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To Minimize the Consumption of Logical Addresses in a Network using OSPF with Overloading Technique

By Neha Grang & Anuj K.Gupta

RIMT-IET, Punjab Technical University, India

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I. INTRODUCTION

Dynamic routing protocols have been used in networks since early 1980. As network evolved so become more complex new routing protocols have emerged [1]. OSPF is a routing protocol developed by IETF (internet engineering task force) [5], it is an interior gateway protocol based on link state [11]. OSPF gets the whole network's information by exchanging the link state information with all other routers. It keeps a map which describes the network topology, then uses SPF algorithm to get the routing table [6]. If we used multiple routers and not all of them are Cisco then you can use OSPF. OSPF is also called route redistribution. It is a translation service between routing protocols.

In link state routing, every node builds a roadmap of connectivity to the network, showing which nodes are connected to which other nodes [10]. Each node then independently calculates the next best path from it to every possible destination in the network. The collection of best paths will then form the routing table. Link State Routing Protocols converge more quickly and they are less prone to routing loops [2]. Convergence is when all routers share information, calculate best path and update the routing table. Faster the convergence, the better is the routing protocol. Examples of link state routing are OSPF / IS-IS Routing protocols. In this paper OSPF routing protocol is discussed.

II. OSPF (OPEN SHORTEST PATH FIRST)

OSPF routers use five types of packets, to maintain a link state database. Which is distributed, on all routers in area. In this database, routers save the same link state information. LSU (link state update)

packet is most important packet in OSPF packets, because it takes the route information from one router to other routers. In OSPF metric is calculated via COST. More the bandwidth of OSPF, less is the cost [2]. Dijkstra algorithm is used to calculate the shortest path [4].

OSPF is supposed to design in hierarchical fashion we can divide large internetwork into smaller internetworks called Areas. OSPF is an example of fast convergence [9]. A network of few routers can converge in a matter of seconds [7]. It is one of the main design goals and an important performance indicator for routing protocols to implement a mechanism that allows all routers running this protocol to quickly and reliably converge [3]. In this paper OSPF protocol is used to design the network. All areas must be connected to Area 0 with ABR. All the routers within same area have same topology table. ASBR is used to bond the one autonomous system to external autonomous system. The goal of design is to localize the updates within area. ABR is called Area Border Router connects unlike areas with the backbone area i.e. Area 0. ASBR is Autonomous System Border Router. It connects different autonomous systems. This is the area design of OSPF routing protocol. The OSPF divides the network into areas to minimize the routing update traffic [12].

a) Features of OSPF

Various features of open shortest path first protocol are as follows:

- Consists of Areas and Self-Governing System.
- Minimum Routing Update Traffic
- Allow Scalability
- Fast Convergence
- Support VLSM
- Unlimited Hop Count
- Allow Multivendor Deployment

b) Tables of OSPF

In OSPF there are different tables for storing different information regarding network [8]

i. Neighbor Table

It contains the information of connected OSPF routers in this table the information of neighbor status router ID are stored.

ii. Topology Table

Each router has full road map of its entire area.

Author ^α : Research Scholar, RIMT-IET, Punjab Technical University, Punjab, India. E-mail : neha.grang@gmail.com

Author ^σ : HOD CSE Dept. RIMT-IET, Punjab Technical University, Punjab, India. E-mail : anujgupta.rimt.ac.in

iii. *Routing Table*

Routing table has best route for reaching different network. OSPF uses this SPF for calculate best path in OSPF process.

III. NAT (NETWORK ADDRESS TRANSLATION)

NAT is Network Address Translation. It allows a router to modify packets to allow for multiple devices to share a single public IP addresses[13]. NAT was used to slow the depletion of available IP address space by providing many private IP addresses[16].NAT decreases the overwhelming amount of public IP addresses required in your networking environment [7].NAT is typically used on a border router[14].

a) *Advantages of NAT*

- Conserve authorized registered addresses.
- Reduces address overlap occurrence.
- Increases Flexibility when linking to internet.
- Eliminate address renumbering.

b) *Types of NAT*

• *Static NAT*

This type of NAT is designed for one to one mapping between local and global addresses. It requires one real IP address for each host on your network [15].

• *Dynamic NAT*

It provides the ability to map an unregistered IP addresses to a registered IP addresses from out of a pool of registered IP addresses.

• *Overloading NAT*

It maps multiple unregistered IP addresses to a single registered IP addresses by using different ports. It is also known as PAT and by using PAT thousands of users connect to the internet by using only one real global IP addresses.

