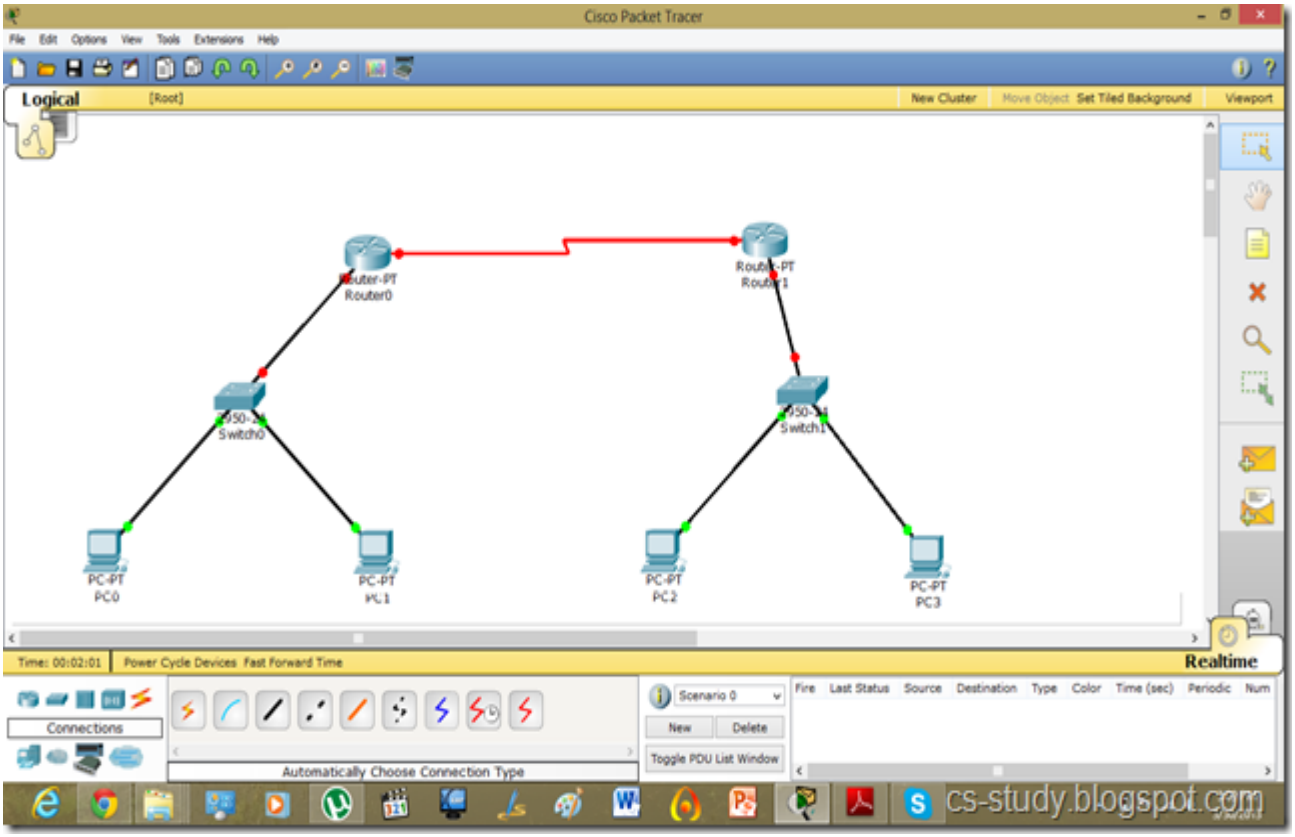
NATIONAL UNIVERSITY OF COMPUTER & EMERGING SCIENCE
Computer Network Lab (CL-307)
Lab Session 13

