Boica Michael Daniel,254400

Simulation of a routing protocol in Cisco Packet Tracer

Goal

The project aims to get familiar with the principle and function of the routing protocol OSPF (Open Shortest Path First) and its response to various scenarios. The task is to create a network in the Packet Tracer environment, assign address ranges, set the OSPF protocol so that routing in the network works properly and then perform routing analysis.

Tasks

1. Get yourself aquinted with the topic of the OSPF routing protocol and how it chooses the route through the network to the destination. Based on the available guide, create a network in a Packet tracer environment and analyze the behavior of OSPF in various situations.
2. Create a network topology using the appropriate network elements, allocate address space, set the OSPF protocol, and set the bandwidth of each link.
3. With help of the tracert command, determine the chosen route through the network and verify that this routing option meets theoretical assumptions. Examine the routing tables of each router of the network. Use the simulation mode to visualize the transmission.
4. Make a change in the bandwidth of the selected link and observe the effect of this change on routing.
5. Simulate a link failure and the subsequent response of OSPF to this fact.

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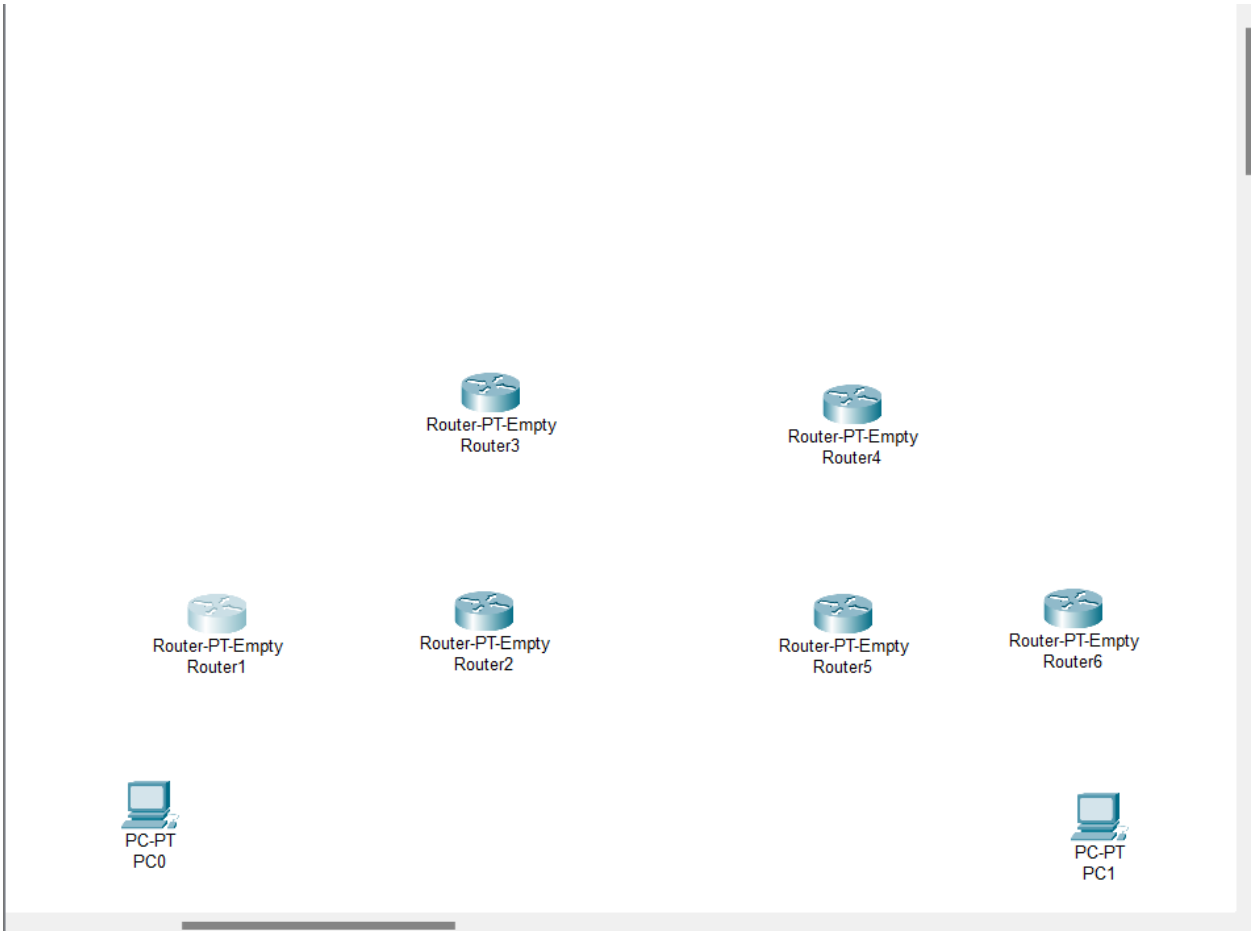
I installed the Cisco Packet Tracer and started to build the topology of the 6 routers and two end devices.



We start to build the module for every Router by pressing click on it and making the connections starting with:

Router A:

