BROADBAND AND HIGH SPEED NETWORKS

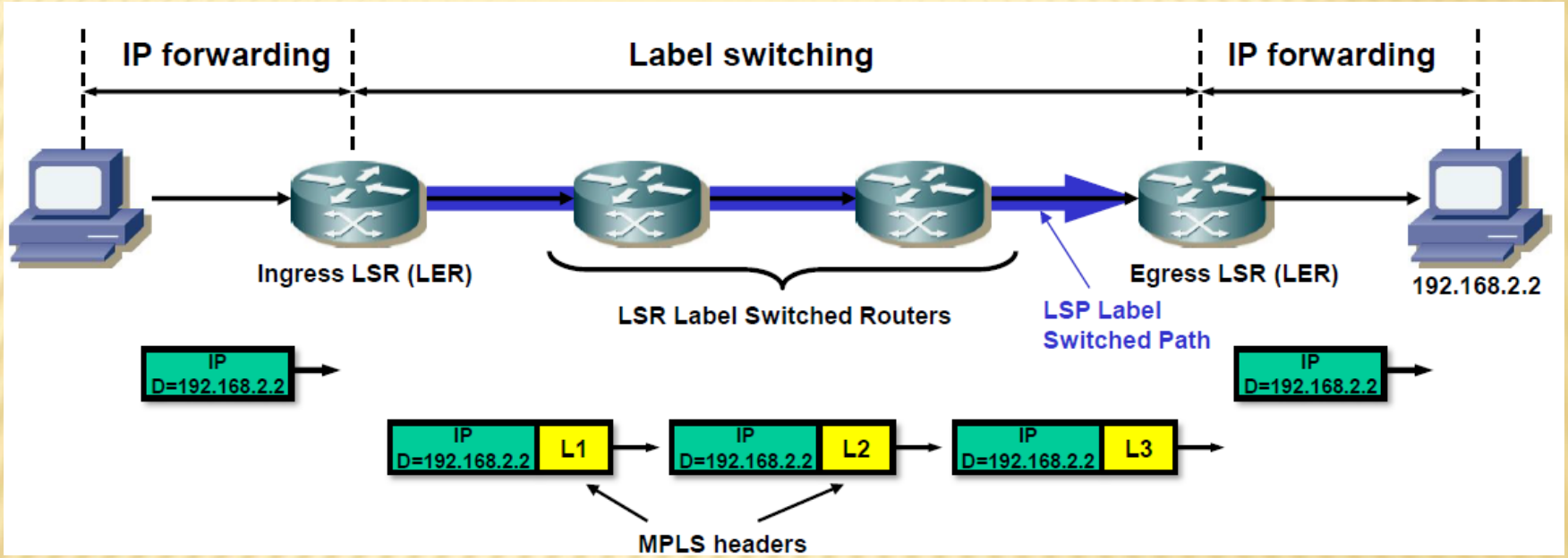
7

Multiprotocol Label Switching (MPLS)

LABEL SWITCH PATH (LSP)

- MPLS provides the following two options *to set up an LSP*:
  - **Hop-by-Hop Routing :** Each LSR independently selects the next hop for a given FEC. This methodology is similar to that currently used in IP networks. The LSR uses any available routing protocols, such as OSPF, …etc.
  - **Explicit routing (ER) :** similar to *source routing*. The *ingress LER* specifies the list of nodes through which the **ER–LSP** traverses. The resources may be reserved to ensure QoS to the data traffic.

