

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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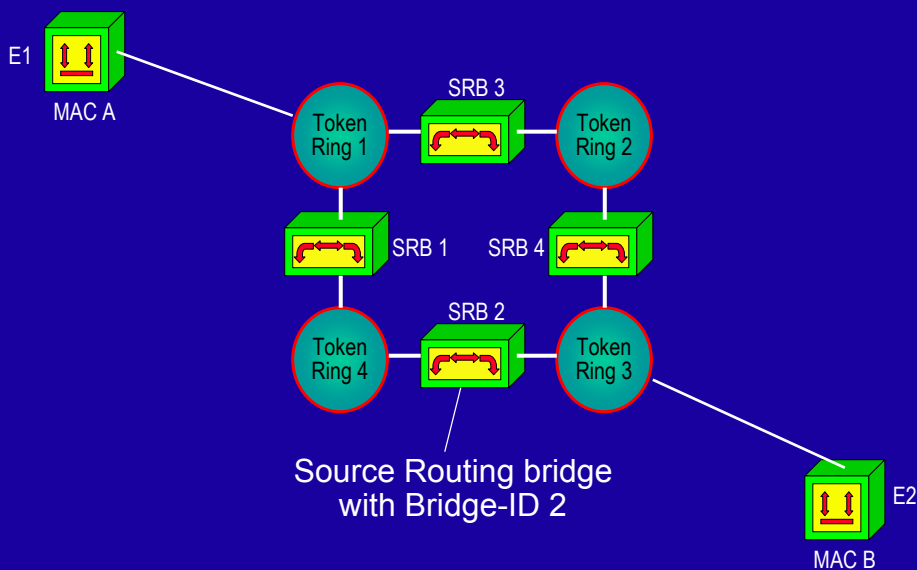
- ❑ method developed by IBM
 - ◆ for coupling several Token Rings with Source Route Bridges (SR)
- ❑ end system
 - ◆ must explicitly insert routing information into the frame (RII = 1; Routing Info)
 - ◆ takes care about routing upon layer 2
- ❑ SR bridges
 - ◆ provide relaying (switching) tasks
 - ◆ 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	LEN	D	LF	res.	RD 1	RD 2	RD 3	RD n
3	5	1	3	4	16	16	16		16 bits

