

L25 - Source Route Bridging

Source Route Bridging

Principles and Procedures

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Agenda

- Introduction and Routing Information
- All Routes Broadcast
- Single Route Broadcast

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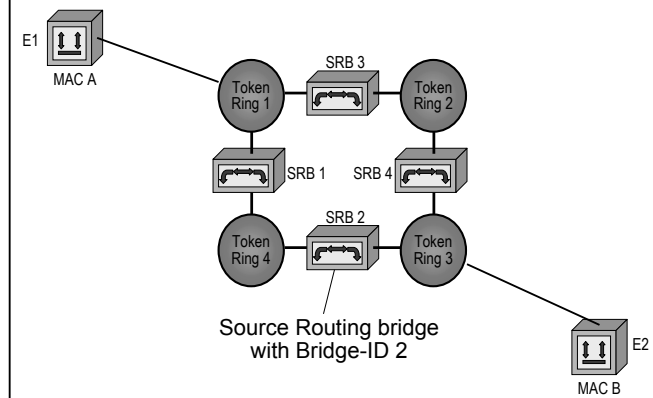
- method developed by IBM
 - ◆ for coupling several Token Rings with Source Route Bridges (SR)
- end system
 - ◆ must explicitly insert routing information into the frame (RII = 1; Routing Info)
 - ◆ takes care about routing upon layer 2
- SR bridges
 - ◆ provide relaying (switching) tasks
 - ◆ routing information in a frame is used by SR Bridge to pass on this frame

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Source Routing Bridging

- end systems must know about the network topology
- SR bridges are not transparent for the end systems
- SR bridges introduce ring topology information
 - ◆ ring number and bridge ID
- route determination
 - ◆ is done by discovering (exploring) the path (source route)
 - ◆ in the discovery process both parties are involved
 - * end systems and all intermediate SR-bridges

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Source Route Bridging

- advantages:
 - ◆ meshed topology can improve reliability and provide load balancing without need of a protocol (like STP)
 - ◆ SR-bridges are built simple (e.g. using PCs); only frames with RII = 1 must be processed by the SR-bridges
- drawbacks:
 - ◆ discovery method causes additional and extensive network-traffic, which is not acceptable for big networks
 - ◆ for example SRB applied on the topology of the Internet: a discovery initiation would terminate after 108 years

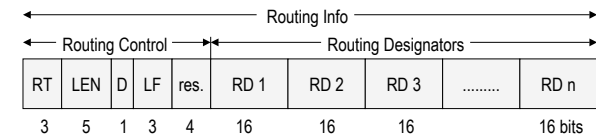
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Routing Info (RII = 1) Format



RT Routing Type
 LEN length bits
 D Direction bit
 LF Largest Frames bits
 RDx Routing Designator
 res. reserved

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Routing Control

- RT (Routing Type):
 - ◆ specifies if source routed frame or discovery frame
 - 0 x x Non-Broadcast (NB; Route completely specified by RDs)
 - 1 0 x All-Routes-Broadcast (ARB; for discovery process)
 - 1 1 x Single-Route-Broadcast (SRB; for modified discovery process using Spanning Tree)
- LEN (Length)
 - ◆ length of routing information in bytes (2 -30)
 - ◆ RI can hold 14 RD at maximum
 - ◆ therefore 13 SR bridges in sequence are possible

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Routing Control

- D (Direction):
 - ◆ tells SR-bridges how to interpret path information
 - 0 Routing Designators are interpreted from left to right
 - 1 Routing Designators are interpreted from right to left
- LF (Largest Frame)
 - ◆ specifies the maximal allowed frame size between two stations

000 ... 516 Byte (ISO 8473)	100 ... 8191 Byte (TB)
001 ... 1500 Byte (E)	101 ... 11407 Bytes (TR,16)
010 ... 2052 Byte (3270)	110 ... 17800 Byte (TR,16)
011 ... 4471 Byte (TR,4)	111 ... 65535 Byte

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Routing Designators

- RDx (Routing Designators)
 - ◆ 12 bit Ring-ID and 4 bit Bridge ID
 - ◆ marks the route from source to the destination
 - * these IDs are maintained by the bridges and inserted (in the RDs) during discovery in the discovery frames by the bridges
- Ring-IDs
 - ◆ unique in the whole Source Route Bridging network
- Bridge-IDs
 - ◆ different only if two or more bridges connect two rings in parallel

