physical and link layers
 - Minimal processing
- Router more general purpose
 - Interconnect various LANs and WANs

Functions of a bridge

- Read all frames transmitted on one LAN and accept those address to any station on the other LAN
- Using MAC protocol for second LAN, retransmit each frame
- Do the same the other way round

Bridge Operation



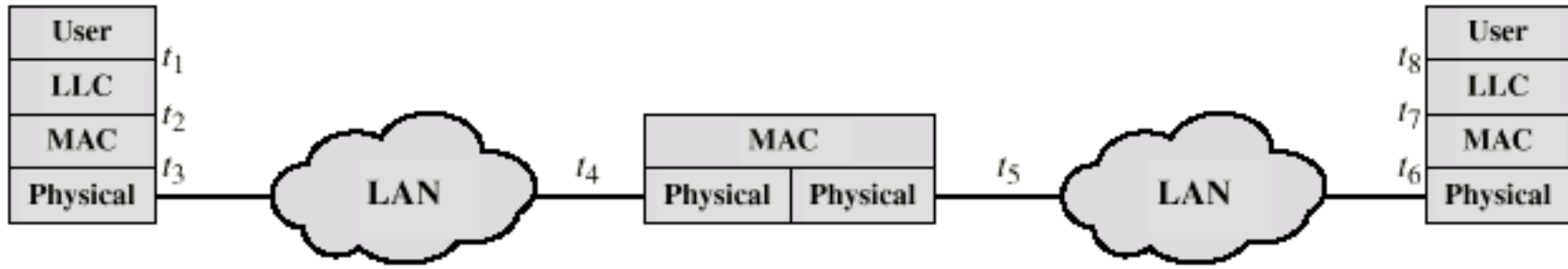
Bridge Design Aspects

- No modification to content or format of frame
- No encapsulation
- Exact bitwise copy of frame
- Minimal buffering to meet peak demand
- Contains routing and address intelligence
 - Must be able to tell which frames to pass
 - May be more than one bridge to cross
- May connect more than two LANs
- Bridging is transparent to stations
 - Appears to all stations on multiple LANs as if they are on one single LAN

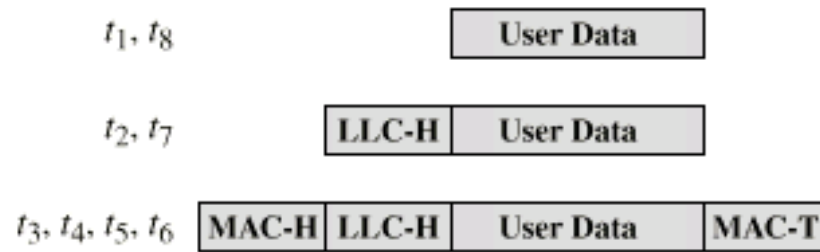
Bridge Protocol Architecture

- a) IEEE 802.1D
- b) MAC level
 - Station address is at this level
- c) Bridge does not need LLC layer
 - It is relaying MAC frames
- d) Can pass frame over external comms system
 - e.g. WAN link
 - Capture frame
 - Encapsulate it
 - Forward it across link
 - Remove encapsulation and forward over LAN link

