

ATM LAN

- ✍ The need for high capacity and throughput on LAN is increasing
- ✍ The need for high-speed backbone connection to tie between a number of small LANs
- ✍ Proposed solutions:
 - » FDDI
 - » ATM

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LAN Generations

- ✍ First generation:
 - » CSMA/CD and token ring
 - » Provides terminal-to-host connection
 - » Moderate data rate
- ✍ Second generation
 - » FDDI
 - » High-speed backbone

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LAN Generations

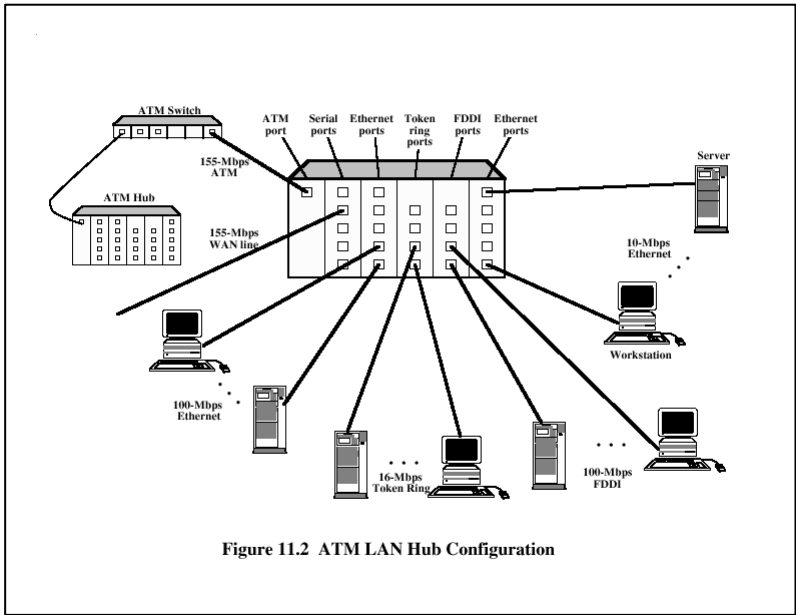
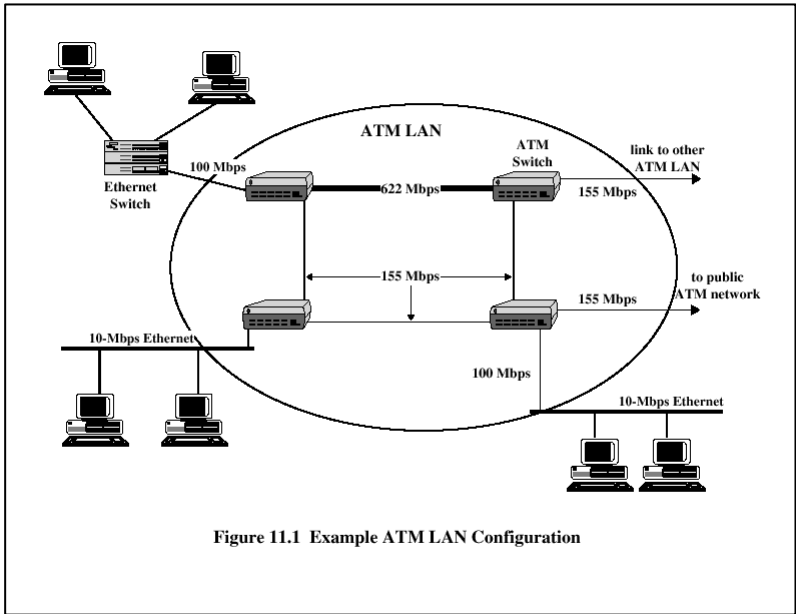
- ✍ Third generation
 - » ATM
 - » Aggregate throughputs and real-time transport guarantees
- ✍ Requirements:
 - » Support multiple, guaranteed classes of services
 - » Provide scalable throughput?
 - » Facilitate the internetworking b/w LAN and WAN

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ATM LAN Configurations

- ✍ Gateway to ATM WAN
 - » An ATM switch acts as a router connecting a premises network to an ATM WAN
- ✍ Backbone ATM switch
- ✍ Workgroup ATM
 - » a group of high-performance workstations connected directly to an ATM switch