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Basic Steps of Source Routing

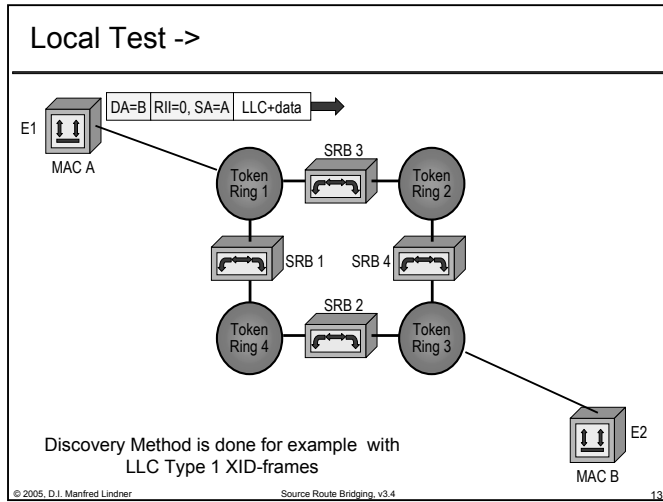
- to generate routing information the end-system sends special LLC-frame (XID or Test) with MAC-DA = destination address
- first trial with RII = 0 to reach destination system on the local ring
- second trial with RII = 1, with RT either set as All-Routes-Broadcast (ARB) or Single-Route-Broadcast (SRB), with LEN = 2, D = 0 and LF according to the frame size
- all bridges connected to the local ring receives and process this frame because RII = 1

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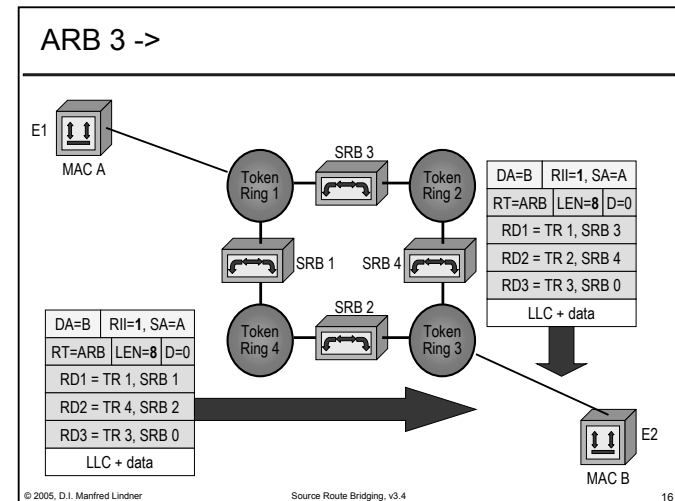
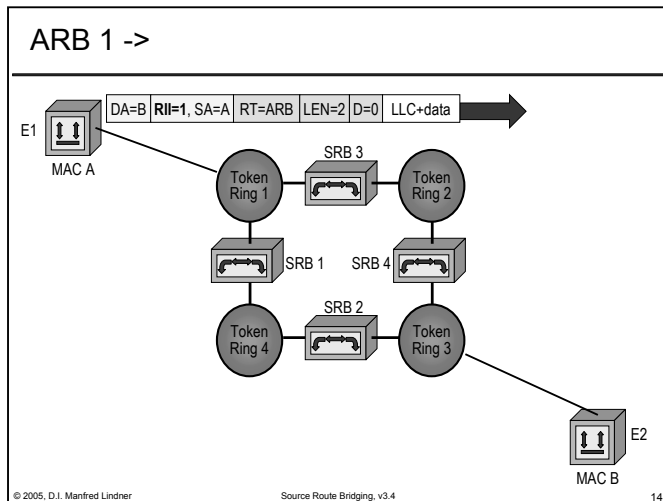
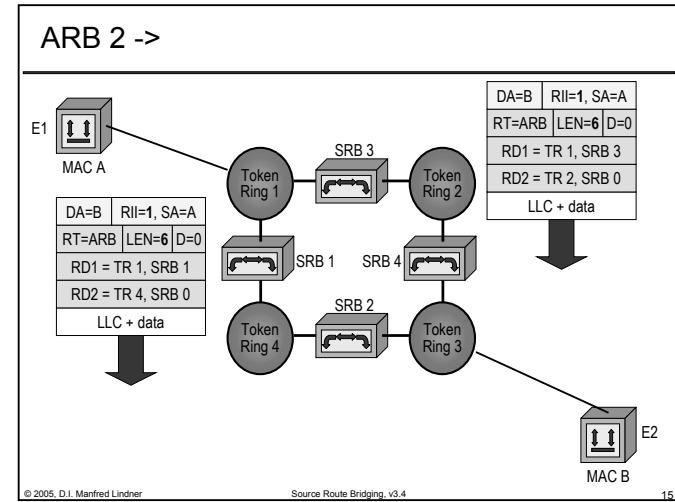
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ARB Steps

