

Traffic Analysis of MPLS and Non MPLS Network including MPLS Signaling Protocols and Traffic distribution in OSPF and MPLS

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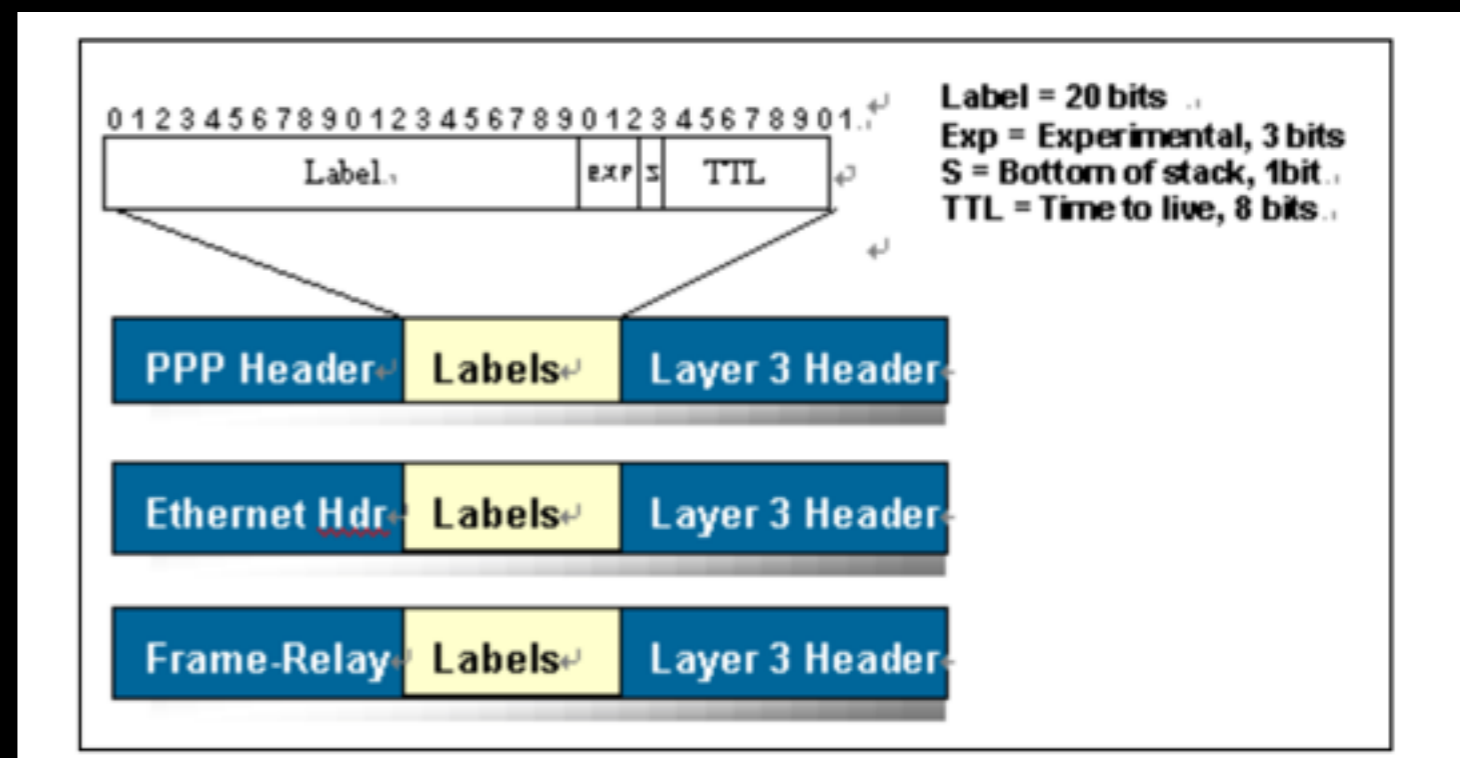
Mahesh Kr. Porwal , Anjulata Yadav and S. V. Charhate from Department of
E & Tc, Shri Govindram Seksaria Institute of Technology and Science, 23 Park
Road Indore, India

Traditional IP network

- Each router use some routing protocols such as Border Gateway Protocol (BGP), Open Shortest Path First (OSPF) to exchange their routing table.
- Each router compare the packet's dst_ip with the routing table to make a decision independently.
- However, IP address comparison is not effective at all.
 - Compare(dst_ip ,(Network address && mask)) in each record - High CPU and memory resource consumption.

