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Study and Analysis of Routing Protocols

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ABSTRACT

In the past few years, modern topologies has changed drastically because of the development of new forms in the routing protocols. In this modern age, the plan process will come into existing services and those can be achieved in upcoming days bearing in mind that we are currently watching an impressive growth of the congestion created by the different applications. It is mainly focused on the relative analysis using the Cisco Packet Tracer of the routing Open Shortest Path First (OSPF), Enhanced Interior Door Routing Protocol (EIGRP), Routing Information Protocol (RIPv2).

Key words: HTTPS, RIP, Cisco Packet Tracer, routing protocols, DNS, HTTP

1. INTRODUCTION

When the first computers were developed, the importance of interconnection led the foremost interest in sharing the results obtained after performing different tasks for which they were initially programmed. Some of the manufacturers started to develop their own interconnection in frameworks [1] for their computer as time passed. Although the need of interlinkage became a foremost issue between users, because of the different protocols which we use in different topographical areas intercommunication became tougher.

The first small actual networks emerged alongside when we found solution to the first issue, which are known as Local Area Network (LAN). In the second level Metropolitan area network (MAN) networks, was developed along with the PC's and different devices (mobile Mobile Phones communication with the help of IP, printers, remaining smart devices with which we can communicate). The Wide Area networks (WAN) are not topographically limited relative to MAN networks. Interconnection is the main advantage in LAN. The price was actually more expensive, because of high speed networks in LAN.

The computer networks now provide us with the opportunity to communicate in actual time. We use networks for maximum ability because we want networks to use in maximum applications such as:

Online applications, File Transfer Protocol (FTP), Terminal Emulation (TELNET), and Email Programs, Groupware.

2. BRIEF INTRODUCTION ABOUT INTERNET PROTOCOLS (IP):

Keeping in mind about the preferences of the network administrator, the routing protocols must be well developed and configured for every network. These are

Auto Adaptive because they converge very quickly stands as big advantage for routing protocols.

If the performance of the hardware is not up to the mark we should carefully choose the approach or solution for the improvement of routing protocol.

There are two dynamic levels of routing protocols. They are [2-4]

1. Interior routing protocols
2. Exterior routing protocols

a. Level 1 Routing Protocol ─ Interior

Protocols for interior routing are defined as follows:

1. Link State Protocols
2. Distance Vector

The following protocols belong to the category "Distance vector": OSPF [5], EIGRP [6] RIPv1 [7] and RIPv2 [9-11] following characteristics describe these protocols:

1. Routing loops is biggest issue.
2. There is no picture explanation of network topology;
3. Hardware is not taxable;
4. Algorithms are very easy to implement and measure by the processor;
5. On small networks, they are scaled
6. We facilitate authentication;

The Open Shortest Path First (OSPF) and Intermediate system and Intermediate system (IS-IS) protocols [12 - 14] are known as "Link state". The following feature characterizes these protocols:

1. We give more complicated (Dijkstra) algorithms that use knowledge from all network devices. In addition, we rebuild the topology of entire network, assessing the network hardware devices ' processing power taxation.

2. They determine the shortest route;

3. Advertisement of link state [15] will be created and alerted to entire network, and each router that uses it will measure the complete network routing table and is called as the linkstate database;

4. The downside of the protocol [16] in terms of cost because we need hardware of great performance that can handle the measure the whole topology of the network.

If we have a chance through route from different routing protocols we use the route of the distance which have shorter administrative .OSPF has administrative distance of 120 while administrative distance of EIGRP is 90. So if we route between these two we use EIGRP because of shorter administrative distance.
The proposed LAN working principle having application as Wireless Sensor nodes [17] by using miniature antennas [18].

ROUTING INFORMATION PROTOCOL (RIP v1). – The complete process is based on routing information of hop count. We have a hop limit of 15 hops on packets. If we get value of 16 as hop count the packet will be dropped. It is a classful protocol. We have administrative distance of 120. RIP supports at most six equal paths to a single destination

ROUTING INFORMATION PROTOCOL (RIP v2). - It is a distance vector routing protocol and known as hybrid routing protocol.

It is the advancement version of RIPv1.We has administrative distance of 120. We use in small networks and also in CIDR. Here we use multicast. It acts as an authentication support with the help of VLSM (Variable-Length Subnet Mask)

RIPv1 and RIPv2 use routing information as hop count.

OPEN SHORTEST PATH FIRST (OSPF).