OSPF Protocol

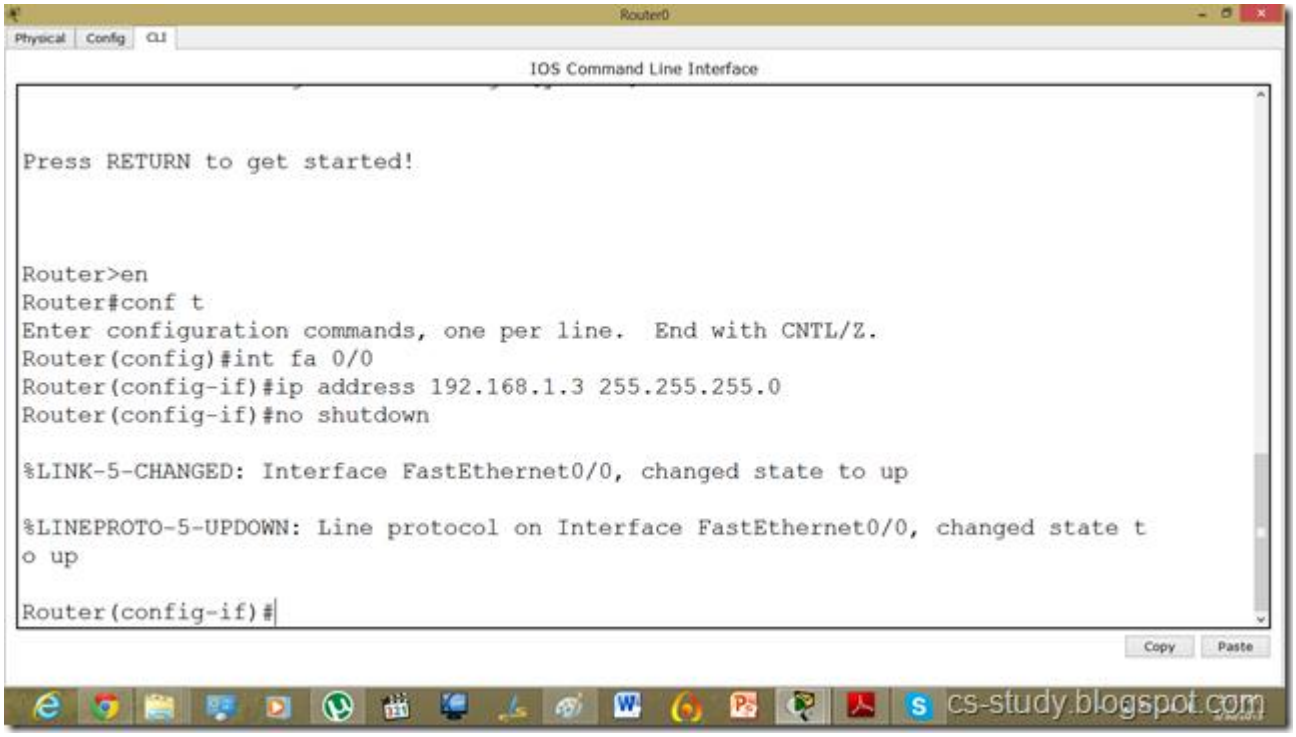
OSPF is an interior gateway protocol (IGP) for routing Internet Protocol (IP) packets solely within a single routing domain, such as an autonomous system. It gathers link state information from available routers and constructs a topology map of the network. The topology is presented as a routing table to the Internet layer which routes packets based solely on their destination IP address. OSPF supports Internet Protocol Version 4 (IPv4) and Internet Protocol Version 6 (IPv6) networks and supports the Classless Inter-Domain Routing (CIDR) addressing model.