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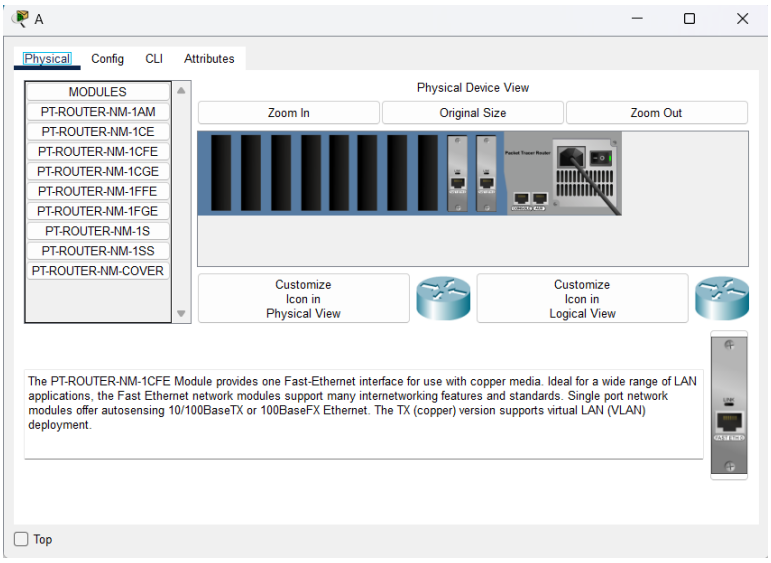
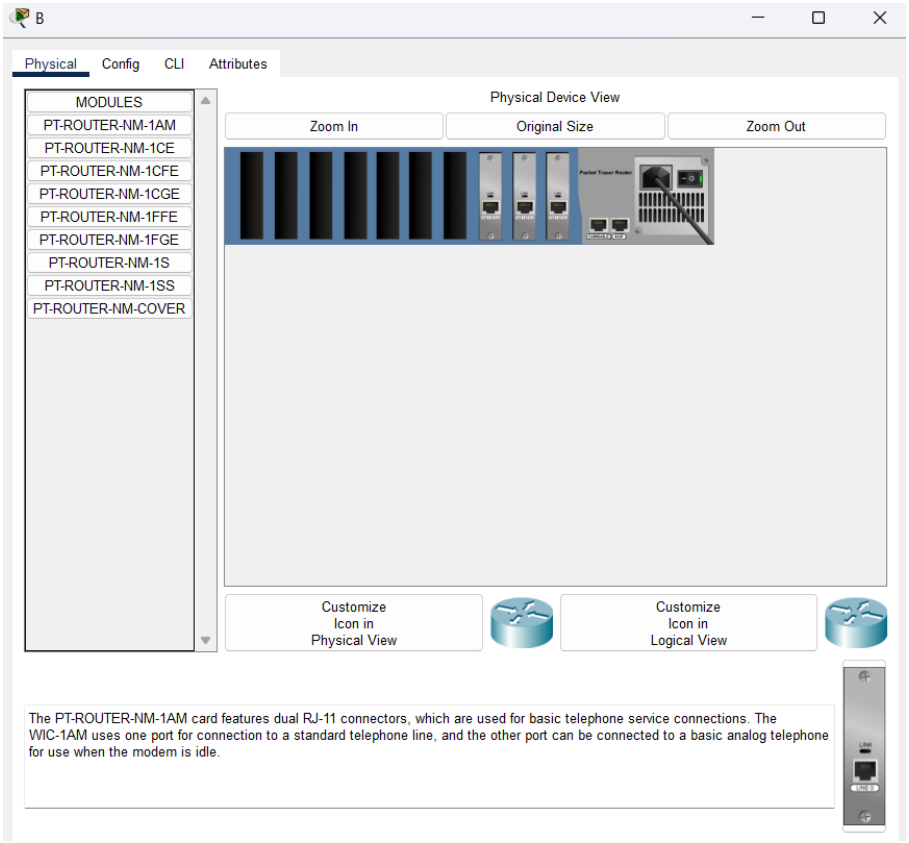


Router B:



Router C:

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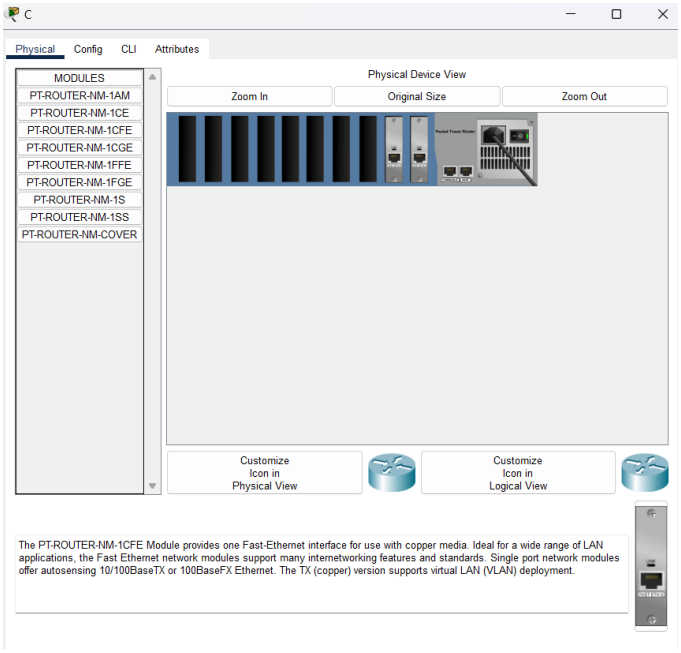
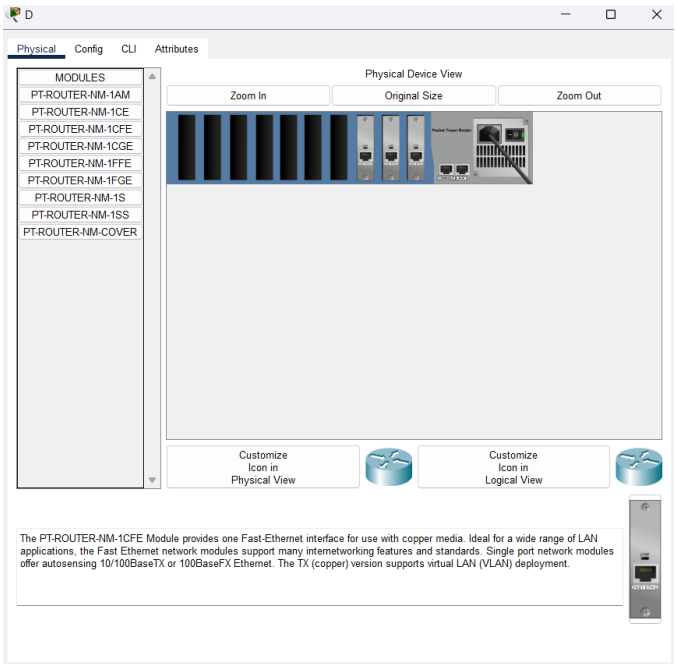


Router D:



Router E:

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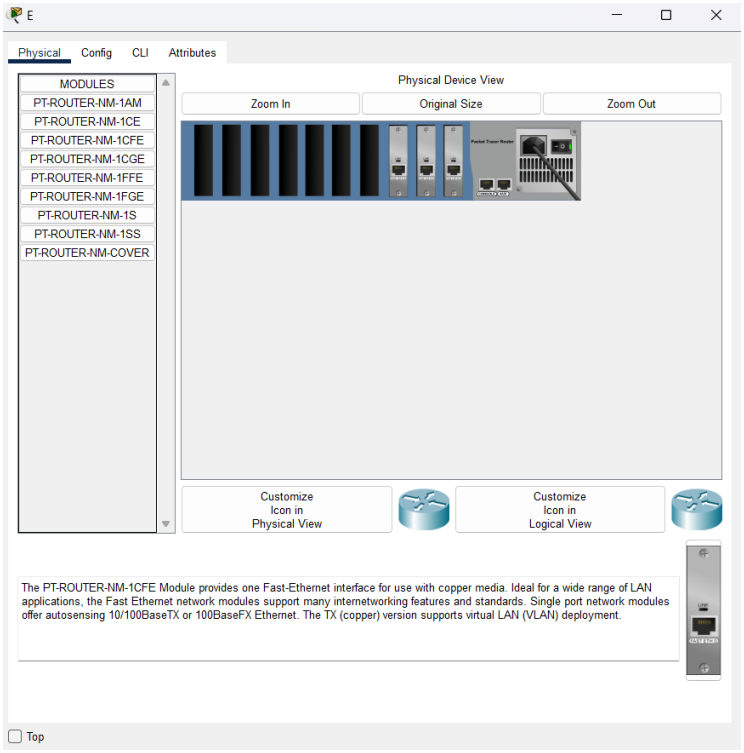
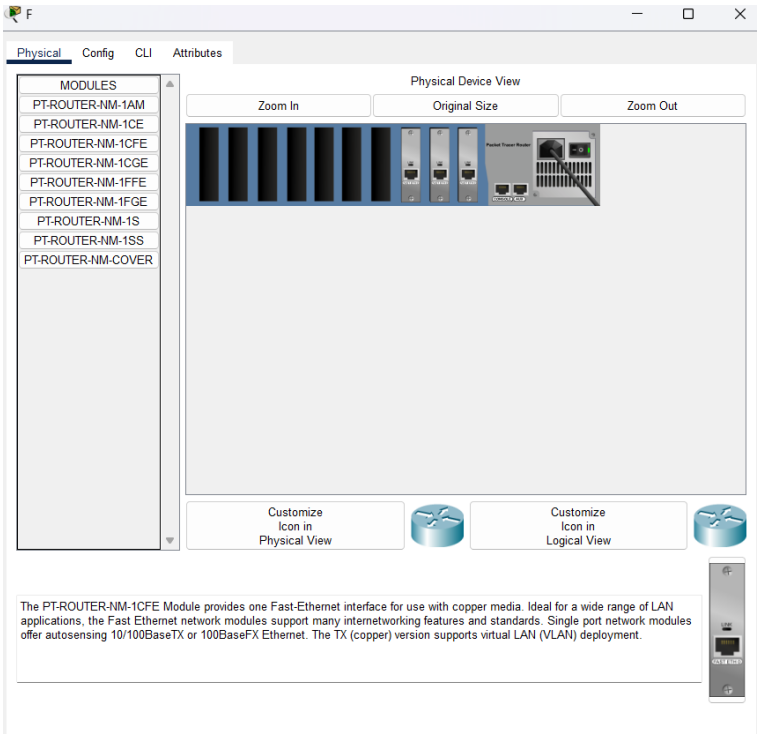
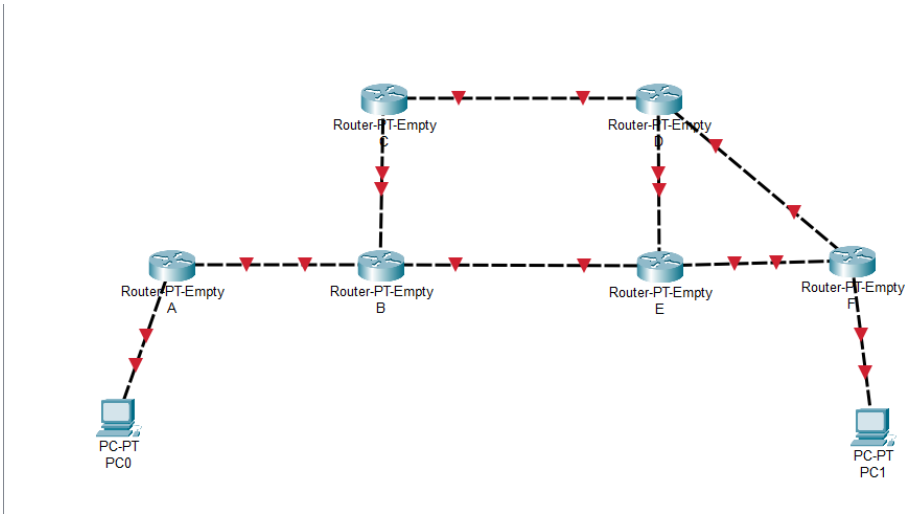


Router F:



Topology without configured interfaces:



3.2 Address space allocation

Router A:

```
        --- System Configuration Dialog ---

Would you like to enter the initial configuration dialog? [yes/no]: n


Press RETURN to get started!



Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int Fa0/0
Router(config-if)#ip addr 10.10.0.1 255.255.255.0
Router(config-if)#no sh

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface FastEthernet1/0
Router(config-if)#ip addr 10.10.10.1 255.255.255.252
Router(config-if)#no sh

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet1/0, changed state to up
```

Router B:

```
        --- System Configuration Dialog ---

Would you like to enter the initial configuration dialog? [yes/no]: n


Press RETURN to get started!



Router>en
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface FastEthernet0/0
Router(config-if)#ip addr 10.10.10.2 255.255.255.252
Router(config-if)#no sh

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
exit
Router(config)#int Fa1/0
Router(config-if)#ip addr 10.10.20.1 255.255.255.252
Router(config-if)#no sh

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet1/0, changed state to up
exit
Router(config)#int Fa2/0
Router(config-if)#ip addr 10.10.30.1 255.255.255.252
Router(config-if)#no sh

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet2/0, changed state to up
```

Router C:

```
        --- System Configuration Dialog ---

Would you like to enter the initial configuration dialog? [yes/no]: n


Press RETURN to get started!



Router>en
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int Fa0/0
Router(config-if)#ip addr 10.10.20.2 255.255.255.252
Router(config-if)#no sh

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
exit
Router(config)#int Fa1/0
Router(config-if)#ip addr 10.10.40.1 255.255.255.252
Router(config-if)#no sh

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet1/0, changed state to up
```

