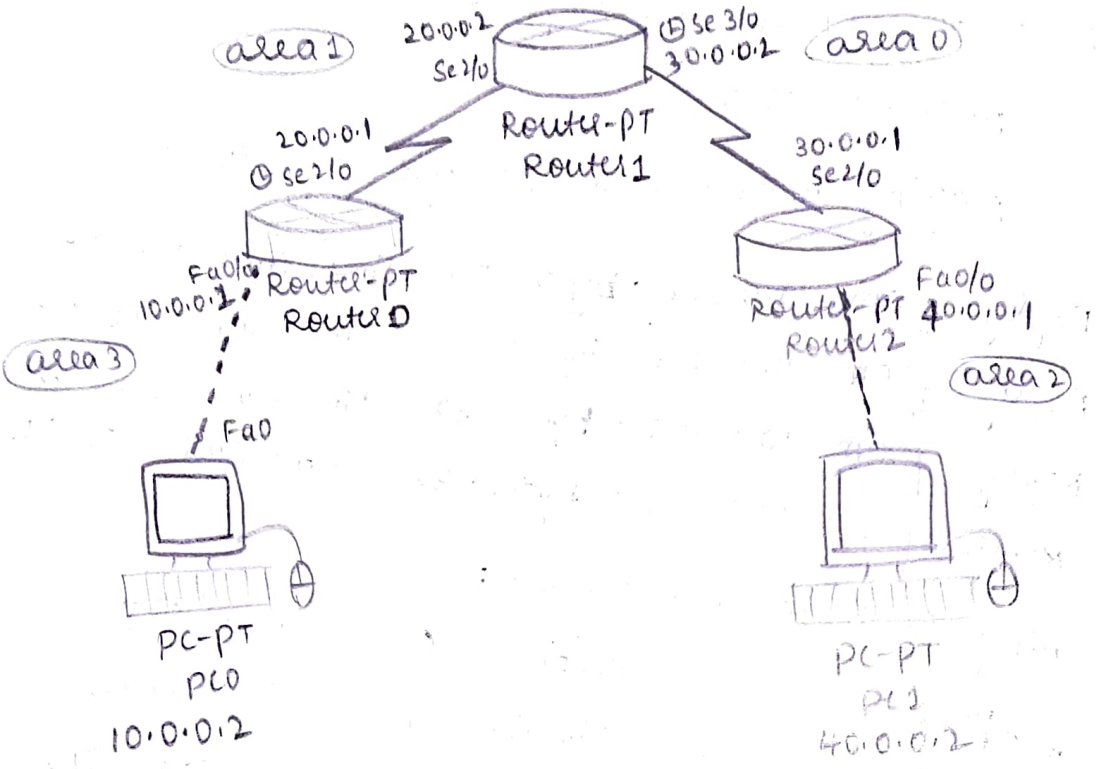
Aim: To Configure OSPF routing protocol and connect areas.

Topology:



Procedure:

step 1: Create a topology as shown above using 2 PCs and three routers.

step 2: Configure ip addresses and gateways for PCs as 10.0.0.2 & 10.0.0.1 for PC0 and 40.0.0.2 & 40.0.0.1 for PC1 respectively.

step 3: Configure ip address to all ~~int~~ router interfaces,

Router R0,

R0 (config)# interface fastethernet 0/0

R0 (config-if)# ip address 10.0.0.1 255.0.0.0

R0 (config-if)# no shut

R0 (config) # interface serial 2/0
R0 (config-if) # ip address 20.0.0.1 255.0.0.0
R0 (config-if) # encapsulation ppp
R0 (config-if) # clock rate 64000
R0 (config-if) # no shut
R0 (config-if) # exit

Similarly, configure for R1 and R2.

Step 4 : Now, Enable ip routing by configuring ospf routing protocol in all routers.