Connection of Two LANs

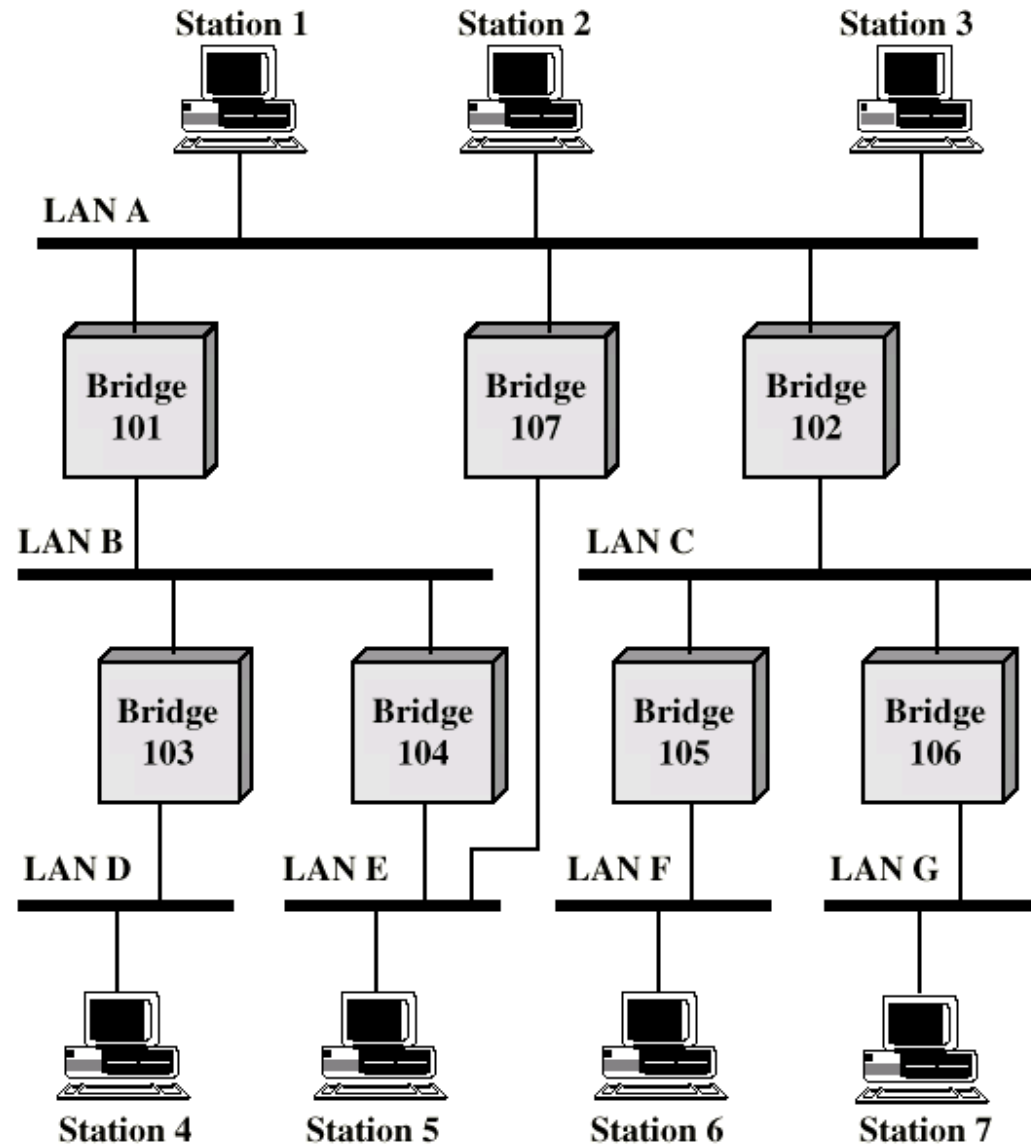


(a) Architecture



(b) Operation

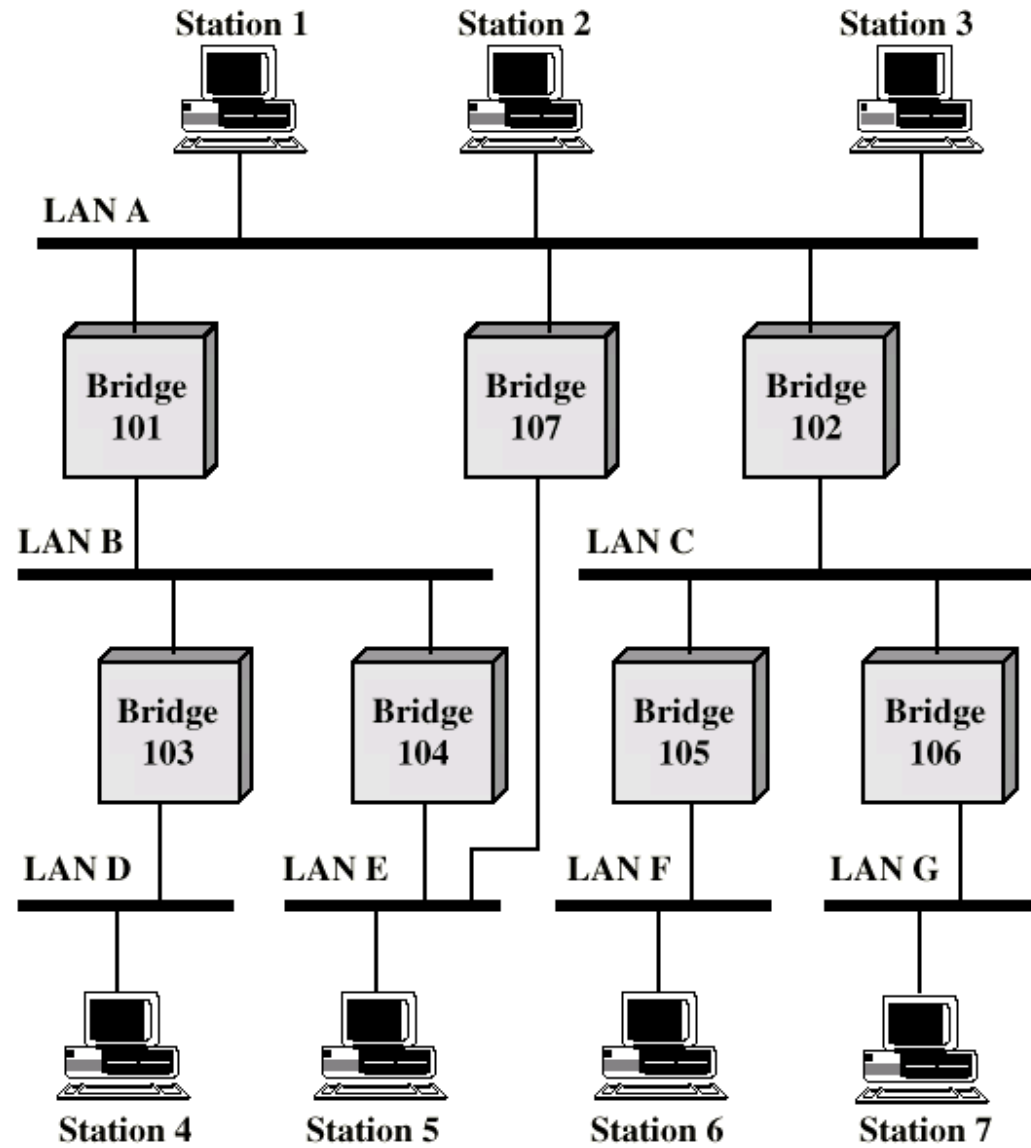
Routing with bridges



Fixed Routing

- a) Complex large LANs need alternative routes
 - Load balancing
 - Fault tolerance
- b) Bridge must decide whether to forward frame
- c) Bridge must decide which LAN to forward frame on
- d) Routing selected for each source-destination pair of LANs
 - Done in configuration
 - Usually least hop route
 - Only changed when topology changes

Multiple LANs



Spanning Tree

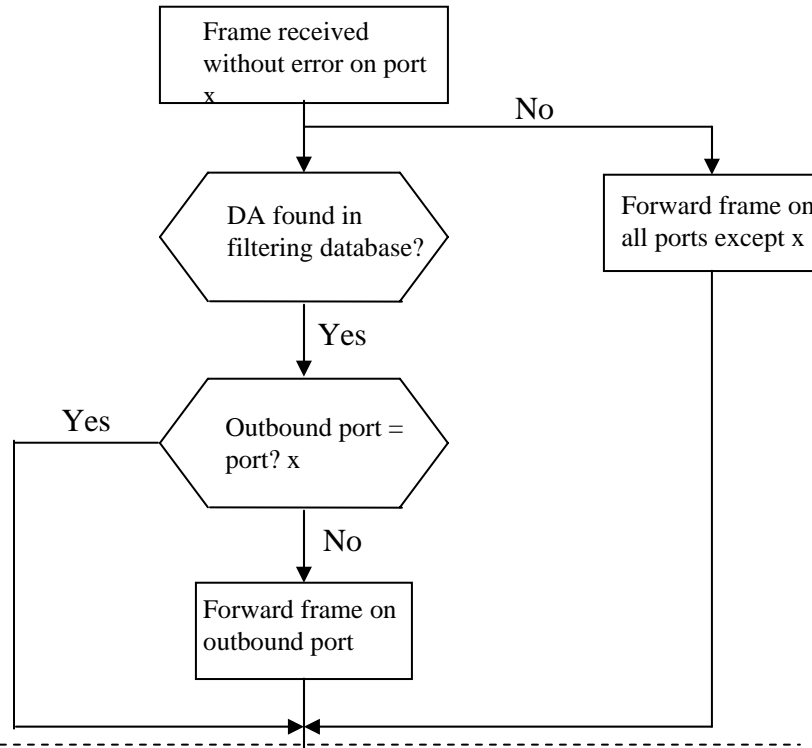
- a) Bridge automatically develops routing table
- b) Automatically update in response to changes
- c) Frame forwarding
- d) Address learning
- e) Loop resolution

Frame forwarding

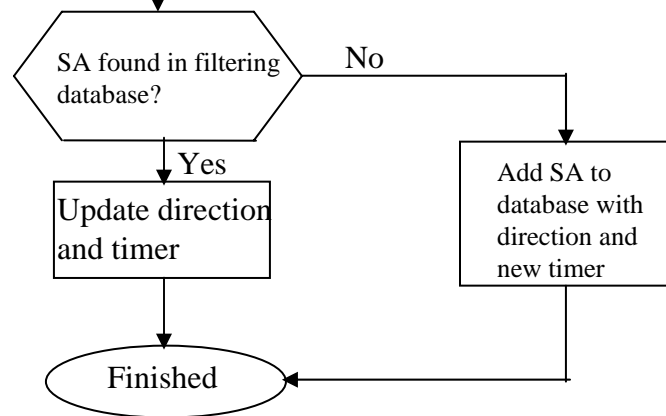
- a) Maintain forwarding database for each port
 - List station addresses reached through each port
- b) For a frame arriving on port X:
 - Search forwarding database to see if MAC address is listed for any port except X
 - If address not found, forward to all ports except X
 - If address listed for port Y, check port Y for blocking or forwarding state
 - Blocking prevents port from receiving or transmitting
 - If not blocked, transmit frame through port Y

Frame forwarding

Bridge Forwarding



Bridge Learning



Address Learning

- a) Can preload forwarding database
- b) Can be learned
- c) When frame arrives at port X, it has come from the LAN attached to port X
- d) Use the source address to update forwarding database for port X to include that address
- e) Timer on each entry in database
- f) Each time frame arrives, source address checked against forwarding database

Spanning Tree Algorithm

- a) Address learning works for tree layout
 - i.e. no closed loops
- b) For any connected graph there is a spanning tree that maintains connectivity but contains no closed loops
- c) Each bridge assigned unique identifier
- d) Exchange between bridges to establish spanning tree

Loop of Bridges

