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 a 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].

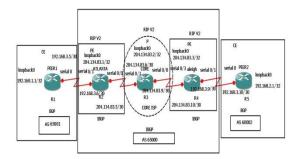
D. ROUTING INFORMATION PROTOCOL (RIP)

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.

P:- A provider (P) device. This is a service provider that exists entirely in the provider (P) network and only connects to other service provider devices (not to customers).

CUSTOMER ADDRESSING

- A. The devices which we used in it are PEER 1 and PEER 2.
- B. The loopback0 for PEER1 is 192.168.1.1/32 and the loopback0 for PEER 2 is 192.168.2.1/32
- C. The serial 0 for PEER 1 is 192.168.3.5/30 and the serial 0 for PEER 2 is 192.168.3.10/30.

SERVICE PROVIDER ADDRESING

- A. The devices in the service provider addressing are ATLANTA, CORE, RALEIGH.
- B. The loopback0 for the ATLANTA is 204.134.83.1/32, CORE is 204.134.83.2/32, RALEIGH is 204.134.83.3/32.
- C. The Serial0/0 for the ATLANTA is 204.134.83.5/30, CORE is 204.134.83.9/30, RALEIGH is N/A.
- D. The Serial0/1 for the ATLANTA is192.168.3.6/30, CORE is 204.134.83.6/30, RALEIGH is 192.168.3.9/30.
- E. The Serial0/3 for the ATLANTA is N/A, CORE is N/A, RALEIGH is 204.134.83.10/30.

Fig.2 Routers are in the on position

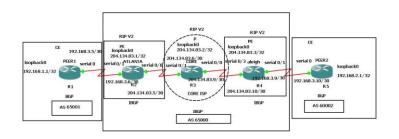


Fig.3 Running mode of the PEER 1

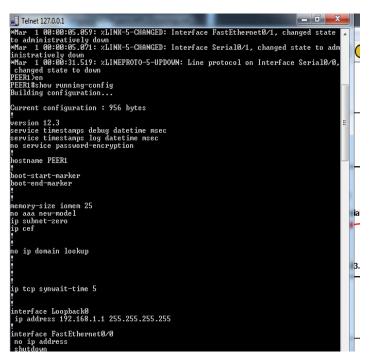


Fig4. Running Interface of PEER 1



Fig5. Running mode of ANTLATA

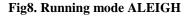
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ip address 204.134.83.1 255.255.255.255	
interface FastEthernet0/0 no ip address shutdown duplex auto speed auto	
interface Seria10/0 ip address 204.134.83.5 255.255.255.252	
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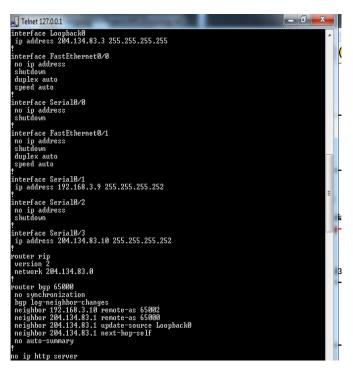
Fig6. Running mode of CORE ROUTER(IP CEF)

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ORE≻en		
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14.134.83.4/30	attached	Serial0/1
04.134.83.4/32	receive	
14.134.83.6/32	receive	
14.134.83.7/32	receive	
14.134.83.8/30	attached	Serial0/0
14.134.83.8/32	receive	
14.134.83.9/32	receive	
14.134.83.11/32	receive	
4.0.0.0/4	drop	
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Fig7. Running mode of CORE ROUTER

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ip subnet-zero		
; • •		
no ip domain lookup		
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! interface Loopback0 iy address 204.134.83.2 255.255	5.255.255	
interface FastEthernet0/0 no ip address skutdown duplex auto speed auto		
: interface Serial0/0 iy address 204.134.83.9 255.255	5.255.252	
: interface FastEthernet0/1 no ip address shutdown		
duplex auto speed auto		
; interface Serial0/1 ip address 204.134.83.6 255.255	5.255.252	
: router rip version 2 network 204.134.83.0		





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Fig.9 MPLS run on ANTLATA COUNTRY

