IMPLEMENTATION OF EIGRP PROTOCOL USING CISCO PACKET TRACER

Report submitted to the SASTRA Deemed to be University as the requirement for the course

CSE302: COMPUTER NETWORKS

Submitted by

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SASTRA

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Project Based Work Viva voce held on ________________

Examiner 1 **Examiner 2**

Table of Contents

ABSTRACT

The need for computer networks is developing at a rapid rate. This study is primarily concerned with determining the most efficient route to the desired location. Due to their ease of implementation and cheap processing requirements, distance vector routing protocols were a popular choice among network engineers in the 1980s. All distance vector protocols, on the other hand, are prone to forming routing loops, which is undesirable in modern computer networks. A routing protocol specifies how routers communicate with one another in order to forward packets along the shortest path possible from a source to a destination node. Cisco claims that its proprietary routing protocol, EIGRP, solves the problem of routing loops and improves network convergence time. If a backup route is available, EIGRP stores it so it can swiftly reconverge. It allows for load balancing on both unequal and equal cost paths. DUAL can now accept additional protocol suites because EIGRP has been extended to be network layer protocol independent. In this work, I will use the EIGRP protocol to determine the shortest path between routers from source to destination.

KEY WORDS: EIGRP , Routing Protocol

7.2	PC2 is being pinged by PC1.
7.3	The packets are successfully transferred from PC1 to PC2.
7.4	Shows how to use several critical EIGRP commands.

ABBREVIATION

EIGRP	Enhanced Interior Gateway Routing Protocol
AS	Autonomous System
IGP	Interior Gateway Protocols
EGP	Exterior Gateway Protocols
BGP	Border Gateway Protocol
RIP	Routing Information Protcol
IP	Internet Protocol
IPV4	Internet Protocol Version 4
IPV6	Internet Protocol Version 6
RTP	Reliable Transport Protocol
ACK	Acknowledgement
ECMP	Equal-Cost Multi-Path
MTU	Maximum Transmission Unit OSPF
IS-IS	Intermediate System – Intermediate System
RTP	Reliable Transport Protocol

CHAPTER 1 INTRODUCTION

Modern networks have a profound impact on our ability to communicate and collaborate with others in ways that they never have before. Web applications, IP telephony, video conferencing, interactive gaming, electronic commerce, education, and other applications all require computer networks. The router is at the heart of the network. A router is a network device that connects two networks by selecting the optimum path between them and safely forwarding packets. Routing tables are used by routers to maintain track of the optimum path for forwarding packets. Different protocols are available to help the router choose the best route to remote networks.

The EIGRP protocol is a distance-vector routing protocol that is used to automate routing decisions and configuration on a computer network. With IOS 9.21, it was published in 1992 as a distance vector, classless routing protocol. It's a Cisco-specific protocol that only works with Cisco routers.

It's a distance vector routing protocol that sends routing updates to directly linked neighbours as vectors of distances. EIGRP-configured routers deliver and receive messages to and from other EIGRP-configured routers in the same Autonomous system (AS). Unlike other well-known routing protocols like RIP, EIGRP simply transmits incremental updates, decreasing the router's effort and the quantity of data that must be transferred. Load balancing on parallel links between sites is supported. It checks if a route is available on a regular basis and, if changes are made, propagates them to surrounding routers. EIGRP packets are encapsulated EIGRP messages. As a result, in my project, I used the EIGRP protocol to determine the shortest path between routers from source to destination.

CHAPTER 2: ROUTING PROTOCOLS

Routers can learn about faraway networks in a variety of methods, including:

-Static routing protocol

-Dynamic routing protocol

Static routing protocol: When routing from a network to a sub network - a network accessed by a single route – static routes are widely employed.

In bigger networks-

dynamic routing protocol: It is utilised to reduce the administrative overhead of using just static routes.

There are two types of dynamic routing protocols:

-Interior gateway protocols (IGP) and

-Exterior gateway protocols (EGP)

The **interior gateway protocol** is used for routing within a self-contained system.

It is used for routing between autonomous systems and is known as the **exterior gateway protocol.**

RIP, IGRP, EIGRP, OSPF, and IS-IS are IGP protocols.

