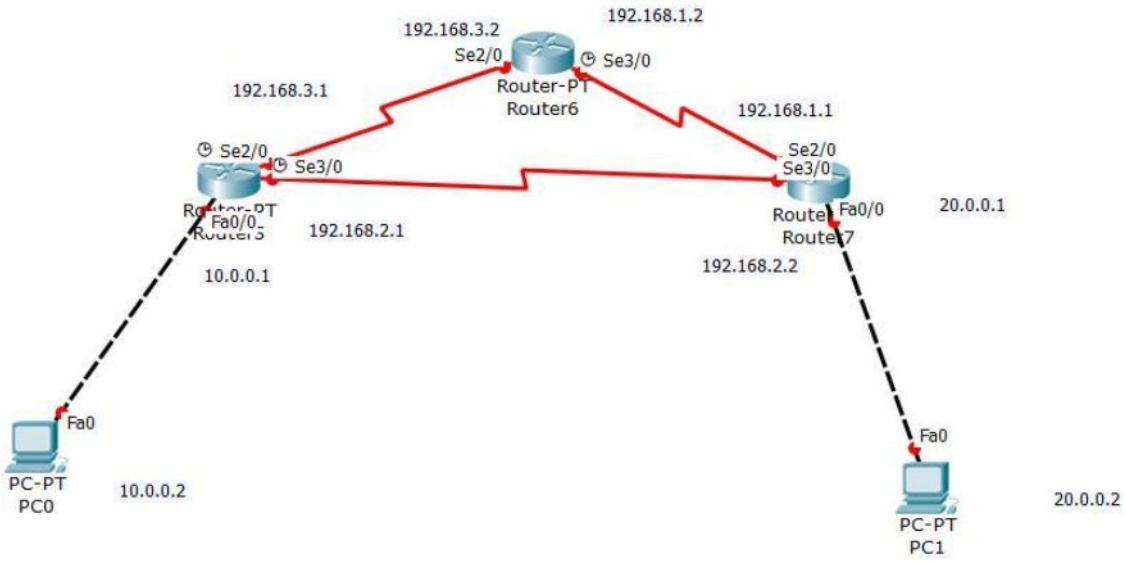
OSPF LAB

Configuring Basic OSPF: Single Area

1).Implement the topology shown in figure and assign ip addresses as given



2).Disable RIP in Each Router(type command “show ip protocols” in enable mode of router to get details of protocols already running in Router.)

2-i).to disable rip, in router CLI>enable>config t>no router rip.Do it for each router if necessary.

3). Enable the OSPF process on the router using the router ospf command as follows:

Router(config)# router ospf *process-id*

Ex:router ospf 1

Parameter Description

process-id: An internally used number to identify the OSPF routing process. The process ID does not need to match process IDs on other routers. Running multiple OSPF processes on the same router is not Recommended because it creates multiple database instances that add extra overhead.

4)Now you’re in **config-router** mode, where you need to assign each interfaces to a single area with its ip address.

2 techniques to do that:

1st Method:

1).If multiple interfaces are using same ip address (with subnetting) then router automatically configure them to single area by command without adding each interface individually shown below:

Router(config-router)#network ip-addr inverse-mask area *area-id*

Inverse mask is same as wildcard-mask

network Parameters

Parameter	Description
address	Is either the network address, the subnet, or the address of the interface. This address instructs the router to recognize which links to advertise to, which links to check for advertisements, and which networks to advertise.
wildcard-mask	Determines how to read the address. The mask has wildcard bits, in which 0 is a match and 1 is "don't care." For example, 0.0.255.255 indicates a match in the first two bytes. If specifying the interface address, use the mask 0.0.0.0 to match all four bytes of the address. An address and wildcard mask combination of 0.0.0.0 255.255.255.255 matches all interfaces on the router.
area-id	Specifies the OSPF area to be associated with the address. This command can be a decimal number or can be in dotted-decimal notation similar to an IP address, such as A.B.C.D.

Ex:in our topology,Router 7 has 3 interfaces with ip(192.168.1.1,192.168.2.2,20.0.0.1)

Here,192.168.1.1 and 192.168.2.2 are from same ip address subnetted as 192.168.0.0/16.

so ,Inverse mask of this network will be 0.0.255.255 (original was 255.255.0.0 or {/16}) we

can apply command for serial interfaces like:

router(config-router)# network 192.168.0.0 0.0.255.255 area 0

We will assign all networks to area 0 only....

