

# *Introduction to Multi Protocol Label Switching (MPLS)*

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# *Agenda*

- Motivation behind MPLS
- Basics
- Components and Protocols
- Operations
- Network Management Centre (NMC)
- Security
- Billing
- Operators providing MPLS Services

# *Motivation*



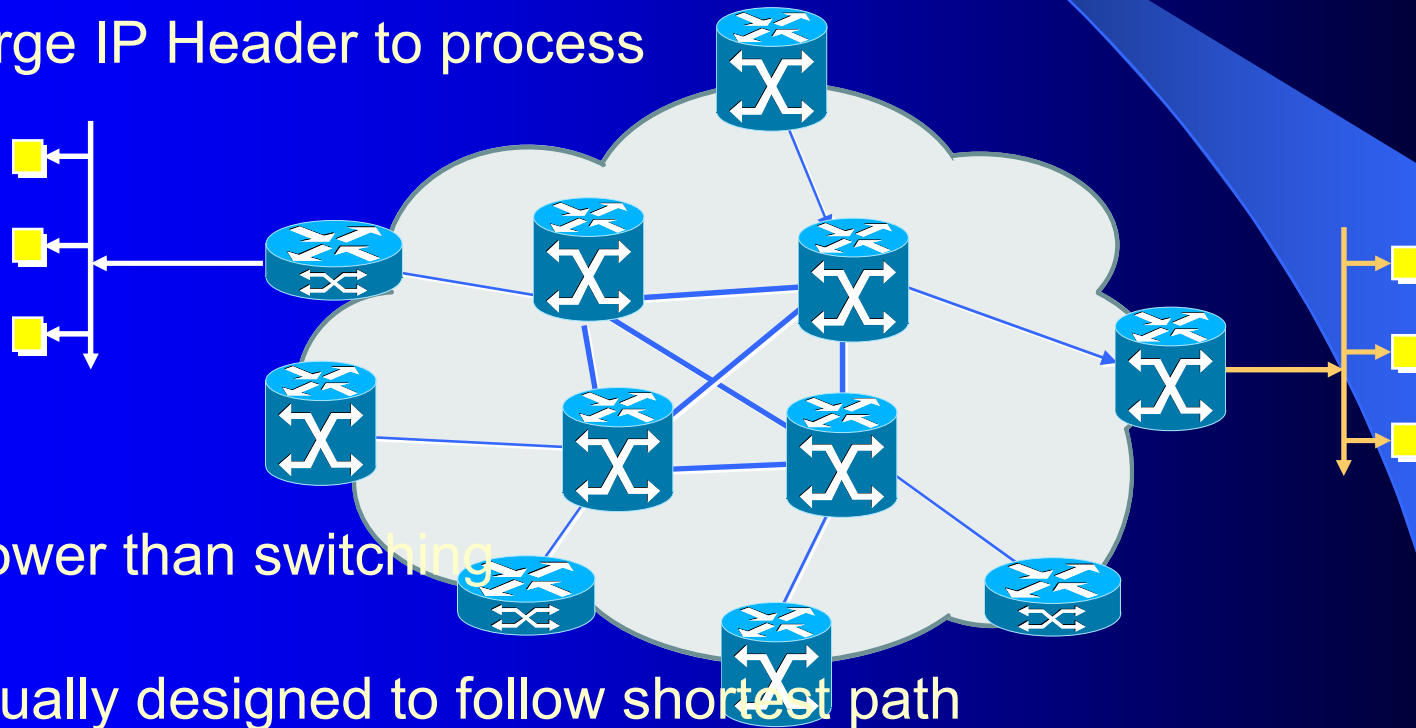
# *Motivation*

- IP
  - The first defined and used protocol
  - De facto the only protocol for global Internet working

.....but there are disadvantages

# Motivation (Contd...)

- Connectionless
- Large IP Header to process



- Slower than switching
- Usually designed to follow shortest path

## *Motivation (Contd...)*

- ATM
  - Connection Oriented (supports QoS)
  - Fast packet switching with fixed length packets
  - Integration of different prioritized traffic in real time because of guaranteed delivery

