ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 5, May 2016

Analyzing the usage of Network Resources using MPLS Traffic Engineering (TE)

Nisha Rani[1], Neha Goyal[2]

M.Tech. Student, Department of CSE, Shri Ram College of Engg. & Mgmt, Palwal, Haryana, India[1]

Asst. Professor, Department of CSE, Shri Ram College of Engg. & Mgmt, Palwal, Haryana, India[2]

ABSTRACT: Traffic Engineering is a way of propagating data over the network in place of management view, existence of resources and the current and required traffic. It also supports the network supplier to make the best utilization of existing resources. Different utilization of internet needs various levels of facilities to be provided, for example voice traffic needs less delay and very less delay variation. Video traffic requires high bandwidth, etc. Hop-by-hop mechanism is utilized to send a packet in a network employing IP protocol. Routing protocols are employed to make routing tables, to discover a route which has the lesser cost, with respect to its metrics to every destination in the network. This method results in the over-usage of some connections while other connections remain unemployed and are under-used, which causes to the network congestion. MPLS does not send data depending on destination address instead it forwards data according to the labels. Utilizing MPLS network, resources can be analyzed by routing data by less congested route instead of the shortest route utilized in routing protocols. These new routes are produced by hand or by various signaling protocols. MPLS provides support to many characteristics i.e. traffic engineering, VPNs and QoS etc. By using MPLS in traffic engineering we can increase the use of network resources building it more effective. In this research paper a comparison evaluation is done depending on parameters of traffic engineering i.e. effective utilization of bandwidth, throughput and delay etc. for various kind of traffic in their movements throughout the network for both MPLS-TE and conventional IP network. RIVERBED simulator is employed to model the comparison results.

KEYWORDS: Multiprotocol layer switching Traffic Engineering, RIVERBED modeler, Virtual Private Network (VPN).

I. INTRODUCTION

Next Generation Network (NGN) which is a packet-based network can provide services including Telecommunication Services and can also make use of multiple broadband, QoS enabled transport technologies and in which service-related functions are independent from underlying transport-related technologies. NGN gives revolution in the mobile networks, the capability to assure the seamless mobility with end-to-end QoS present an essential criterion of the success in the NGN. Because of high demand of multimedia facilities traffic engineering has become a necessary characteristic, traffic engineering in telecommunication depends on special performance parameters. It offers options to choose best route for data routing while effectively utilizing network resources.

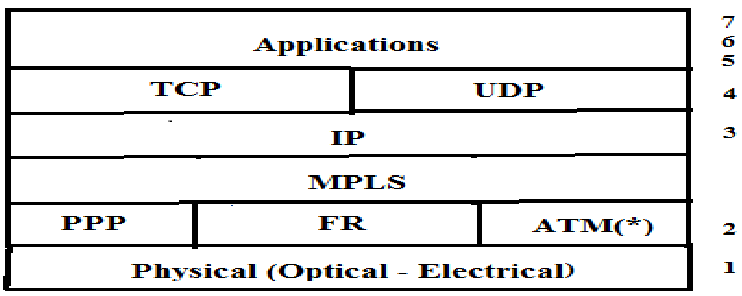

Figure 1: Position of MPLS in OSI Model

ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 5, May 2016

Therefore, to fulfill this goal IETF (Internet Engineering Task force) has demonstrated MPLS. MPLS enhance traffic engineering over IP-based networks while utilizing the Open System Interconnection Model (OSI) layers, particularly between the Link Layer (Layer 2) and the Network Layer (layer 3).

II. NEXT GENERATION NETWORK (NGN)

"A Next Generation Network is a packet-based network enable to give services including Telecommunication Services and enable to make usage of multiple broadband, Quality of Service-enabled transport technologies and in which service–related functions are not dependent from underlying transport related technologies. It gives unrestricted means by users to distinct service providers. Generalized mobility which will give continuous and ubiquitous provision of services to users is supported by it." The ITU-T definition highlights three main essential features:

• no specific technologies are selected and characterize the NGN networks.

• QoS functionalities are very important in this architecture.

