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Approaches to Avoid Routing Disruptions with BGP in Autonomous System

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ABSTRACT: BGP is one of the most important protocols of the Internet, is a standard exterior gateway protocol to exchange routing information between different Autonomous Systems. BGP is having the techniques to avoid looping problems in Traffic Engineering. This loop free mechanism can only be implemented with the Full mesh connectivity, in which all routers must be connected to every other router. However, Full mesh connectivity is not an appropriate solution particularly in large networks where resources are limited. Two approaches were introduced in this paper as alternates to full connectivity topology in IPv4, those are Confederation and Route Reflector. In this paper, the performances of two methods were discussed In GNS3 software based on the CPU utilization and runtime to compute load average and these results were plotted in graph. Based on these results conclusions were derived, which methodology is preferable based on traffic circumstances.

KEYWORDS: BGP, IPv4, Runtime, CPU, GNS3 software.

I. INTRODUCTION

The Internet, initially developed as an interconnection of small number of networks has become essential in globe with advancements like Broadcast services, faster communication, IPTV etc. Routers the backbone components in the Internet works based on the different Routing protocols which guarantee communication between different networks [1]. A routing table is the memory of router that keeps track of the routing information. The techniques which are using in the routing process are compared with the help of convergence comparison [2]. BGP is the protocol which is used to interconnect different autonomous systems is the key in Internet world. The importance of BGP is clear and operates in robust state and many of its behaviors are essential in Internet connectivity [3]. IPv4 address allocation of BGP on the routers for their identification on Internet will affects the BGP table growth, and the address policies have better controlled with BGP table growth [4]. The routers which are directly connected in BGP for the traffic transmission between autonomous systems are peer routers. The optimal path selection between routers which are peers is with the help of optimal path selection [5]. There will be link failures between routers which are caused by the disruptions in networks like Looping, link failures occur [6]. The disruptions will be eliminated by the technique of the full mesh connectivity, this cause scalability increases different type of failures [7]. This link failure problems increases poor convergence behaviour problems cause end-to-end packet loss in Internet paths [8]. In this paper we proposed two methods as alternatives to full mesh connectivity, and also compare the performances of two methods.

II. RELATED WORK

The looping problem in networks is caused when the same information is received by the router from two source routers. This problem occurs in the second updating process of routing information exchange between routers. From the methods of avoiding routing disruptions by using Local preference and metric attributes is not scalable solution because configuration should be done at every router [9]. The looping problem is clearly explained with the help of the following Figure 1.

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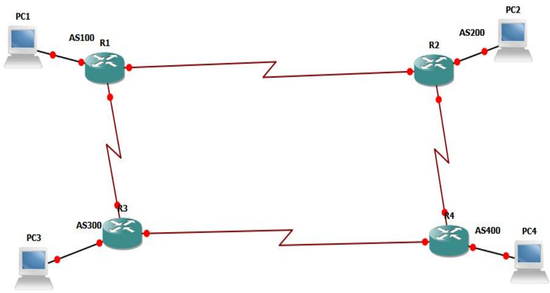

Figure 1. Looping problem in Routing process

In the first updating process peering routers will exchange information with each other about their direct connected network information. In the first updating message router 4 has no knowledge about the networks connected to router 1. This information will be known with the help of peer routers which have knowledge about AS100, in the second updated message. In above network router 4 will receives the same message from router 2 and router 3 this will causes looping problem. This problem however, reduced with the help of full mesh connectivity in which all routers will exchange about all networks only in single update message. Here there is no need of second update in the case of full mesh connected networks. But this full mesh connectivity requires more resources, this leads more resources to be used in the network connectivity. This is not an appropriate solution where there is more resource utilization increases link cost which is not economical.

III. APPROACHES TO AVOID LOOPING PROBLEM

The approaches which are introduced in this paper eliminate the problem of looping, without need of the full mesh connectivity. The first mechanism is BGP Confederation and the second one is BGP Route Reflectors. In both approaches there will be limited link cost in network connectivity.

A. *CONFEDERATION:*

The implementation of Confederation reduces the full mesh inside the Autonomous Systems by dividing single AS into multiple ASs and considering the whole group as single Confederation. Each confederated AS will have the full meshed and will have connections to other ASs inside the main confederation. Even though these ASs will have external peers to exchange information between ASs in Confederation, this will be treated as if the information is exchanging between Internal peers. In this way the confederation is preserving the metric and local preference as it is seen as single AS to the outside world. Even though routers in the sub ASs will have full connectivity for the information exchange the overall link cost has been reduced effectively. CPU power will be utilized by the routers for packet transmission and routing information exchange. This utilization will vary for different time intervals based on the task performed by the router. The runtime to compute the load average is also a performance parameter and it decides how fast routing information is exchanged between routers. The lower run time values indicate the fast convergence behavior of the network which gives the better performance.

