

MPLS Architecture for evaluating end-to-end delivery

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Abstract- This paper presents a MPLS architecture for evaluating end to end delivery. In this we have made a topology through which we show end to end delivery using MPLS. The method we use for end to end delivery is Cisco Express Forwarding (CEF), Label Distribution Protocol (LDP), Tag Distribution Protocol (TDP), Exterior Gateway Routing in this we use Border Gateway Protocol (BGP), Interior Gateway Routing in this we use Routing Information Protocol (RIP) protocol and the tool which we have been used for making the topology is Graphical Network Simulator (GNS). MPLS is improved in the future by reducing labels in the network.

Index Terms- MPLS, BGP, TDP, CEF, LDP, GNS

I. INTRODUCTION

In MPLS if we do end to end delivery, firstly all data traffic in the MPLS network is MPLS labeled. The topology which we have made in this paper uses the concept of Provider Edge (PE), Customer Edge (CE), and Core Router or provider (p). Customer Edge routers are held by the customer it self. There are two interfaces of the Customer Edge routers. One interface of the customer Edge is attached with the customer and the second interface is attached with the provider Edge. Provider Edge is also called as Label Edge Routers . which is hold by the service provider. At the encapsulation or the incoming side of the MPLS network the Provider Edge attach the labels to the packet. At the decapsulation or the outside of the MPLS network the provider edge routers remove the label. Provider router (p) are also called label switch router . Based on the MPLS labels it switch packet hop by hop.

MPLS label

MPLS uses a concept of labels. For transferring across a network the MPLS attach label to packet. Label is of fixed length. The size of the label is 20 bits. Basically the size of the MPLS packet header is 32 bits which is equal to 4bytes. There are four parts in the MPLS header which are as follows : one is Label which contains 20 bits , second is EXP that is experimental which contains 3 bits, Third one is S that is stacking bit which contains 1 bit and the fourth which is last one that is TTL stands for time to live.

II. WORKING OF THE MPLS

As previously discussed MPLS attach the label to the data packets for transferring data across a network. The importance of MPLS is only on a local node to node connection. In this the function of the node is that it forwards the packet by swapping the current label for the fitting label to route the packet to just

after that node. In this way the forwarding concept through out the network is label swapping. The label swapping concept enables the high speed switching of the packet through the backbone of the MPLS network. MPLS Predefined the route through which a data takes across a network and convert that information in to label which is understand by the network routers[4].

A. HOW we establish the route in the MPLS network

In order to pass over the data across a network we use label switch path (LSP). Always the packet enters in to the MPLS network at an incoming side or encapsulation Label Switch Router (LSR) and exits the MPLS network at an outside or decapsulation LSR. In LSR there are predefined Switching tables are there according to that core devices switches labeled packet. LSR can be a switch or router[4].

B. Forward Equivalence Class (FEC)

A Forward Equivalence Class is a class in which the same type of group of packets are described. The same routing treatment is given to the packets of FEC. In hop- by- hop routing the next hop is independently selected by the router for a given Forwarding Equivalence Class[4].

III. METHODS

The method we use for end to end delivery is defined as follows:-

A. Switching Method Cisco Express Forwarding (CEF)

CEF is a switching method used by the Cisco Ios for packet forwarding. CEF is the default packet forwarding method in MPLS network. When the router forward the packet the router must know the destination address of the packet which is present in the table. Each and every protocol through which the router can forward the packet must have a separate forwarding table[5].

CEF mandatory in MPLS

Only with the help of Label Forwarding Information Base (LFIB) the labeled packets enter the router are switched. There is a CEF table on the router. Only with the help of CEF Table the IP packets enter the router are switched and the packet which is at the decapsulation can be a labeled packet or an IP packet. Basically there are two main components of CEF. One component is Forwarding Information Base (FIB) and the Second component is adjacency table. The FIB is also known as CEF table[5].