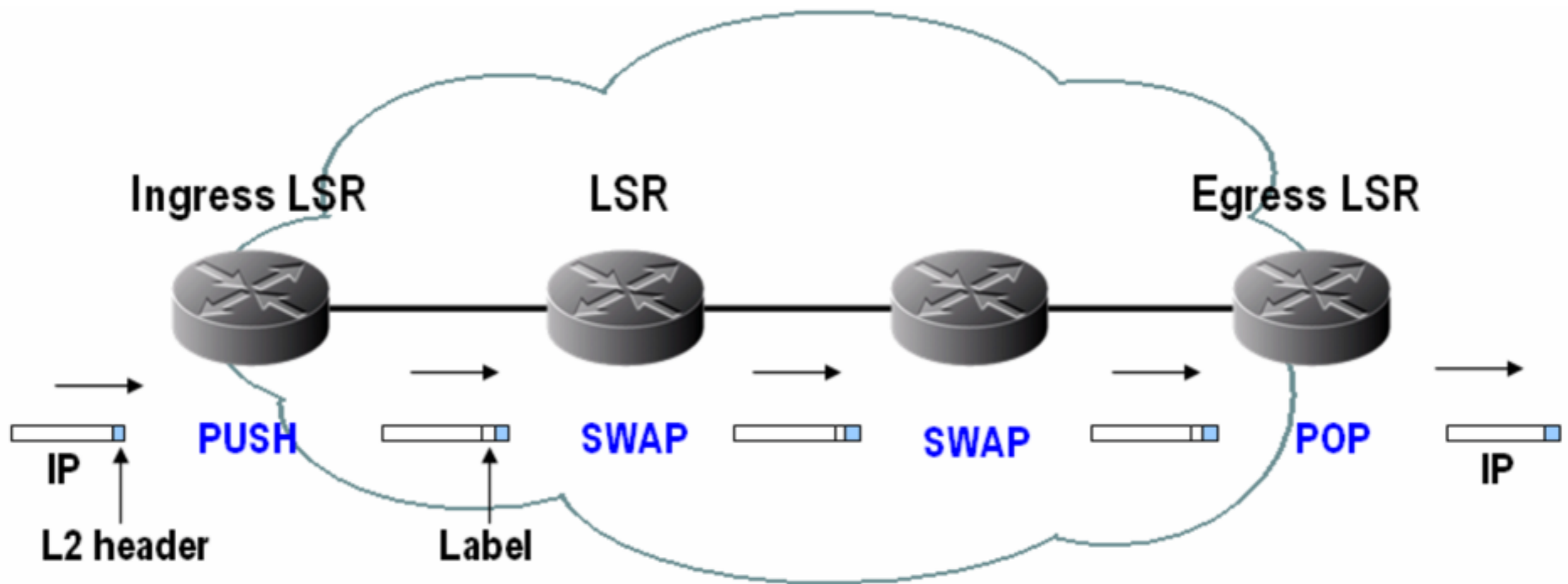
Multi-Protocol Label Switching

- MPLS is an extension to the existing Internet Protocol (IP) architecture.
- It provides a set of procedures for combining the performance, QoS and traffic management of the Layer 2 label-swapping paradigm with the scalability and flexibility of Layer 3 routing functionality.
- It was defined in RFC3031.