BGP is the only EGP routing protocol that is currently viable.

IGP protocols are divided into two categories:

-Distance vector routing protocols

-Link state routing protocols

Distance vector routing protocols: Description A simple routing protocol that determines the best forwarding path based on distance or hop count as the key parameter. To stay current, it sends copies of its routing table to its adjacent routers on a regular basis.

Link state routing protocols: This is a sophisticated routing protocol that communicates with other routers to identify the optimum path. In the entire network, link state routers update information from router to router.

CHAPTER 3
ENHANCED INTERIOR GATEWAY ROUTING PROTOCOL

EIGRP is a network protocol that allows routers to exchange data more quickly than with previous protocols. EIGRP emerged from IGRP, and routers are testing if EIGRP and IGRP can coexist because one protocol's metrics can be converted into the other protocol's metrics. It preserves a copy of the routing table of its neighbour.

3.1 Hybrid characteristics of EIGRP:

- EIGRP determines the optimum path among all "possible" paths using the diffusing update algorithm (DUAL). DUAL also aids in the prevention of routing loops.
- It will build neighbour associations with routers in the same Autonomous System that are nearby to it (AS).
- Most EIGRP packets are delivered using the Reliable Transport Protocol (RTP).
- Because it is a classless protocol, it is compatible with VLSMs.

3.2 EIGRP has the following general characteristics:

- EIGRP allows for load balancing and backup packet transfer routes.

• It uses a 90-degree Administrative Distance for routers that originate in the local Autonomous System.

• For external routes arriving from outside the local Autonomous System, an Administrative Distance of 170 is applied.

• It chooses the best route based on bandwidth and delay.

• Although the default maximum hop-count is set to 100, it has a maximum hop-count of 224.

3.3 EIGRP, like OSPF, creates three distinct tables:

• Neighbor table - a list of all routers that are neighbours; neighbours must be from the same Autonomous System.

• Autonomous system topology table — a list of all pathways in the autonomous system.

• The optimum route for each known network is stored in the routing table.

3.4 EIGRP employs five main types of packets:

• Hello packets are used to find new neighbours and build relationships with them. Multicast EIGRP greeting packets use unpredictable delivery.

• Routing information is propagated using update packets. Update packets are only delivered when they are required. EIGRP updates only contain the routing information that is required and are only sent to routers that require it. EIGRP update packets are sent in a reliable manner. When only one router requires an update, it is provided as a multicast

. • When dependable delivery is employed, acknowledgement (ACK) packets are delivered for update, query, and reply packets.

• DUAL uses query and replay packets to seek for networks and do other functions. Queries and responses are delivered in a secure manner.

EIGRP is an advanced distance-vector routing protocol that automates routing decisions and configuration on a computer network. It's a feature on routers that allows them to share routes with other routers in the same Autonomous System. Load balancing on parallel links between sites is supported. It checks if a route is available on a regular basis and propagates routing changes to surrounding routers if they occur. VLSMs and summarization are supported by this classless routing technology. It provides a backup packet transport path.

It supports all IGRP functionalities. As a result, I used the EIGRP protocol in my project to choose the optimal path from source to destination.

3.5 EIGRP Metrics :

The following factors are used by EIGRP to choose the best possible path.

- Load
- Bandwidth
- delay
- MTU
- Reliability (Maximum Transmission Unit)

By default, EIGRP determines the optimum path to a remote network based solely on bandwidth and delay.

CHAPTER 4

NETWORK ARCHITECTURE AND CONFIGURE EXPLAINATION

In Cisco software, I design the network topology depicted in the diagram. In Cisco software, it contains two systems and four routers that are connected by a wired line. To begin, assign an IP address to all of the routers' and PCs' ports as shown in the diagram. To conform the terminal, I should first enable router mode and then enable global configuration mode in router setup. Add IP addresses to the respective routers after selecting the first serial port of the routers. Then, for the routers involved in the network configuration, add clock rate and bandwidth. The clock rate is the actual speed at which data will move over a network link. Bandwidth directs packets to the most direct way to their destination. Enable the ports on the respective router. After that, pick the second serial port, assign an IP address, and enable the router's ports. This configuration applies to all of the routers in the source code topic.

