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Realization of a Typical ISP Network Using GNS3 Tool

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Abstract: Internet is the network of networks and is also called 'internetwork'. Border Gateway Protocol (BGP) is the protocol of the internet. It is a standardised Exterior Gateway Protocol. It manages how packets are routed across the internet through the exchange of routing and reachability of information. In this paper we have put in efforts to realize a typical ISP network using a Network Simulation Tool. Efforts have been made to design a sophisticated network containing a network architecture well suited to route packets between various ISPs providing services for accessing, using or participating in the Internetwork. To realise an ISP network we have to draw limelight on various networking concepts and protocols. Redistribution [1], virtual-link configuration, Access Control List, internal BGP, external BGP and BGP route reflectors are a few considerable concepts and have paramount importance in building a worldly-wise ISP network.

Keywords: Border Gateway Protocol (BGP), realize a typical ISP network using a Network Simulation Tool, Redistribution, virtual-link configuration, Access Control List, internal BGP, external BGP and BGP route reflectors.

I. INTRODUCTION

Border gateway protocol often abbreviated as BGP and is an Exterior Gateway Protocol. BGP is the protocol of the internet as it is the protocol designed for handling large scalability. The internet is a very complex network and in fact the network of networks. If there is only a single link to the internet then there are no real reasons to dynamically exchange routes with an ISP. In case of multi-homing to different ISPs, BGP is the best dynamic routing protocol. BGP can be further classified into:

A. iBGP
iBGP is used to carry some/all internet prefixes across backbone.

B. eBGP
eBGP is used to exchange prefixes with other Autonomous Systems (AS)

II. SOFTWARE REQUIREMENTS SPECIFICATION

Software Requirement Specification performs the overall description of the ISP network to be realized.

A. Functional Requirements

Functional requirements define the functionality of a system to be developed.
The functional requirements of the proposed system are:

- Choosing a routing protocol to route packets within the Autonomous System.[2]
- Route redistribution between two different routing protocols at the Border Routers.
- Logical division of certain parts of the network into areas and connecting them to the backbone area using virtual links.
- Use of *iBGP* inside an AS.
- To configure *eBGP* between ISPs in a multi-homed network architecture.

B. Non-functional Requirements

Non-functional requirements play the behaviour and performance of the system at its critical stages.

- Scalability
  Provisions will be made to accommodate more routers and links thereby providing larger scalability.
- Security
  ACLs [3], encryption algorithms and firewalls constitute the security blocks.

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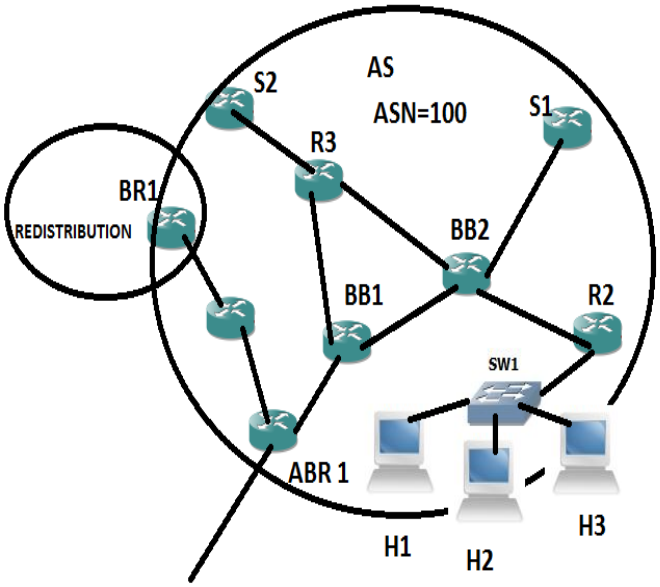

Figure 1 shows a network enclosed within an AS.

III. BGP GENERAL OPERATION

- Learns multiple paths via internal and external BGP speakers.
- Picks the best path and installs in the forwarding table.
- Best path is sent to external BGP neighbours.
- Policies applied by influencing the best path selection [4].

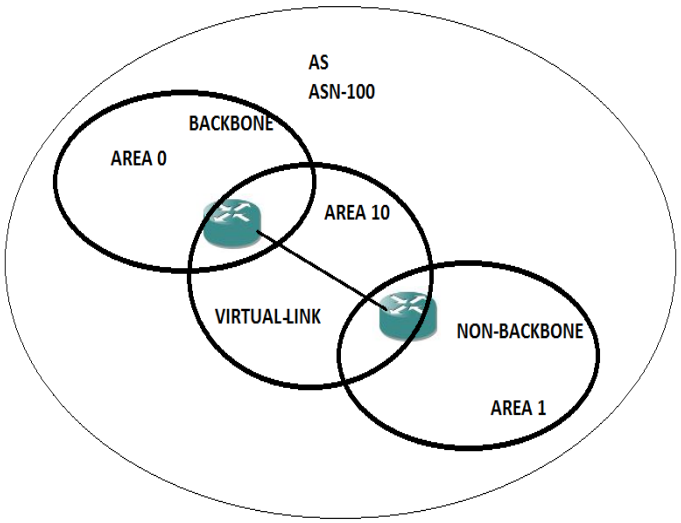

Figure 2shows a backbone area connected to non-backbone using virtual links.