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 |

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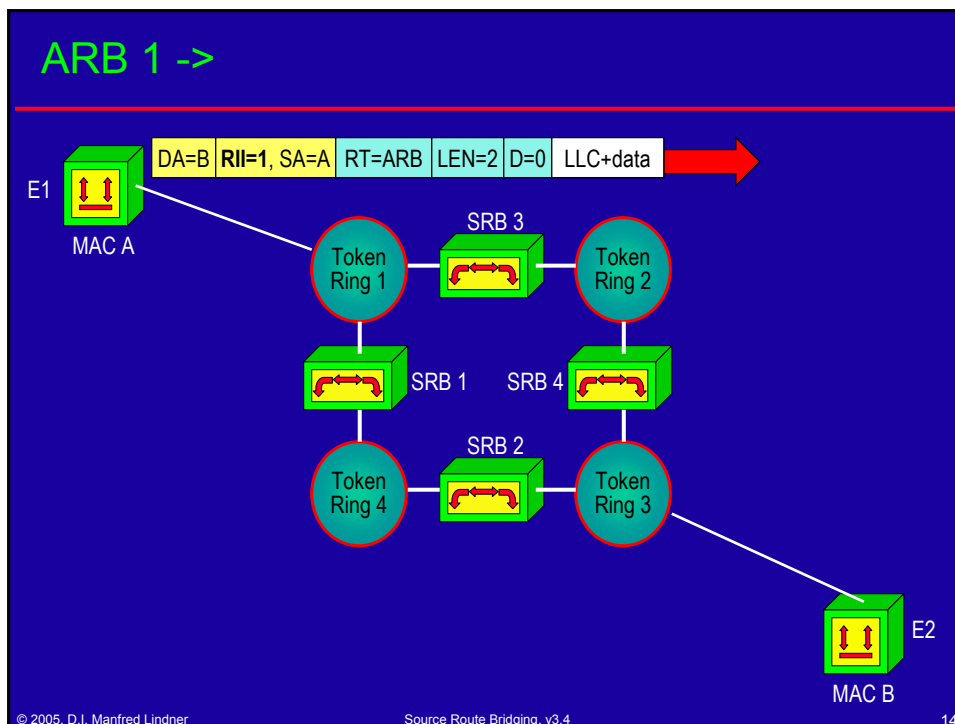
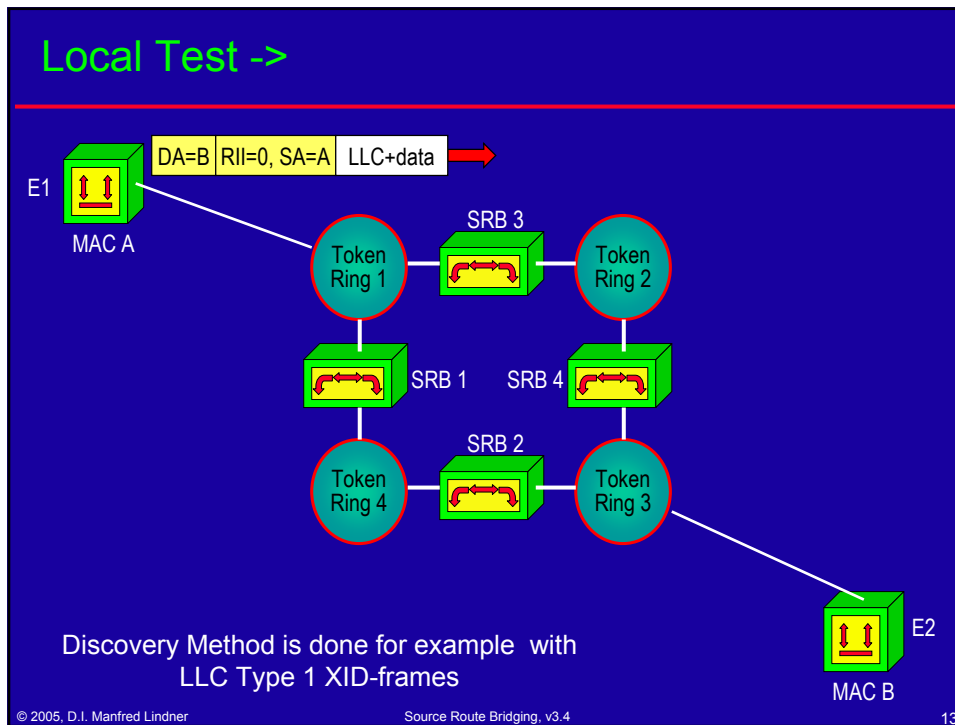
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- ❑ Introduction and Routing Information
- ❑ All Routes Broadcast
- ❑ Single Route Broadcast