Manipulation of CEF

First of all when a packet enters in to the router it removes the Layer 2 information then in the CEF table the router consider

the destination IP address. After that the decision takes for forwarding the packets in to the destination then the output of this forwarding decision points to one adjacency entry in the adjacency table. The Layer 2 rewrite string is restored from the adjacency table. With the help of this the router is able to place a new Layer 2 header on to the frame. Do this process right before switching the packet out onto the outside interface approaching the next hop. It is used in the distributed manner[5].

How do CEF Labeling IP Packets

It is necessary to Label the IP packets at the edge of the MPLS network. At the incoming side of the LSR there is a stack of label is imposed on the IP packet. It is not necessary that we impose only one label on the IP packet at incoming side of the provider edge router there can be two or more labels on the IP packet at the incoming side of the provider edge router. In order to check which label is imposed on the IP packet ,we can check it from the CEF Table. We can enable CEF with global ip cef command[5].

A. LABEL DISTRIBUTION PROTOCOL (LDP)

As we discussed above, We use LSR which performs label swapping in order to forward the packet that means label should be distributed. There are two way to achieve it. one way is that on an already present routing protocol piggyback the labels and the second way is that we can develop a new protocol to do this. In the MPLS network the LDP for the Forward Equivalence Class carries the labels. In order to distribute prefixes between different autonomous system we use only one protocol that is Border Gateway Protocol (BGP). In order to distribute the labels for interior routes we use the LDP. Therefore all point to point connected Label Switch Router must establish an label distribution protocol session between them. Label mapping messages are exchanged between the LDP session by the LDP neighbours. The label which is bound to Forward Equivalence Class(FEC) is known as label mapping. We can enable the LDP by the mpls ip command[5].

B. TAG DISTRIBUTION PROTOCOL (TDP)

TDP is a connection oriented technique and takes a full guarantee of sequential delivery. TDP protocol is used by the switching routers in order to communicate tag binding information to their peers. TDP supports many protocols. The main function of the TDP is that it provides the means for creating and distributing the binding information by the help of Tag Switching Routers (TSR). In order to distribute and release the binding information for network layer protocols we use TSRs.

C. BORDER GATEWAY PROTOCOL (BGP)

In the MPLS provider communicates with the help of the BGP. As in the previous days the provider takes the upper layers of layer 2 as the responsibility for routing and we only worry about the Layer 2. But now days participates run BGP on their router in order to possible the working of MPLS. In order to connect with external network we use BGP[6].

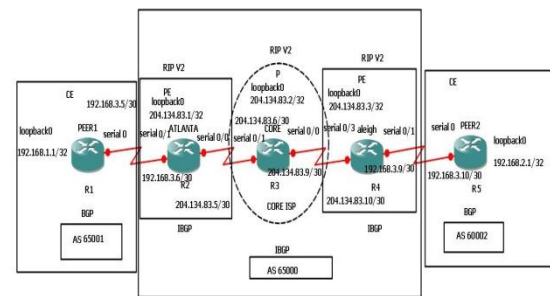
D. ROUTING INFORMATION PROTOCOL (RIP)

Routing Information protocol is Interior Gateway Protocol. In which the routing is performed with in a single autonomous system. Enhancement of the RIP is the RIP2. Messages are updated at regular interval when there is a change in the network topology. In RIP we use a hop count in order to measure the distance between the source and destination. Total no. of hop count we use here are 15 and RIP timer is generally a 30 seconds.

IV. SIMULATION

The simulator used for MPLS end to end delivery is GNS Simulator. GNS is a graphical Network Simulator it supports the simulation of complex networks .

Fig1.Topology shows routers are in off position



In this topology, there are basically five routers . The name of the five routers as follows:

- A. PEER 1
- B. PEER 2
- C. ATLANTA
- D. CORE ROUTER
- E. ALIEGH

In this topology routers are in the off position ,Red lights indicate that the routers are off

- A. *PEER1*:- In this topology peer1 is working as the customer edge. *CUSTOMER EDGE*:- A customer edge (CE) device. This is a router that connects to the customer network and to a service provider.
- B. *PEER2*:- In this topology peer2 is also acting as a customer edge.
- C. *ATLANTA*:- In this topology Atlanta is the provider edge.
- D. *PROVIDER EDGE*:- A provider edge (PE) device. This is a service provider that connects to a customer and into the provider (P) network.
- E. *CORE ROUTER*:- In this topology core router is the core ISP. which is also known as the internet cloud. The name of this router is known as P router.