2nd Method: [Interface wise]

In router 7 we have to assign 20.0.0.1 interface individually to area 0.

For that 2nd method will be used....Command will be:

Router(config-router)#network 20.0.0.1 0.0.0.0 area 0

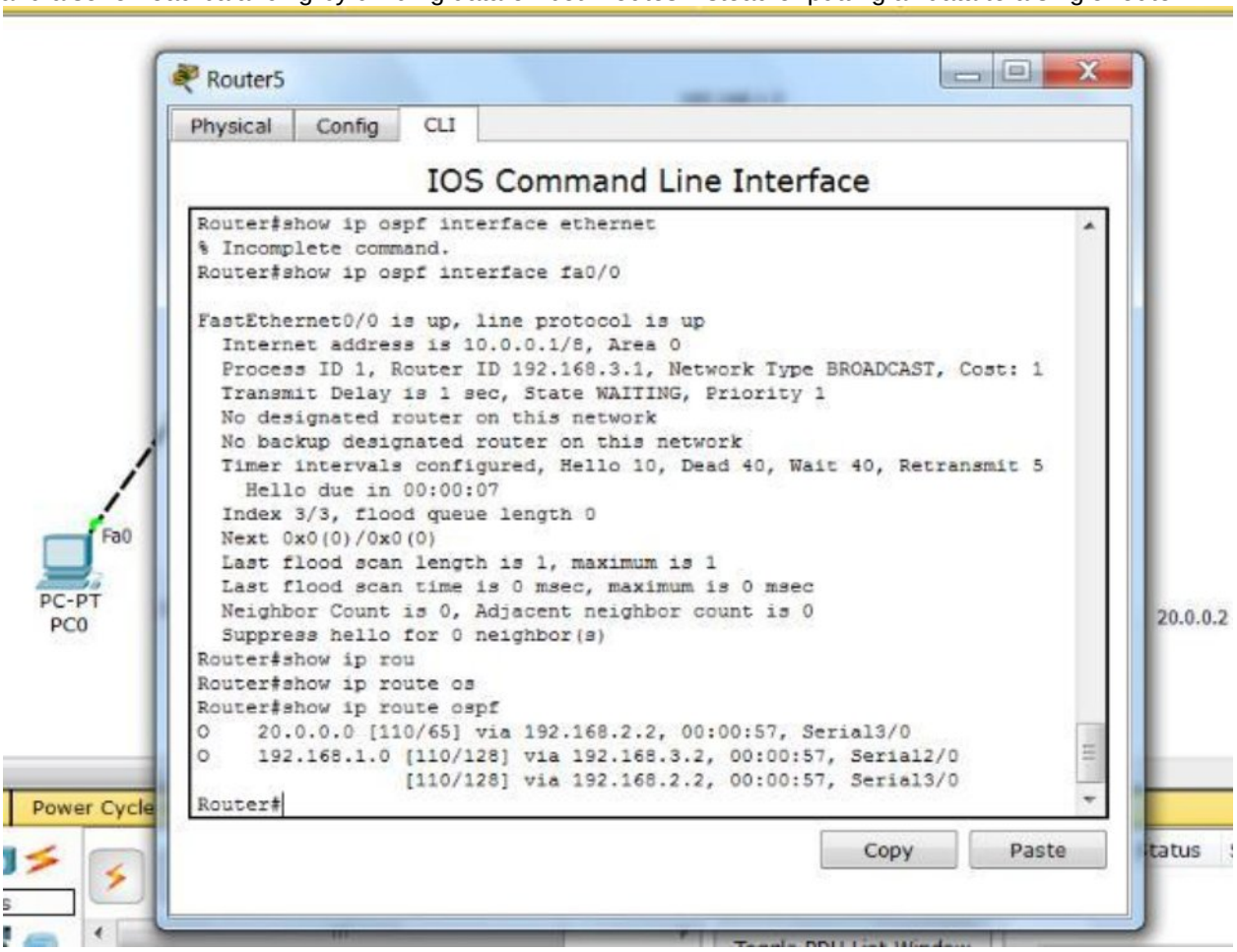
[here,for individual interface to be set up,we need to use 0.0.0.0 as wildcard-mask and 20.0.0.1 will be interface ip address instead of network ip as it was in 1st method..]