ROUTING AT EDGE, SWITCHING IN CORE

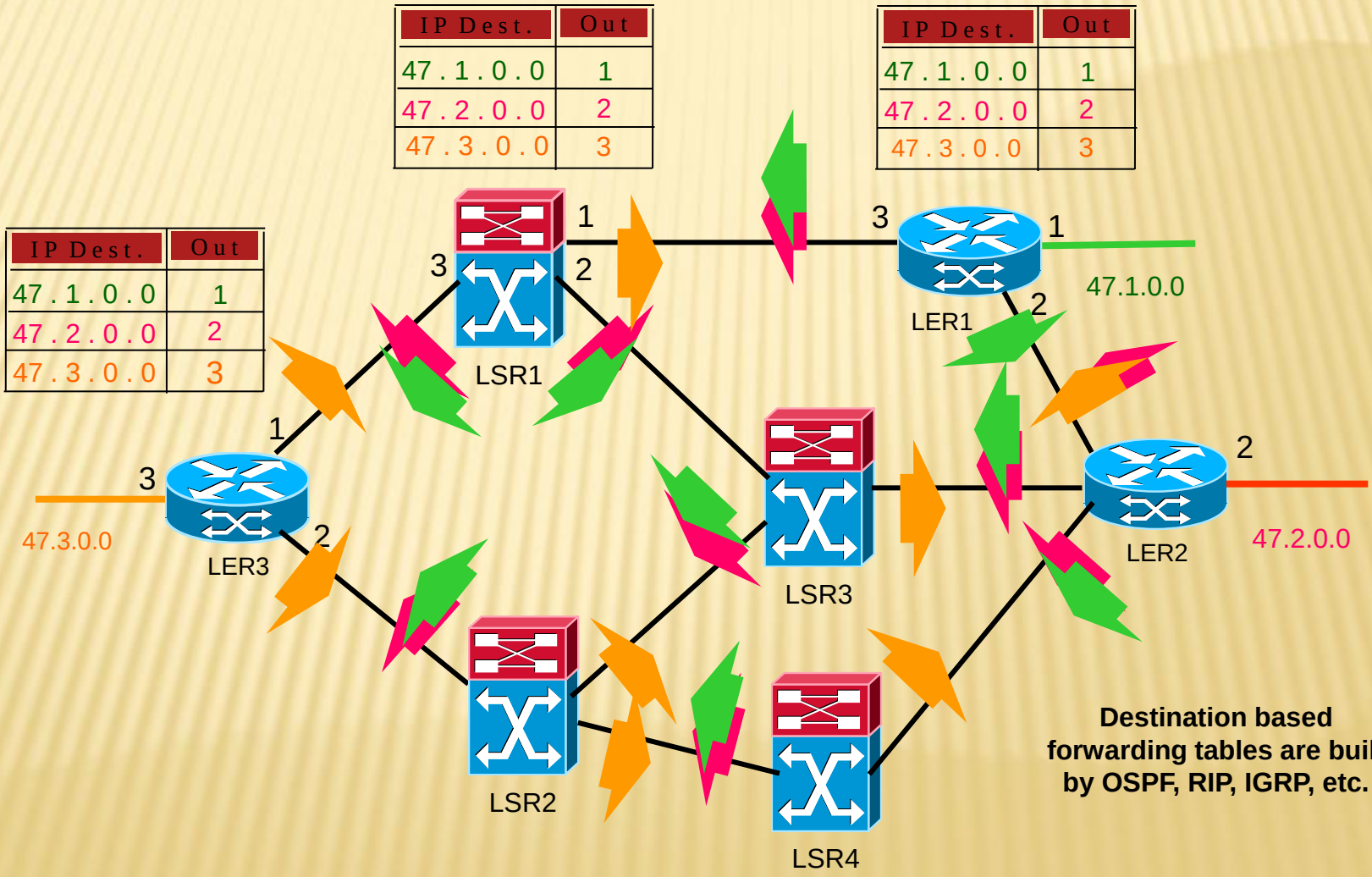


IP Forwarding

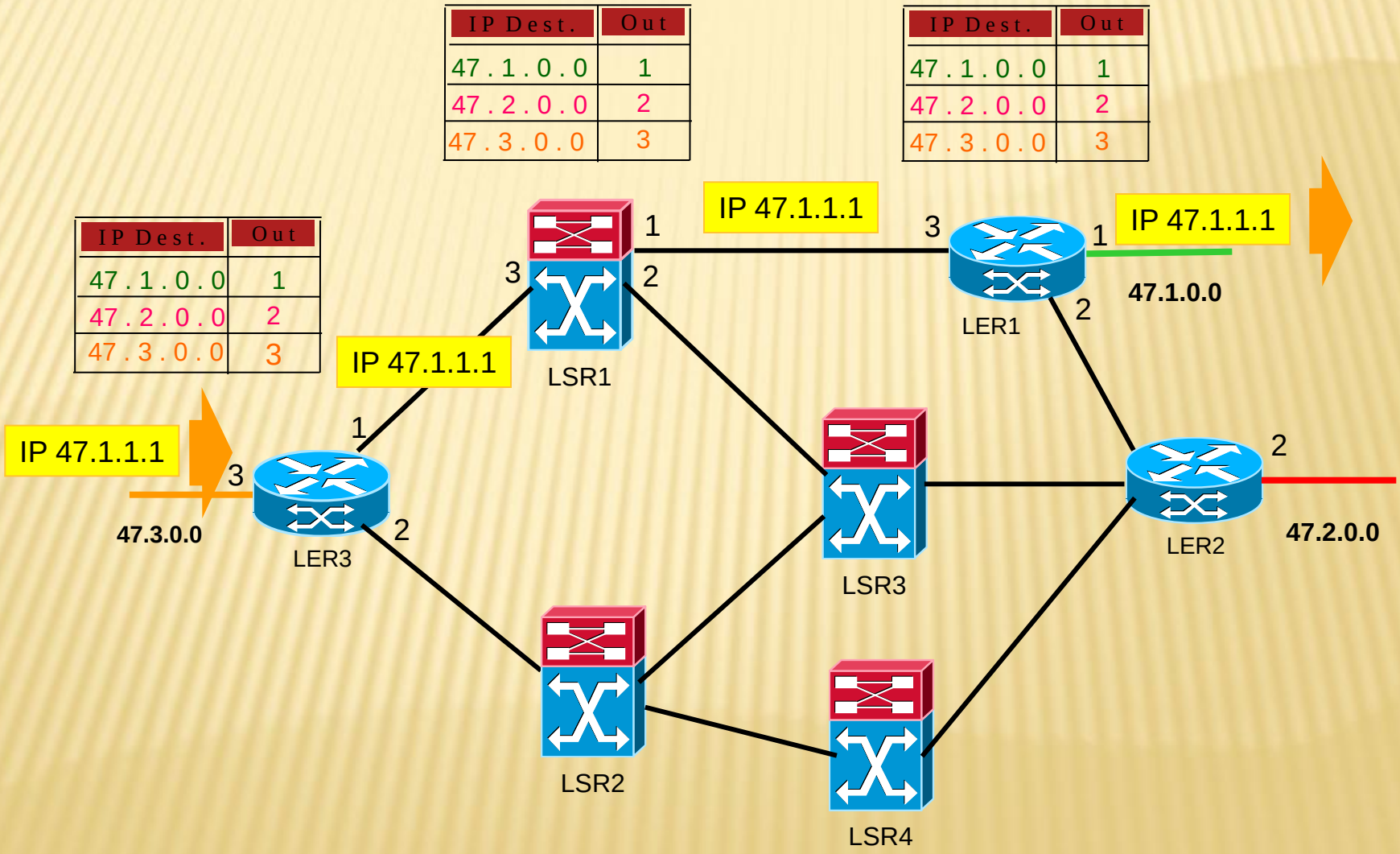
Label Switching

IP Forwarding

TRADITIONAL IP