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<pre>dministratively down Har 1 00:00:10.755: xLINK-5-CHANGED: Interface Ethernet1/3, changed state to a dministratively down Har 1 00:00:10.75: xSYS-5-CONFIG_I: Configured from memory by console Har 1 00:00:19.455: xLINK-FO-CHANGED: Line protocol on Interface Ethernet1/ , changed state to down Har 1 00:00:19.455: xLINEFROTO-5-UPDOUN: Line protocol on Interface Ethernet1/ , changed state to down Har 1 00:00:20.509: xLINEFROTO-5-UPDOUN: Line protocol on Interface Ethernet1/ , changed state to down Har 1 00:00:20.509: xLINEFROTO-5-UPDOUN: Line protocol on Interface Ethernet1/ , changed state to down Har 1 00:00:20.603: xLINEFROTO-5-UPDOUN: Line protocol on Interface Ethernet1/ , changed state to down Har 1 00:00:20.503: xLINEFROTO-5-UPDOUN: Line protocol on Interface Ethernet1/ , changed state to down Har 1 00:00:25.271: xSYS-5-RESTART: System restarted Cisco Internetuork Operating System Software IOS (cn) 3600 Software (C3660-JS-H), Uorsion 12.3(12), RELEASE SOFTWARE (fc3) Technical Support: http://www.cisco.con/techsupport Conpiled Mon 29-Mou-041 41:28 by kellythw Har 1 00:00:25.275: xSNNF-5-COLDSTART: SNNF agont on host AILANTA is undergoin g a cold start Har 1 00:00:25.275: xBNF-5-CDLORTARE: sNNF agont on host AILANTA is undergoin g a cold start Har 1 00:00:31.003: xLDP-5-NBRCHG: TDP Neighbor 204.134.83.23 Up Har 1 00:00:55.039: zBCP-5-ADJCHANGE: neighbor 192.160.3.3 Up Har 1 00:00:55.039: zBCP-5-ADJCHANGE: neighbor 192.160.3.5 Up ATLANTAMENow tag ATLANTAMENow tag-switching inte ATLANTAMENow tag-switching int ATLANTAMEN</pre>	dministratively down	otata ta	10
<pre>dministratively down Mar 1 00:00:19.455: %INEPFOTO-5-UPDOWN: Line protocol on Interface Ethernet1/ 0, charged state to down Mar 1 00:00:19.455: %INEPFOTO-5-UPDOWN: Line protocol on Interface Ethernet1/ 1, charged state to down Mar 1 00:00:20.603: %INEPFOTO-5-UPDOWN: Line protocol on Interface Ethernet1/ 2, charged state to down Mar 1 00:00:20.603: %INEPFOTO-5-UPDOWN: Line protocol on Interface Ethernet1/ 2, charged state to down Mar 1 00:00:20.603: %INEPFOTO-5-UPDOWN: Line protocol on Interface Ethernet1/ 3, charged state to down Mar 1 00:00:25.291: %SYS-5-RESTART: System restarted Cisco Internetuork Operating System Software IOS (th) 3600 Software (C3660-JS-M), Userion 12.3(12), FELEASE SOFTWARE (fc3) Technical Support: http://www.cisco.con/techsupport Compiled Mon 29-Nov-041 14:28 by kellythwi 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: TDP Neighbor 204.134.83.210 is UP Mar 1 00:00:50.319: %EQP-5-ADJCHANGE: neighbor 192.160.3.5 Up ATLANTABen Mar 4 ATLANTABen Mar 4 ATLANTABen Mar 4 ATLANTABen Mar 5 ATLANTABen Mar 6 ATLANTABen MAR 5 ATLANTABEN MAR</pre>	dministratively down		
<pre>Mar 1 00:00:19.167: x8YS-5-CONFIG_1: Configured from memory by console Mar 1 00:00:19.467: x8YS-5-CONFIG_1: Configured from memory by console Mar 1 00:00:19.455: XLINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/ 0, changed state to down Mar 1 00:00:20.633: XLINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/ 1, changed state to down Mar 0:00:00:20.633: XLINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/ 2, changed state to down Mar 1 00:00:20.633: XLINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/ 3, changed state to down Mar 1 00:00:20.21: XSYS-5-RESTART: System restarted Cisco Internetwork Operating System Software Cisco Internetwork Operating System Software 108 Software (C3660-JS-H), Uersion 12.3(12), RELEASE SOFTWARE (fc3) Iechnical Support: http://www.cisco.com/techeupport Compiled Mon 29-Noo-041 41:28 by kellptow Mar 1 00:00:25.295: XSNNP-5-COLBIART: SNNP agent on host AILANTA is undergoin g a cold start Mar 1 00:00:25.295: XLDP-5-NBRCHG: neighbor 204.134.83.2:0 is UP Mar 1 00:00:25.295: XDP-5-ADJCHANGE: neighbor 204.134.83.3 Up Mar 1 00:00:56.039: XLDP-5-ADJCHANGE: neighbor 204.134.83.3 Up Mar 1 00:00:56.5039: XLDP-5-ADJCHANGE: neighbor 192.168.3.5 Up ATLANTABen AILANTABenow tag-switching interfaces Interface IP Tunnel Operational FastEthernet8/0 Yes</pre>		state to	a
