Implementation of Class Based Priority Tunneling In Multi Protocol Label Switching Networks

Nisha.R, N.Usha Bhanu

ABSTRACT: ***In this paper implementation of the Class Based Tunnel Selection(CBTS) in MPLS network using TE is discussed. The objective of TE in MPLS network is to alternate data path link when the network is congested. It also provides the combination of ATM's (Asynchronous Transfer Mode) TE capabilities along with CoS (Class Of Service)at layer 2.5 to reduce latency and hence speed is improved. Traffic Engineering (TE) in MPLS network using tunnel for transmission of data packets. RSVP protocol is being used for reserving bandwidth along the path from source to destination. Here a CBTS mechanism is used to reroute sensitive traffic based on the priority of the customer through tunnels. The tunnel formation along the LSP (Label Switch Path) for forwarding packets is simulated using GNS3 tool. The simulation result shows that the round trip time of tunnel1(high priority) with packet size of 8000 bytes takes 439milliseconds which is faster than tunnel2(medium priority) with packet size of 8000bytes.It also reroutr sensitive traffic in real time which is used in voice and data world for transmitting information.***

Keywords-MPLS (Multi Protocol Label Switching, CBTS (Class Based Tunnel Selection), TE (Traffic Engineering, Tunneling,RSVP(Resource Reservation Protocol).

I.INTRODUCTION

A.MPLS Technology

Multi Protocol Label Switching is a new technology that will be used by many future core n[1].MPLS is a modern solution to address a multitude will be used by many future core networks [1].MPLS is a modern solution to address a multitude problems faced by present day networks. It doesn't replace IP routing, but will work alongside with existing and future routing technology to provide the connection oriented switching based on a label applied at the edge of an MPLS domain.

The physical elements of MPLS networks are shown in Fig.1. MPLS networks consist of two types of routers: LER and LSR routers. Label Edge Routers (LER) site at the edge of the MPLS network [2]. These routers play an important role in the addition and removal of labels packages when traffic enters or exits from the MPLS networks. The algorithm used for implementing shortest path routing in Virtual Private network as in [4].

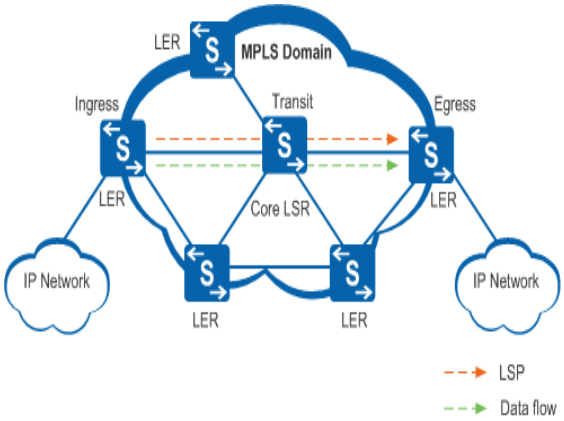

Fig .1 MPLS Network

The implementation of MPLS to forward data packets involve following steps:

(i) Assignment of label per label switching router.
(ii) To establish Label Distribution Protocol session in MPLS.
(iii) Label Distribution.
(iv) Label retaining.

In real time service providing networks traffic engineering plays a vital role in providing services to the existing networks with the improved Class of Services (CoS).

B. Components of MPLS:

Components of MPLS networks are MPLS header, Forward Equivalence Class(FEC),Label switched path(LSP) and Label distribution path(LDP),Label Forwarding Information Base(LFIB).Header is 32 bit equal 4byte fixed identifier as shown in Fig.2 value label inside the MPLS header has only localsignificance because it applies only to the jump between neighboring routers[2].

