ISSN: 2248-9622 www.ijera.com
Vol. 2, Issue 3, May-Jun 2012, pp. 381-384

Multi-Protocol Label Switching (MPLS)

Mr. Manish G. , Sahil S. , Indraneel K. , Ankitk, JegaPriya J.

ABSTRACT

Multi- Protocol Label Switching (MPLS) has been proposed as a new approach which combines the benefits of interworking and routing in layer 3 and layer 2 i.e. Network layer and Data Link Layer. But its major technological significance lies in implementing Traffic Engineering. The most important requirement of TE is that the characteristics, as well as resource availability, on links on the network (in addition to bandwidth that would be used for cost computations) be propagated across the network to allow efficient choice of possible TE LSP paths. In this paper we propose a new constraint based routing algorithm for MPLS networks. The proposed algorithm uses both bandwidth and delay constraints. It means that the delay of the path which is computed by the algorithm is less than or equal to the delay constraint value and the residual bandwidth of all the links along the computed path must be equal to or greater than the bandwidth constraint value. In the proposed algorithm best path is computed based on avoiding critical links to reduce call blocking rate, deleting the paths which are not satisfying the bandwidth and delay constraints to reduce complexity of the algorithm and using shortest path algorithm to reduce path length. The proposed algorithm also compares two different topologies to study the performance of our proposed algorithm.

Keywords-: **MPLS Networks, Traffic Engineering, Path Selection, Constraint Based Routing.**

I.INTRODUCTION

Internet has become an integrated carrier gradually, which has multi business such as data, voice, video, multimedia and so on. New multimedia applications require the network to guarantee quality of service. MPLS network has the capability of routing with some specific constraints for supporting desired QOS. Rather than replacing IP routing, MPLS is designed to overlay its functionality on top of existing and future routing technologies and to work across a variety of physical layers to enable efficient data forwarding together with reservation of bandwidth for traffic flows with differing QOS requirements regarding bandwidth, delay, jitter, packet loss and reliability. MPLS is an efficient encapsulation mechanism which uses labels appended to packets for transport of data. A router supporting MPLS is a label switched router. An edge node is an LSR connected to a non- LSR. An ingress LSR is the one by which a packet enters the MPLS network, an egress LSR is one by which a packet leaves the MPLS network. Labels are small identifiers placed in the traffic. They are inserted by the ingress LSR, and ultimately removed by the egress LSR. As traffic transits the MPLS network, label tables are consulted in each MPLS device. These are known as the Label Information Base or LIB. By looking up the inbound interface and the label in the LIB, the outbound interface and label are determined. The LSR can then substitute the outbound label for the incoming and forward the frame . The labels are locally significant only, meaning that the label is only useful and relevant on a single link , between adjacent LSRs. The adjacent LSR label tables however should end up forming a path through small or all of the MPLS network, a label switched path (LSP), so that when a label is applied, traffic transits multiple LSRs. If traffic is found to have no label, a routing lookup is done and possibly a new label applied.

MPLS [10] works by prefixing packets with an MPLS header, containing one or more labels. This is called a label stack. Contains four fields:

• A 20 bit label value.
• A 3-bit Traffic class field for QOS priority (experimental) and ECN (Explicit Congestion Notification)
• A 1 bit bottom of stack flag. If this is set, it signifies that the current label is the last in the stack.
• An 8 bit TTL (Time to Live) field.

ISSN: 2248-9622 www.ijera.com
Vol. 2, Issue 3, May-Jun 2012, pp. 381-384

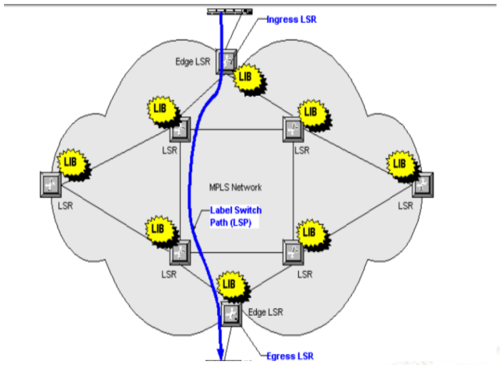

Fig. MPLS Network

These MPLS labeled packets are switched after a label lookup/switch instead of a lookup into the IP table. Labels are distributed between LER's and LSR's using the Label Distribution Protocol (LDP). LSR's in an MPLS network regularly exchange label and reach ability information with each other using standardized procedures in order to build a complete picture of the network they can then use to forward packets. When an unlabeled packet enters the ingress router and needs to be passed on to an MPLS tunnel, the router first determines the forwarding equivalence class (FEC) the packet should be in and then inserts one or more labels in the packet's newly created MPLS header. The packet is then passed onto the next hop router for this tunnel. When a labelled packet is received by an MPLS Router , the topmost label is examined .

