

RESEARCH PAPER

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THE AMAZING DUAL ROLE PLAYER - BIGP

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Abstract: The protocols EGP and IGP are the two key components of the present internet infrastructure. In a domain, routers forward IP packet within and between domains. Each domain uses an intra-domain routing protocol known as Interior Gateway Protocol (IGP) like IS-IS, OSPF, RIP etc to populate the routing tables of its routers. Between domains routing information must also be exchanged to ensure that a host in one domain can reach another host in remote domain. The inter-domain routing protocol performing this is called Exterior Gateway Protocol (EGP). Basically EGP used nowadays is Border Gateway Protocol (BGP). The fundamental difference between the two is that BGP has smaller convergence as compared to the IGP's. On the other hand IGP has lesser scalability as compared to BGP. So through this paper there is a proposal to create a new protocol which can act as an IGP (when we consider inter-domain transfer of traffic) and also can act as BGP (when we consider intra-domain transfer of traffic).

Keywords: Interior Gateway Protocol (IGP), Exterior Gateway Protocol (EGP), Border Gateway Protocol (BGP), routing tables.

INTRODUCTION

In computer networking, routing basically involves two activities: determination of optimal routing paths and the transport of packets through an internetwork. Through an internetwork the transport of packets is relatively straightforward. On the other hand, path determination can be very complex. Border Gateway Protocol (BGP) is one protocol that addresses the task of path determination in today's networks. It performs inter-domain routing in Transmission Control Protocol/Internet Protocol (TCP/IP) networks. BGP is an exterior gateway protocol (EGP) that is it performs routing between multiple autonomous systems or domains and exchanges routing and reachability information with other BGP systems. BGP was developed to replace its predecessor the Exterior Gateway Protocol (EGP). It is the standard exterior gateway-routing protocol used in the global Internet. BGP solves serious problems with EGP and more efficiently scales the Internet growth [5,13].

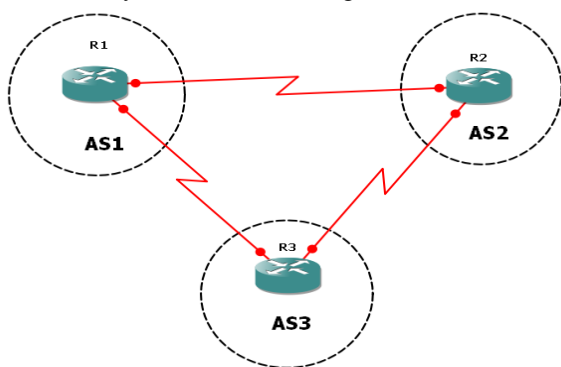


Figure 1: A BGP topology

The above figure shows a simple BGP topology which consists of three autonomous systems which are linked together using serial cables. The core routers R1, R2 and R3 are of the autonomous system AS1, AS2 and AS3 respectively. The primary function of a BGP system is to exchange network-reachability information, including

information about the list of autonomous system paths, with other BGP systems. Each BGP router maintains a routing table which lists all feasible paths to a particular network. However the router does not refresh the routing table. The routing information received from the peer routers is retained until an incremental update is received [3,4,6].

Interior gateway protocols (IGP) are the protocols which are used to route the data in an autonomous system [11,12]. Three main branches of routing protocol algorithms exist for IGP routing protocol that are Distance vector, Link-state and Balanced hybrid. RIP was first popularly used IP distance vector protocol. Interior Gateway Routing Protocol (IGRP) introduced a little later. Because of their slow convergence and other problems Link-state protocols in particular OSPF and integrated IS-IS solved the main issue with distance vector protocols [8, 11].

