Faculty of Engineering and Technology

Electrical and Computer Engineering Department

ENCS4130 || Computer Networks Laboratory

Problem Solution in

EXP. No. 4. Dynamic Routing 2

(Link State Routing Protocols)

Open Shortest path first (OSPF)

Prepared By: Eman Asfour

Instructor: Dr. Ismail Khater

T.A: Eng. Burhan Dar Assi

Section: 2

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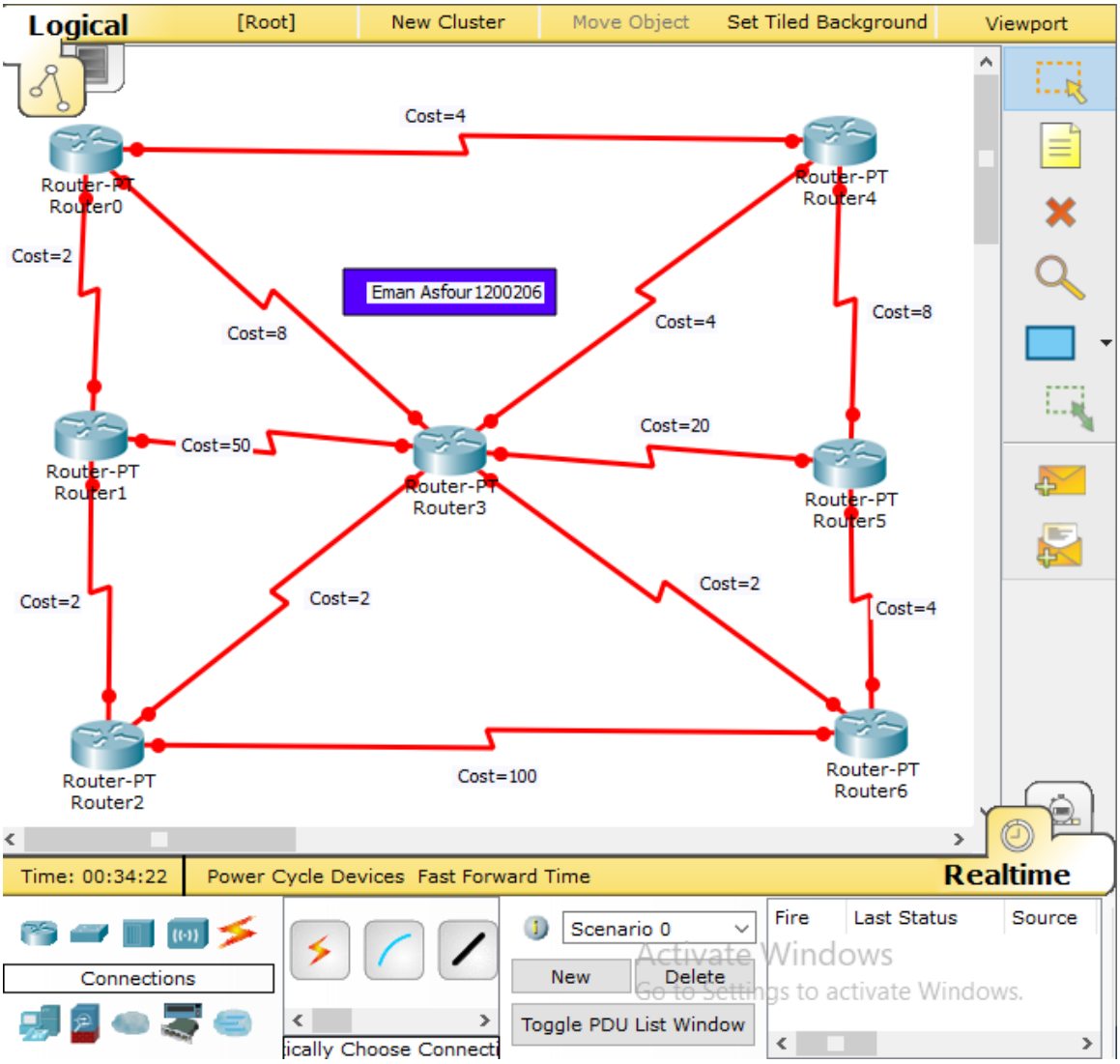

Figure 1: The Topology for TODO

1. Find the shortest path from Router 0 to Router 6 using Dijkstra's algorithm. Show your steps. .

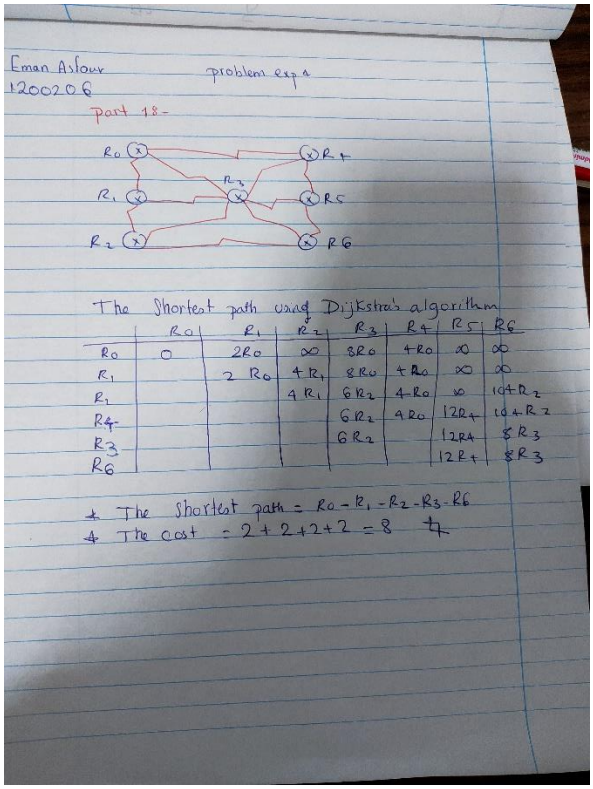

Figure 2: Dijkstra's algorithm

2. What is the cost of the shortest path from Router 0 to Router 6? The cost = 8

***Part Two*:**

For addressing:

My ID = 1200206, So A=2 and B=6

The address = 192.2.6.0/30
Using Packet Tracer software, the topology is:

Network	Device	Interface	IP	Subnet Mask	Wildcard Mask
Network 0 192.2.6.0/30	R0	Se2/0	192.2.6.1	255.255.255.252	0.0.0.3
	R1	Se2/0	192.2.6.2	255.255.255.252	0.0.0.3
Network 1 192.2.6.4/30	R1	Se3/0	192.2.6.5	255.255.255.252	0.0.0.3
	R2	Se2/0	192.2.6.6	255.255.255.252	0.0.0.3
Network 2 192.2.6.8/30	R0	Se6/0	192.2.6.9	255.255.255.252	0.0.0.3
	R4	Se2/0	192.2.6.10	255.255.255.252	0.0.0.3
Network 3 192.2.6.12/30	R0	Se3/0	192.2.6.13	255.255.255.252	0.0.0.3
	R3	Se6/0	192.2.6.14	255.255.255.252	0.0.0.3
Network 4 192.2.6.16/30	R1	Se6/0	192.2.6.17	255.255.255.252	0.0.0.3
	R3	Se3/0	192.2.6.18	255.255.255.252	0.0.0.3
Network 5 192.2.6.20/30	R2	Se6/0	192.2.6.21	255.255.255.252	0.0.0.3
	R3	Se2/0	192.2.6.22	255.255.255.252	0.0.0.3
Network 6 192.2.6.24/30	R2	Se3/0	192.2.6.25	255.255.255.252	0.0.0.3
	R6	Se2/0	192.2.6.26	255.255.255.252	0.0.0.3
Network 7 192.2.6.28/30	R3	Se7/0	192.2.6.29	255.255.255.252	0.0.0.3
	R4	Se6/0	192.2.6.30	255.255.255.252	0.0.0.3
Network 8 192.2.6.32/30	R3	Se8/0	192.2.6.33	255.255.255.252	0.0.0.3
	R5	Se3/0	192.2.6.34	255.255.255.252	0.0.0.3
Network 9 192.2.6.36/30	R3	Se9/0	192.2.6.37	255.255.255.252	0.0.0.3
	R6	Se6/0	192.2.6.38	255.255.255.252	0.0.0.3

