Terna Engineering College

Computer Engineering Department

Program: Sem V

Course: Computer Network Lab

Faculty: Umesh B Mantale, D V Thombre and Ramesh Shahabade

LAB Manual

PART A

(PART A: TO BE REFERRED BY STUDENTS)

Experiment No. 8

A.1 Objective:

Configure Network using Link State Vector Routing protocol (OSPF).

A.2 Prerequisite:

Cisco Packet tracer / Physical Cisco Router, Physical Switch, cables

A.3 Outcome:

After successful completion of this experiment, students will be able to

Explore various routing algorithms and Protocols of the network layer using the simulator and Physical devices.

A.4 Theory:

Open Shortest Path First (OSPF) is a link-state routing protocol which 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 the 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).

OSPF terms –

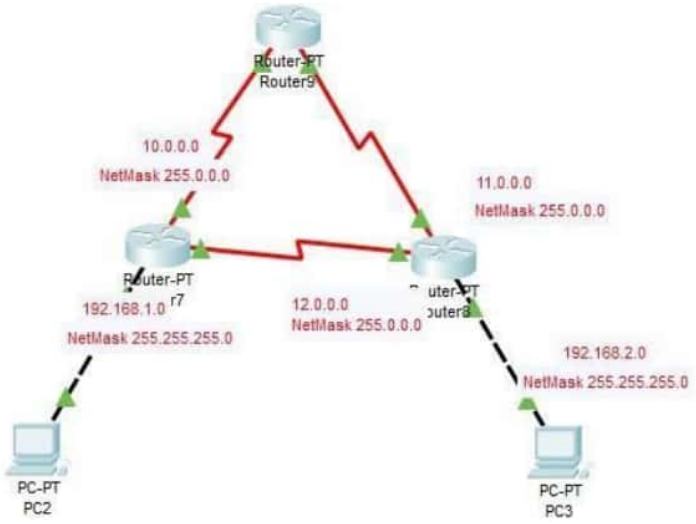
1. **The router I'd –** It is the highest active IP address present on the router. First, the highest loopback address is considered. If no loopback is configured then the highest active IP address on the interface of the router is considered.
2. **Router priority –** It is a 8-bit value assigned to 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 adjacency formed. DR distributes the LSAs to all the other routers. DR is elected in a broadcast network to which all the other routers shares their DBD. In a broadcast network, router requests for an update to DR and DR will respond to that request with an update.
4. **Backup Designated Router (BDR) –** BDR is backup to DR in a broadcast network. When DR goes down, BDR becomes DR and performs its functions.

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

1. The router having the highest router priority will be declared as DR.
2. If there is a tie in router priority then 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.

OSPF states – The device operating OSPF goes through certain states. These states are:

1. **Down –** In this state, no hello packet has been received on the interface.
   Note – The Downstate doesn't mean that the interface is physically down. Here, it means that OSPF adjacency process has not started yet.
2. **Init –** In this state, hello packet has been received from the other router.
3. **2WAY –** In the 2WAY state, both the routers have received the hello packets from other routers. Bidirectional connectivity has been established. **Note –** In between the 2WAY state and Exstart state, the DR and BDR election takes place.
4. **Exstart –** In this state, NULL DBD are exchanged. In this state, the master and slave election takes place. The router having the higher router I'd become the master while other becomes the slave. This election decides which router will send it's DBD first (routers who have formed neighbour ship will take part in this election).
5. **Exchange –** In this state, the actual DBDs are exchanged.
6. **Loading –** In this sate, LSR, LSU and LSA (Link State Acknowledgement) are exchanged.
   Important – When a router receives DBD from another router, it compares its own DBD with the other router DBD. If the received DBD is more updated than its own DBD then the router will send LSR to the other router stating what links are needed. The other router replies with the LSU containing the updates that are needed. In return to this, the router replies with the Link State Acknowledgement.
7. **Full –** In this state, the synchronization of all the information takes place. OSPF routing can begin only after the Full state.



Sample Network Design

PART B

(PART B: TO BE COMPLETED BY STUDENTS)

(Students must submit the soft copy as per following segments within two hours of the practical. The soft copy must be uploaded on the Blackboard or emailed to the concerned lab in charge faculties at the end of the practical in case the there is no Blackboard access available)

Roll No. 50	Name: Amey Thakur
Class: TE-Comps B	Batch: B3
Date of Experiment: 28/09/2020	Date of Submission: 28/09/2020
Grade :	

B.1 Document created by the student:

(Write the answers to the questions given in section 5.1 during the 2 hours of practice in the lab here)