Based on the contents of the Label a swap, push or pop operation can be performed on the packet's label stack. Routers can have prebuilt lookup tables that tell them which kind of operation to do based on the topmost label of the incoming packet so they can process the packet very quickly.

To ensure end to end QOS guarantees [8],[9], QOS routing protocols usually impose a minimum QOS requirement on the path for data transmission . Restricting the hop count of the path being elected can reduce the resource consumption while selecting the least loaded path can balance the network load. There exist many QOS routing protocols in MPLS networks. All of them can find an optimal path by using their path selection algorithms.

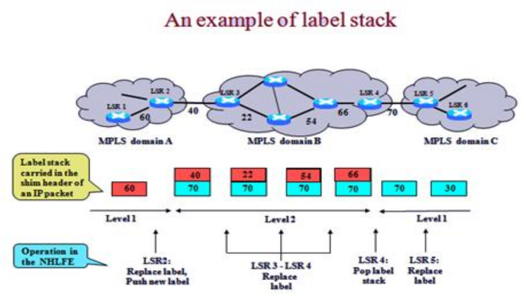

Fig 2 MPLS Label Stack

In this paper we focus on both `bandwidth and delay constraints. It means that the delay of the path which is computed by the algorithm is less than or equal to the delay constraint value and the residual bandwidth of all the links along the computed path must be equal to or greater than the bandwidth constraint value. The proposed MPLS Routing algorithm called New QOS Routing Algorithm for MPLS Networks Using Delay and Bandwidth constraints present performance improvement based on CPU Time, path length, call back ratio and maximum flow.

II. IMPLEMENTATION

Packetizing data from source, sent to ingress LER.

- Ingress LER then adds 20 bit shim header to the packets received.
- 20 bit shim header along with the packet is sent over a label switched path.
- To perform the function of label switching LSR are responsible.
- LSR will decide the forward and the backward path of a packet i.e. if the path is free or with less traffic it will use the path. But if there is a failure in path then the label is either moved to its backward, LSR or may be to LER, or it is retransmitted.
- Label is forwarded to an egress LER, where MPLS shim header is removed and IP header is retained and forwarded to its destination.

PROPOSED ALGORITHM

This section presents a New QOS Routing Algorithm for MPLS Networks Using Bandwidth and Delay as constraints. To explain proposed algorithm consider a network with n nodes (routers) . To setup the paths a subset of these routers is considered to be the ingress-egress routers. A path setup request arrives at the ingress router in which an explicit route for the request is computed locally. The ingress router set up the path to the egress and reserves resources on each link along the

ISSN: 2248-9622 www.ijera.com
Vol. 2, Issue 3, May-Jun 2012, pp. 381-384

path. For computation of explicit route, ingress router requires knowing current network topology, links reserved bandwidth and minimum delay which we are assuming to be known. Our optimization goal is as follows: to determine a feasible path for each request which satisfies the constraints of bandwidth and delay and performs better in terms of call blocking ratio, path length, CPU time and maximum flow [3].

III Designing Objectives

- Minimize interference levels among source- destination node pairs, in order to reserve more resource for future bandwidth demands.
- Balancing traffic loads through underutilized paths in order to reduce network congestion.
- Optimize the network resource utilization using Dijkstra's algorithm.
- Reduce algorithm complexity.

Calculation of Critical links

C(j)=Total demands per link/ Length of all possible connections (1)

From (1), critical links directly depends on the value of total demands per link. Higher value of criticality means that numbers of future requests are possible through these ingress-egress routers. So, avoid critical links with higher values to reduce network congestion. It also satisfies the first objective to minimize interference levels among source-destination node pairs.

Calculation of Link Weight

Here weight of link j could be determined by:
W(j)=C(l)/Residual bandwidth of the link (2)
From (2), Weight of the link is directly proportional to critical links and hence higher the value of criticality, higher will be the weight of that particular link (j). Also, it is inversely proportional to the Residual bandwidth, so when residual bandwidth is less, weight of the link will be more. So in the proposed algorithm ,we are avoiding the link with more weight, so as to balance loads through under utilized paths.