Network10 192.2.6.40/30	R4	Se6/0	192.2.6.41	255.255.255.252	0.0.0.3
	R5	Se2/0	192.2.6.42	255.255.255.252	0.0.0.3
Network11 192.2.6.44/30	R5	Se6/0	192.2.6.45	255.255.255.252	0.0.0.3
	R6	Se3/0	192.2.6.46	255.255.255.252	0.0.0.3
7.7.7.0/24	Router6	Loopback0	7.7.7.7	255.255.255.0	0.0.0.255

Table 1: Subnetting

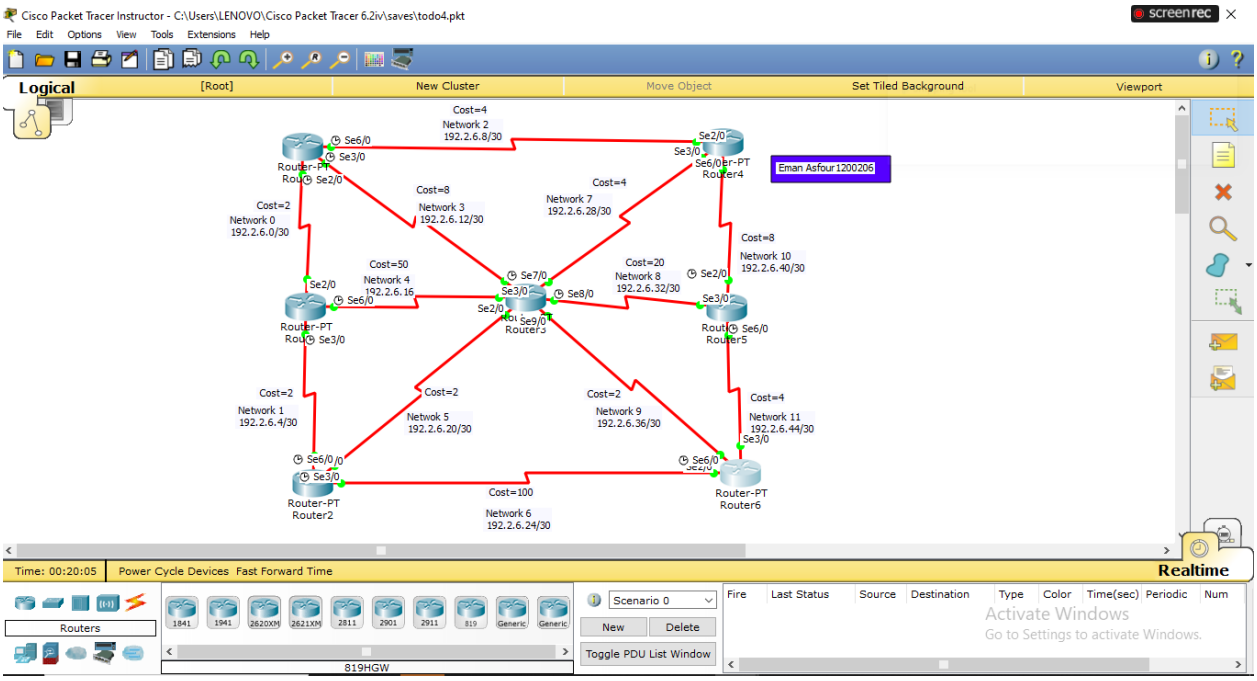

Figure 3: The Topology on packet tracer

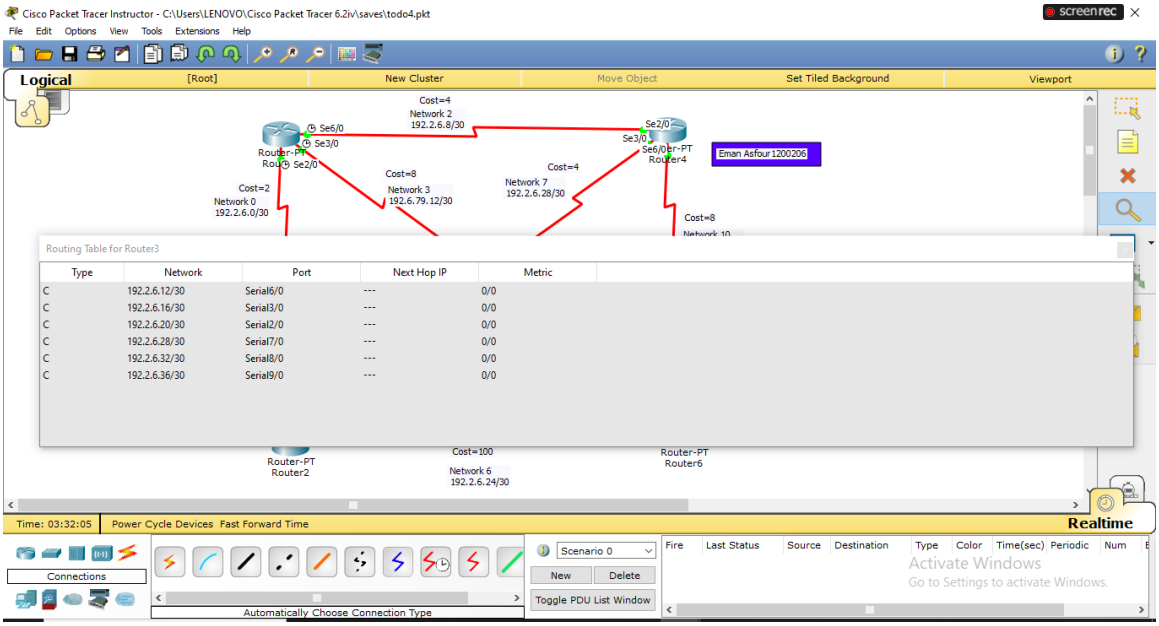

Figure 4: Checking for addresing

Configure the loopback IP