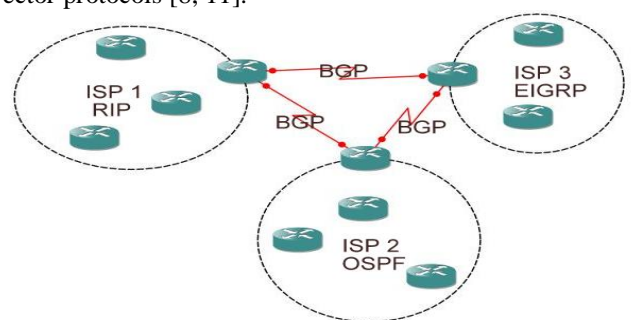


Figure 2: Comparing Locations used for implementing IGPs and EGPs.

The above figure shows three different ISPs which are treated as three autonomous systems. Different IGPs are used to communicate intra-ISP. ISP1, ISP2 and ISP3 are using RIP, OSPF and EIGRP protocols respectively. BGP is used for inter-ISP communication.

HEADER OF BIGP

BIGP has been developed for inter and intra autonomous system interaction. Each packet will have a header which is shown in figure given below.

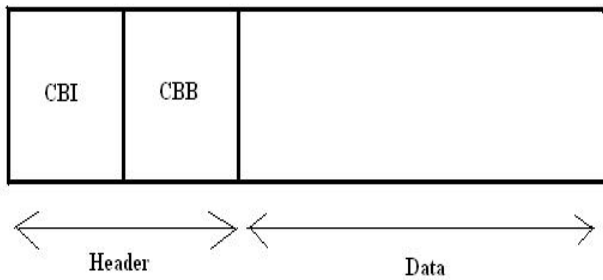


Figure 3: BIGP header

We can see that we have two fields in the header. They are CBI (CARE BIT FOR IGP) and CBB (CARE BIT FOR BGP). When a packet enters a network with a large number of routers, the routing information with each router is more than a limit that an IGP protocol can handle. Then the CBB bit is set to one to turn functionality of BGP ON. Large amount of data can now be handled by this routing protocol. In the case when a packet enters a network where each router has amount of data that can be handled by an IGP protocol, then the CBI bit is set to one to turn it ON and CBB is put to zero. In this way when CBI is one it will indicate that a packet has entered an intra-autonomous communication system and thus BIGP will work as a normal IGP. On the other hand when CBB is one it will indicate that a packet has entered an inter-autonomous communication. At the time of encapsulation this header can be put on packets by a normal or any core router. During this time router will also ON the required care bit according to information given by its own as well its neighbor routers table.

CONVERGENCE OF BIGP

Convergence is a very important issue when we talk of BGPs. This means that convergence rate of BGPs is slow. On the other hand all the IGPs such as OSPF have a faster convergence. If we are going to make convergence faster for inter-autonomous system this will make our system very unstable. Each update if flooded the way it is done in IGPs, this will lead to crash the main backbone of our present day internet [9,17]. In BIGP we have a solution to this problem that is we have two sets of algorithms i.e. Algorithm1 and Alogithm2. Algorithms basically deal with setting up path of data flow and transfer of packets. That’s why they play a very important role in handling convergence of a considered network under. Algorithm1 is used for intra-autonomous transfer of data and it is similar to Dijkstra shortest path first (SPF) algorithm. This calculates the current best routes and adds those to the routing TABLE A and will provide all functionalities of an algorithm used in various IGPs for path detection as well as transfer of data. Algorithm2 is used for inter-autonomous transfer of data and is similar to Best path algorithm which assigns the first valid path as the current best path and then compares the best path with the next path in the list until BIGP reaches the end of the list of valid paths. Routing TABLE B stores all this data. The rules that are used to determine the best path are same as Best path algorithm used in BGP router.