B. *ROUTE REFLECTOR:*

The routing protocols utilize the CPU power in the routers for calculating the shortest path for the packet transmission to the other routers [8]. It is an alternative to the full mesh connectivity in the single AS by keeping one router is selected as Route Reflector, all other routers will be connected to RR. In the first update message the RR will exchange the network information with all other routers in the Autonomous System. After the first update Route Reflector will convey the topology information to the all network information to all other routers in the second update message. Here in the Route Reflector approach the information about known networks is known with the help of only one router to all other routers in the second updated message. The looping problem is completely eliminated with the help of RR without going for full mesh connectivity as an alternate. This Route Reflector will utilize CPU power to exchange the routing information between peering routers and also for routing updates. In the single update all Information is to be exchanged to all routers from the RR will uses more CPU utilization in the process of exchanging routing information. The delay is low in the packet transmission with the help of RR since, it is not taking more than two update messages to exchange all the information available. The run time to compute the load average is the performance parameter in RR which decides how fast the routing information is exchanged to all routers.

IV. EXPERIMENTAL ANALYSIS

The experiments were carried in the Graphic Network Simulator (GNS3) software which is used to simulate the routers in the virtual environment, also to configure routers with various routing protocols. The CPU power utilization, run time computation all can be verified with the help of GNS3 software. In this paper experiments were carried for two different approaches as follows in this section.

A. *PERFORMANCE OF CONFEDERATION:*

The topology is created using GNS3 emulation software based on BGP routing protocol environment in IPv6. The routers which were taken in the simulation were the CISCO priority routers of the series c7200 which supports all dynamic routing protocols in real environment. The interfaces used to connect the routers are the WAN links have the capacity 1.544Mbps to transfer the routing information between them. The confederation process is shown in the below Figure 2.

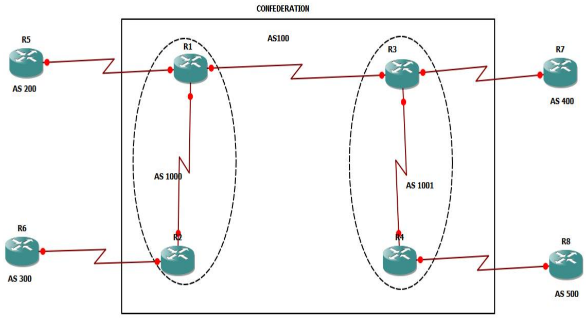

Figure 2. Confederation of Autonomous System 100

The Autonomous System is considered for confederation is AS100, and four routers were considered which are connected to external ASs through eBGP peers. Here the full mesh connectivity in AS100 is eliminated with the process of Confederation, by dividing AS into two Sub Autonomous Systems. The router 1 and router 2 were confederated as AS1000, and router 3 and router 4 were confederated as AS1001. In this sub AS the routers were connected each other with the help of WAN link. The performance of confederation is in terms of two parameters. The run time to compute the load average is the value which is time the network is taking for routing information exchange and is 336ms in the following network. The CPU power utilization is to be known in the router for different time intervals for the default OSPF timer values. The percentage of CPU Utilization is more when the initialization process is going on the routers. These values are taken in the screen shot of the processes of routers is shown in the Figure 3 below. When CPU percentage utilization reaches more than 5% then it is represented with the mark in the process. From the below Figure 2, it is noted that the maximum CPU power utilization is 8%.

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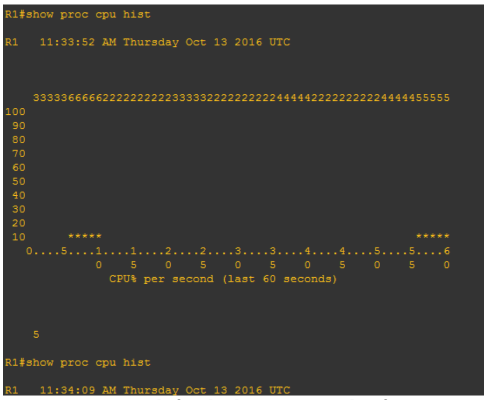

Figure 3. CPU graph for the last 60 seconds of router 1

B. ***PERFORMANCE OF ROUTE REFLECTOR:***

The Route Reflector approach is simulated using the GNS3 software and the performance analysis is monitored. The routers which are used here belong to series c7200 which are verified for different processes like packet transmission. The technique of route reflector in the AS100, has four routers for information exchange which are connected to the external BGP peers as shown in the Figure 4.