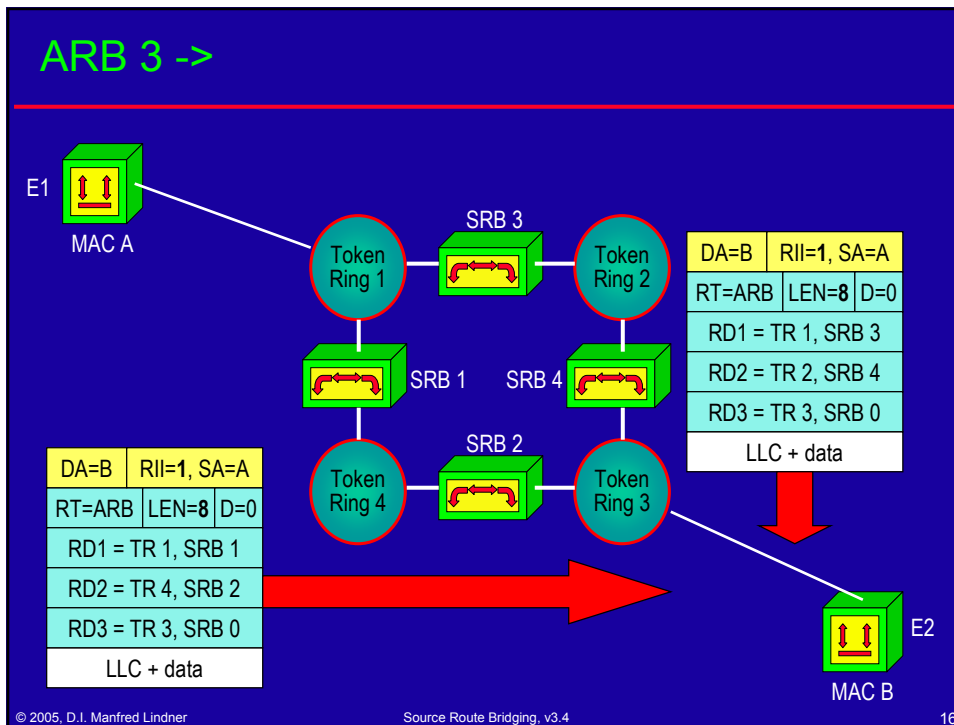
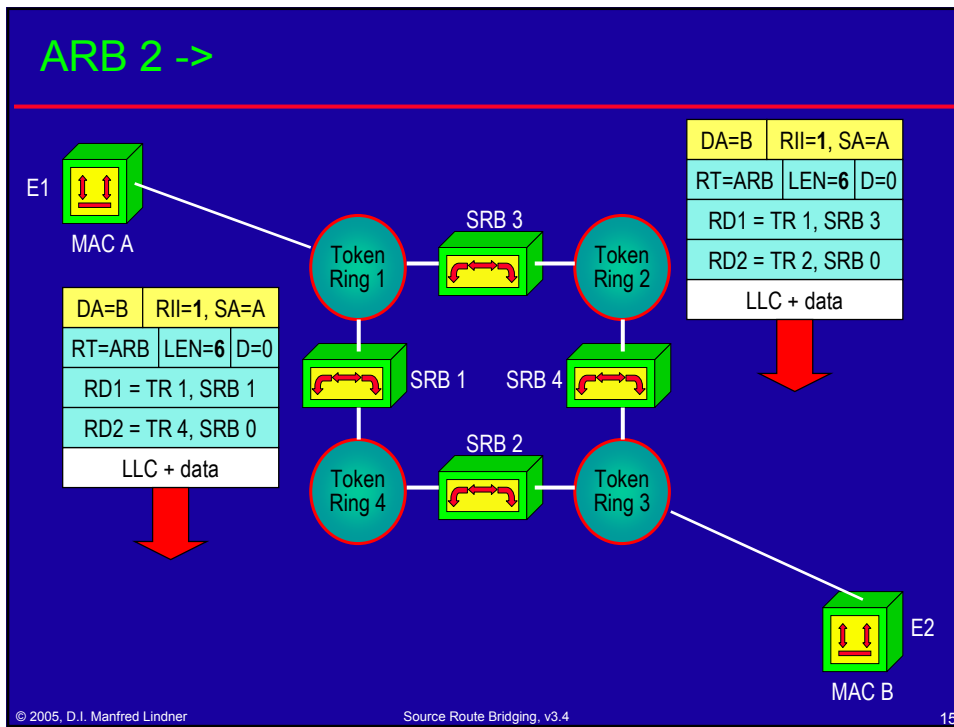
Basic Steps of Source Routing

- ❑ 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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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