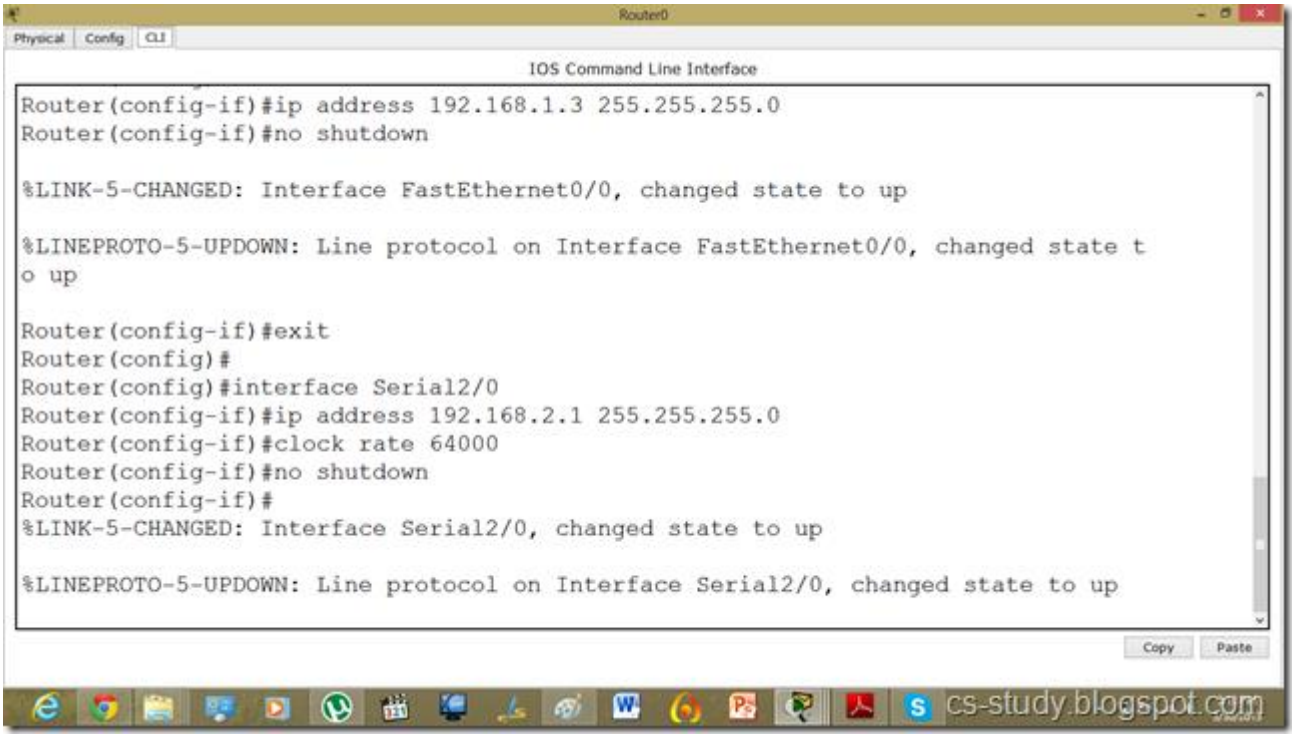
OSPF detects changes in the topology, such as link failures, and converges on a new loop-free routing structure within seconds. It computes the shortest-path tree for each route using a method based on Dijkstra's algorithm. The OSPF routing policies for constructing a route table are governed by link metrics associated with each routing interface. Cost factors may be the distance of a router (round-trip time), data throughput of a link, or link availability and reliability, expressed as simple unitless numbers. This provides a dynamic process of traffic load balancing between routes of equal cost.

We are going to apply OSPF (open shortest path first) protocol on packet tracer. Let us take the following simple topology.