It is used for secure message transmission. We use Dijkstra algorithm to find the shortest route. We get graph with the help of formula, and allot certain cost between two connecting points. OSPF is developed by Internet Engineering Task Force (IETF) as Interior Gateway Protocol (IGP), i.e., the protocol that aims at moving the packet within a large independent system or routing. It is a network layer protocol which works on protocol number89 and uses administrative distance of 110. The OSPF protocol uses IP 224.0.0.5 and 224.0.0.6 to communicate via multicast messages.

Enhanced Interior Gateway Routing Protocol (EIGRP). - It was introduced in the mid-eighties by Cisco as a competitor with OSPF, because of its flexible algorithm which is very easy, it can even work well on big size networks but this is not in the case of OSPF. Up to 2015, this One was only used on Cisco devices. Since 2015, it was available for free use and now EIGRP is most efficient of all.

Table I: Comparison between Routing Protocols

Protocol	RIP	OSPF	EIGRP
Time of Convergence	-	+	+
Patented	×	×	✓
Usage of Bandwidth	↑	↓	↓
Usage of Resource	↓	↑	↑
Supporting Multiple path	×	✓	✓
Non-IP protocol	×	×	✓
VLSM	×	✓	✓
Scalability	×	✓	✓

Table1: In this table (-) represents Slow and (+) represents High; (↑) represents High and (↓) represents low; (×) represents no and (✓) represents yes ;

b. Level 2 Protocols - Exterior

It has just one sort -"Path Vector Routing Protocol". To this sort have a place the accompanying protocols: Border Gateway Protocol (BGP) and Exterior Gateway Protocol (EGP). These are typically utilized for connecting internet services and enormous organizations. They are particularly made and utilized for web.

3.RELATIVE STUDY OF THE ROUTING IN CISCO PACKET TRACER

It is a Software developed by Cisco organization so as to simulate devices (router 2811, switch 2960, Voice Over Internet Protocols 7960 cell Mobile Phones, computers and other devices that can be allocated to IP-s) and different protocols used for interconnecting devices to build networks; they canbe contemplated with regard to their purpose in order to avoid problems that may arise.
By using the software, we created and analysed computer network which we have classified into six departments. At first the admin block we designed multiple workstations (workplace 1, 2, 3, 4, 5, 6, 7, 8, 9 - students of admin block, Server3, admin block) which will route IPs from router 2 by Dynamic Host Configuration Protocol (DHCP) from network 10.20.30.0/22, server3 admin block and a wireless router that allocates IPs in 192.169.0.0/26 using the similar technique. We use 3G connection for cell Mobile Phones and tablet are interconnected to network of 192.168.1.5/29 (Figure 1). We gave Virtual Local Area Network (VLAN) names as Electronic students, Electrical Students, Mechanical Students, Computer students.

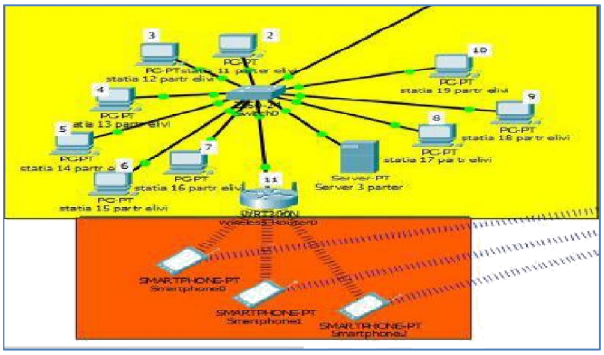

Figure 1: Admin block area of the applications

We built 4 VLANs and gave names for Management block as: Electronic students, Electrical Students, Mechanical Students, Computer students. The following networks have been defined by the VLAN: Electronic students-192.0.1.0/24, Electrical Students -192.0.2.0/24, Mechanical Students -192.0.3.0/24 and Computer students-192.0.99.0/24 (Figure 2).

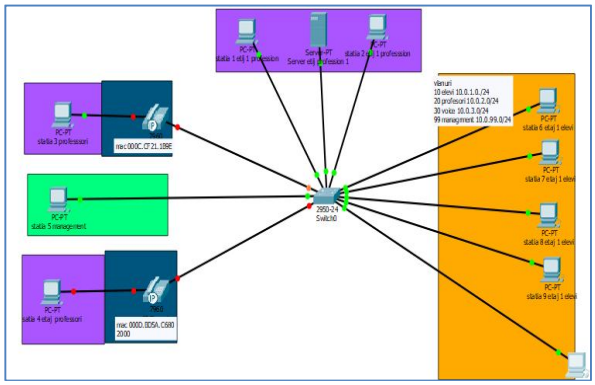

Figure 2: Management block Area

In Admission block, We built 4 VLANs and gave names as: :Electronic students, Electrical Students, Mechanical Students, Computer students and the following networks were allocated to: Electronic students -192.1.1.0/24, Electrical Students -192.1.2.0/24, Mechanical Students -192.1.3.0/24 and Computer students-192.0.99.0/24. All users receive IPs from router 4 using the DHCP protocol (Figure 3).