Fig.3 Running mode of the PEER 1

```

Telnet 127.0.0.1
*Mar 1 00:00:05.059: %LINK-5-CHANGED: Interface FastEthernet0/1, changed state
to administratively down
*Mar 1 00:00:05.071: %LINK-5-CHANGED: Interface Serial0/1, changed state to ad
ministratively down
*Mar 1 00:00:31.519: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0,
changed state to down
PEER1>en
PEER1#show running-config
Building configuration...

Current configuration : 956 bytes
!
version 12.3
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname PEER1
!
boot-start-marker
boot-end-marker
!
memory-size iomem 25
no aaa new-model
ip subnet-zero
ip cef
!
no ip domain lookup
!
ip tcp synwait-time 5
!
interface Loopback0
ip address 192.168.1.1 255.255.255.255
!
interface FastEthernet0/0
no ip address
shutdown

```

- Fig4. Running Interface of PEER 1**

```
Telnet 127.0.0.1
hostname PEER1
boot-start-marker
boot-end-marker

memory-size iomem 25
no aaa new-model
ip subnet-zero
ip cef

no ip domain lookup

ip tcp synwait-time 5

interface Loopback0
 ip address 192.168.1.1 255.255.255.255

interface FastEthernet0/0
 no ip address
 shutdown
 duplex auto
 speed auto

interface Serial0/0
 ip address 192.168.3.5 255.255.255.252
 no fair-queue

interface FastEthernet0/1
 no ip address
 shutdown
 duplex auto
 speed auto

interface Serial0/1
 no ip address
 shutdown
```

- Fig.2 Routers are in the on position**

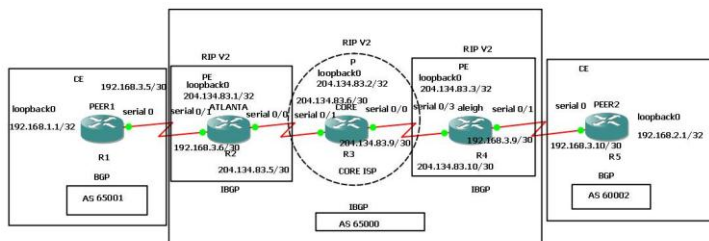


Fig5. Running mode of ANTLATA

```
Telnet 127.0.0.1
?
interface Loopback0
 ip address 204.134.83.1 255.255.255.255
?
interface FastEthernet0/0
 no ip address
 shutdown
 duplex auto
 speed auto
?
interface Serial0/0
 ip address 204.134.83.5 255.255.255.252
?
interface FastEthernet0/1
 no ip address
 shutdown
 duplex auto
 speed auto
?
interface Serial0/1
 ip address 192.168.3.6 255.255.255.252
?
router rip
 version 2
 network 204.134.83.0
?
router bgp 65000
 no synchronization
 bgp log-neighbor-changes
 neighbor 192.168.3.5 remote-as 65001
 neighbor 204.134.83.3 remote-as 65000
 neighbor 204.134.83.3 update-source Loopback0
 neighbor 204.134.83.3 next-hop-self
 no auto-summary
?
no ip http server
 ip classless
?
line con 0
 exec-timeout 0 0
```

Fig7. Running mode of CORE ROUTER

```
Telnet 127.0.0.1
?
memory-size iomem 15
no aaa new-model
ip subnet-zero
ip cef
?
no ip domain lookup
?
?
?
interface Loopback0
 ip address 204.134.83.2 255.255.255.255
?
interface FastEthernet0/0
 no ip address
 shutdown
 duplex auto
 speed auto
?
interface Serial0/0
 ip address 204.134.83.9 255.255.255.252
?
interface FastEthernet0/1
 no ip address
 shutdown
 duplex auto
 speed auto
?
interface Serial0/1
 ip address 204.134.83.6 255.255.255.252
?
router rip
 version 2
 network 204.134.83.0
?
no ip http server
 ip classless
```

