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Configure and Monitor the Networking using EIGRP Protocol

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Abstract: In this modern internet generation, routing protocol plays an important role. The Enhanced Interior Gateway Routing Protocol (EIGRP) is an advanced protocol for distance-vector routing used on a computer network to simplify routing and configuration decisions. Data packets are transmitted from router to router via internet networks before they reach their destination device on the Internet. The main objective of this paper is to configure and monitor the network by the provider. The protocol implemented, EIGRP is analyzed using the GNS3 software. In GNS3 software, the setup that includes routers and hosts is simulated to display a network that consists of three areas. It analyzed the ping test, display neighbours and topology table, and the number packet received and sent. As a result, the simulated protocol, EIGRP show acceptable performance with hellos sent/received packets are 3544/1766, 144/143 and 6383/2107 of a router; R1, R2, and R3 respectively. In conclusion, EIGRP is the best in routing protocol and it provides excellent internetworking.

Keywords: EIGRP, routing protocol, GNS3

1. Introduction

Several protocols are used in the networking environment today, and routing protocols are among the most popular routers. Their job is to ensure that routers have accurate remote network information to make correct packet forwarding decisions to their destination. Routers and switches are involved in the network. The router is a system that communicates between two or more networks located in separate geographical locations, that is knowledge to its destination. When the packet enters the router, the packet's destination IP address is checked and the entry on its routing table. If the address is found in the routing table, the corresponding interface is placed as a packet. The switch is a networking system for computers that links network segments. Routing is the method of transmitting data from source to destination. It consists of two types, static and dynamic routing [1].

Open Short Path First (OSPF), Routing Information Protocol (RIP), Intermediate System to Intermediate System (IS-IS) and Enhanced Interior Gateway Routing Protocol (EIGRP), are the dynamic routing protocols that normaly used in a network. There are benefits and drawbacks to of routing protocol. The determination and choice of routing protocols depend on several parameters that affect the network efficiency. Most of the routing protocols were developed as open protocols, but some of them were produced as proprietary solutions. EIGRP, created by Cisco Systems, Inc., is an example of a proprietary routing protocol. Therefore, EIGRP was originally only available on Cisco-produced computers [2]. In 2013, Cisco decided to release the basic EIGRP specification as IETF Knowledge RFC 7868, that allows the subsequent start of different open-source EIGRP implementations [3].

This paper's main target is to configure and monitor the network of the dynamic routing protocol. We will configure the ping test as we want to check if the computer is connected to the network or not. Following with, check

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the event log of the protocol. Furthermore, the information about interfaces needs to configure so that each device's neighbours can be displayed in their area and get the entire EIGRP topology entries.

2. Related Work

Karna et al. [4] did the performance analysis of Interior Gateway Protocol (IGPs) using GNS3. They took ten generic routers, and calculate the packet loss, jitter, convergence time, end-to-end delay, throughput, one by one on the three routing protocols. The protocols that have been simulated are RIP, EIGRP and OSPF. On the other hand, performance evaluation of routing protocol RIPv2, OSPF, EIGRP with BGP has been conducted by Masruroh et al. [5], simulation proses using GNS3 to analyze the performance of a network based on convergence, throughput, jitter and packet loss that combine the IGPs with External Gateway Protocol (BGP). While the performance analysis of OSPF and EIGRP routing protocols for Greener Internetworking was compared and resulting of EIGRP uses fewer system resources and produces lesser heat, unlike OSPF [6]. Therefore, the resources are saved in networking.

Those researchers did the evaluation and analysis with multiple protocols to make the comparison. But, Kontšek and Segeč [7] use only EIGRP implementations to test the network's current open-source. The topology consists of 4 main routers which are Quangga, FRR, OpenBSD and Cisco. With these routers, EIGRP is testing the process of IPv4 and IPv6 protocols. The experiment results are that only FRR and OpenBSD implementations of EIGRP are stable, but they need some more advanced features to complete the feature set.

2.1 Enhanced Interior Gateway Routing Protocol

EIGRP is a modified Interior Gateway Routing Protocol (IGRP) protocol, an advanced routing protocol developed and published by Cisco in 2016. EIGRP is an advanced variant of the distance vector protocol with several characteristics like link-state protocols. As a hybrid protocol, the Cisco core documentation states EIGRP. As distance vector protocols create neighbour relationships as in link-state protocols, EIGRP opens its table to its environment [8]. Whenever a new router is connected to the network, three phases are followed by EIGRP-neighbor discovery, topology exchange and router selection. To test the EIGRP routers parameter, hello packet is sent to decide if the router could become a neighbour. The routers regularly broadcast the topology details in the topology exchange to revise the topology changes. The topology table for selecting the path based on the cost metric is evaluated by each router. The path with the lowest value for the cost is chosen. For wide enterprise networks, EIGRP is useful because it requires less energy compared to that of link-state IGPs. It is one of the best available distance-vector IGPs [9]. Other than that, in the local topology table, EIGRP maintains something like a successor route and a feasible successor route. The path by which the packets are forwarded and have the best metric is the successor route. The possible successor route is when the successor route goes down or has the second-best metric, the router can forward packets. Thus, this is the benefit of EIGRP; it does not have to send hello packets to figure out another possible path once a route goes down. It just leads to a potential successor path.