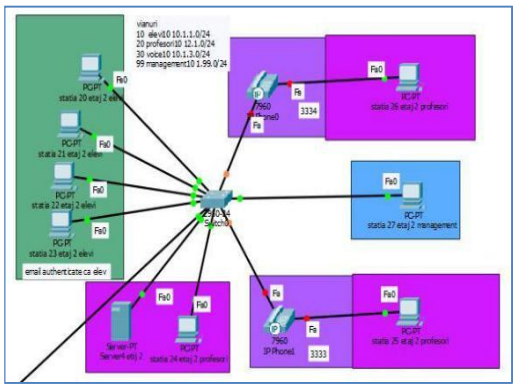

Figure 3: Admission block Area

We built 4 VLANs and gave names for hostel block as: Electronic students-192.3.1.0, Electrical Students - 192.3.2.0, Mechanical Students -192.3.2.0 and Computer students-192.0.99.0. In addition to the workstations, in this area we also consider a web server with a static IP 192.3.2.2/24 declared on DNSserver so that any computer from any network can access the site www.cezar.ro (Figure 4).

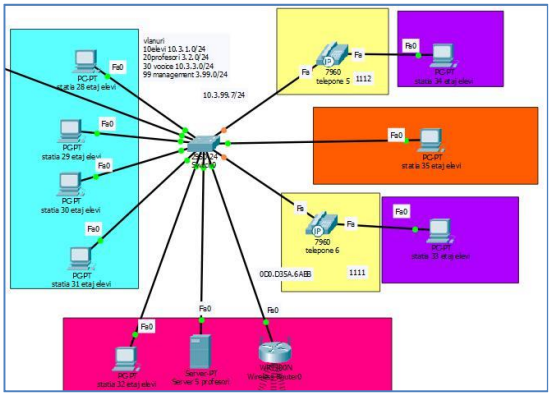

Figure 4: Hostel block area

Home is the fifth area. It is a database that provides access to the devices such as: workshop, camera, study lamp, central heating (CH), (TMD) Temperature monitoring device and air conditioner (AC). Every devices is allocated to 101.217.1.0/24as static IPs. With the help of 3G area and SmartMobile Phone 2 we open workshop door. We're opening the IOE control application to access the Home Administration Server. We use 2202 as password and cezar as user name. Upon establishing the connection, all system parameters can be controlled and modified in this area (Figure 5).

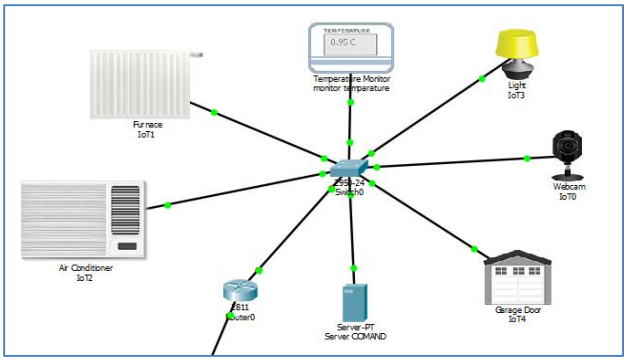

Figure 5.: Waiting Room

Here in the waiting room we can switch on the home appliances such as light, fan, air conditioner etc.., with the help of wireless router by using smart Mobile Phone.

The Servers area which we have created has DOMAIN NAME SYSTEM, ELECTRONIC-MAIL, NETWORK TIME PROTOCOL and CENTRAL OFFICE SERVER 3G

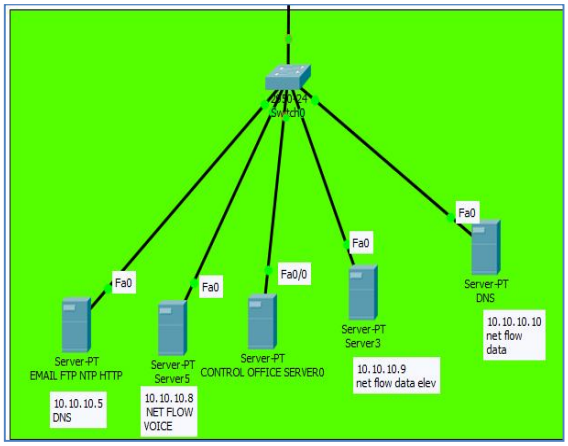

Figure 6: Servers Area

Here we use 4 Smart Mobile Phones in which Smart Mobile Phone 0 and Smart device 1 which have IPs are in contact with wireless router in Admin block and also connected to wireless network.