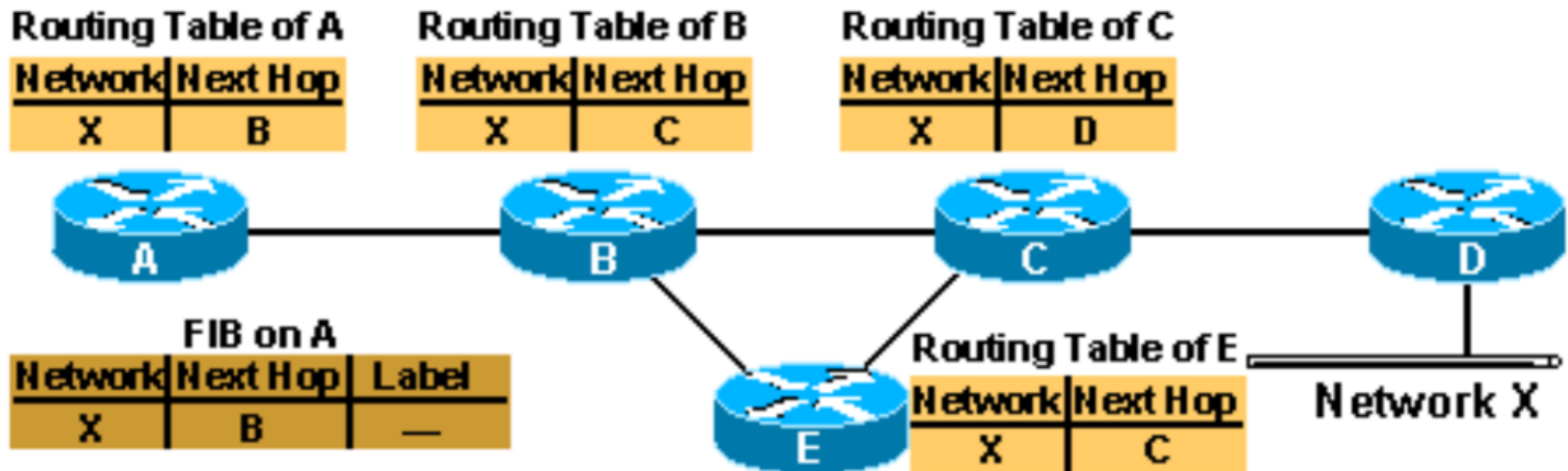
MPLS domain

- LSR(Label Switch Router)
- Ingress LSR -> LSR -> Egress LSR

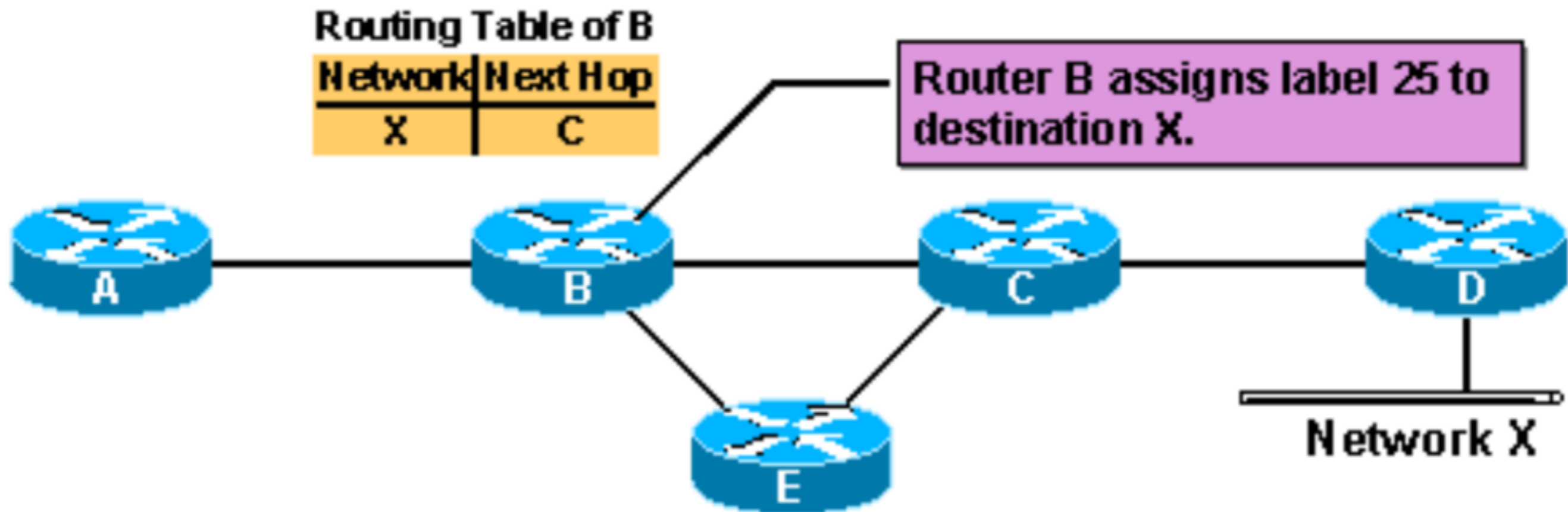