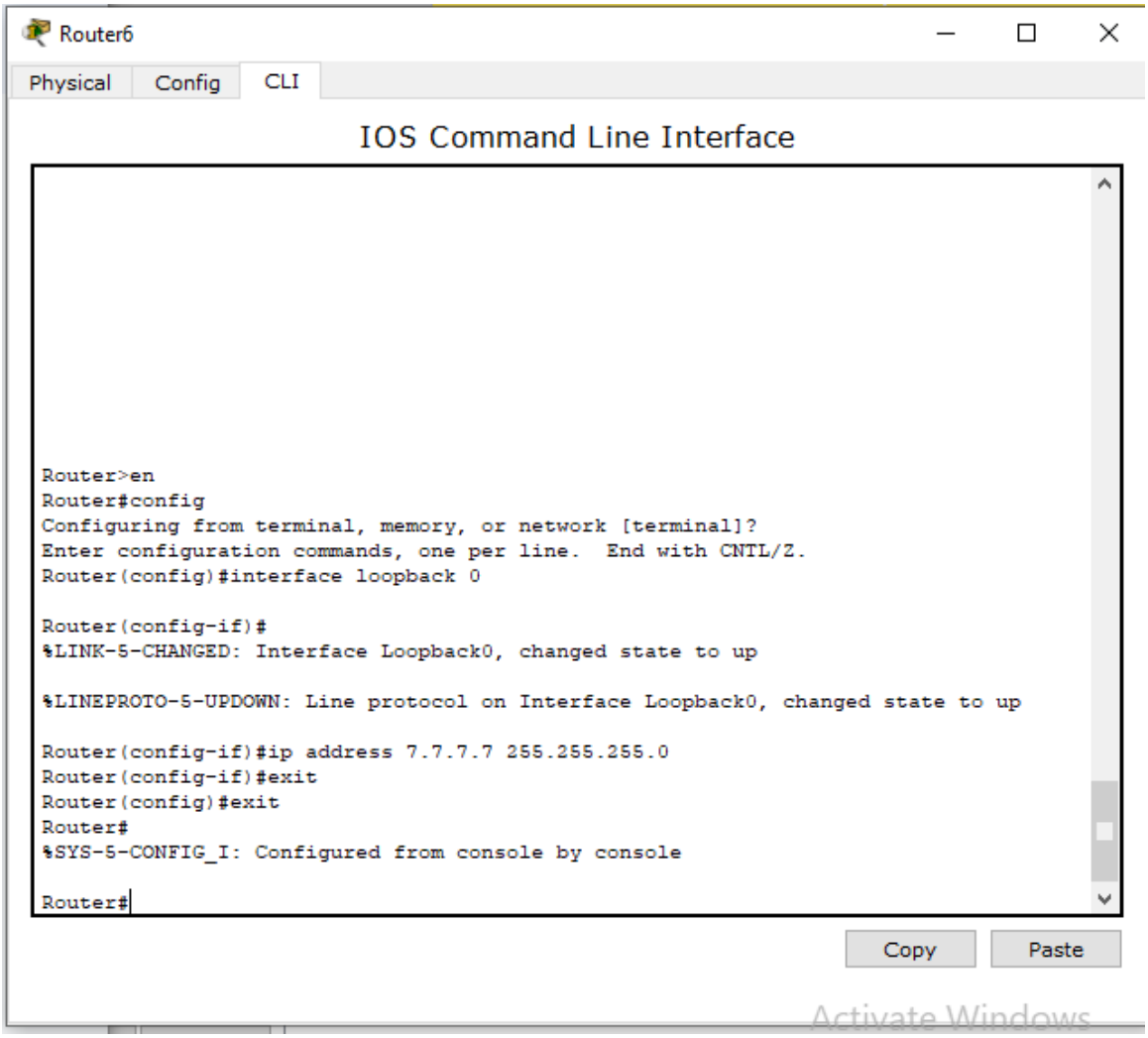

Figure 5: loopback on R6

OSPF

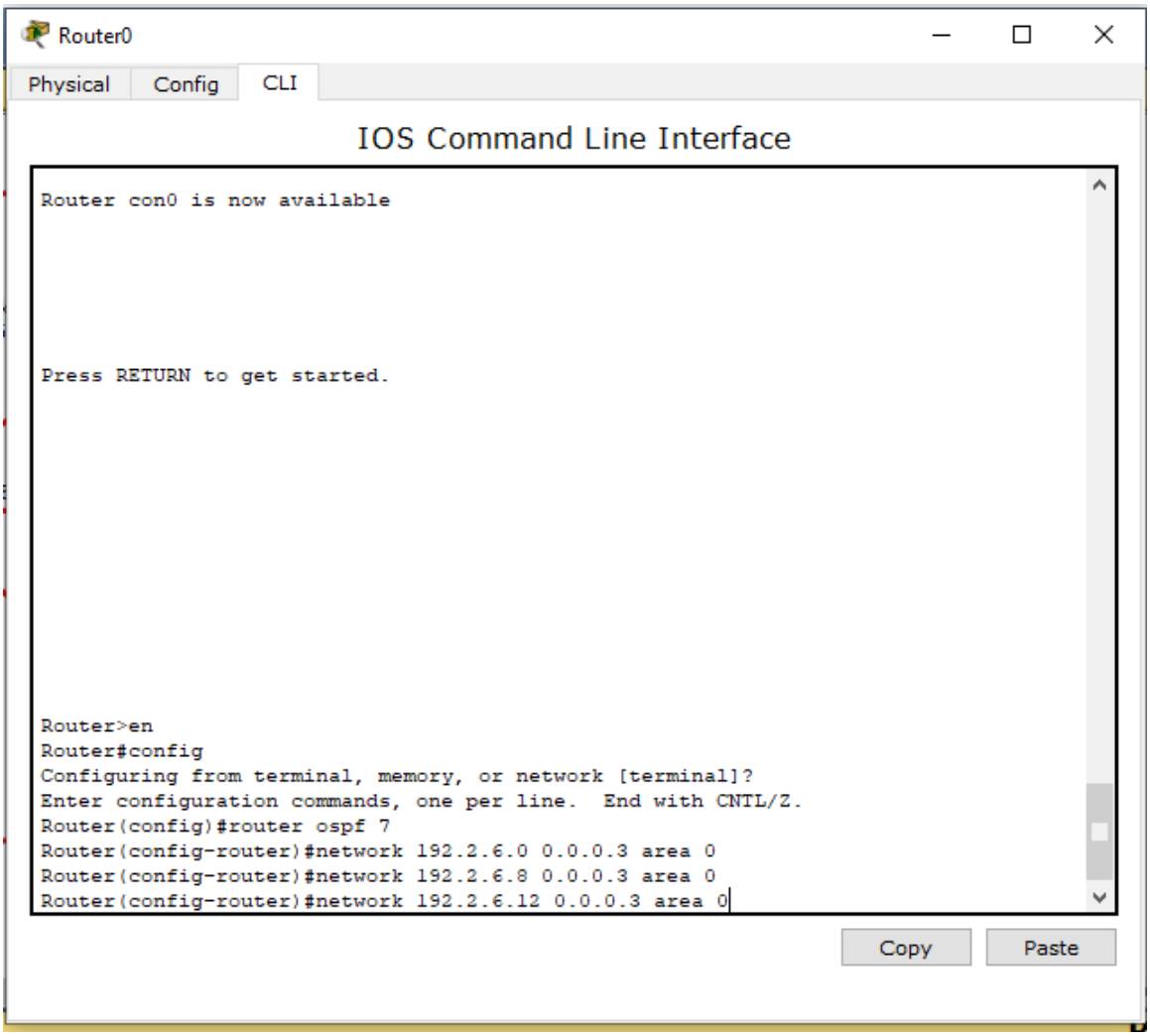

Figure 6: OSPF on R0

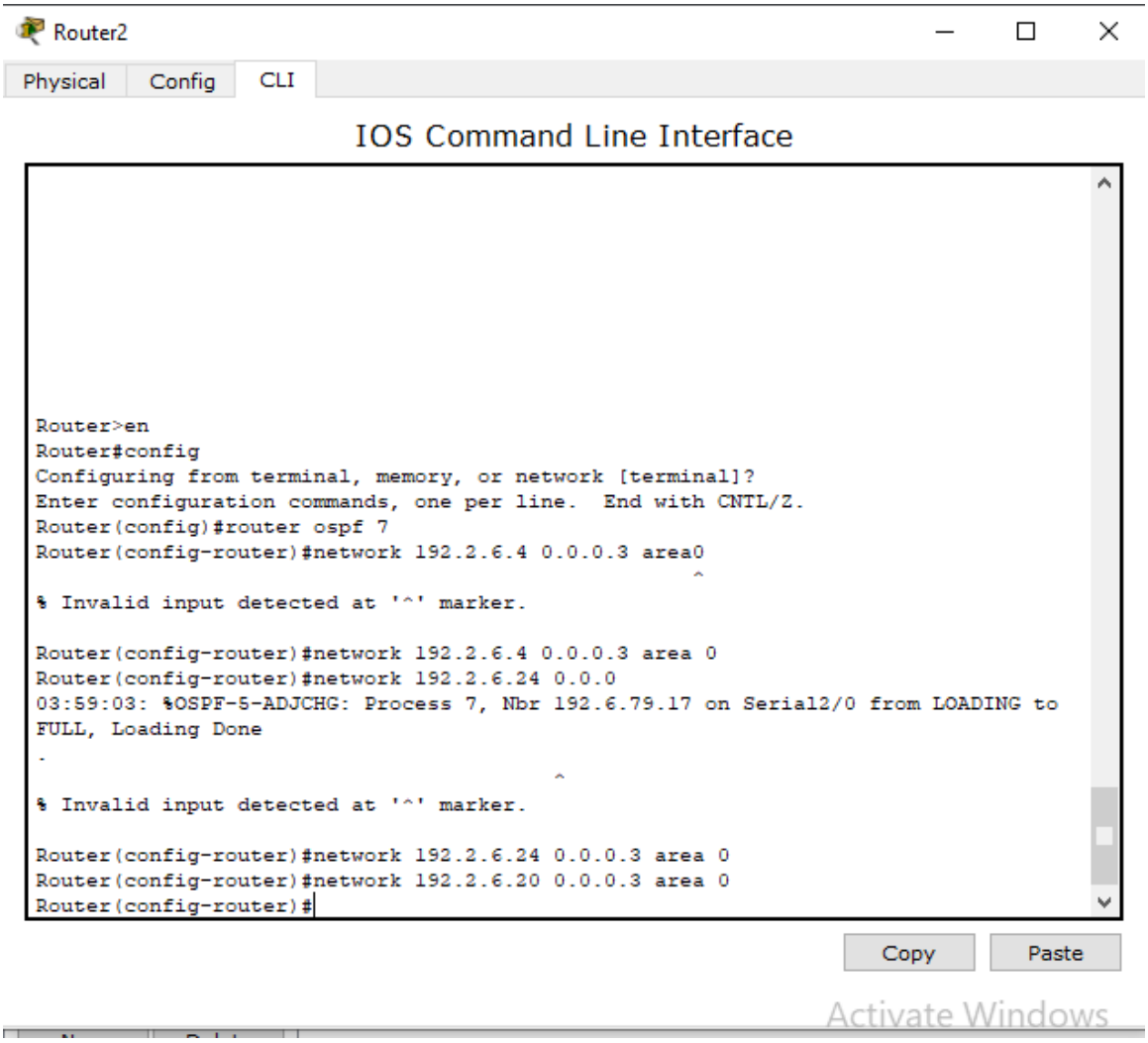

Figure 7: OSPF of R2

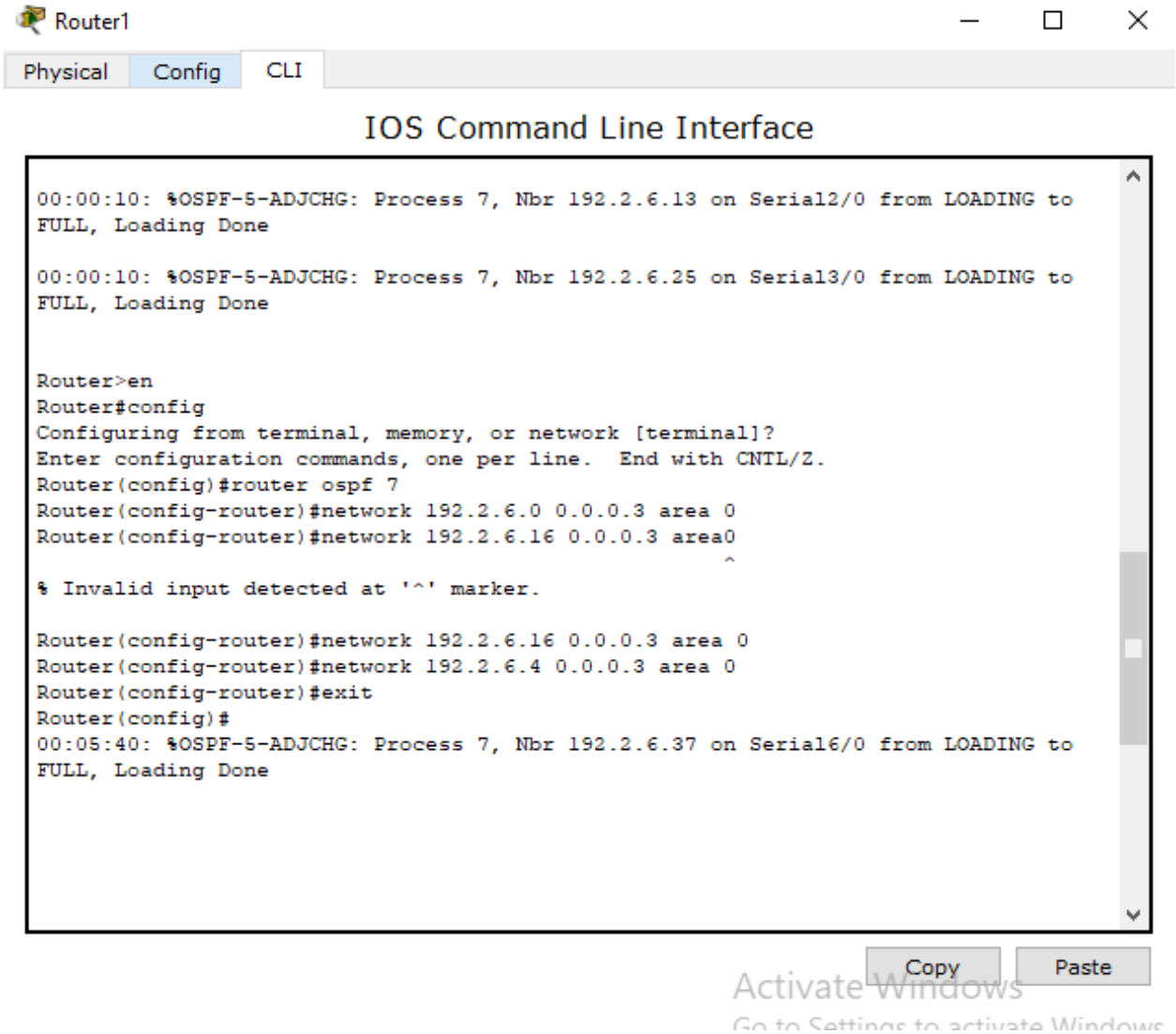

