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Quality of service analysis of traffic engineering implementation on voip multi protocol label switching (mpls) network

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Abstract. The packet-switch data network in most cases does not guarantee the quality of service either partially or completely. Due to the challenges of traditional routers to provide this request, especially for voice and video, the Multi Protocol Label Switching (MPLS) method is used. MPLS is designed to add a set of rules to IP so that traffic can be classified, marked and applied to policies. Traditional IP routing is based on passing traffic to the destination as quickly as possible. As a result, the routing protocol looks for the shortest path to the destination based on the link cost (also called the metric) that the packet is forwarded to. Traditional IP routing does not take into account the bandwidth of available links. This can cause some links to be used too much compared to others. MPLS TE solves this problem. Source-based routing is applied to traffic from the headend router (MPLS TE tunnel source). Explicitly defined paths can be configured on the headend router where traffic for a particular LSP must follow. The performance is measured using parameters of throughput, delay, jitter and packet loss. The measurement results show a throughput value of 86 Kbps, delay 0.02 s, jitter 22.42 ms and packet loss 0%.

1. Introduction

An increasing number of Internet users make services such as telephones reach their customers via the Internet or what is often called as Voice over Internet Protocol (VoIP). Voice communication can be achieved through an IP-based network, be it Internet, Intranet or Local Area Network (LAN) [1]. This makes Internet Service Providers (ISPs) to increase the quality of their services.

With this improvement, conventional routers face the challenge of presenting the necessary high available bandwidth, quick routing and quality of service support (QoS). Due to the challenges of traditional routers to provide this request, especially for voice and video, the Multi Protocol Label Switching (MPLS) method is used [2]. MPLS is able to improve router performance in providing real time services [3]. Multiprotocol label switching (MPLS) is a convergence of connection-oriented forwarding techniques and Internet routing protocols. The most prominent incarnation of the MPLS standard utilizes the capability of switching high-performance cells from asynchronous switch (ATM) switch devices, and integrating them into networks that use the existing IP routing protocol [4]. As standardization progresses, packet-based MPLS also appears to simplify packet processing mechanisms within core routers, replacing full or partial classification headers and the longest search of prefixes with simple label index searches.

The technique commonly utilized in large ISP is to utilize layer 2 networks (ATM or FR) to administer networks. In this way is frequent named an overlay solution, a comprehensive range of virtual circuits that connect the IP backbone. It serves to avoid accumulation that take place in hop-by-hop routing on the IP backbone with destination-based routing. In this way, the current can be routed individually via layer 2 topology and traffic engineering can be obtained. But the weakness of this way is the scalability problem and a link damage can lead dozens of Virtual Circuits to go down, coercing the IP routing protocol to be converted again. The breakthrough to this issue could be coordinated between layer 2 network and layer 3 IP networks. This breakthrough is MPLS, a collection of methods for integrate performance, QoS and traffic management from the Layer 2 label-swapping paradigm with the scalability and flexibility of Layer 3 routing functions [5].

VOIP uses conventional routing has a low call quality due to delay and packet loss. To send real time traffic through data networks is a big challenge for researchers. MPLS is the best solution to improve the quality of VOIP services. MPLS is the best solution to improve the quality of VOIP services. MPLS has several reasons to become the future protocol [5]. First, MPLS really has a multiprotocol architecture. Where MPLS utilizes the switching mechanism using a simple label that is very flexible on existing applications, such as MPLS at ATMs and frame relay. Second, through the use of traffic classification, queue and scheduling (CQS) engineering, MPLS is able to control service quality features. Third, MPLS provides scalability solutions and allows significant flexibility in routing. Fourth, connection oriented architecture and reliable service quality features easily enable high quality end user service features.

This paper discusses the performance of VoIP networks based on multi protocol label switching traffic engineering (MPLS-TE). Performance is measured using variable throughput, delay, packet loss and jitter. Routing protocols used to connect MPLS networks using the open shortest path first (OSPF).

2. Method

Conventional IP routing is based on passing traffic to the destination as quickly as possible. As a result, the routing protocol looks for the shortest path to the destination based on the link cost (also called the metric) that the packet is forwarded to. Furthermore, IP packets are continued per-hop, ie each router (hop) forwards packets based on the destination IP address. Conventional IP routing does not take into account the bandwidth of available links. This can cause some links to be used too much compared to others.

This behavior in traditional IP routing can be overcome using Policy-Based Routing (PBR). However, it requires a policy to be implemented on each router along the path to the destination. This can produce a large configuration on each router. MPLS TE solves this problem. Source-based routing is applied to traffic from the headend router (MPLS TE tunnel source). Explicitly defined paths can be configured on the headend router where traffic for a particular LSP must follow. The benefits of implementing MPLS TE are as follows:

1. MPLS TE provides an efficient way to forward traffic across a network, avoiding links that are overused and underused.
2. MPLS TE adjust to changing bandwidth.
3. MPLS TE takes into account the configured bandwidth of the link.