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ATM LAN Emulation

✎ Areas of Compatibility

- » Interaction between end system on ATM and an end system on a "legacy" LAN
- » Interaction between end systems on similar "legacy" LANs
- » Interaction between end systems on dissimilar "legacy" LANs

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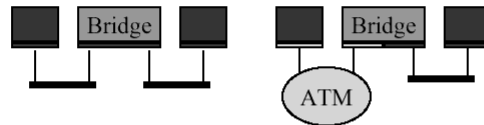
ATM LAN Emulation

✎ Solutions proposed

- » Router
- » Convert all end systems to operate directly on ATM
- » ATM Forum Solution:
 - ATM LAN Emulation

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LAN Emulation



- ❑ Problem: Need new networking s/w for ATM
- ❑ Solution: Let ATM network appear as a virtual LAN
- ❑ LAN emulation implemented as a device driver below the network layer

Features

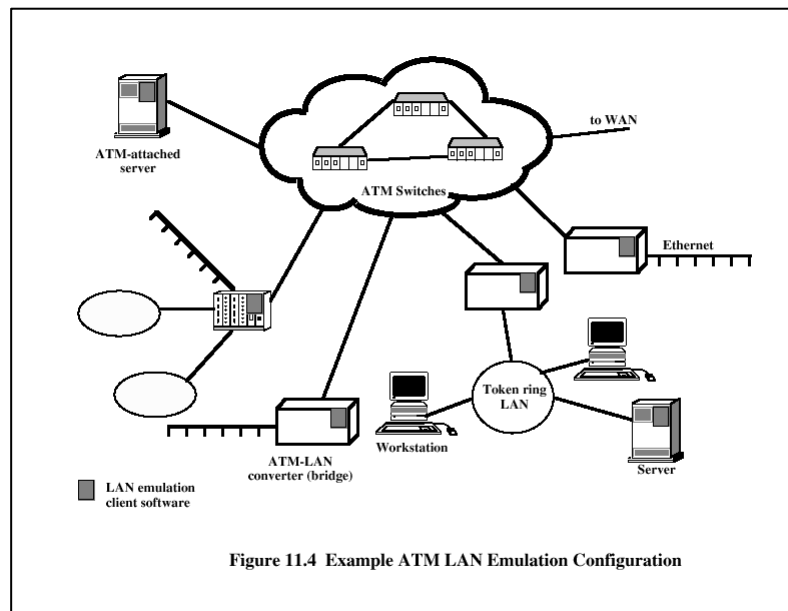
- ❑ One ATM LAN can be n virtual LANs
- ❑ Logical subnets interconnected via routers
- ❑ Need drivers in hosts to support each LAN
- ❑ Only IEEE 802.3 and IEEE 802.5 frame formats supported. (FDDI can be easily done.)
- ❑ Doesn't allow passive monitoring
- ❑ No token management (SMT), collisions, beacon frames.
- ❑ Allows larger frames.

LE Header (2 Bytes)	IEEE 802.3 or 802.5 Frame
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ATM LAN Emulation (Cont.)

- ✎ Current protocol supports:
 - » Two separate LANs of the same type exchanging MAC frames across ATM network
 - » An end system on a LAN interoperates with an end system emulating the same LAN attached directly to ATM switch

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Protocol Architecture

- ✎ All LAN Emulation connections utilize the AAL5 adaptation layer to fragment data frames into 53 byte ATM cells.
- ✎ The ATM switches merely transport the cells just as they would for any other connection.