Then, as indicated in the diagram, add IP addresses to PC1 and PC2. For comparable PCs, this setup comprises IP, Subnet Mask, and Gateway address. Then connect the routers to the respective PCs. Because I want this route to be the successor, I only add bandwidth to routers 1 and 2. The router 1 will choose this route (PC1 R1 R2R3PC2) when delivering packets from PC1 to PC2 because it has the better bandwidth. If the above paths fail, it will use the alternative route (PC1R1R4R3PC2).

Then I'll configure the EIGRP protocol on all of the routers in the diagram. The EIGRP protocol must first be enabled, and then all routers must have an Autonomous System number. It must be consistent across all routers. As a result, packets in the network link can flow in the correct paths. Then, in the setup, add an adjacent network address. Then, to save the EIGRP configuration, click ctrl + z. Then, on all routers in the network, implement the same EIGRP configuration. Finally, I assigned all of the code to the appropriate PCs and routers.

4.1 Device used:

Computer (PC): A computer is a type of end device that is used to display data, send messages, and so on.

A router is a layer-3 (network layer) device that decides on the routing of data/information sent to a remote destination. Routers are at the heart of any networked system, including the internet.

Gateways: A piece of software (or a mix of software and hardware) that allows data to be exchanged between networks that use various protocols for data sharing.

4.2 Tool used: CISCO PACKET TRACER

Cisco Systems created a cross-platform visual simulation tool that allows users to develop network topologies and simulate current computer networks.

Using a mimicked command line interface, this software allows users to replicate the configuration of Cisco routers and switches.

This software is primarily intended for students in the Cisco Network Associate Academy as an educational tool to aid in the learning of fundamental CCNA topics.

4.3 Network layer:

This is the OSI model's third layer. It takes care of the service request from the transport layer and passes it forward to the Datalink layer. The network layer is critical in moving packets from source to destination. It assists in uniquely identifying hosts outside subnets and sets the path that packets will travel or be routed to reach their destination in my project

. **4.4 Physical layer:** It is the sole layer in the OSI model that deals with the physical connection between two stations. This layer specifies the hardware, wiring, frequencies, and pulses that are utilised to represent binary signals. In my project, I'll be connecting Ethernet cables to various equipment such as switches, routers, and computers.

CHAPTER 5: WORK EXPLAINATION

In the preceding paragraph, I discussed the architecture of my project, which is depicted in the picture. I do this by connecting two PCs to their respective routers. First, I ping PC2 (200.0.0.2) from PC1 (100.0.0.2) and it is successfully established, as shown in the diagram below. The main goal of my project is to identify the shortest road from PC1 to PC2. There are two paths to PC2, namely (PC1R1R2R3PC2 and PC1R1R4R3PC2). To find the optimal path, I use the command (display IP EIGRP topology) in Router 1. It displays the correct path to reach PC2 from PC1, and the best path is (10.0.0.2), as shown in the diagram below. EIGRP protocol chose 10.0.0.2 path to reach PC1 due to better bandwidth on that route.

5.1 Steps involved:

- First, in Cisco software, establish the network topology indicated in the diagram.
- Then, on the respective routers, specify the IP address, clock rate, and bandwidth.
- Give PCs an IP address.
- Then, on the respective routers, configure EIGRP (Enhanced Interior Gateway Routing Protocol).

5.2 List of important EIGRP commands:

- Show IP route: Displays all of the routing table's available routes.
- Show IP route EIGRP: This option only shows the best available path to the destination based on EIGRP.

• Display IP EIGRP neighbours: Displays the neighbor's IP address along with uptime data.

• Display IP EIGRP topology: Shows how devices are connected in the network, including successors and distances that are feasible.

The output of these instructions is shown in the diagram below.

