A scenario of a communication system in which two standalone systems can send data through the shortest path using the OSPF protocol using 3 routes

A project

Submitted by

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Contents

LIST OF FIGURES

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I would like to express my sincere gratitude towards my guide, **Dr. Charanjit Singh**, who gave his full support in the working of this project work with his stimulating suggestions and encouragement all the time. He has always been a source of ideas.

I would like to thank my friends and family for the strength that keep me standing and for the hope that keep me believing that this report would be possible.

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1. OSPF

Open Shortest Path First (OSPF) is a link-state routing protocol that is used to find the best path between the source and the destination router using its own Shortest Path First). OSPF is developed by Internet Engineering Task Force (IETF) as one of the Interior Gateway Protocol (IGP), i.e, the protocol which aims at moving the packet within a large autonomous system or routing domain. It is a network layer protocol which works on protocol number 89 and uses AD value 110. OSPF uses multicast address 224.0.0.5 for normal communication and 224.0.0.6 for update to designated router (DR)/Backup Designated Router (BDR).

1.1 OSPF Terms:

1. **Router Id** – It is the highest active IP address present on the router. First, the highest loopback address is considered. If no loopback is configured then the highest active IP address on the interface of the router is considered.

2. **Router priority** – It is an 8-bit value assigned to a router operating OSPF, used to elect DR and BDR in a broadcast network.

3. **Designated Router (DR)** – It is elected to minimize the number of adjacencies formed. DR distributes the LSAs to all the other routers. DR is elected in a broadcast network to which all the other routers share their DBD. In a broadcast network, the router requests for an update to DR, and DR will respond to that request with an update.

4. **Backup Designated Router (BDR)** – BDR is a backup to DR in a broadcast network. When DR goes down, BDR becomes DR and performs its functions.

5. **DR and BDR election** – DR and BDR election takes place in the broadcast network or multi-access network. Here are the criteria for the election:

   - The router having the highest router priority will be declared as DR.
   - If there is a tie in router priority then the highest router I'd be considered.

- First, the highest loopback address is considered. If no loopback is configured then the highest active IP address on the interface of the router is considered.

1.2 Dynamic Routing Table:

Dynamic Routing Table A dynamic routing table is updated periodically by using one of the dynamic routing protocols such as RIP, OSPF, or BGP. Whenever there is a change in the Internet, such as a shutdown of a router or breaking of a link, the dynamic routing protocols update all the tables in the routers (and eventually in the host) automatically.

Protocols, such as Open Shortest Path First (OSPF), allow the administrator to assign a cost for passing through a network based on the type of service required. OSPF protocol allows each router to have several routing tables based on the required type of service.

The Open Shortest Path First or OSPF protocol is an intradomain routing protocol based on link state routing. Its domain is also an autonomous system. Areas To handle routing efficiently and in a timely manner, OSPF divides an autonomous system into areas. An area is a collection of networks, hosts, and routers all contained within an autonomous system. An autonomous system can be divided into many different areas. All networks inside an area must be connected. Routers inside an area flood the area with routing information. At the border of an area, special routers called area border routers summarize the information about the area and send it to other areas. Among the areas inside an autonomous system is a special area called the backbone; all the areas inside an autonomous system must be connected to the backbone. In other words, the backbone serves as a primary area and the other areas as secondary areas. This does not mean that the routers within areas cannot be connected to each other, however. The routers inside the backbone are called the backbone routers. Note that a backbone router can also be an area border router. If, because of some problem, the connectivity between a backbone and an area is broken, a virtual link between routers must be created by an administrator to allow continuity of the functions of the backbone as the primary area.

The OSPF protocol allows the administrator to assign a cost, called the metric, to each route. The metric can be based on a type of service (minimum delay, maximum throughput, and so on). As a matter of fact, a router can have multiple routing tables, each based on a different type of service.

