Lab 10: link state routing OSPF multi area

1. Introduction:

1.2. Link state routing protocol:

Link-state routing protocols take a different approach. Link-state routing protocols are more like a road map because they create a topological map of the network and each router uses this map to determine the shortest path to each network. Just as you refer to a map to find the route to another town, link-state routers use a map to determine the preferred path to reach another destination.
Link-state routing protocols are also known as shortest path first protocols and built around Edger Dijkstra's shortest path first (SPF) algorithm. The SPF algorithm will be discussed in more detail in a later section.

The IP link-state routing protocols are shown in the figure:

- Open Shortest Path First (OSPF)
- Intermediate System-to-Intermediate System (IS-IS)

Link-state routing protocols have the reputation of being much more complex than their distance vector counterparts. However, the basic functionality and configuration of link-state routing protocols is not complex at all. Even the algorithm itself can be easily understood, as you will see in the next topic. Basic OSPF operations can be configured with a router ospf process-id command and a network statement, similar to other routing protocols like RIP and EIGRP.

1.2. Working of link state routing protocol:

1. Each router learns about its own links, its own directly connected networks.
2. Each router is responsible for meeting its neighbors on directly connected networks.
3. Each router builds a Link-State Packet (LSP) containing the state of each directly connected link
4. Each router floods the LSP to all neighbors, who then store all LSPs received in a database.
5. Each router uses the database to construct a complete map of the topology and computes the best path to each destination network.

1.3. OSPF protocol:

Routers connect networks using the Internet Protocol (IP), and OSPF (Open Shortest Path First) is a router protocol used to find the best path for packets as they pass through a set of connected networks. OSPF is designated by the Internet Engineering Task Force (IETF) as one of several

Interior Gateway Protocols (IGPs) that is, protocols aimed at traffic moving around within a larger autonomous system network like a single enterprise's network, which may in turn be made up of many separate local area networks linked through routers.
The OSPF routing protocol has largely replaced the older Routing Information Protocol (RIP) in corporate networks. Using OSPF, a router that learns of a change to a routing table (when it is reconfigured by network staff, for example) or detects a change in the network immediately multicasts the information to all other OSPF hosts in the network so they will all have the same routing table information. Unlike RIP, which requires routers to send the entire routing table to neighbors every 30 seconds, OSPF sends only the part that has changed and only when a change has taken place. When routes change sometimes due to equipment failure the time it takes OSPF routers to find a new path between endpoints with no loops (which is called "open") and that minimizes the length of the path is called the convergence time.

1.4. Wild card mask:

Wildcard masks are used to specify a range of network addresses. They are commonly used with routing protocols (like OSPF) and access lists.
Like a subnet mask, a wildcard mask is 32 bits long. It acts as an inverted subnet mask, but with wildcard mask, the zero bits indicate that the corresponding bit position must match the same bit position in the IP address. The one bit indicate that the corresponding bit position doesn't have to match the bit position in the IP address.

2. Tools required:

- CISCO Packet tracer

3. Objective of the Experiment:

Upon completion of this lab, you will be able to:

- Cable a network according to the Topology Diagram
- Erase the startup configuration and reload a router to the default state
- Perform basic configuration tasks on a router
- Configure and activate interfaces
- Configure OSPF routing on all routers
- Configure OSPF router IDs
- Verify OSPF routing using show commands.

4. Walk through tasks:

4.1. Task1:

Construct a topology that have four routers, two switches and four PC's, we have to configure OSPF routing protocol in it, this topology have three areas Area0, Area1 and Area2. Area1 and Area2 should be connected to area0. Configure all the interfaces, use serial ports between routers and Fast Ethernet ports between switches with router and PC's.