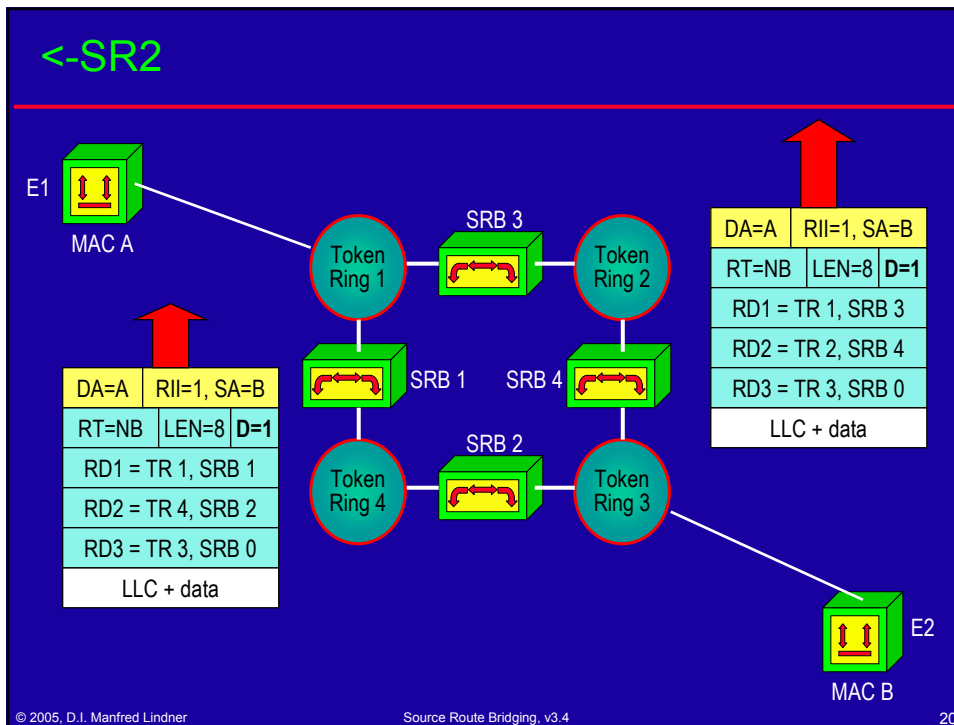
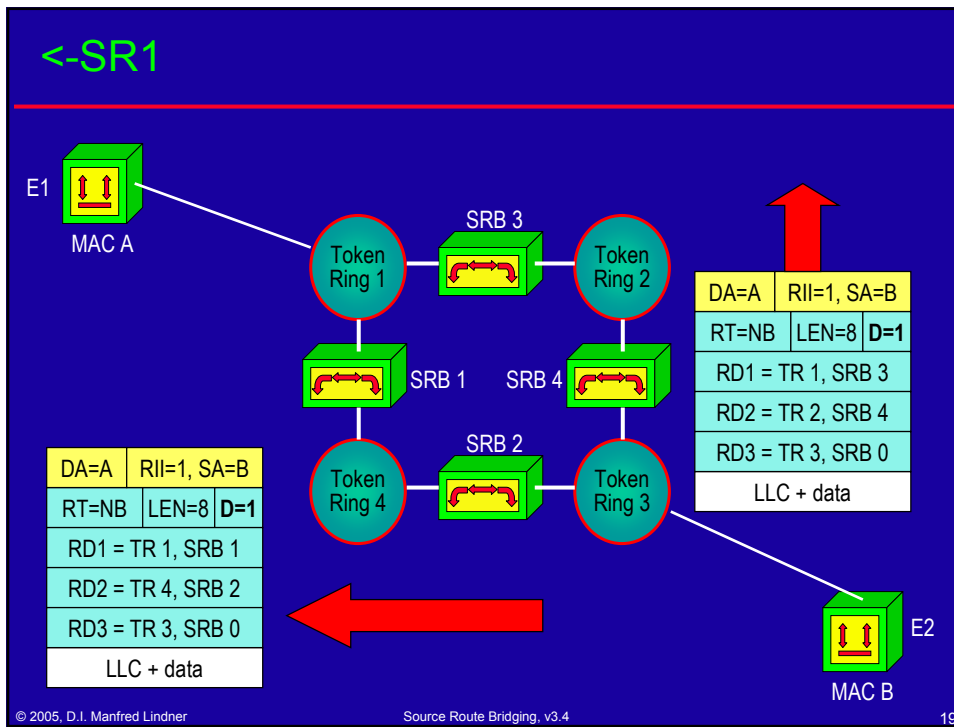
- ❑ commonly, source end systems selects the route of the first received XID-frame
- ❑ then all following LLC-frames from source to destination end system
 - ◆ are transmitted with RII = 1, RT = Non-Broadcast Route (NB) and appropriate RDs
- ❑ informations about all determined paths