IP FORWARDING USING HOP-BY-HOP CONTROL

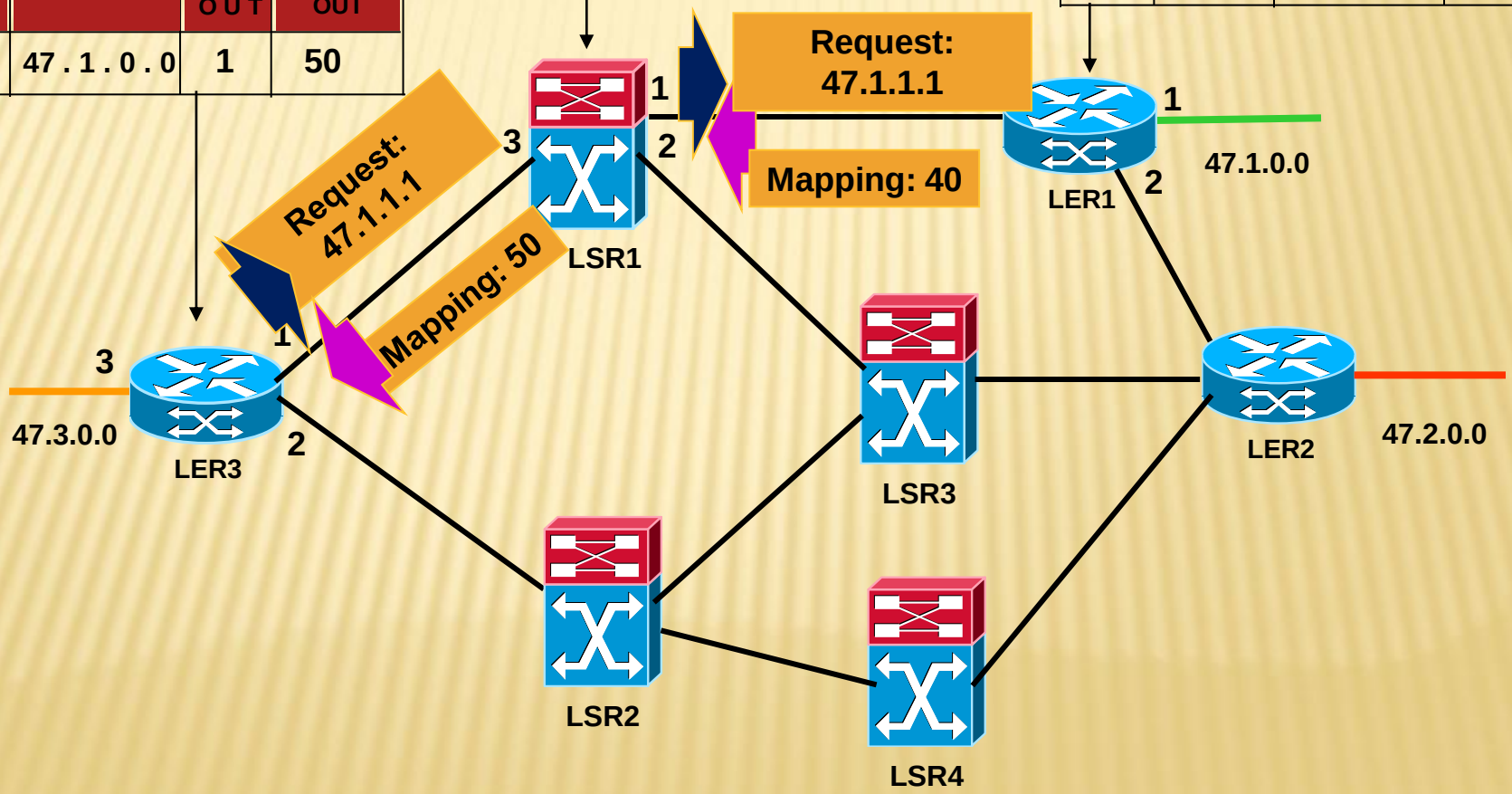


MPLS LABEL DISTRIBUTION

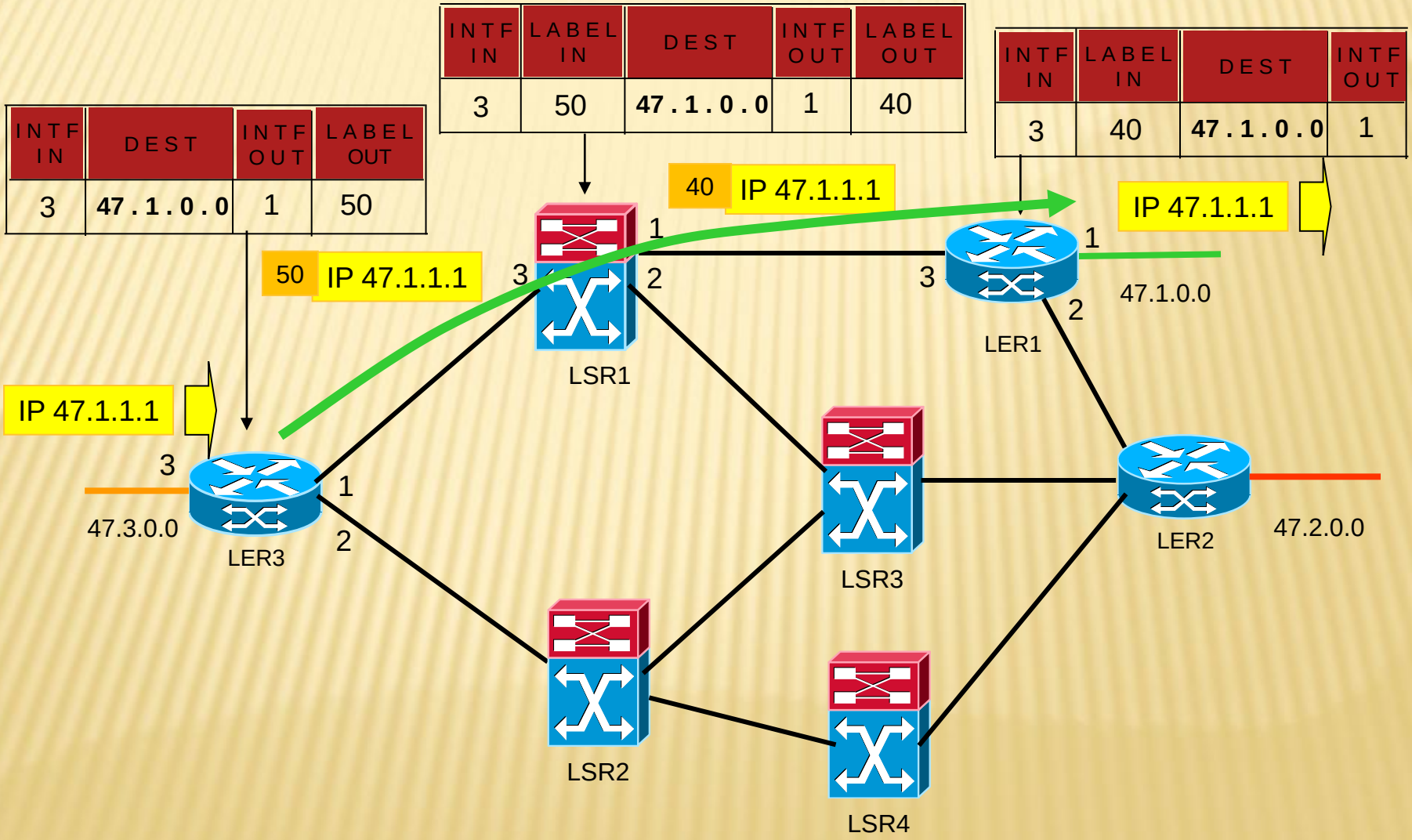
INTF IN	DEST	INTF OUT	LABEL OUT
3	47 . 1 . 0 . 0	1	50