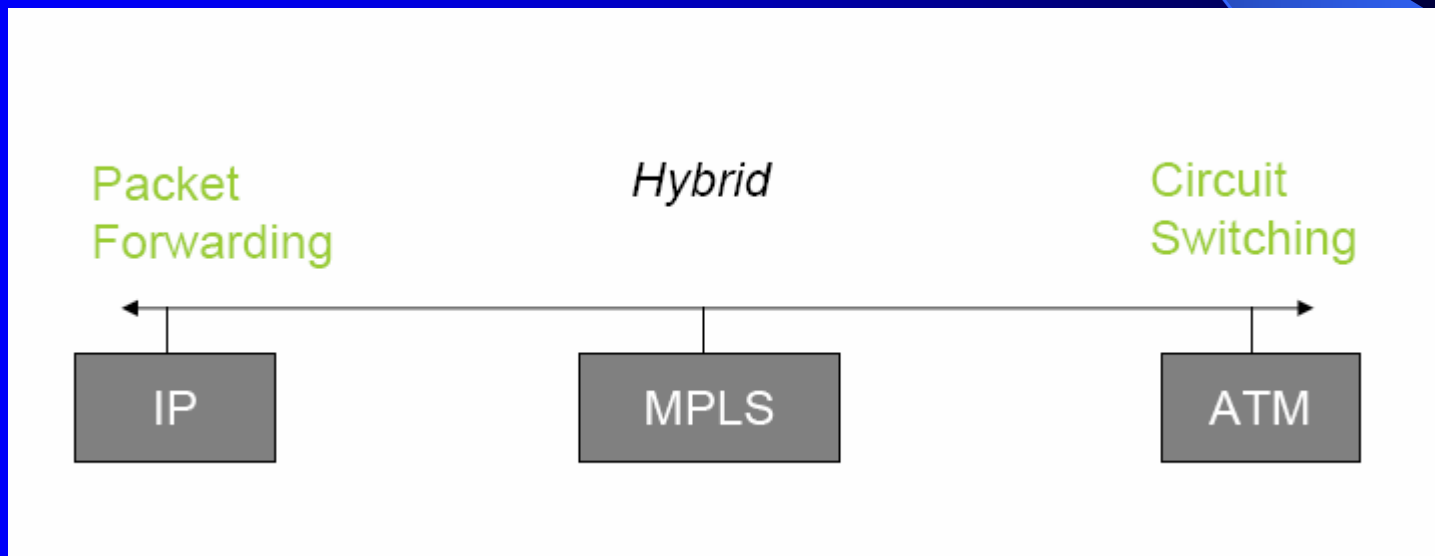
.....but there are disadvantages

# *Motivation (Contd...)*

- ATM Disadvantages
  - Complexity
  - Expensive

# Motivation (Contd...)

- IDEA  
Combine the features of Layer 2 and Layer 3



# *MPLS Definition*

## ***Multi Protocol :***

Indifferent towards protocol used at Layer 2

## ***Label***

Labels instead of IP addresses for processing

## ***Switching:***

Routing at the speed of Switching

MPLS is an Internet Engineering Task Force (IETF)-specified framework that provides efficient forwarding, routing and switching of traffic flow through the network.

As data, video, and voice networks are converging on one platform, the need for Multi-Protocol Label Switching (MPLS) is a natural progression.

# *BASICS OF MPLS*

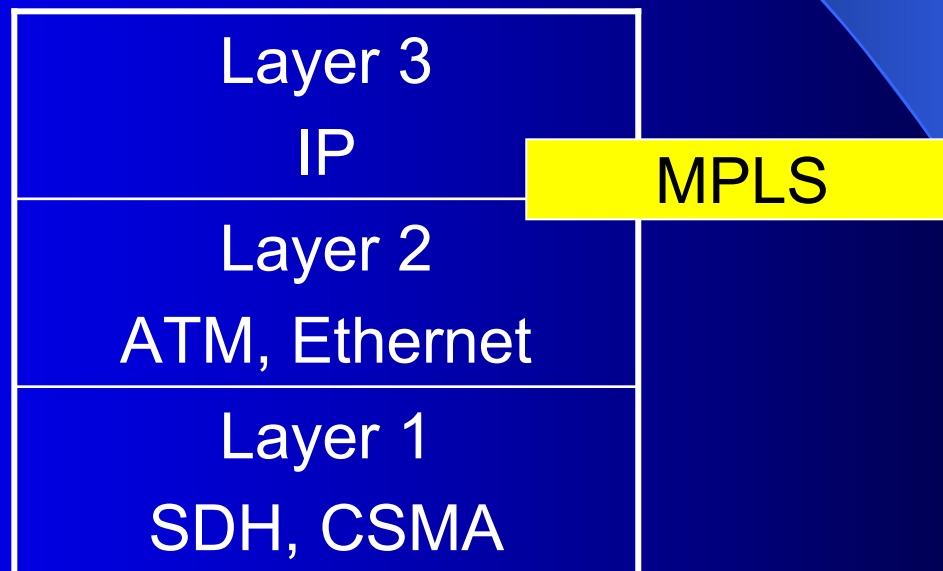
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# *MPLS Basics*

- Multi Protocol Label Switching is arranged between Layer 2 and Layer 3



# *MPLS Basics (Contd...)*

- Flow Management
- Independent of Layer-2 protocols
- Maps IP-addresses to fixed length label
- Interfaces to existing routing protocols