2.CLI COMMANDS

2.1 CLI commands for Router 0 (Router 1841)-

Router>en

Router#config t

Router(config)#int fa0/0

Router(config-if)#ip address 192.168.5.2 255.255.255.0

Router(config-if)#no shut

Router(config-if)#exit

Router(config)#int fa0/1

Router(config-if)#ip address 192.168.6.1 255.255.255.0

Router(config-if)#no shut

Router(config-if)#exit

Router(config)#router ospf 1

Router(config-router)#network 192.168.6.0 0.0.0.255 area 0

Router(config-router)#network 192.168.5.0 0.0.0.255 area 0

Router(config-if)#exit

2.2 CLI commands for Router PT (Router 8)-

Router>en

Router#config t

Router(config)#int se3/0

Router(config-if)#ip address 192.168.3.1 255.255.255.0

Router(config-if)#clock rate 9600

Router(config-if)#no shut

Router(config-if)#exit

Router(config)#int se2/0

Router(config-if)#ip address 192.168.2.2 255.255.255.0

Router(config-if)#no shut

Router(config-if)#exit

Router(config)#router ospf 1

Router(config-router)#network 192.168.3.0 0.0.0.255 area 0

Router(config-router)#network 192.168.2.0 0.0.0.255 area 0

Router(config-if)#exit

2.3 CLI commands for Router PT (Router 6)-

Router>en

Router#config t

Router(config)#int fa0/0

Router(config-if)#ip address 192.168.1.1 255.255.255.0

Router(config-if)#no shut

Router(config-if)#exit

Router(config)#int fa1/0

Router(config-if)#ip address 192.168.6.2 255.255.255.0

Router(config-if)#no shut

Router(config-if)#exit

Router(config)#int se2/0

Router(config-if)#ip address 192.168.2.1 255.255.255.0

Router(config-if)#clock rate 9600

Router(config-if)#no shut

Router(config-if)#exit

Router(config)#int se3/0

Router(config-if)#ip address 192.168.8.2 255.255.255.0

Router(config-if)#clock rate 64000

Router(config-if)#no shut

Router(config-if)#exit

Router(config)#router ospf 1

Router(config-router)#network 192.168.1.0 0.0.0.255 area 0

Router(config-router)#network 192.168.2.0 0.0.0.255 area 0

Router(config-router)#network 192.168.6.0 0.0.0.255 area 0

Router(config-router)#network 192.168.8.0 0.0.0.255 area 0

Router(config-if)#exit

2.4 CLI commands for Router PT (Router 7)-

Router>en

Router#config t

Router(config)#int fa0/0

Router(config-if)#ip address 192.168.4.1 255.255.255.0

Router(config-if)#no shut

Router(config-if)#exit

```
Router(config)#int fa1/0

Router(config-if)#ip address 192.168.5.1 255.255.255.0

Router(config-if)#no shut

Router(config-if)#exit

Router(config)#int se2/0

Router(config-if)#ip address 192.168.3.2 255.255.255.0

Router(config-if)#no shut

Router(config-if)#exit

Router(config)#int se3/0

Router(config-if)#ip address 192.168.7.2 255.255.255.0

Router(config-if)#clock rate 64000

Router(config-if)#no shut

Router(config-if)#exit

Router(config)#router ospf 1

Router(config-router)#network 192.168.3.0 0.0.0.255 area 0

Router(config-router)#network 192.168.4.0 0.0.0.255 area 0

Router(config-router)#network 192.168.5.0 0.0.0.255 area 0

Router(config-router)#network 192.168.7.0 0.0.0.255 area 0

Router(config-if)#exit
```

2.5 CLI commands for Router PT (Router 2)-

Router>en

Router#config t

Router(config)#int se2/0

Router(config-if)#ip address 192.168.8.1 255.255.255.0

Router(config-if)#no shut

Router(config-if)#exit

Router(config)#int se3/0

Router(config-if)#ip address 192.168.7.1 255.255.255.0

Router(config-if)#no shut

Router(config-if)#exit

Router(config)#router ospf 1

Router(config-router)#network 192.168.7.0 0.0.0.255 area 0

Router(config-router)#network 192.168.8.0 0.0.0.255 area 0

Router(config-if)#exit

3.OUTPUT

In this chapter of the report, I will be pasting the screenshots of the circuit and the outputs as well, and will be explaining them in short.