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ATM-LAN Bridge

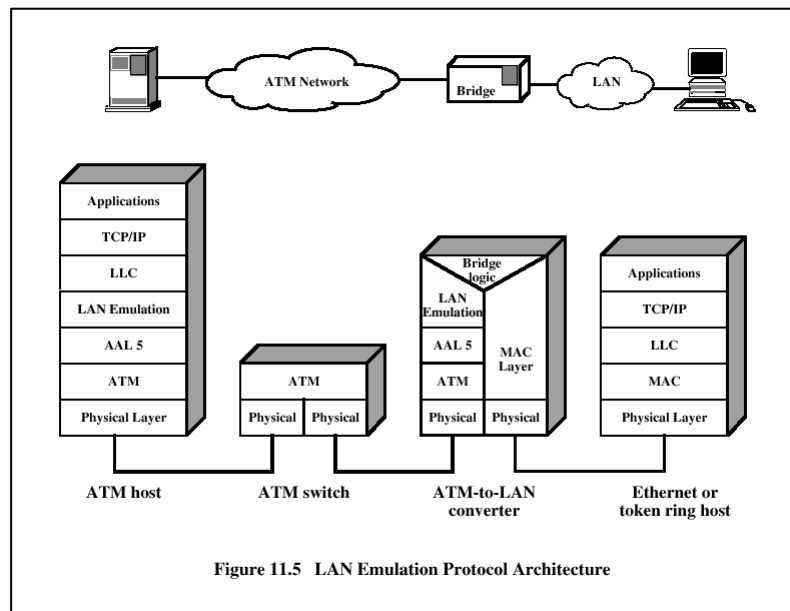
- ✎ Implements not only the MAC layer emulation features of LAN Emulation similar to an ATM attached host driver but also the portions of the protocol designed for proxy devices.
- ✎ This includes exposing portions of the bridge forwarding table and forwarding unknown frames to the legacy networks.

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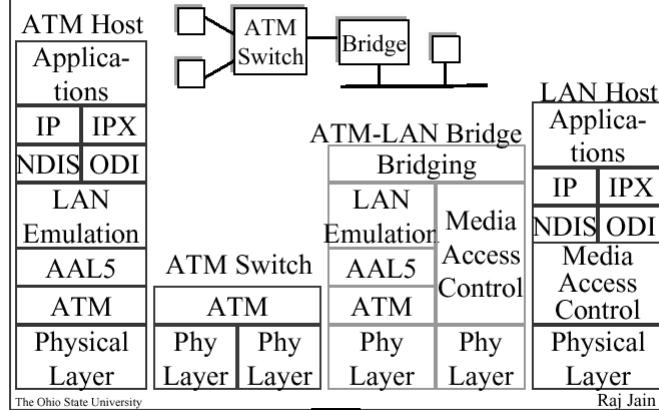
ATM-LAN Bridge

- ✎ On the legacy side of the bridge, the LAN Host shown emphasizes the fact that no changes are required in order to support connectivity with ATM
- ✎ This allows network migration to occur by implementing ATM in the bandwidth critical sections of the network and allowing existing legacy nodes to remain largely unaffected.