# *MPLS Promises*

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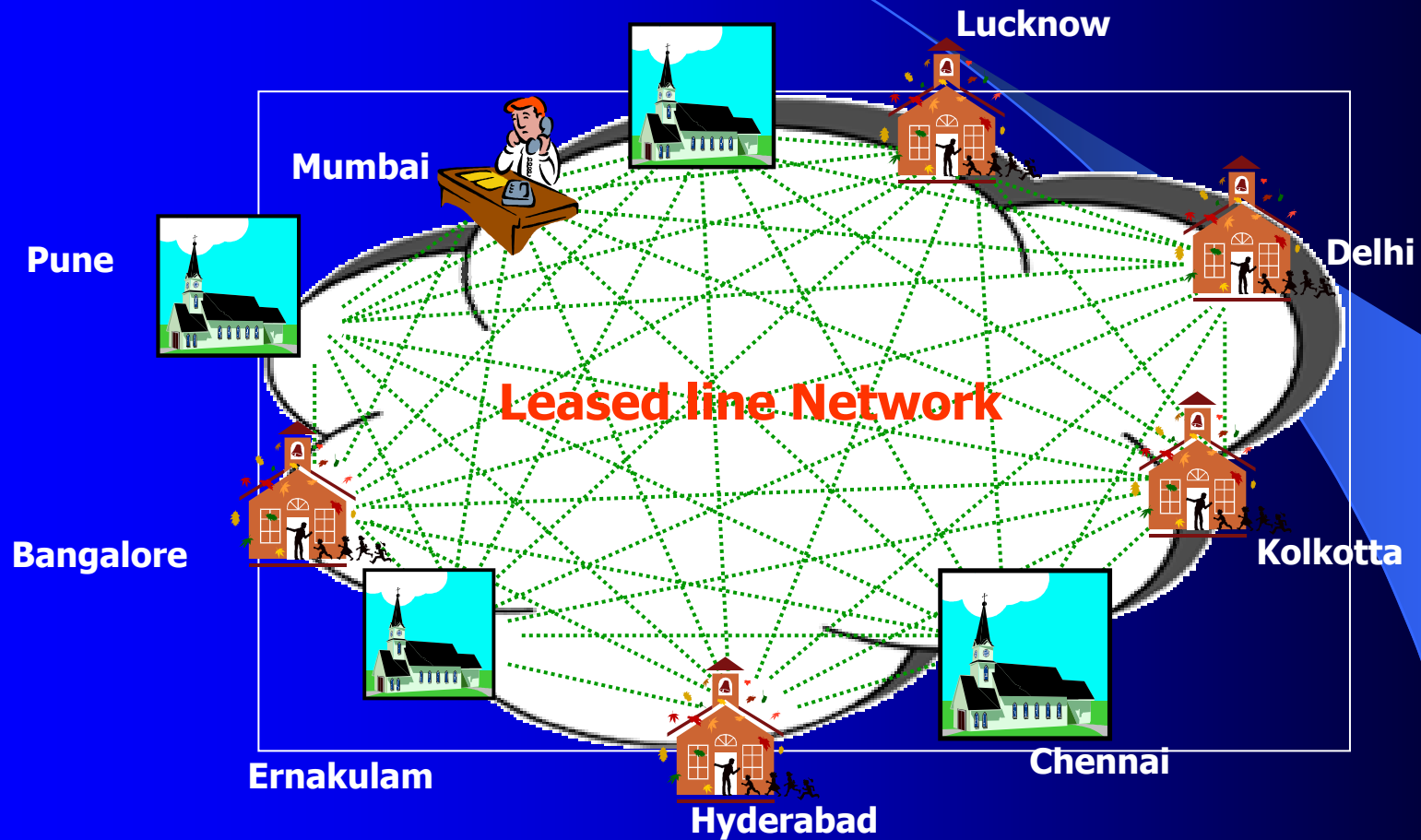
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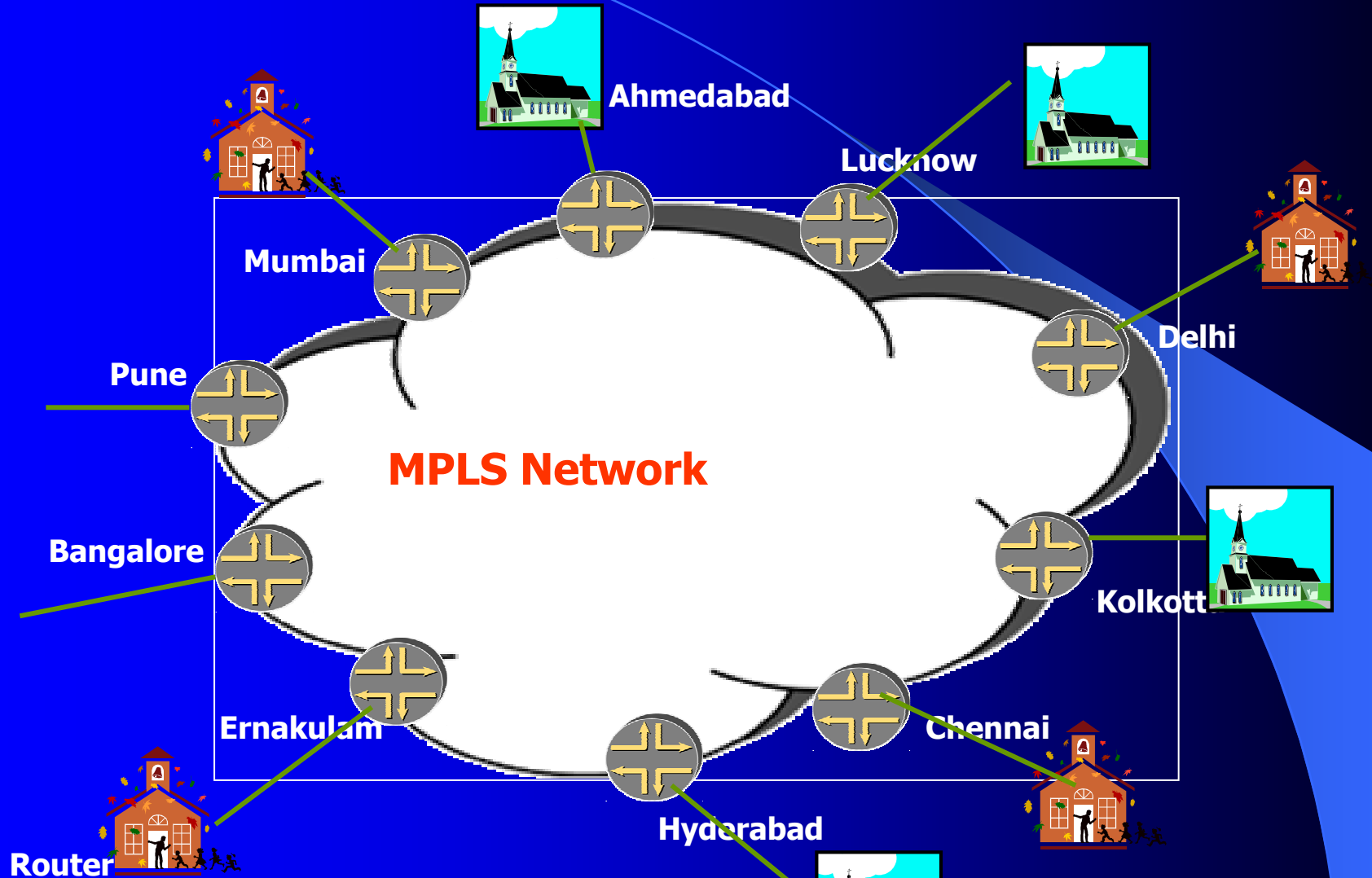
# *MPLS Promises*