Router R0,

Router (config) # router ospf 1
Router (config-router) # router-id 1.1.1.1
Router (config-router) # network 10.0.0.0 0.255.255.255 area 3
Router (config-router) # network 20.0.0.0 0.255.255.255 area 1
Router (config-router) # exit

Similarly, configure for R1 and R2.

Step 5 : Now check routing table of R0

Router # show ip route
C - connected
O - ospf
C 10.0.0.0/8 is directly connected, Fa 0/0
C 20.0.0.0/8 is directly connected, serial 2/0
O IA 40.0.0.0/8 via 20.0.0.2, 00:04:23, serial 2/0
O IA 30.0.0.0/8 via 20.0.0.2, 00:07:29, serial 2/0

Here R1 knows area 0. Network 20.0.0.0 connected to R1 from R0, so R0 learns networks through this network.

Router(config)# router ospf 1, 1 => process id (1-65535)

There must be one interface up to keep ospf process up. So it's better to configure loopback address to routers. It is a virtual interface never goes down once we configured.

R0(config-if)# interface loopback 0

R0(config-if)# ip add 172.16.1.252 255.255.0.0

R0(config-if)# no shut

Similarly, configure for R1 and R2

Step 6: Now, check routing table of R3

R3# show ip route

codes: O-ospf C-connected.

O IA 20.0.0.0/8 via 30.0.0.2, 00:18:58, serial 2/0

C 40.0.0.0/8 is directly connected, FastEthernet 0/0

C 30.0.0.0/8 is directly connected, serial 2/0

Here, R3 doesn't know about the area3 so we have to create virtual link between R0 and R1

Step 7: Create virtual link between R0, R1 by this we create a virtual link to connect area3 to area0.

In R0,

R0(config)# router ospf 1

R0(config-router)# area1 virtual-link 2.2.2.2

In R1, R1(config)# router ospf 1

R1(config-router)# area1 virtual-link 1.1.1.1

Step8: R1 and R2 get updates about Area3. Now, check routing table of R2

R2 # show ip route

Codes: O-OSPF C-connected

O IA 20.0.0.0/8 via 30.0.0.1, 00:01:56, serial 2/0

C 40.0.0.0/8 is directly connected, fastethernet 0/0

O IA 10.0.0.0/8 via 30.0.0.2, 00:01:56, serial 2/0

C 30.0.0.0/8 is directly connected, serial 2/0

Step9: ping PC1 from PC0,

Result:

In PC0,

PC> ping 40.0.0.2

pinging 40.0.0.2 with 32 bytes of data:

Reply from 40.0.0.2: bytes=32 time=2ms TTL=125

Reply from 40.0.0.2: bytes=32 time=10ms TTL=125

Reply from 40.0.0.2: bytes=32 time=14ms TTL=125

Reply from 40.0.0.2: bytes=32 time=2ms TTL=125

ping statistics for 40.0.0.2:

packets: Sent=4, Recieved=4, Lost=0 (0% loss)