CHAPTER 6: SOURCE CODE

Router 1 IP configuration

```
Router>
Router>en
Router#conf t
Router(config)#int s0/0
Router(config-if)#ip add 10.0.0.1 255.0.0.0
Router(config-if)#clock rate 64000
Router(config-if)#bandwidth 72000
Router(configure-if)#no shut

Router(config-if)#int s0/1
Router(config-if)#ip add 40.0.0.2 255.0.0.0
Router(config-if)#no shut

Router(config-if)#int f0/0
Router(config-if)#ip add 100.0.0.1 255.0.0.0
Router(config-if)#no shut
```

Router(config-if)#exit

Router 2 IP configuration

Router>

Router>en

Router#conf t

Router(config)#int s0/0

Router(config-if)#ip add 10.0.0.2 255.0.0.0

Router(configure-if)#no shut

Router(config-if)#int s0/1

Router(config-if)#ip add 20.0.0.1 255.0.0.0

Router(config-if)#clock rate 64000

Router(config-if)#bandwidth 72000

Router(config-if)#no shut

Router(config-if)#exit

Router 3 IP configuration

Router>

Router>en

Router#conf t

Router(config)#int s0/0

Router(config-if)#ip add 20.0.0.2 255.0.0.0

Router(configure-if)#no shut

Router(config-if)#int s0/1

Router(config-if)#ip add 30.0.0.1 255.0.0.0

Router(config-if)#clock rate 64000

Router(config-if)#no shut

Router(config-if)#int f0/0

Router(config-if)#ip add 200.0.0.1 255.0.0.0

Router(config-if)#no shut

Router(config-if)#exit

Router 4 IP configuration

Router>

Router>en

Router#conf t

Router(config)#int s0/0

Router(config-if)#ip add 30.0.0.2 255.0.0.0

Router(configure-if)#no shut

Router(config-if)#int s0/1