- SR bridges
 - ◆ append their RDs consisting of input ring number RN, their Bridge-ID and output-ring number and emit that frame on the other port
 - * Bridge-ID at the output ring = 0
- one XID-frame of the source end system
 - ◆ triggers several XID-frames to get to the destination by using all possible paths
- every XID-frame
 - ◆ is confirmed with a XID-response-frame with RT = 0xx (route exists, NB) by the destination
- source receives
 - ◆ all XID-response-frames as NB-frames and selects a route for its future communication to that destination

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ARB Steps

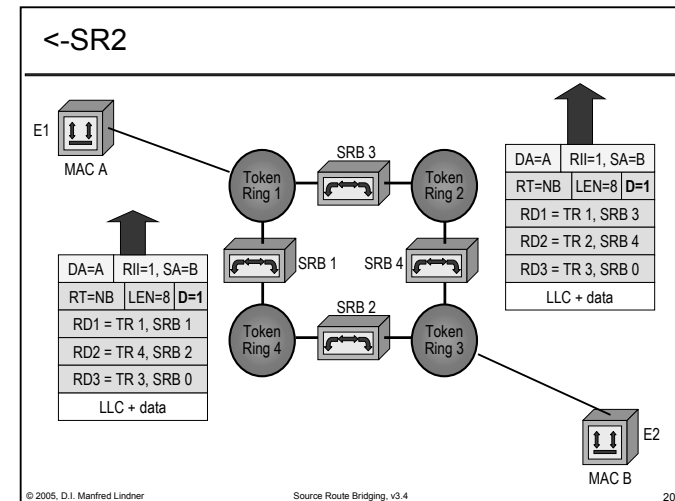
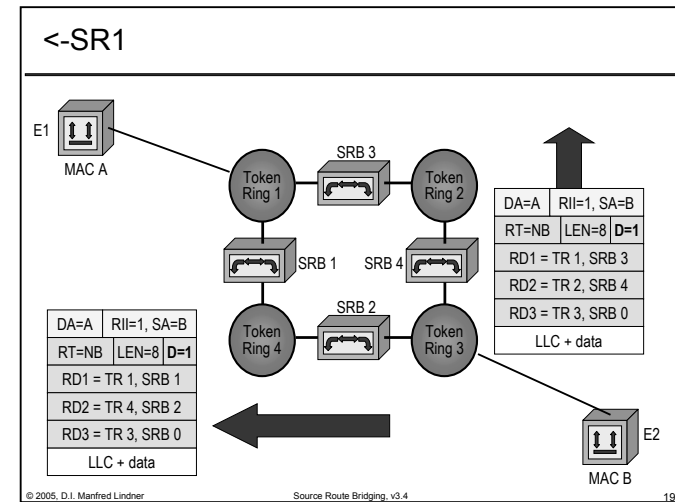
- commonly, source end systems selects the route of the first received XID-frame
- then all following LLC-frames from source to destination end system
 - ◆ are transmitted with RII = 1, RT = Non-Broadcast Route (NB) and appropriate RDs
- informations about all determined paths
 - ◆ can be stored in a local cache of the source end system to deal fast with new connection requests
- location change of end-systems
 - ◆ can be noticed by an aging-mechanism and thereby solved automatically