Fig6. Running mode of CORE ROUTER(IP CEF)

```
Telnet 127.0.0.1
to administratively down
CORE>
CORE>en
CORE#show ip cef
Prefix      Next Hop      Interface
0.0.0.0/0    drop          Null0 (default route handler entry)
0.0.0.0/32    receive
204.134.83.2/32 receive
204.134.83.4/30 attached    Serial0/1
204.134.83.4/32 receive
204.134.83.6/32 receive
204.134.83.7/32 receive
204.134.83.8/30 attached    Serial0/0
204.134.83.8/32 receive
204.134.83.9/32 receive
204.134.83.11/32 receive
224.0.0.0/4   drop
224.0.0.0/24 receive
255.255.255.255/32 receive
CORE#
*Mar 1 00:00:31.915: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0,
changed state to down
*Mar 1 00:00:31.931: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1,
changed state to down
CORE#
```

Fig8. Running mode ALEIGH

```
Telnet 127.0.0.1
interface Loopback0
 ip address 204.134.83.3 255.255.255.255
?
interface FastEthernet0/0
 no ip address
 shutdown
 duplex auto
 speed auto
?
interface Serial0/0
 no ip address
 shutdown
?
interface FastEthernet0/1
 no ip address
 shutdown
 duplex auto
 speed auto
?
interface Serial0/1
 ip address 192.168.3.9 255.255.255.252
?
interface Serial0/2
 no ip address
 shutdown
?
interface Serial0/3
 ip address 204.134.83.10 255.255.255.252
?
router rip
 version 2
 network 204.134.83.0
?
router bgp 65000
 no synchronization
 bgp log-neighbor-changes
 neighbor 192.168.3.10 remote-as 65002
 neighbor 204.134.83.1 remote-as 65000
 neighbor 204.134.83.1 update-source Loopback0
 neighbor 204.134.83.1 next-hop-self
 no auto-summary
?
no ip http server
```


Fig.9 MPLS run on ANTLATA COUNTRY

Fig11. LABEL BINDINGS ON ANTLANTA

```
Select Telnet 127.0.0.1
*Mar 1 00:00:13.259: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/
2, changed state to up
*Mar 1 00:00:13.259: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/
3, changed state to up
*Mar 1 00:00:18.339: %LINK-5-CHANGED: Interface Ethernet1/0, changed state to a
dministratively down
*Mar 1 00:00:18.747: %LINK-5-CHANGED: Interface Ethernet1/1, changed state to a
dministratively down
*Mar 1 00:00:18.751: %LINK-5-CHANGED: Interface Ethernet1/2, changed state to a
dministratively down
*Mar 1 00:00:18.755: %LINK-5-CHANGED: Interface Ethernet1/3, changed state to a
dministratively down
*Mar 1 00:00:19.167: %SYS-5-CONFIG I: Configured from memory by console
*Mar 1 00:00:19.455: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/
0, changed state to down
*Mar 1 00:00:20.599: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/
1, changed state to down
*Mar 1 00:00:20.603: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/
2, changed state to down
*Mar 1 00:00:20.603: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/
3, changed state to down
*Mar 1 00:00:25.291: %SYS-5-RESTART: System restarted --
Cisco Internetwork Operating System Software
IOS (tm) 3600 Software (C3660-JS-M), Version 12.3(12), RELEASE SOFTWARE (fc3)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2004 by Cisco Systems, Inc.
Compiled Mon 29-Nov-04 14:28 by kellythw
*Mar 1 00:00:25.295: %SNMP-5-COLDSTART: SNMP agent on host ATLANTA is undergoin
g a cold start
*Mar 1 00:00:31.003: %LDP-5-NBRCHG: LDP Neighbor 204.134.83.2:0 is UP
*Mar 1 00:00:40.219: %BGP-5-ADJCHANGE: neighbor 204.134.83.3 Up
*Mar 1 00:00:56.939: %BGP-5-ADJCHANGE: neighbor 192.168.3.5 Up
ATLANTA#
ATLANTA#show
ATLANTA#show tag
ATLANTA#show tag-switching int
ATLANTA#show tag-switching interfaces
Interface IP Tunnel Operational
FastEthernet0/0 Yes (tdp) No Yes
ATLANTA#
```