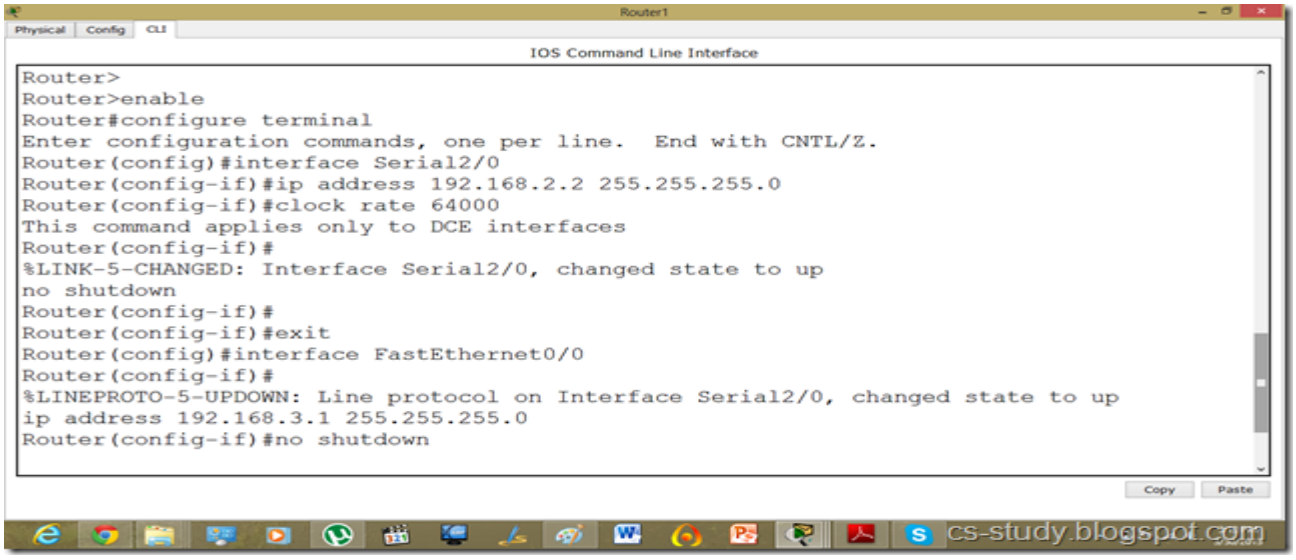


Now, let us apply the ospf on it. But before that, as usual. Let us assign IP addresses and change the state of interfaces.