Refer B.5

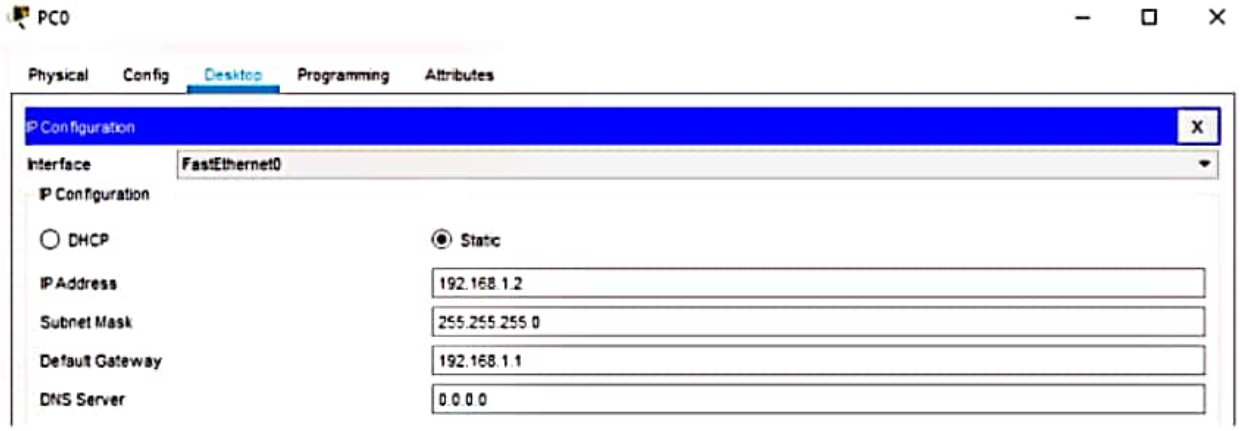
B.3 Observations and learning:

(Students are expected to understand the selected topic. Have to list out the components & functionality. Prepare a flow of the algorithm defined in the paper. List the performance metrics that are used)

B.3.1 Interface Configuration table

created by the student:

SN O.	NAME OF THE DEVICE	INTERFACE	IP ADDRESS	Subnet Mask	Default Gateway
1.	Router 0	Fast ethernet 0/0	192.168.1.1	255.255.255.0	--------
2.	Router 0	Serial 2/0	10.10.0.2	255.0.0.0	--------
3.	Router 0	Serial 3/0	12.12.0.2	255.0.0.0	--------
4.	Router 1	Fast ethernet 0/0	----------	----------	--------
5.	Router 1	Serial 2/0	10.10.0.3	255.0.0.0	--------
6.	Router 1	Serial 3/0	11.11.0.2	255.0.0.0	--------
7.	Router 2	Fast ethernet 0/0	192.168.2.1	255.255.255.0	--------
8.	Router 2	Serial 2/0	11.11.0.3	255.0.0.0	--------
9.	Router 2	Serial 3/0	12.12.0.3	255.0.0.0	--------
10.	PC0	Fast ethernet 0/0	192.168.1.2	255.255.255.0	192.168.1.1
11.	PC1	Fast ethernet 0/0	192.168.2.2	255.255.255.0	192.168.2.1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Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
IP Address
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Subnet Mask
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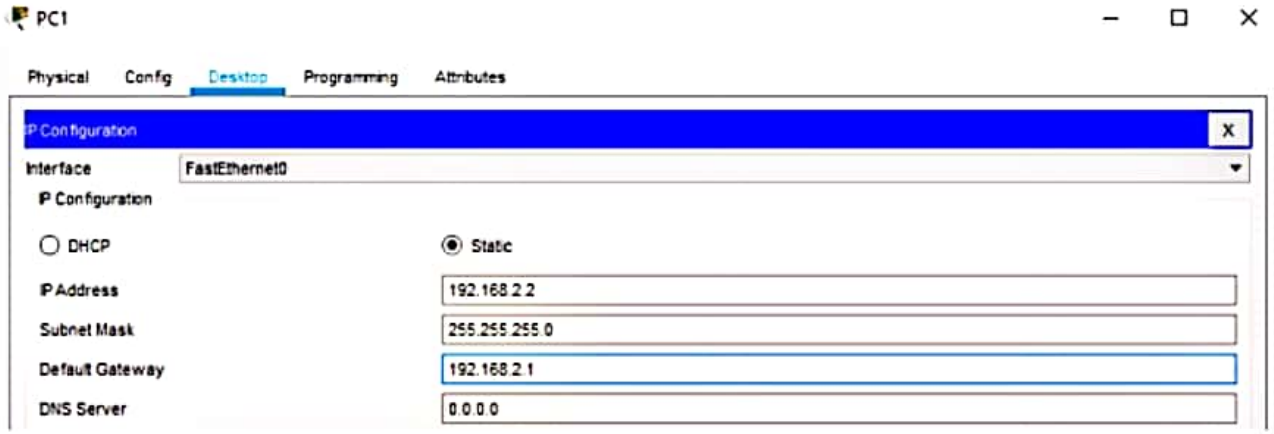
Default Gateway
192.168.1.1
DNS Server
0.0.0.0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Programming
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Interface
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IP Configuration
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Default Gateway