MPLS operation

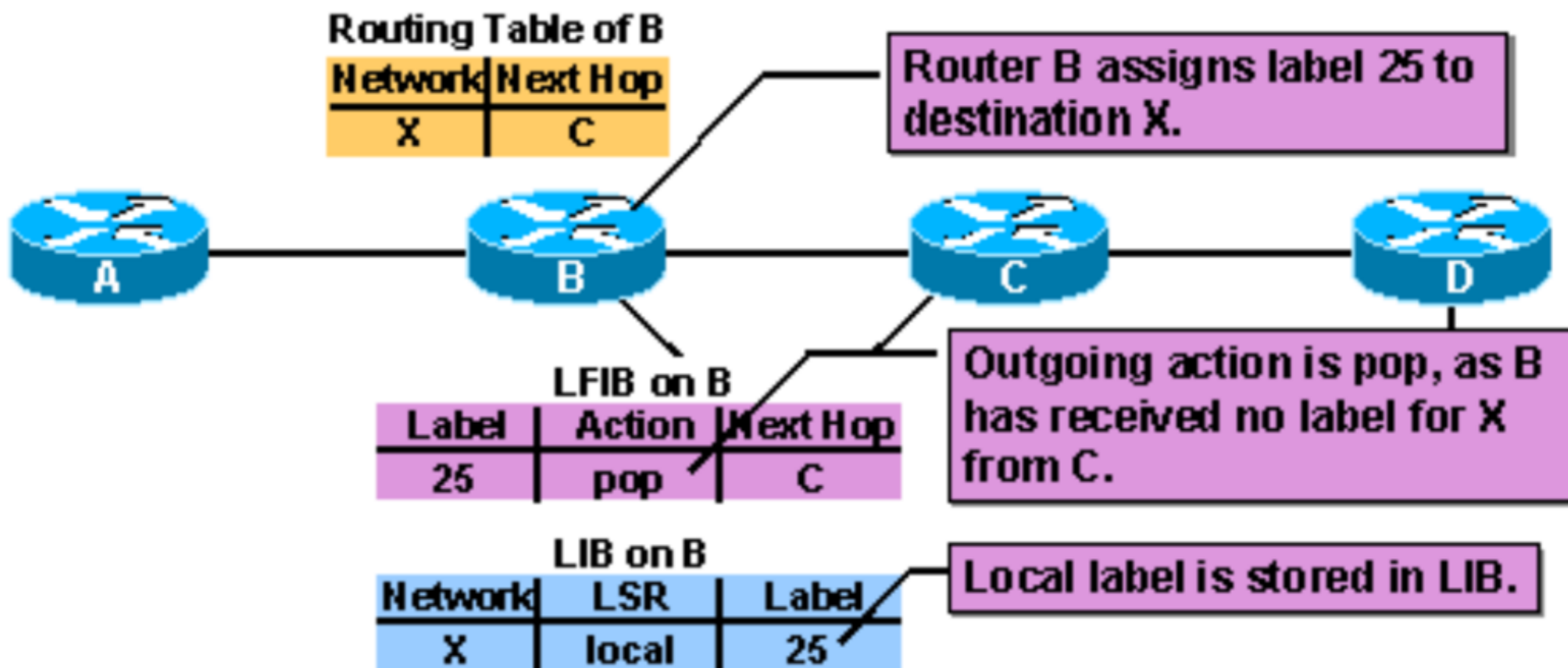
- Ingress LSR - A
 - Maintain a Forwarding Information Base (FIB)
- Egress LSR - C