To configure this, we have to execute following steps:

1. Open cisco packet tracer.
2. Add four 2811 routers, 2 generic switches and four generic PC's from the tool box in the cisco packet tracer in the work space.
3. Click on the router and go in the physical tab of the router to turn off the router switch, after turning it off add WIC IT module in the slots of the router and turn it on again for its connection with other router with serial cable.
4. Repeat the step three for all the routers.
5. Connect all router by using serial cable.
6. Connect switches with routers and PC's with switches using copper straight through cable from the connections tabs.
7. Mention all the network addresses and IP addresses in front of every network element in the workspace.

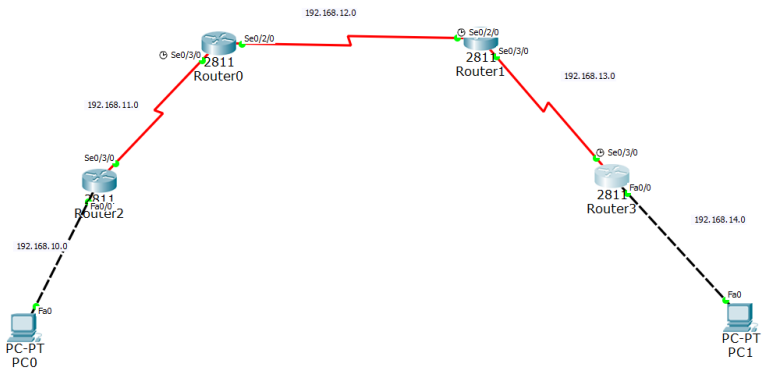

Figure 1: complete topology with connections.

8. Now draw circle around the network topology to show different areas in this network.

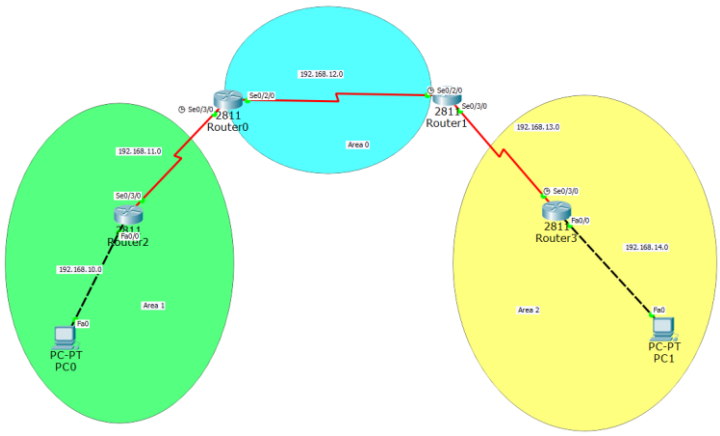

Figure 2: Shows area of the network

9. Now configure every interface of the routers whether its serial interface or Fast Ethernet interface by giving them respective IP's and clock rates for serial interfaces as you have mentioned in the workspace. I have configured Router 2 serial interface like this:

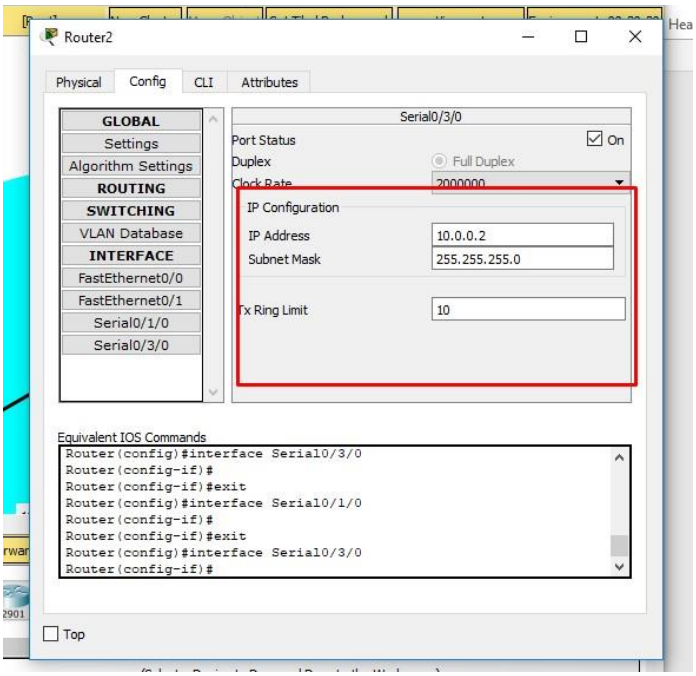

Figure 3: configuration of packet tracer

10. Configuration for Fast Ethernet should be like this in Router2:

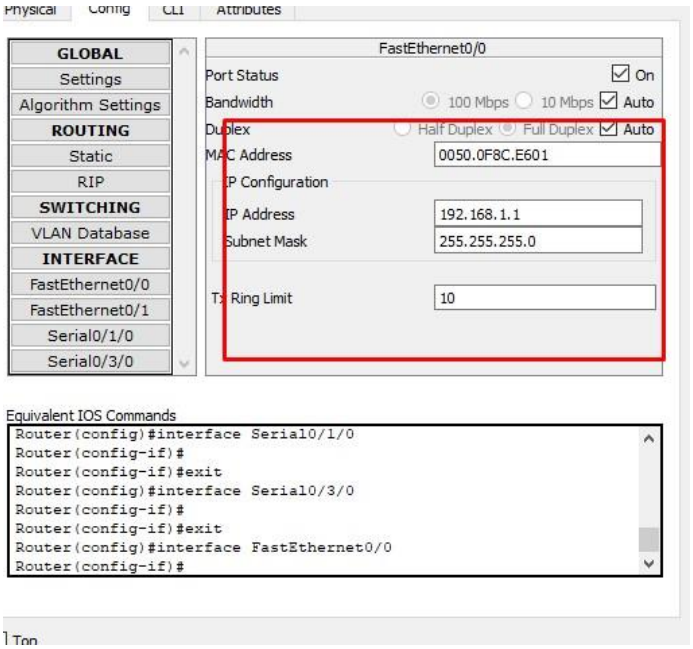

Figure 4: configuration of Fast Ethernet

11. In the same way configure every router interface, these were the tasks that you had already done in so many labs before this.
12. Also provide IP addresses and Default gateways in all PC's.
13. Now we will configure OSPF in our routers.
14. For this click on the router 2 and configure ospf routing by writing commands: **En**
    Config t
    Router ospf 1
    Network " give ip address of attached network" " wildcard mask" area 1 End
15. Do as illustrated in the figure below:

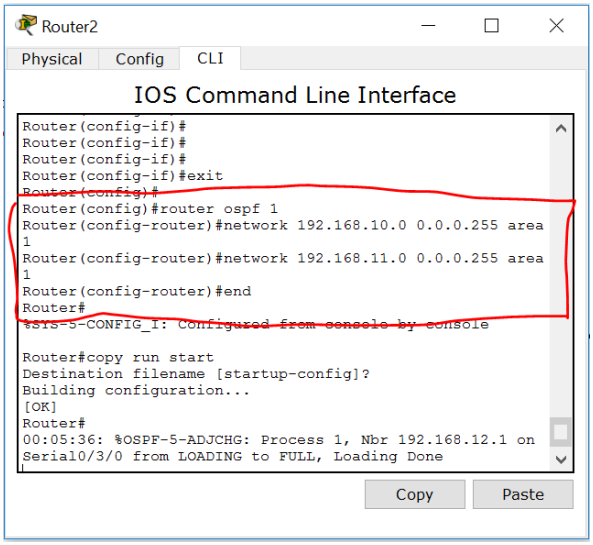

Figure 5: OSPF configuration of router 2

16. Do same steps for area 0 router these are the router to which every other area router should be connected the figure below shows the configuration of Router 0:

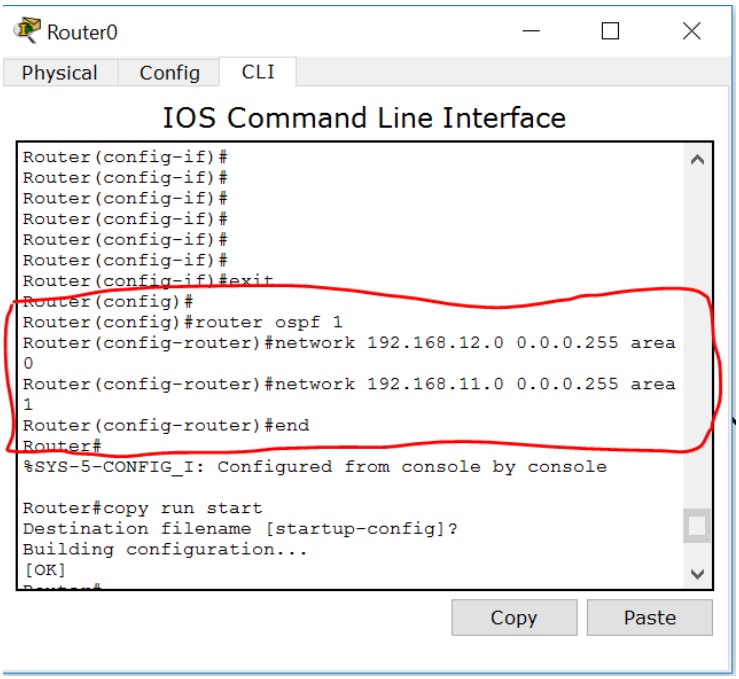

Figure 6: OSPF configuration of router 0

17. After configuring OSPF in router 2 and router 0, configure area 2 router, which is router 1, configure this as shown in below figure and mention all connecting networks with it.

Figure 8: Configuration of router 1 of area

18. After adding one network add another network in router one, which is connected with its serial port. You can see its routing table to verify ospf multi-area routing by using command

    Show ip route

    As demonstrated in the figure below:

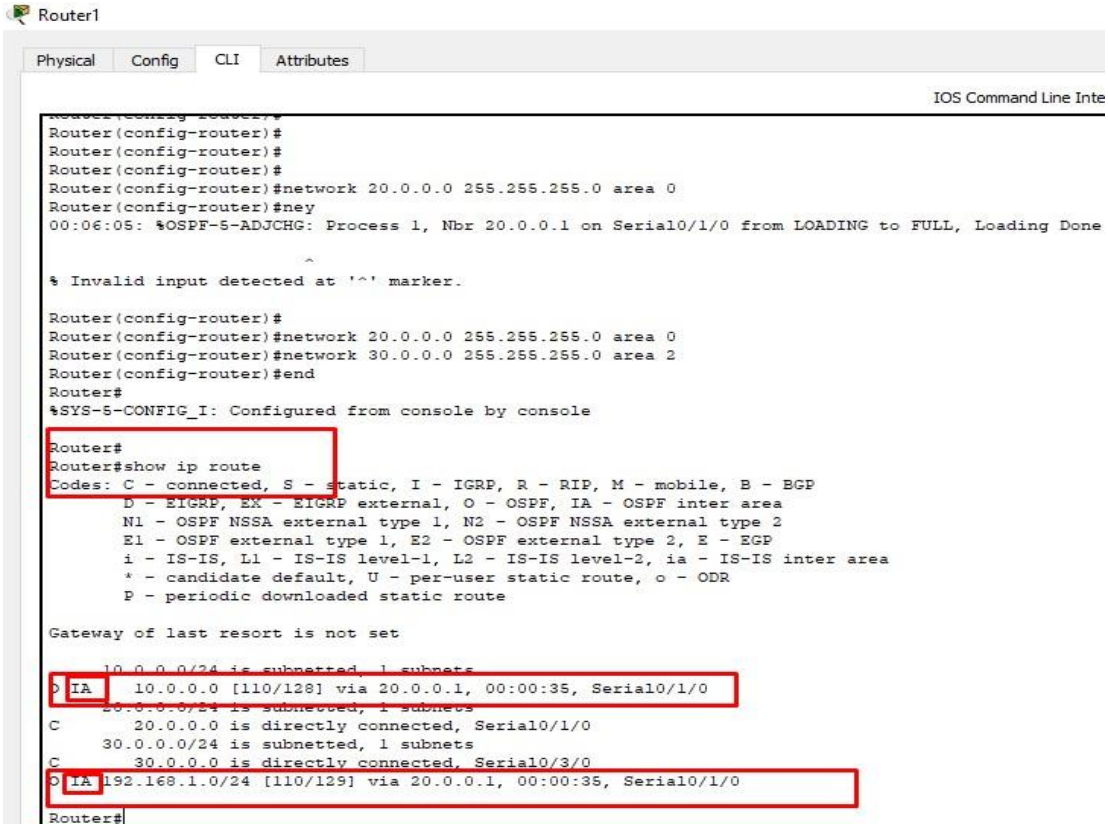

Figure 7: Results of multi-area OSPF routing

19. Configure last router which is on the other end connected with switch with fast Ethernet cable and also connected with router with serial cable.
20. In this router both the network belongs to area to, so you can configure this by writing commands.

    En
    Config t
    Router ospf 1
    Network 30.0.0.0 0.255.255.255 area 2
    Network 192.168.10.0 0.0.0.255 area 2
    End

Which you can verify from the given figure below:

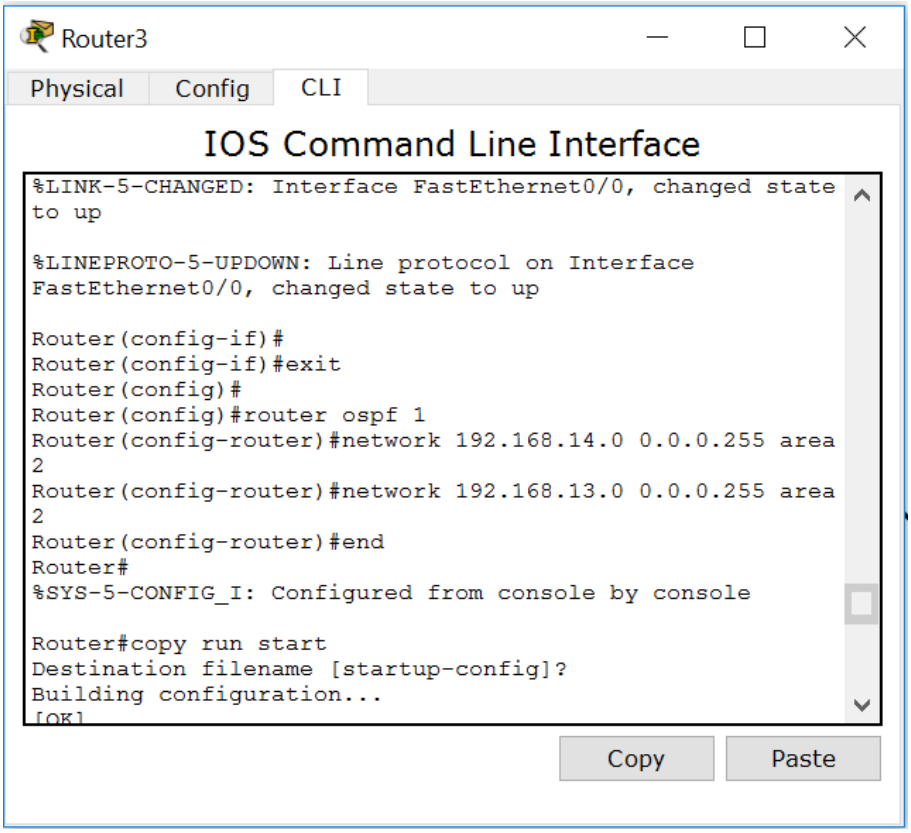

Figure 8: shows the configuration of Router 3

21. Moreover, you can verify your ospf routing from the routing table of router 3, by writing command of:

Show ip route

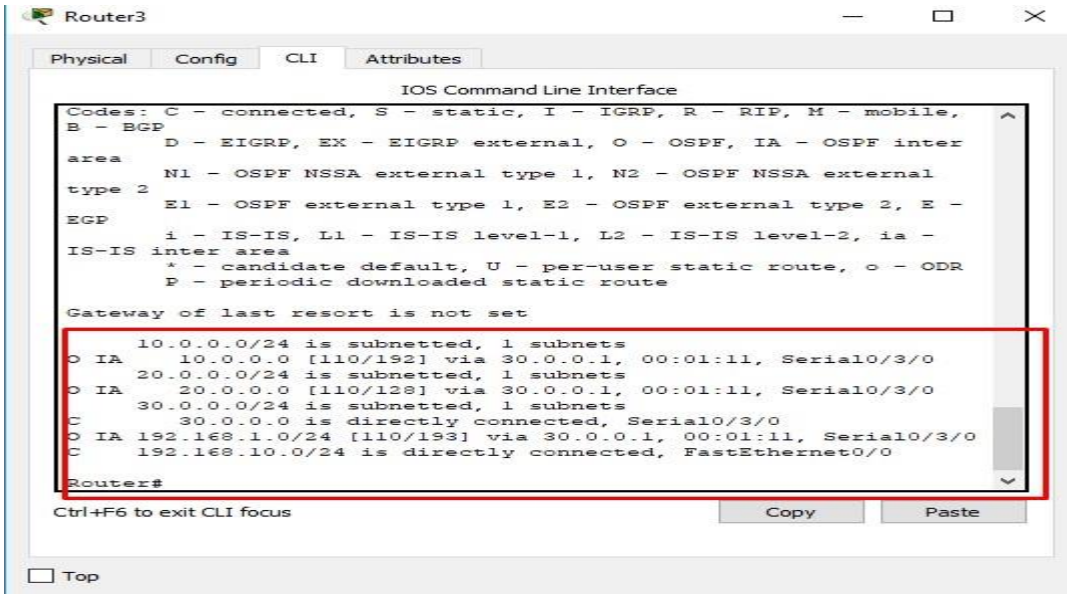

Figure 11: Results of routing table of router 3

22. Now all the router is configured and we should verify our all our ospf routing by pinging from one pc from one end of the network to other PC on other side of the network.