INTF IN	LABEL IN	DEST	INTF OUT	LABEL OUT
3	50	47 . 1 . 0 . 0	1	40

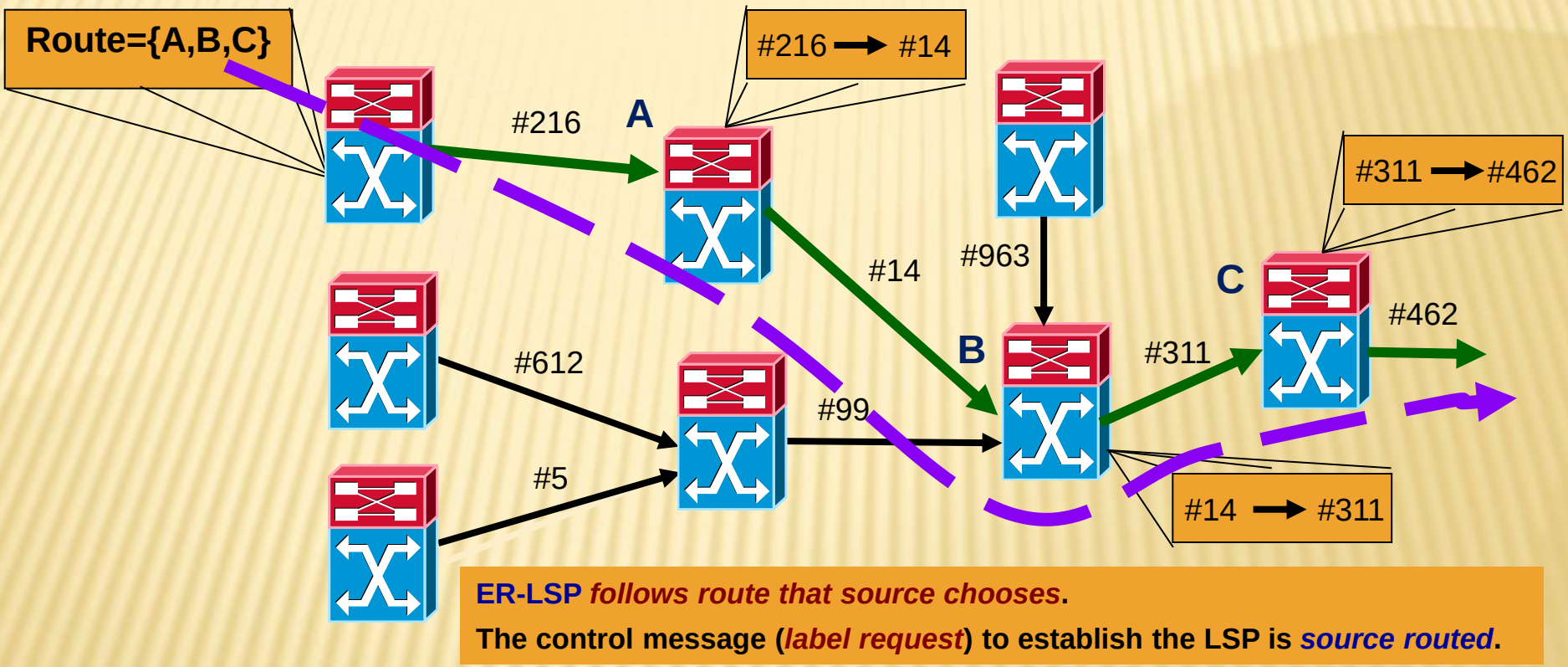
INTF IN	LABEL IN	DEST	INTF OUT
3	40	47 . 1 . 0 . 0	1



LABEL SWITCHED PATH (LSP)



EXPLICITLY ROUTED LSP (ER-LSP)

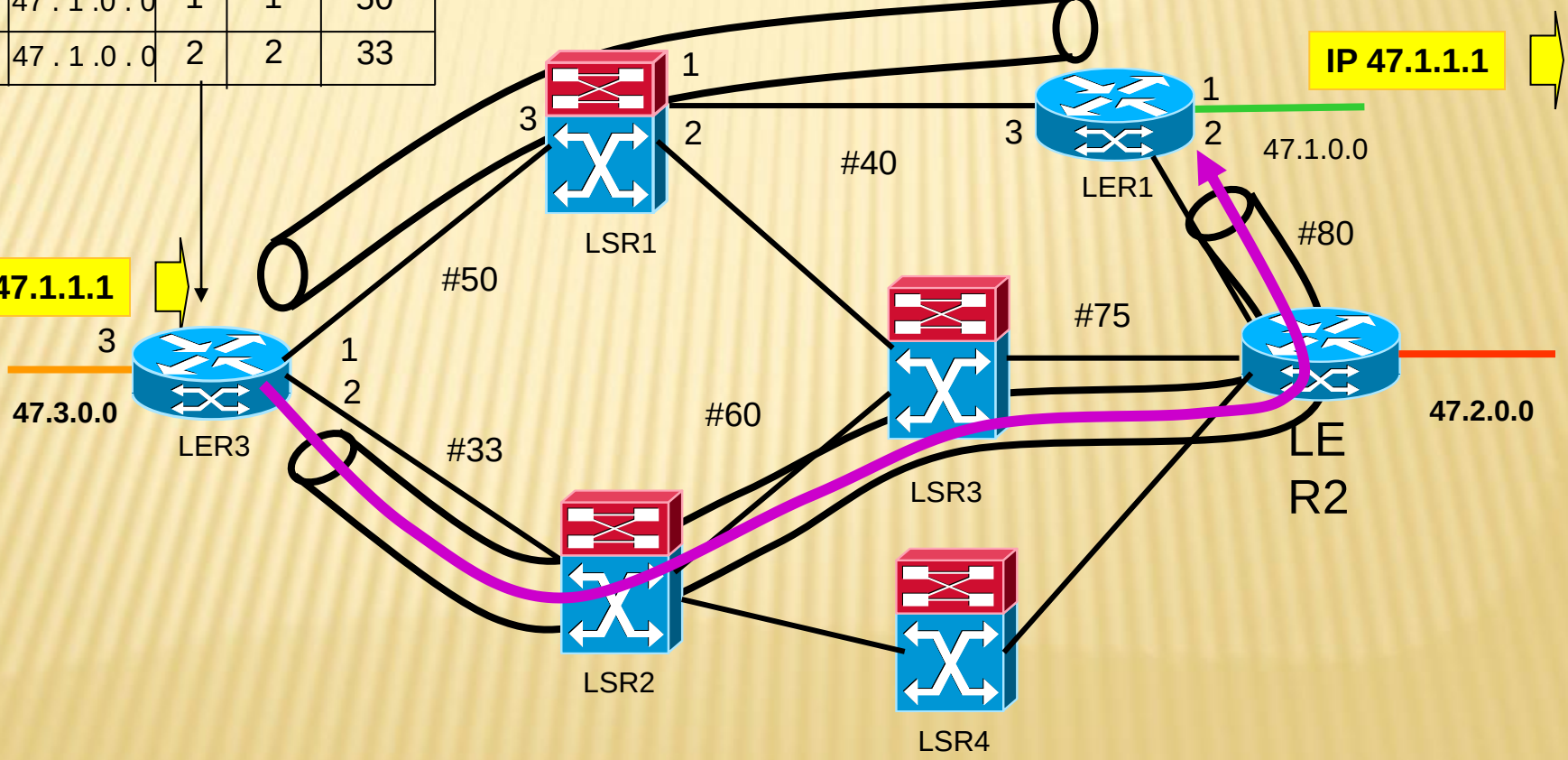


ER-LSP *follows route that source chooses*.

The control message (*label request*) to establish the LSP is *source routed*.