- Improves packet-forwarding performance in the network
- Supports QoS and CoS for service differentiation
- Improves network scalability
- Integrates IP and ATM in the network
- Builds interoperable networks providing multi vendor interoperability
- Reduces the complexity of network operations

# Leased Line Network



# MPLS Network



Router

Links

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# *Components and Protocols*

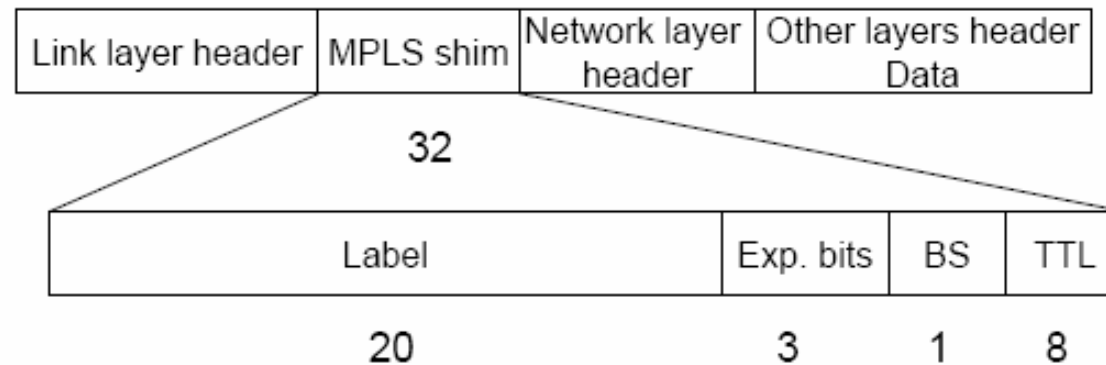
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# MPLS Components