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DNS Server
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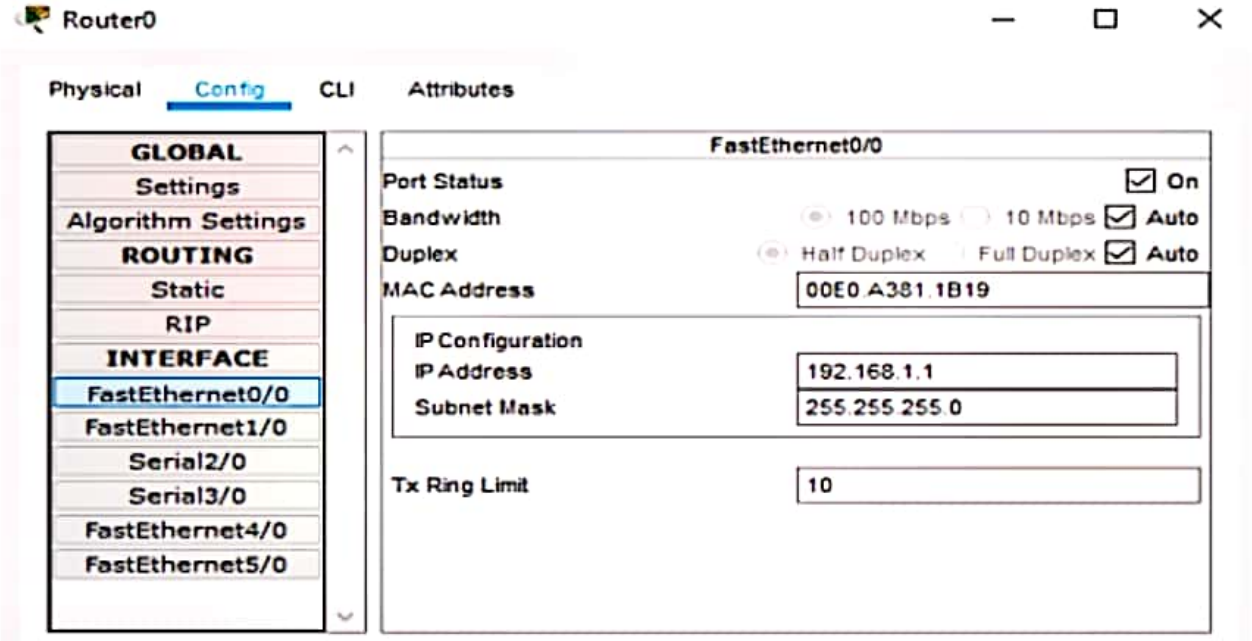
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Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
INTERFACE
FastEthernet0/0
FastEthernet1/0
Serial2/0
Serial3/0
FastEthernet4/0
FastEthernet5/0
FastEthernet0/0
Port Status
On
Bandwidth
100 Mbps
10 Mbps
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Duplex
Half Duplex
Full Duplex
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Subnet Mask
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Tx Ring Limit
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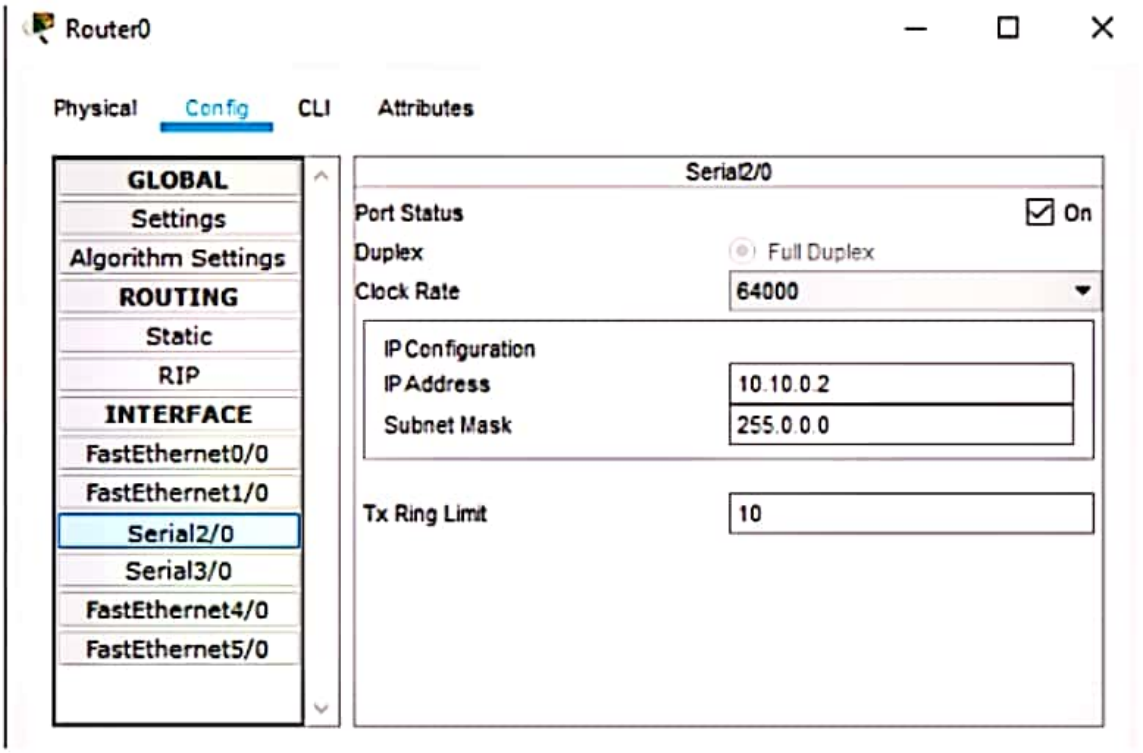
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Settings
Algorithm Settings
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Static
RIP
INTERFACE
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FastEthernet1/0
Serial2/0
Serial3/0
FastEthernet4/0
FastEthernet5/0
Serial2/0
Port Status
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Full Duplex
Clock Rate
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IP Configuration
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Subnet Mask