<pre>Hax 1 00:00:19.455: zLINEFROTO-5-UPDOIN: Line protocol on Interface Ethernet1/ 0, changed state to down Hax 1 00:00:20.509: zLINEFROTO-5-UPDOIN: Line protocol on Interface Ethernet1/ 1, changed state to down Hax 1 00:00:20.603: zLINEFROTO-5-UPDOIN: Line protocol on Interface Ethernet1/ 2, changed state to down Hax 1 00:00:25.291: xSYS-5-RESTART: System restarted Cisco Internetuork Operating System Software IOS (tn) 3600 Software (C3660-JS-H), Uprion 12.3(12), RELEASE SOFTWARE (fc3) Technical Support: http://www.cisco.con/techsupport Compiled Mon 29-Mou-041 41:28 by kellythw Hax 1 00:00:25.295: xSNNP-5-COLDSTART: SNNP agont on host AILANTA is undergoin g a cold start Hax 1 00:00:25.295: xSNNP-5-COLDSTART: SNNP agont on host AILANTA is undergoin g a cold start Hax 1 00:00:31.003: zLDP-5-NBRCHGE: neighbor 204.134.83.240 is UP Hax 1 00:00:32.093: zBCP-5-ADJCHANGE: neighbor 192.160.3.5 Up ATLANTABehow tag-switching int AILANTABehow tag-switching int AILANTABehow tag-switching int AILANTABehow tag-switching int AILANTABehow tag-switching int AILANTABehow tag-switching int ILANTABehow tag-switching int IASTEARTABEHOW tag-switching int IASTEARTABEHOW tag-switching int ILANTABEHOW tag-swi</pre>	Mar 1 00:00:19.167: XSYS-5-CONFIG_I: Configured from memory by cons	ole	
<pre>Max 1 00:00:20.599: xLINEPROTO-5-UPDOUN: Line protocol on Interface Ethernet1/ 1, changed state to down Max 1 00:00:20.603: xLINEPROTO-5-UPDOUN: Line protocol on Interface Ethernet1/ 2, changed state to down Max 1 00:00:25.291: xSYS-5-RESTART: System restarted Cisco Internetuork Operating System Software IOS (cha) 3600 Software (C3660-JS-M), Uorsion 12.3(12), RELEASE SOFTWARE (fc3) Technical Support: http://www.cisco.com/techsupport Compiled Mon 29-Mou-041 41:28 by kellythw Max 1 00:00:25.295: xSNNP-5-COLDSTART: SNNP agont on host AILANTA is undergoin g a cold start Max 1 00:00:25.295: xSNNP-5-COLDSTART: SNNP agont on host AILANTA is undergoin g a cold start Max 1 00:00:31.003: xLDP-5-NBRCHG: TDP Neighbor 204.134.83.210 is UP Max 1 00:00:35.093: zBCP-5-ADJCHANGE: neighbor 192.160.3.5 Up ATLANTASen AILANTAKehow tag-switching int AILANTAKehow tag-switching int AILANTAKehow tag-switching int AILANTAKehow tag-switching int AILANTAKehow tag-switching int ILANTAKehow tag-switching int IANTAKEhow tag-switching int INTLANTAKehow tag-switching int Interface IP Tunnel Operational FastEkternet0/0 Yes (Cd) No Yes</pre>	*Mar 1 00:00:19.455: XLINEPROTO-5-UPDOWN: Line protocol on Interface	Ethernet1	1
 Max 1 00:00:20.603: 2.11NEPF0T0-5-UPDOWN: Line protocol on Interface Ethernet1/ 2, changed state to down Max 1 00:00:20.603: 2.11NEPF0T0-5-UPDOWN: Line protocol on Interface Ethernet1/ 3, changed state to down Max 1 00:00:25.291: 2878-5-RESTART: System restarted Cisco Internetuork Operating System Software Ioternetuork Operating System Software Ioternetuork Operating System Software Conspiled Mon 29-Nov-041 41:28 by kellythw Max 1 00:00:25.295: 28NMP-5-COLDSTART: SNMP agent on host ATLANTA is undergoin g a cold start Max 1 00:00:31.003: 2.LDP-5-NBRCHG: TDP Neighbor 204.134.83.210 is UP Max 1 00:00:35.0939: 28GP-5-ADJCHANGE: neighbor 192.160.3.5 Up MTLANTABen Kag-switching int ATLANTABen May Soft Soft Soft Soft Soft Soft Soft Soft	Mar 1 00:00:20.599: %LINEPROTO-5-UPDOWN: Line protocol on Interface	Ethernet1	1
2, changed state to down "Max 1 09:09:20.633: XLIKEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/ 3, changed state to down "Max 1 09:09:25.29:1: XSVS-5-RESTART: System restarted Cisco Internetwork Operating System Software Cisco Internetwork Operating System Software Compiled Non 29-Nov-041 41:28 by kellytow "Max 1 09:00:25.29:5: XSNR-5-COLDSTART: SNRP agent on host AILANTA is undergoin y a cold start "Max 1 00:00:25.29:5: XSNR-5-COLDSTART: SNRP agent on host AILANTA is undergoin y a cold start "Max 1 00:00:25.29:5: XSNR-5-COLDSTART: SNRP agent on host AILANTA is UP "Max 1 00:00:25.29:5: XSNR-5-COLDSTART: SNRP agent on host AILANTA is UP "Max 1 00:00:50:39: XLDP-5-NBRCHG: neighbor 204.134.83.2:0 is UP "Max 1 00:00:50:39: XLDP-5-ADJCHANGE: neighbor 192.160.3.5 Up ATLANTASen AILANTASen AILANTASen AILANTASen UP AILANTABehow tag-suitching interfaces Interface IP Iunnel Operational FastEthernet0/0 Yes (tdp) No Yes		Ethanasti	
3, changed state to down "Max 1 00:00:25.291: S8YS-5-RESTART: System restarted Cisco Internetwork Operating System Software Cost Carbon Software Cost Carbon Software Cost Carbon Software Computing K C: 1286-280H by size Systems Inc. Computing K C: 1286-280H by size Systems Inc. Max 1 00:00:00:20:20:20:20:20:20:20:20:20:20:2	2, changed state to down		
