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Border Gateway Protocol –A Best Performance Protocol when used for External Routing than Internal Routing

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ABSTRACT

The paper addresses the interoperability issues between Internal Border Gateway Protocol (IBGP) over other Interior Gateway Protocols (IGPs) by knowing the characteristics of the respective protocols and also studies the efficiency of External Border Gateway protocol (EBGP) as an Exterior Gateway Protocol (EGP). Furthermore, it shows how IGRP proves to be inefficient over other IGPs. Comparison of other IGPs and IBGP is made using administrative distance, metric, convergence and many more parameters in order to prove the loopholes in IGRP. The comparison of the distinguishing facts and features of these protocols has been tabulated for the steady reference. Demonstration through diagrams for different network architectures is being made. Description, the interoperability issues between them and the results with the suggestions how to make use of them are been presented. Practical implementation of the presented issues was done and was found that BGP should only be used for exterior routing and not for the interior routing.

Keywords

Interior Gateway Protocols, Exterior Gateway Protocols, External and Internal BGP.

1. INTRODUCTION

BGP (Border Gateway Protocol) is a protocol for exchanging routing information between gateway hosts in a network of autonomous systems [1]. BGP is mainly used between gateway hosts on the Internet [2]. The routing table contains a list of known routers, the addresses they can reach, and a cost metric associated with the path to each router. This is done so that the best path can be chosen. BGP communicates with autonomous system local networks using Internal BGP (IBGP) if any Interior Gateway Protocol (IGP) is not configured [3]. The Interior Gateway Protocols are Routing Information Protocol, Open Shortest Path First, and Enhanced Interior Gateway Routing Protocol which are used for communication between hosts in the same autonomous network [4]. The latest BGP-4 uses classes Inter-domain Routing [5]. In this paper, I have discussed the behavior of BGP when used as an External Border Gateway Protocol (EBGP) and Internal Border Gateway Routing Protocol (IBGP) and I have shown how BGP can be used efficiently as an EBGP and why IBGP should not be preferred over IGP protocols.

This paper is organized as follows: Section II describes the autonomous system. Section III and IV discusses the External Border Gateway protocol and Internal Border Gateway protocol respectively. Section V derives the shortcomings of IBGP over the other IGPs. The conclusion and analytical assessment is built in the section VI and VII.

1.1 Autonomous System (AS)

An autonomous system is one network or sets of networks under a single administrative control. This may contain a set of computers [6]. A good example will be a set of computers in the company or in the college which have the same administrator control.

2. BORDER GATEWAY PROTOCOL

Here the routing table contains a list of known routers, the addresses they can reach, and a cost metric associated with the path to each router so that the best available route is chosen.

2.1 External Border Gateway Protocol (EBGP)

The main function of EBGP is to make communication possible between to two gateway hosts routers i.e. between two different autonomous system (AS) [7]. BGP is configured on both the edge gateway routers of two different autonomous system.

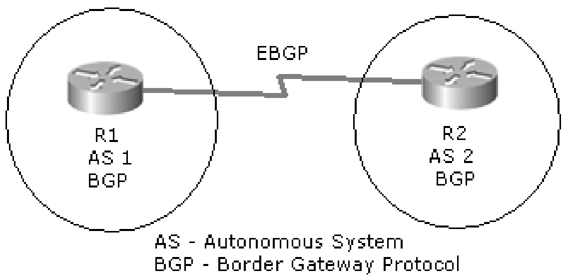

Fig 1 : BGP working as an External BGP between two edge routers of different autonomous system

The edge routers of the two autonomous systems are communicating via EBGP. BGP when used as an EBGP it has a major advantage of having very efficient administrative distance i.e. 20.

Administrative distance (AD) is the first criterion that a router uses to determine which routing protocol to use if two protocols provide route information for the same destination i.e. it helps in taking decision as in which path to select the best path [8]. This serves to be best rather than using any other Exterior Gateway Protocol.

2.2 Internal Border Gateway Protocol (IBGP)

When the communication using Border Gateway Protocol is done in the same Autonomous system, Internal order Gateway Protocol comes into the picture [9]. The IBGP network is illustrated in the Fig.2.