3. Proposed Network

The proposed network aims to accomplish the configuration of the network using EIGRP. It is implemented in the GNS3 platform. Uses this platform to configure the experimental setup, network configuration specification, ping test, event log, determine the neighbours, topology table of EIGRP and the number of packets sent and received by this protocol. Fig. 1 shows the designed topology for configuration.

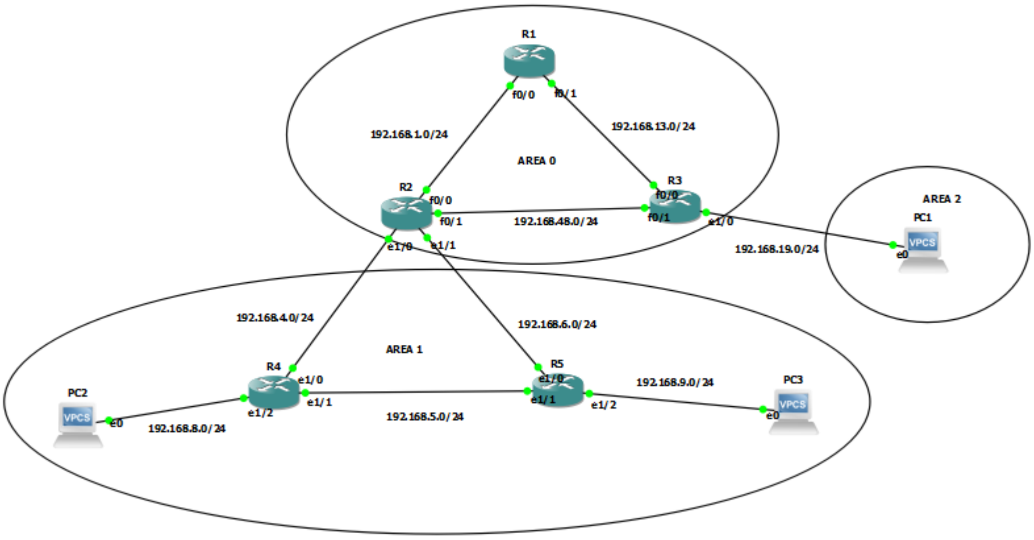

Fig. 1 - Designed topology for configuration

4. Simulation of the Conceptual Model

As in the actual implementation, the simulation was performed at this stage. Topology, which also works as a simulate on the tool and been developed using GNS3. As shown in Fig. 1, three areas are configured and simulated with the following objects used in the design.

- Area 0
  a. one unit cisco router 2600 (R1) with two fast ethernet ports,
  b. one unit cisco router 2600 (R2) with two fast ethernet ports and two ethernet ports,
  c. one unit cisco router 2600 (R3) with two fast ethernet ports and one ethernet port.
- Area 1
  a. two units cisco router 3600 (R4 and R5) with three ethernet ports,
  b. two units PC which connected with two routers.
- Area 2
  a. one unit PC which connected to a router, R3.

5. Result and Discussion

In this simulation, the network address in Area 0 that connects R1 to R2 is 192.168.1.0/24, while R1 to R3 is 192.168.13.0/24, and R2 to R3 is 192.168.48.0/24. Then, in Area 1, R4 connected to R2 with a network address of 192.168.4.0/24, while R4 to end-user (PC2) with network address 192.168.8.0/24. The same router, R4 with network address 192.168.5.0/24 connected to R5. The R5 link to R3 with network address 192.168.6.0/24 and linked with the end-user (PC3) with network address 192.168.9.0/24. Finally, in Area 2, PC1 link to R3 with network address 192.168.19.0/24. All of these areas performing the EIGRP routing protocol.

With this topology, the interfacing is performing for each router. Fig. 2 until 4 shows the configuration of network switching parameters for R1, R2 and R3, respectively. Thus, all routers are connected, and the ping test has been complete with the simulation results shown in Fig. 5 until 7.

```
R1#sh ip int brief
Interface              IP-Address      OK? Method Status                Protocol
FastEthernet0/0        192.168.1.1     YES manual up                    up
FastEthernet0/1        192.168.13.1    YES manual up                    up
Ethernet1/0            unassigned      YES unset  administratively down down
FastEthernet2/0        unassigned      YES unset  administratively down down
```

Fig 2 - Configuration switching for R1

```
R2#sh ip int br
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            192.168.1.1     YES NVRAM  up                    up
FastEthernet0/1            192.168.48.1    YES NVRAM  up                    up
Ethernet1/0                192.168.4.1     YES manual up                    up
Ethernet1/1                192.168.6.1     YES manual up                    up
Ethernet1/2                unassigned      YES NVRAM  administratively down down
Ethernet1/3                unassigned      YES NVRAM  administratively down down
Ethernet2/0                unassigned      YES NVRAM  administratively down down
FastEthernet3/0            unassigned      YES NVRAM  administratively down down
```

