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Convergence Analysis Of RIP And OSPF In IPv6 Network

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Abstract: Routing is the heartbeat of the Internet. Several routing protocols exist nowadays but the most common ones are Routing Information Protocol (RIP) and Open Shortest Path First (OSPF). The prime objectives of this project are to investigate the consequences of deploying RIP and OSPF simultaneously on a IPv6 network and to analyze Quality of Service (QoS).

I. INTRODUCTION

The goal of this project is to investigate the behavior of routing convergence. It begins with an explanation of IP addressing. The report discusses the two routing protocols: Routing Information Protocol (RIP) and Open Shortest Path First (OSPF) into great detail. The report then examines the structure of a routing table and the route selection process.

In order to be practical in the investigation of the routing convergence, we perform an experiment that involved routers. It is assumed that an end customer requires redundancy for its Wide Area Network (WAN) connection. The customer purchases WAN connectivity from two different ISPs that are, running two different routing protocols hence routing information must be redistributed. We conduct the experiment such that network convergences under different failure situation are examined. We will also modify the timers of RIP and OSPF to inspect any improvement.

II. EXSISTING SYSTEM

Nowadays Routing between different networks involves the usages of routers. The routers maintain a routing table. Routers are configured manually by the process called static routing. Static routing is very difficult for larger networks.

PROPOSED SYSTEM

IPv6 network is implemented in this project with enabling the RIP and OSPF dynamic protocols that dynamically update the routing information that helps to forward the packet from source to destination.

This document describes the modifications to OSPF to support version 6 of the Internet Protocol (IPv6). The fundamental mechanisms of OSPF (flooding, Designated Router (DR) election, area support, Short Path First (SPF) calculations etc.) remain unchanged. However some changes have been necessary either due to changes in protocol semantics between IPv4 and IPv6, or simply to handle the increased address size of IPv6. These modifications will necessitate incrementing the protocol version from version 2 to version 3. OSPF for IPv6 is also referred to as OSPF version 3 (OSPFv3).

Changes between OSPF for IPv4, OSPF Version 2, and OSPF for IPv6 as described herein include the following. Addressing semantics have been removed from OSPF packets and the basic Link State Advertisements (LSAs). New LSAs have been created to carry IPv6 addresses and prefixes. OSPF now runs on a per-link basis rather than on a per-IP-subnet basis. Flooding scope for LSAs has been generalized.

Even with larger IPv6 addresses, most packets in OSPF for IPv6 are almost as compact as those in OSPF for IPv4. Most fields and packet- size limitations present in OSPF for IPv4 have been relaxed. In addition, option handling has been made more flexible.

In the recent years, the Ad-Hoc networks have been the focus of many researches especially in the routing protocols which include Proactive and Reactive routing. [2] The strategy of forwarding the data packets from the source to the destination is the ultimate goal of routing protocols. Hence, the difference between these protocols is based on searching, maintenance and recovering the route path. The potential problem in Ad-Hoc networks is how to determine the optimum routing protocol that satisfies the needs of the application regarding to some criteria. This work will present the evaluation of proactive routing protocol Routing Information Protocol (RIP) and reactive routing protocol Dynamic Source Routing (DSR) based on the Qual Net simulation. Moreover, the performance of these routing protocols will be measured based on the throughput, delay, average jitter and energy consumption metrics. The present paper shows that the routing information protocols (RIP) have better evaluation performance compared to DSR in the scenario.

The IPv6 protocol is an upgrade of the IPv4 protocol, belonging to the TCP/IP (Transmission Control Protocol Internet Protocol) suite's protocol stack, used to identify, by means of an IP address, each computer interface or device that connects to Internet or to an Intranet [4]. Migrating from IPv4 to IPv6 in an instant is impossible because of the huge size of the Internet and of the great number of IPv4 users. [5]

IPv6 is basic to the operation of the network and the first specifications of this protocol were developed by Internet Engineering Task Force (IETF) at the 90"s. An important factor for the adoption of the new protocol is the

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expansion in use of new technologies based on the concept ''always on'', such as xDSL, cable, Ethernet, optical fiber, and Power Line Communication; however, but the main motivation for the transition to the new protocol is the expansion of available public addresses for Internet, which will allow the connection to the network for multiple devices such as PDAs and mobile phones, among others.