Verification:

To verify that OSPF has been properly configured, use the following show commands:
The **show ip protocols** command displays IP routing protocol parameters about timers,filters, metrics, networks, and other information for the entire router.

The **show ip route ospf** command displays the OSPF routes known to the router. This command is one of the best ways to determine connectivity between the local router and the rest of the internetwork.

Unlike RIP,OSPF maintains all routes which are of same cost,so that it can be used when one is down and also for load balancing by dividing data on both routes instead of putting all data to a single route.



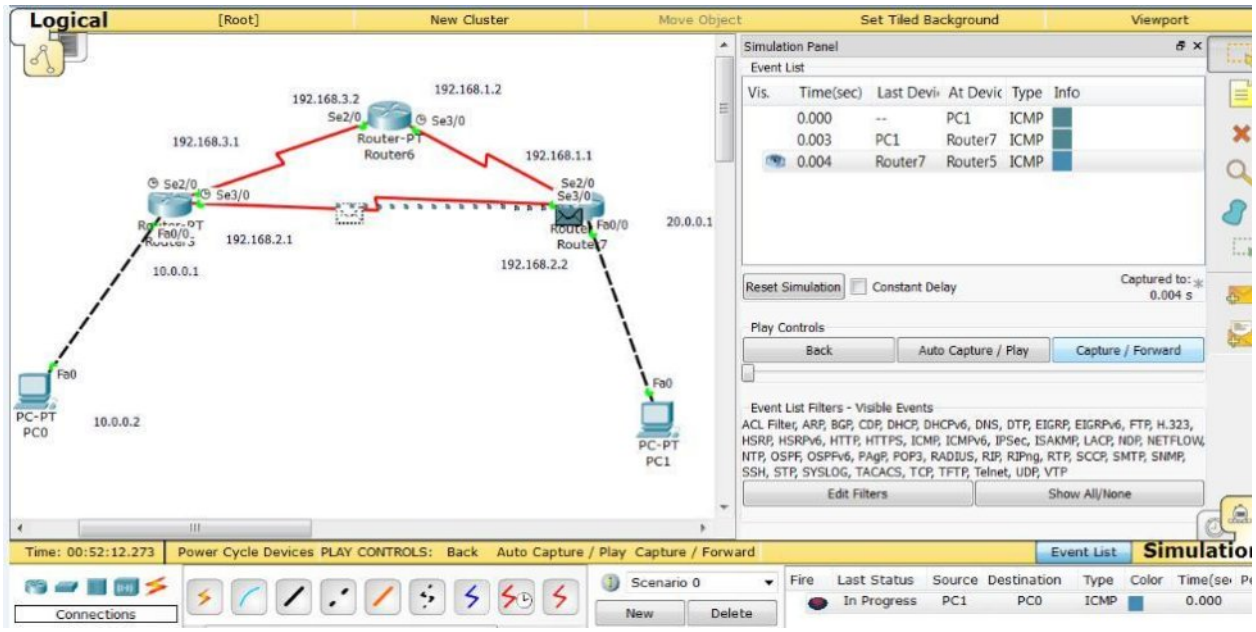
As shown in figure to reach at 192.168.1.0,Router 5 has maintained 2 paths with same cost.

The **show ip ospf interface** command verifies that interfaces are configured in the intended areas. If the router does not specify a loopback address, the router chooses the interface with the highest address as the router ID. In addition, this command displays the timer intervals (including the hello interval) and shows the neighbor adjacencies