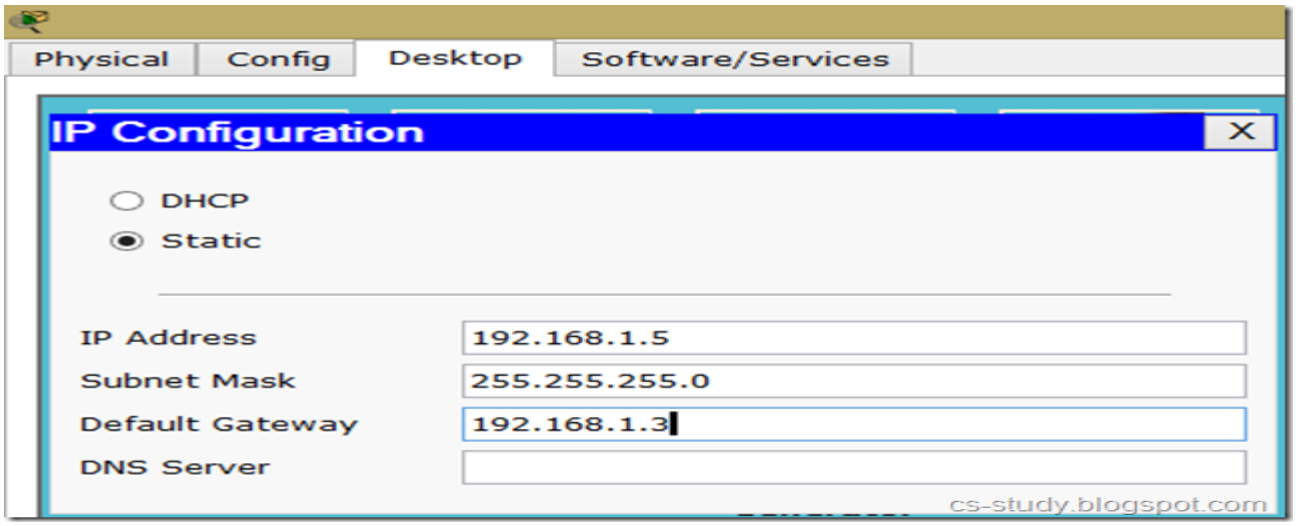


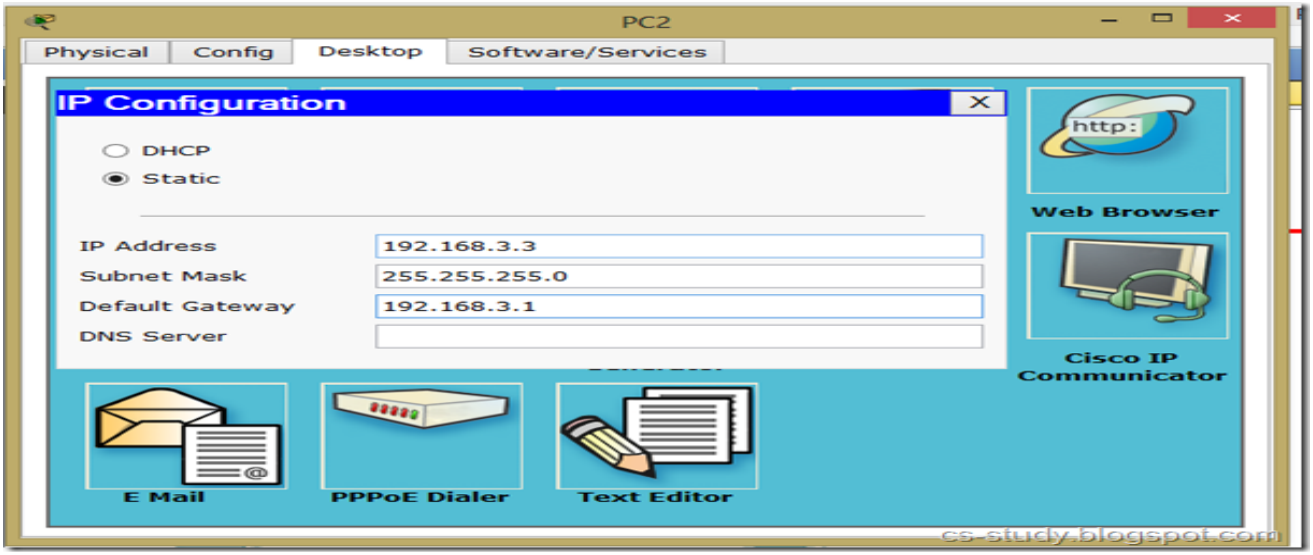


Similarly for the other router.