LSR label allocation

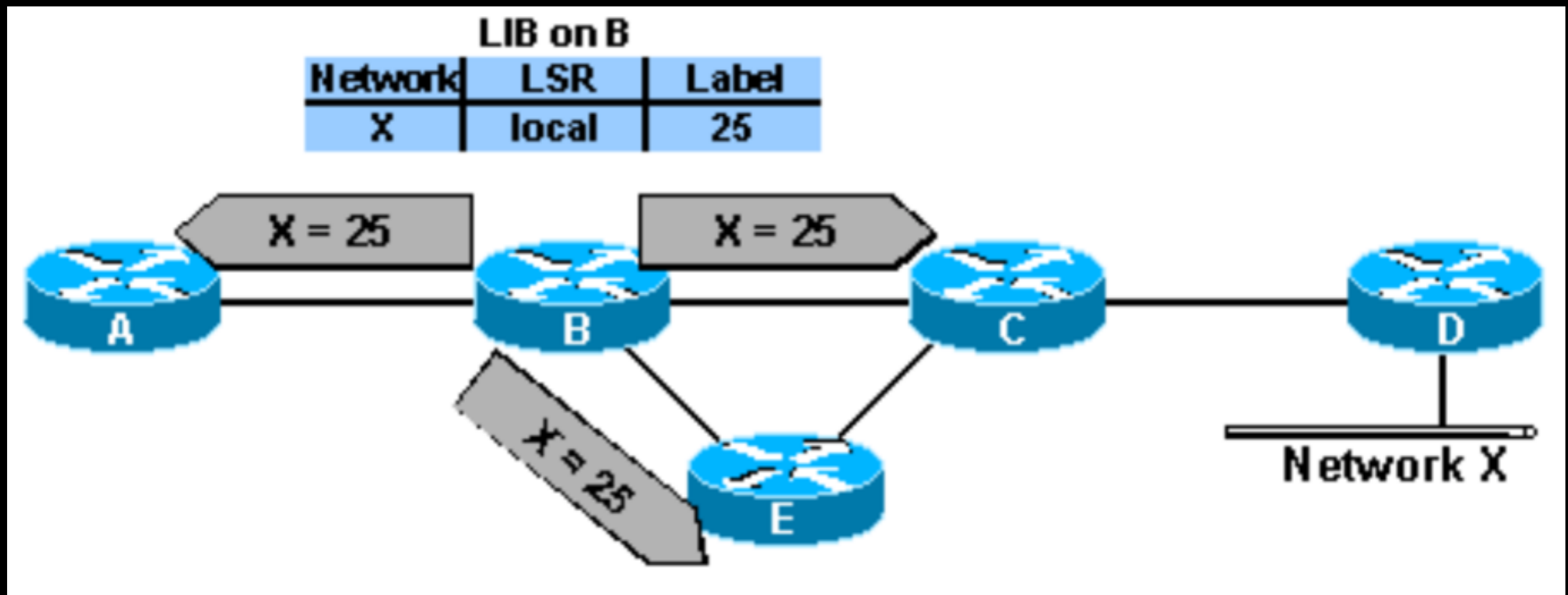


LSR build Label Information Base (LIB) and Label Forwarding Information Base (LFIB)



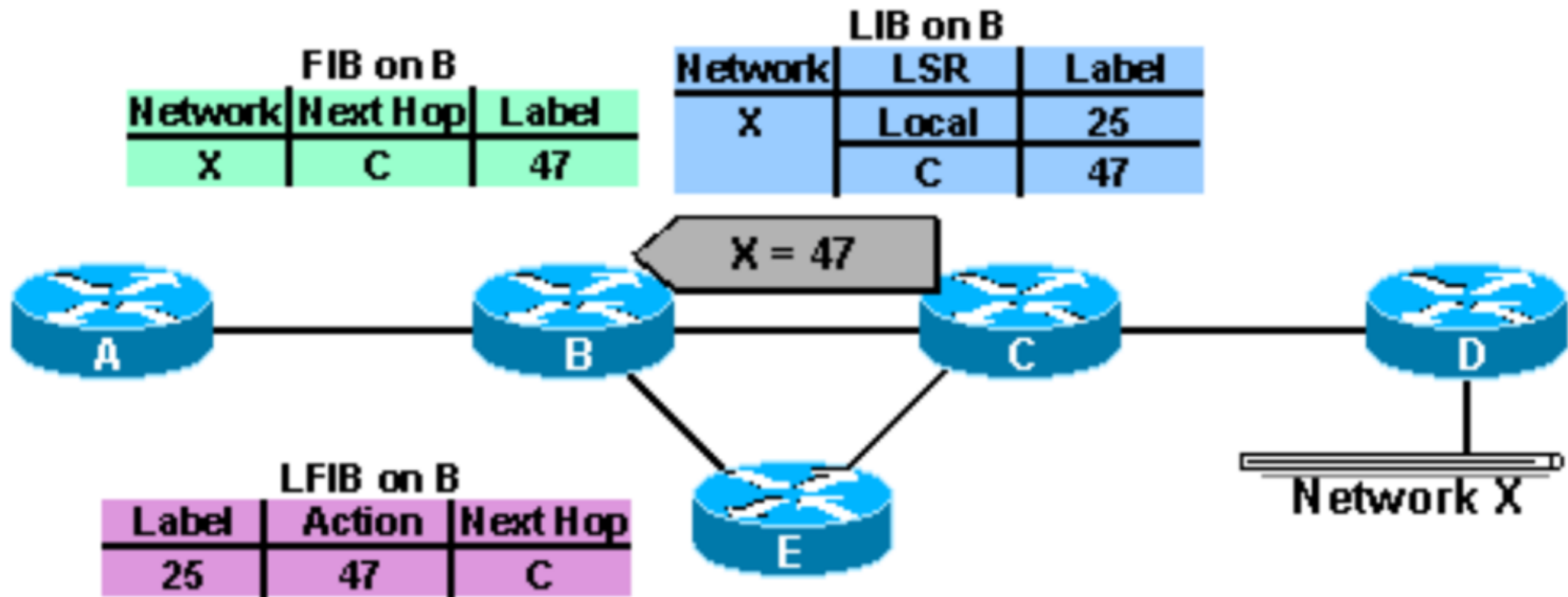
LSR Label Distribution

- Label Distribution Protocol (LDP)
 - Neighbor discovery - UDP
 - Label information exchange - TCP