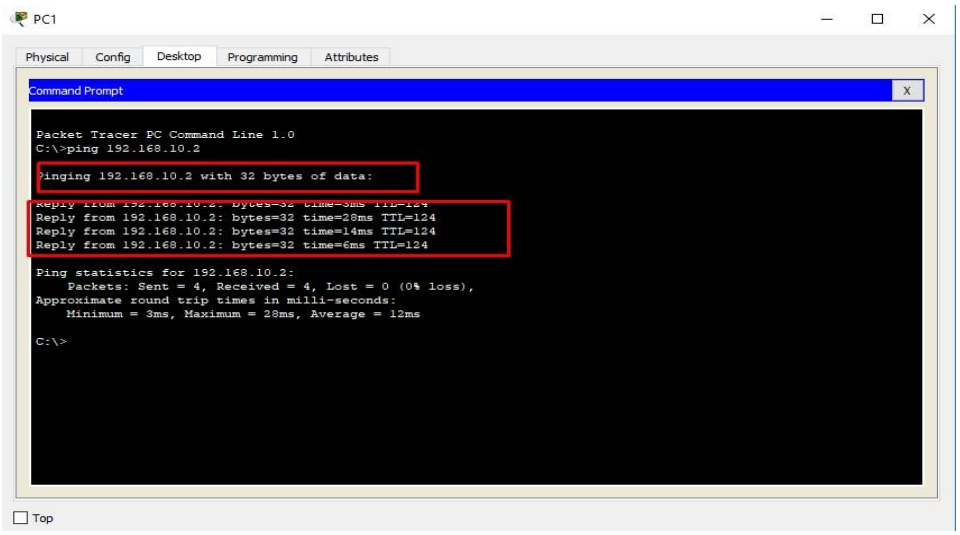

Figure 9: Results of pinging

5. Practice tasks:

5.1. Task 1:

Construct the topology given below using subnatting and show the following:

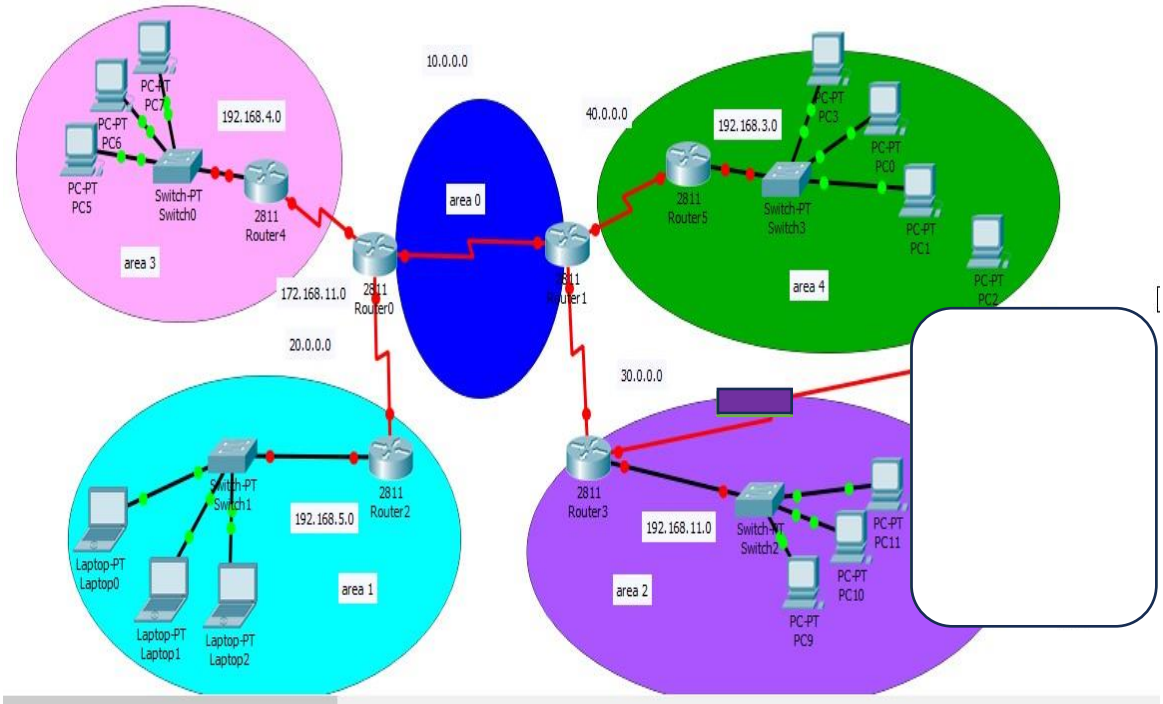

Figure 13: Practice Task topology

1. Create this topology in a way as shown.
2. Configure multi-area OSPF routing in this topology.
3. Configure every router interface with IP address as mentioned 4. Provide IP addresses to every PC attached.
5. Configure OSPF area wise.
6. Configure DCE and DTE ports of router before configuring OSPF in it.
7. At last show routing table of every router that should be configured in a way that is mentioned.
8. Ping PC13 from LAPtop0 and show the results.
9. Ping PC9 from PC3 and show the results.
10. Send PDU to PC2 to PC7 and show the results.