The size of an IPv6 address is 128 bits, 4 times bigger than an IPv4 address; an 32 bits address space allows up to 4.294.967.296 combinations.[5] while the 128 bits of an IPv6 address allows up to 340.282.266.920.938.463.463.374.607.431.768.211.465 (or 3,4 x 1038), therefore it is obvious the increase in available addresses [6].

At the end of the seventies, when the IPv4 address space was designed, was unimaginable that it could be exhausted; however due to technological changes and assignation politics that did not foreseen the recent increase in the Internet hosts quantity, the IPv4 address space was depleted to such an extent that in 1992 was made evident the need for a replacement [6].

1. IPv6 Address Format

IPv6 addresses have two logical parts: a 64-bit network prefix, and a 64-bit host address part. The host address is often automatically generated from the interface MAC address. An IPv6 address is represented by 8 groups of 16-bit hexadecimal values separated by colons (:) shown as follows: 2001:0db8:85a3:0000:0000:8a2e:0370:7334

The hexadecimal digits are case-insensitive.
The 128-bit IPv6 address can be abbreviated with the following rules:

- **Rule one:** Leading zeroes within a 16-bit value may be omitted. For example, the address fe80:0000:0000:0000:0202:b3ff:fe1e:8329 may be written as fe80:0:0:0:202:b3ff:fe1e:8329
- **Rule two:** One group of consecutive zeroes within an address may be replaced by a double colon (**::**). For example, fe80:0:0:0:202:b3ff:fe1e:8329 becomes fe80 ::202:b3ff:fe1e:8329
- A single IPv6 address can be represented in several different ways, such as 2001:db8::1:0:0:1 and 2001:0DB8:0:0:1::1.

2. Assignment of Addresses

IPv6 addresses can be statically assigned using an identifier (ID) of manual interface or an ID of EUI-64 interface, it also can be dynamically configured by using stateless address auto-configuration or by DHCPv6. Static configuration: Consists on manually enter the IPv6 address of a node in a configuration file or through the use of proper tools of the operative system. Information to be included is the IPv6 address and the network prefix size [8]. This configuration is divided into static configuration using the ID of manual interface, in which the entire IPv6 address is used, both the network section and the device identifier section [7]; and into static configuration using the ID of EUI-64 interface, in which in order to obtain the ID, the host takes the MAC address from the link layer device, however as the MAC address only has 48 bits, then the MAC address is split in half and in the middle is inserted the default hexadecimal value FFFE of 16 bits in order to complete an unique interface ID of 64 bits [7].

Dynamic configuration: Through this method the host automatically learns the necessary parameters to obtain an IP address that will be used in the communication process with end devices. It is divided into stateless auto configuration, in which each router broadcasts information of the network including the prefix assigned to each of its interfaces. With the obtained information in this broadcasting, the end systems create a unique address concatenating the prefix with the ID in EUI-64 interface format. The "stateless" name comes from that no device keeps track of the assigned IP addresses [9]. The other method is with DHCPv6, its operation is similar to the traditional DHCP, hosts obtain its interface address, information and configuration parameters from a server.

3. ROUTING INFORMATION PROTOCOL (RIP)

RIP is an interior routing protocol that is based on Distance Vector routing. RIP uses hop count to calculate the best route. It is simple but has many drawbacks. RIP uses hop count as a cost metric for each link, and each link has a cost of 1[12]. The maximum path cost is 15 so RIP is limited to use in ASs that are not larger than 15 hops. Every 30 seconds the router sends copy of the routing table to its neighbors. The routing table is updated whenever the network topology is changed; each router informs its adjacent neighbors about the updating in the routing table. When the router receives an update, first it compares the new route with the current routing table, then adds a new path to the routing table and informs its adjacent neighbors about the updating in the routing table.