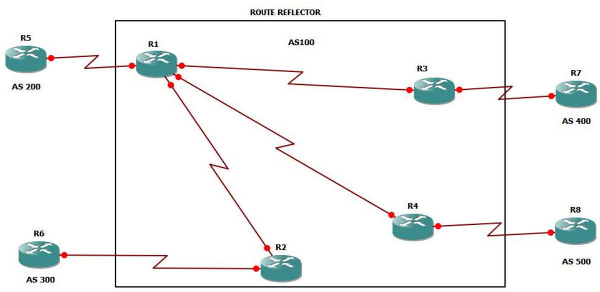

Figure 4.Route Reflector approach for AS100

The router R1 is taken as the Route Reflector in AS100 which is connected to all other routers in the AS to exchange the routing information. In the first update all network information known by the routers in AS100 will be known to the router R1. In the second update this R1 will convey the network information to all other routers in AS100. In this way Route Reflector eliminates the full mesh connectivity. All the routers considered here which connects to external BGP peers. This Route reflector will only take two updates to exchange the routing information hence its run time is low. The run time to compute the load average in the RR is 224ms. The CPU power utilization is to be known in the router for different time intervals for the default OSPF timer values. The percentage of CPU Utilization is more when the initialization process is going on the routers. These values are taken in the screen shot of the processes of routers is shown in the Figure 3 below. When CPU percentage utilization reaches more than 5% then it is represented with the mark in the process. The maximum CPU power utilization is 6% from the below Figure 5.

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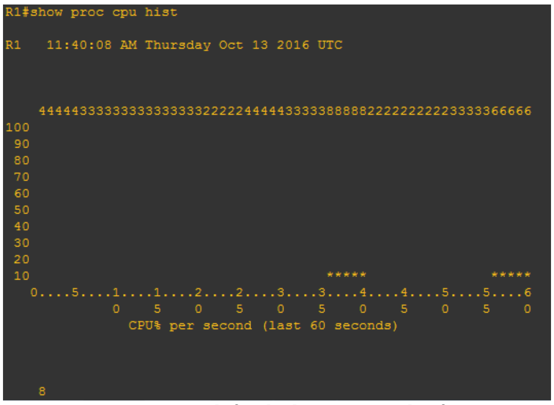

Figure 5. CPU graph for the last 60 seconds of router

V. SIMULATION AND RESULTS

On comparing the results the Run time, and CPU power utilizations are varying for different approaches used in the BGP configurations. Here we have used two techniques to avoid looping problems in the BGP practices, each having the better performance in respective parameters. The Route Reflector is taking the minimum time to compute the load average value which is 224ms, on the other hand the Confederation technique is taking the more value which is 336ms. These values of the run times for the two approaches are given in the tabular form in Table 1.

BGP TECHNIQUE	Rum time
Confederation	336
Route Reflector	224

Table 1. Run time comparison for two BGP approaches

The CPU utilization is plotted in graph for Confederation and Route Reflector approaches for different time intervals. The Route Reflector is connected to all other routes in the AS and also needs to send the routing information to all other routers hence it is taking more CPU power. The maximum CPU power is taken by the Route Reflector is indicated in graph which is 8%. Confederation is taking the less CPU utilization than the RR which is 6% from the figure 6.

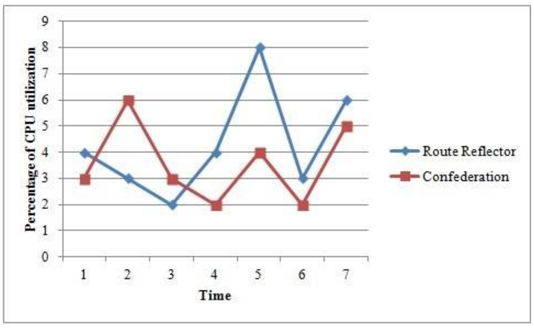

Figure 6. Comparison between CPU utilizations for two BGP approaches

VI. CONCLUSION AND FUTURE WORK

The aim of this paper is proposing approaches to avoid looping problem, without going for the full mesh connectivity. The two approaches which are discussed in this paper are Confederation and Route Reflector. The performance of the two techniques is analyzed based on two parameters Run time and CPU power utilization. The results of the approaches were tabulated and also plotted in the graph. These approaches were verified in GNS3 software with routers connected with both Ethernet and WAN interfaces. According to the experimental results Confederation is giving the better performance over RR in terms of CPU power utilization, so it is better using

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confederation technique where less CPU resources are available. Route Reflector takes less Run time when compared with the Confederation there by increasing routing table update speed, hence Confederation is suitable in applications where less updating time between routers is needed. However BGP configuration with different approaches requires lot of knowledge on specific networks and also requires network management practice. This paper gives some detail about approaches to be used to avoid looping problems, and this is a wide research area that has just started exploring.

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