 Max 1 00:00:25.291: 2828-5-RESTART: System restarted Cisco Internetuork Operating System Software Idennical Support: http://www.cisco.com/technupout Gapyright Sci 1986-2004 by Gisco Systems. Inc. Compiled Mon 29-Nov-041 41:28 by kellythwi Max 1 00:00:25.295: 28NMP-5-COLDSTART: SNMP agent on host ATLANTA is undergoin g a cold start Max 1 00:00:31.003: zLDP-5-NBRCHG: TDP Neighbor 204.134.83.2:00 Max 1 00:00:31.003: zLDP-5-ADJCHANGE: neighbor 204.134.83.2:00 Max 1 00:00:56.939: zBGP-5-ADJCHANGE: neighbor 192.160.3.5 Up Mar 1 00:00:56.939: zBGP-5-ADJCHANGE: neighbor 192.160.3.5 Up MTLANTABen tag-switching int ATLANTABen tag-switching int ATLANTABen tag-switching int ATLANTABen tag-switching int ATLANTABen tag-switching interfaces Interface IP Tunnel Operational FastElternet0/0 Yes 		Ethernet1	1
Cisco Internetwork Operating System Software [OS (tn) 3608 Software (C3660-JS-M), Usersion 12.3(12), RELEASE SOFTWARE (fc3) [echmical Support: http://www.cisco.com/techsupport Computing (c) 1986-2084 by scisco Systems. Inc. Compiled Mon 29-Mou-04 14:28 by kellythw Mar 1 08:08:25.295: XSNHP-5-COLDSTART: SNMP agent on host AILANTA is undergoin y a cold start: 1.003: XLDP-5-NBRCHG: DP Meighbor 204.134.03.3: Up Mar 1 08:08:25.295: XSNHP-5-COLDSTART: SNMP agent on host AILANTA is undergoin y a cold start: 1.003: XLDP-5-NBRCHG: DP Meighbor 204.134.03.3: Up Mar 1 08:08:05.0:39: XLDP-5-NDJCHANGE: neighbor 204.134.03.3: Up Mar 1 08:08:05.0:39: XLDP-5-NDJCHANGE: neighbor 192.160.3.5: Up ATLANTA/sen AILANTA/sen AILANTA/sen AILANTA/sen ot ag-switching interfaces Interface IP Iunnel Operational FastEthernet0/0 Yes (tdp) No Yes	3, changed state to down MMar 1 00:00:25.291: XSYS-5-RESTARI: System restarted		
Technical Support: http://www.cisco.com/techsupport Copyright (c) 1986-2004 by cisco Systems. Inc. Compiled Mon 29-Mou-04 14:28 by kellythw whar 1 00:00:25.295: xSNMP-5-COLDSTART: SNMP agent on host AILANTA is undergoin g a cold start whar 1 00:00:25.295: xSNMP-5-NBRCHG: DP Neighbor 204.134.83.2:0 is UP whar 1 00:00:25.039: zDP-5-NBRCHG: neighbor 204.134.03.3 Up whar 1 00:00:55.039: zBCP-5-ADJCHANGE: neighbor 192.160.3.5 Up ATLANTA'sen AILANTA'sen AILANTA'sen AILANTA'sen tag-switching inte AILANTA'show tag AILANTA'show tag-switching interfaces Interface IP Tunnel Operational FastEthernet0/0 Yes (tdp) No Yes	Cisco Internetwork Operating System Software	1000 C 2 0 C 10 C C	
Guyuright (c) 1986-2004 by cisco Systems, Ing Compiled Mon 29-Nov-04 14:28 by kellythwi Max 1 00:00:25,295: 28NMP-5-COLDSTART: SNMP agent on host ATLANTA is undergoin g a cold start Max 1 00:00:31.003: zLDP-5-NBRCHG: TDP Neighbor 204.134.83.2:0 is UP Max 1 00:00:40:219: zBCP-5-ADJCHANGE: neighbor 204.134.83.2:0 p ATLANTA-en ATLA	Technical Support: http://www.cisco.com/techsupport	RE (Fe3)	
 Max 1 00:00:25,295: zSNMP-5-ČOLDSTÅRT: SNMP agent on host ATLANTA is undergoin q a cold start Max 1 00:00:31.003: zLDP-5-NBRCHG: TDP Neighbor 204.134.83,2:0 is UP Max 1 00:00:00:20:219: zBCP-5-ADJCHANGE: neighbor 204.134.03.3 Up Max 1 00:00:056.939: zBCP-5-ADJCHANGE: neighbor 192.160.3.5 Up ATLANTAben ATLANTAben ATLANTAben tag ATLANTABehow tag ATLANTABehow tag ATLANTABehow tag-switching interfaces Interface IP Tunnel Operational FastEtherenet0/0 Yes 	Copyright (c) 1986-2004 by cisco Systems, Inc.		
g a cold start Max 1 00:00:31.003: XLDP-5-NBRCHG: TDP Neighbor 204.134.83.2:0 is UP Max 1 00:00:60:31.003: XLDP-5-ADJCHANGE: neighbor 204.134.83.3 Up MTA 1 00:00:56.939: XBGP-5-ADJCHANGE: neighbor 192.160.3.5 Up ATLANTAkshow tag ATLANTAkshow tag ATLANTAkshow tag-suitching int ATLANTAkshow tag-suitching interfaces Interface Interface IP Tunnel Operational FastEthernet0/0 Yes		s underso i	
Max 1 00:00:40.219: 28GP-5-ADJCHANGE: neighbor 204.134.03.3 Up ATLANTAben ATLANTAben ATLANTAben ATLANTAkehow tag ATLANTAkehow tag-suitching interfaces IntEANTAkehow tag-suitching interfaces IntEANTAKehow tag-suitching interfaces Interface IP Tunnel Operational FastEthernet0/0 Yes (tdp) No Yes	g a cold start		
Mar 1 00:00:56.939: zBGP-5-ADJCHANGE: neighbor 192.160.3.5 Up ATLANTAben ATLANTABehow tag ATLANTABehow tag-switching int ATLANTABehow tag-switching interfaces Interface IP Tunnel Operational FastEthernet0/0 Yes (tdp) No Yes	#Mar 1 00:00:31.003: %LDP-5-NBKCHG: IDP Neighbor 204.134.83.2:0 is 0 #Mar 1 00:00:48.219: %BGP-5-ADJCHANGE: neighbor 204.134.83.3 Un	P	
ATLANTARshow tag ATLANTARshow tag-switching int ATLANTARshow tag-switching interfaces Interface IP Tunnel Operational FastEthernet0/0 Yes (tdy) No Yes	Mar 1 00:00:56.939: %BGP-5-ADJCHANGE: neighbor 192.168.3.5 Up		
ATLANIAHshow tag ATLANIAHshow tag-switching interfaces Interface I P Tunnel Operational FastEthernet0/0 Yes (tdp) No Yes			
ATLANTAWshow tag-switching interfaces Interface IP Tunnel Operational FastEthernet0/0 Yes (tdp) No Yes	ATLANTA#show tag		
Interface IP Tunnel Operational FastEthernet0/0 Yes (tdp) No Yes			
	Interface IP Tunnel Operational		
n 1 Mil 1 Mil			
	11001100		