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Tx Ring Limit
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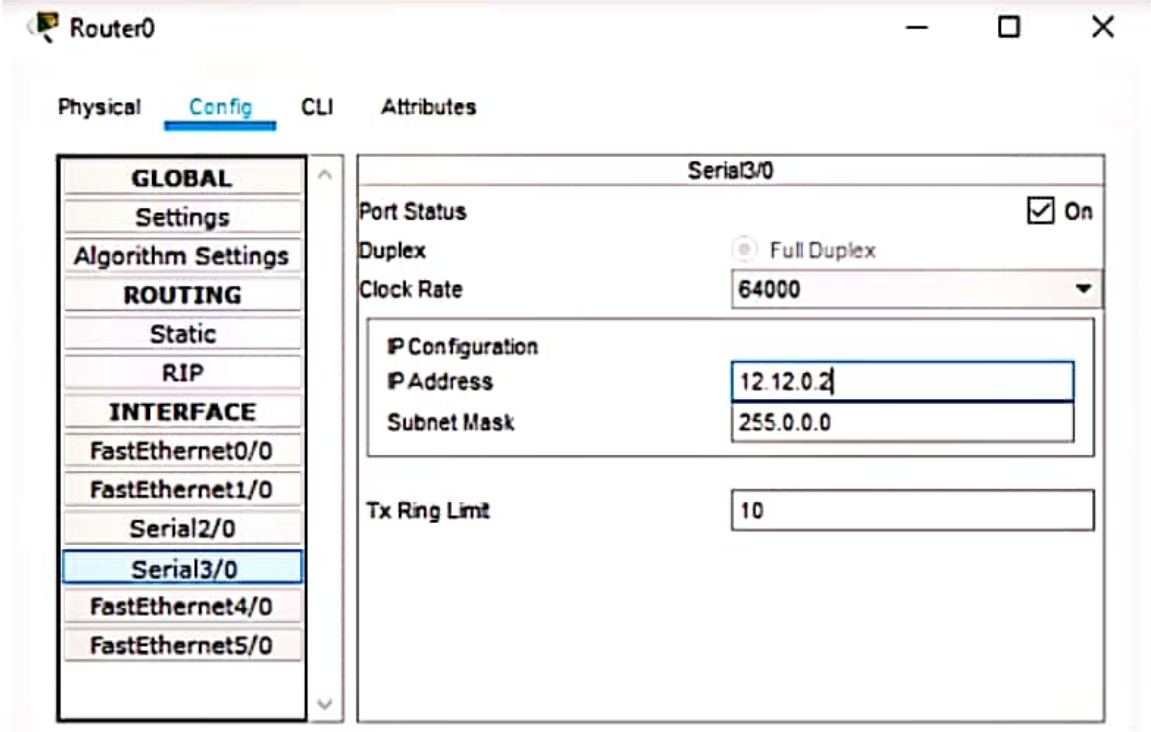
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Algorithm Settings
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RIP
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Serial3/0
FastEthernet4/0
FastEthernet5/0
Serial3/0
Port Status
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Clock Rate
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Subnet Mask
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Tx Ring Limit
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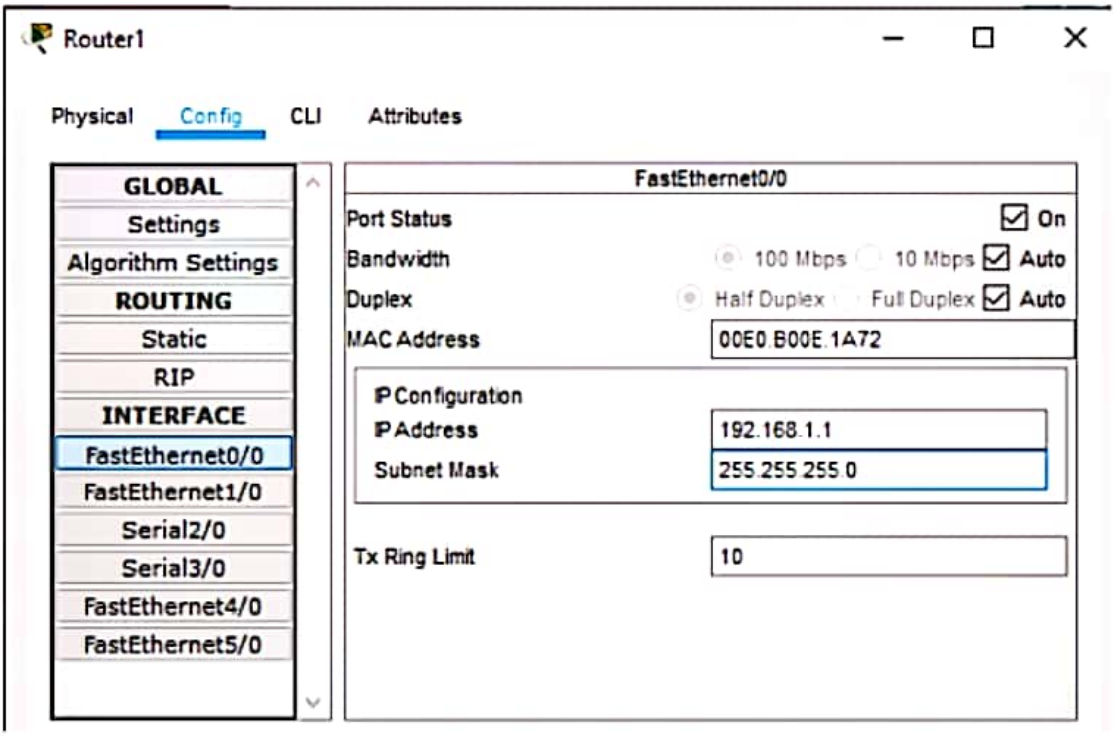
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Attributes
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Settings
Algorithm Settings
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Static
RIP
INTERFACE
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FastEthernet1/0
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Serial3/0
FastEthernet4/0
FastEthernet5/0
FastEthernet0/0
Port Status
On
Bandwidth
100 Mbps
10 Mbps
Auto
Duplex
Half Duplex
Full Duplex
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MAC Address
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IP Configuration