Router(config-if)#ip add 40.0.0.1 255.0.0.0

Router(config-if)#clock rate 64000

Router(config-if)#no shut

Add IP Address to PC1

IP: 100.0.0.2

Subnet Mask: 255.0.0.0

Gateway: 100.0.0.1

Add IP Address to PC2

IP: 200.0.0.2

Subnet Mask: 255.0.0.0

Gateway: 200.0.0.1

Configure EIGRP in Router 1

Router(config)#

Router(config)#router eigrp 10

Router(config-router)#network 10.0.0.0

R Router(config-router)#network 100.0.0.0

Router(config-router)#^Z

Router#

Configure EIGRP in Router 2

Router(config)#

Router(config)#router eigrp 10

Router(config-router)#network 10.0.0.0

Router(config-router)#network 20.0.0.0

Router(config-router)#^Z

Router#

Configure EIGRP in Router 3

Router(config)#

Router(config)#router eigrp 10

Router(config-router)#network 20.0.0.0

Router(config-router)#network 30.0.0.0

Router(config-router)#network 200.0.0.0

Router(config-router)#^Z

Router#

Configure EIGRP in Router 4

Router(config)#

Router(config)#router eigrp 10

Router(config-router)#network 30.0.0.0

Router(config-router)#network 40.0.0.0

Router(config-router)#^Z

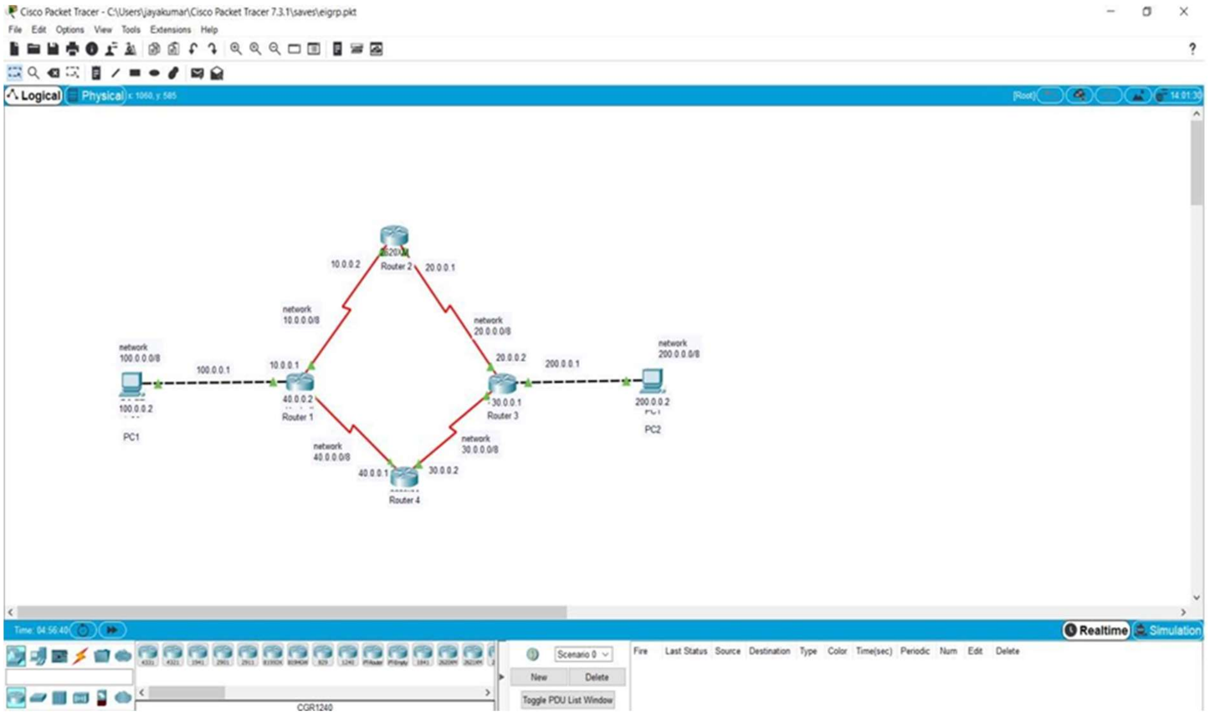
Router#

outer(config-router)#network 40.0.0.0

CHAPTER 7: RESULT AND DISCUSSION

The implementation of the EIGRP protocol using Cisco packet tracers yielded the following results, as shown in the preceding discussion.

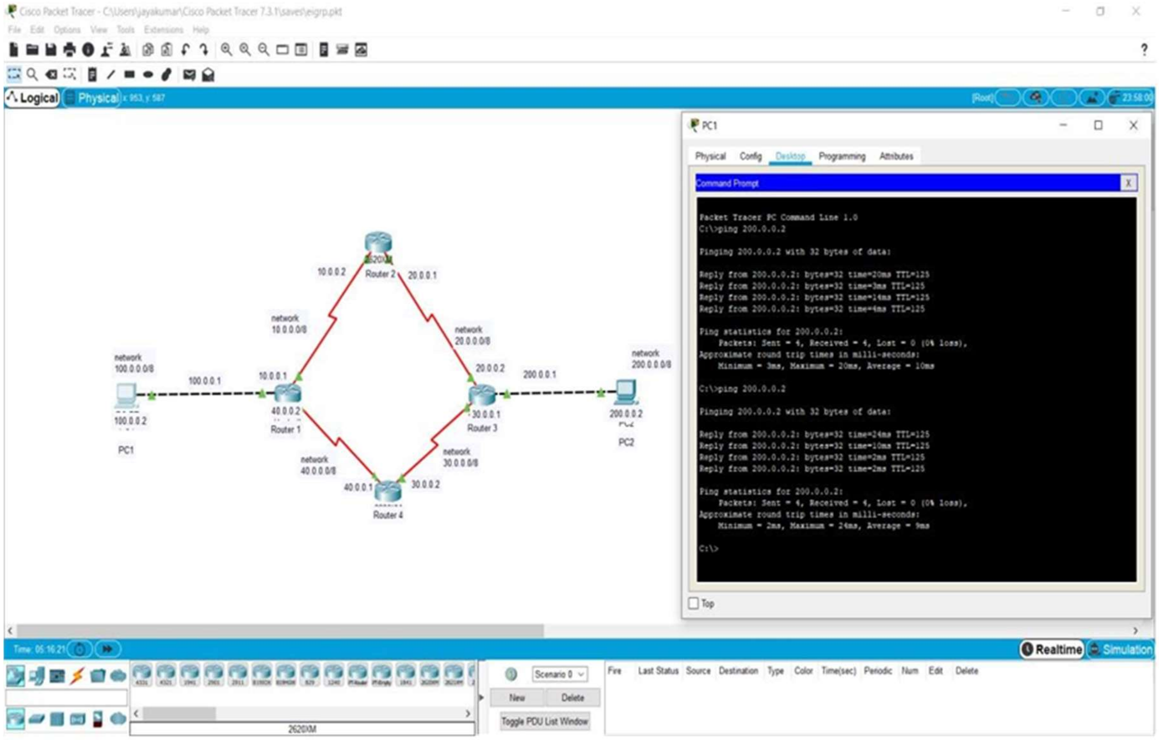
Network Topology



laying out a network topology

Fig 7.2 PC2 is being pinged by PC1.