IV. SYSTEM DESIGN

A typical ISP network may consist of the following:

A. A network of routers and switches at the nodes enclosed within an AS with a particular AS number and running static or dynamic routing protocols. Figure 1 shows a network enclosed within an AS.

B. OSPF routing protocol and division of the network into logical areas called OSPF areas. A backbone area also called area 0 is a must and all other areas are connected to the backbone area using virtual links. Figure 2 shows a backbone area connected to non-backbone using virtual links. [5]

C. Redistribution at the Border Routers to advertise the network running different routing protocols. Figure 3 shows route redistribution at the Border Router (BR). (RIP with OSPF)

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D. *iBGP* and *eBGP* in-between the routers in an AS and between one or more AS respectively. Many BGP routing policies must be applied for the best path selection. Figure 4 shows the network configured with *iBGP*,*eBGP* and route reflectors.

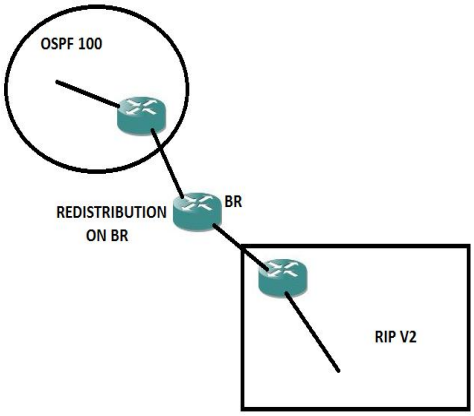

Figure 3 shows route redistribution at the Border Router. (RIP with OSPF)

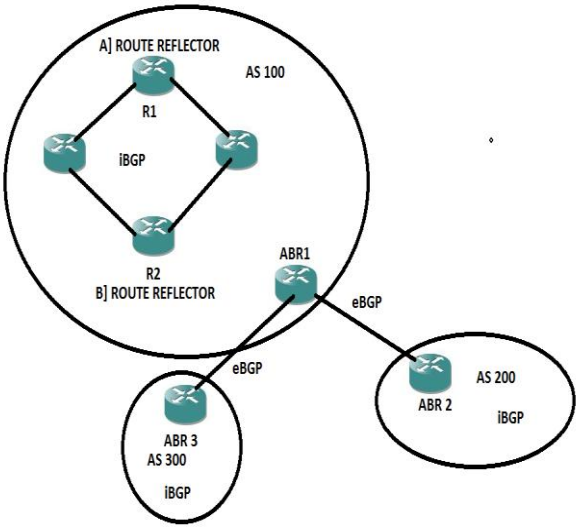

Figure 4 shows the network configured with *iBGP*,*eBGP* and route reflectors.

V. CONSOLIDATED NETWORK

Figure 5 shows a typical ISP network constituting the Internet Service Providers at respective locations. ABR1, ABR2, ABR3 and ABR5 are the autonomous Border Routers of ISP1, ISP2, ISP3, ISP4 and ISP5 respectively. The ISPs are interconnected using external BGP and IGP, along with *iBGP* running within the AS. BGP is the protocol of the internet and is highly scalable and has numerous metrics for building a sophisticated internetwork.

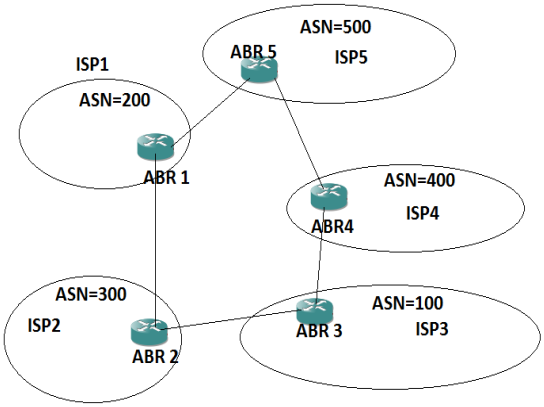

Figure 5 shows a typical ISP network constituting the internet provider at respective locations.

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VI. CONCLUSIONS

BGP which is the protocol of the internet is the most complex and difficult to configure internet protocol. Its emphasis on security and scalability makes it essential. BGP is the best suited protocol for multi-homed scenarios. The categorization of BGP into *iBGP* and *eBGP* is very beneficial. *iBGP* allows peering with routers within the same AS and *eBGP* between two different AS in a multi-homed ISP scenario.

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BIOGRAHY

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