Remaining Smart devices are in contact with wireless router in Hostel block and not only to router but also to 3G network. We will also use 2 tablets and they are tablets 0 and tablets 1 and these are also connected in the same pattern as Smart devices are connected and Wi-Fi acts as medium for those two routers and basic work station is 3G

A. First Situation – study of network using EIGRP routing protocol

In this Case we've got designed the routers with the assistance of EIGRP routing protocol

The reaction times obtained for this case are shown in table II and table III

Table 2: REACTION TIMES IN FIRST SITUATION - EIGRP PROTOCOL (DNS, HTTPS)

The Second Situation – OSPF Protocol			
Time (s)	**DNS Service**	**Time(s)**	**HTTPS Service**
0	Workplace	0.022	Workplace
0.002	Admin block Switch	0.023	Admin block Switch
0.003	Router - 2	0.024	Router - 2
0.004	Router - 3	0.025	Router - 1
0.005	Servers Room Switch	0.026	Router - 4
0.006	Server DNS	0.027	Hostel block Switch
0.007	Servers Room Switch	0.028	Server 4 Faculty
0.008	Router - 3	0.029	Hostel block Switch
0.009	Router - 2	0.030	Router - 4
0.010	Admin block Switch	0.031	Router - 1
0.011	Workplace	0.032	Router - 2
		0.033	Admin block Switch
		0.034	Workplace

Table 3: REACTION TIMES IN FIRST SITUATION - EIGRP PROTOCOL (HTTP, RTP)

First Situation–EIGRP Protocol			
Time (s)	**HTTP Service**	**Time (s)**	**RTP Service**
0	Smart device - 2	0	Mobile phone - 1
0.002	Wireless router - 0	0.002	Management block Switch
0.003	Hostel block Switch	0.003	Router- 2
0.004	Router – 4	0.004	Router- 3
0.005	Router – 1	0.005	Router- 4
0.006	Home Router	0.006	Admission block Switch
0.007	Home Switch	0.007	Mobile phone - 3
0.008	Administration server		
0.010	Home switch		
0.011	Home Router		
0.012	Router –		
0.013	Router – 4		
0.014	Hostel block Switch		
0.015	Wireless router - 0		
0.021	Smart device - 2		

Above results in table II & table III are the results for the EIGRP protocol. From these results we can observe;

• While gaining access to the web server inbetween the workplace, Admin block Students and Server 4 Faculty. If we use the service HTTPS from the starting of the browser and the time taken by the web page is 0.034 sec.

• If we use the HTTP Protocol in the direction of Smart device - 2 to Administration Server and Smart device - 2 we got the delay of 0.021 sec.

• If we use the Real Time Transfer Protocol between Mobile phone 1 and Mobile phone 3 we got the delay of 0.007 sec.

B. Second Situation – study of network using routing protocol OSPF

In this Case, The reaction times are given in Table IV and Table V.

Table 4: REACTION TIMES IN CASE OF SECOND SITUATION - OSPF PROTOCOL (DNS, HTTPS)

The Second Situation – OSPF Protocol			
Time (s)	**DNS Service**	**Time(s)**	**HTTPS Service**
0	Workplace	0.022	Workplace
0.002	Admin block Switch	0.023	Admin block Switch
0.003	Router - 2	0.024	Router - 2
0.004	Router - 3	0.025	Router - 1
0.005	Servers Room Switch	0.026	Router - 4
0.006	Server DNS	0.027	Hostel block Switch
0.007	Servers Room Switch	0.028	Server 4 Faculty
0.008	Router - 3	0.029	Hostel block Switch
0.009	Router - 2	0.030	Router - 4
0.010	Admin block Switch	0.031	Router - 1
0.011	Workplace	0.032	Router - 2
		0.033	Admin block Switch
		0.034	Workplace

Table 5: REACTION TIMES IN CASE OF SECOND SITUATION - OSPF PROTOCOL (HTTP, RTP)