Copy Paste

Router D:

```
        --- System Configuration Dialog ---

Would you like to enter the initial configuration dialog? [yes/no]:

Press RETURN to get started!



Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int Fa0/0
Router(config-if)#ip addr 10.10.40.2 255.255.255.252
Router(config-if)#no sh

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
exit
Router(config)#int Fa1/0
Router(config-if)#ip addr 10.10.60.2 255.255.255.252
Router(config-if)#no sh

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet1/0, changed state to up
exit
Router(config)#int Fa2/0
Router(config-if)#ip addr 10.10.70.2 255.255.255.252
Router(config-if)#no sh

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet2/0, changed state to up
```

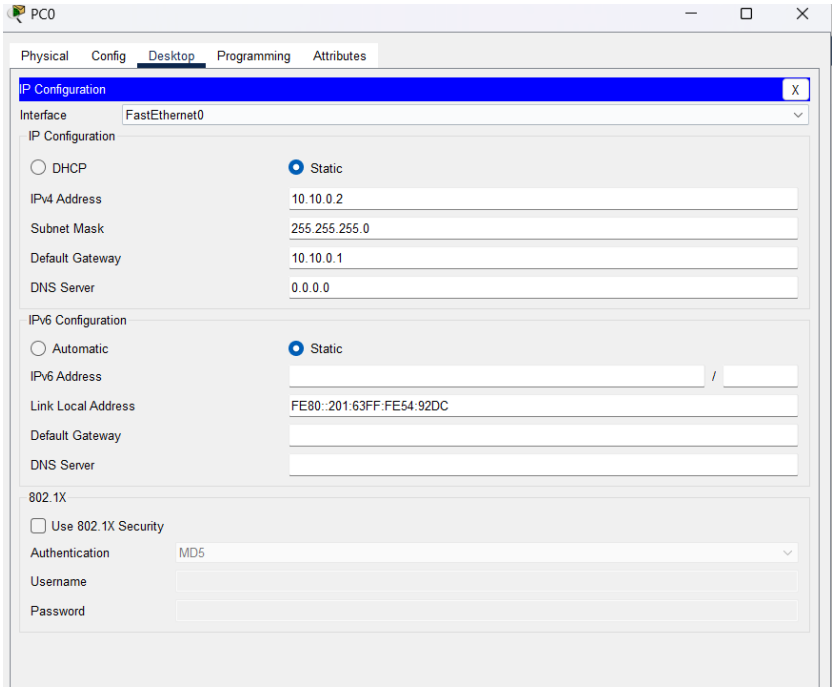
Router E:

```
        --- System Configuration Dialog ---

Would you like to enter the initial configuration dialog? [yes/no]: n


Press RETURN to get started!



Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int Fa0/0
Router(config-if)#ip addr 10.10.30.2 255.255.255.252
Router(config-if)#no sh

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
exit
Router(config)#int Fa1/0
Router(config-if)#ip addr 10.10.60.1 255.255.255.252
Router(config-if)#no sh

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet1/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet1/0, changed state to up
exit
Router(config)#int Fa2/0
Router(config-if)#ip addr 10.10.50.1 255.255.255.252
Router(config-if)#no sh

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet2/0, changed state to up
```

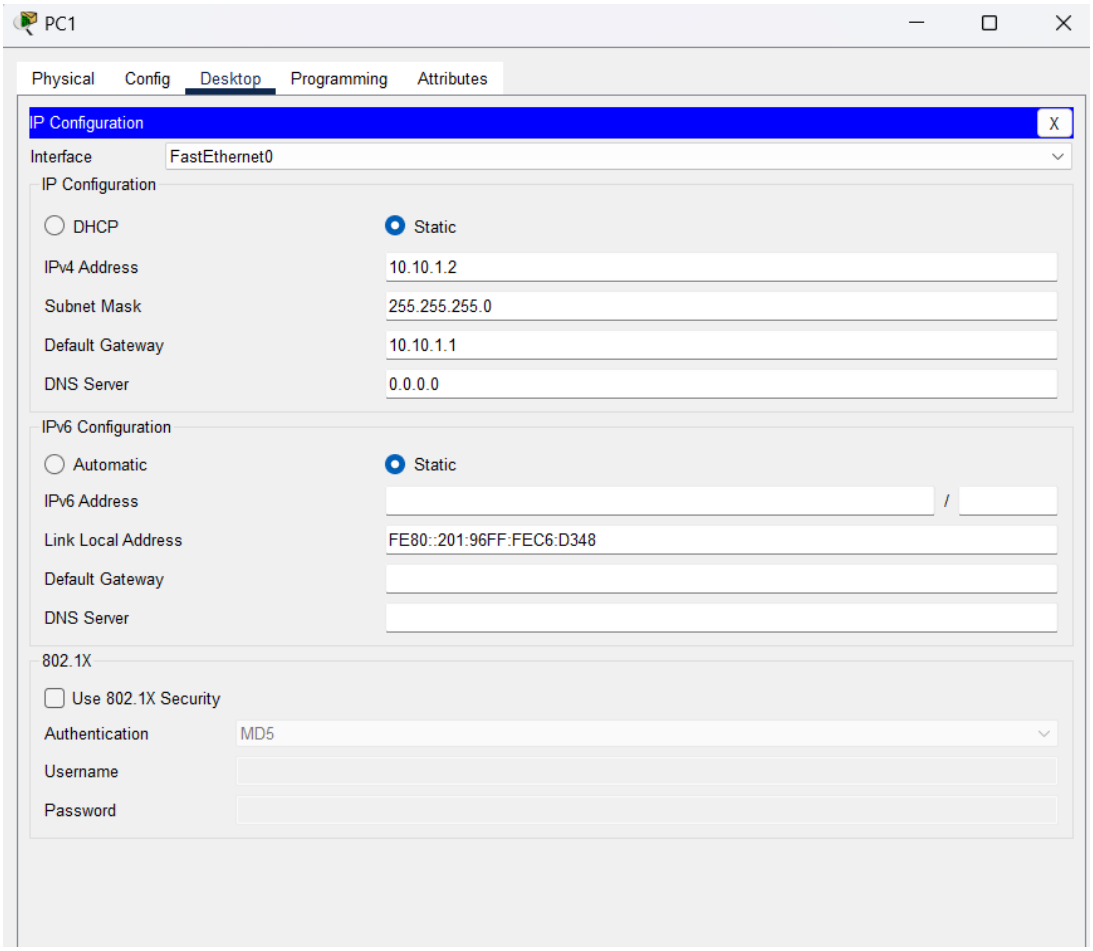
Router F:

```
        --- System Configuration Dialog ---

Would you like to enter the initial configuration dialog? [yes/no]: n


Press RETURN to get started!



Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int Fa0/0
Router(config-if)#ip addr 10.10.70.1 255.255.255.252
Router(config-if)#no sh

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
exit
Router(config)#int Fa1/0
Router(config-if)#ip addr 10.10.50.2 255.255.255.252
Router(config-if)#no sh

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet1/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet1/0, changed state to up
exit
Router(config)#int Fa2/0
Router(config-if)#ip addr 10.10.1.1 255.255.255.0
Router(config-if)#no sh

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet2/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet2/0, changed state to up
```