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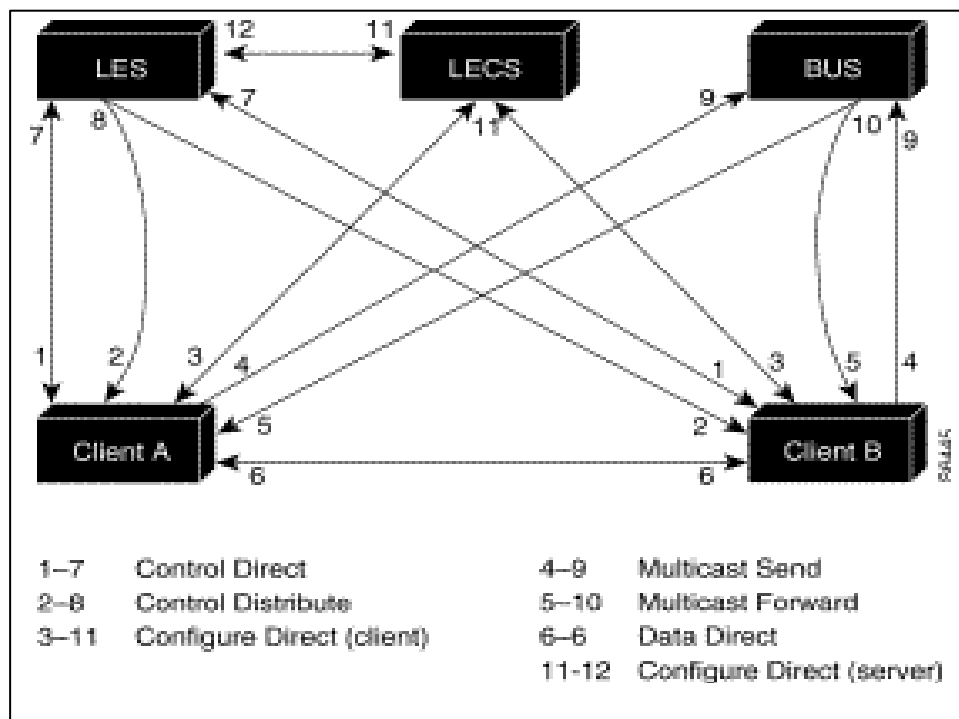
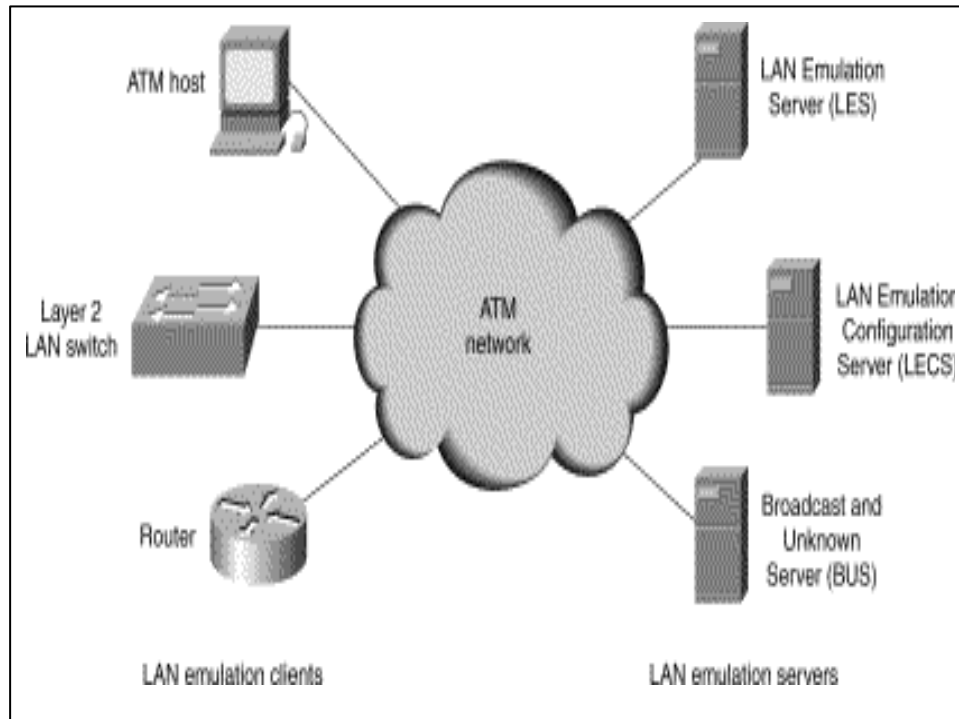


