MPLS-BGP based LSP setup techniques

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Abstract

Internet routing is based on a distributed system composed of many routers, grouped into management domains called Autonomous Systems (ASes). Routing information is exchanged between ASes using Border Gateway Protocol. When BGP is used to distribute a particular route, it can be also be used to distribute an MPLS label which is mapped to that route. In this paper the comparison of conventional BGP and MPLS based BGP has been done for different network topology with and without the application of Route Reflectors(RR).

1 Introduction

Internet routing is based on a distributed system composed of many routers, grouped into management domains called Autonomous Systems (ASes). Routing information is exchanged between ASes using Border Gateway Protocol. Generally MPLS techniques uses different signaling protocols such as LDP, CR-LDP, RSVP and BGPs for LSP setup. Initially BGP protocol was used for route distribution in MPLS techniques. Now the traditional BGP protocol [1] is not only used for route distribution but also for LSP setup in the Internet. The BGP-4-Extension protocol has label assignment capability as explained in [2]. This paper shows the comparision of different MPLS-BGP based LSP setup techniques based on BGP abstract model [3], with the application of Route Reflector(RR) [4] .

2 MPLS-BGP based LSP setup techniques

MPLS-BGP techniques have the ability to distribute the label along with the route of a given destination, which is selected by conventional BGP route selection techniques. The labeled route is called the LSP (label switching path). Route distribution and label distribution in MPLS network is upstream, in that, nodes neighbouring the destination will compute the best route by the conventional BGP method and assign a label by MPLS-BGP method, then this labeled route is exported to their neighbouring nodes. These nodes will in-return compute the labeled routes with the same procedure and export to their neighbours. In this way whole network will have the best routes along with the labels to the destination. Every node will have the decision making capability to advertise a new route and also to withdraw an advertised route from the neighbouring nodes during link failure and node failure conditions. Also every node will have the capability to update its LIB (Label Information Base) table.

Assuming a MPLS-BGP network containing N nodes, of which every node v_i maintains the label information table (LIB), which contains an in coming and out going labels of the corresponding best path. Each of the nodes v_i defines path attributes and a label for a route originating from j and destined to neighbouring ASs. MPLS-BGP label distribution schemes has been described in [5] for the following three different cases: 1). MPLS-BGP label distribution without route reflectors, 2). MPLS-BGP label distribution with route reflectors, and 3). MPLS-BGP label distribution with multiple route advertisements.

An algorithm for the node convergence time and network convergence time of conventional BGP and for all the MPLS-BGP label distribution schemes has been considered in [5]. For all the cases the node processing time has not been considered. The node convergence time is calculated at all the BGP speakers and the network as a whole. A BGP update message received by a node is compared with the previously existing routing Update. If they happen to be same then the BGP assumes that the node is stabilized and hence terminates the timer which helps in calculating the convergence time at that node. Convergence time [5][6] of the network is calculated when all the BGP speakers have stabilized. The simulation manager runs a timer and when all the nodes are stabilized, network convergence time is noted.

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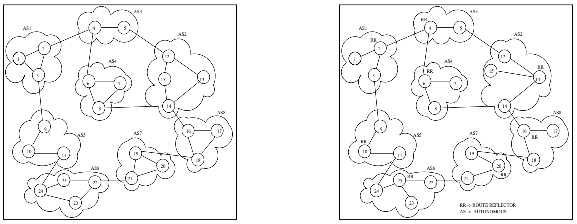

(a) (b)

Figure 1: Network model for simulation (a). 1 and 3, (b). 2 and 4.

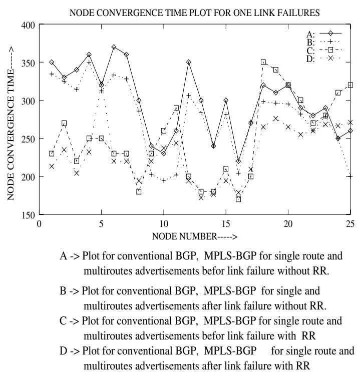

Figure 2: Node convergence time for simulation 1 and 2

3 Simulation and results

The simulation is carried out using the BGP abstract model. The simulation was done by using up to 25 nodes because of complexity involved in implementing myriads of policies in each of these nodes. In practice, many AS consist of dozens and even hundreds of internal and border routers. These routers exchange NLRI within their AS using protocols like IBGP with configuration like route reflectors. We includes results for conventional BGP and all the cases of MPLS-BGP label distribution schemes explained previously. Simulation consisted of two parts: simulating using conventional BGP and then simulating using MPLS-BGP label distribution schemes. During simulation the nodes processes all messages (route announcements and withdrawals) in sequence. Hence the delay characteristics of a node, in finding the best route to a destination, in our model is an over-estimation. In both cases we presents the convergence time with respect to node numbers of the network.

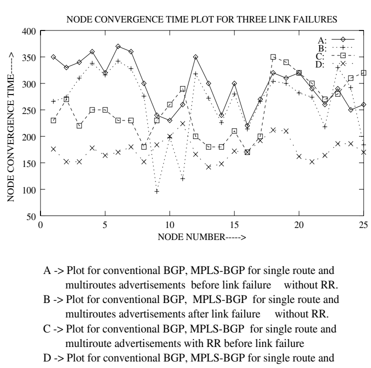

Figure 3: Node convergence time for simulation 1 and 2

Assumptions: 1). All the nodes are MPLS-BGP speakers, 2). Link delays are same (10 times units), 3). Processing time for both the cases at every node is constant, so it is neglected in calculations. We consider four different simulations for node convergence analysis. For simulation 1, the figure 2 shows the node convergence time plot for single link failures of the network topology without route reflectors, figure 1(a). In simulation 2, the same figure 1 shows the node convergence time plot for single link failures of the network topology with route reflectors, figure 1(b). We have taken 60 experiments for simulation 1 and 2 and finally average node convergence time has been calculated. In simulation 3 and 4, the figure 3 shows the node convergence time plot for three link failures for the same network topology. We have taken the average node convergence time of simulation 3 and 4 for 25 experiments by taking three different link failure of every experiments.

4 Conclusion

The simulation explains the convergence time for all the cases of MPLS-BGP label distribution scheme. The convergence time differs according to the type of network. As shown in the plot, the node convergence time of MPLS-BGP without and with route reflectors are different. The convergence time depends on the number of connections in the network. The network which uses route reflectors has less number of connections as compared to network without route reflectors. So the convergence time of the network with route reflectors is lesser than the network without route reflectors, as shown in the plot. The application of the route reflector in the network reduces the convergence time.

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