• service - related functions are not dependent for underplaying transport-related technologies. The typical constituents in NGN can be illustrated in Figure access and core networks. The access networks include disparate wireless and wire line access technologies to give ubiquitous services to end users networks take care to transport the data legacy technologies such as Asynchronous Transport IP-based technologies such as Multi by IETF, the Differentiated Services and the Integrated Services model. The end-to-end communication operators and a large number of network technologies. For the best service provisioning; the presence of various actors and distinct transport the effect to define a complex scenario with essential challenges for interconnection, interworking and interoperation between network technologies and telecommunication operators.

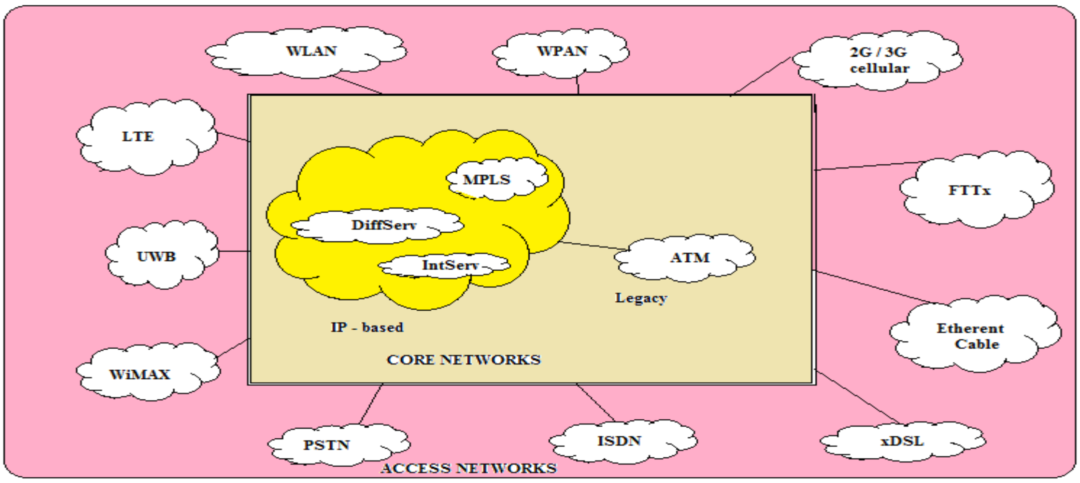

Figure 2: Typical constituents of Next Generation Networks grouped in access and core networks technologies

III. MPLS

MPLS was demonstrated to address the IP flaws, it offers extra facilities to the applications employing IP. As demand for multimedia services is greater, traffic engineering has become a necessary requirement for the network service suppliers as it makes the basis of some performance parameters. MPLS offers the solution to the problems of traffic engineering i.e. QOS, speed, network congestion and delay etc. MPLS sends data through labels attached to every packet, these labels are allocated among all the nodes making the network. Constraint-based Routed Label Distribution Protocol (CR-LDP) and Resource Reservation Protocol (RSVP) are the two label distribution which offers support for Traffic Engineering. The first router does the routing lookup, similar to IP routing based protocol, but rather than next hop it discovers the destination router and also a previously determined route from its current location to the final router. The router uses a label (or shim) on the data packets depending on this information. Now other routers as

ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 5, May 2016

described utilizes this label to send traffic further in the network without doing any extra IP lookups. At the final router the packet is forwarded by normal IP routing and label is forwarded.

