Characteristics of Connectionless Networks

- A host can send a packet anywhere at any time
  - Packet turns up at a switch forwarded
    - Provided switches table is populated
- Host sends packets does not know (connected / up) status of destination
- Each packet forwarded independent of each other
  - Successive packet can go through other switches
- A switch or link failure may not seriously affect communication

Frame Forwarding in Bridges

- Learning bridges
  - Does not forward all frames that it receives
  - Packet arrives from 1 to 2
    - Not forwarded
  - Forwarding based on Source Address in the packet

Frame Forwarding in Bridges

- When Bridge boots up: Table empty
- Entries are added over time
- Timeout with each entry
- Discards entries after a specified period of time
- Bridge useful for extending a LAN

Extending LANs using Bridges

- To extend a LAN use a bridge
  - This can introduce loops
    - Packets circulate forever
    - Distributed spanning tree algorithm
      - Removes loops
- Bridges are also useful for redundancy
- Bridges exchange configuration information
- Bridges select ports on which it will forward frames

Routing Packets in a LAN

- If source and destination are on the same LAN discard frame
- If destination and source LANs are different forward to appropriate LAN
- If destination not known – flood
- Multiple bridges to improve reliability

Spanning trees

- Two bridges connecting LANs 1 and 2
  - At any point in time only one bridge is active
- Facts:
  - Each bridge unique ID – MAC address + priority
  - Special group of addresses
    - all bridges on this LAN
    - Each port of the bridge has a unique ID within the bridge
  - Concept of root bridge
    - Bridge with lowest value of bridge ID

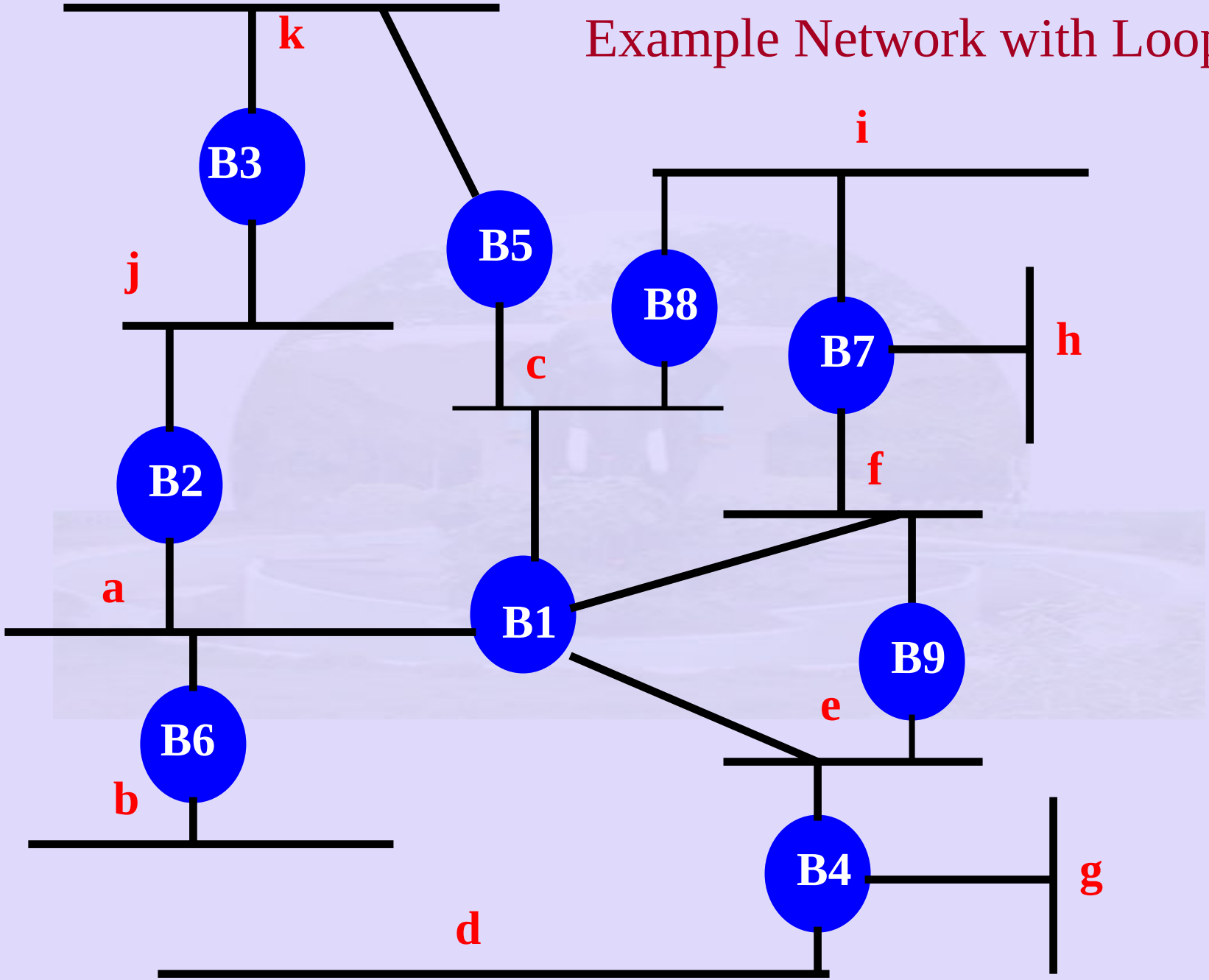
Spanning Tree Algorithm

- Each bridge finds the lowest cost path to root bridge
  - If two ports have same cost, choose the one with smaller port ID
- Construct minimum spanning tree
  - Using distributed BFS