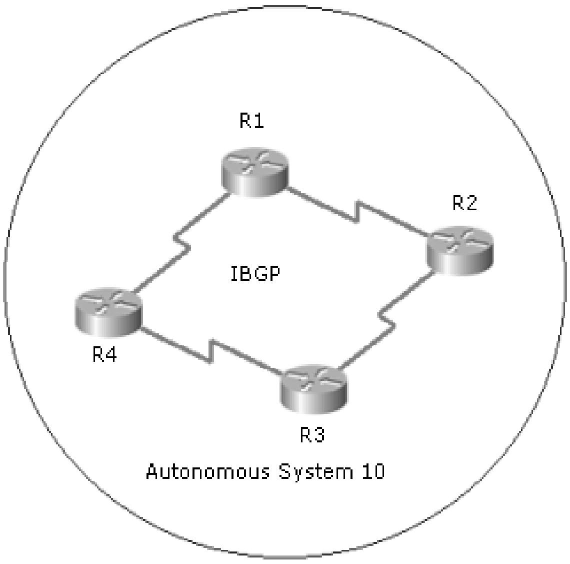

Fig 2 : Internal Border gateway Protocol network

To route the information within same autonomous system there are many Interior Gateway Protocols (IGP) for example Routing Information protocol (RIP), RIP version 2, Enhanced Interior Gateway Protocol (EIGRP), Open Shortest Path First (OSPF). All the aforesaid protocols do the same work as an IBGP does [10]. But there are many problems faced with BGP when used as an IBGP.

3. SHORTCOMINGS OF IBGP OVER INTERIOR GATEWAY PROTOCOLS (IGPs)

The major disadvantage of using IGBP network is that it ruins the administrative distance to 200 from EBGPs 20. In comparison with any other IGP protocol IBGPs AD value is bad. The figure shows the comparison of different IGPs' and their AD values [11]. Comparison with RIP and EIGRP, AD value of IBGP proves to be worst as shown in the Fig.3. The second major Loophole of IGRP is that, for an IGRP network to work, full mesh configuration is required i.e. all the devices in the network has to be connected to each other as shown in the Fig.4.

This serves to be a major disadvantage in the companies because there are hundreds of devices connected in a network. To get rid of this BGP gives a facility to make server client configuration i.e. to enable route reflector client. This configuration tells the other two devices connected to it that, "I am your server and you both are my clients". This technique reduces the hardware making it efficient. This is aptly illustrated in the following Fig.5.

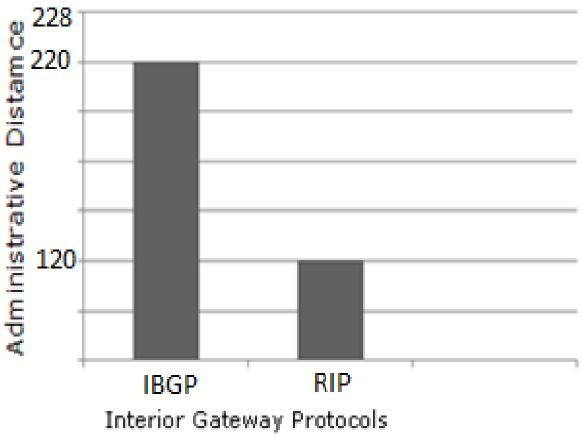

Fig 3 : Comparison of AD values of different Interior Gateway Protocols.

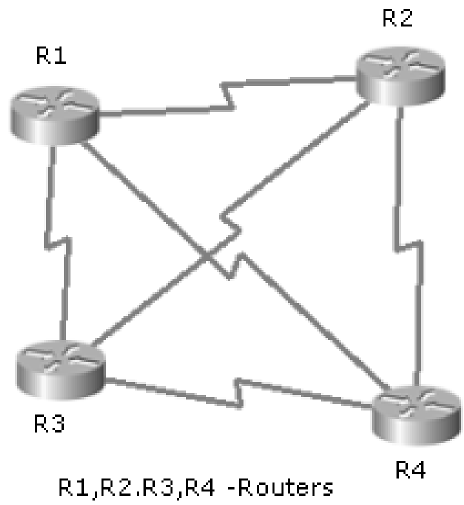

Fig 4 : Full mesh configuration required for IBGP network.

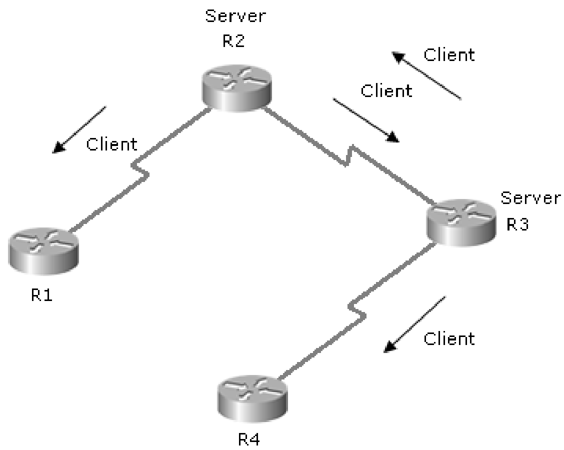

Fig 5 : Route-reflector technique to create full mesh.