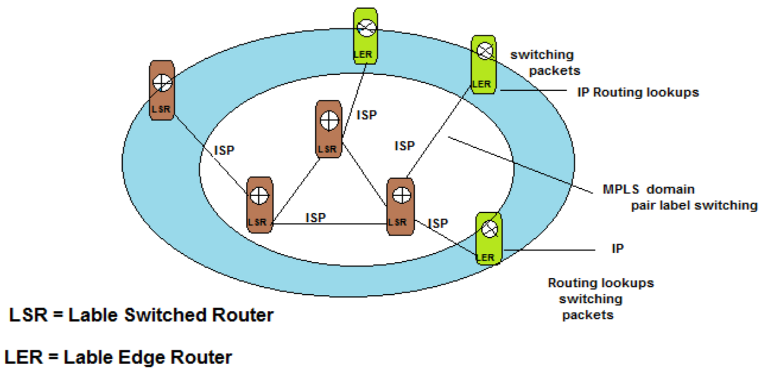

Figure 3: MPLS Network infrastructures

MPLS data forwarding or broadcasting of packets needs a label switched path or LSP which is a unidirectional tunnel available between the routers in a MPLS network model. The label edge router (LER) is a router which chooses the initial route and introduces a packet in an MPLS LSP. MPLS network switching in the middle of LSP is done by Label switching router (LSR). The LSP final router also called as egress router eliminates the label. A label distribution protocol is utilized to allocate address/label mappings between neighboring nodes. MPLS label format utilizes a 32-bit label field, which consists the under described fields.

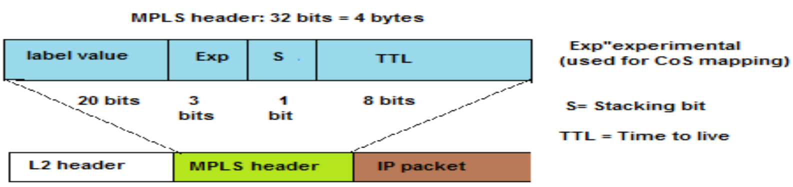

Figure 4: MPLS Label

In MPLS, each packet has a label with them. This label is a shim header field. The shim header is inserted between link layer header and IP header of the packet. These packet headers build a MPLS stack. The described figure explains a MPLS stack consisting various headers and its location in the packet.

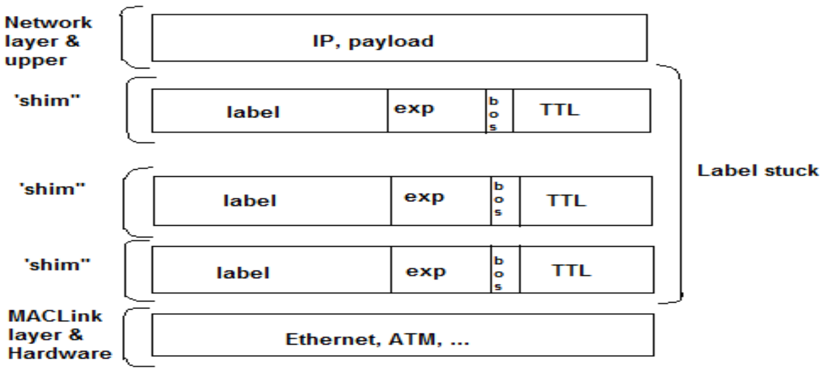

Figure 5: Position of MPLS stack in Network Protocol stack

ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 5, May 2016

3.3 MPLS Forwarding

Consider an IP packet is forwarded by host A to host B in Fig. 6 the packets are sent by employing MPLS routing network. When first MPLS router represents in MPLS domain also known as Ingress label edge router or LER obtains a packet, its source and destination are examined and the packet is categorized in forward equivalence class. All the packets related to same FEC utilize same virtual route or circuit also known as label switched path (LSP).

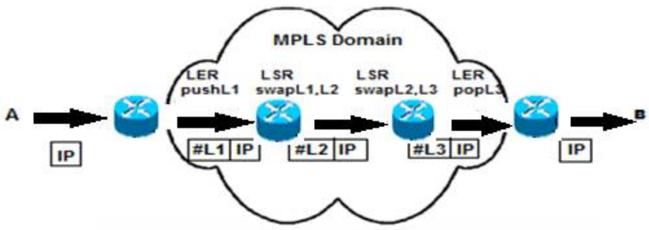

Figure 6: MPLS Forwarding

Now take in figure 6 that virtual route or circuit has already been developed for the FEC of the packet forwarded from point A to point B, the ingress LER adds a header L1 on the packet and sends it further. The other MPLS domain routers change their MPLS header by exchanging label among them as L1 with L2 and L2 with L3. The final router also called egress router or LER eliminates MPLS header L3 so that the packet can be managed by later host or IP routers that may be unknown of MPLS domain.