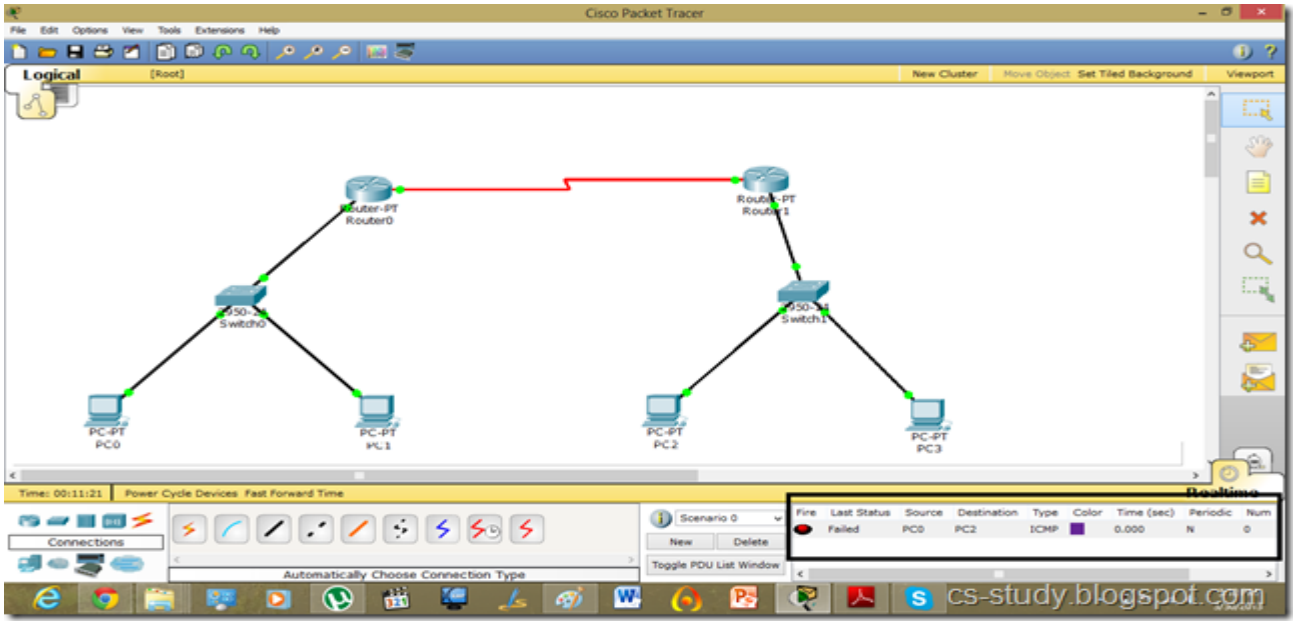


Assigning the IP addresses to PCs as follows.





Now, as we can see, interfaces are up but the communication is not enabled because we have not applied the protocol yet.



Let's do it.

Router(config)# router ospf process ID

This command will enable OSPF routing protocol in router. Process ID is a positive integer. We can use any number from 1 to 65,535. Process ID is locally significant. We can run multiple OSPF process on same router. Process ID is used to differentiate between them. Process ID need not to match on all routers.

Router(config-router)# network IP_network_# [wildcard_mask] area [area number]

Network command allows us to specify the interfaces which we want to include in OSPF process. This command accepts three arguments network number, wildcard mask and area number.

Network number

Network number is network ID. We can use any particular host IP address or network IP address. For example we can use 192.168.1.1 (host IP address) or we can use 192.168.1.0 (Network IP address). While targeting a specific interface usually we use host IP address (configured on that interface).While targeting multiple interfaces, we use network IP address. So any interface that belongs to specified network ID will be selected.