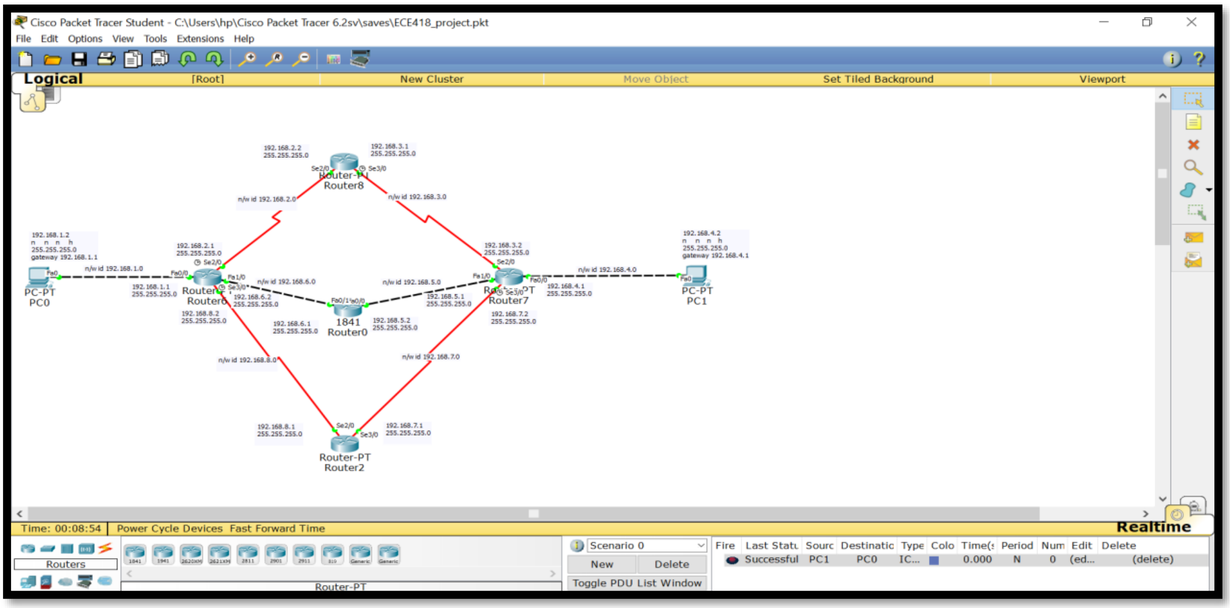

Figure 1-Circuit Diagram

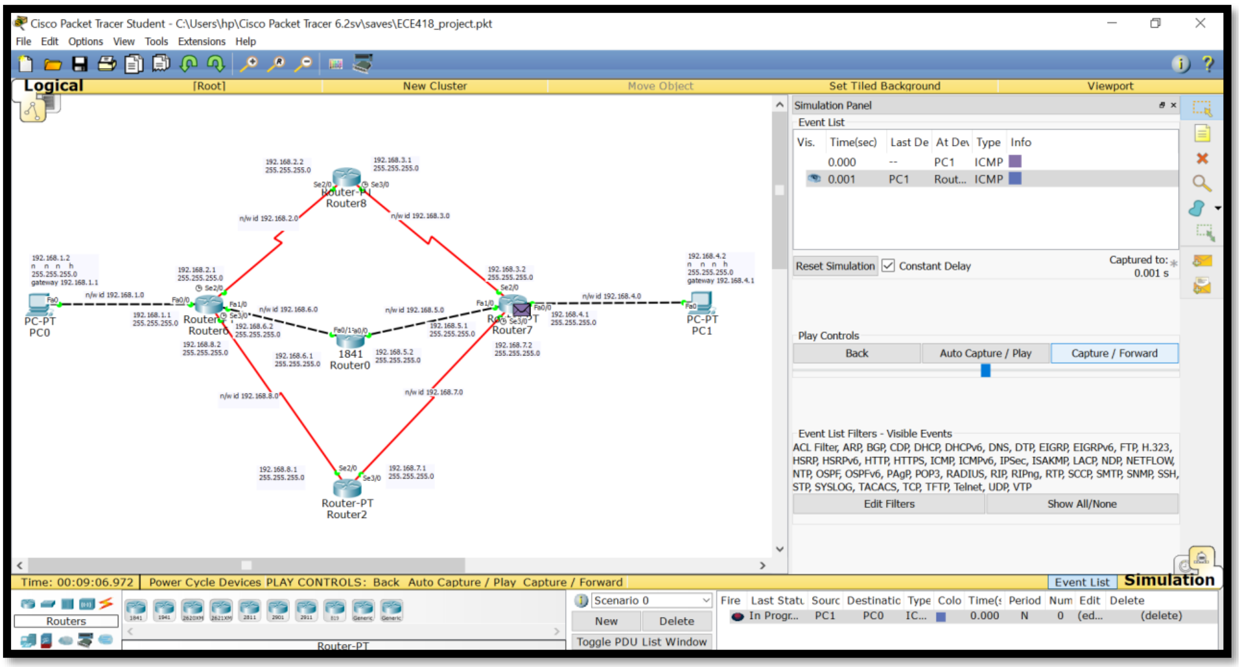

Figure 2- Message being transmitted from PC1 to PC0

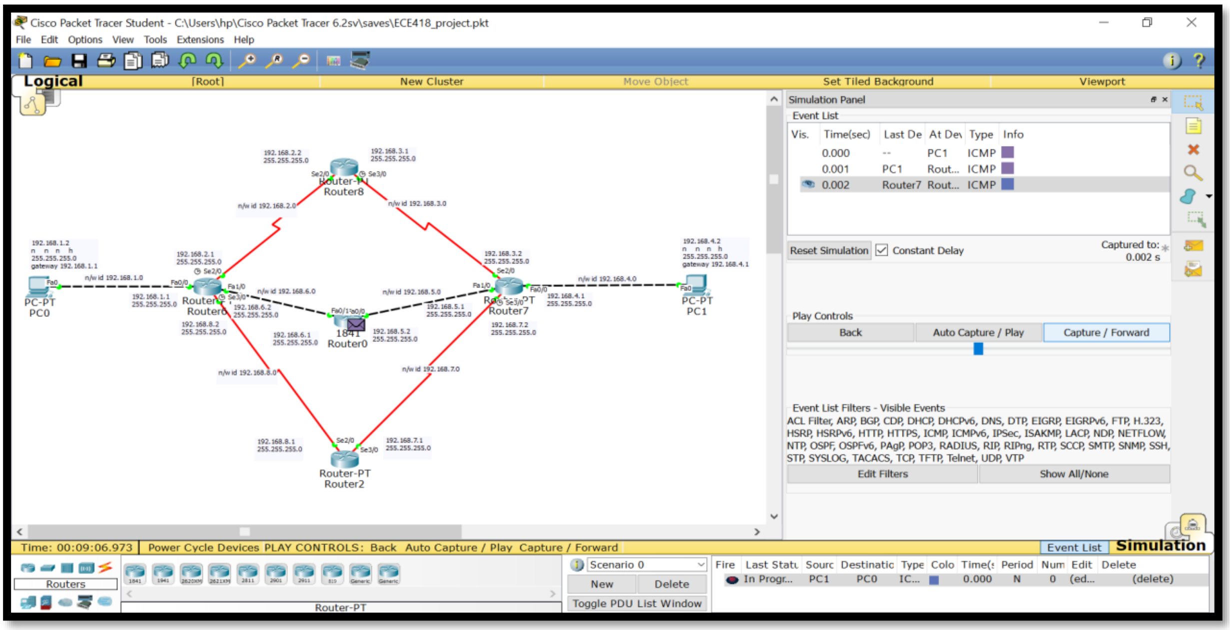

Figure 3-Message taking the fast ethernet path

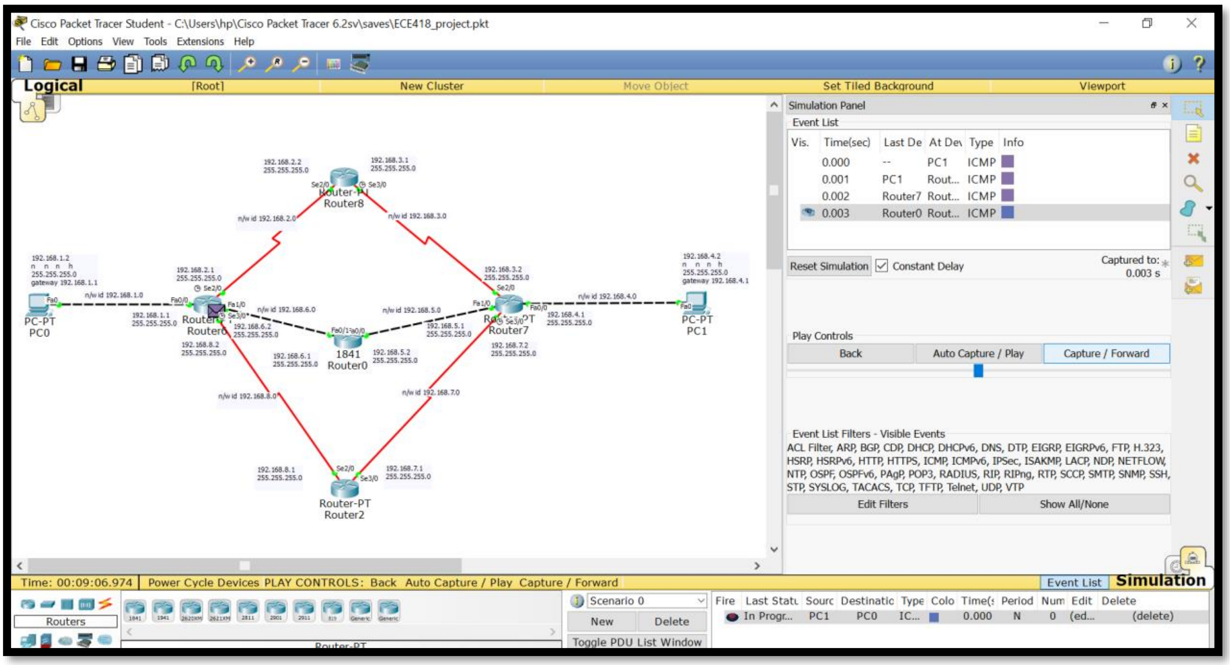

Figure 4-Message reached the router of the other network