Figure 8: OSPF for R1

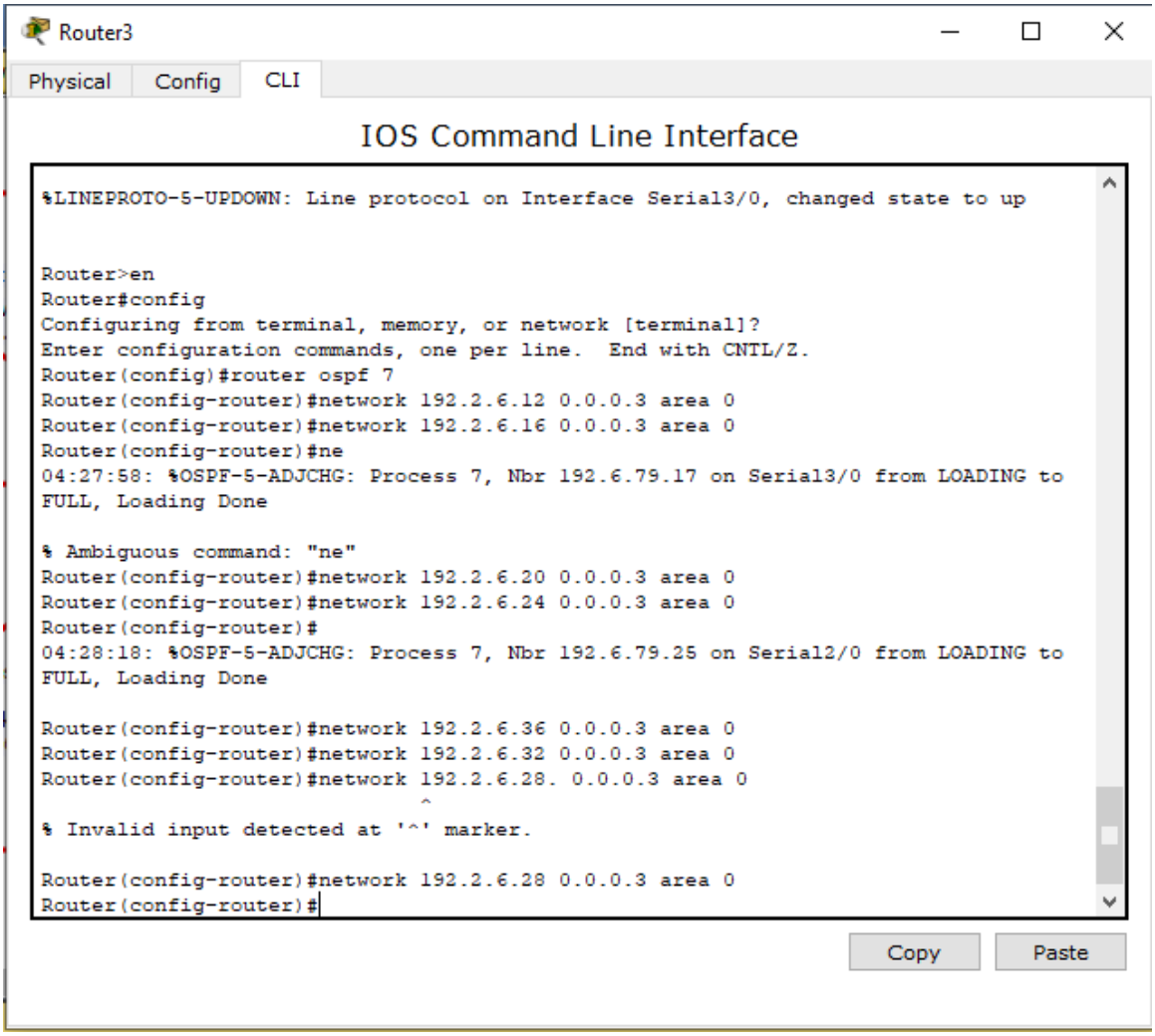

Figure 9: OSPF of R3

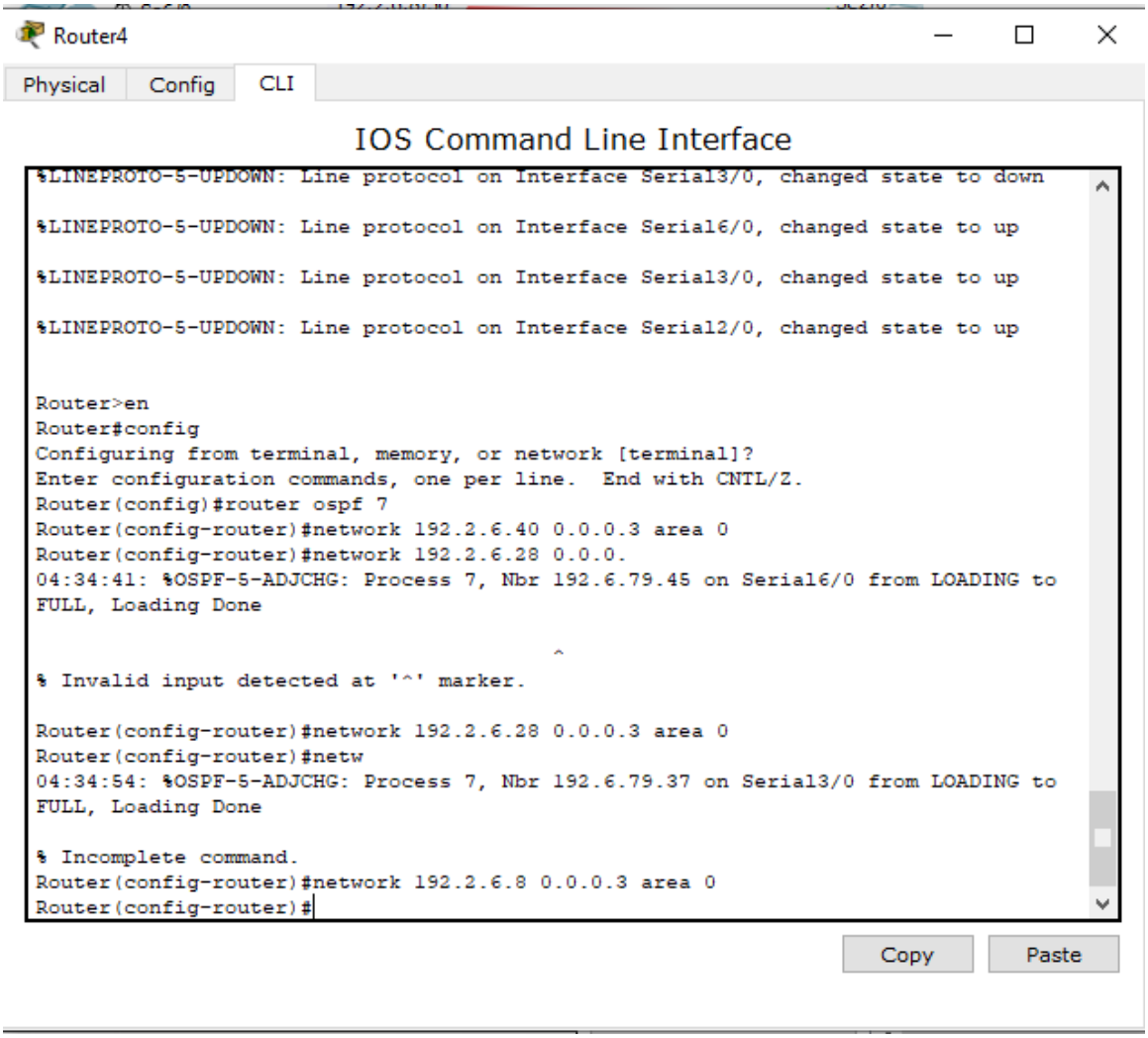

Figure 10: OSPF of R4

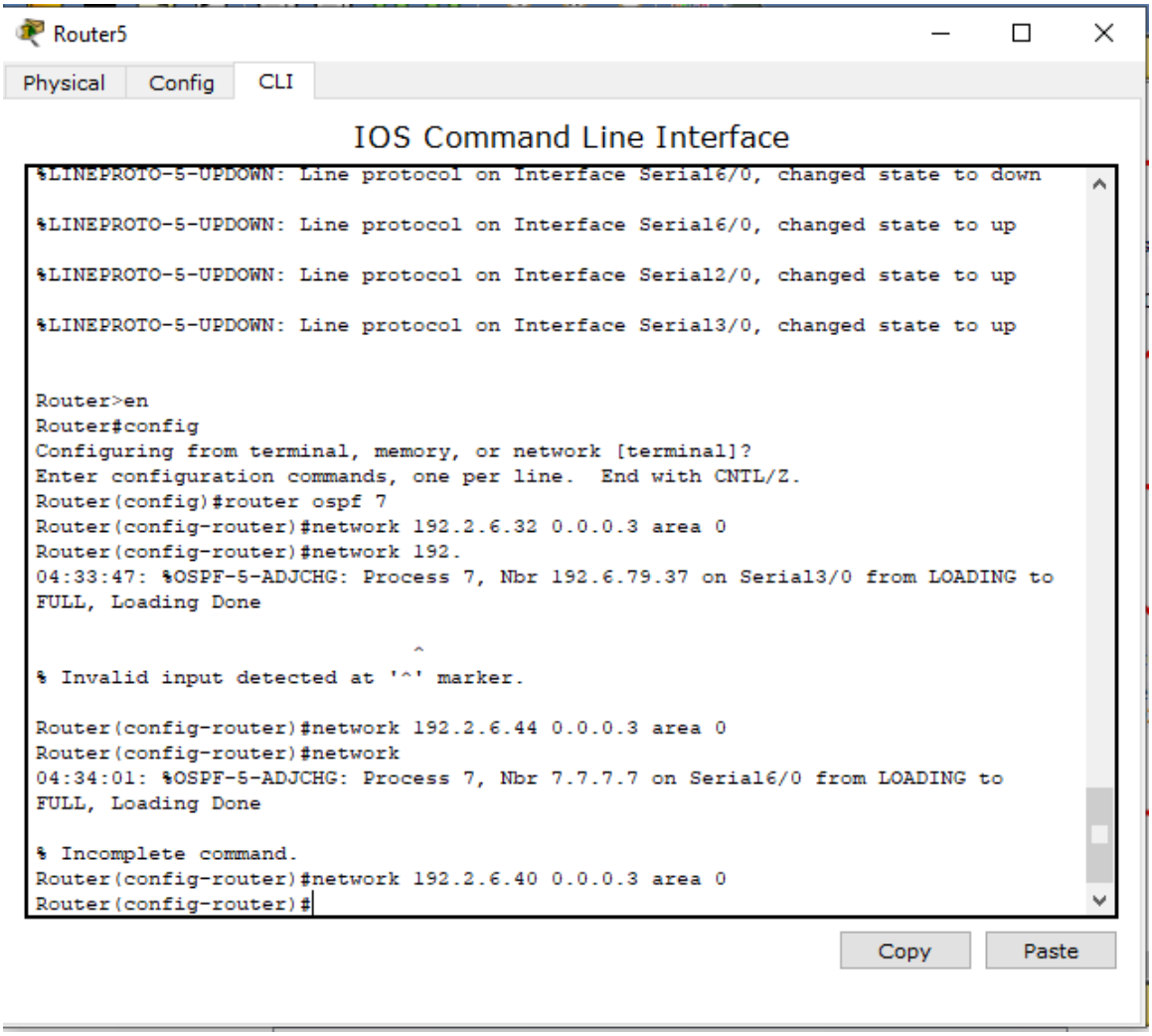

Figure 11: OSPF of R5