Fig10. MPLS run on CORE ISP

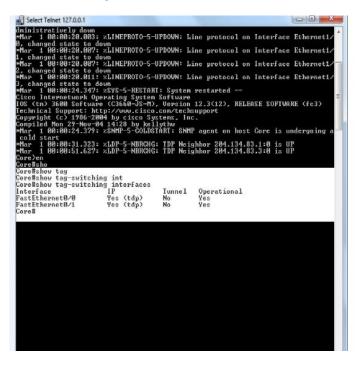


Fig11. LABEL BINDINGS ON ANTLANTA

Telnet 127.0.0.1	
TLANTAWshow tag-switching tdp di	A
TLANTA#show tag-switching tap at TLANTA#show tag-switching tap discovery	
Local TDP Identifier:	
204.134.83.1:0	
Discovery Sources:	
Interfaces:	
FastEthernet0/0 (tdp): xnit/recv TDP Id: 204.134.83.2:0	
TLANTA#show tag-switching tdp bind	
TLANTA#show tag-switching tap bind TLANTA#show tag-switching tap bindings	
tib entry: 192.168.3.4/30, rev 4	
local binding: tag: inp-null	
tib entry: 204.134.83.1/32, rev 6	_
local binding: tag: inp-null	
remote binding: tsr: 204.134.83.2:0, tag: 16	
tib entry: 204.134.83.2/32, rev 8	
local binding: tag: 16	
remote binding: tsr: 204.134.83.2:0, tag: imp-nul. tib entry: 204.134.83.3/32, rev 12	1
local binding: tag: 18	
remote binding: tsr: 204.134.83.2:0, tag: 17	
tib entru; 204.134.83.4/30. rev 2	
local binding: tag: inp-null	
remote binding: tsr: 204.134.83.2:0, tag: imp-null	L
tib entry: 204.134.83.8/30, rev 10	
local binding; tag; 17	
remote binding: tsr: 204.134.83.2:0, tag: imp-nul	L
TLANTA# TLANTA#show tag-switching tdp binding	
TLANIA#show tag-switching tap binding	
TLANTA#show tag-switching tdp neighbor	
Peer TDP Ident: 204.134.83.2:0; Local TDP Ident 204.13	34.83.1:0
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	
TLANTA#	