- Label
  - Identifies the path a packet should traverse

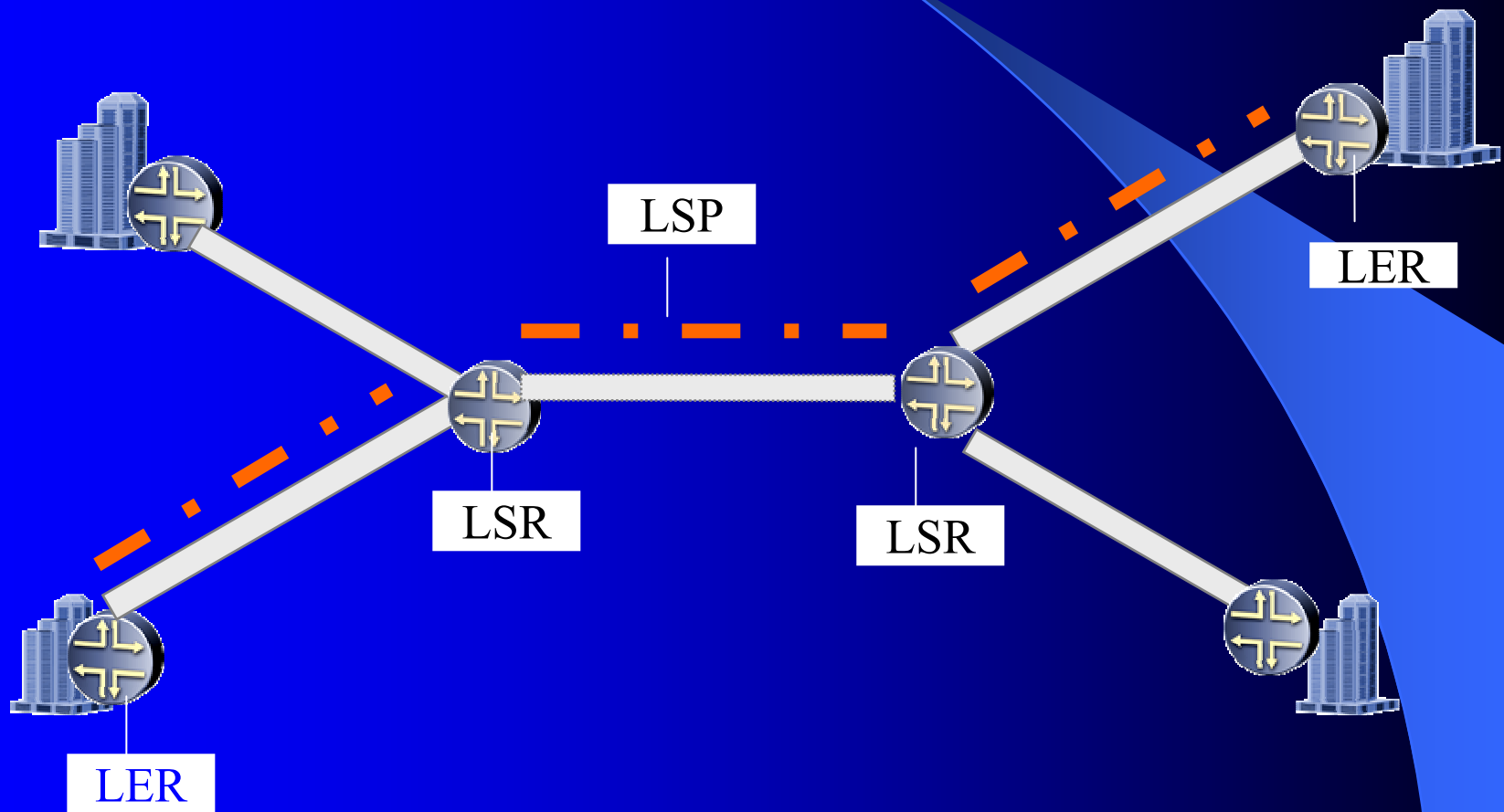


Exp.bits: Experimental Bits, often used for Class of Service

BS: Bottom of Stack bit, is set if no label follows

TTL: Time To Leave, used in the same way like in IP

# MPLS Components (Contd...)



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# MPLS Components (Contd...)