Calculation of path

The weight of path belonging to source destination node pair {S,D} is obtained by (3)
W{S,D}= ΣW(j) where {j€ L{S,D}} (4)
This path weight is used to route LSP from ingress node S to egress node D. The constraint is to avoid the path with more path weight. However, if there are many result paths with the same minimum path weight, the algorithm would pick a shortest path between those result paths in order to reserve network bandwidth.

Algorithm steps

The algorithm steps are shown below:

Bandwidth and Delay Guaranted Algorithm

1) compute c(j) i.e. the critical links according to the formula(1)
2) compute weight of link according to the formula.(2)
3) Use Minimum Interface Routing Algorithm to obtain the path with minimum path weight W{S,D}.
4) Prune the path to select the best path as follows. Suppose(j,k) is the link between thee node j and k
(i) if Bandwidth (j,k)< bandwidth constraint then delete the path containing link (j,k)
(ii) if delay(j,k)>delay constraint then delete paths containing link(j,k).
5) use Djikstra's Algorithm to obtain the short test path among the path selected.
6) Establish the best path with requested Bandwidth and delay constraints.
7) If no path selected the algorithm fails.

IV PERFORMANCE EVALUATION

There are 4 measured parameters to test the performance of algorithms, i.e , call back ratio, mean length, maximum flow and CPU calculation time. These parameters can be obtained from(5) to (8). MPLS Routing algorithm must have low call blocking ratio, less mean path length, high maximum flow and low CPU calculation time

$$Call\ back\ Ratio = \frac{Number\ of\ requests\ rejected}{Total\ number\ of\ requests} \quad (5)$$

$$Mean\ Length = \frac{Total\ number\ of\ links}{Total\ number\ of\ requests - Number\ of\ requests\ rejected} \quad (6)$$

$$Maximum\ Flow = mean\ (available\ bandwidth) \quad (7)$$

$$CPU\ Time = Total\ Simulation\ Time \quad (8)$$

V. CONCLUSION

In this paper, we have proposed a new QOS Routing algorithm for MPLS networks, using Bandwidth and delay as constraints. Paths are selected based on critical links so as to minimize interference with the future requests.

REFERENCES

[1] Antonio Capone, Luigi Fratta, Fabio Martigon, " Dynamic online QOS Routing schemes: Performance and bounds, Article in press, Science Direct, Computer Networks (2005)

[2] Koushik Kar, Murali Kodialam, T. V. Lakshman, "Minimum Interference Routing of Bandwidth Guaranteed Tunnels with MPLS Traffic Engineering Applications", IEEE Journal On Selected Areas In Communications, VOL. 18, No. 12, December 2000.

[3] Alidadi A., Mahdavi M., Hashmi M.R., "A New Low- Complexity QOS Routing Algorithm for MPLS Traffic Engineering", Proceedings of the 2009 IEEE 9th Malaysia International Conference on Communications 15-17 December 2009 Kuala Lumpur Malaysia, Pg 205-210.

[4] M. Kodialam, T.V. Lakshman, Minimum Interference Routing with applications to MPLS traffic engineering, IEEE INFOCOM 2000, March 2000

[5] Kotti, A. Hamza, R. Bouleimen, K,"Bandwidth Constrained Routing Algorithm for MPLS Traffic Engineering", Networking and Services, ICNS, Third International Conference on, 19-25 June 2007

[6] Gopalan, K, and Chiueh, T.C. and Lin, Y.J, "Load balancing routing with bandwidth- delay guarantees", IEEE Commiuiicurionr Magazine, Vol 42, pp 108-113, June 2004.

[7] Piyaporn Krachodnok, "Constrained Based Routing with Maximize Residual Bandwidth and Link Capacity- Minimize Total Flows Routing Algorithm for MPLS Networks, IEEE, ICICS 2005, Pg 1509-1513.

[8] S. Chen, K.Nahrstedt, "An overview of quality of service routing for the next generation high speed networks: problems and solutions, IEEE Network 12 (6)(1988) 64-79.

[9] Bin Wang, Xu Su, C.L.P Chen, A new bandwidth guaranteed routing algorithm for MPLS traffic Engineering, in: IEEE International Conference on Communications, ICC 2002, vol 2 , 2002, pp 1001-1005