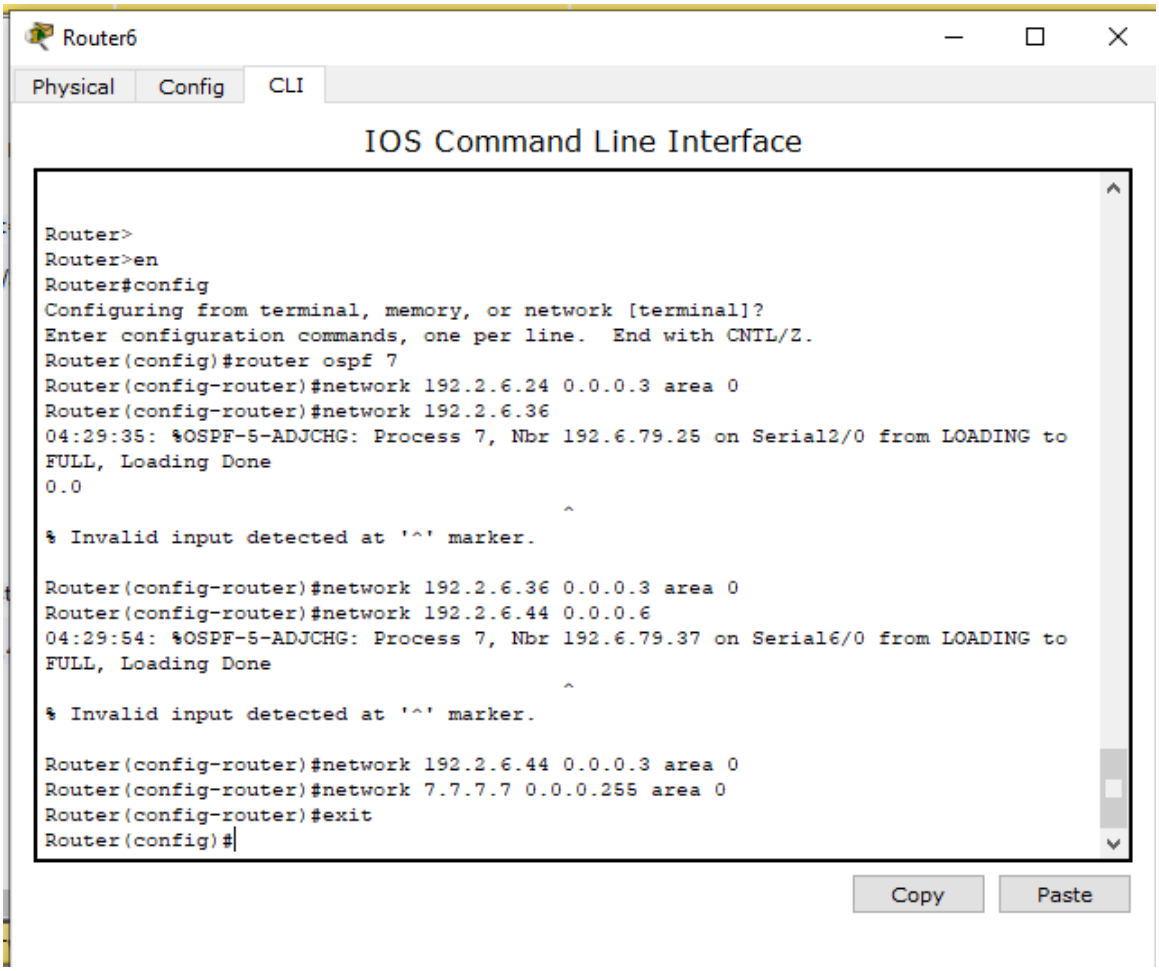

Figure 12: OSPF on R6

All of the routers had OSPF routing enabled. Set the loopback IP address 7.7.7.7/24 on Router 6.

We must compute the bandwidth in order to set the bandwidth values between the links:

Equation 1: The relationship between bandwidth and cost in the OSPF

$$Bandwidth = 100Mb/cost$$

Cost = 2 → Bandwidth = 50Mb = 50000Kb

Cost = 4 → Bandwidth = 25Mb = 25000Kb

Cost = 8 → Bandwidth = 12.5Mb = 12500Kb

Cost = 20 → Bandwidth = 5Mb = 5000Kb

Cost = 50 → Bandwidth = 2Mb = 2000Kb

Cost = 100 → Bandwidth = 1Mb = 1000Kb

Testing

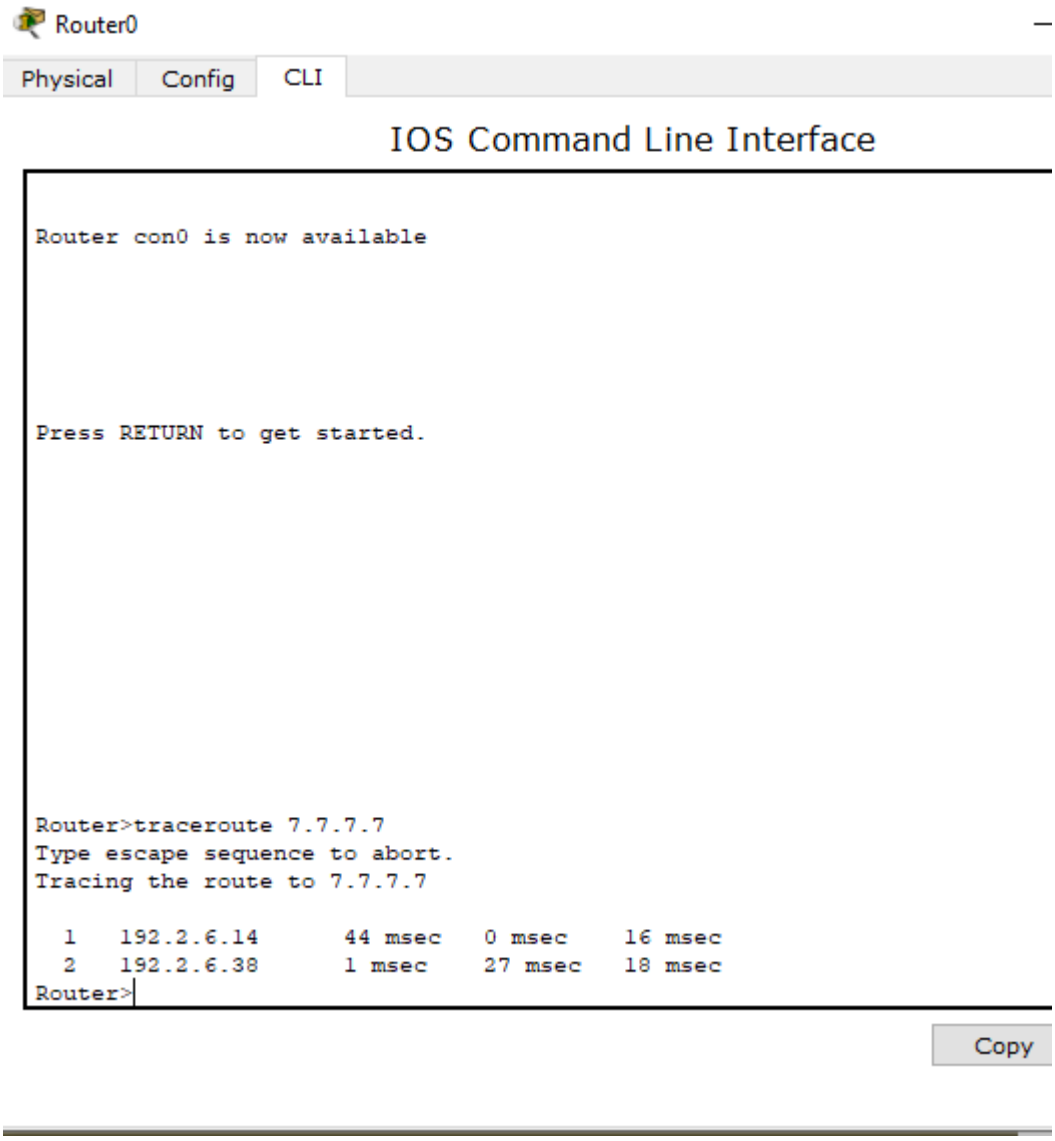

Figure 13: traceroute command

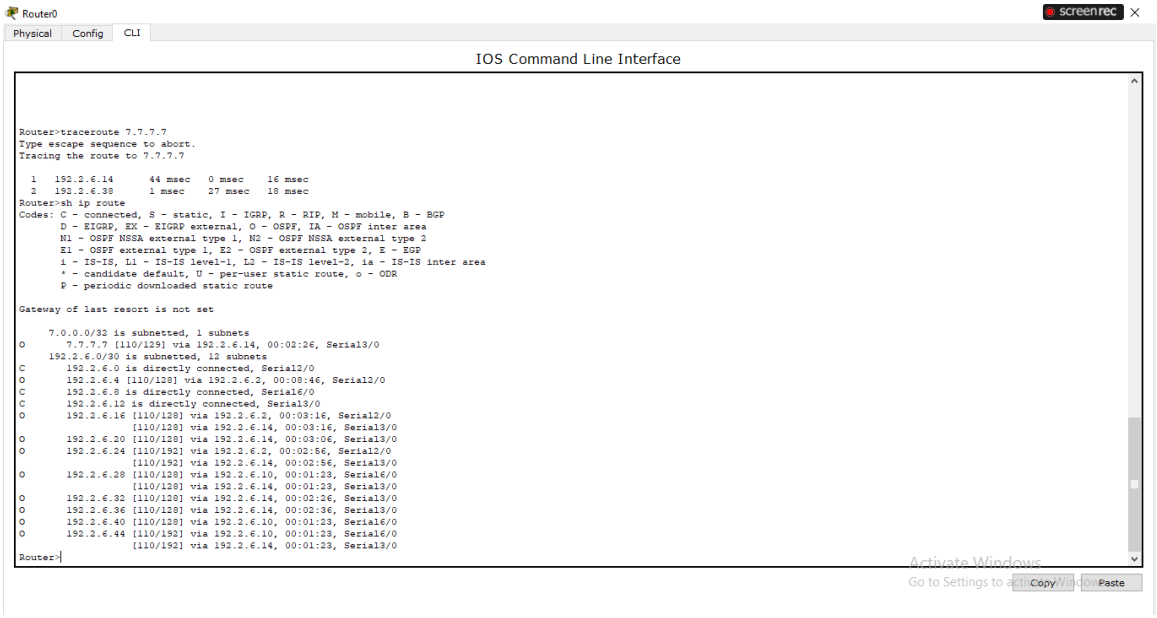

Figure 14: Show IP route

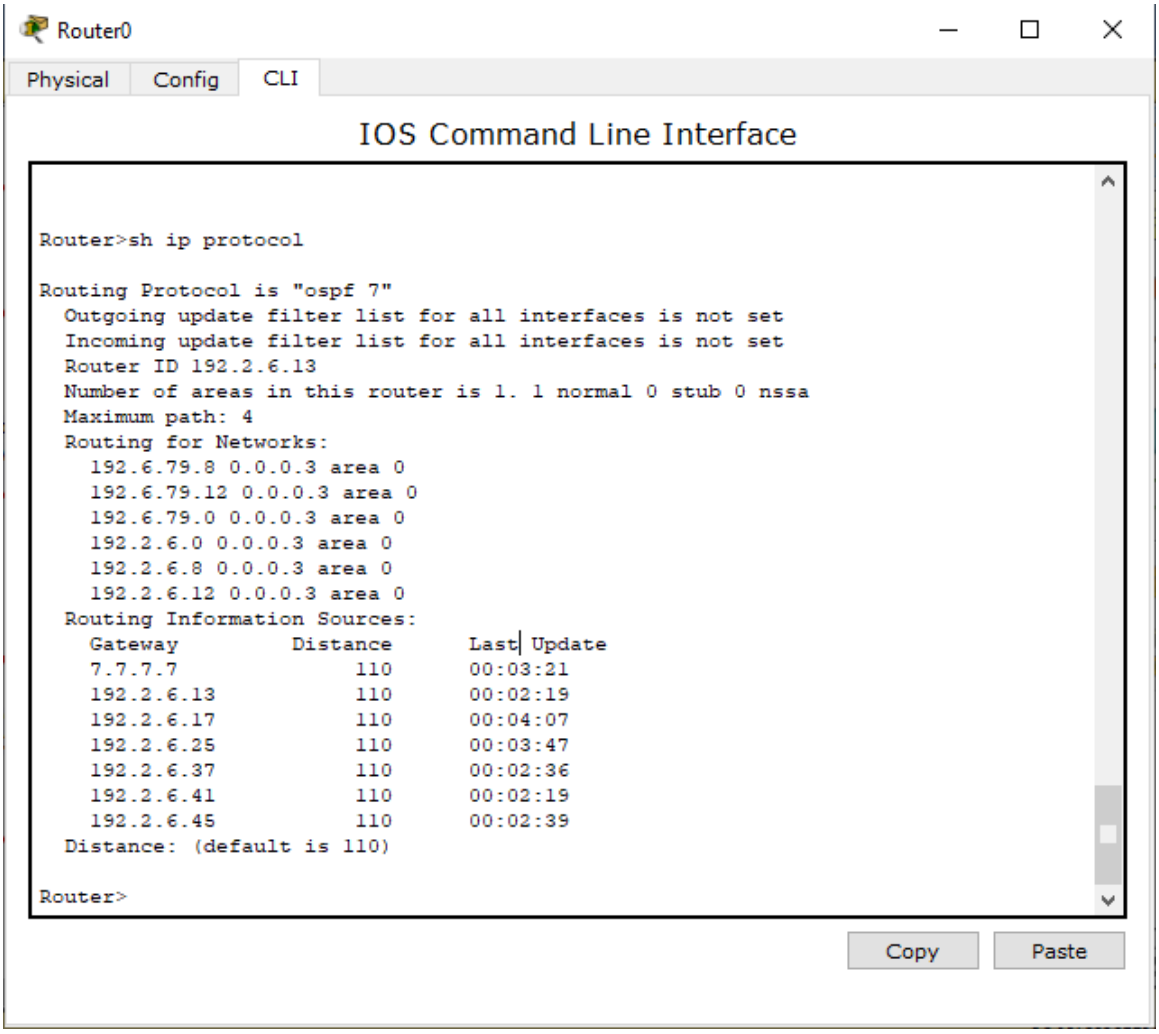

Figure 15: Show IP Protocol

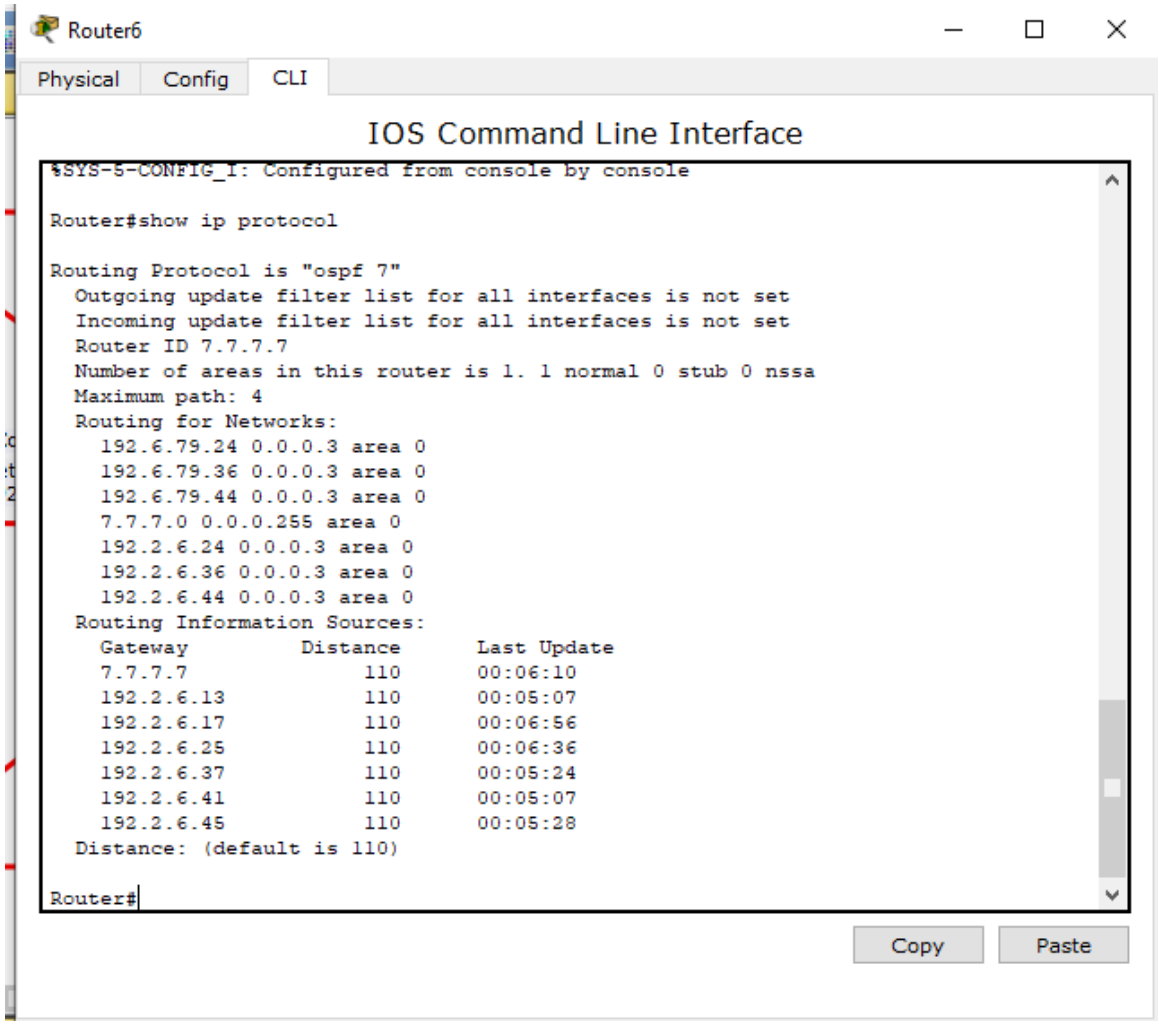

Figure 16: Show IP protocol on R6

To trace the path from Router 0 to Router 6's loopback address (7.7.7.7), the `**traceroute**` command is utilized from Router 0's command line interface. The output of this command indicates the sequence of intermediary routers through which the packet traverses before reaching its final destination. In this case, the packet passes through two intermediary routers. Firstly, it traverses router 192.2.6.14, followed by router 192.2.6.38.

Following the `**traceroute**` operation, the `show ip route` command is issued on Router 0 to inspect its routing table. This command displays information about known routes within the network. The output reveals that the route to reach Router 6's loopback address (7.7.7.7) is learned via OSPF (Open Shortest Path First), indicated by the 'O' code. The cost or metric associated with this route is 129. This cost metric represents the cumulative distance, based on various factors such as link

bandwidth, delay, reliability, and load, which OSPF uses to determine the best path. In this case, the route to 7.7.7.7 is reachable via next hop 192.2.6.14.