IP Address
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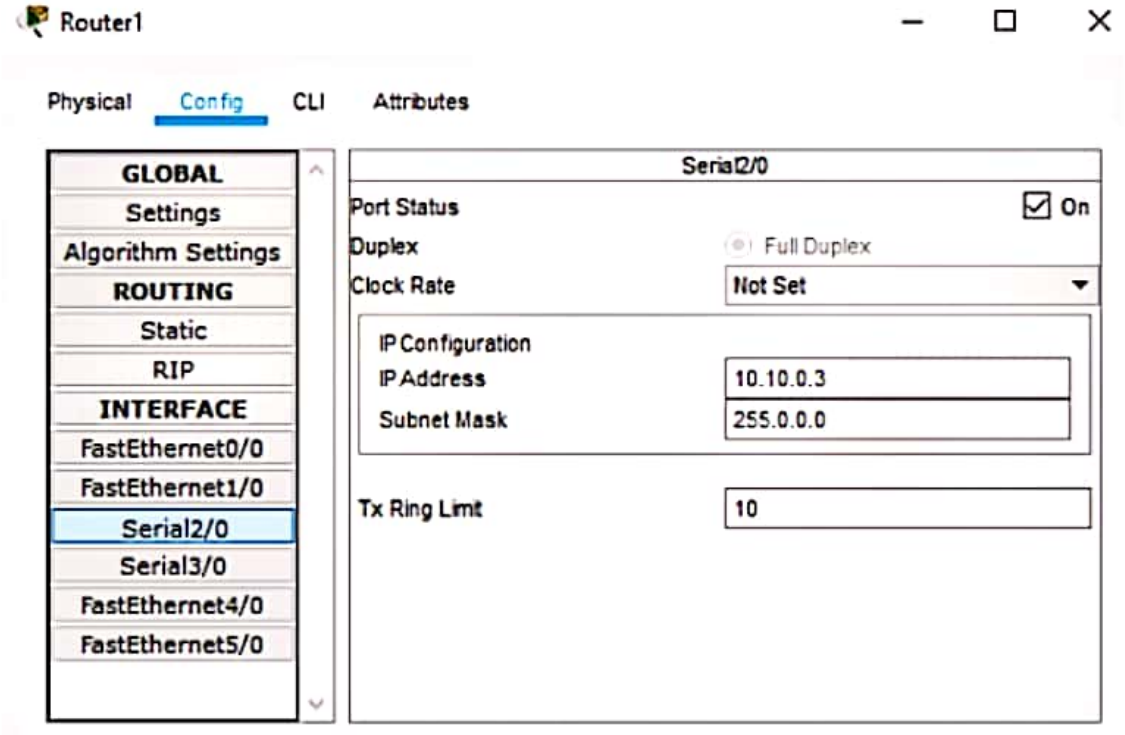
Subnet Mask
255.255.255.0
Tx Ring Limit
10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Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
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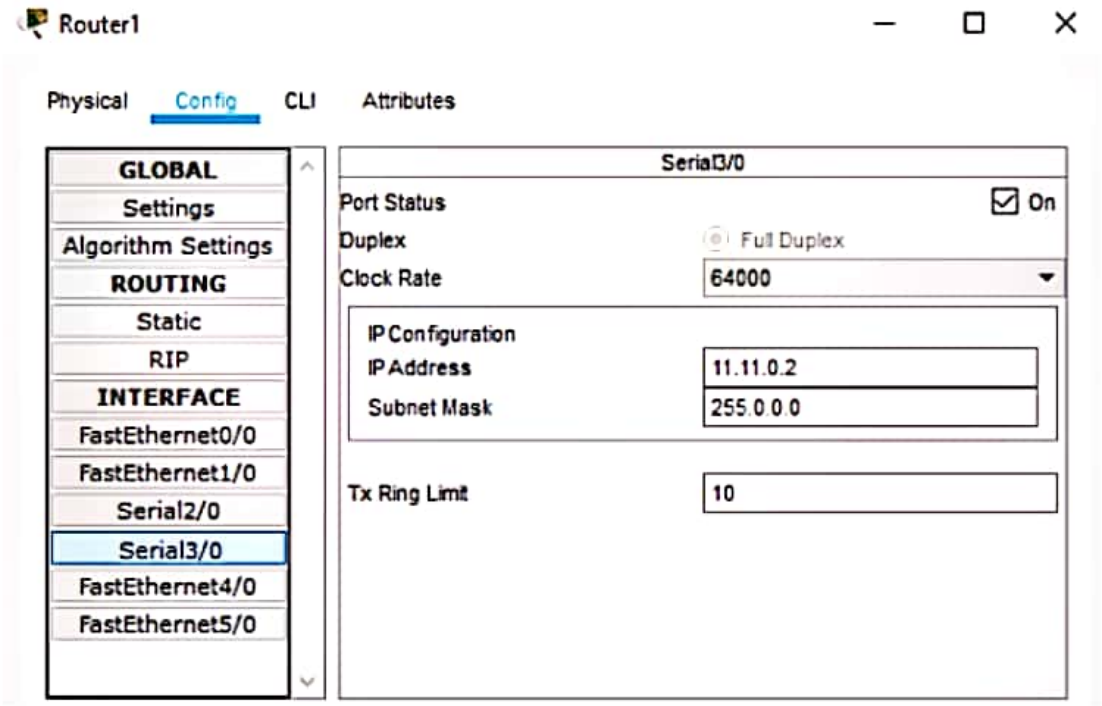
Static
RIP
INTERFACE
FastEthernet0/0
FastEthernet1/0
Serial2/0
Serial3/0
FastEthernet4/0
FastEthernet5/0
Serial2/0
Port Status
On
Duplex
Full Duplex
Clock Rate
Not Set
IP Configuration
IP Address
10.10.0.3
Subnet Mask
255.0.0.0
Tx Ring Limit
10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Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
INTERFACE
FastEthernet0/0
FastEthernet1/0
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Serial3/0
FastEthernet4/0
FastEthernet5/0
Serial3/0
Port Status
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Full Duplex
Clock Rate
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IP Configuration
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Subnet Mask
255.0.0.0
Tx Ring Limit
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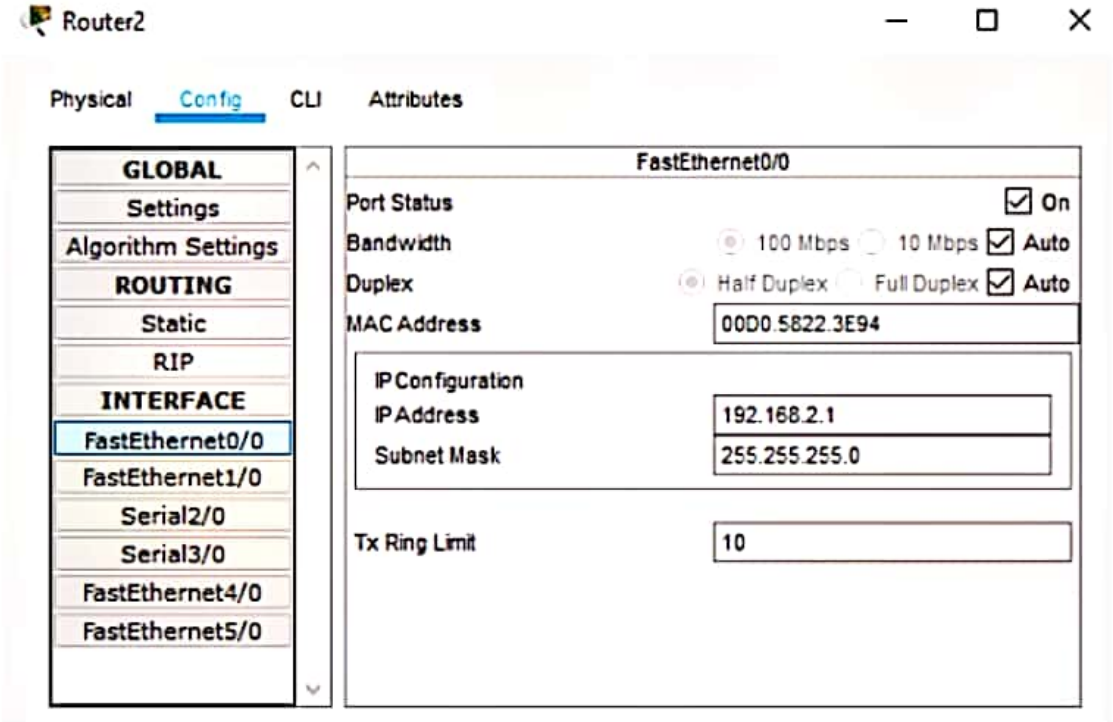
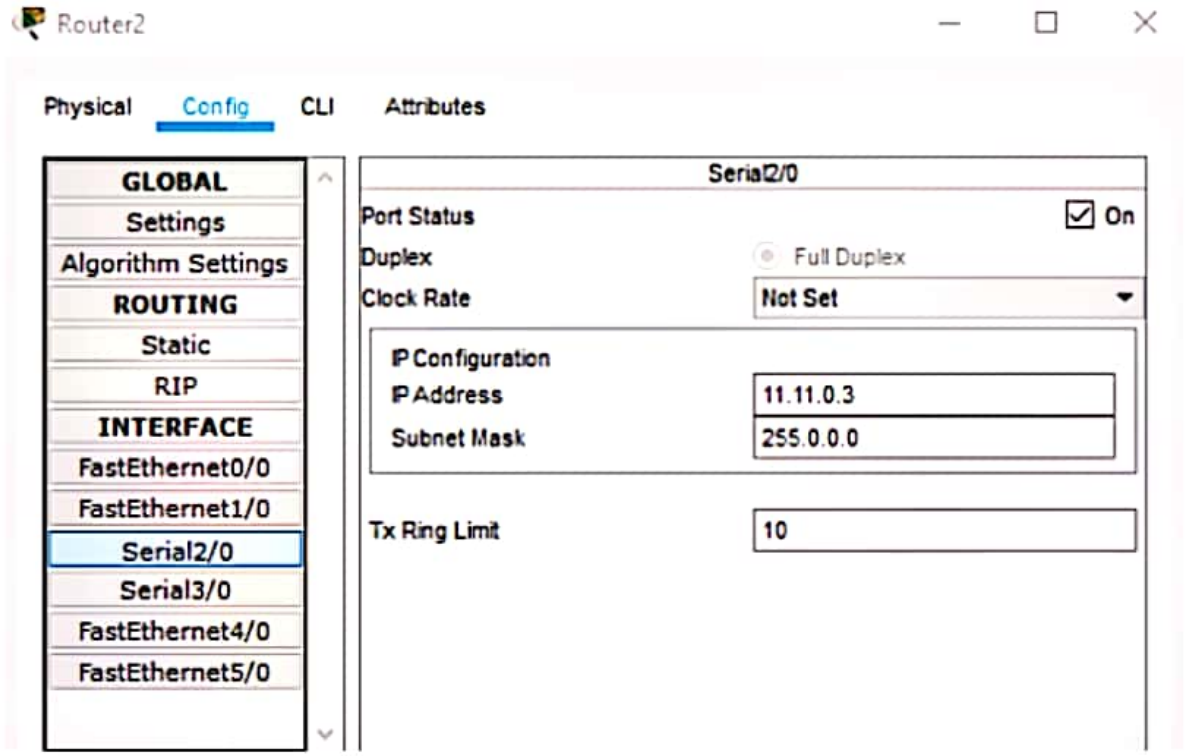
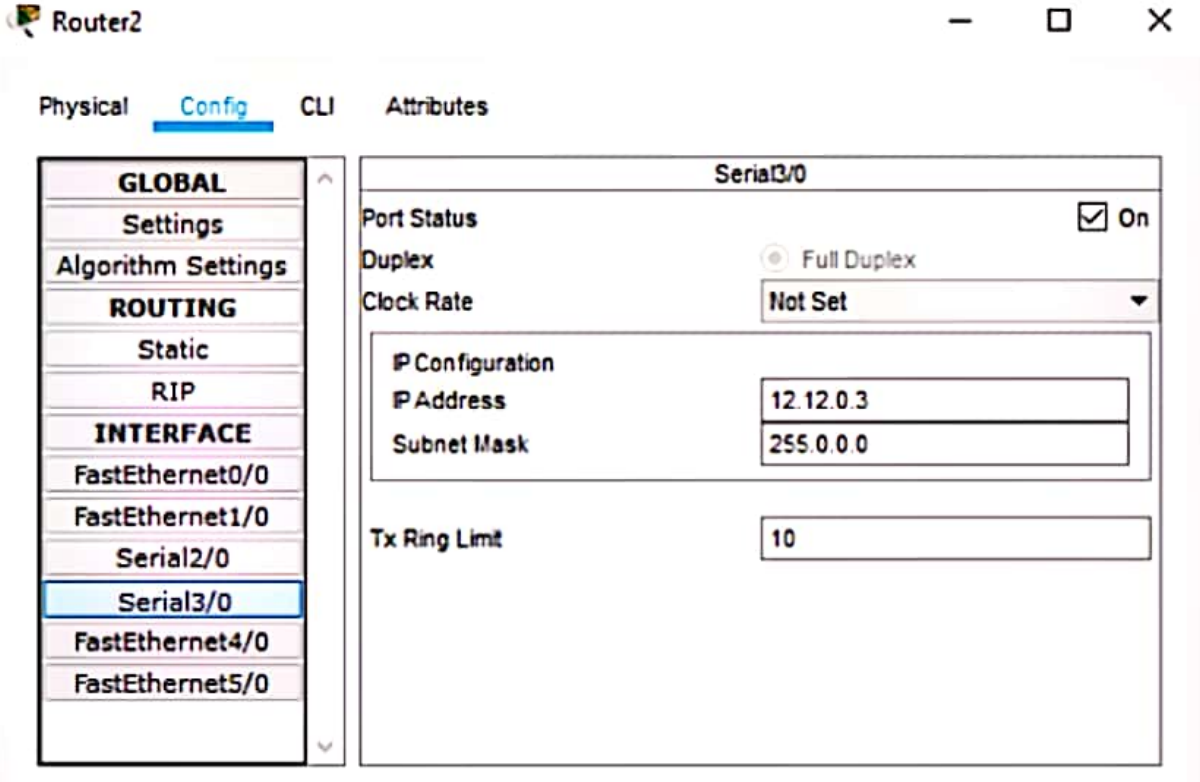