V. MPLS TRAFFIC ENGINEERING

Traffic engineering is a complicated task in conventional IP network, this kind of networks utilizes shortest path algorithms to forward data from source node to destination node. For e.g. OSPF (open shortest path first) in IP. These protocols do the function of sending data packets but can easily introduce the problems like.

- Longest path is under-usage while shortest path is over-usage leading to network congestion.
- Load sharing cannot be achieved in IP network.
- And routing lookups are performed at each router.

MPLS traffic engineering means that routers utilize the MPLS label switching mechanism for improving the uses of network resources. Labels are allocated to the routers utilizing label distribution protocol; ingress router allocates labels to packets. These packets are then broadcasted utilizing label switching. When full label information is swapped, any router can arrive to any other router in MPLS. Unlike IP which forwards depending on destination address, MPLS let the LSP source to evaluate the route, make MPLS Forwarding state and maps packets on to that specific LSP. The idea of traffic trunk is employed to carry out traffic engineering in a MPLS network domain. The traffic trunk is a collection of traffic flows positioned inside an LSP.

VI. SIMULATION METHODOLOGY

The Simulation of MPLS and IP network has been performed utilizing RIVERBED simulator. Two scenarios have been taken into account for Simulations having same network configuration.
Scenario 1 is for IP network without TE.
Scenario 2 is for MPLS network with TE.
The comparison of results is performed between two network models.
All the connections function in full duplex mode. Four clients and three servers are also utilized. Every client employs different kind of traffic VoIP, FTP and Video conferencing.

 DOI: 10.15680/IJIRCCE.2016. 0405144

ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 5, May 2016

VII. RESULT ANALYSIS

Comparison of performance metric of IP model and MPLS-TE networks is done. Performance Parameters that are compared involves end to end delay, throughput (packet send and receive), FTP response time. It is clearly noted that MPLS-TE performance is better as compared to IP network model. In the situation of heavy load such as high traffic, the MPLS-TE performance is again better. In 1st scenario such as in IP network model, packets are forwarded employing OSPF, hence all packets are sent through shortest route and no other route was taken. While in 2nd scenario such as in MPLS-TE network model LSPs are built, the edge router LER1 is taken as the source router and the edge router LER2 is taken as destination router of the LSPs.

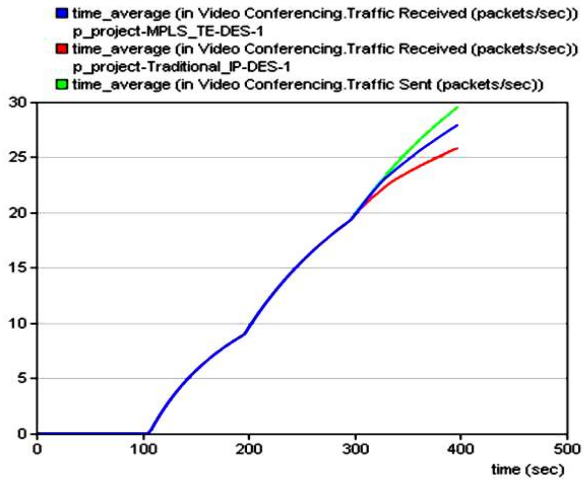

Figure 7: Video packets send and received

Simulation results depicted in fig 7 and fig 8 represents that the MPLS model throughput is higher as compared to IP model and also during bad possible load IP network packets begin to drop sooner in comparison of MPLS network model. The traffic engineering demonstrated in MPLS temporarily decreases the network congestion. Packets are propagated with lesser delays and more transmission speed in MPLS.