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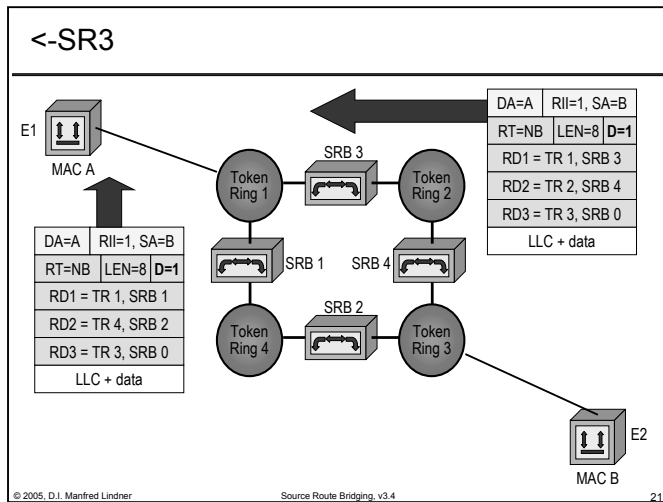
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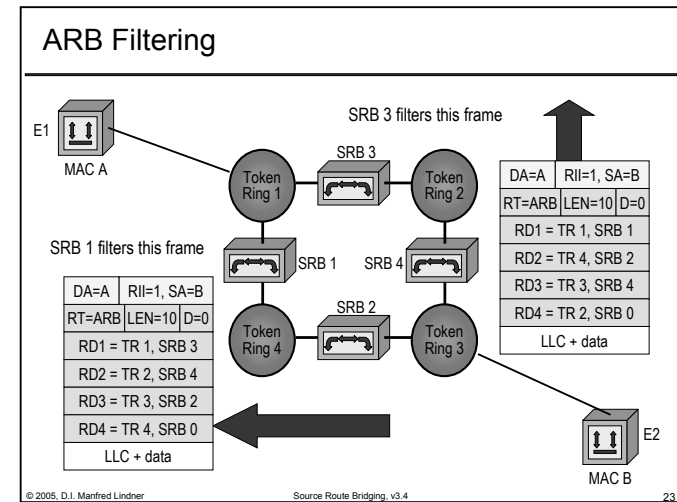
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ARB Unwanted Effects, Filtering

- in our example SRB 2 and SRB 4
 - ◆ must forward ARB-XID-frame received from the other bridge from TR3 to TR2 or TR4
 - ◆ only SRB1 and SRB3 can filter these frames
- generic rule for filtering of frames
 - ◆ ARB- and SRB-frames
 - * if RD-sequence already contains a ring number which is equal to the outgoing ring number of a bridge, then this frame must be filtered → loops are avoided
 - ◆ SR-frames
 - * if RD-sequence contains no combination Ring number/Bridge-ID/ring number which is equal to the ingoing-ring number/ own Bridge-ID/outgoing ring number, then this frame must be filtered

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Single Route Broadcast (SRB)

- disadvantage of ARB
 - ◆ generate unwanted frames even for non-existing destinations
 - ◆ could be improved by SRB
- source sends XID-frame with SRB
 - ◆ this frame will be passed on by only one bridge in each ring, thereby marking an unique path to the destination
- spanning tree
 - ◆ for explorer frames to implement this
 - ◆ spanning tree either configured statically by network administrator or dynamically by spanning tree protocol

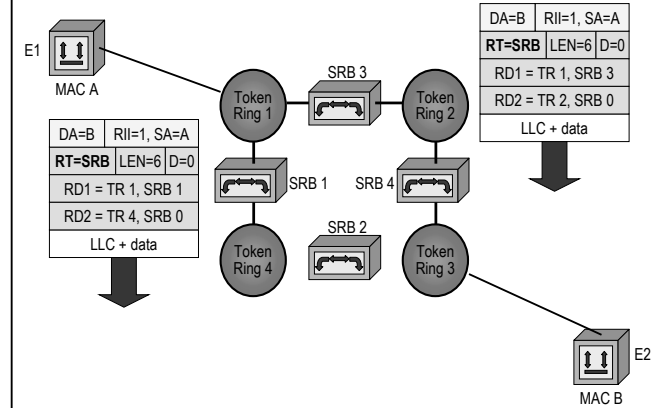
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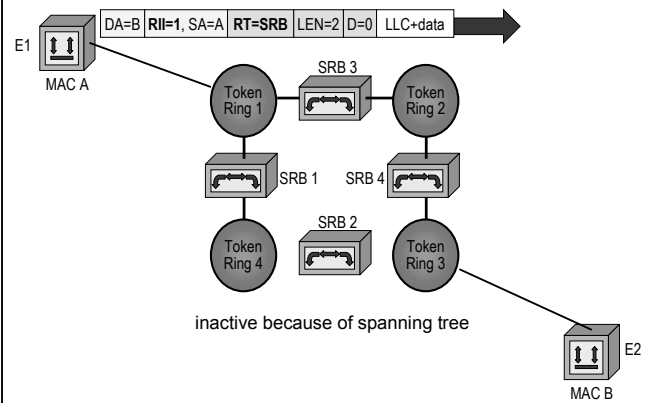
SRB 2 →