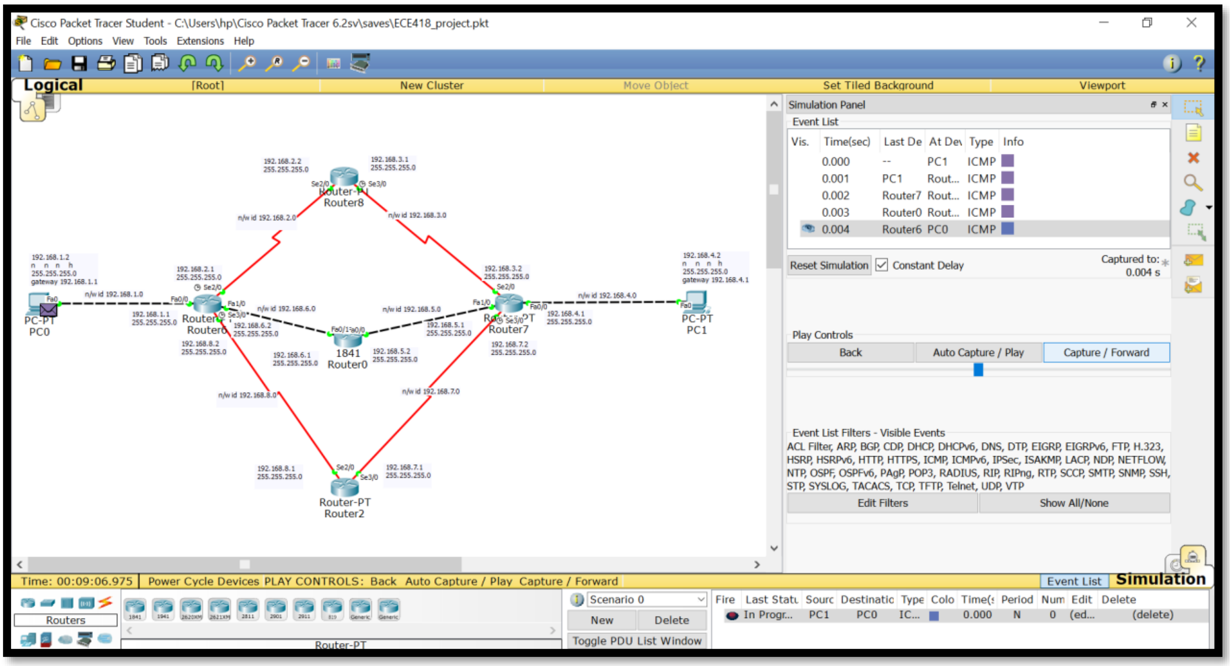

Figure 5-Message reached its destination

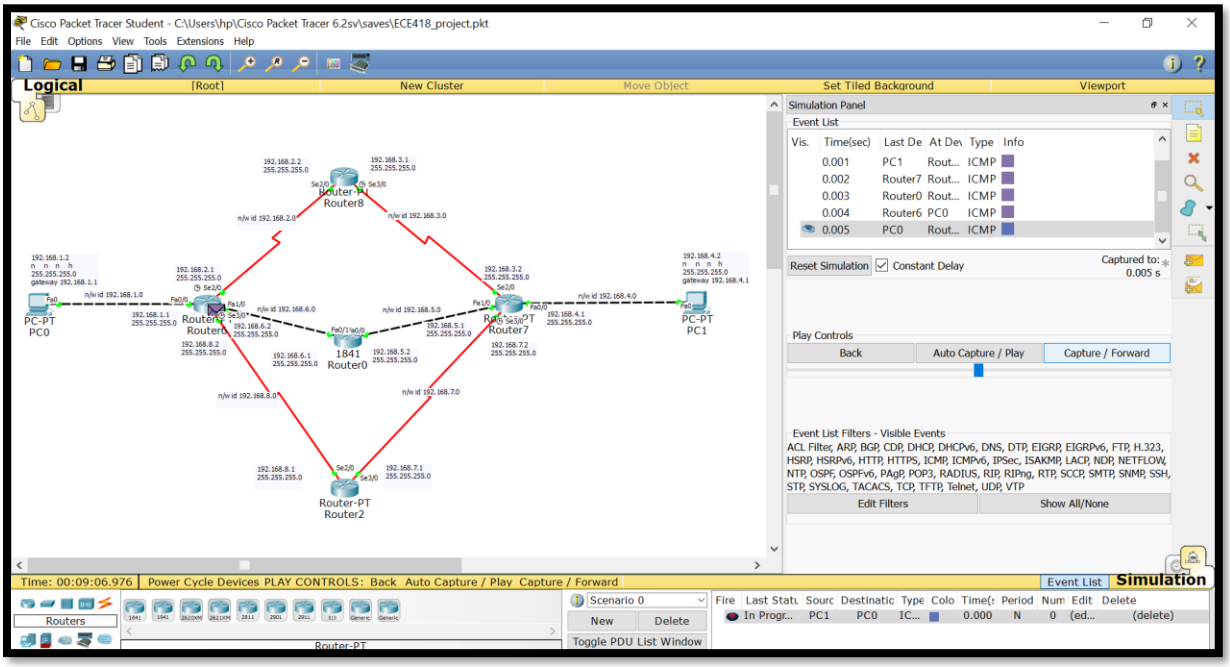

Figure 6-Acknowledgement being transmitted back to source PC

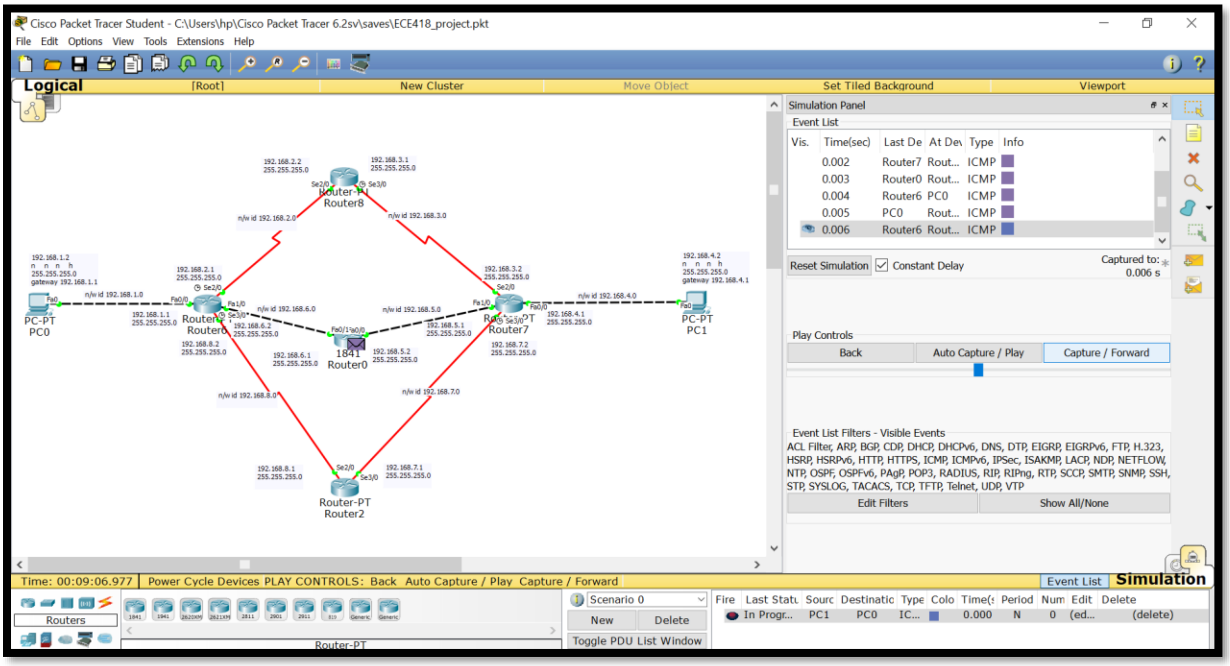

Figure 7-Acknowledgement taking the fast ethernet route

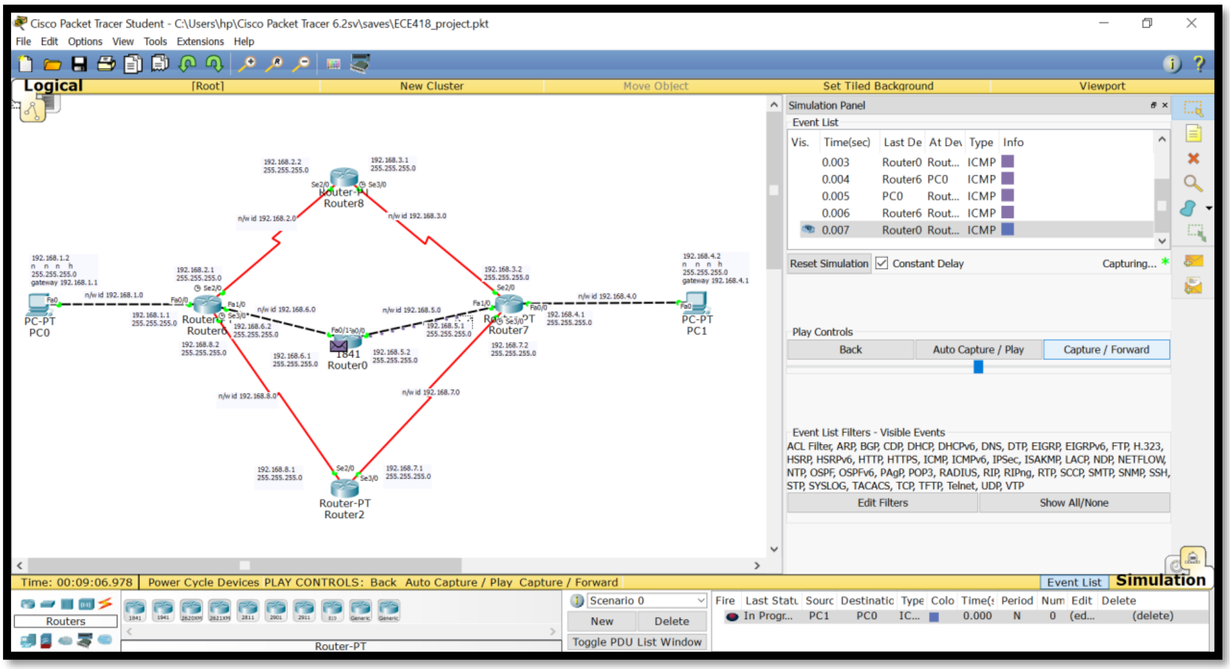

Figure 8-Message Transmission Visible