This technique though has a major shortcoming that every router in its group of three has to be made server and the rest

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two the clients. In the live scenario having hundreds of computers it's not feasible to make many servers and clients. This makes a load on the processor of the device making the network inefficient. Another way to get rid of full mesh configuration is to make physical connectivity as shown in Fig.4 or to make a virtual connection by defining the neighbors as shown in Fig 6.

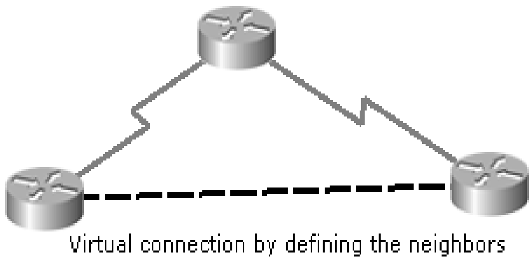

Fig 6 : Virtual connectivity by defining neighbors.

On both the routers R and R2, the command should be given saying "You are my neighbor". Let us assume that they are in AS 10, the command to be written on R1 and R2 is as follows,

Neighbor *ip add of interface of R3 router* remote as 10

neighbor *ip add of interface of R1 router* remote as 10

But again this is not feasible because its tediousness and its increasing commands make the processor to work slower. This makes an IBGP a not to be used protocol for the internal network having the same autonomous system. Instead, RIP v2, EIGRP can be used which don't have all these problems. All the configurations in rest all the IGP protocols are very straight forward [12]. In sum, IBGP should not be preferred over all the IGP protocols. Thus, BGP should only be used for the exterior routing than interior routing. The comparison of all the distinguishing aspects featuring the characteristics such as route computation, AD value, complexity, processing intensity is shown below. The final preference of usage of this protocol is concluded at the last.

Table 1. Comparison of all Interior Gateway protocols

IGP's → Characteristics ↓	IBGP	RIP	EIGRP	OSPF
AD Value	200	120	90	110
Processor Intensity	More	Less	Less	Less
Full mesh network	Yes	No	No	No
Complexity	More	Less	Less	Less
Proprietary	No	No	Yes-Cisco	No
Convergence	Slow	Slow	Fast	Fast
Route computation	Distance Vector algorithm	Bell-ford algorithm	Diffusing update algorithm	Dijkstra algorithm
Classless suppose	Yes	V1-No V2- Yes	Yes	Yes
VLSM support	Yes	V1- No V2- Yes	Yes	Yes
Path metric	Possible metric are the four path attributes	Hop count	Composite(K values)	Bandwidth (Cost)
Final preference	least	Higher than IBGP	Highest	Highest

4. CONCLUSION

The paper studies the loopholes generated in using the Internal Border Gateway Protocol of BGP. The analysis highlights insightful features of External Border Gateway Protocol and also the comparison of IBGP and other Interior Gateway Protocols. Furthermore, the concept explains how the IBGP proves to be not-to-be used protocol over other IGPs. In sum, EBGP proves to be very efficient as an Exterior gateway Protocol than IBGP as an Interior Gateway protocol in network usage.

5. ANALYTICAL ASSESSMENT

I have made practical implementation of these IBGP and EBGP in CISCO labs at Thane center, India and I further investigated the working of them, in which EBGP was found to be very efficient over other Exterior gateway Protocols and IBGP was found to be unworthy over other Interior Gateway Protocols.

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Mr. Nikhil Hemant Bhagat is currently pursuing his Final year of B.E. Electronics and Telecommunication Engineering from Lokmanya Tilak College of Engineering, Mumbai University, INDIA 2011-2012. He is the Head of the Department of Student Affairs committee of IEEE, 2011. He has also completed Network + technician and PC technician certifications from NIIT in the year 2010. He became Microsoft Certified in Dec. 2010 and was regarded as Microsoft Office Specialist 2007. He underwent practical experience in Mobile Communications from Mahanagar Telephone Nigam Ltd. (Govt. of India), Mumbai in June-July 2011. He went deep into Computer Networks by acquiring Cisco certifications like Cisco Certified Network Associate (CCNA Routing & Switching) in July 2011 and Cisco Certified Network Professional (CCNP Routing & Switching) in Oct. 2011. He further assimilated couple of certifications like Windows XP Professional and IT Technology Professional 2010 from Ranksheet.com. He is currently targeting Cisco Certified Internet Expert (CCIE Routing and Switching) certification. His areas of interests are Computer Networks, Neural Networks and Network Security.