EXPLICITLY ROUTED LSP (ER-LSP)

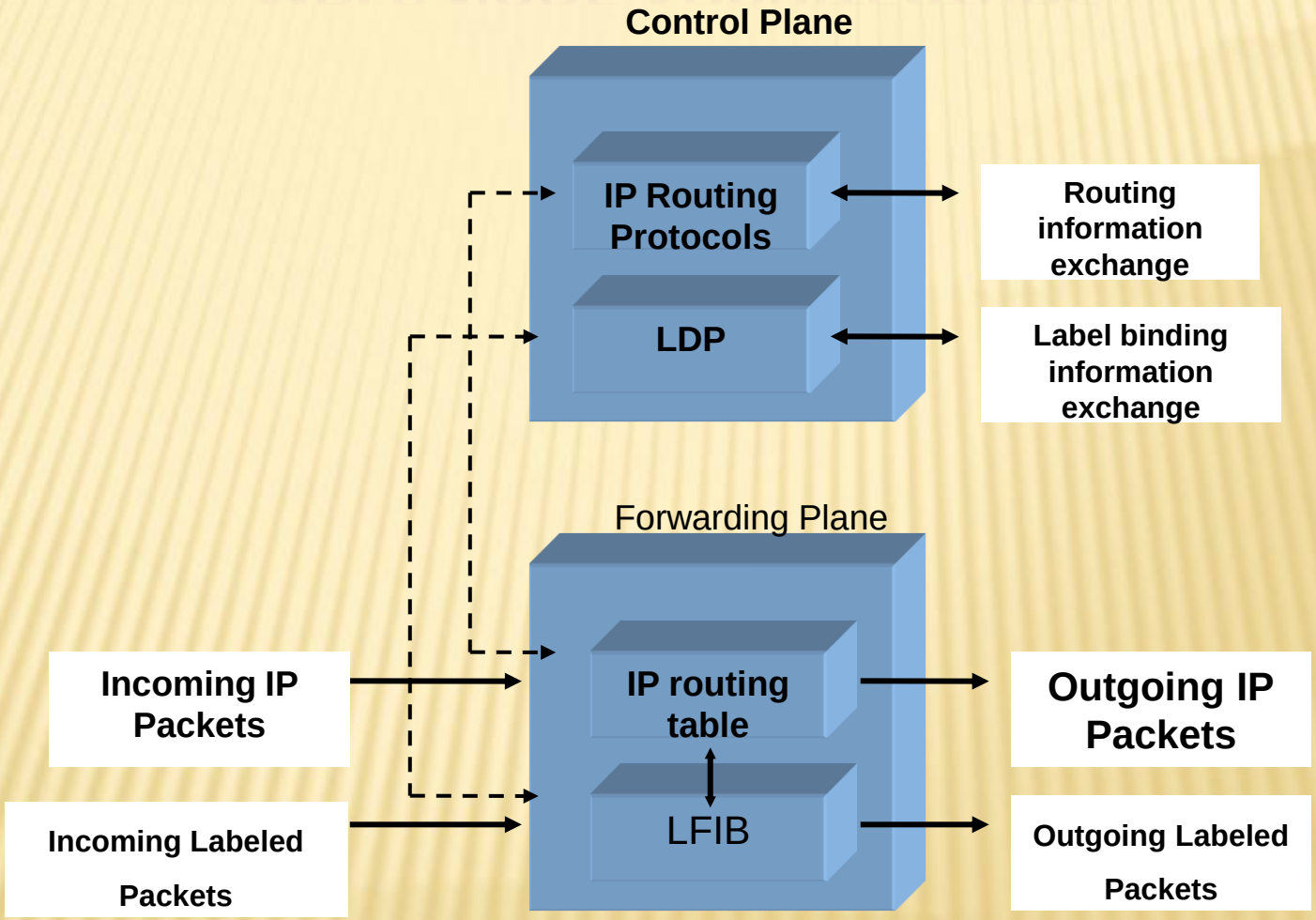
INTF IN	DEST	QoS	INTF OUT	LABEL IN
3	47 . 1 .0 . 0	1	1	50
3	47 . 1 .0 . 0	2	2	33



ER LSP - ADVANTAGES

- Operator has routing *flexibility* (policy-based, QoS-based)
- Can use routes other than shortest path
- Can compute routes based on constraints (traffic engineering)

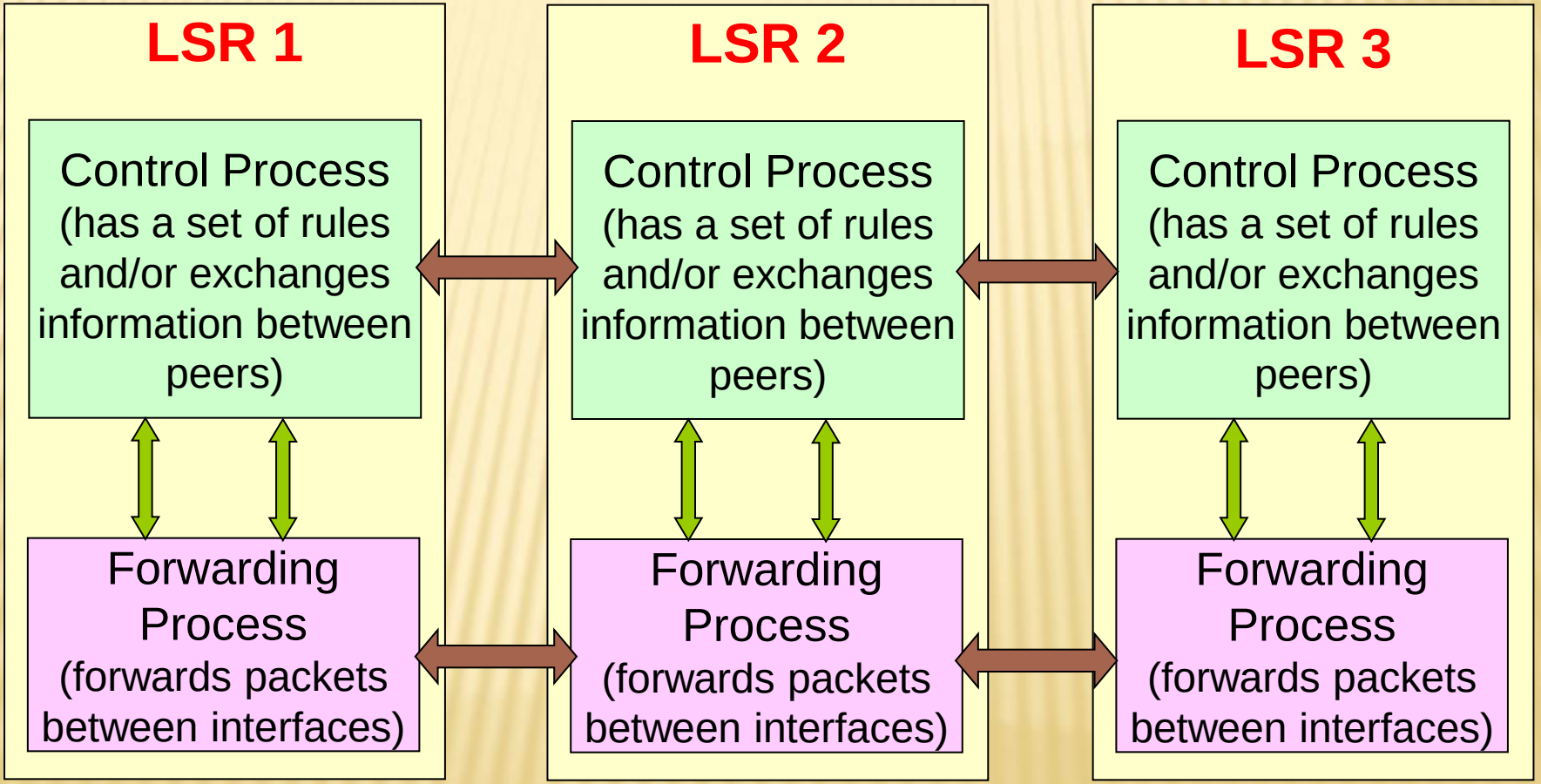
MPLS NODE ARCHITECTURE



Label Forwarding Information Base (LFIB)