3.1 DISTANCE VECTOR ALGORITHM

1. The routing by distance vector collects data of the information of the routing table of its neighbors.
2. The routing by distance vector determines the best route adding the metric value that receives as the routing information happens from router to another one.
3. With most of the protocols of routing by distance vector, the updates for the changes of topology consist of periodic updates of the tables. The information happens from router to another one, giving generally like result one more a slower convergence.

3.2 VERSIONS OF RIP

There are three versions of the Routing Information Protocol:

1. RIPv1
2. RIPv2
3. RIPng.

2.3.3 RIP version 1

The original specification of RIP, defined in RFC 1058, uses classful routing. The periodic routing updates do not carry subnet information, lacking support for variable length subnet masks (VLSM). This limitation

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makes it impossible to have different-sized subnets inside of the same network class. In other words, all subnets in a network class must have the same size. There is also no support for router authentication, making RIP vulnerable to various attacks.

2.3.4 RIP version 2

It included the ability to carry subnet information, thus supporting Classless Inter-Domain Routing (CIDR)[10]. To maintain backward compatibility, the hop count limit of 15 remained. RIPv2 has facilities to fully interoperate with the earlier specification if all Must Be Zero protocol fields in the RIPv1 messages are properly specified. In addition, a compatibility switch feature allows fine-grained interoperability adjustments.

In an effort to avoid unnecessary load on hosts that do not participate in routing, RIPv2 multicasts the entire routing table to all adjacent routers at the address 224.0.0.9, as opposed to RIPv1 which uses broadcast. Unicast addressing is still allowed for special applications.

RIPv2 is Internet Standard STD56 (which is RFC 2453). Route tags were also added in RIP version 2. This functionality allows for routes to be distinguished from internal routes to external redistributed routes from EGP protocols.

2.3.5 RIPng

RIPng – Is the Next Generation version of RIP that adds support for IPv6. It is still classified as a Distance Vector routing protocol and uses Hop Count just like RIPv1 and RIPv2. RIPng not designed to be used in large networks, but should work fine in most small and medium sized networks. It does not support more than 15 hops just like RIPv1 and RIPv2. RIPng does not authenticate packets (it doesn't need to because it makes use of IPsec). It does not use subnet masks but uses a prefix length instead. RIPng uses the multicast address FF02::9 RIPng does not use UDP port 520 like RIPv1 and RIPv2, but uses UDP port 521 instead.

2.4 OPERATION OF RIP

The Routing Information Protocol (RIP) is a distance-vector routing protocol, which employs the hop count as a routing metric. RIP prevents routing loops by implementing a limit on the number of hops allowed in a path from the source to a destination. The maximum number of hops allowed for RIP is 15. This hop limit, however also limits the size of networks that RIP can support. A hop count of 16 is considered an infinite distance and used to deprecate inaccessible, inoperable, or otherwise undesirable routes in the selection process.

Originally each RIP router transmitted full updates every 30 seconds[11]. In the early deployments, routing tables were small enough that the traffic was not significant. As networks grew in size, however, it became evident there could be a massive traffic burst every 30 seconds, even if the routers had been initialized at random times. It was thought, as a result of random initialization, the routing updates would spread out in time, but this was not true in practice.

2.4.1 ADVANTAGES

1. Easy to configure
2. Incase of equal hop count from source to destination, it load balances and deliver the packets in different routes.

2.4.2 DISADVANTAGES

1. The network is restricted to the size of 15 hops due to the solution to the "count to infinity" problem.
2. The convergence is too slow.

The network topology and the convergence time are been absorbed and result are drawn in the graph. To