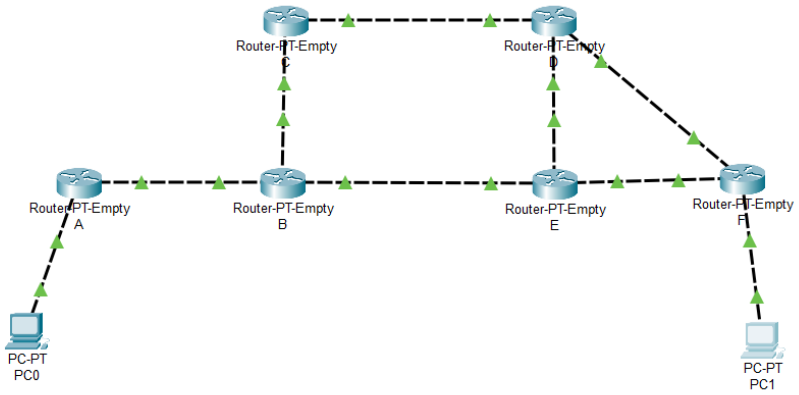
PC0:



PC1:



We managed to set the required address range for individual devices in the network and now the topolgy looks like this:



3.3 Routing settings and link speed configuration

We will now proceed to set up network routing using the OSPF protocol. For each router, we need to enter information about directly connected networks, through which the router maintains its neighborhood with other routers.

Router A:

```
Cisco Internetwork Operating System Software
IOS (tm) PT1000 Software (PT1000-I-M), Version 12.2(28), RELEASE SOFTWARE (fc5)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2005 by cisco Systems, Inc.
Compiled Wed 27-Apr-04 19:01 by miwang

PT 1001 (PTSC2005) processor (revision 0x200) with 60416K/5120K bytes of memory
.
Processor board ID PT0123 (0123)
PT2005 processor: part number 0, mask 01
Bridging software.
X.25 software, Version 3.0.0.
2 FastEthernet/IEEE 802.3 interface(s)
32K bytes of non-volatile configuration memory.
63488K bytes of ATA CompactFlash (Read/Write)

Press RETURN to get started!


%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet1/0, changed state to up


Router>en
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#network 10.10.0.0 0.0.0.255 area 0
Router(config-router)#network 10.10.10.0 0.0.0.3 area 0
Router(config-router)#
```

Router B:

```
Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#network 10.10.10.0 0.0.0.3 area 0
Router(config-router)#network 10.10.20.0 0.0.0.3 area 0
00:17:59: %OSPF-5-ADJCHG: Process 1, Nbr 10.10.10.1 on FastEthernet0/0 from LOADING to FULL,
Loading Done

Router(config-router)#network 10.10.30.0 0.0.0.3 area 0
Router(config-router)#
```

Router C:

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet1/0, changed state to up


Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#network 10.10.20.0 0.0.0.3 area 0
Router(config-router)#network 10.10.40.0 0.0.0.3 area 0
Router(config-router)#
```

Router D:

```
Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#network 10.10.40.0 0.0.0.3 area 0
Router(config-router)#network 10.10.0.0 0.0.0.3 area 0
00:24:34: %OSPF-5-ADJCHG: Process 1, Nbr 10.10.40.1 on FastEthernet0/0 from LOADING to FULL,
Loading Done

Router(config-router)#no network 10.10.10.0 0.0.0.3 area ^Z
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#no network 10.10.0.0 0.0.0.3 area 0
Router(config-router)#network 10.10.60.0 0.0.0.3 area 0
Router(config-router)#network 10.10.70.0 0.0.0.3 area 0
Router(config-router)#
```

Router E:

```
Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#network 10.10.30.0 0.0.0.3 area 0
Router(config-router)#network 10.10.60.0 0.0.0.3 area 0
00:29:33: %OSPF-5-ADJCHG: Process 1, Nbr 10.10.30.1 on FastEthernet0/0 from LOADING to FULL,
Loading Done

Router(config-router)#network 10.10.50.0 0.0.0.3 area 0
00:29:48: %OSPF-5-ADJCHG: Process 1, Nbr 10.10.70.2 on FastEthernet1/0 from LOADING to FULL,
Loading Done

Router(config-router)#
```

Router F:

```
Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#network 10.10.70.0 0.0.0.3 area 0
Router(config-router)#network 10.10.50.0 0.0.0.3 area 0
00:31:52: %OSPF-5-ADJCHG: Process 1, Nbr 10.10.70.2 on FastEthernet0/0 from LOADING to FULL,
Loading Done

Router(config-router)#network 10.10.10.0 0.0.0.3 area 0
00:32:04: %OSPF-5-ADJCHG: Process 1, Nbr 10.10.60.1 on FastEthernet1/0 from LOADING to FULL,
Loading Done

Router(config-router)# no network 10.10.10.0 0.0.0.3 area 0
Router(config-router)#network 10.10.1.0 0.0.0.255 area 0
Router(config-router)#
```

Speed settings

Router A:

```
Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int Fa0/0
Router(config-if)#ex
Router(config)#int Fa1/0
Router(config-if)#bandwidth 10000
Router(config-if)#
```

Router B:

```
Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int Fa0/0
Router(config-if)#bandwidth 10000
Router(config-if)#ex
Router(config)#int Fa1/0
Router(config-if)#bandwidth 10000
Router(config-if)#ex
Router(config)#Fa2/0
               ^
% Invalid input detected at '^' marker.