Fig 3 - Configuration switching for R2

```
R3#sh ip int br
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            192.168.13.1    YES NVRAM  up                    up
FastEthernet0/1            192.168.48.1    YES NVRAM  up                    up
Ethernet1/0                192.168.19.1    YES NVRAM  up                    up
FastEthernet2/0            unassigned      YES NVRAM  administratively down down
```

Fig 4 - Configuration switching for R3

```
R1#ping 192.168.1.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
R1#ping 192.168.13.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.13.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
```

Fig 5 - EIGRP protocol, ping test for R1

```
R2#ping 192.168.48.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.48.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
R2#ping 192.168.1.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
```

Fig 6 - EIGRP protocol, ping test for R2

```
R3#ping 192.168.13.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.13.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R3#p
*Mar  1 00:56:15.003: %IP-4-DUPADDR: Duplicate address 192.168.13.1 on FastEthernet0/0, sourced by cc01.1e90.0001
R3#ping 192.168.48.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.48.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
```

Fig 7 - EIGRP protocol, ping test for R3

Once performing the ping test, the entries in the EIGRP protocol table is monitored and analyzed. Fig. 8 until 10 shows protocol table of R1, R2 and R3, respectively.

```
R1#sh ip protocols
Routing Protocol is "eigrp 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Default networks flagged in outgoing updates
  Default networks accepted from incoming updates
  EIGRP metric weight K1=1, K2=0, K3=1, K4=0, K5=0
  EIGRP maximum hopcount 100
  EIGRP maximum metric variance 1
  Redistributing: eigrp 1
  EIGRP NSF-aware route hold timer is 240s
  Automatic network summarization is in effect
  Automatic address summarization:
    192.168.13.0/24 for FastEthernet0/0
    192.168.1.0/24 for FastEthernet0/1
  Maximum path: 4
  Routing for Networks:
    192.168.1.0
    192.168.13.0
  Routing Information Sources:
    Gateway         Distance      Last Update
  Distance: internal 90 external 170
```

Fig 8 - Routing Protocol R1

```
R2#sh ip protocols
Routing Protocol is "eigrp 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Default networks flagged in outgoing updates
  Default networks accepted from incoming updates
  EIGRP metric weight K1=1, K2=0, K3=1, K4=0, K5=0
  EIGRP maximum hopcount 100
  EIGRP maximum metric variance 1
  Redistributing: eigrp 1
  EIGRP NSF-aware route hold timer is 240s
  Automatic network summarization is in effect
  Automatic address summarization:
    192.168.48.0/24 for FastEthernet0/0
    192.168.1.0/24 for FastEthernet0/1
  Maximum path: 4
  Routing for Networks:
    192.168.1.0
    192.168.48.0
  Routing Information Sources:
    Gateway         Distance      Last Update
  Distance: internal 90 external 170
```

Fig 9 - Routing protocol Router 2

```
R3#sh ip protocols
Routing Protocol is "eigrp 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Default networks flagged in outgoing updates
  Default networks accepted from incoming updates
  EIGRP metric weight K1=1, K2=0, K3=1, K4=0, K5=0
  EIGRP maximum hopcount 100
  EIGRP maximum metric variance 1
  Redistributing: eigrp 1
  EIGRP NSF-aware route hold timer is 240s
  Automatic network summarization is in effect
  Automatic address summarization:
    192.168.48.0/24 for FastEthernet0/0, Ethernet1/0
    192.168.19.0/24 for FastEthernet0/0, FastEthernet0/1
    192.168.13.0/24 for FastEthernet0/1, Ethernet1/0
  Maximum path: 4
  Routing for Networks:
    192.168.13.0
    192.168.19.0
    192.168.48.0
  Routing Information Sources:
    Gateway         Distance      Last Update
  Distance: internal 90 external 170
```

Fig 10 - Routing Protocol Router 3

As a result, we can get a number of the data packet received in this routing protocols from the ping test and other parameters configuration, as shown in Table 1.

Table 1 - EIGRP traffic

Routers	Hellos sent/received	Hello Process ID	PDM Process Queue	IP Socket Queue	EIGRP Input Queue
R1	3544/1766	156	109	0/2000/1/0	0/2000/1/0
R2	144/143	156	109	0/2000/1/0	0/2000/1/0
R3	6383/2107	156	109	0/2000/2/0	0/2000/2/0

6. Conclusion

Based on simulation results that have been done, we can conclude that EIGRP presented a simple description of the EIGRP routing protocol, its distinctive characteristics, and Cisco's brief history of open release of specifications. The network topology used in the testing process was presented in subsequent sections. These basic implementations can only be run if the router devices are linked with the fastEthernet wire. Thus, this proposed configuration and network, can be tested and implemented into VMworkstations.

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