The Second Situation – EIGRP Protocol			
Time(s)	**HTTP Service**	**Time(s)**	**RTP Service**
0	Smart device-2	0	Mobile Phone- 1
0.003	Wireless router - 0	0.002	Management block Switch
0.004	Hostel block Switch	0.003	Router- 2
0.005	Router - 4	0.004	Router- 3
0.006	Router - 1	0.005	Router- 4
0.007	Home Router	0.006	Management block Switch
0.008	Home Switch	0.007	Mobile Phone- 1
0.009	Server - 1		
0.011	Home Switch		
0.012	Home Router		
0.013	Router - 1		
0.014	Router - 4		
0.015	Hostel block Switch		
0.016	Wireless router - 0		
0.022	Smart device-2		

The above Tables; table VI & table V are the results for the OSPF protocol. From these results we can observe:

• While gaining access to the web server inbetween the workplace Admin block Students and Server 4 Faculty, if we use the HTTPS service from the time of starting of the browser to display the web page the time taken is 0.034 sec.

• If we use the HTTP Protocol in the direction of Smart device - 2, Administration Server and Smart device - 2 we got the delay of 0.022 sec.

• If we use the Real Time Transfer Protocol between Mobile phone 1 and Mobile phone 3 we got the delay of 0.007 sec.

C. Third Situation – study of network using RIPv2 routing protocol

In this case, the Reaction times are given in table VI and VII.

Table 6: REACTION TIMES IN CASE OF THIRD SITUATION - RIPV2 PROTOCOL (DNS, HTTPS)

The Third Situation – OSPF Protocol			
Time (s)	**DNS Service**	**Time(s)**	**HTTPS Service**
0.003	workplace	0.330	Workplace 16
0.004	Admin block Switch	0.331	Admin block Switch
0.005	Router - 2	0.332	Router - 2
0.006	Router - 3	0.333	Router - 1
0.007	Servers Room Switch	0.334	Router - 4
0.008	Server–DNS	0.335	Hostel block Switch
0.009	Servers Room Switch	0.336	Server - 5 Teachers
0.010	Router - 3	0.337	Hostel block Switch
0.011	Router - 2	0.338	Router - 4
0.012	Admin block Switch	0.339	Router - 3
0.013	workplace	0.340	Router - 2
		0.341	Admin block Switch
		0.342	workplace

Table 7: REACTION TIMES IN CASE OF THIRD SITUATION - RIPV2 PROTOCOL (HTTP, RTP)

The Third Situation – EIGRP Protocol			
Time(s)	**HTTP Server**	**Time(s)**	**RTP Service**
0.004	Smart device - 2	0.026	Mobile Phone- 1
0.005	Wireless router - 0	0.027	Management block Switch
0.006	Hostel block Switch	0.028	Router- 2
0.007	Router - 4	0.029	Router- 3
0.008	Router - 1	0.030	Router- 4
0.009	Home Router	0.031	Admission block Switch
0.010	Home Switch	0.032	Mobile Phone- 3
0.011	Server - 1		
0.013	Home Switch		
0.014	Home Router		
0.015	Router - 1		
0.016	Router - 4		
0.017	Hostel block Switch		
0.018	Router-Wireless - 0		
0.023	Smart device - 2		

From the above results in table VI and table VII in the case of RIPv2 protocol, we observe:

• While gaining access to the web server inbetween the workplace Admin block Students and Server 4 Faculty, If we use the HTTPS service from the time of starting of the browser and the time of display of the web page the time taken was 0.33 sec;

• If we use the HTTP Protocol in the direction of Smart device - 2, Administration Server and Smart device - 2, we got the delay of 0.023 sec;

• If we use the Real Time Transfer Protocol between Mobile Phone 1 to Mobile Phone 3 we got the delay of 0.032 s.

4. CONCLUSION

From the Simulation and their outputs, wecome to a conclusion that the EIGRP Protocol is more efficient because of its algorithm which is not complicated unlike that of the OSPF; We can scale EIGRP protocol in not only medium networks but also in large networks , whereas the OSPF is very well covered on medium and large networks, afterwards it will find the short route. Every router will send the routing table to the entire network and the router which is using this routing table will calculate the topology of whole network, needs huge resources and cost is higher than that of the EIGRP. Another routing protocol is the RIP protocol as it has bad timing it generates delays in the network.

From the response time we can distinguish the routing protocols and these differences are because of the algorithms which produce delays. One of the capable software for the simulation is the CISCO PACKET TRACER which helps to design and simulates the virtual networks. This helps us to find the less traffic congestion route and also helps in increasing the network security.

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