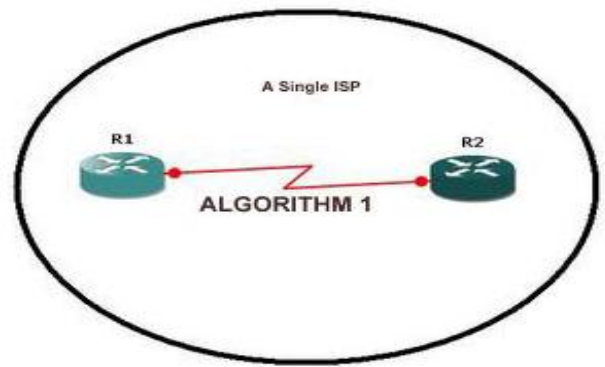


Figure 4: Intra-autonomous interaction using BIGP

When a router receives a packet having a BIGP header it checks its care bits. If CBI is ON then as shown in the above figure router will enable its ALGORITHM1 mode so that the convergence becomes faster. And all the information will be stored in routing TABLE A of the router (explained later). The network will converge faster [2]. After every 30-60 sec timely updates will be sent to the neighbors.

Router switches to ALGORITHM2 mode when CBB bit is ON. This makes convergence slower. The network now does not send updates at every regular interval and routing TABLE B is filled. In this router need not worry about routing TABLE A’s entries.

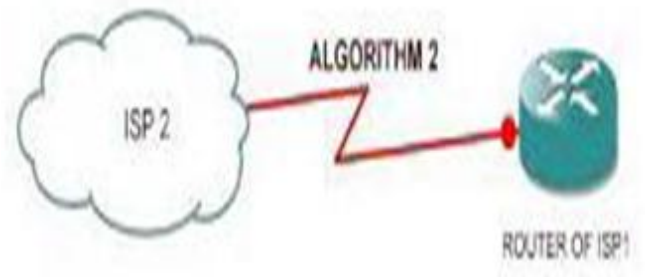


Figure 5: Inter-autonomous interaction using BIGP

SCALABILITY OF BIGP

There is a problem with IGPs that is it is difficult to scale them whenever there is an interaction with a larger network with a large number of routers in a network. But this problem is corrected in BGP by two ways i.e. confederations and route reflectors [7]. But we are going to follow a different technique in BIGP. Instead of having autonomous numbers for each autonomous system, different domain numbers in case EIGRP and OSPF, we have a single number system known as ASN for dividing inter and intra both areas of autonomous systems[10,16]. Based on complexity of the network there would be a specific number range. While configuring a router we must know that if our network wants faster convergence those networks should be given a lower range of ASN. If our requirement is of lower convergence then a larger range of ASN will be given. When we receive a packet in a particular network we will check its ASN number present in its BIGP header first. If ASN number is large then there is a need of making BIGP more scalable [16]. But we can still utilize the concepts of confederations and route reflectors side by side with the use of ASNs. This will make it easy to use a single protocol that can be used universally in the internet system.

ROUTING TABLES OF BIGP

The router will make entry to routing TABLE A or routing TABLE B depending on whether CBB or CBI is in ON state as per the earlier discussion. But we are discussing here what exactly these routing tables contain [14].

Routing Table A:

Whenever a router receives the packet having CBI bit ON, router shifts all its CPU processing for filling this table. The basic aim is to fill entries in such a way that it makes the convergence of the network faster. The neighbor relationships are made at faster rate and timely hello packets are exchanged between the routers which have enabled ALGORITHM1 mode of BIGP. So basically in this we will have the complete information of all the neighboring routers those are in neighbor relationship with the current router. It will also have the information of the DR (designated router) and BDR (backup designated router) when elections take place in case of non- broadcasting medium. It also contains data of entire network which is in its reach. If our network is attached to a network using some other protocol except BIGP then a boundary router needs to be made as an ASBR. This information is also present in this table. If we have configured a smaller network as a stub or a total stub then this information should also be stored in this table. So all information about networks (ASN number in the packet headers) having smaller ASN values are stored in this table. This table is same as of the routing table of an IGP routing protocol [19].