Router(config)#int Fa2/0
Router(config-if)#bandwidth 1000
Router(config-if)#ex
Router(config)#
```

Router C:

```
Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int Fa0/0
Router(config-if)#badnwidth 10000
                  ^
% Invalid input detected at '^' marker.

Router(config-if)#bandwidth 10000
Router(config-if)#ex
Router(config)#int Fa1/0
Router(config-if)#bandwidth 10000
Router(config-if)#ex
Router(config)#
```

Router D:

```
Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int Fa0/0
Router(config-if)#bandwidth 10000
Router(config-if)#ex
Router(config)#int Fa1/0
Router(config-if)#bandwidth 20000
Router(config-if)#ex
Router(config)#int Fa2/0
Router(config-if)#bandwidth 5000
Router(config-if)#ex
Router(config)#
```

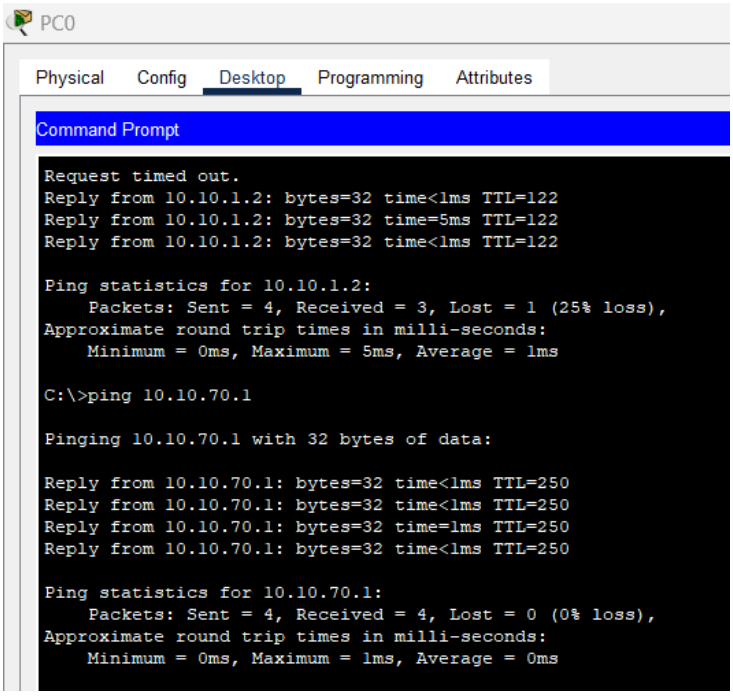
Router E:

```
Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int Fa0/0
Router(config-if)#bandwidth 1000
Router(config-if)#ex
Router(config)#int Fa1/0
Router(config-if)#bandwidth 20000
Router(config-if)#ex
Router(config)#int Fa2/0
Router(config-if)#bandwidth 20000
Router(config-if)#ex
Router(config)#
```

Router F:

```
Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int Fa0/0
Router(config-if)#bandwidth 5000
Router(config-if)#ex
Router(config)#int Fa1/0
Router(config-if)#bandwidth 20000
Router(config-if)#
```

3.4 OSPF routing anaylis



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```
C:\>ping 10.10.50.2

Pinging 10.10.50.2 with 32 bytes of data:

Reply from 10.10.50.2: bytes=32 time<1ms TTL=250
Reply from 10.10.50.2: bytes=32 time<1ms TTL=250
Reply from 10.10.50.2: bytes=32 time=4ms TTL=250
Reply from 10.10.50.2: bytes=32 time<1ms TTL=250

Ping statistics for 10.10.50.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 4ms, Average = 1ms

C:\>ping 10.10.1.1

Pinging 10.10.1.1 with 32 bytes of data:

Reply from 10.10.1.1: bytes=32 time=2ms TTL=250
Reply from 10.10.1.1: bytes=32 time<1ms TTL=250
Reply from 10.10.1.1: bytes=32 time<1ms TTL=250
Reply from 10.10.1.1: bytes=32 time<1ms TTL=250

Ping statistics for 10.10.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 2ms, Average = 0ms
```

Tracert from PC0 to PC1

```
C:\>traceart 10.10.1.2
Invalid Command.

C:\>tracert 10.10.1.2

Tracing route to 10.10.1.2 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      10.10.0.1
  2    0 ms      0 ms      2 ms      10.10.10.2
  3    0 ms      0 ms      0 ms      10.10.20.2
  4    1 ms      0 ms      0 ms      10.10.40.2
  5    0 ms      0 ms      0 ms      10.10.60.1
  6    0 ms      0 ms      0 ms      10.10.50.2
  7    0 ms      0 ms      0 ms      10.10.1.2

Trace complete.
```

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Router A:

```
Router>en
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/8 is variably subnetted, 9 subnets, 2 masks
C       10.10.0.0/24 is directly connected, FastEthernet0/0
O       10.10.1.0/24 [110/41] via 10.10.10.2, 00:17:07, FastEthernet1/0
C       10.10.10.0/30 is directly connected, FastEthernet1/0
O       10.10.20.0/30 [110/20] via 10.10.10.2, 00:17:07, FastEthernet1/0
O       10.10.30.0/30 [110/110] via 10.10.10.2, 00:17:07, FastEthernet1/0
O       10.10.40.0/30 [110/30] via 10.10.10.2, 00:17:07, FastEthernet1/0
O       10.10.50.0/30 [110/40] via 10.10.10.2, 00:17:07, FastEthernet1/0
O       10.10.60.0/30 [110/35] via 10.10.10.2, 00:17:07, FastEthernet1/0
O       10.10.70.0/30 [110/50] via 10.10.10.2, 00:17:07, FastEthernet1/0

Router#
```

Router B:

```
Router>en
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/8 is variably subnetted, 9 subnets, 2 masks
O       10.10.0.0/24 [110/11] via 10.10.10.1, 00:19:08, FastEthernet0/0
O       10.10.1.0/24 [110/31] via 10.10.20.2, 00:19:08, FastEthernet1/0
C       10.10.10.0/30 is directly connected, FastEthernet0/0
C       10.10.20.0/30 is directly connected, FastEthernet1/0
C       10.10.30.0/30 is directly connected, FastEthernet2/0
O       10.10.40.0/30 [110/20] via 10.10.20.2, 00:19:08, FastEthernet1/0
O       10.10.50.0/30 [110/30] via 10.10.20.2, 00:19:08, FastEthernet1/0
O       10.10.60.0/30 [110/25] via 10.10.20.2, 00:19:08, FastEthernet1/0
O       10.10.70.0/30 [110/40] via 10.10.20.2, 00:19:08, FastEthernet1/0
```