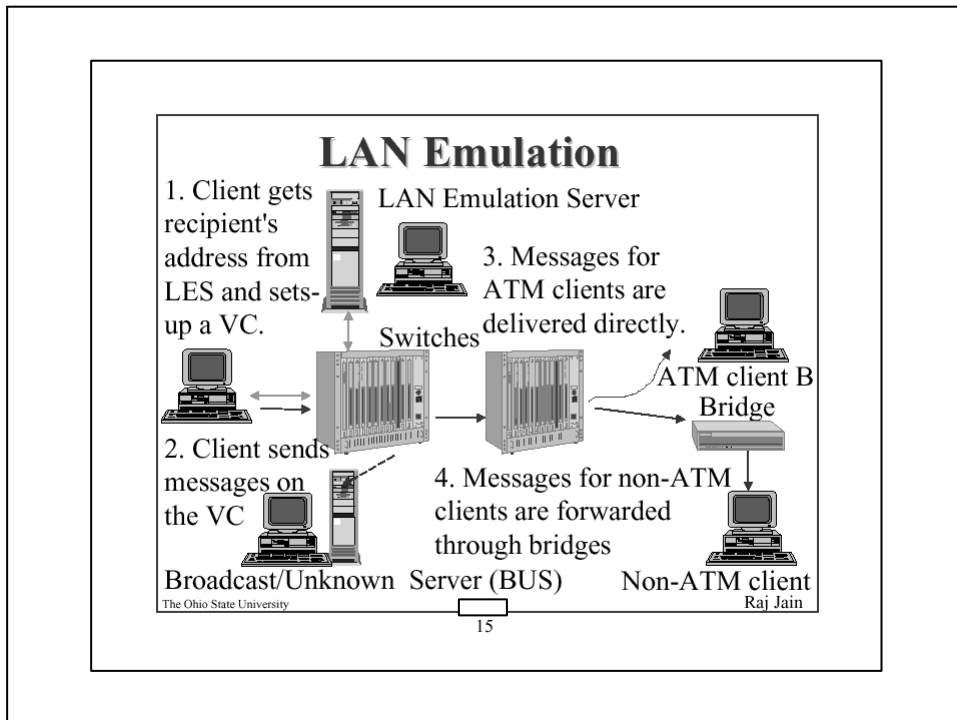
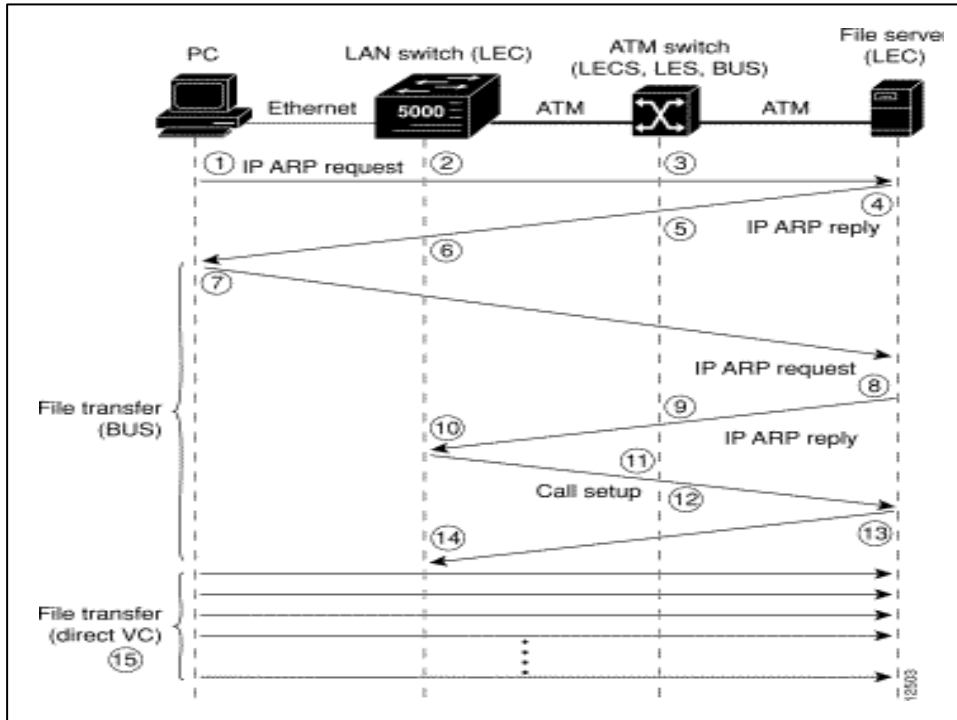
Protocol Layers



Protocol Layers (Cont)

- NDIS = Network Driver Interface Specification
- ODI = Open Datalink Interface
- IPX = NetWare Internetworking Protocol
- **LAN Emulation Software:**
 - LAN Emulation Clients in each host
 - LAN Emulation Servers
 - LAN Emulation Configuration server (LECS)
 - LAN Emulation Server (LES)
 - Broadcast and unknown server (BUS)





Operation

- Initialization:
 - Client gets address of LAN Emulation Configuration Server (LECS) from its switch, uses well-known LECS address, or well known LECS PVC
 - Client gets Server's address from LECS
- Registration:
 - Client sends a list of its MAC addresses to Server.
 - Declares whether it wants ARP requests.