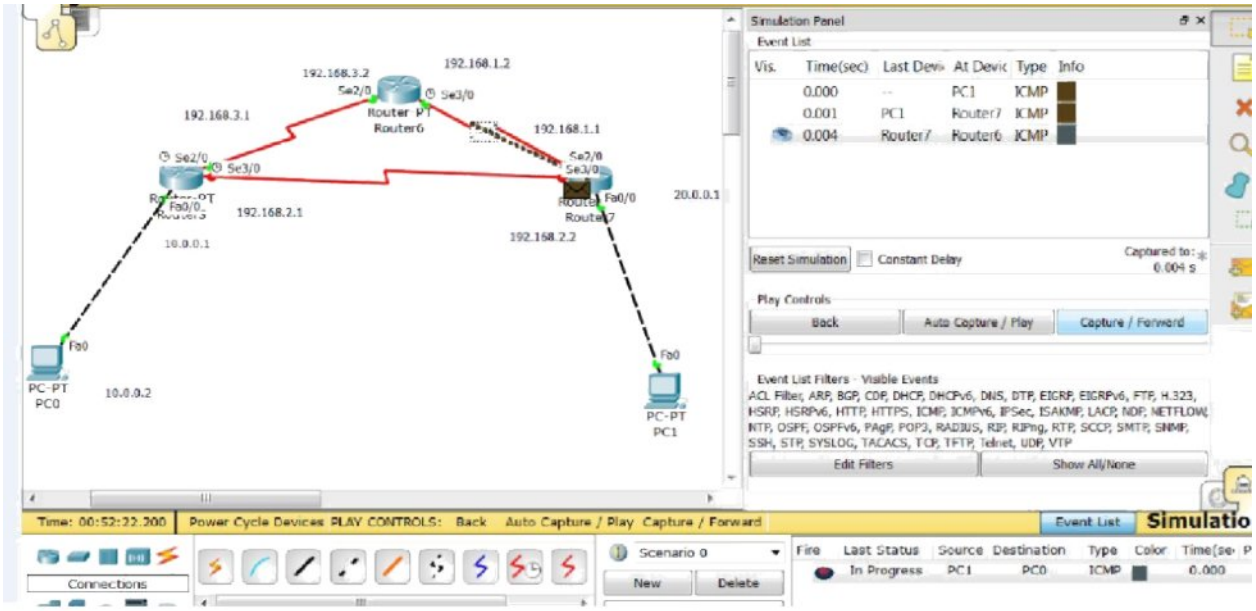
Working???

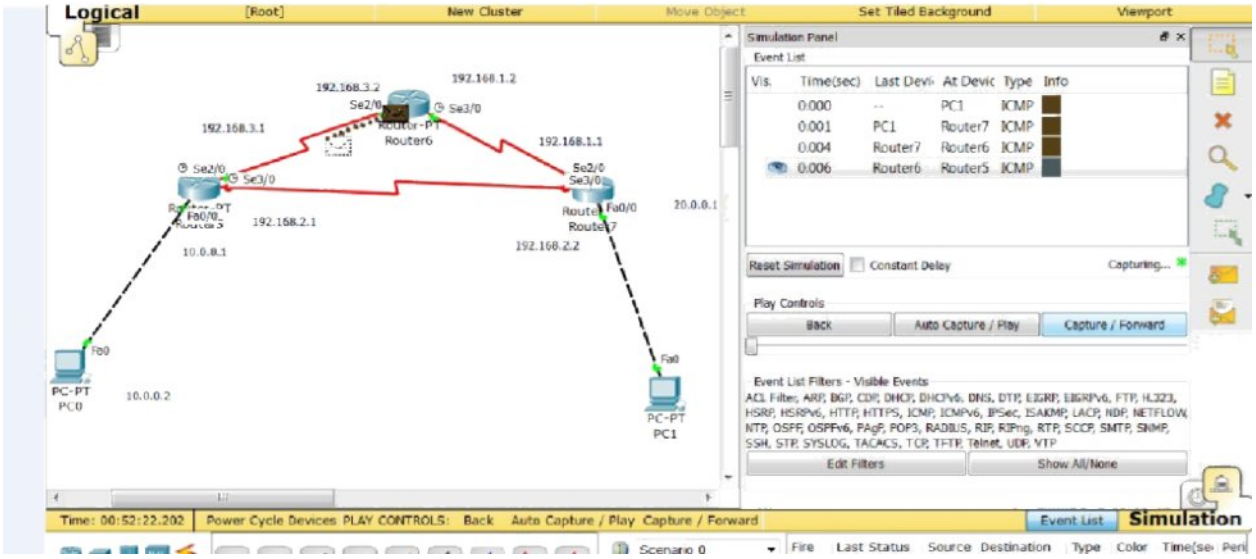
Try pinging 2 PCs.

Ping from PC1 to PC0.