As earlier seen there is lots of consumption of IP addresses because to represent each host on global network each requires a unique IP address. This increases the consumption of IP addresses .In this paper a method named as NAT overloading will be used with OSPF as a routing protocol.

c) *NAT Terms*

- *Inside Local* : Name of inside source address before conversion.
- *Outside Local* : Name of inside destination address before conversion.
- *Inside Global* : Name of inside host after conversion.
- *Outside Global* : Name of outside destination host after conversion.[7]

IV. NETWORK SIMULATION

GNS3 (Graphical Network Simulator) is used, to design complex network topologies and to launch simulations on them. In this paper the results are shown with the help of GSN3.In figure. 1 the network is created and each router provided an IP address. The circle shows different ISP. In this network 12 routers and 4 Hosts are created. Configure each router by giving slots. Then connect the routers with serial cables. Routers attached with fast Ethernet represent the Host. A unique IP address is provided to each router and same IP address is given to each host.

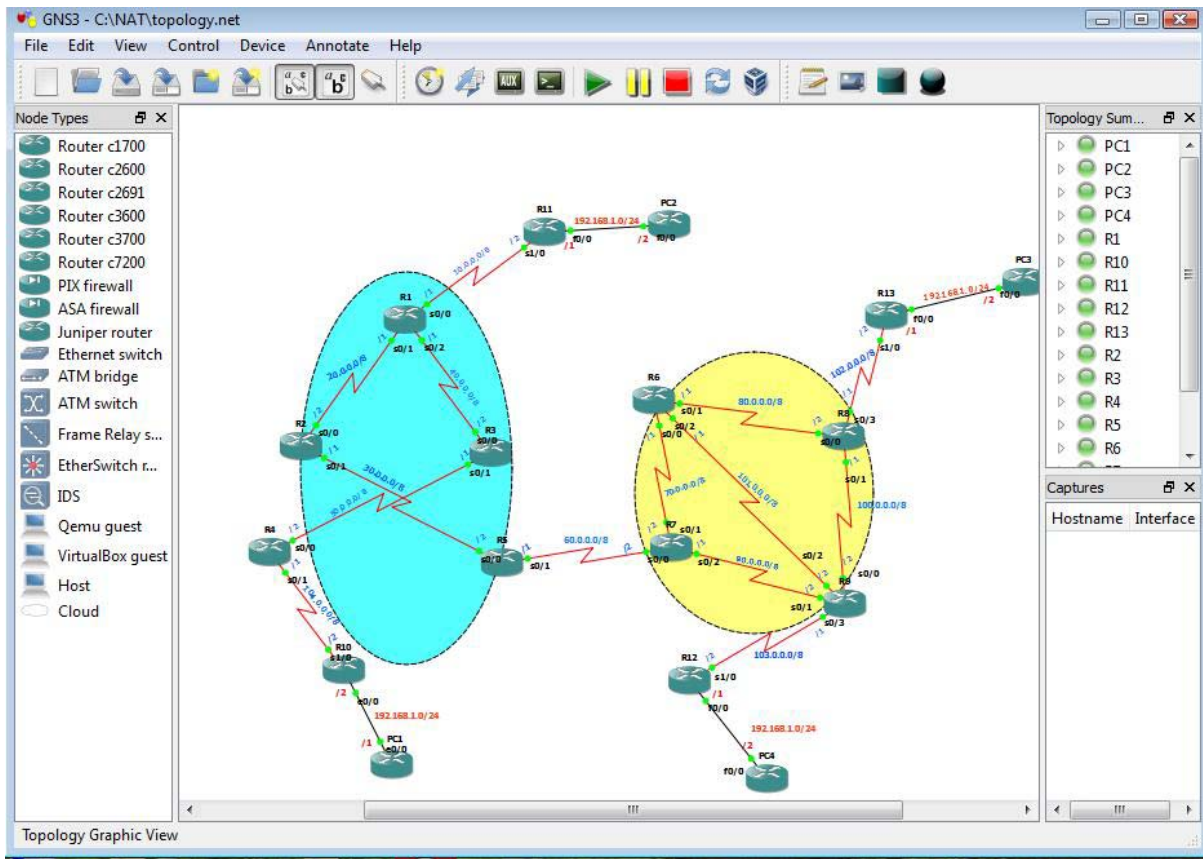


Figure 1 : Simulation of a network using GNS3

After creating a network, OSPF routing protocol is applied over a network. OSPF is applied on each of the router and host used in the network. After applying the OSPF protocol we can check the output of OSPF with the help of routing tables. Figure 1 shows the configuration of OSPF. Figure 3 shows the routing table of R1. With the help of routing table we can check the protocols and connection of each router.

```

R1
interface Serial1/3
no ip address
shutdown
serial restart-delay 0
!
interface FastEthernet2/0
no ip address
shutdown
duplex auto
speed auto
!
router ospf 1
log-adjacency-changes
network 10.0.0.0 0.255.255.255 area 0
network 20.0.0.0 0.255.255.255 area 0
network 40.0.0.0 0.255.255.255 area 0
!
    
```