Fig10. MPLS run on CORE ISP

```
Telnet 127.0.0.1
ATLANTA#show tag-switching tdp di
ATLANTA#show tag-switching tdp discovery
Local TDP Identifier:
204.134.83.1:0
Discovery Sources:
Interfaces:
FastEthernet0/0 (tdp): xmit/rcv
TDP Id: 204.134.83.2:0
ATLANTA#show tag-switching tdp bind
ATLANTA#show tag-switching tdp bindings
tib entry: 192.168.3.4/30, rev 4
local binding: tag: imp-null
tib entry: 204.134.83.1/32, rev 6
local binding: tag: imp-null
remote binding: tr: 204.134.83.2:0, tag: 16
tib entry: 204.134.83.2/32, rev 8
local binding: tag: 16
remote binding: tr: 204.134.83.2:0, tag: imp-null
tib entry: 204.134.83.3/32, rev 12
local binding: tag: 17
remote binding: tr: 204.134.83.2:0, tag: 17
tib entry: 204.134.83.4/30, rev 2
local binding: tag: imp-null
remote binding: tr: 204.134.83.2:0, tag: imp-null
tib entry: 204.134.83.0/30, rev 10
local binding: tag: 17
remote binding: tr: 204.134.83.2:0, tag: imp-null
ATLANTA#
ATLANTA#show tag-switching tdp binding
ATLANTA#show tag-switching tdp nei
ATLANTA#show tag-switching tdp neighbor
Peer TDP Ident: 204.134.83.2:0; Local TDP Ident 204.134.83.1:0
TCP connection: 204.134.83.2.34490 - 204.134.83.1.711
State: Oper; PIEs sent/rcvd: 14/14; Downstream
Up time: 00:09:11
TDP discovery sources:
FastEthernet0/0, Src IP addr: 204.134.83.6
Addresses bound to peer TDP Ident:
204.134.83.9 204.134.83.2 204.134.83.6
ATLANTA#
```

Fig12. LABEL BINDINGS ON CORE ISP

```
Select Telnet 127.0.0.1
*Mar 1 00:00:20.003: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/
0, changed state to down
*Mar 1 00:00:20.007: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/
1, changed state to down
*Mar 1 00:00:20.007: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/
2, changed state to down
*Mar 1 00:00:20.011: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/
3, changed state to down
*Mar 1 00:00:24.347: %SYS-5-RESTART: System restarted --
Cisco Internetwork Operating System Software
IOS (tm) 3600 Software (C3660-JS-M), Version 12.3(12), RELEASE SOFTWARE (fc3)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2004 by Cisco Systems, Inc.
Compiled Mon 29-Nov-04 14:28 by kellythw
*Mar 1 00:00:24.379: %SNMP-5-COLDSTART: SNMP agent on host Core is undergoing a
cold start
*Mar 1 00:00:31.323: %LDP-5-NBRCHG: LDP Neighbor 204.134.83.1:0 is UP
*Mar 1 00:00:51.627: %LDP-5-NBRCHG: LDP Neighbor 204.134.83.3:0 is UP
Core#
Core#show
Core#show tag
Core#show tag-switching int
Core#show tag-switching interfaces
Interface IP Tunnel Operational
FastEthernet0/0 Yes (tdp) No Yes
FastEthernet0/1 Yes (tdp) No Yes
Core#
```

```
Select Telnet 127.0.0.1
Interface IP Tunnel Operational
FastEthernet0/0 Yes (tdp) No Yes
FastEthernet0/1 Yes (tdp) No Yes
Core#shi
Core#sho
Core#show tag
Core#show tag-switching bin
Core#show tag-switching bin
Core#show tag-switching tdp bin
Core#show tag-switching tdp bindings
tib entry: 192.168.3.4/30, rev 11
remote binding: tr: 204.134.83.1:0, tag: imp-null
tib entry: 192.168.3.8/30, rev 12
remote binding: tr: 204.134.83.3:0, tag: imp-null
tib entry: 204.134.83.1/32, rev 8
local binding: tag: 16
remote binding: tr: 204.134.83.1:0, tag: imp-null
tib entry: 204.134.83.2/32, rev 6
local binding: tag: imp-null
remote binding: tr: 204.134.83.1:0, tag: 16
tib entry: 204.134.83.3/32, rev 18
remote binding: tr: 204.134.83.3:0, tag: 17
local binding: tag: 17
remote binding: tr: 204.134.83.1:0, tag: 18
tib entry: 204.134.83.4/30, rev 4
local binding: tag: imp-null
remote binding: tr: 204.134.83.1:0, tag: imp-null
tib entry: 204.134.83.0/30, rev 2
local binding: tag: imp-null
remote binding: tr: 204.134.83.1:0, tag: 17
remote binding: tr: 204.134.83.3:0, tag: imp-null
Core#_
```