Fig12. LABEL BINDINGS ON CORE ISP

<pre>Interface IP Tunnel Operational SatEChernetD/0 Yes (tdp) No Yes SoreEshow tag-suitching bin SoreEshow tag-suitching tdp bin SoreEshow tag-suitching tag-sui</pre>	hernet8/0 Yes (tdp) No Yes hernet8/1 Yes (tdp) No Yes hi ho hou tag_suitching bin hou tag_suitching thin hou tag_suitching td hou tag_suitching td bin	4
<pre>RastEchernet0/1 Ves (tdp) No Ves DoreEshi D</pre>	hernet8/1 Yes (tdp) No Yes hi ho hov tag hov tag=suitching bin hov tag=suitching td hov tag=suitching td hov tag=suitching td hov tag=suitching td	
<pre>Core Eshi Core Eshi C</pre>	hi ho hou tag_suitching bin hou tag_suitching bin hou tag_suitching tdu bin	
<pre>GaveEaho GaveEahout tag GaveEahout tag GaveEahout tag_suitching bin GaveEahout tag_suitching tdg Dindlings tdg GaveEahout tag_suitching tdg Dindlings tib remote binding: tar: 2004.134.03.1:0, tag: imp-null remote binding: tar: 2004.134.03.3:0, tag: imp-null tib entry: 2004.134.03.1:02, rev 8 remote binding: tar: 2004.134.03.1:0, tag: imp-null remote binding: tar: 2004.134.03.1:0, tag: 16 tib entry: 2004.134.03.2:22, rev 6 lib entry: 2004.134.03.2:22, rev 10 lib entry: 2004.134.03.2:22, rev 10 lib entry: 2004.134.03.3:23, rev 10 lib entry: 2004.134.03.3:23, rev 10 local binding: tag: 17 tib entry: 2004.134.03.3:24, rev 10 local binding: tag: 2004.1304.03.1:0, tag: 10 remote binding: tag: 2004.1304.03.1:0, tag: 10 remote binding: tag: 2004.134.03.1:0, tag: 10 remote binding: tag: 2004.134.03.1:0, tag: 16 remote binding: tag: 2004.134.03.1:0, tag: 16 remote binding: tag: 2004.134.03.1:0, tag: 16 remote binding: tag: 2004.134.03.3:0, tag: 17 tib entry: 2004.134.03.3:23, rev 10 local binding: tag: 2004.134.03.3:0, tag: 10 remote binding: tag: 200</pre>	ho hov tag hov tag-suitching bin hov tag-suitching tin hov tag-suitching tdp bin	
<pre>Core Bahou tag-suitching bin Sore Bahou tag-suitching bin Sore Bahou tag-suitching tag bind bind Sore Bahou tag-suitching tag bind bind Sore Bahou tag-suitching tag bind bind Sore Bahou tag-suitching tag bind bind bind sore Bahou tag-suitching tag remote binding: tag: 164,134,83,310, tag: imp-null tib entry: 204,134,83,1/32, rev 8 local bind ing: tag: 16 local bind ing: tag: 204,134,83,310, tag: 16 remote bind bing: tag: 204,134,83,310, tag: 17 log bind bind bind bind bind bind bind bind</pre>	hou tag-suitching bin hou tag-suitching td hou tag-suitching td hou tag-suitching tdp bin	
<pre>Core Elow tag-suiching td Sore Elow tag-suiching td Sore Elow tag-suiching td Sore Elow tag-suiching td bindings tib entry: 192,163,34/38, rev 11 remote binding: tar: 204,134,83,1:0, tag: imp-null tib entry: 192,163, 8-30, ev 12 remote binding: tar: 16 remote binding: tar: 16 remote binding: tar: 204,134,83,1:0, tag: imp-null remote binding: tar: 204,134,83,1:0, tag: imp-null remote binding: tar: 204,134,83,1:0, tag: imp-null remote binding: tar: 204,134,83,1:0, tag: 16 tib entry: 204,134,83,3/32, rev 10 remote binding: tar: 204,134,83,3:0, tag: 16 remote binding: tar: 204,134,83,3:0, tag: 16 remote binding: tar: 204,134,83,3:72, rev 10 local binding: tag: 17 the entry: 204,134,83,3:72, rev 10 remote binding: tag: 17 the entry: 204,134,83,3:72, rev 10 local binding: tag: 17 remote b</pre>	hov tag-switching bin hov tag-switching td hov tag-switching tdp bin	
<pre>DoveBahow tag-suitching tdy bin SoveBahow tag-suitching tdy bin SoveBahow tag-suitching tdy bin SoveBahow tag-suitching tdy bin tib entry: 192,166.3.4/3n rev 114.83.1:0, tag: imp-null tib entry: 192,168.3.8/30, rev 12 remote binding: tar: 204.134.83.3:0, tag: imp-null tib entry: 204.134.83.1/32, rev 8 local binding: tag: 16 remote binding: tag: 16 local binding: tag: 204.134.83.3:0, tag: 16 local binding: tag: 204.134.83.3:0, tag: 16 local binding: tag: 204.134.83.3:2, rev 6 local binding: tag: 204.134.83.3:2, rev 16 remote binding: tag: 204.134.83.3:2, tag: 16 remote binding: tag: 204.134.83.3:2, rev 18 local binding: tag: 204.</pre>	how tag-switching td how tag-switching tdp bin	
Bowellshow tag-suitching tdp bin ScreBihow tag-suitching tdp bindings tib entry: 192.168.3.4/30, rev 11 remethow tag-suitching tdp bindings tib entry: 192.168.3.4/30, rev 11 remethow tag-suitching: tar: 204.134.83.1:0, tag: imp-null tib entry: 192.168.3.0/30, rev 12 tib entry: 192.168.3.0/30, rev 13 tib entry: 192.168.3.0/30, rev 10 remote binding: tar: 204.134.83.3:0, tag: imp-null remote binding: tar: 204.134.83.3:0, tag: 16 tib entry: 204.134.83.2/32, rev 6 local binding: tar: 204.134.83.1:0, tag: 16 remote binding: tar: 204.134.83.3:0, tag: 17 remote binding: tar: 204.134.83.3:0, tag: 18	how tag-switching tdp bin	
<pre>CoreEshow tag-switching tdp bindings tib entry: 192.166.3.4/30, rev 11 remote binding: tsr: 204.134.63.1:0, tag: imp-null tronote binding: tsr: 204.134.83.3:0, tag: imp-null tib entry: 204.134.83.1/32, rev 8 local binding: tag: 16 remote binding: tag: 16 tib entry: 11.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1</pre>	how tag-switching tdp bin	
<pre>tib entry: 192.168.3⁻4/38, rev 1i remote binding: tar: 204.134.03.1:0, tag: imp-null tib entry: 192.168.3.0⁻38, rev 12 remote binding: tar: 204.134.83.3:0, tag: imp-null tib entry: 204.134.83.1/22, rev 8 remote binding: tar: 204.134.83.3:0, tag: imp-null remote binding: tar: 204.134.83.3:0, tag: 16 tib entry: 204.134.83.2/32, rev 6 local binding: tar: 204.134.83.3:0, tag: 16 tocal binding: tar: 204.134.83.3:0, tag: 16 remote binding: tar: 204.134.83.3:0, tag: 17 remote binding: tar: 204.134.83.3:0, tag: 18 remote binding:</pre>		