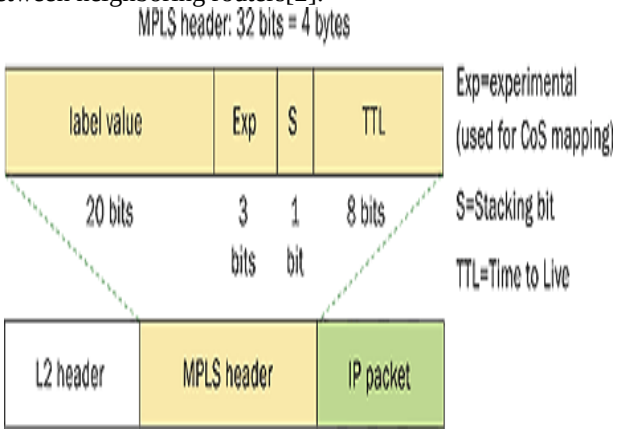

Fig. 2 MPLS header

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C. Traffic Engineering

Traffic Engineering (TE) is the process of steering traffic across the backbone network to facilitate efficient use of available bandwidth between a pair of routers. Prior MPLS TE [2] was performed either by IP or by ATM (Asynchronous Transfer Mode), depending on the protocol used in between two edge routers in a network. When two end points with multiple path network, traffic engineering with IP is mostly implemented for calculating the interface cost [6].

The remainder of this paper is organized as follows. In section II review of Class Based Tunnel selection in MPLS networks is discussed. In section III the existing MPLS Traffic Engineering networks is discussed. In Section IV presents proposed solution which consists of short description of the Class Based Tunnel Selection and fast reroute mechanism to reduce latency and increase speed. Section V provides implementation results in comparison with the existing literature.

II.REVIEW OF CLASS BASED TUNNEL SELECTION IN MPLS NETWORK.

MPLS TE class based tunnel selection enables the SP (Service Provider Router)to dynamically route and forward traffic of different classes of service(CoS) into different TE tunnels [1]between the same tunnel headend and the same tailend.The set of TE tunnels from same headend to same tailend that are configured to carry different CoS values is referred as tunnel bundle.CBTS(Class Based Tunnel Selection) supports tunnel selection based on the value of the exponent field.The high priority customers are addressed through Tunnel 1,medium Priority customers are addressed through Tunnel 2 and Low Priority customers are routed through Tunnel 3.

A.Traffic Engineering in MPLS

MPLS traffic engineering automatically creates and maintains a label switch paths through the network using [4] RSVP protocol. The LSP (Label Switch Paths) resource requirement and network resource such as bandwidth to determine the path that LSP taken. In ISP (Internet Service Provider) WAN connections are very expensive to offer the quality of service[5]. Traffic engineering enables ISP to route network traffic in terms of throughput and delay and reduces the cost of network.

B. Tunneling

When MPLS is implemented, the IP network [5] transforms into the label switched domain in which the TE label switched paths or tunnels. TE tunnels, Tunnel1and Tunnel2 can be configured so that can map to separate paths enabling efficient bandwidth utilization. TE tunnels configured on routers are unidirectional. Therefore, to implement bidirectional TE deployment between routers[6]. All pertinent tunnels configuration are always performed by edge routers. The TE tunnels or LSP will be used to link the edge routers across the core of the service provider network.

C. Load Balancing

Splitting traffic [3] and routing its portions through multipath, balances the load in the network and facilitate an efficient management of the available energy resources. All protocol does the Load Balancing mechanisms.

D. Resource Reservation Protocol (RSVP)

To ensure the reach ability of LSPs(Label Switch Path) which carrying the packets reservation protocol is used for integrated networks. RSVP is used for the signaling process which means ensure the path is free. Bandwidth reservation is the main job of reservation protocol[4].The information is generated by RSVP are transferred via the headend router this information travels through the tunnels. An RSVP message is sent from source to destination. So, it will form the path which a packet has to travel from hop to next hop[8].Path generated by the RSVP protocol gives the request to the destination router in another means whether it is idle or ready to get some packet through the LSP which is formed by MPLS.

Border Gateway Protocol (BGP) is a routing protocol used to transfer data and information between different host gateways shown in Fig.3. It is used to exchange [8] routing information for the Internet and is the protocol used between Internet service providers (ISP).