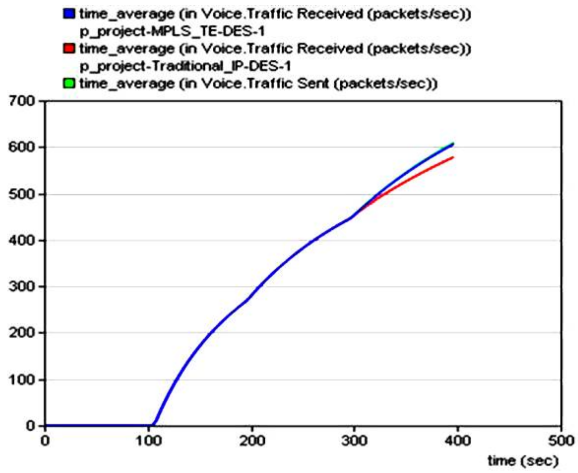

Figure 8: Voice Packet send and received

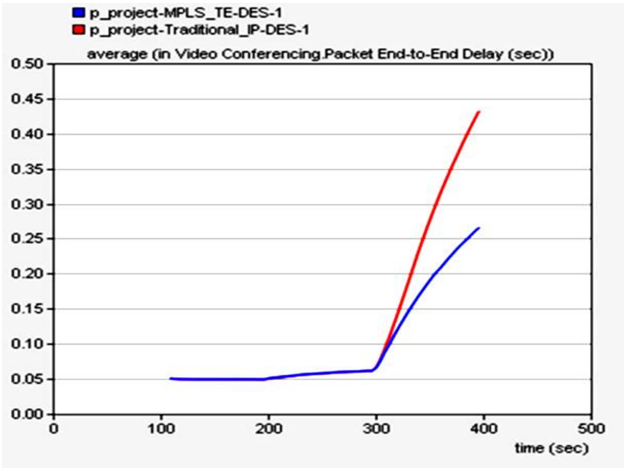

Figure 9: Video Packet End to End Delay

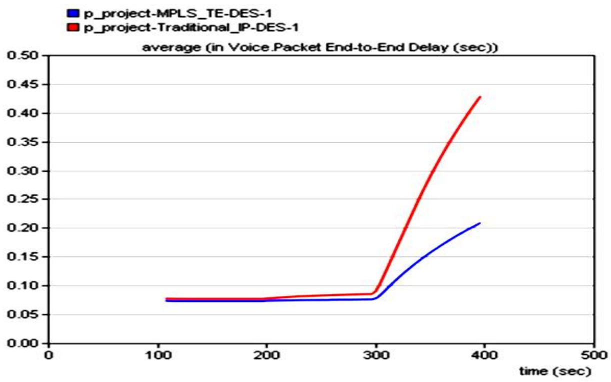

Figure 10: Voice Packet end to end delay

Figure 9 and figure 10 depicts the end to end delay of Figure voice and video traffic, it is clearly explained that MPLS has lesser delay as compared to the IP model in situation of heavy load. Figure 10 depicts the delay variation of voice and video traffic, the delay variation increases the IP threshold sooner than MPLS TE and also it is lesser in MPLS.

VIII. CONCLUSION

The paper work has explained the efficient resources implementation in MPLS network. The results of simulation describe that the performance of traffic engineering parameters i.e. throughput, packet delay etc. in MPLS network is much better and very static in comparison of conventional IP network. The network resources are examined at their optimal performance with the support of Traffic engineering. Also the service end to end quality is also being confirmed. In this research paper, the comparison of performance metric of IP model and MPLS-TE networks is done. Performance parameters that are compared involves end to end delay, throughput (packet send and receive), FTP response time. It is clearly noted that MPLS-TE performance is better as compared to IP network model. In the situation of heavy load such as high traffic, the MPLS-TE performance is again better.

REFERENCES

[1] Hang Man and Yang Li, "Multi-Stream Video Transport Over MPLS Networks", IEEE Workshop of Multimedia Signal Processing, Dec 2002.
[2] Jeevan Kharel, "Performance Evaluation of Voice Traffic over MPLS Network with TE nd QoS Implementation", M.Sc. thesis, School of Computing Blekinge Institute of Technology, Sweden, Nov 2011.
[3] Muhammad R. A. Rahimi, Habibah Hashim, Ruhani Ab Rahman, "Implementation of Quality of Service (QoS) in Multi-Protocol Label Switching (MPLS) Networks", International Colloquium on Signal Processing & Its Applications (CSPA), 2009

ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 5, May 2016

[4] Jawad Oubaha, Adel Echchaachoui, Ali Ouacha, and Mohammed Elkoutbi, "New Method: Mapping of 802.11e into MPLS Domains, Conception and Experimentation" Springer-Verlag Berlin Heidelberg CCIS 189, 2011, pp. 470–483.
[5] Mohsin Khan, "MPLS Traffic Engineering in ISP Network", International Journal of Computer Applications (0975 – 8887), Volume 59– No.4, Dec 2012.
[6] Tatiana Onali, "Quality of Service Technologies for Multimedia Applications in Next Generation Networks", Ph.D. thesis, University of Cagliari, Italy, 2009.
[7] Mahesh Kr. Porwal, Anjulata Yadav, S. V. Charhate. July, "Traffic Analysis of MPLS and Non MPLS Network including MPLS Signaling Protocols and Traffic distribution in OSPF and MPLS", International Conference on Emerging Trends in Engineering and Technology, ICETET, June 2008.
[8] Md. Arifur Rahman, Ahmedul Haque Kabir, K. A. M. Lutfullah, "Performance Analysis and the Study of the behavior of MPLS Protocols",\ International Conference on Computer and Communication Engineering, Kuala Lumpur, Malaysia, May 2008.
[9] Abdellah Jamali, Najib Naja and Driss El Ouadghiri, "An Enhanced MPLS-TE for Transferring Multimedia packets", International Journal of Advanced Computer Science and Applications, (IJACSA), Vol. 3, No.8, 2012.
[10] Keerthi P. Jannu. June, "RIVERBED simulation of voice over MPLS with Considering Traffic Engineering", M.Sc. Thesis, School of Computing, Blekinge Institute of Technology, Sweden, 2010.
[11] Faiz Ahmed and Dr. Irfan Zafar, "Analysis of traffic engineering parameters while using multi-protocol label switching (MPLS) and traditional IP networks", Asian Transactions on Engineering (ATE ISSN: 2221-4267) Volume 01 Issue 03, 2011.
[12] Anupkumar M Bongale and Nithin N., "Analysis of Link Utilization in MPLS Enabled Network using RIVERBED IT Guru", International Journal of Computer Applications (0975 – 8887), Volume 41– No.14, March 2012.
[13] E. Rosen, A. Viswanathan, R. Callon. January, "Multiprotocol Label Switching Architecture", Network Working Group RFC 3031, 2001
[14] Wei Sun Praveen Bhaniramka, Raj Jain, "Quality of Service using Traffic Engineering over MPLS: An Analysis", 25th Annual IEEE Conference, Local Computer Networks, LCN Proceeding, 2000.
[15] Abdellah Jamali, Najib Naja, Driss EI Ouadghiri and Redouane Benaini, "Improving Quality of Service (QoS) in Multi-Protocol Label Switching Module", IEEE Mediterranean Microwave Symposium, Nov 2009.
[16] Yan Chen, Toni Farley and Nong Ye, "QoS Requirements of Network Applications on the Internet", International Journal of Information Knowledge Systems Management, 2004, IOS Press (55-76).
[17] Er. Sourabh Jain. July, "Performance Analysis of Voice over Multiprotocol Label Switching Communication Networks with Traffic Engineering", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 2, Issue 7, 2012
[18] Junaid Ahmed Zubairi., "Voice Transport Techniques over MPLS", International Symposium of High Capacity Optical Networks and Enabling Technologies, 2008.
[19] Aruna Kapoor, Sunila Godara, Sanjeev Khambra, Amandeep, "Comparative Analysis of Signaling Protocols in Mpls Traffic Engineering", National Workshop-Cum- Conference on Recent Trends in Mathematics and Computing (RTMC), 2011.
[20] Dr. Reyadh Shaker Naoum and Mohanand Maswady, "Performance Evaluation for VOIP over IP and MPLS" , World of Computer Science and Information Technology Journal (WCSIT), Vol. 2, No. 3, 2012, 110-114.
[21] Jasmina Barakovic Himzo Bajric, and Amir Husic., "Multimedia Traffic Analysis of MPLS and non-MPLS Network", International Symposium ELMAR-2006, Zadar, Croatia, June 2006.