Fig15. ANTLATA FORWARDING TABLE TAGS

```

Select Telnet 127.0.0.1
local binding: tag: imp-null
tth entry: 204.134.83.1/32, rev 6
    local binding: tag: imp-null
    remote binding: tsr: 204.134.83.2:0, tag: 16
tth entry: 204.134.83.2/32, rev 8
    local binding: tag: 16
    remote binding: tsr: 204.134.83.2:0, tag: imp-null
tth entry: 204.134.83.3/32, rev 12
    local binding: tag: 10
    remote binding: tsr: 204.134.83.2:0, tag: 17
tth entry: 204.134.83.4/30, rev 2
    local binding: tag: imp-null
    remote binding: tsr: 204.134.83.2:0, tag: imp-null
tth entry: 204.134.83.8/30, rev 10
    local binding: tag: 17
    remote binding: tsr: 204.134.83.2:0, tag: imp-null
ATLANTA#
ATLANTA#show tag-switching tdp binding
ATLANTA#show tag-switching tdp nei
ATLANTA#show tag-switching tdp neighbor
Peer TDP Ident: 204.134.83.2:0; Local TDP Ident 204.134.83.1:0
ICP connection: 204.134.83.2.34490 - 204.134.83.1.711
State: Oper; PIES sent/rcvd: 14/14; Downstream
Up time: 00:09:11
TDP discovery sources:
    FastEthernet0/0, Src IP addr: 204.134.83.6
Addresses bound to peer TDP Ident:
    204.134.83.2    204.134.83.2    204.134.83.6
ATLANTA#show tag-switching forwarding-table
ATLANTA#show tag-switching fo
Local Outgoing Prefix Bytes tag Outgoing Next Hop
tag tag or UC or tunnel id switched interface
16 Pop tag 204.134.83.2/32 0 Fa0/0 204.134.83.6
17 Pop tag 204.134.83.8/30 0 Fa0/0 204.134.83.6
18 17 204.134.83.3/32 0 Fa0/0 204.134.83.6
ATLANTA#