Label Distribution Protocol (LDP)

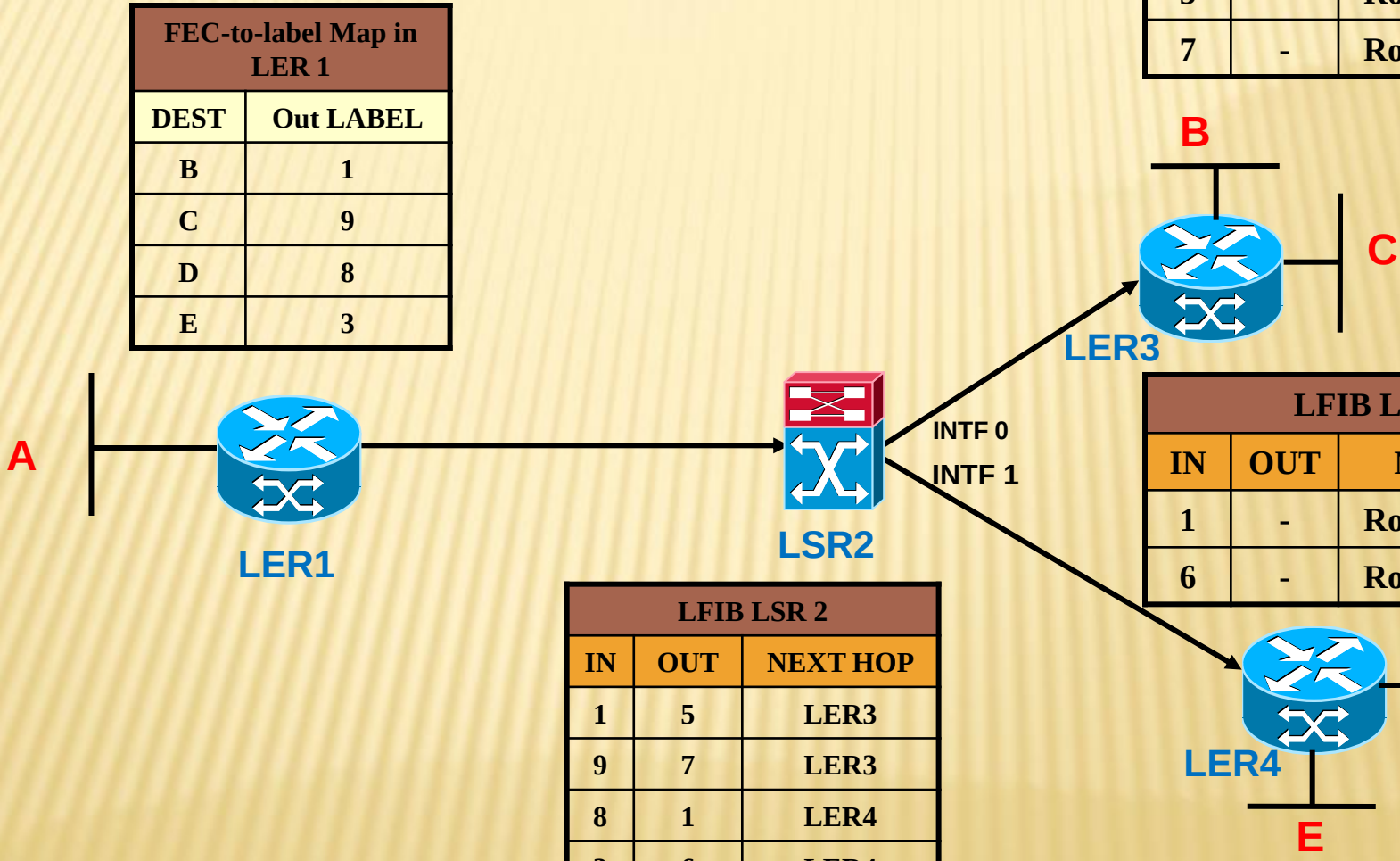
DECOUPLING CONTROL AND FORWARDING PROCESSES



MPLS ARCHITECTURE EXAMPLE

FEC-to-label Map in LER 1	
DEST	Out LABEL
B	1
C	9
D	8
E	3

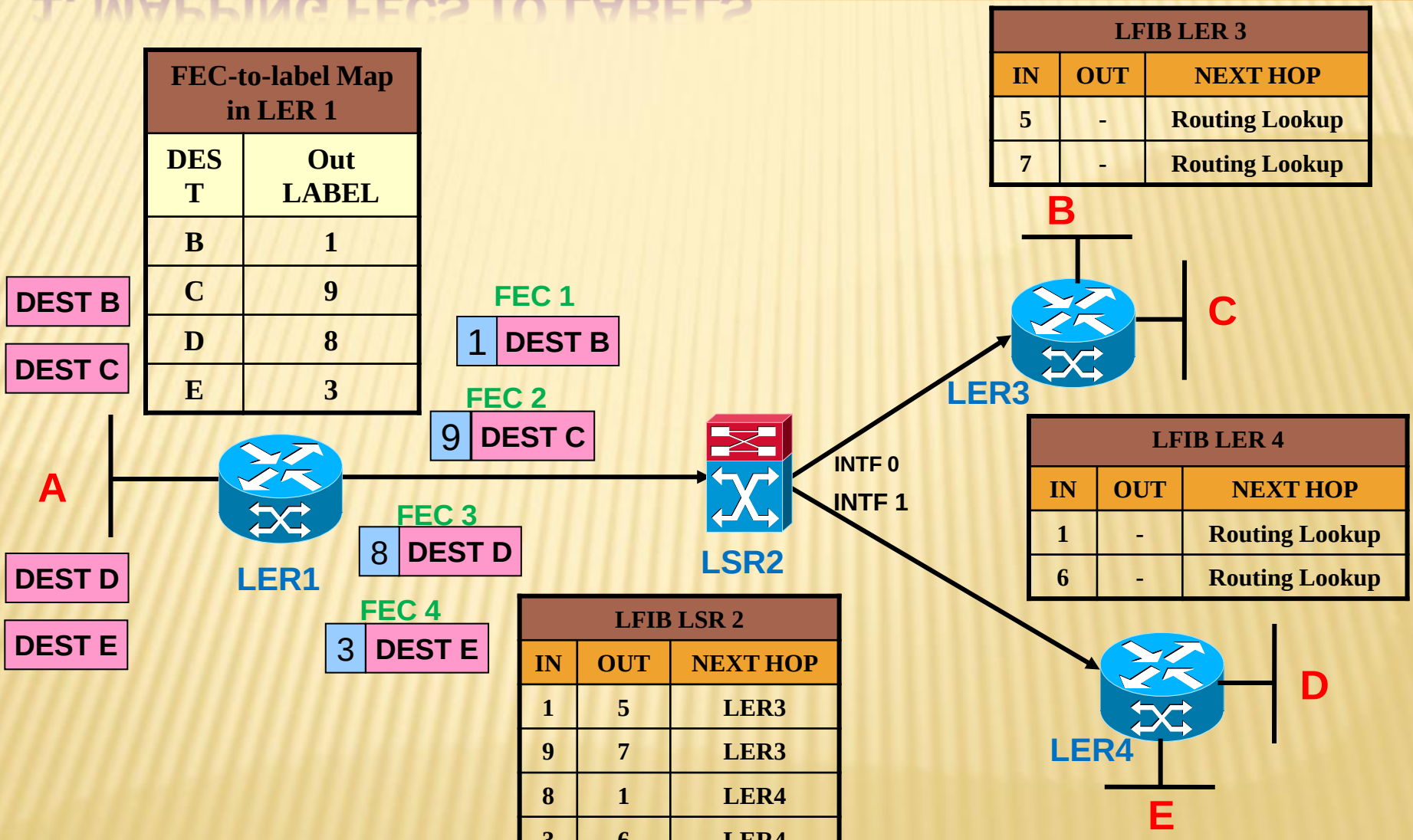
LFIB LER 3		
IN	OUT	NEXT HOP
5	-	Routing Lookup
7	-	Routing Lookup