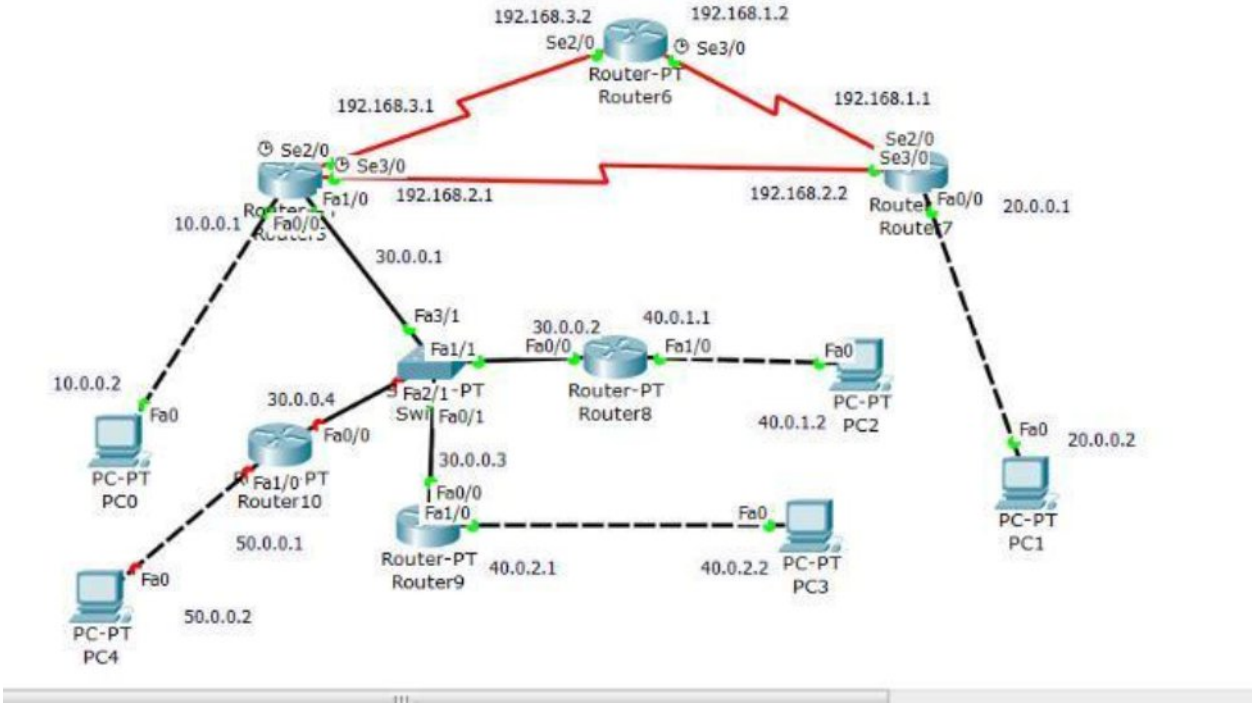


Now,Disable the serial interface se3/0 in router 7 and ping again...It will use other maintained path..


Simulation Panel
Event List
Vis. Time(sec) Last Devi At Devic Type Info
0.000 -- PC1 ICMP
0.001 PC1 Router7 ICMP
0.004 Router7 Router6 ICMP
Reset Simulation
Constant Delay
Captured to: 0.004 s
Play Controls
Back
Auto Capture / Play
Capture / Forward
Event List Filters - Visible Events
Edit Filters
Show All/None
192.168.3.2
192.168.1.2
Se2/0
Se3/0
Router-PT
Router6
192.168.3.1
192.168.1.1
Router7
192.168.2.1
192.168.2.2
20.0.0.1
10.0.0.1
Fa0/0
Fa0
PC-PT
PC0
10.0.0.2
PC1
Time: 00:52:22.200
Power Cycle Devices PLAY CONTROLS: Back Auto Capture / Play Capture / Forward
Event List
Simulatio
Connections
Scenario 0
New
Delete
Fire Last Status Source Destination Type Color
In Progress PC1 PC0 ICMP 0.000


Logical
[Root]
New Cluster
Move Object
Set Tiled Background
Viewport
Simulation Panel
Event List
Vis. Time(sec) Last Devi At Devic Type Info
0.000 -- PC1 ICMP
0.001 PC1 Router7 ICMP
0.004 Router7 Router6 ICMP
0.006 Router6 Router5 ICMP
Reset Simulation
Constant Delay
Capturing...
Play Controls
Back
Auto Capture / Play
Capture / Forward
Event List Filters - Visible Events
Edit Filters
Show All/None
192.168.3.2
192.168.1.2
Se2/0
Se3/0
Router-PT
Router6
192.168.3.1
192.168.1.1
Router7
192.168.2.1
192.168.2.2
20.0.0.1
10.0.0.1
Fa0/0
Fa0
PC-PT
PC0
10.0.0.2
PC1
Time: 00:52:22.202
Power Cycle Devices PLAY CONTROLS: Back Auto Capture / Play Capture / Forward
Event List
Simulation
Scenario 0
Fire Last Status Source Destination Type Color

Extending the Topology:



Implement the topology as above.