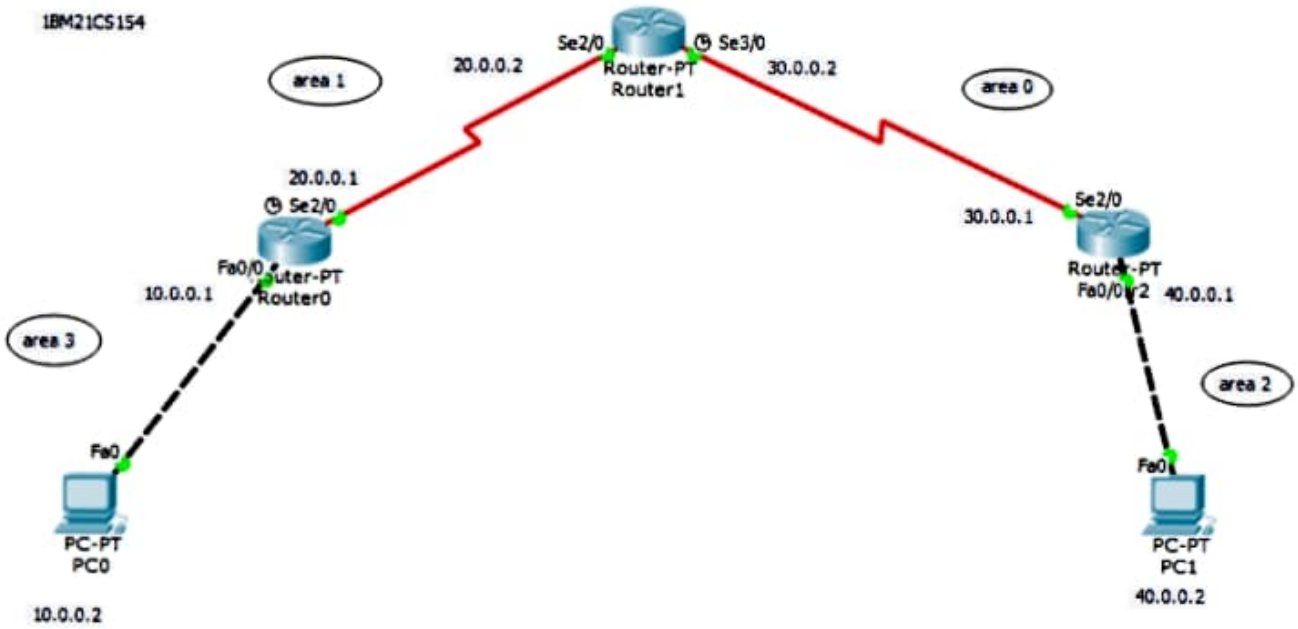
Approximate round trip times in milli-seconds:

minimum: 2ms, Maximum=14ms, Average=7ms

10/10

25/8/23

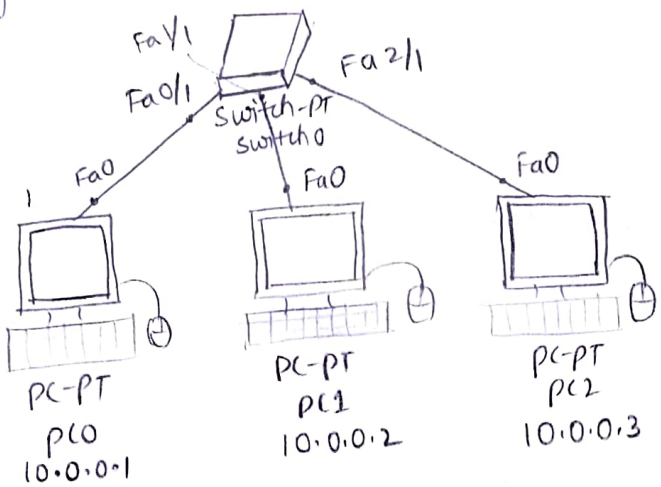
```
PC>ping 40.0.0.2

Pinging 40.0.0.2 with 32 bytes of data:

Request timed out.
Reply from 40.0.0.2: bytes=32 time=2ms TTL=125
Reply from 40.0.0.2: bytes=32 time=2ms TTL=125
Reply from 40.0.0.2: bytes=32 time=2ms TTL=125

Ping statistics for 40.0.0.2:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 2ms, Average = 2ms

PC>ping 40.0.0.2

Pinging 40.0.0.2 with 32 bytes of data:

Reply from 40.0.0.2: bytes=32 time=2ms TTL=125
Reply from 40.0.0.2: bytes=32 time=10ms TTL=125
Reply from 40.0.0.2: bytes=32 time=14ms TTL=125
Reply from 40.0.0.2: bytes=32 time=2ms TTL=125

Ping statistics for 40.0.0.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 14ms, Average = 7ms
```



2)

Aim: To construct simple LAN and understand the concept of Address resolution protocol (ARP)

Topology:



Procedure:

Step 1: Drag and drop 3 PCs and 1 Switch to the workspace and connect them according to the topology as shown above.