Figure 2 : Configuration of OSPF

```

R1 (config-router) #do show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2
i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
ia - IS-IS inter area, * - candidate default, U - per-user static route
o - ODR, P - periodic downloaded static route

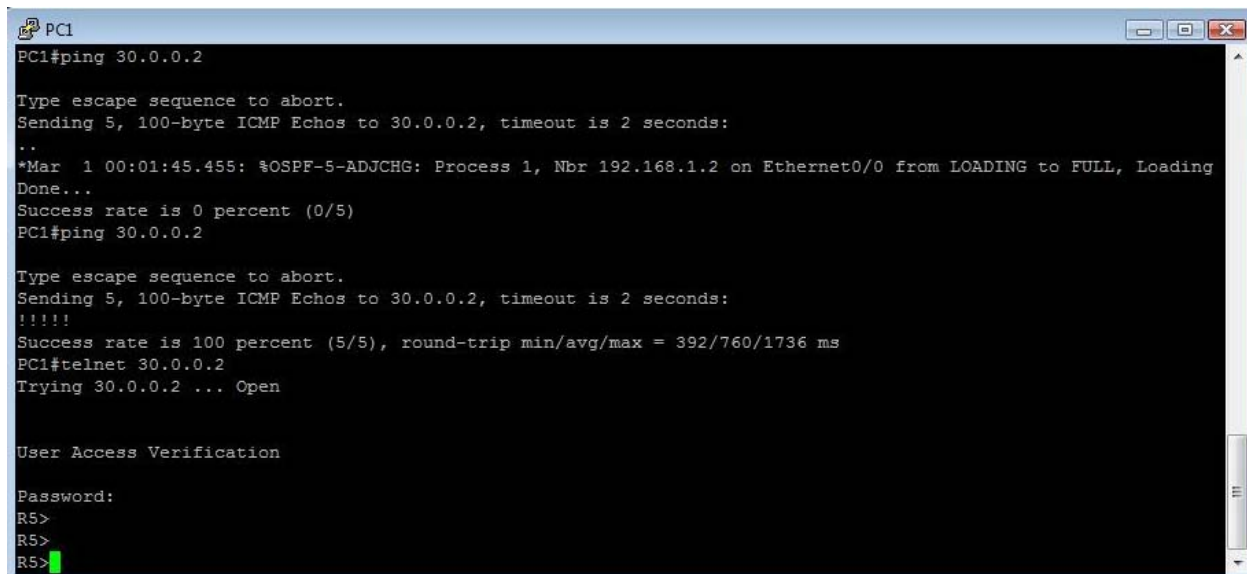
Gateway of last resort is not set

O 102.0.0.0/8 [110/384] via 20.0.0.2, 00:00:06, Serial0/1
O 50.0.0.0/8 [110/128] via 40.0.0.2, 00:00:06, Serial0/2
O 103.0.0.0/8 [110/320] via 20.0.0.2, 00:00:06, Serial0/1
O 100.0.0.0/8 [110/320] via 20.0.0.2, 00:00:06, Serial0/1
O 70.0.0.0/8 [110/256] via 20.0.0.2, 00:00:06, Serial0/1
O 101.0.0.0/8 [110/320] via 20.0.0.2, 00:00:06, Serial0/1
O 80.0.0.0/8 [110/320] via 20.0.0.2, 00:00:06, Serial0/1
C 20.0.0.0/8 is directly connected, Serial0/1
C 40.0.0.0/8 is directly connected, Serial0/2
C 10.0.0.0/8 is directly connected, Serial0/0
O 192.168.1.0/24 [110/65] via 10.0.0.2, 00:00:04, Serial0/0
O 104.0.0.0/8 [110/128] via 10.0.0.2, 00:00:04, Serial0/0
O 90.0.0.0/8 [110/256] via 20.0.0.2, 00:00:04, Serial0/1
O 60.0.0.0/8 [110/192] via 20.0.0.2, 00:00:04, Serial0/1
O 30.0.0.0/8 [110/128] via 20.0.0.2, 00:00:04, Serial0/1
R1 (config-router) #
    
```

Figure 3 : Check the Routing Table of each Router

After applying OSPF on a network the overloading technique is applied. To apply this technique.

Firstly a pool is created. After creating a pool an ACL (Access Control List) is created and then NAT statement is applied on a network. After applying network translation. We can open any router remotely.



```

PC1
PC1#ping 30.0.0.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 30.0.0.2, timeout is 2 seconds:
..
*Mar  1 00:01:45.455: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.1.2 on Ethernet0/0 from LOADING to FULL, Loading
Done...
Success rate is 0 percent (0/5)
PC1#ping 30.0.0.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 30.0.0.2, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 392/760/1736 ms
PC1#telnet 30.0.0.2
Trying 30.0.0.2 ... Open

User Access Verification

Password:
R5>
R5>
R5>

```

Figure 4 : R5 is opened remotely when PC1 is used

V. CONCLUSION

In this Paper the NAT overloading technique is used to decrease the consumption of IP addresses by using same IP addresses without any conflicts. The original intention for NAT was to slow the depletion of available IP address space by allowing many private IP addresses to be represented by some smaller number of public IP addresses. By using this method the maximum of 65,535 private addresses by using only a single IP address purchased in a single private network. This increases the availability.

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