We are appending LAN to the existing topology to see how OSPF works in LAN.

Especially for LAN,OSPF selects DR(Designatd Router) and BDR(Backup Designated Router) .So that Router outside the LAN need not to connect to all the routers in LAN. All the information will be exchanged between DR and outside Router and then Every routers other than DR or BDR (called 'DROTHER') can get updated by exchanging information with DR.

Every Router has Router-ID which will be the highest ip-address among all its interfaces. Which will be used to uniquely identify the router.

In our example above, router 10 will be having router-id as 50.0.0.1.

DR,BDR ELECTION:

Highest Router-ID router will become DR,second Highest Router-ID router will become BDR,all other will become DROTHER.Also depands on priority..changing priority will change DR.

Show ip ospf neighbor command is used to find the neighbor router and adjacent router.

Neighbor Vs. Adjacent:

OSPF neighborhood is a relation of two routers that allows them to **see and understand** each other but **nothing more**. In particular, two OSPF neighbors **do not exchange any routing information** - the only packets they exchange is Hello packets.

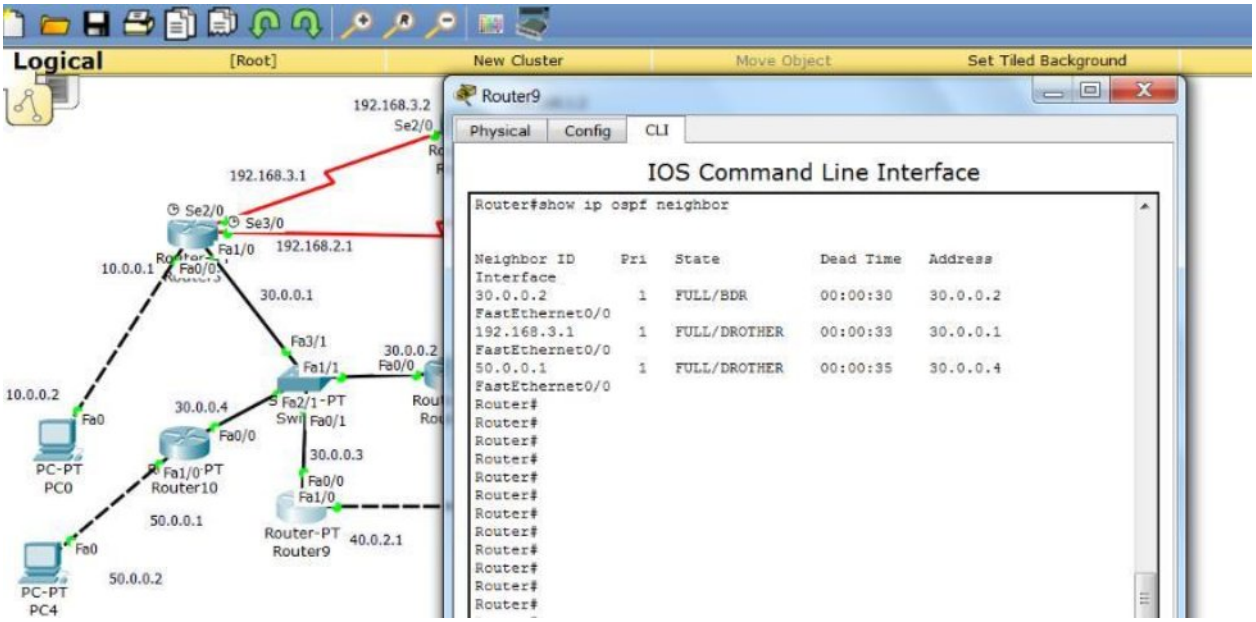
OSPF adjacency is formed between **selected neighbors and allows them to exchange routing information**. So, two routers must first be neighbors, only then they can become adjacent. Two routers become adjacent if:

- At least one of them is DR or BDR (on multi access type networks i.e., LAN), or
- They are interconnected by a point-to-point or point-to-multipoint network type