 - ◆ can be stored 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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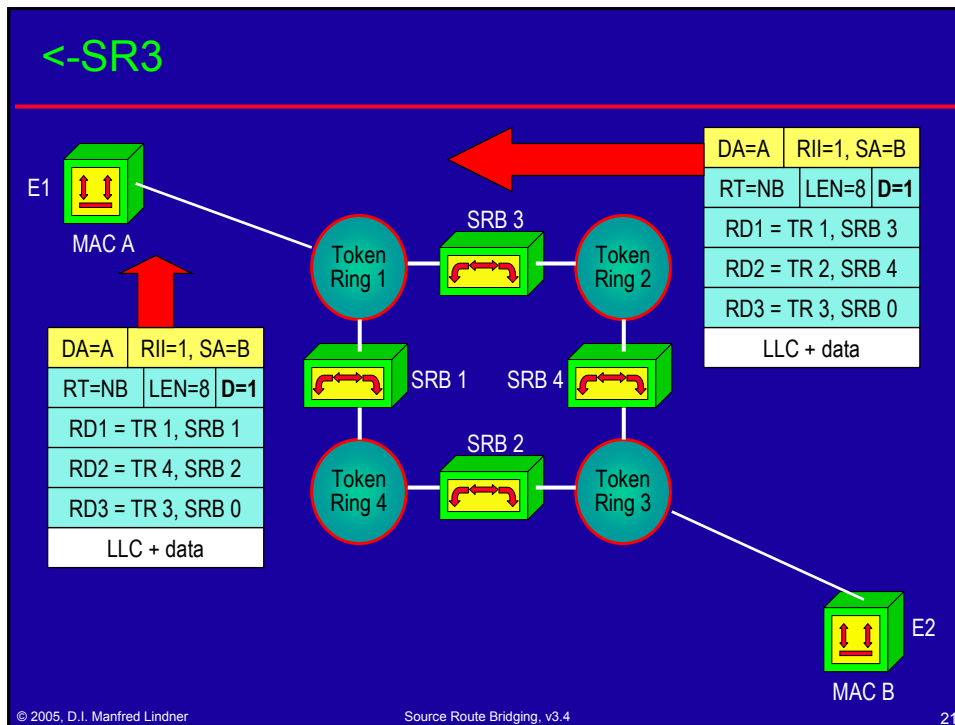
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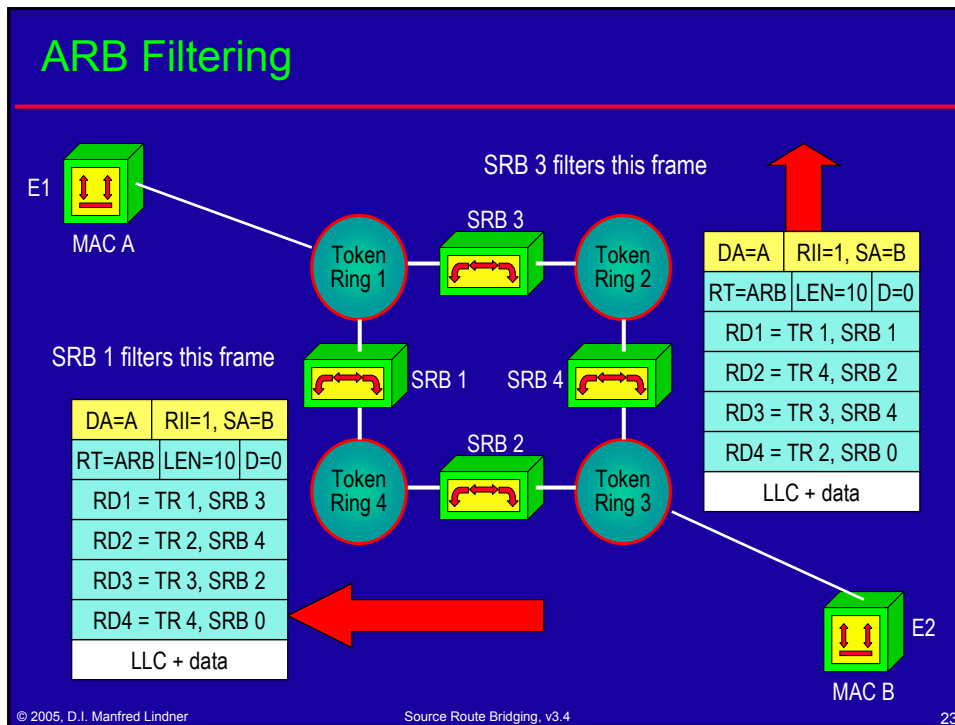
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ARB Unwanted Effects, Filtering