There are five routers that function to forward MPLS routing and switch traffic on the network under a single administrative domain. In MPLS there are two main roles, namely the Label Switch Router (LSR) and the Label Edge Router (LER) [6]. LSR is responsible for packet forwarding according to the switching label and this router is located at the core of the MPLS network. In this study using three LSR namely Router P1, P2, and P3. LSR has the ability to routing layer 3 packages. While LER is responsible for adding or removing label packages that are going to or out of the LER router [7]. LER has the ability to complete routing layer 3 packages. The research used two LERs, namely PE1 Router and PE2 Router. While the CE1 router and CE2 Router are routers that deal directly with the user. Users in this topology have two users running Internet-based phone applications and OpenVPN Client. The VOIP server is connected to one of the LSR routers.

Evaluation of the application of OSPF and BGP routing protocols on VoIP networks based on MPLS-TE is done by measuring Quality of Service which consists of throughput, delay, packet loss and jitter. Measurement is done by observing the RTP package using Wireshark software. MPLS-TE network topology built is shown in Figure 1.

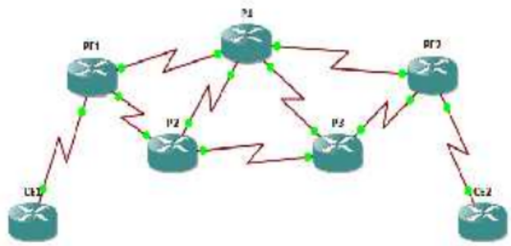

Figure 1.Network topology of MPLS-TE

3. Result and Discussion

Experiments carried out by building a VOIP network based on MPLS TE. The router used is seven routers consisting of 3 LSR routers, 2 LER routers and 2 CE routers. The LSR router is responsible for forwarding the packet while the LER router is responsible for adding or removing labels on the packet that enters or leaves the MPLS domain. Each router is configured for the OSPF routing protocol, then the conversation is carried out through the IP Telephony application on the user's computer. During the conversation process, an RTP packet is observed to calculate Quality of Service (QoS) which includes, throughput, delay, packet loss and jitter. After that the MPLS and the RTP packet are re-observed after each router. The experimental results in the first section are shown in Table 1.

Table 1. Performance Measurement

Parameter	**no mpls**		**with mpls**		**MPLS-TE**	
	user 1	***user 2***	***user 1***	***user 2***	***User 1***	***User 2***
Throughput (kbps)	76,8	86	92,32	86,51	86	86
Packet Loss (%)	0	0	0	0	0	0
Delay (s)	0,02	0,02	0,02	0,02	0,02	0,02
Jitter (ms)	18,40	20,73	9,67	11,38	22, 42	22,42

The addition of labels to the packet header can improve throughput and jitter values in OSPF routing protocols on the application of MPLS TE. TABLE 1 shows that the application of MPLS on VOIP networks is able to increase the throughput value and improve the value of jitter. Whereas for packet loss and delay parameters tend to be the same. This is due to the simplicity of the network created and the small number of users, 2 users. This increase in throughput and jitter values is because when the packet enters the MPLS domain, the LER or PE router will add a label to the header packet that makes it easy for the LSR or P router to carry out packet forwarding. On the other hand, the LER or PE router will delete the label on the packet that leaves the MPLS domain. Based on TABLE 1, the application of MPLS on VOIP networks increases the throughput value by 10% and the improvement of jitter values by 40%.

4. Conclussion

Based on the results of the study and discussion it can be concluded that the overall application of MPLS is able to improve the Quality of Service (QoS) OSPF routing protocols on VoIP networks, especially in throughput parameters. Furthermore, it is necessary to experiment with MPLS implementation on a larger VoIP network and additional tunneling to secure data packet delivery.

References

[1] R. Yunos, S. A. Ahmad, N. M. Noor, R. M. Saidi dan Z. Zainol, "Analysis of Routing Protocol of VOIP VPN over MPLS Network," dalam *2013 IEEE Conference on Systems, Process & Control (ICSPC)*, Kuala Lumpur, 2013.

[2] M. M. Al-Quzwini and S. A. Sharafali, "Performance Evaluation of MPLS TE Signal Protocols with Different Audio Codecs," *Journal of Emerging Trends in Computing and Information Sciences Vol. 5 No. 6,* pp. 447-463, 2014.

[3] G. Liu and X. Lin, "MPLS Performance Evaluation in Backbone Network," in *ICC 2002. IEEE International Conference on Communications, 2002.*, New York, 2002.

[4] G. Armitage, "MPLS: The Magic Behind the Myths," *IEEE Communications Magazine,* Vols. Volume: 38,, no. Issue: 1, pp. 124-131, Januari 2000.

[5] M. K. Porwal, A. Yadav and S. Charhate, "Traffic Analysis of MPLS and Non MPLS Network including MPLS Signaling Protocols and Traffic distribution in OSPF and MPLS," in *First International Conference on Emerging Trends in Engineering and Technology*, Nagpur, Maharashtra, India, 2008.

[6] A. M. Sllame, "Modeling and Simulating MPLS Networks," in *The 2014 International Symposium on Networks, Computers and Communications*, Hammamet, Tunisia, 2014.

[7] S. Ahmad, W. A. Hamdani and M. H. Magray, "Performance Evaluation of IPv4 and IPv6 over MPLS using OPNET," *International Journal of Computer Applications Vol. 125 No. 3,* pp. 34-38, 2015.

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