Spanning Tree Algorithm

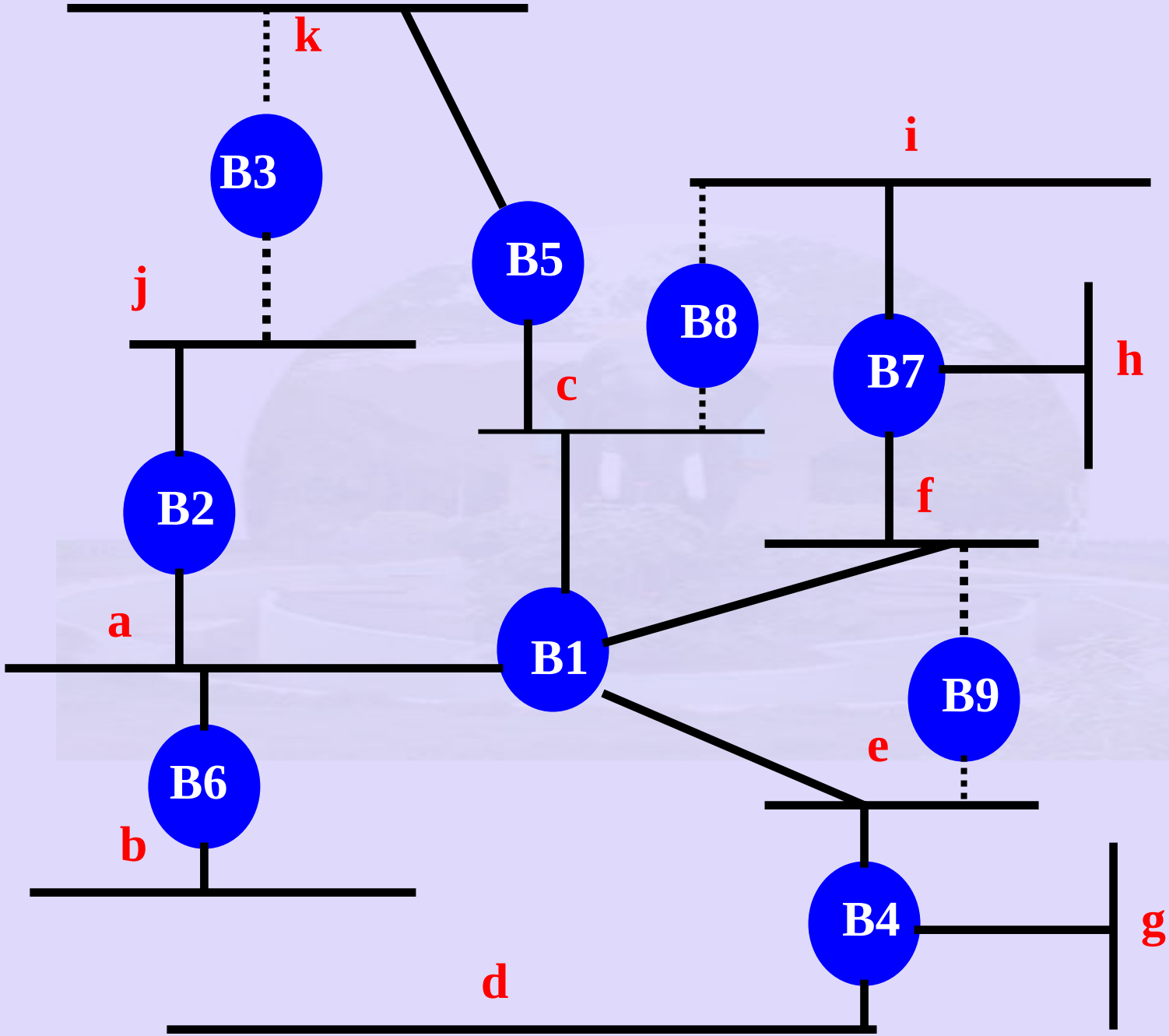
- Initially
  - All nodes think they are root bridges and send configuration information
  - Each node checks configuration information received from other nodes
    - Stops generating messages if its ID is higher
      - Send information to other nodes stating that it is one hop away from root bridge
  - Each node computes path to root
    - Discards some paths
      - i.e. the port with longer paths are made inactive
  - System stabilises only when root node generates configuration messages

Example Network with Loops



Example

- Configuration message (root, d, node)
- Activity node B9
- B9 receives (B4, 0, B4), (B1, 0, B1)
- 1 < 9, 4 < 9, B9, B4 accept B1 as root
- B9 receives (B1, 1, B4) from B4 and (B1, 1, B8)
- B9 notices that distances to root from B4, B8 are the same as that of B9
- 9 > 8, 9 > 4, B9 stops forwarding on both its interfaces


k
B3
B5
i
j
B8
B7
h
c
B2
f
a
B1
B9
e
B6
b
B4
g
d

Remote Bridges

- Connect one or more distant LANs
- Complete MAC frame put in payload