- 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)

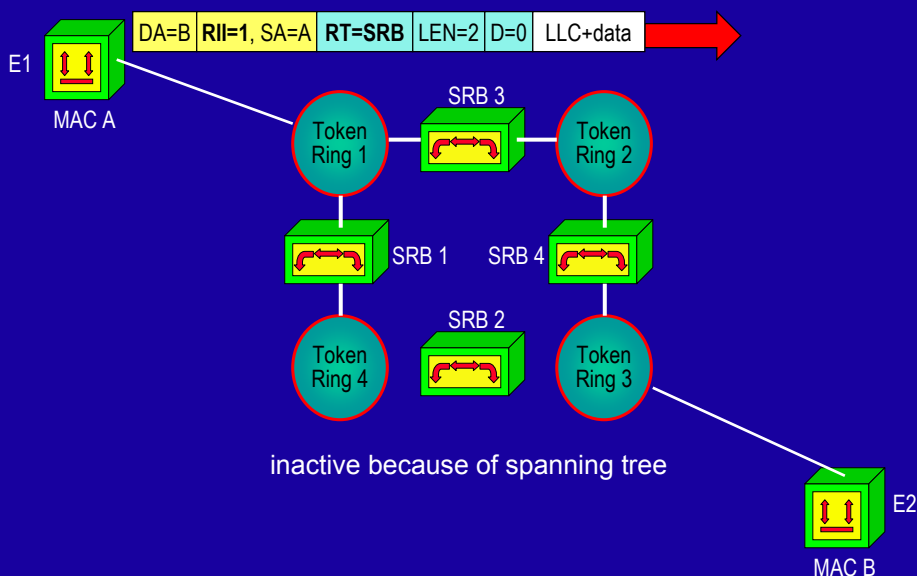
- ❑ disadvantage of ARB
 - ◆ generate unwanted frames even for non-existing destinations
 - ◆ could be improved by SRB
- ❑ source sends XID-frame with SRB
 - ◆ this frame will be passed on by only one bridge in each ring, thereby marking an unique path to the destination
- ❑ spanning tree
 - ◆ for explorer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

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SRB 1 →

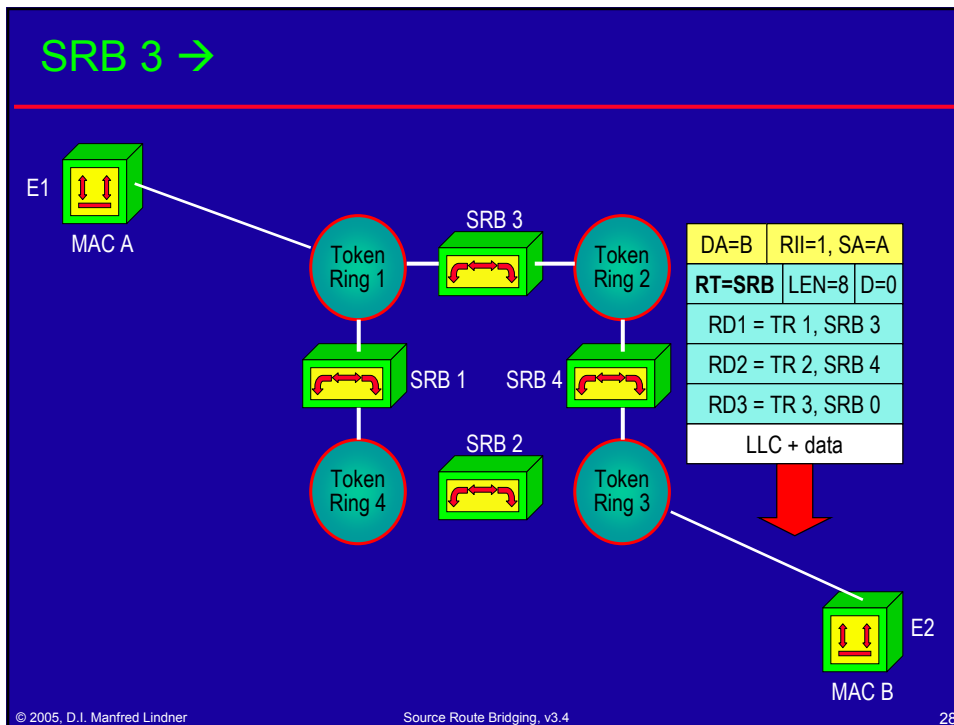
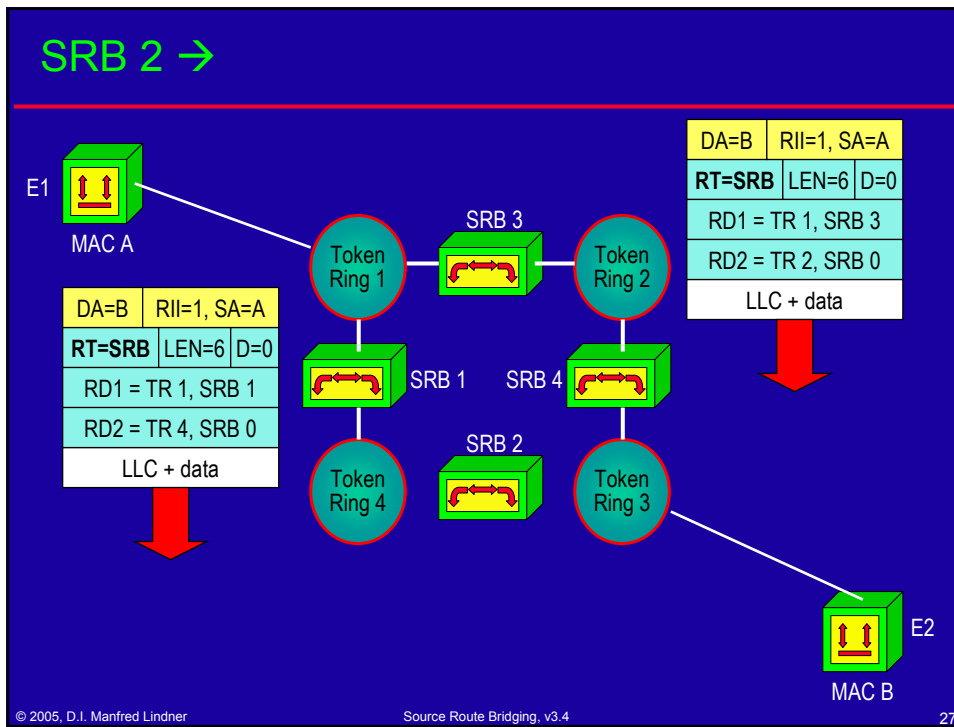