- Label Edge Router (LER)
  - Operates at the edge of the access network & MPLS network
  - Responsible for assignment and removal of labels
  - Supports Multiple Protocols connected to dissimilar networks (such as frame relay, ATM, and Ethernet)

# *MPLS Components (Contd...)*

- **Label Switching Router (LSR)**
  - High Speed Router that operates in the core of MPLS network
- **Label Switched Path (LSP)**
  - Path formed from source to destination
  - Two options to set up an LSP:
    - a) hop-by-hop routing
    - b) explicit routing

# MPLS Components (Contd...)

- Forward Equivalence Class (FEC)
  - Group of packets that share the same requirement
  - A path is a representation of a FEC
- Label Distribution Protocol (LDP)
  - IETF defined protocol for explicit signaling and management

# MPLS Components

- Label Information Base (LIB)
  - Table maintained by the Routers
  - Contents of the table specify the mapping between a label and an FEC

## Example of LIB Table:

Input Port	Incoming Port Label	Output Port	Outgoing Port Label
1	3	3	6
2	9	1	7

# *MPLS Operations*

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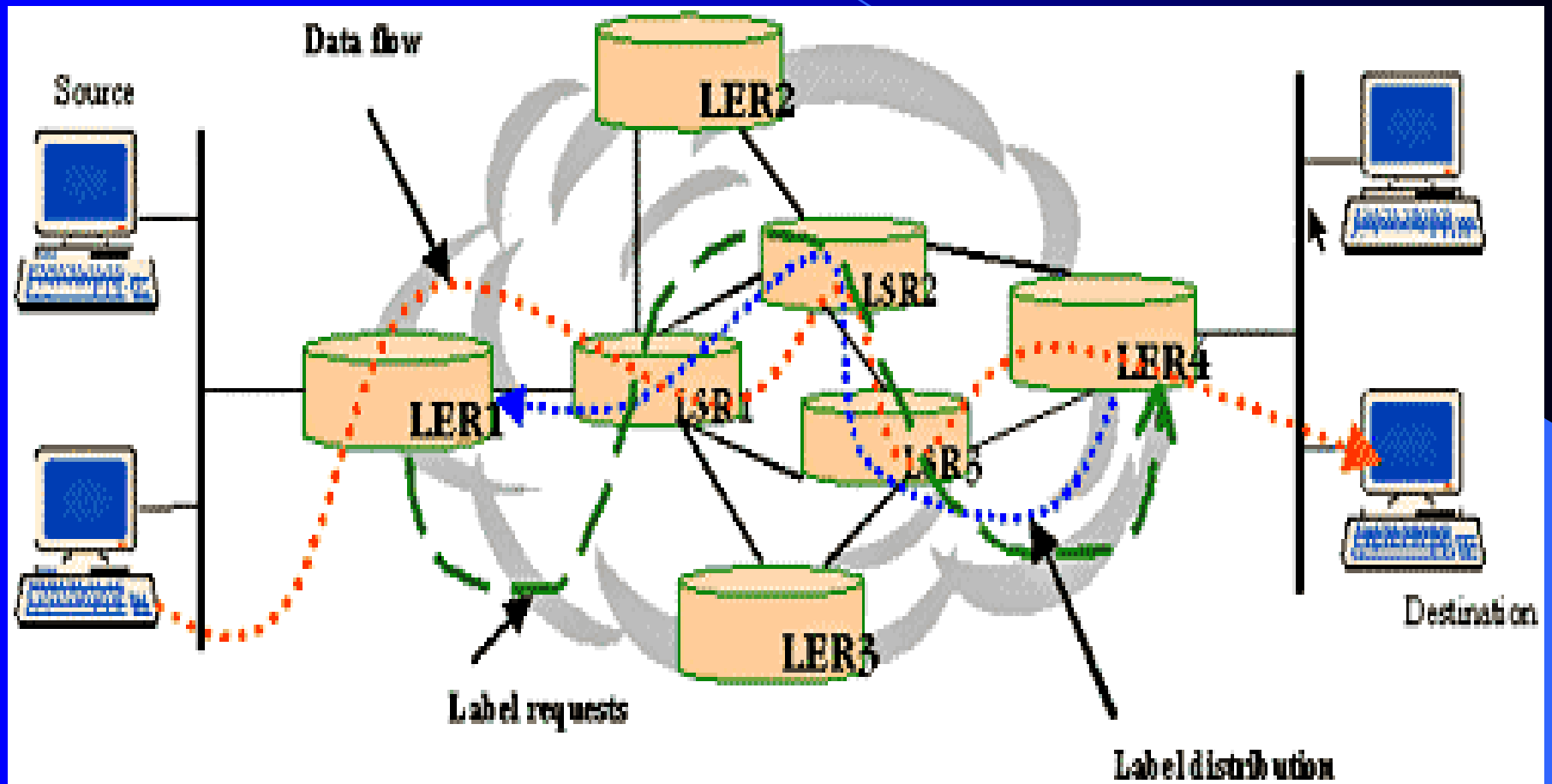
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# MPLS Operations

- Steps Involved:
  - label creation and distribution
  - table creation at each router
  - label-switched path creation
  - label insertion/ table lookup/forwarding

# MPLS Operations



# *Network Management Centre*

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# *Network Management Centre (NMC)*

- Network management plays a vital role in monitoring and controlling an MPLS network for Redundancy and Reliability.
- NMC controls the following factors:
  - LSP usage-Congestion Control
  - Label distribution
  - Creation of VPNs

# *MPLS Features*

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# *MPLS Features*

- Traffic Engineering
  - Efficient Link Utilization
  
- Class of Service (CoS)
  - Differentiated types of service across an MPLS network.
  