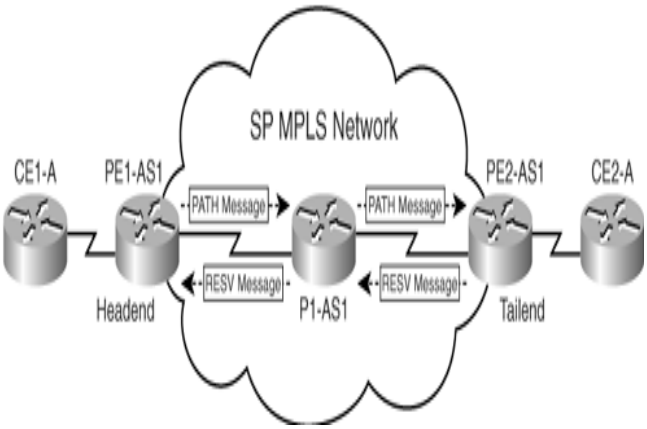

Fig.3 Border Gateway Protocol (BGP)

Intermediate System to Intermediate System (IS-IS) protocol[10] ,which means that the routers can exchange topology information with their nearest neighbours. It is a link state protocol the next hop address to which data is forwarded is determined by choosing the best end to end path to the destination[9].

III.EXISTING MPLS TRAFFIC ENGINEERING NETWORK

When the routers are more in number, the routing information increases, latency also increases therefore network performance decreases [2]. To overcome this the following concept is used. TE is employed in the core of the network. So, the pair of tunnels to be configured in network. The core network wants to transfer information to the customer means it transfers through provider edge router. RSVP algorithm is used for reservation of bandwidth along the tunnels[8]. In Fig.4 if Router2 tries to send data to Router7.

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If the data size is 100kbps and the network consists of two tunnels. It transfers 50kbps in tunnel 1 and other 50kbps in tunnel 2. So it sends the data according to the configuration of bandwidth. If one tunnel fails the fast reroute mechanism which searches the another route. Fast reroute mechanism is a technique for protecting MPLS traffic engineer and LSP(Label Switch Path) from link node failure by locally recovery the LSP at the point of failure, permit data to continue to flow.

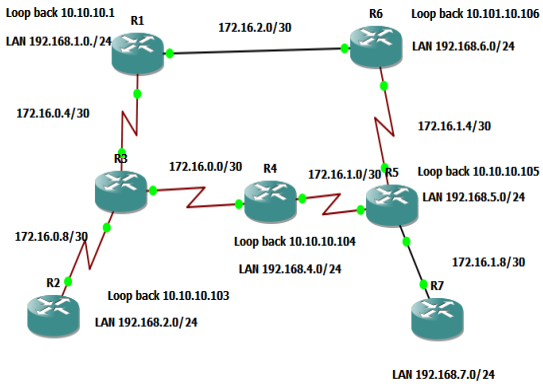

Fig.4Traffic Engineering label switch path or Traffic engineering tunnels (Tunnel 1 and Tunnel 2) show path that can be used by traffic between routers R2 and R7.

OSPF is the IGP protocol (Interior Gate way Protocol)which is used in MPLS TE by configuring tunnels between the routers[4]. So the traffic will go without any packet loss.

IV.PROPOSED METHOD

In a classic method of IP networking, packets are progressed by hop basics. For forwarding data packet the bandwidth is not optimally used because if a router choose a single path all other path remains idle. To utilize the available bandwidth TE is employed into the core network. So, the pair of tunnels to be configured in network. If the core network wants to transfer information to the customer based on the priority the tunnels are classified shown in Fig.5. The tunnel1 (high priority) carries a packet size of 8000 bytes takes round trip time of 439 milliseconds to reach the destination .The tunnels2 (medium priority) carries a packet size of 8000 bytes with round trip time of 469milliseconds.

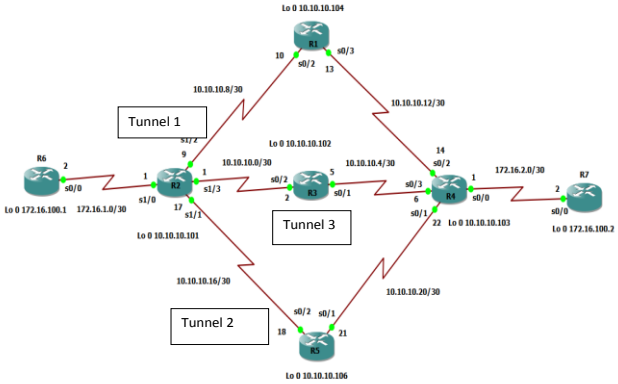

Fig.5.Class Based Tunnel Selection based on Priority of the Customer.