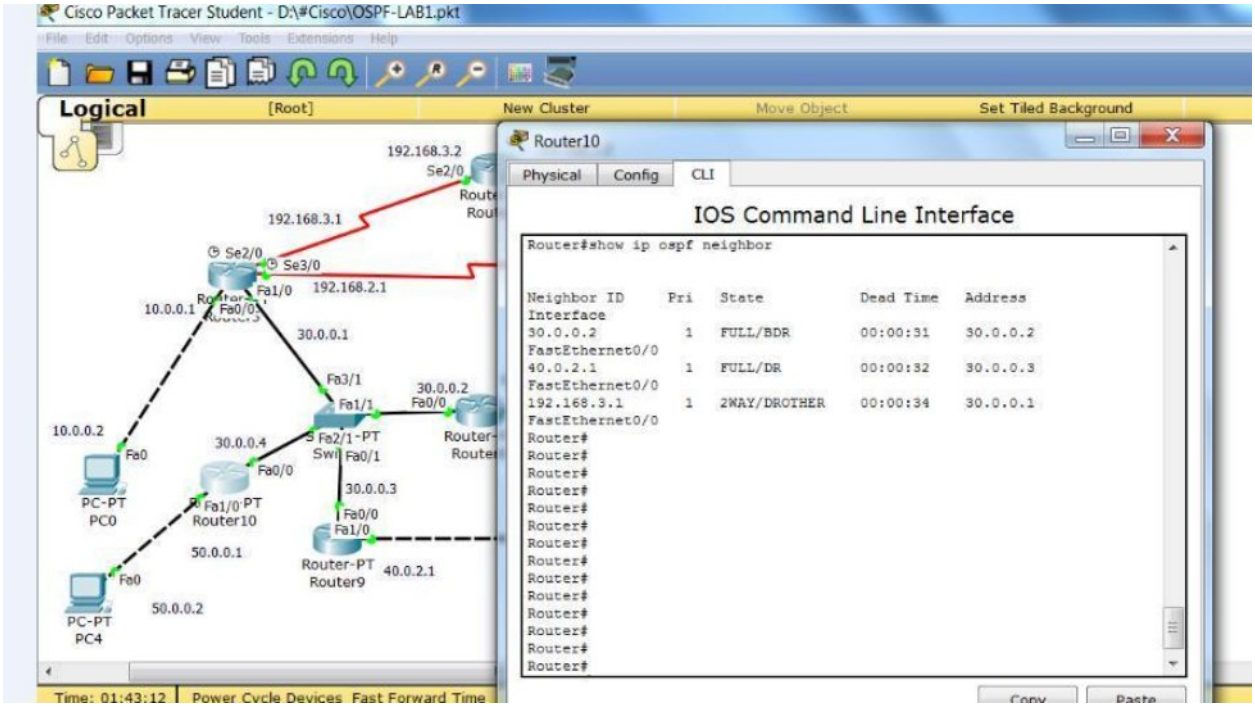
So, to sum it up, OSPF neighbors are simply routers that sit on the same segment and hear each other, but they do not engage in any closer cooperation. OSPF adjacent routers exchange routing information.

IN OUR TOPOLOGY:

Router 9 is DR:



Router 10 is DROTHER and Router 8 is BDR.