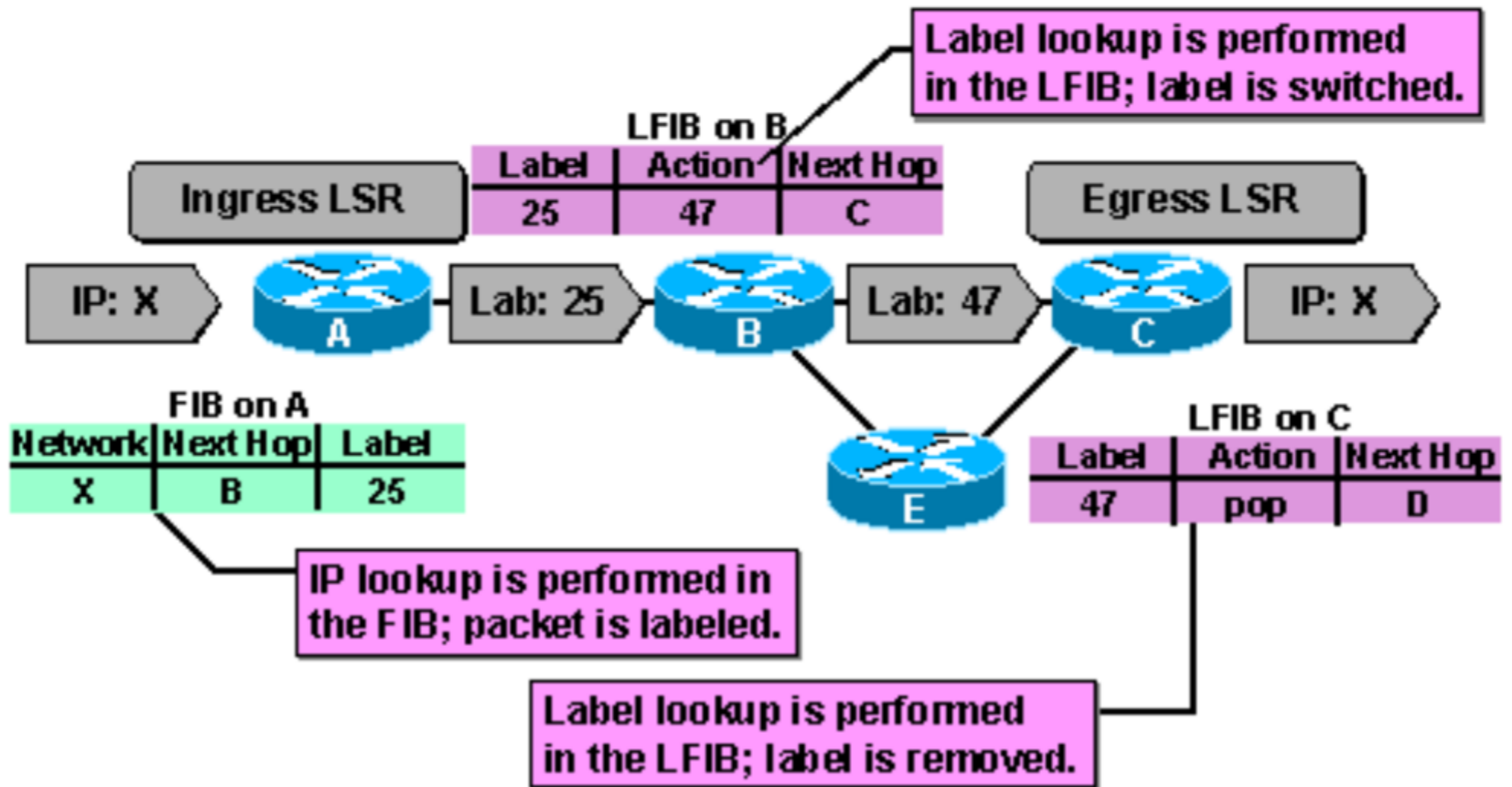


Label information aggregation

- Aggregate the label information into LFIB



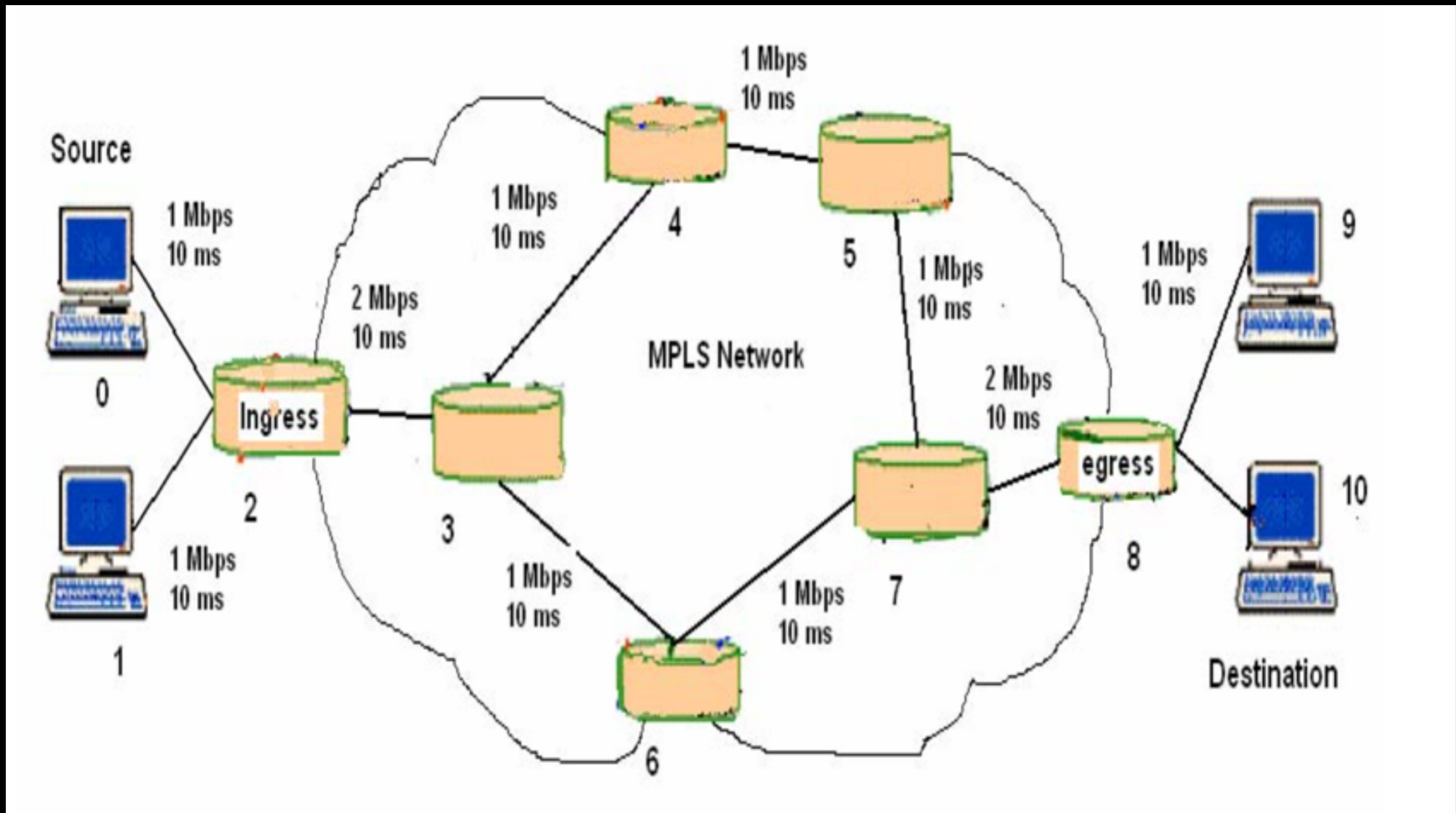
Forward packets in MPLS



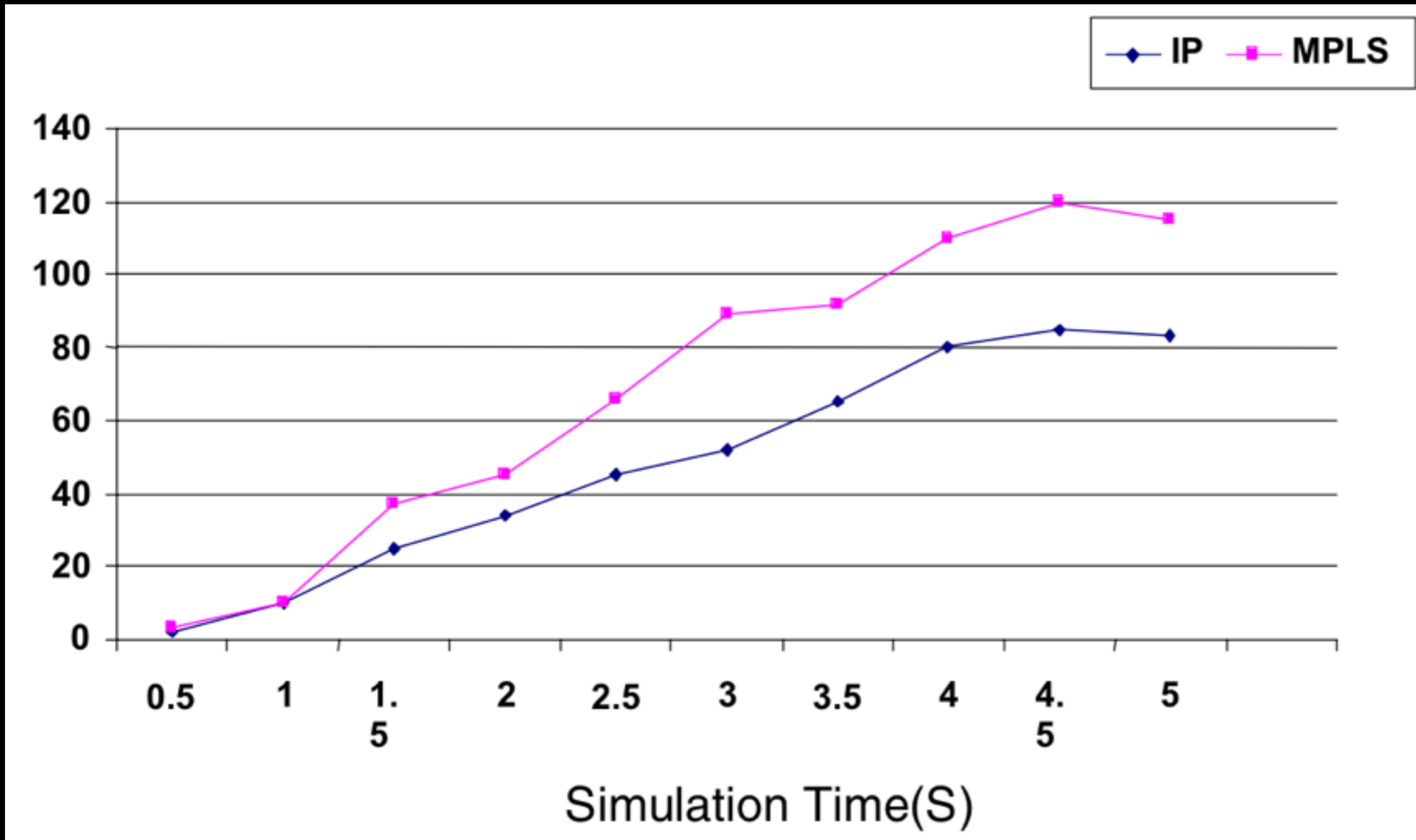
Types of LDP

- CR-LDP (Constrain-based Routing Label Dispatch Protocol, RFC-3212)
- RSVP (Resource Reservation Protocol, RFC-2205)
 - Provide quality of service
- RSVP-TE (Resource Reservation Protocol - Traffic Engineering, RFC-3209)
 - Provide more network parameter (bandwidth, jitter and maximum burst) for the LSR.

Experiment - test topology



Experiment - throughput



Comparison

	IP	MPLS
No. of Packets received	712	867
Throughput (Mbps)	0.5832	0.7102
BW Utilization (%)	58.32	71.02
End to End Delay (s)	0.042	0.038
Average Jitter (s)	$0.35 * 10^{-3}$	$0.21 * 10^{-4}$

Summary

- Paper conclusions:
 - Explain how does MPLS operate.
 - Through the results analysis, it is clear that with proper MPLS Traffic Engineering applied to the network, the performance of the network is significantly improved.
- Personal opinion:
 - It makes me understand why switching can be more effective than IP routing.
 - It is a good architecture because it has advantages of both IP's and ATM's.

Reference

1. Multiprotocol Label Switching Architecture (RFC 3031)
2. Multiprotocol Label Switching (MPLS) - Cisco, [<http://www.cisco.com/c/en/us/products/ios-nx-os-software/multiprotocol-label-switching-mpls/index.html>]
3. MPLS 概論, [<http://eservice.seed.net.tw/class/class0801c.html>]
4. Multi-Protocol Label Switching 課程講義, [<http://140.125.33.160/course/95/high%20speed%20computer%20network/MPLS講義.pdf>]