<pre>remote binding: tar: 204.134.03.1:0, tag: imp-null tib entry: 192.166.3.0-30, ev 12, remote binding: tar: 204.134.83.3:0, tag: imp-null tib entry: 192.166.41.34.83.1:0, tag: imp-null remote binding: tar: 204.134.83.1:0, tag: imp-null remote binding: tar: 204.134.83.1:0, tag: 16 tib entry: 204.134.83.2-22, rev 6 li remote binding: tar: 204.134.83.3:0, tag: 16 remote binding: tar: 204.134.83.3:0, tag: 16 remote binding: tar: 204.134.83.3:0, tag: 17 tib entry: 204.134.83.3.242, rev 10 local binding: tag: 17 local binding: tag: 17 local binding: tag: 17 local binding: tag: 17 </pre>		
<pre>tib entry: 192.168.3.8/30, rev 12 remote binding: ter: 204.134.83.3:0, tag: imp-null tib entry: 204.134.83.1/32, rev 8 local binding: tag: 16 local binding: tag: 16 the try: 204.134.83.2/32, rev 6 local binding: ter: 204.134.83.3:0, tag: 16 the entry: 204.134.83.2/32, rev 6 local binding: ter: 204.134.83.3:0, tag: 16 remote binding: ter: 204.134.83.3:0, tag: 17 remote binding: ter: 204.134.83.3:0, tag: 18 remote binding: ter: 204.134.83.3:0, tag: 18 remote binding: ter: 204.134.83.1:0, tag: 18 remote binding: ter: 204.134.83.0, tag: 18</pre>	reporte binding: tsp: 204 134 83 1:0 tag: imp-pull	
<pre>remote binding: ter: 204.134.83.3:0, tag: imp-null tib entry: 204.134.83.1/32, rev 8 local binding: tag: 16 remote binding: ter: 204.134.83.3:0, tag: imp-null remote binding: ter: 204.134.83.3:0, tag: 16 to entry: 204.134.83.2/32, rev 6 local binding: tag: 20, rev 6 local binding: ter: 204.134.83.3:0, tag: 17 tib entry: 204.134.83.2/22, rev 1 local binding: tag: 7 remote binding: ta</pre>		
<pre>local binding: tag: 16 remote binding: tag: 204.134.83.1:0, tag: imp-null remote binding: tag: 204.134.83.3:0, tag: 16 th entry: 204.134.83.2/32, rev 6 local binding: tag: imp-null remote binding: tag: 204.134.83.1:0, tag: 16 remote binding: tag: 204.134.83.2:0, tag: 17 tib entry: tag: 204.134.83.2:0, tag: 17 remote binding: tag: 71 local binding: tag: 71 remote binding: tag: 70 remote binding: tag: 70</pre>	remote binding: tsr: 204.134.83.3:0, tag: imp-null	E
<pre>remote binding: ts: 204.134.83.1:0, tag: imp-null remote binding: ts: 204.134.83.1:0, tag: imp-null tib entry: 204.134.83.2:22, rev 6 intry: 204.134.83.2:22, rev 6 remote binding: ts: 204.134.83.3:0, tag: 16 remote binding: ts: 204.134.83.3:0, tag: 17 th entry: 204.134.83.3:22, rev 10 local binding: ts: 204.134.83.1:0, tag: 18 remote binding: ts: 204.134.83.3:0, tag:</pre>	entry: 204.134.83.1/32, rev 8	
<pre>remote binding't tsr: 204.134.83.3:0, tag': 16 tib entry: 204.134.83.2/32, rev 6 local binding: tag: inp-null remote binding: tsr: 204.134.83.1:0, tag: 16 remote binding: tsr: 204.134.83.3:0, tag: 17 tib entry: Dbin134.3.3/32, rv 10 remote binding: tsr: 204.134.83.1:0, tag: 18 remote binding: tsr: 204.134.83.1:0, tag: 18 remote binding: tsr: 204.134.83.1:0, tag: 18 remote binding: tsr: 204.134.83.1:0, tag: 18</pre>		
tib entry: 204.134.83.2/32, rev 6 local binding: tag: inp-null remote binding: tsr: 204.134.83.1:0, tag: 16 remote binding: tsr: 204.134.83.3:0, tag: 17 tib entry: 204.134.83.3/32, rev 10 local binding: tag: 17 remote binding: tsr: 204.134.83.1:0, tag: 18 remote binding: tsr: 204.134.83.3:0, tag: 18		
local binding: tag: inp-null remote binding: tar: 204.134.03.1:0, tag: 16 remote binding: tar: 204.134.03.3:0, tag: 17 th entry: 204.134.03.3:72, rev 10 remote binding: tar: 204.134.03.1:0, tag: 18 remote binding: tar: 204.134.03.1:0, tag: 18 remote binding: tar: 204.134.03.1:0, tag: 18	remote binding: tsr: 204.134.83.3:0, tag: 16	
remote binding: tsr: 204.134.83.1:0, tag: 16 remote binding: tsr: 204.134.83.1:0, tag: 17 tib entry: 204.134.83.3/32, rev 10 local binding: tag: 17 remote binding: tsr: 204.134.83.1:0, tag: 18 remote binding: tsr: 204.134.83.3:0, tag: 18		
remote binding: tsr: 204.134.83.3'0, tag: 17 the mtry: 204.134.83.3'22, rev 10 local binding: tag: 17 remote binding: tsr: 204.134.83.1'0, tag: 18 remote binding: tsr: 204.134.83.3'0, tag: 1mp-null		
tib entry: 204.134.83.3/32, rev 10 local binding: tag: 17 remote binding: tsr: 204.134.83.1:0, tag: 18 remote binding: tsr: 204.134.83.3:0, tag: imp-null		
local binding: tag: 17 remote binding: tsr: 204.134.83.1:0, tag: 18 remote binding: tsr: 204.134.83.3:0, tag: imp-null	204-134-83-3/32 wev 10	
remote binding: tsr: 204.134.83.1:0, tag: 18 remote binding: tsr: 204.134.83.3:0, tag: imp-null	local binding: tag: 17	
remote binding: tsr: 204.134.83.3:0, tag: imp-null	remote binding: tsr: 204.134.83.1:0, tag: 18	
tib entry: 204.134.83.4/30, rev 4	remote binding: tsr: 204.134.83.3:0, tag: imp-null	
local binding: tag: inp-null	local binding: tag: inp-null	
remote binding: tsr: 204.134.83.1:0, tag: imp-null remote binding: tsr: 204.134.83.3:0, tag: 18	remote binding: tsr: 204.134.83.1:0, tag: imp-null	
remote plnding: tsp: 204.134.83.3.0, tag: 18 tib entry: 204.134.83.8/30, rev 2	Penote Dinding: tsr: 204.134.83.3:0, tag: 18	
local binding: tag: inp-null		
remote binding: tar: 204.134.83.1:0, tag: 17	repute hinding: tay: 104.134.83.1:0. tag: 17	
remote binding: tsr: 204.134.83.3:0, tag: imp-null	remote binding: tsr: 204.134.83.3:0, tag: imp-null	
Core#		

