ABSTRACT

Multiprotocol label switching (MPLS) uses label table to solve the routing table lookup at each instance or at each hop of the MPLS network, it uses its own table known as label table for forwarding of packets according to label rather than IP address. Label table is smaller than IP table so forwarding of packets is done faster as compared to routing table lookup.

Here a more novel approach is used in a MPLS network by using a hierarchical MPLS network which further shortens the label table and make the packet forwarding more faster than the available algorithm. In hierarchical approach the table become shorter and to find a path will become easier and faster.

KEYWORDS

MPLS, IGP, TE, LER, LER, iLER, eLER, FIB, RIB, LIB, LFIB

1. INTRODUCTION

In most conventional packet-based networking the forwarding of packet is done from source to destination based solely on destination address. IETF, proposed an alternative approach to this routing model known as Multiprotocol Label Switching (MPLS). In MPLS network, routing table lookup is done only at ingress and egress of MPLS network. In MPLS network, there are routers known as Label Edges Routers (LER) and Label Switch Routers (LSR) and the path followed by the labels and packets is Label Switch Path (LSP). The routers from where the packets enter in the MPLS network is called Ingress Label Edge Routers (iLER), at iLER the routing lookup of routing table is done which matches routing table with label table and attaches a label in a packet. From iLER, the forwarding of table is done via labels rather than IP lookup. The path this packet taken is known as LSP. Whereas the router from where the label packets emerges to outer of MPLS label is Egress Label Edges Routers (eLER), at this router again the label table matches with routing table and label removes at this router and packets forwarded as per IP labels.

The routers inside the MPLS network are known as Label Switch Routers (LSR), These routers donot effort for routing table lookup. Their functions is only label swapping by looking only label table. Thus MPLS is known to be at layer 2.5 protocol as it contain the essential features of layer 3 routing table and layer 2 switching function.

In MPLS, Traffic Engineering (TE) is used which is advanced feature of MPLS which was not available in conventional packet based forwarding. TE is an advanced feature of MPLS which controls the traffic flows through one's network in order to optimize Resource utilization and network performance[9]. The need to use TE arises because the Interior Gateway Protocol(IGP) always uses shortest path to forward traffic[5]. Now as all the packets follow the same shortest route then there exist the problem of underutilization of larger or longer path and overutilization of shortest path which results in congestion in the shortest path. To overcome this problem traffic engineering is used.

Fig 2 MPLS Multi Label Diagram

As shown in fig 2 MPLS implements a general model in which a labeled packet may carry any number of labels[7], organized as a last in, first out sequence. This sequence is referred to as an MPLS label stack. Multiple entry label stacks are used for the implementation of MPLS based services such as VPLS, VPRN, trace, ping and others or traffic engineering applications[4].

The rest of this paper is organized as follows. Section 2 gives the protocol for finding paths for LSP, Section 3
describes the method and methodology used for hierarchical design, Section 4 describe the Result and paper concluded in section 5.

2. PROTOCOLS FOR FINDING LSP –
We had used a static numbering approach for finding the paths LSP within MPLS network, this numbering is done based on counts of number of hops. The path with minimum number of hops is numbered as 1st and path having second least number of hops numbered as 2nd and so on. As all the packets take the shortest path and with the increase of users the congestion in the path number 1st increases and it become congested, now we provide a feedback mechanism here to overcome this problem.[1]

As LSP is unidirectional, hence packets going from router1 to router2 can’t have a two way communication, for a two way communication we have to establish two LSP from router1 to router2 and back from router2 to router1. Now as the LSP1 becomes congested due to over traffic in path from router1 to router2, then packet coming from router2 to router1 will carry a packet with 1 bit added to that packet which shows the congestion in a particular path. Congestion can be detected within the device by ATCC device.[8]

This 1 bit value can have value 1 or 0. The value 1 tells us about congestion in path from router1 to router2 whereas value0 represent this path as congestion free. If the value of this bit is 1 then rest of packets takes path number 2, even it’s a longer path but congestion free hence reduces congestion in the network even as the number of users increases, whereas if value of this bit is 0 then rest of packets keep on forwarding from this path only as this is shortest and congestion free path.

Also since this is statically done hence this algorithm is faster than using any dynamic routing protocol for finding the path. Thus, our LSP are set up in this MPLS network.

3. METHOD AND METHODOLOGY –
The method used in this is to reduce the size of label table to further optimize the routing and packet forwarding within MPLS network. This can be achieved by breaking MPLS network into hierarchical structure into small MPLS network. Thus when breaks up into smaller network, the size of label table become smaller and each MPLS network act as a new node of MPLS network, thus this created a smaller label table and in a hierarchical structure.

This is the case with small networks but when considering a large and complex networks, we can’t rely on MPLS alone again IGP and EGP have to be used which again uses routing table and make forwarding complex and takes longer time. Now for larger and complex network we subdivide a larger network into smaller network and make it a hierarchical structure, the advantage of this is that it shortens the label table used for forwarding and make forwarding faster and effective. Fig 3 and Fig. 4 shows the method of forwarding the packets as per the label and routing table lookup and also the type of tables used in forwarding mechanism.
divide a particular network into smaller groups and the time reduces exponentially.

**4. RESULT**

When considering a large and complex network, we find that by dividing a larger network into smaller MPLS groups and each group act as a new node or a label in bigger network, we can make a label table a smaller and routing and forwarding become faster. As using of MPLS is came into existence for reducing the routing table lookup and forwarding is based on labels by looking into label table which is smaller than routing table. We make forwarding on the base of label table only and the size of label table is reduces further by further grouping the large network into smaller groups.

Apart from this the IGP used in this case is static which makes it faster and having a feedback which prevent congestion even when the number of user increases or traffic increases within the network.

**6. CONCLUSION**

This paper proposed a methodology of reducing the time taken to forward a packet in a large and complex number and reduces the size of label table used for forwarding of packets, thus decreases time and make routing and forwarding faster and efficient.

IGP used to find path is static routing with feedback which more enhance speed and prevent congestion with increase in number of users.

In near future we will try to implement services which uses this method of forwarding.

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