Router2
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
INTERFACE
FastEthernet0/0
FastEthernet1/0
Serial2/0
Serial3/0
FastEthernet4/0
FastEthernet5/0
FastEthernet0/0
Port Status
On
Bandwidth
100 Mbps
10 Mbps
Auto
Duplex
Half Duplex
Full Duplex
Auto
MAC Address
00D0.5822.3E94
IP Configuration
IP Address
192.168.2.1
Subnet Mask
255.255.255.0
Tx Ring Limit
10


Router2
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
INTERFACE
FastEthernet0/0
FastEthernet1/0
Serial2/0
Serial3/0
FastEthernet4/0
FastEthernet5/0
Serial2/0
Port Status
On
Duplex
Full Duplex
Clock Rate
Not Set
IP Configuration
IP Address
11.11.0.3
Subnet Mask
255.0.0.0
Tx Ring Limit
10


Router2
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Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
INTERFACE
FastEthernet0/0
FastEthernet1/0
Serial2/0
Serial3/0
FastEthernet4/0
FastEthernet5/0
Serial3/0
Port Status
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Duplex
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Clock Rate
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IP Configuration
IP Address
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Subnet Mask
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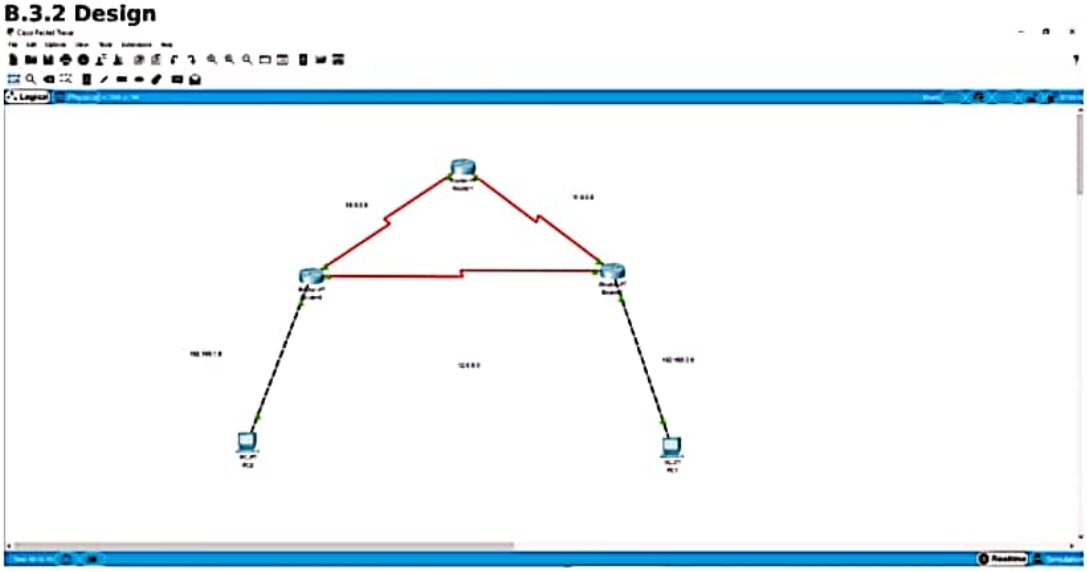
Tx Ring Limit
10