Furthermore, the `show ip protocol` command is executed on Router 0 to gather information about OSPF configuration parameters. This command provides details about OSPF routing, including the router ID, the number of areas, and routing for specific networks. The router ID for Router 0 is specified as 192.2.6.13, which serves as a unique identifier within the OSPF domain. Similarly, the router ID for Router 6 can be determined using the `show ip protocol` command on Router 6 itself.

Additionally, the provided figures describe specific configurations related to OSPF networks in area 0, which is the backbone area of OSPF. It outlines subnet addresses and subnet masks for the network topology. The note also associates bandwidth values with OSPF costs, where higher bandwidth corresponds to lower OSPF costs. These cost values play a crucial role in OSPF's path selection algorithm, influencing the determination of the most efficient routes within the OSPF network.

In conclusion, the process of setting up a network topology, configuring addressing, implementing OSPF, and understanding OSPF cost calculations involves several key steps. This includes designing the network layout, assigning IP addresses, configuring OSPF routing protocols, and determining OSPF costs based on factors like bandwidth. In analyzing the output of the `show ip route` command on Router 0, it's revealed that the cost (metric) to reach Router 6 is [110/128]. This indicates the OSPF cost associated with the path taken, where 110 represents the OSPF cost to reach the destination, and 128 is the cumulative metric. OSPF routing decisions are crucially influenced by these costs, which are calculated based on various network parameters. Additionally, the Router IDs for Router 0 and Router 6, specified as 192.15.85.13 and 192.15.85.46 respectively, play significant roles in OSPF routing and network topology. Overall, understanding OSPF routing and its associated parameters is essential for effectively managing and optimizing network performance.