Fig13. END TO END DELIVERY, BGP, LDP

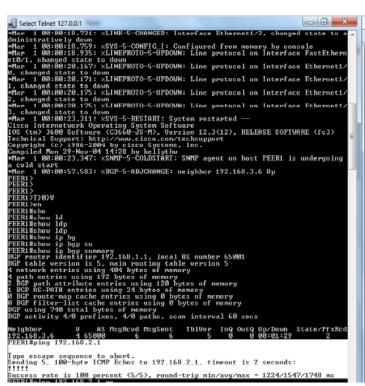
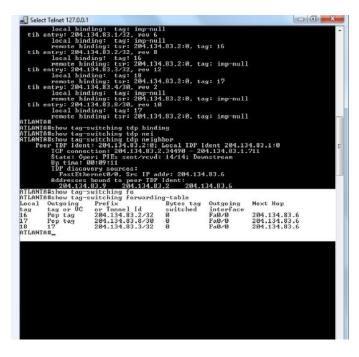


Fig14. ANTLATA FORWARDING TABLE



	t Telnet 127.0.0.1					×
	local bin	ding: tag: inp-nu	11			
CTD 6	entry: 204.	134.83.1/32, rev 6	2			
	local bing	ding: tag: imp-nu nding: tsr: 204.13	11 02 0.0 +-			
+ib a	renote bi	134.83.2/32, rev 8	4.03.2:0, ta	g: 10		
CID 6	local bin	ding: tag: 16				
	negate bi	nding: tsr: 204.13	4 93 2.0 +=	at impenull		
tib e	entru: 204	134.83.3/32, rev 1	2	a. Tub unit		
0 2.0 0	local bin	ding: tag: 18				
	renote bir	nding: tsr: 204.13	4.83.2:0, ta	g: 17		
tib e	intry: 204.	134.83.4/30, rev 2				
	local bine	ding: tag: imp-nu	11			
	renote bin	nding: tsr: 204.13	4.83.2:0, ta	g: imp-null		
tib e	ntry: 204.	134.83.8/30, rev 1	0			
	local bin	ding: tag: 17	4 02 0.0			
TLANTE	renote bi	nding: tsr: 204.13	4.03.2:0, ta	g: imp-null		
		switching tdp bind	ing			
TLANTO	Hishow tag-	switching tdp bind switching tdp nei	Tuð			
TLANTA	the how tag	switching tdp neig	hhow			
Pee	r TDP Ident	t: 204.134.83.2:0:	Local TDP I	dent 204.13	4.83.1:0	52
100	TCP conner	t: 204.134.83.2:0; ction: 204.134.83.	2.34490 - 20	4.134.83.1.	711	-
	State: Ope	er; PIEs sent/rcud	: 14/14; Dou	nstream		
	Up time: 0	00:09:11				
	TDP disco	very sources:				
		ernet0/0, Src IP a		.83.6		
	Addresses	bound to peer TDP	Ident:	2012 C. 2012 C. 2017		
TTAUTA	204.134	.83.9 204.134.8 switching fo	3.2 204.1	34.83.6		
		switching forwardi	norm table			
	Outgoing	Prefix	Bytes tag	Outgoing	Next Hop	
	tag or VC	or Tunnel Id	switched	interface	Hexe hop	
		204.134.83.2/32	Ø	Fa@/Ø	204.134.83.6	
tag			9	Fa0/0	204.134.83.6	
tag 16	Pop tag					
tag L6 L7		204.134.83.8/30	й Й	FaQ/Q		
ag 6 7 8	Pop tag Pop tag 17			Fa0/0	204.134.83.6	
ag 6 7 8	Pop tag Pop tag 17	204.134.83.8/30		Fa0/0		
ag 6 7 8	Pop tag Pop tag 17	204.134.83.8/30		Fa0/0		
ag 6 7 8	Pop tag Pop tag 17	204.134.83.8/30		Fa0/0		
ag 6 7 8	Pop tag Pop tag 17	204.134.83.8/30		Fa0/0		
ag 6 7 8	Pop tag Pop tag 17	204.134.83.8/30		Fa0/0		
ag 6 7 8	Pop tag Pop tag 17	204.134.83.8/30		Fa0/0		
ag 6 7 8	Pop tag Pop tag 17	204.134.83.8/30		Fa0/0		
ag 6 7 8	Pop tag Pop tag 17	204.134.83.8/30		Fa0/0		
ag 6 7 8	Pop tag Pop tag 17	204.134.83.8/30		Fa0/0		
ag 6 7 8	Pop tag Pop tag 17	204.134.83.8/30		Fa0/0		
ag 6 7 8	Pop tag Pop tag 17	204.134.83.8/30		Fa0/0		
tag 16 17 18	Pop tag Pop tag 17	204.134.83.8/30		Fa0/0		
tag 16 17 18	Pop tag Pop tag 17	204.134.83.8/30		Fa0/0		
tag 16 17 18	Pop tag Pop tag 17	204.134.83.8/30		Fa0/0		
tag 16 17 18	Pop tag Pop tag 17	204.134.83.8/30		Fa0/0		
tag 16 17 18	Pop tag Pop tag 17	204.134.83.8/30		Fa0/0		
Local tag 16 17 18 Atlanta	Pop tag Pop tag 17	204.134.83.8/30		Fa0/0		
tag 16 17 18	Pop tag Pop tag 17	204.134.83.8/30		Fa0/0		
tag 16 17 18	Pop tag Pop tag 17	204.134.83.8/30		Fa0/0		

Fig16. TRACEOUT

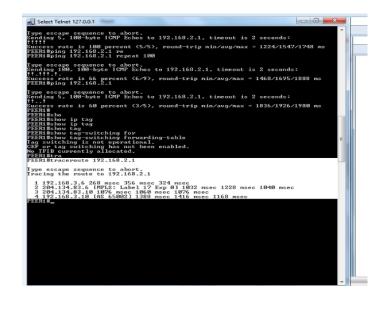


Fig15. ANTLATA FORWARDING TABLE TAGS

Fig18. End to End Delivery of MPLS

8 shatha 137001	- 0 - X -
Select Telnet 127.0.0.1	
ATLANTA#show tag-switching forwarding-table tag ATLANTA#show tag-switching forwarding-table tags x Inconplete connand.	
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 tag tag or UG or Tunnel Id switched interface	Next Hop
16 Pop tag 204.134.83.2/32 0 Fa0/0 MGC/Encape=14/14, MRU=1504, Tag Stack() CC0110C000001CC0210C000000004 No output feature configured	204.134.83.6
Per-packet load-sharing 17 Popt 204.134.83.8/30 0 Fa0/0 MAC/Encaps=14/14, MRU-1584, Tag Stack() CC0110C80001CC0210CS00000884 No output teature configured	204.134.83.6
Per-packet laad-sharing 18 17 204.134.83.3/32 0 Fa0/0 MAC/Encape-14/18, MRU-1540, Tag Stack(1?) CC0110C000001CC0210C000000847 00011000 No output feature configured	204.134.83.6
Per-packet load-sharing ATLANTA#sho ATLANTA#show ip ATLANIA#show ip mp	E
ATLANTA#show ip mpl ATLANTA#show ip mpl ATLANTA#show ip mpls ATLANTA#show ip mpls	_
ATLANTA#show mpl ATLANTA#show mpls ?	
atn-ldp ATM LDP Protocol information forwarding-table Show the Label Forwarding Information l interfaces Por-interface MPLS forwarding informat:	
ip MPLS IP information label Label information	
ldp Label Distribution Protocol information traffic-eng Traffic engineering information	n
ATLANTA#show mpls for	
ATLANTA#show mpls forwarding-table Local Outgoing Prefix Bytes tag Outgoing tag tag or UC or Tunnel Id switched interface	Next Hop
16 Pop tag 204.134.83.2/32 0 Fa0/0	204.134.83.6
17 Pop tag 204.134.03.0/30 0 Fa0/0 18 17 204.134.83.3/32 0 Fa0/0	204.134.83.6 204.134.83.6
ATLANIA#show mpls int ATLANIA#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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