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Single Route Broadcast (SRB)

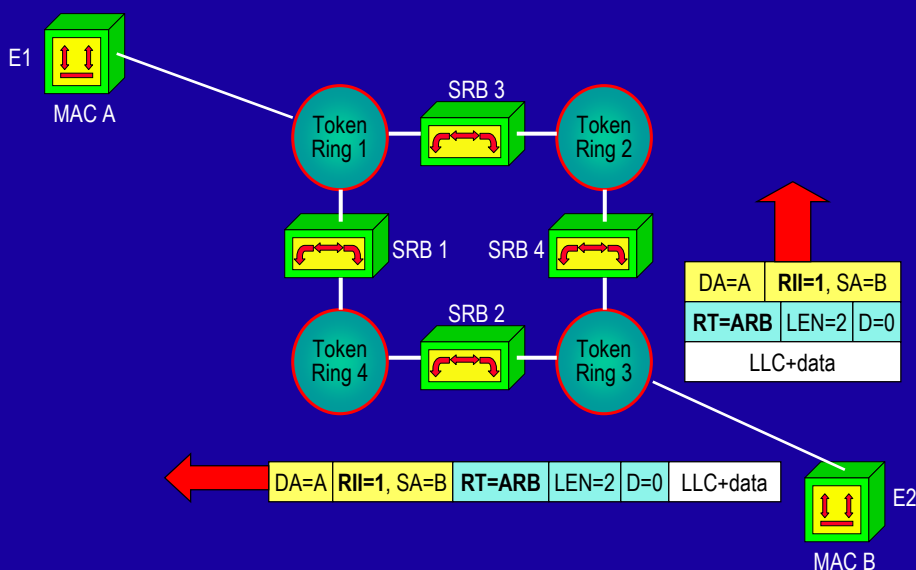
- ❑ destination replies
 - ◆ with a ARB-XID-frame; this frame will be processed by all bridges
- ❑ hence source receives
 - ◆ several ARB-XID-frames; every frame contains RDs which mark its route
 - ◆ information about all possible routes and can select an appropriate one
- ❑ advantage of SRB method
 - ◆ 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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<- SRB 4



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