Finally tunnel3 (low priority)carries a packet size of 8000 bytes with roundtrip time of 480milliseconds to reach the customer. Tunnels are configured according to the exponent value. If any one of the tunnel fails the fast reroute mechanism which searches another route. Fast reroute mechanism is a technique for protecting MPLS traffic engineer and LSP(Label Switch Path) from link node failure by locally recovery the LSP at the point of failure, permit data to continue to flow. OSPF is the IGP protocol (Interior Gate way Protocol)which is used in MPLS TE by configuring tunnels between the routers. So the traffic will go without any packet loss. The link state IS-IS (Intermediate System to Intermediate System) protocol helps in exchange of topology information with nearest neighbor routers. The BGP(Border gate way Protocol)protocol is used to transfer data and information between different host gateways. By using these protocols the packet are transmitted successfully through the tunnels.

V.RESULT AND DISCUSSION

In Class Based Tunnel Selection the time taken to transmit packet size of 8000bytes from source to destination based on the priority is shown in Table.1.The result is based on based on travelling and reaching the destination of the packet from one router to another. Three types of data samples have taken to obtain the result as follows. The first output is taken by configuring the tunnel1 with high priority. Second the output is taken by configuring the tunnel 2 with medium priority and third output is taken by configuring the tunnel 3 with low priority.

Table .1 Round Trip Time delay router using Class Based Tunnel Selection.

TUNNELS Referring to Fig.5	ROUND TRIP TIME TAKEN
Tunnel 1(High Priority)	439milliseconds
Tunne2(Medium Priority)	469milliseconds

Tunne3(Low Priority)	480milliseconds

Observation:

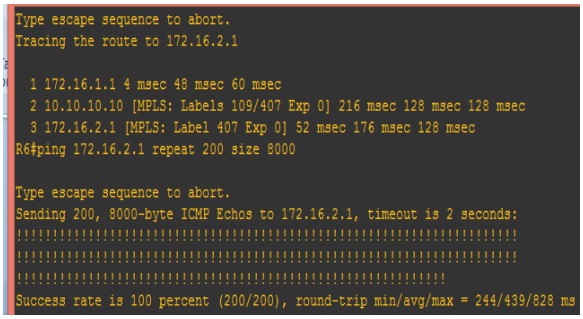

Fig.6 Time taken for transferring packets through Tunnel1(High Priority)

After implementing the Class Based Tunnel Selection in MPLS network for a packet Size of 8000 byte sent through the Tunnel 1 as shown in Fig.6.The simulation result shown in Fig.6 describes that the Tunnel1 with high priority is faster than remaining tunnels with medium and low priority .Thus the latency is reduced with increase in performance when compared to the delay estimation of CBTS using exclusion method[1] for voice data packet an upper bond of 150ms delay was obtained. .By implementing traffic engineering in MPLS network the round trip time for the data packet size of 8000bytes is 36ms faster than the existing IP network is shown in Table.2.

Table .2 Comparison of CBTS With and Without Priority

Class Based Tunnel Selection(CBTS)	Round Trip Time (ms) [1]	Round Trip Time of Proposed work
Without priority	150ms[1]	36ms
With priority	Not discussed	439ms

In the proposed method priority for the existing customers for data achieves a round trip delay of 439ms for a single customer for routing between source to destination is shown in Table.2. The simulation result shows that the latency is reduced with increased speed for transmitting data packets. For the above results it is given that the CoS parameter Latency is decreased with increased speed in transmission of data packets to destination router. Hence it is used in the telephonic voice world for easy and speed transmission of data packets.

The future scope of this work can be extended with development of algorithm for providing CBTS mechanism with the combination of QoS and CoS measurement.

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