Transfer packets from PC1 to PC2 is successfully we obtain



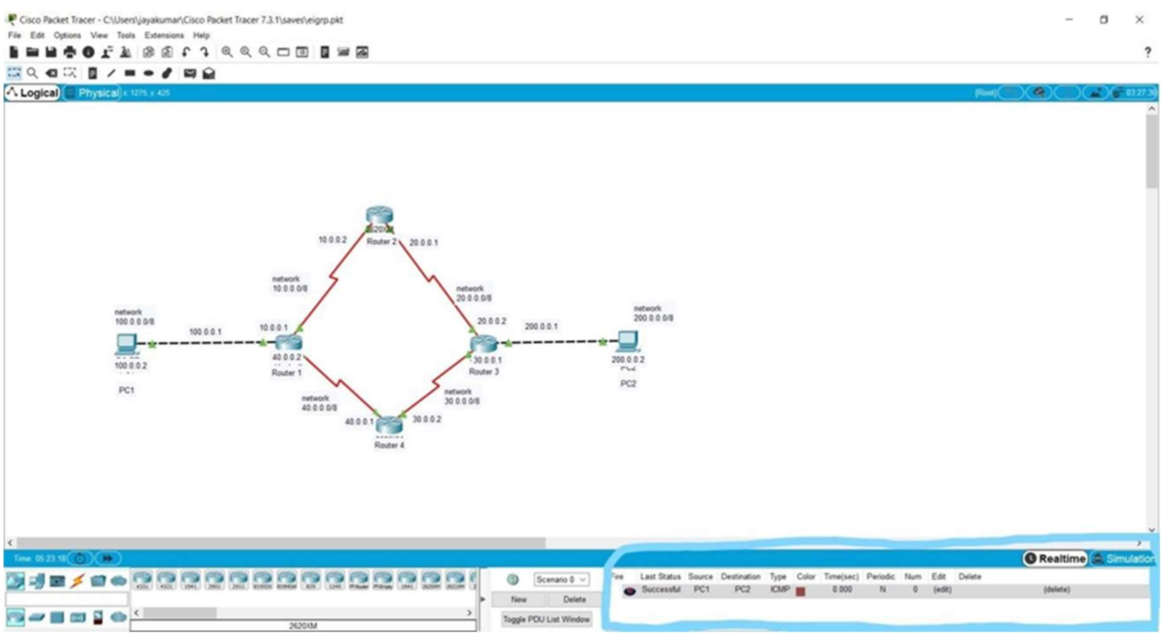
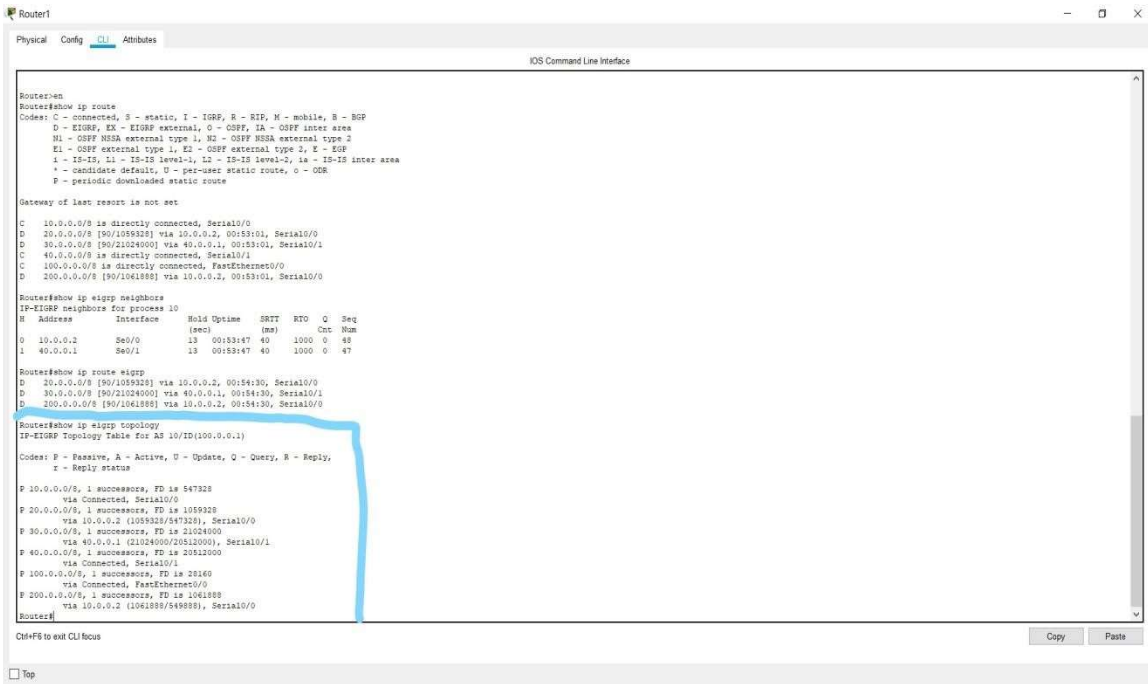