Routing Table B:

Whenever a router receives a packet having CBB bit ON it commands its processor to fill this table. All routers who enable ALGORITHM2 mode of BIGP fill this table. It happens in networks where we have smaller convergence requirement. If in a network we have smaller convergence requirements we have larger ASNs. So basically here we store ASN (generally ASNs here have large values) values of all neighboring routers. In such case all the paths, to reach a particular router, are calculated and stored [1,20]. The intermediate neighbor cannot exchange the information of its other two connected neighbors in between them here. For this case the other two have to be made the neighbors. So in this table all the information related to this has to be stored. We can say that this table is similar to routing table of a BGP routing protocol.

WORKING OF THIS NEW PROTOCOL (EXAMPLE)

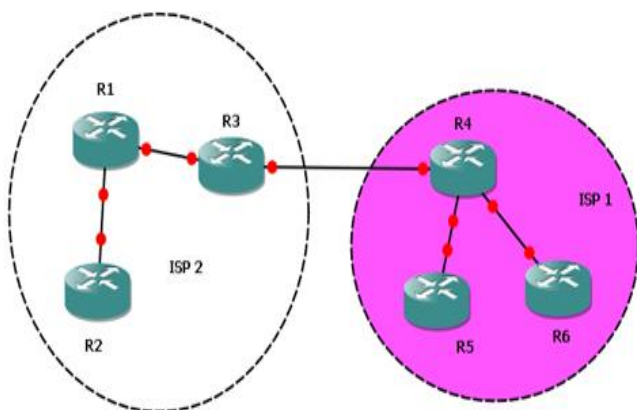


Figure 6: A Simple Network

In the above figure we can see a simple network where we have both inter (between R3 and R4) and intra (say between R2 and R3). Suppose we need to transfer data between R3 and R4. Router R3 will send its hello packet to all its neighbors and from this it will come to know about the type of network. Since here inter-autonomous transfer of data is required R3 will set an ASN number in the BIGP header which will be selected from a larger range of ASN numbers. This ASN number will let the routers receive the packets from is required. It will prepare other routers in ISP 1 and ISP 2 for inter-autonomous interactions. It will also send data packets to R4 in which BIGP header will have CBB field set to one, so that BGP type of data flow can take place. Now suppose we want to send data between R2 and R3. R2 will send hello packets to all its neighbors and from this it will come to know about type of network. Since here intra-autonomous transfer of data is required R2 will set an ASN number that is selected from smaller range of ASN numbers. This ASN number will let the routers receiving packets from R2 know that the network in which data is transferred is small. This will prepare other routers within ISP 2 for intra-autonomous interactions. It will also send packets to R3 via R1 having BIGP header in which CBI field is set to one, so that IGP type of data flow can take place.

CONCLUSION AND FUTURE PROSPECTUS

Nowadays in internet we use different routing protocols for configuring different networks across the globe. BIGP protocol can solve this problem. Using it we need to configure just a single routing protocol. This makes a bridge between IGP and BGP routing protocols. This can save our cost of setup and can increase the efficiency as well as [13,18]. We can also save time as we need not redistribute the packets for making data flow possible between two different routing protocols. So now we don't have to separately configure IGP and BGP because both can be configured by configuring a single BIGP protocol. Care of scalability and convergence will be done automatically. So we can say BIGP will lead to faster network setup. There are some limitations involved with using this kind of a protocol.

It will take lots of time and effort to completely remove the concept of using different routing protocols for different types of network that are in use these days and introducing a new concept of using a single routing protocol all over the internet. Also for new protocol new specifications will need to be formulated regarding wires, routers etc. New IOS supporting this protocol need to be made and uploaded on routers so that BIGP can work on various networks. As we have seen that we have maintained two different tables TABLE A and TABLE B. Both these tables maintain data for IGP and BGP interactions in the network respectively. If we are able to make the data of both these tables interact with each other, then this will increase efficiency of BIGP hundred times. So in future we can try to make possible the interaction between TABLE A and TABLE B. Also there is a need to find more ways on how to make BIGP more scalable for actual implementation in our present day internet. Also our protocol should support both IPV4 and IPV6.

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