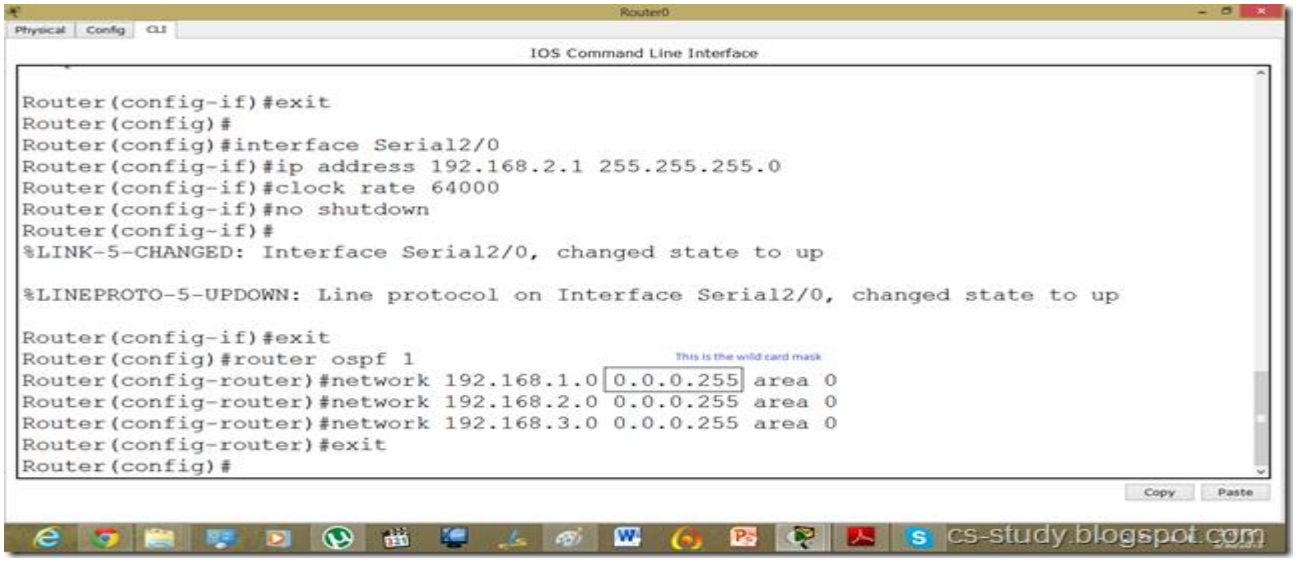
Wildcard mask

Wildcard mask are used with network ID to filter the interfaces. Wildcard mask is different from subnet mask. Subnet mask is used to separate the network portion and host portion in IP address. While wildcard mask is used to match corresponding octet in network portion. Wildcard mask tells OSPF the part of network address that must be matched. Wildcard masks are explained with examples in access list tutorials of this category.

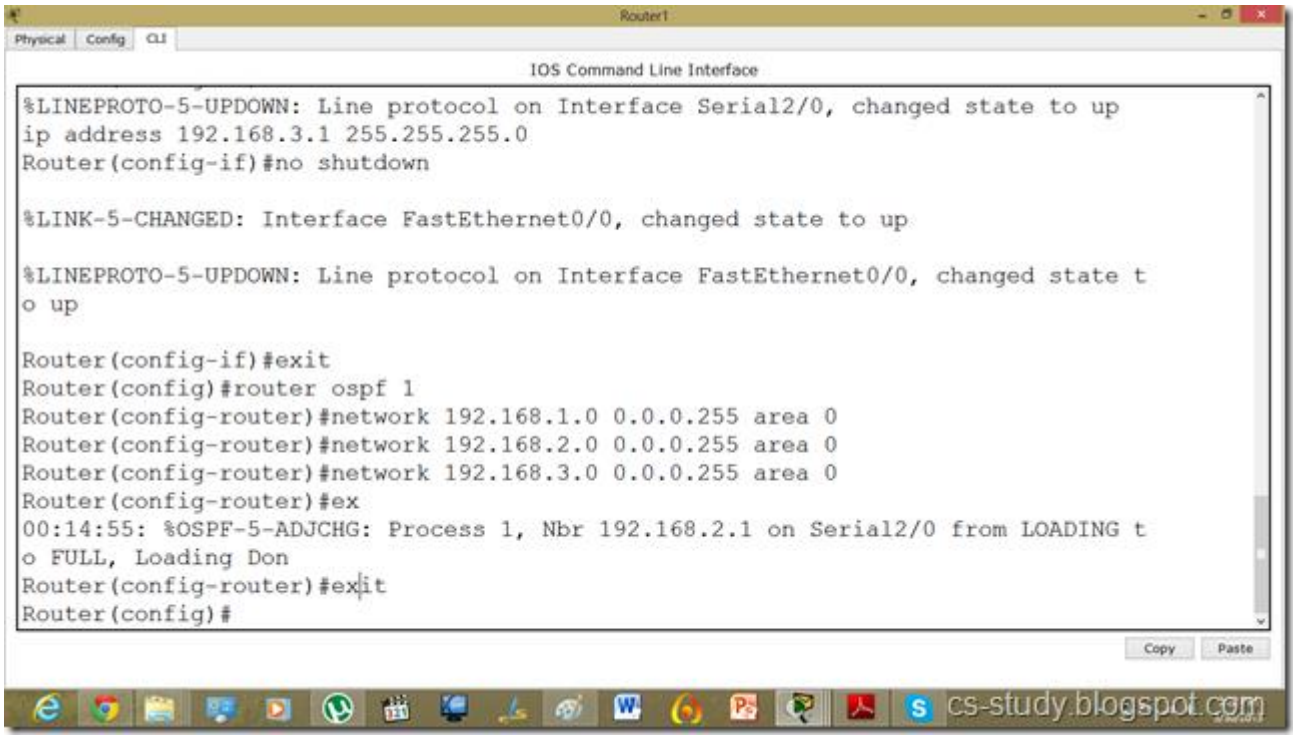
OSPF AREAS:

For this tutorial let's move on third argument. Third argument which network command accept is area number. This parameter say router to put matched interface in specified area. An OSPF network is divided into areas that are logical groupings of hosts and networks. An area includes its router having interfaces connected to the network. Each area maintains a separate link state database whose information may be summarized towards the rest of the network by the connecting router. Thus, the topology of an area is unknown outside of the area. This reduces the routing traffic between parts of an autonomous system.