```

Fig16. TRACEOUT

```

Select Telnet 127.0.0.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.2.1, timeout is 2 seconds:
Success rate is 100 percent (5/5), round-trip min/avg/max = 1224/1547/1748 ms
PEER1#ping 192.168.2.1 repeat 100
Type escape sequence to abort.
Sending 100, 100-byte ICMP Echos to 192.168.2.1, timeout is 2 seconds:
Success rate is 66 percent (6/9), round-trip min/avg/max = 1468/1695/1808 ms
PEER1#ping 192.168.2.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.2.1, timeout is 2 seconds:
!!..!
Success rate is 60 percent (3/5), round-trip min/avg/max = 1836/1926/1980 ms
PEER1#
PEER1#show
PEER1#show ip tag
PEER1#show ip tag
PEER1#show tag
PEER1#show tag-switching for
Sending 5, tag-switching forwarding-table
Tag switching is not operational.
or tag switching has not been enabled.
No IPFB currently allocated.
PEER1#exit
PEER1#traceroute 192.168.2.1
Type escape sequence to abort.
Tracing the route to 192.168.2.1
 1 192.168.3.6 268 msec 356 msec 324 msec
 2 204.134.83.6 [MPLS: Label 17 Exp 0] 1032 msec 1228 msec 1040 msec
 3 204.134.83.10 1076 msec 1068 msec 1076 msec
 4 192.168.3.10 [AS 65002] 1388 msec 1416 msec 1160 msec
PEER1#

```

Fig18. End to End Delivery of MPLS

```
Select Telnet 127.0.0.1
<cr>
ATLANTA#show tag-switching forwarding-table tag
ATLANTA#show tag-switching forwarding-table tags
% Incomplete command.
ATLANTA#show tag-switching forwarding-table tags ?
<0-1048575> Tag value X or tag range "X - Y"
ATLANTA#show tag-switching forwarding-table deta
ATLANTA#show tag-switching forwarding-table detail
Local Outgoing Prefix Bytes tag Outgoing Next Hop
tag tag or UC or Tunnel Id switched interface
16 Pop tag 204.134.83.2/32 0 Fa0/0 204.134.83.6
MAC/Encaps=14/14, MRU=1504, Tag Stack()
CC0110C80001CC8210C800000047
No output feature configured
Per-packet load-sharing
17 Pop tag 204.134.83.0/30 0 Fa0/0 204.134.83.6
MAC/Encaps=14/14, MRU=1504, Tag Stack()
CC0110C80001CC8210C800000047
No output feature configured
Per-packet load-sharing
18 17 204.134.83.3/32 0 Fa0/0 204.134.83.6
MAC/Encaps=14/18, MRU=1500, Tag Stack(17)
CC0110C80001CC8210C800000047 00011000
No output feature configured
Per-packet load-sharing
ATLANTA#show ip
ATLANTA#show ip mp
ATLANTA#show ip mpls
ATLANTA#show ip mpls
ATLANTA#show ip mpls
ATLANTA#show mpls
ATLANTA#show mpls ?
atn-ldp ATM LDP Protocol information
forwarding-table Show the Label Forwarding Information Base (LFIB)
interfaces Per-interface MPLS forwarding information
ip MPLS IP information
label Label information
ldp Label Distribution Protocol information
traffic-eng Traffic engineering information
ATLANTA#show mpls for
ATLANTA#show mpls forwarding-table
Local Outgoing Prefix Bytes tag Outgoing Next Hop
tag tag or UC or Tunnel Id switched interface
16 Pop tag 204.134.83.2/32 0 Fa0/0 204.134.83.6
17 Pop tag 204.134.83.0/30 0 Fa0/0 204.134.83.6
18 17 204.134.83.3/32 0 Fa0/0 204.134.83.6
ATLANTA#show mpls int
ATLANTA#show mpls interfaces
Interface IP Tunnel Operational
FastEthernet0/0 Yes (tdp) No Yes
ATLANTA#show mpls ip
```

V. CONCLUSION AND FUTURE

The conclusion of this paper is that in which we do the label switching. This label switching technology is used to improve the performance of network layer routing. In this scenario basically a main role of three things that is customer edge, provider edge, core isp. The provider edge performs the label imposition to the packets and send the labeled packet to its way. In which each LSR in the LSP doesn't examine the layer 3 portion of the packet only label examine the layer 3 portion of the packet. In which we do the end to end delivery by externally using BGP protocol and internally using RIP protocol and the future of this paper is that we can improve the performance by reducing the number of labels.

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