Operation (Cont)

- Address Resolution:
 - Client sends ARP request to Server.
 - Unresolved requests sent to clients, bridges.
 - Server, Clients, Bridges answer ARP
 - Client setups a direct connection
- Broadcast/Unknown Server (BUS):
 - Forwards multicast traffic to all members
 - Clients can also send unicast frames for unknown addresses

Bridge

- ✍ Interconnects two or more LANs (either similar or dissimilar) at the MAC level.
- ✍ Capable of deciding whether or not to forward frame.
- ✍ Creates an extended network and keeps local traffic off.
- ✍ Can make minor changes to frame header.
- ✍ Does not inspect or modify the network layer packets inside frames.

Characteristics of Bridges

- ✍ Routing Tables
- ✍ Filtering
- ✍ Forwarding
- ✍ Learning Algorithm

✎ Routing table

- » Contains one entry per station of network to which bridge is connected.
- » Is used to determine the network of destination station of a received packet.

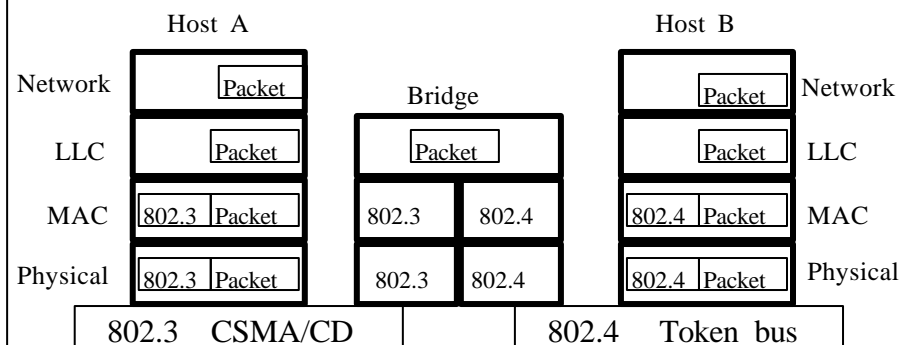
✎ Filtering

- » Is used by bridge to allow only those packets destined to the remote network.
- » Packets are filtered with respect to their destination and multicast addresses.

✎ Forwarding: the process of passing a packet from one network to another.

✎ Learning: the process by which the bridge learns how to reach stations on the internetwork.

Operation of a LAN bridge from 802.3 to 802.4

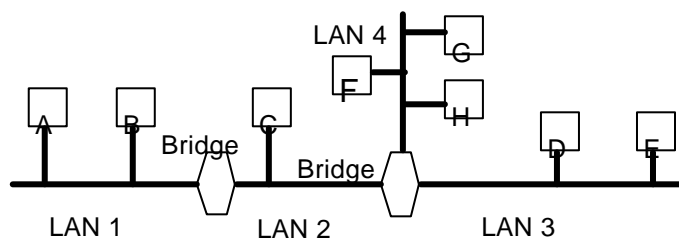


Transparent Bridges

- ✎ The first IEEE 802 bridge is a transparent bridge or spanning tree bridge.
- ✎ People wanted to have complete transparency: when a site with multiple LANs buys bridges designed to the IEEE standard, just plug connectors into bridges. So,
 - » no need for hardware/software changes,
 - » no setting of address switches,
 - » no downloading of routing tables or parameters.

✍ A transparent bridge accepts every frame transmitted on all the LANs to which it is attached.

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- ✗ Topology can change dynamically.
- ✗ There must be only one path of bridges and LANs between any two segments in the bridged LAN
- ✗ Bridges must support Spanning Tree Protocol if network contains loops.
- ✗ Have the advantage of being easy to install
- ✗ Use only a subset of topology.
- ✗ Are chosen by the CSMA/CD and token bus.

Source Routing Bridges

- ✗ Token ring people chose the source routing bridge.
- ✗ Transmitter, or source, of frame in source routing specifies which route the frame is to follow.
- ✗ Every machine in the network knows, or can find, the best path to every other machine; discovery frame is used.
- ✗ Sender knows whether or not the destination is on its own LAN.

Comparison of Bridges

Issue	Transparent Bridge	Source Routing Bridge
Orientation	Connectionless	Connection-oriented
Transparency	Transparent to hosts	Not transparent
Configuration	Automatic	Manual
Routing	Suboptimal	Optimal
Locating Destinations	Backward learning	Discovery frames
Failures	Handled by bridges	Handled by hosts
Complexity	In the bridges	In the hosts