Fig 7.3 The packets are successfully transferred from PC1 to PC2

We get some key EIGRP commands from that.

Fig 7.4 Shows how to use several critical EIGRP commands



Using the Show IP EIGRP topology commands, the highlighted area of the above image shows the optimal path to reach PC2 from PC1.

CHAPTER 8 MERITS OF EIGRP

- It can connect to IPV4 and IPV6 networks.
- It features a flexible network design with a 90-meter administrative distance.
- EIGRP (Enhanced Interior Gateway Routing Technology) is an advanced distance vector routing protocol that helps automate routing decisions and configuration on a computer network
- It allows for load balancing and provides backup packet transfer channels.
- With a multi-address family, it makes the move much easier. • It has encryption for security

and can be used for WAN routing with iBGP.

- It has encryption for security and can be used for WAN routing with iBGP.
- It features a flexible network design with a 90-meter administrative distance.
- It uses 'need-based' updates to reduce network load.
- With a multi-address family, it makes the move much easier.

CHAPTER 9 DEMERITS OF EIGRP

- Because EIGRP is a Cisco proprietary protocol, it can only be used on Cisco products.
- EIGRP is a distance vector routing system that rely on neighbor-provided routes.
- The Cisco network devices can access the EIGRP routing protocol.
- It is not expandable, thus it will not support future applications.
- EIGRP cannot be used by routers from other vendors.

CHAPTER 10 CONCLUSION

EIGRP is the most advanced routing protocol, relying on distance vectors and state route links to determine the best route path. When compared to OSPF, it consumes fewer system resources. A router is a device that assists in sharing and routing packets in the most efficient manner. Cisco packet tracer software is highly useful for setting up a network and getting immediate results. Finally, I use the command show IP EIGRP topology in the associated network to identify the optimum path. It will have a greater impact in real time because it uses essential resources, and the main drawback is that it is not expandable.

CHAPTER11

IMPLEMENTATION OF EIGRP BASED SOLUTION

Verifying there is connectivity in the network between routers and to other devices.

Verifying EIGRP behaviors in case of topology change, by testing link failure and router failure events.

Documentation

The successful EIGRP execution shown above, the solution and verification process and results should be documented for future reference. The following items should be included in the documentation:

• A topology diagram

• The Internet Protocol (IP) addressing scheme

• The hierarchy of the areas

• EIGRP-enabled networks and interfaces on each router

CHAPTER 12: REFERENCE

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3. **Cisco's Enhanced Interior Gateway Routing Protocol (EIGRP), RFC 7838, d. Savage, J. Ng, S. Moore, D. Slice, P. Paluch, and R. White. May 2016, http://tools.ietf.org/html/rfc7868**