- Virtual Private Networks (VPNs)
  - A VPN is a private connection over an shared network

# *Security*

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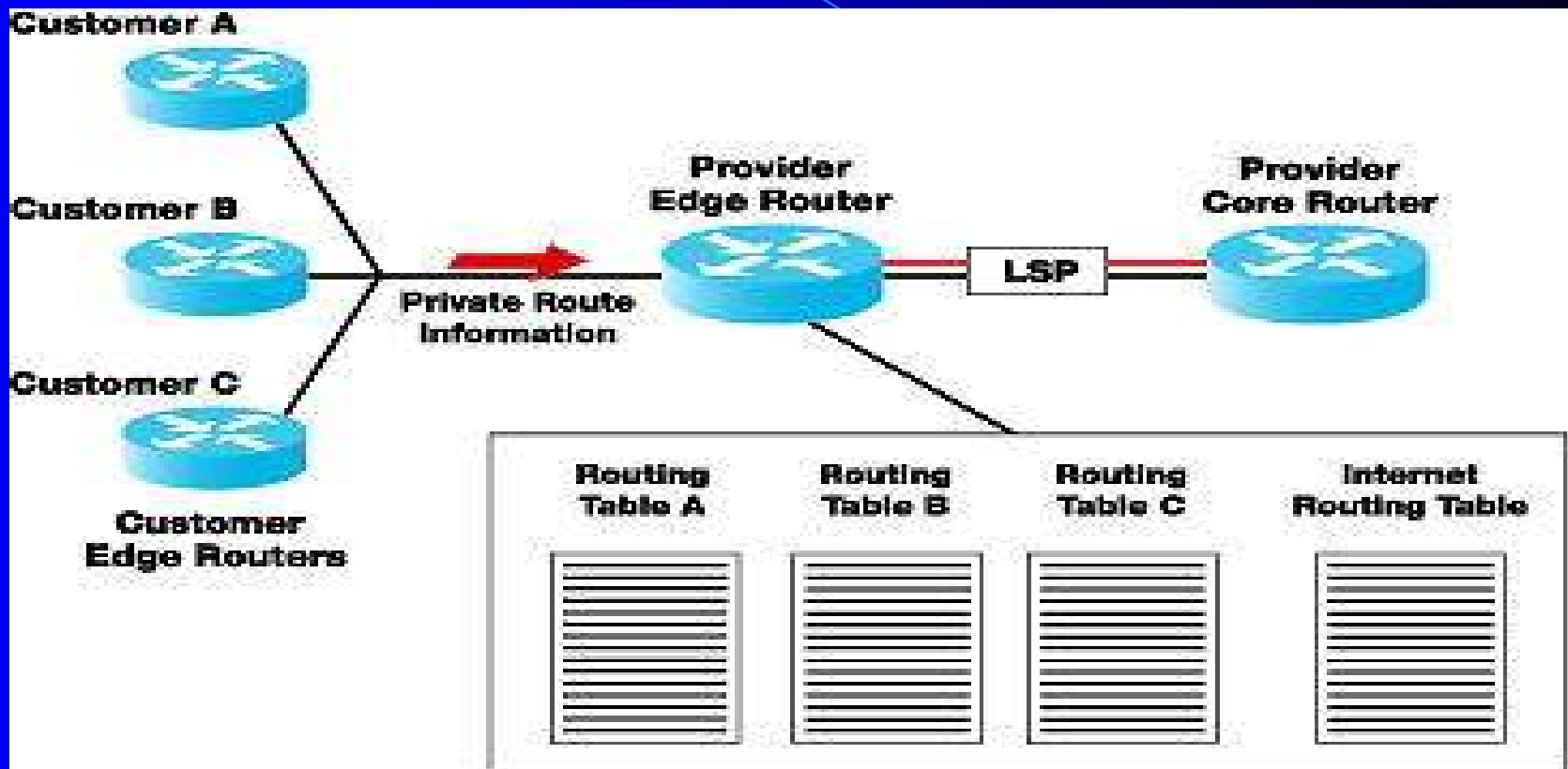
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# *Security*

- MPLS networks provide separation of address and traffic
  - ✓ Packets from one VPN do not inadvertently go to another VPN
- Malicious spoofing is impossible