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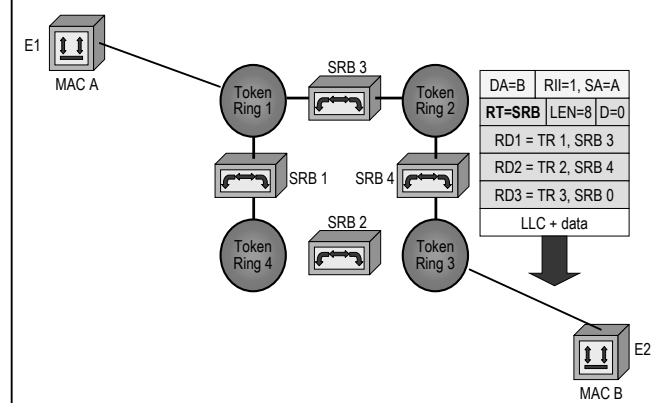
SRB 1 →



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SRB 3 →



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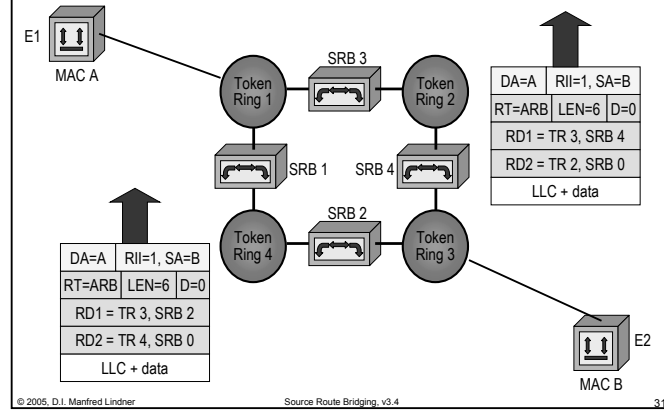
Single Route Broadcast (SRB)

- destination replies
 - ◆ with a ARB-XID-frame; this frame will be processed by all bridges
- hence source receives
 - ◆ several ARB-XID-frames; every frame contains RDs which mark its route
 - ◆ information about all possible routes and can select an appropriate one
- advantage of SRB method
 - ◆ ARB with unwanted effects (flooding the whole net along all paths with frames) happens only on the way back and only if destination device resides on this net

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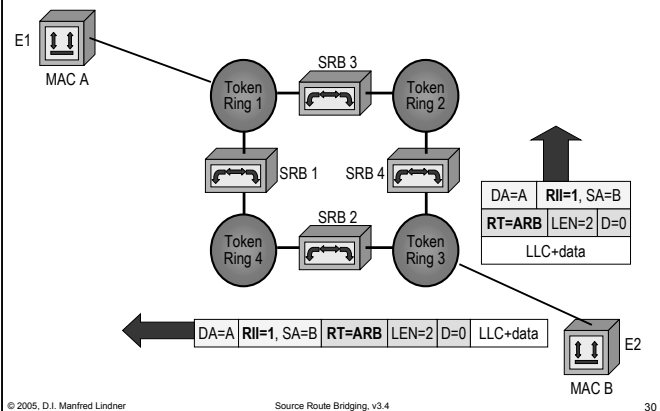
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← SRB 5



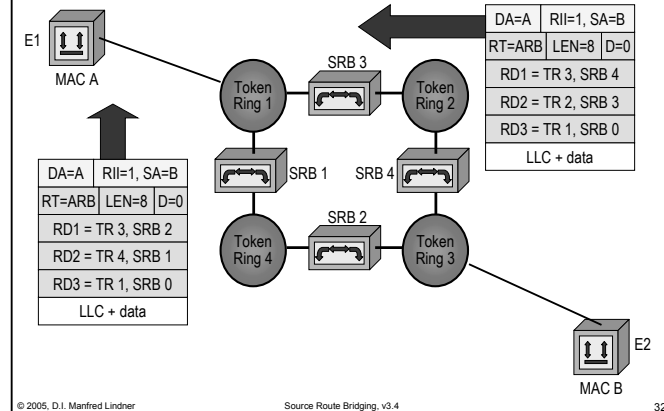
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← SRB 4



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← SRB 6



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