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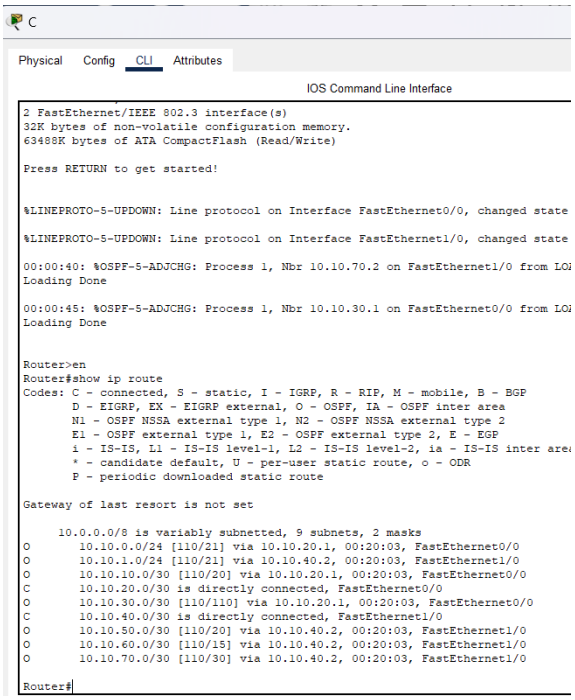
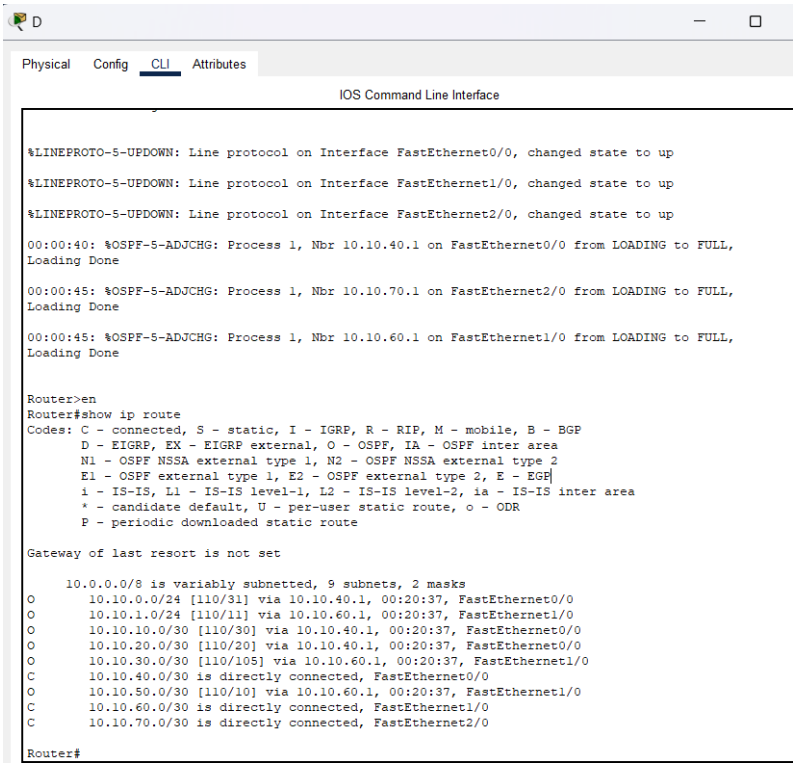
Router C:



Router D:



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Router E:

```
Router>EN
Router#SHOW IP ROUTE
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/8 is variably subnetted, 9 subnets, 2 masks
O       10.10.0.0/24 [110/36] via 10.10.60.2, 00:21:40, FastEthernet1/0
O       10.10.1.0/24 [110/6] via 10.10.50.2, 00:21:50, FastEthernet2/0
O       10.10.10.0/30 [110/35] via 10.10.60.2, 00:21:40, FastEthernet1/0
O       10.10.20.0/30 [110/25] via 10.10.60.2, 00:21:40, FastEthernet1/0
C       10.10.30.0/30 is directly connected, FastEthernet0/0
O       10.10.40.0/30 [110/15] via 10.10.60.2, 00:21:40, FastEthernet1/0
C       10.10.50.0/30 is directly connected, FastEthernet2/0
C       10.10.60.0/30 is directly connected, FastEthernet1/0
O       10.10.70.0/30 [110/25] via 10.10.60.2, 00:21:40, FastEthernet1/0
                      [110/25] via 10.10.50.2, 00:21:40, FastEthernet2/0
```

Router F:

```
Router>en
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/8 is variably subnetted, 9 subnets, 2 masks
O       10.10.0.0/24 [110/41] via 10.10.50.1, 00:22:17, FastEthernet1/0
C       10.10.1.0/24 is directly connected, FastEthernet2/0
O       10.10.10.0/30 [110/40] via 10.10.50.1, 00:22:17, FastEthernet1/0
O       10.10.20.0/30 [110/30] via 10.10.50.1, 00:22:17, FastEthernet1/0
O       10.10.30.0/30 [110/105] via 10.10.50.1, 00:22:27, FastEthernet1/0
O       10.10.40.0/30 [110/20] via 10.10.50.1, 00:22:17, FastEthernet1/0
C       10.10.50.0/30 is directly connected, FastEthernet1/0
O       10.10.60.0/30 [110/10] via 10.10.50.1, 00:22:17, FastEthernet1/0
C       10.10.70.0/30 is directly connected, FastEthernet0/0

Router#
```