B.3.2 Design



B.4 Conclusion:

(Students must write the conclusion as per the attainment of individual outcome listed above and learning/observation noted in section B.3)

We are now able to Configure Network using Link State Vector Routing protocol (OSPF).

OSPF is a very complex protocol. It uses five different types of messages. These are as follows:

1. Hello message (Type 1) – It is used by the routers to introduce itself to the other routers.
2. Database description message (Type 2) – It is normally sent in response to the Hello message.
3. Link-state request message (Type 3) – It is used by the routers that need information about specific Link-State packets.
4. Link-state update message (Type 4) – It is the main OSPF message for building Link-State Database.
5. Link-state acknowledgement message (Type 5) – It is used to create reliability in the OSPF protocol.

B.5 Question of Curiosity

(To be answered by the student based on the practical performed and learning/observations)

Questions to answer:

1. What is the backbone area?
2. What are the different tables maintained by OSPF?
3. How are DR and BR elected?

Q.1 What is backbone area?

Ans:

The backbone area (Area 0) is the core of an OSPF network. All other areas are connected to it and all traffic between areas must traverse it. All routing between areas is distributed through the backbone area. While all other OSPF areas must connect to the backbone area, this connection doesn't need to be direct and can be made through a virtual link.

Q.2. What are the different tables maintained by OSPF?

Ans:

In link state routing protocol there are different tables for storing different types of information regarding router and its networks. There are 3 tables in OSPF same like EIGRP.

1. OSPF Neighbor Table
2. OSPF Topology Table
3. OSPF Routing Table

Q.3. How are DR and BDR elected?

Ans:

Two rules are used to elect a DR and BDR:

1. Router with the highest OSPF priority will become a DR. By default, all routers have a priority of 1.
2. If there is a tie, a router with the highest router ID wins the election. The router with the second highest OSPF priority or router ID will become a BDR.