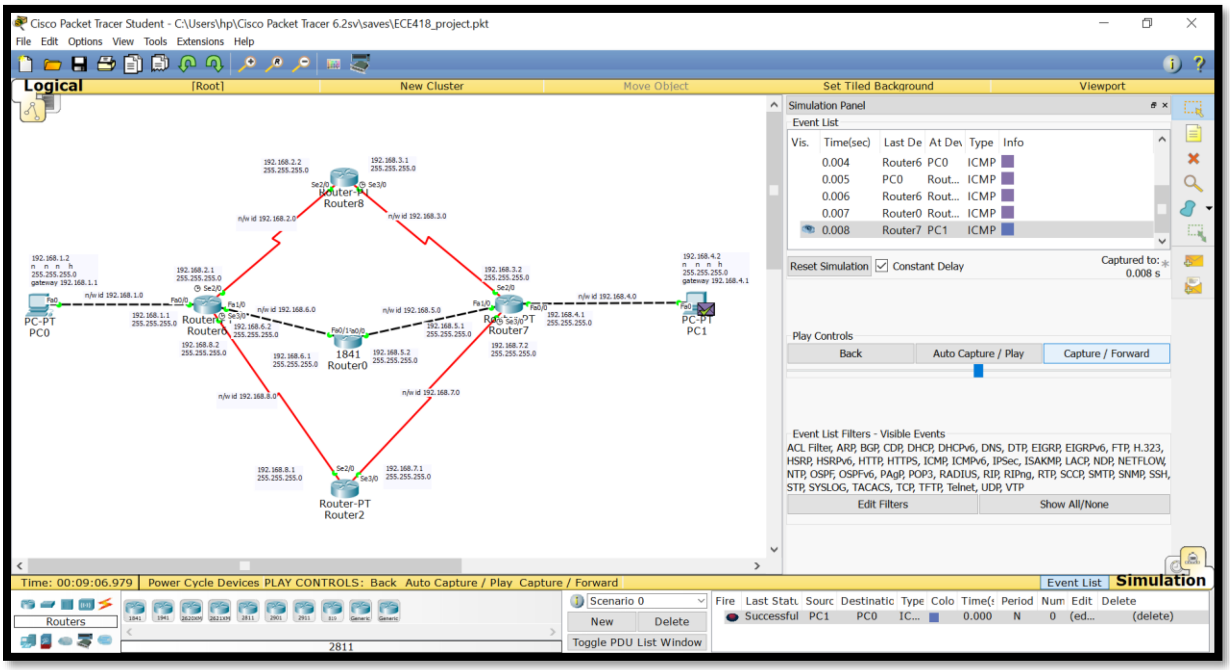

Figure 9-Acknowledgement Received, Transmission Successful

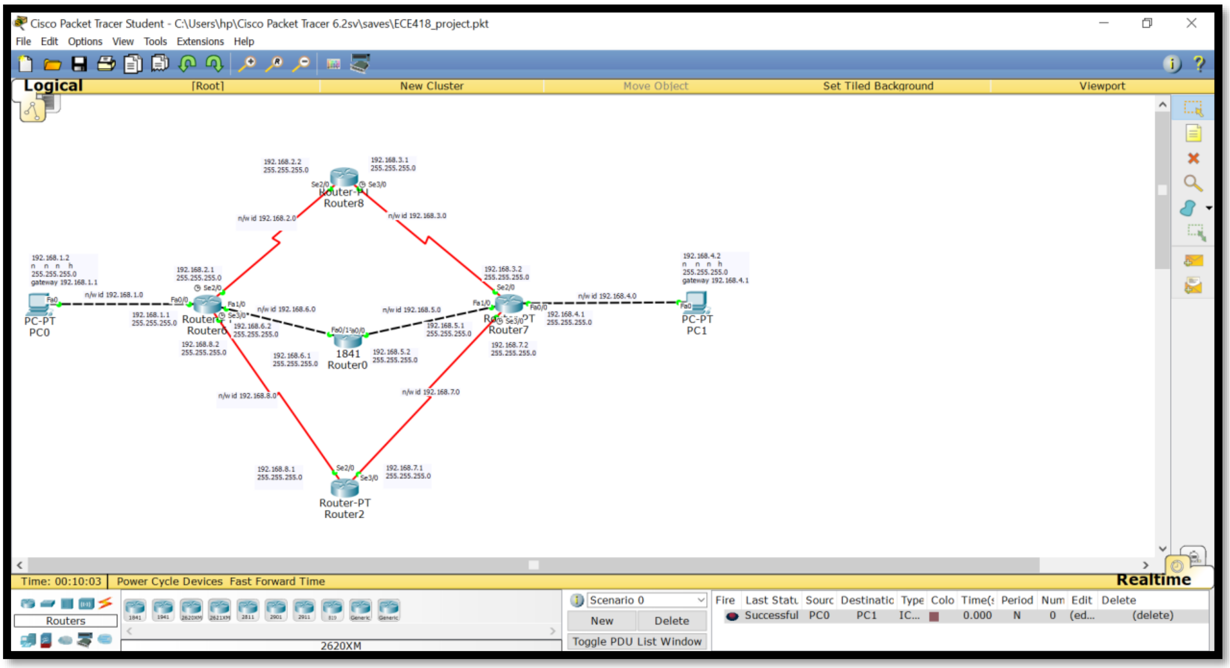

Figure 10-Message Transmission Successful

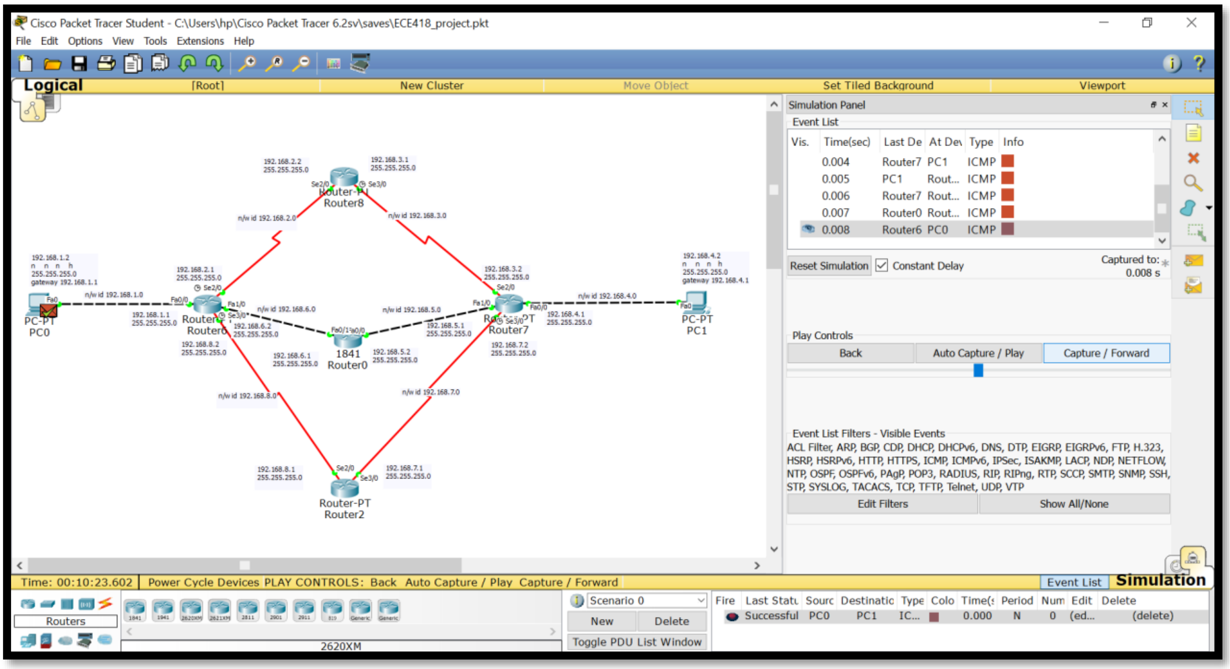

Figure 11-Message Successfully transmitted from PC0 to PC1

4. CONCLUSION

In conclusion, the scenario of a communication system in which two standalone systems can send data through the shortest path using the OSPF protocol with 3 routes is a practical and effective solution for modern-day communication networks. The Open Shortest Path First (OSPF) protocol is a reliable routing protocol that enables the transmission of data between two standalone systems through the shortest path possible. The use of 3 routes further enhances the efficiency and reliability of the communication system, ensuring that data can be transmitted quickly and securely even in the event of network congestion or failures.

Overall, the implementation of such a communication system can greatly benefit organizations and businesses that require fast and reliable communication networks to carry out their daily operations. It can provide a seamless and uninterrupted communication experience, which is crucial in today's fast-paced digital world. Therefore, it is recommended that organizations and businesses consider implementing a communication system using the OSPF protocol with 3 routes to ensure efficient and reliable data transmission