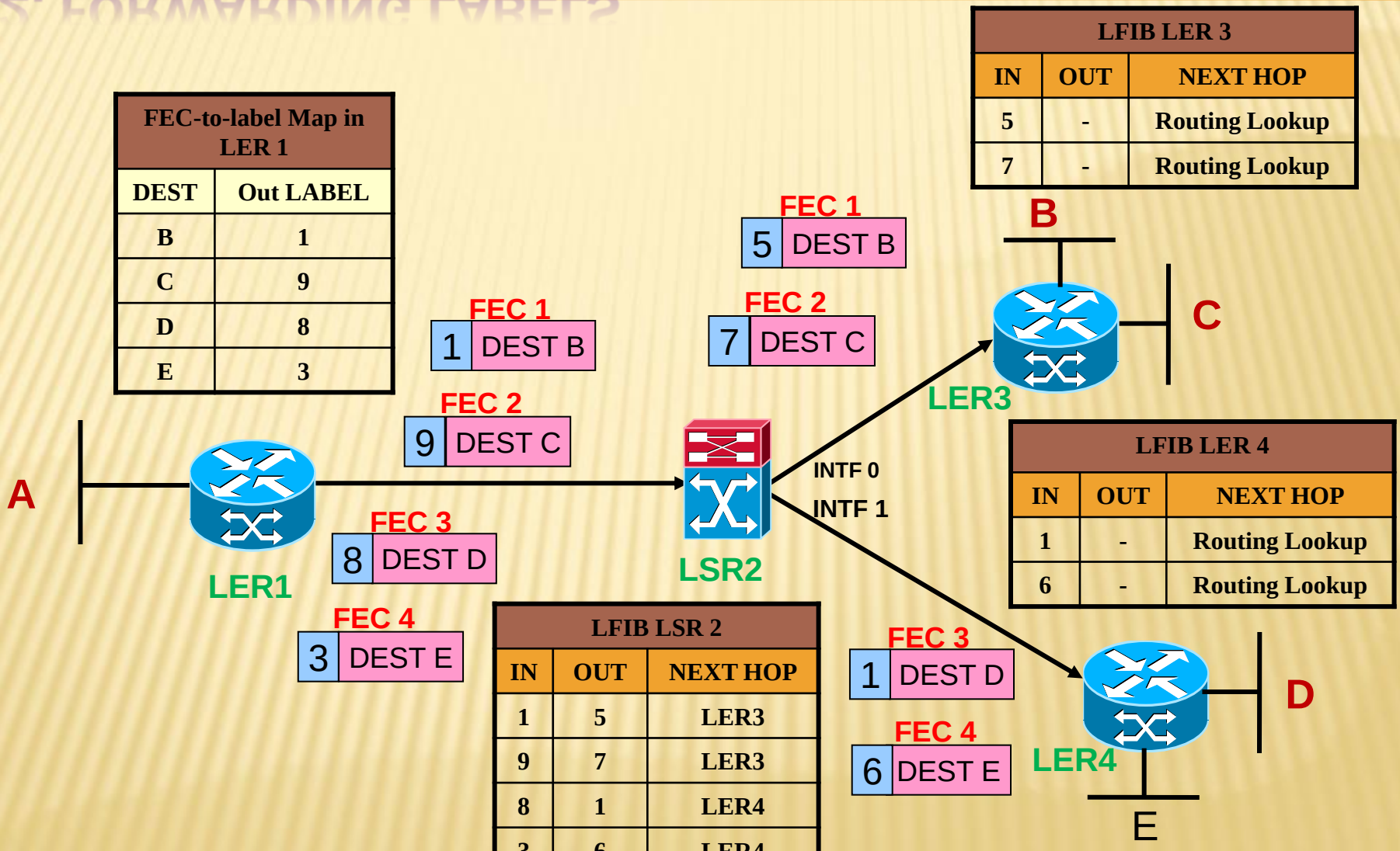
LFIB LSR 2		
IN	OUT	NEXT HOP
1	5	LER3
9	7	LER3
8	1	LER4
3	6	LER4