Step 2: Configure the IP addresses for the PC's as 10.0.0.1, 10.0.0.2 and 10.0.0.3 for PC0, PC1 and PC2 respectively.

Step 3: Now, in the command prompt of PC0, if we run the command "arp -a" initially arp table will be empty.

Step 4: Also in CLI of switch, the command -show mac address-table can be given on every transaction to see how the switch learns from the transactions and build the address-table. Initially all tables are empty.

Step 5: Now ping from PC0 to PC1

PC > ping 10.0.0.3

Pinging 10.0.0.3 with 32 bytes of data:

Reply from 10.0.0.3 bytes=32 time=0ms TTL=128

Reply from 10.0.0.3 : bytes=32 time=0ms TTL=128
Reply from 10.0.0.3 : bytes=32 time=0ms TTL=128
Reply from 10.0.0.3 : bytes=32 time=0ms TTL=128

ping Statistics for 10.0.0.3:
Packets: Sent = 4, Recieved = 4, Lost = 0 (0% loss)
Approximate round-trip times in milli-seconds
minimum = 0ms, Maximum = 0ms, Average = 0 ms

Step6: Run "arp-a" command again, in pc0

pc > arp -a

Internet address	physical address	Type
10.0.0.3	0090.2176.1580	dynamic

Similary ping pc2 from pc0 and rerun arp-a comma -nd,

pc > arp -a

Internet address	physical address	Type
10.0.0.3	0090.2176.1580	dynamic
10.0.0.2	0060.5C26.935d	dynamic

pc > arp -d
pc > arp -a
NO ARP Enteries found.

"arp -d" command is used to clear the table.

Observation: By using ARP protocol, physical/MAC address of each device will get stored in the table, whenever there is a new transaction. with the help of this dynamically table, switch performs forwarding of packet.

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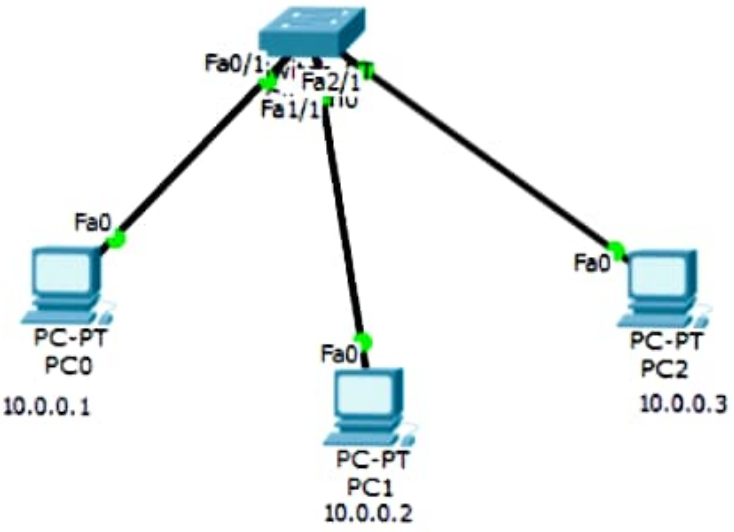

Command Prompt

```
Packet Tracer PC Command Line 1.0
PC>ping 10.0.0.1

Pinging 10.0.0.1 with 32 bytes of data:

Reply from 10.0.0.1: bytes=32 time=1ms TTL=128
Reply from 10.0.0.1: bytes=32 time=0ms TTL=128
Reply from 10.0.0.1: bytes=32 time=0ms TTL=128
Reply from 10.0.0.1: bytes=32 time=0ms TTL=128

Ping statistics for 10.0.0.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

PC>arp -a
  Internet Address      Physical Address      Type
  10.0.0.1              00d0.bale.cb8d        dynamic

PC>arp -d
PC>arp -a
No ARP Entries Found
PC>
```