# Security (Contd...)



## Provider Edge/Customer Edge Router Relationship

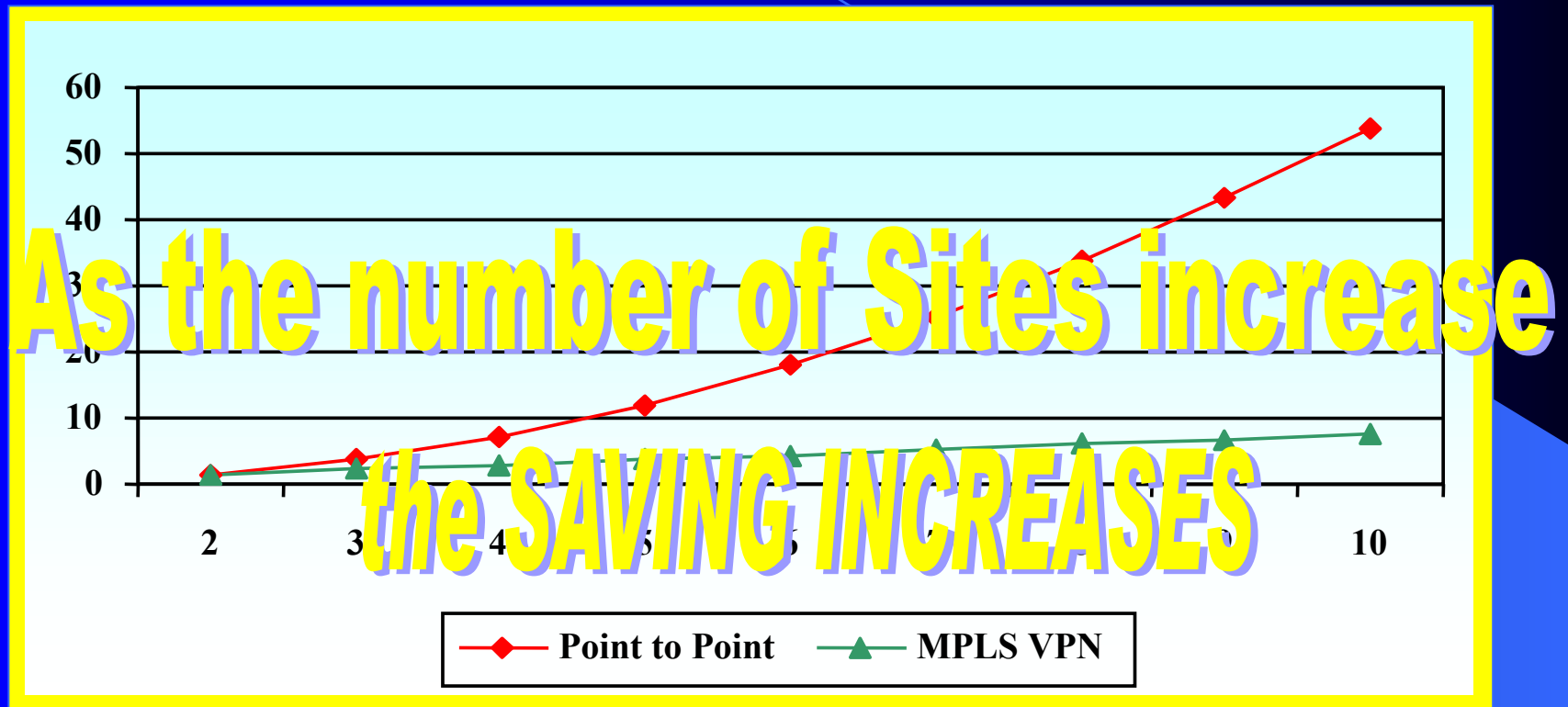
# *MPLS Costing*



# *Factors affecting Costing*

- **BW required**
- **Number of MPLS Ports required**
- **Period of hiring of ports**
- **Uptime Requirement (SLA)**
- **Prioritized Traffic (Class of Service)**

# How Cost Effective is MPLS?



Just for 10 sites the cost factor is 1/8<sup>th</sup> of Leased Lines.

# Tariff Chart (\*BSNL port charges)

Class of Service	Bandwidth	64K	128K	1Mbps	2Mbps
Gold	99 %	0.77L	1.38L	5.84L	12.32L
Silver	50%	0.58L	1.04L	4.38L	9.24L
Best effort	25%	0.38L	0.69L	2.92L	6.16L

# *MPLS Operators*

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# MPLS Operators

- Service Providers:
  - ✓ BSNL, Tata Tele Services, Bharti Telecom, Reliance Infocomm.....
- Hardware Suppliers:
  - ✓ Cisco, Juniper, Nortel, Alcatel, Huawei.....

***THANK YOU***