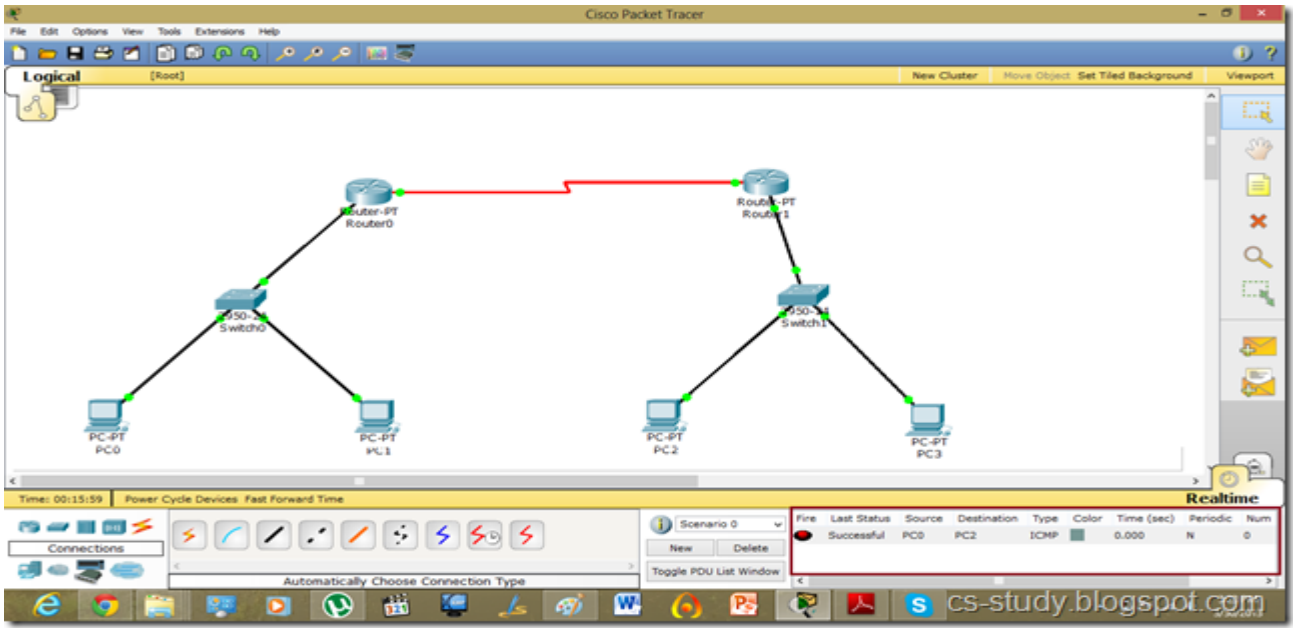
On router 0.



On router 1.



After applying protocol successfully, the traffic is flowing. Couple of things worth discussing
i. you will have to provide area id and process id on ospf protocol.
ii. You will have to provide wildcard mask on ospf.



That's it. Our network is ready to take the advantage of OSPF routing. To verify the setup we will use ping command. ping command is used to test the connectivity between two devices. We have two routes between source and destination. tracert command is used to know the route which is used to get the destination.

You can also run the following commands.

Router#show ip route: Display all routes from routing table

Router#show ip route ospf: Display all routers learned through OSPF from routing table

Router#show ip ospf interface: Display information about all OSPF active interfaces

Router#show ip ospf neighbor detail: List OSPF neighbors with detail info

Router#show ip ospf database: Display data for OSPF database