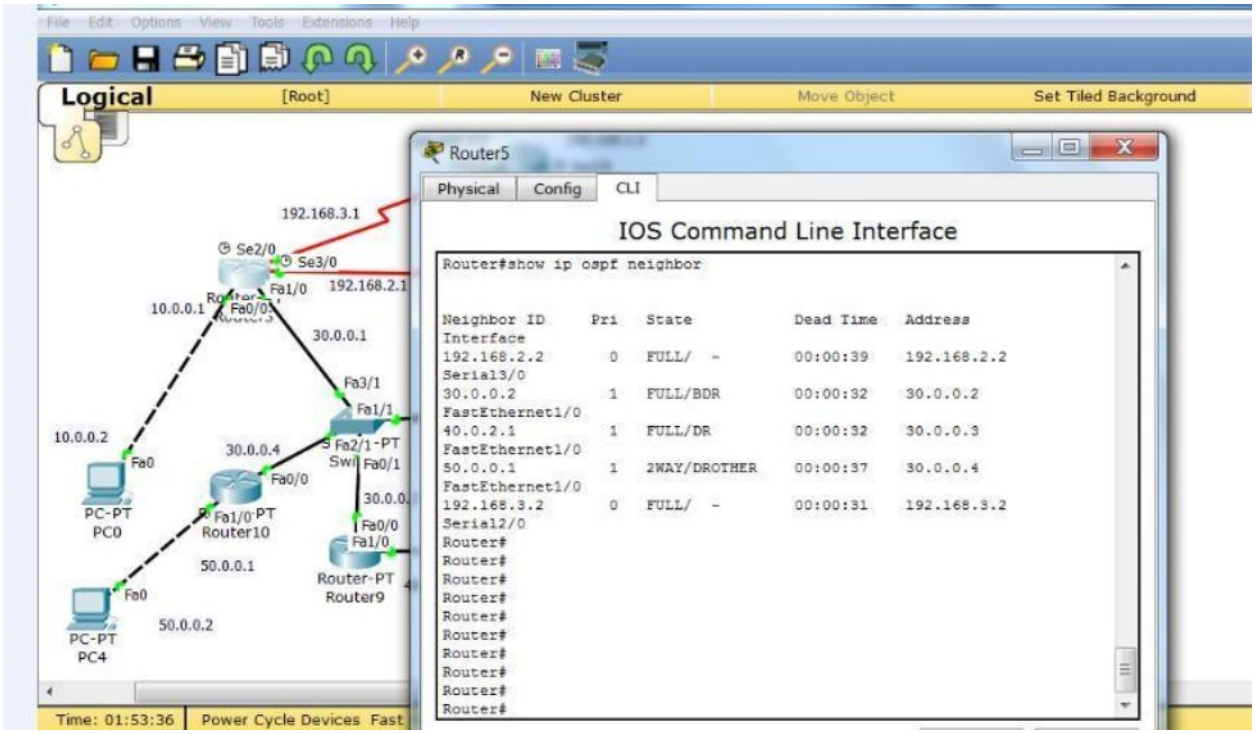
FULL:

Full is the normal state for an OSPF router. If a router is stuck in another state, it is an indication that there are problems in forming adjacencies. The only exception to this is the 2-way state, which is normal in a broadcast network. Routers achieve the FULL state with their DR and BDR in broadcast media and FULL state with every neighbor in the remaining media such as point-to-point and point-to-multipoint.

2-Way:

This state designates that bi-directional communication has been established between two routers. Bi-directional means that each router has seen the other's hello packet. This state is attained when the router receiving the hello packet sees its own Router ID within the received hello packet's neighbor field. At this state, a router decides whether to become adjacent with this neighbor. On broadcast media, a router becomes full only with the designated router (DR) and the backup designated router (BDR); it stays in the 2-way state with all other neighbors. On Point-to-point and Point-to-multipoint networks, a router becomes full with **all connected routers.**

Router 5 is outside Router



DR and DBR are not used on point-to-point interfaces (indicated by a dash [.]).

To determine the router ID of a router, enter the **show ip ospf** command.

Manipulating Router-ID: To Manually set the Router ID,Follow commands:

router ospf 1

router-id *ip-addr*

exit

exit

Assign higher router ID to any DROTHER router. Observe that it became DR.

clear ip ospf process

//This command restarts the OSPF routing process so that it will reselect the new IP address as its router ID.

show ip ospf

"first line shows new router id.."

Debug ip ospf adj command:Debugging allows you to see exactly which OSPF packets are being sent between routers.

QUESTIONS TO BE ANSWERED….

1).Implement topology (one without LAN).Ping 2 PCs Successfully.

2).show ospf route table of any one router.

3).Implement extended topology(add LAN).Show DR,BDR and DROTHER routers.

4).change router id of DROTHER router using **router-id command.** Where w.x.y.z will be the higher ip address than DR router-ID.After restarting OSPF process, **show the new DR,BDR and DROTHER routers**.

5).Ping PC1 and PC4 successfully in above topology.[screenshot is needed]

[use any one of loop back or router-id method to change router-id.which shold be higher than current DR router-ID.]

6).screenshot for command: **debug ip ospf adj**

7).Relationship between routers:[neighbor or adjacent??]

a)DR ←→ BDR

b)DR ←→ DROTHER

c)BDR ←→ DROTHER

e) Router outside LAN ←→ DR

f) Router outside LAN ←→ Router outside LAN

g)DROTHER ←→ DROTHER

d)Router outside LAN ↔ DROTHER