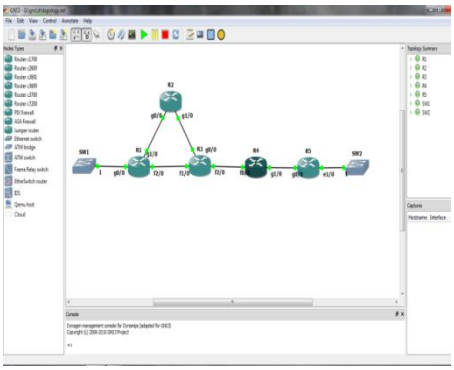

Fig:1 Network Topology

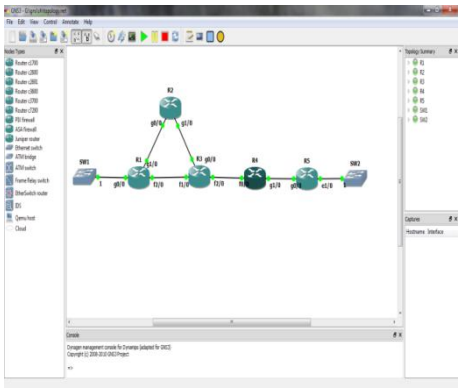

Fig 2:OSPF Network –I

Fig:3 Output for RIP Network-I

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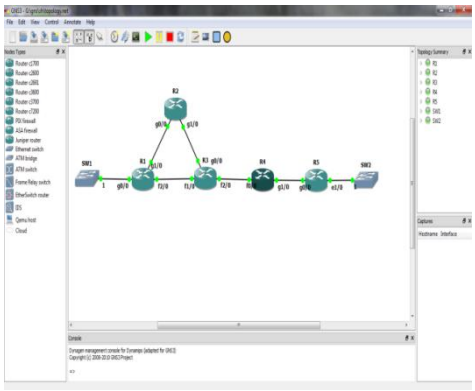

Fig 4:RIP Network-1

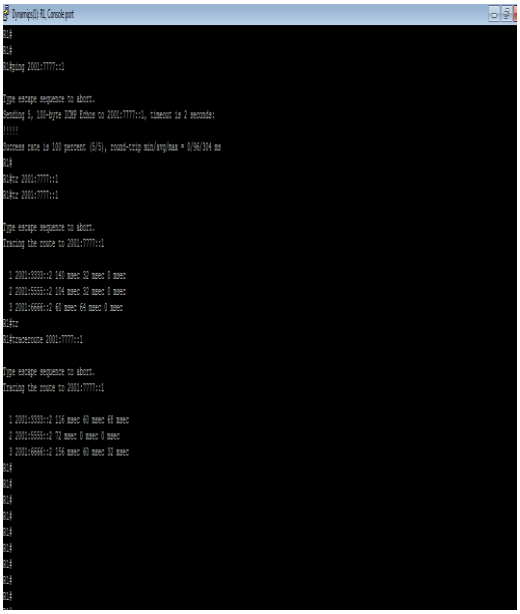

Fig:5 Output for OSPF Network-I

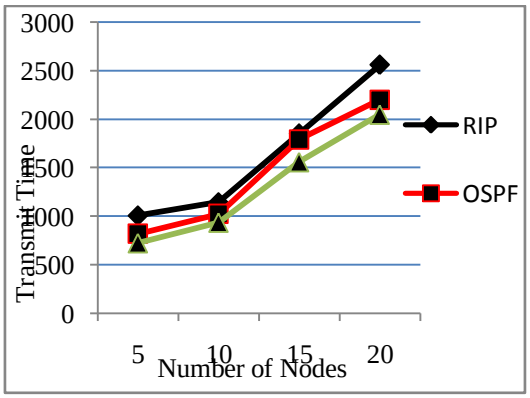

Fig:6 Comparison Of Two Protocols

III. CONCLUSION

The study on earlier chapters shows that working with this OSPF protocol will have following advantages:

- Classless routing protocol
- Updates are through multicast (244.0.0.5)
- Administrative distance is 110
- Acknowledge is sent in every 30 sec
- Hierarchical design in Multiple area
- First and foremost area is called as backbone.

A new framework on routing strategies in WAN was developed with simultaneous deployment of OSPF and RIP. The impact on topological parameters such as node degree was incorporated in bandwidth allocation to reduce the resource requirements and the total network cost. When additional bandwidth of Gigabit Ethernet was assigned to significant links, the performance matched to that of the case where all links were assigned with gigabit Ethernet. The performance variation for different proportions of deployment of OSPF and RIP were analyzed and it was shown that higher proportion of OSPF resulted in reduction in both the packet loss and convergence time

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