LFIB LER 4		
IN	OUT	NEXT HOP
1	-	Routing Lookup
6	-	Routing Lookup

1. MAPPING FECS TO LABELS



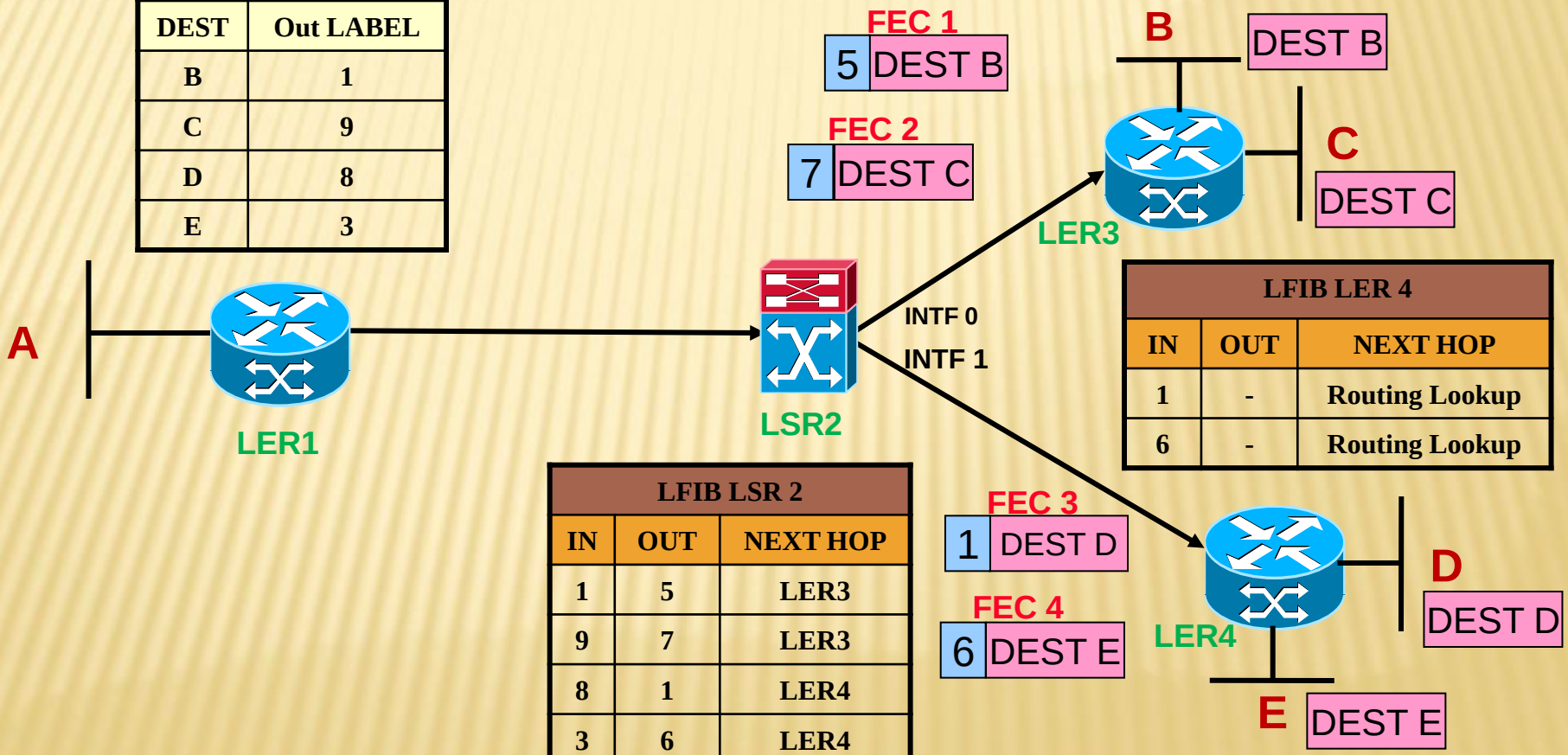
2. FORWARDING LABELS



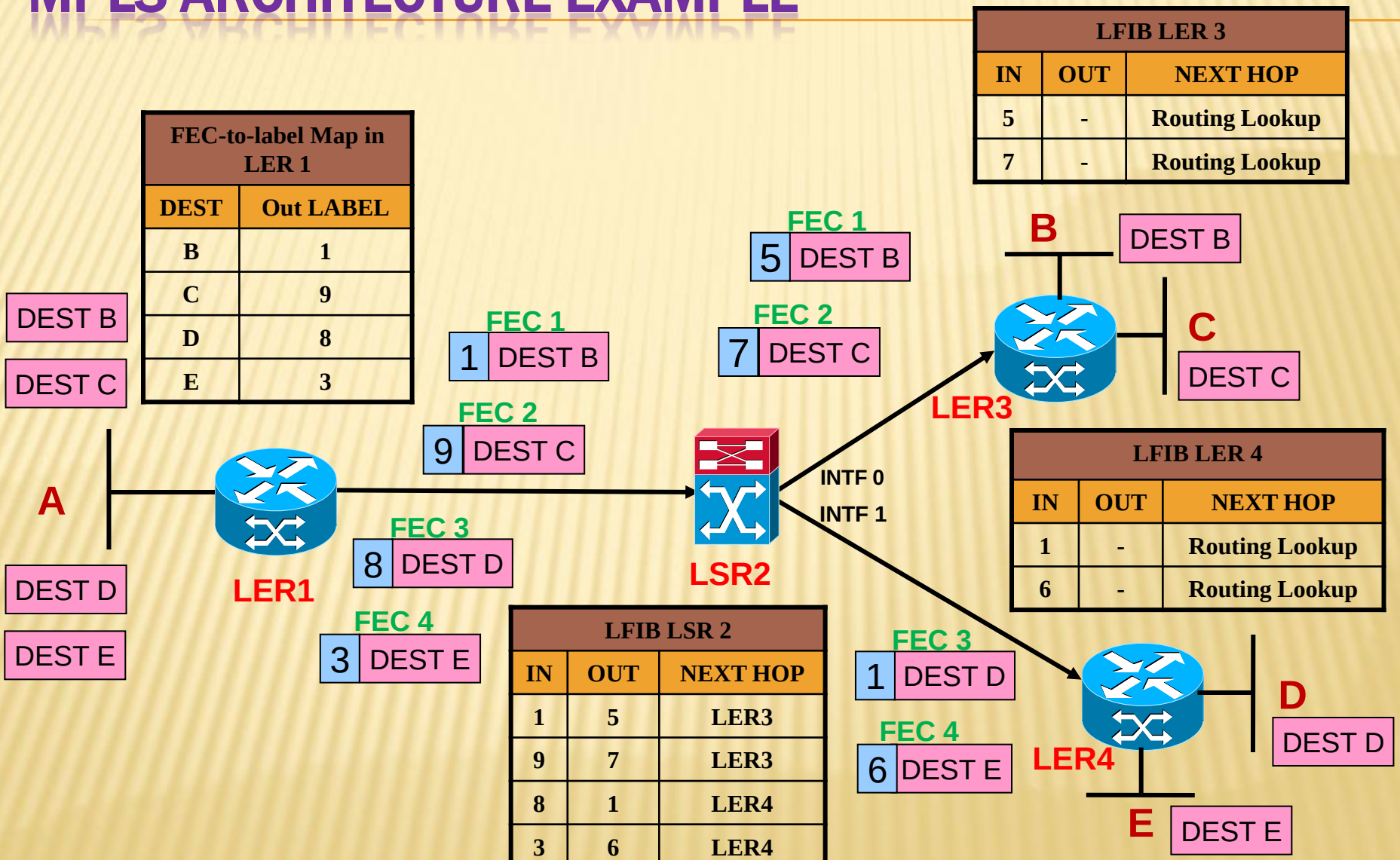
3. REMOVING MPLS HEADER

FEC-to-label Map in LER 1	
DEST	Out LABEL
B	1
C	9
D	8
E	3

LFIB LER 3		
IN	OUT	NEXT HOP
5	-	Routing Lookup
7	-	Routing Lookup



LFIB LER 4		
IN	OUT	NEXT HOP
1	-	Routing Lookup
6	-	Routing Lookup

LFIB LSR 2		
IN	OUT	NEXT HOP
1	5	LER3
9	7	LER3
8	1	LER4
3	6	LER4

MPLS ARCHITECTURE EXAMPLE