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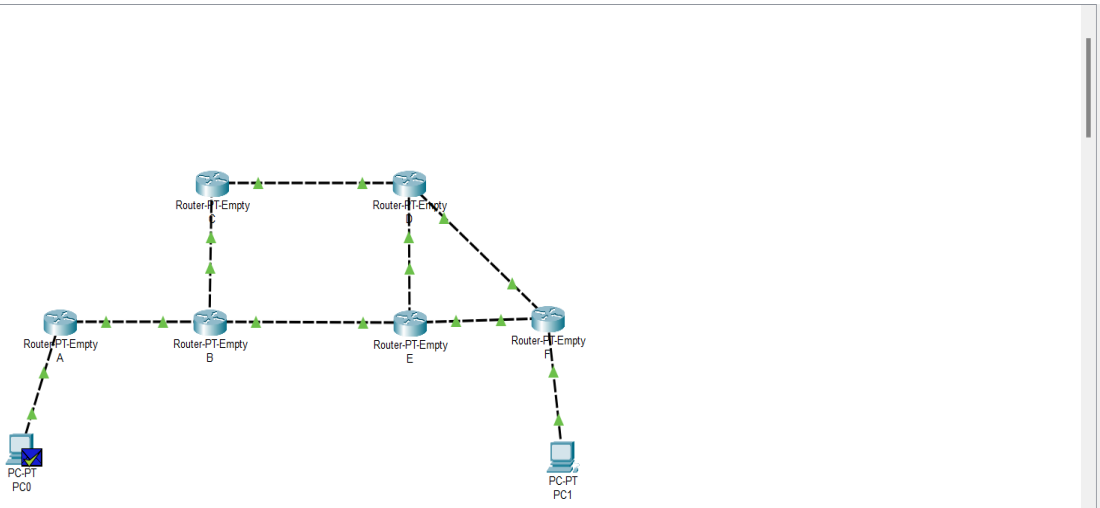
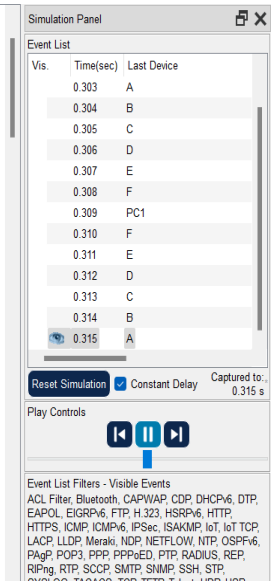
Simulation results:





3.5 Changing the speed of link B-E and its effect on the routing

Router B:

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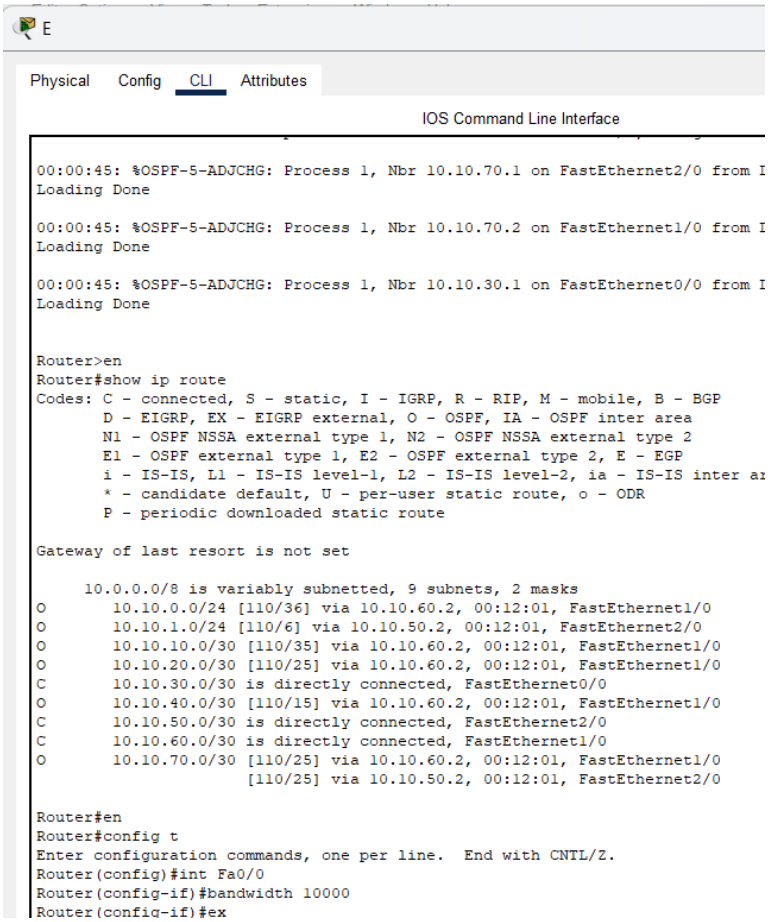
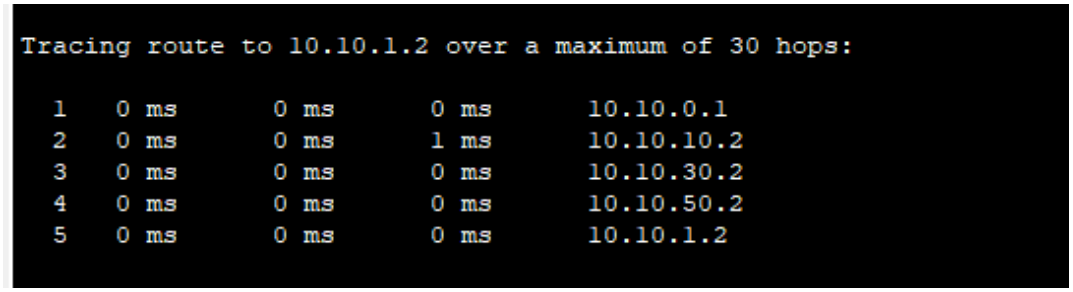
Router E:



Tracert 10.10.1.2 results:



For route A-B-E-D-F:

We need to change only the BW between E and F from the previous example. We'll need to make it smaller so it can follow the path of E-D-F. We can set E-F to 1Mb/s.

Router E:

```
Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int Fa2/0
Router(config-if)#bandwidth 1000
Router(config-if)#ex
```

Router F:

```
Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int Fa1/0
Router(config-if)#bandwidth 1000
Router(config-if)#ex
Router(config)#
```

Tracert 10.10.1.2:

```
Tracing route to 10.10.1.2 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      10.10.0.1
  2    0 ms      0 ms      0 ms      10.10.10.2
  3    0 ms      0 ms      0 ms      10.10.30.2
  4    0 ms      0 ms      0 ms      10.10.60.2
  5    0 ms      0 ms      0 ms      10.10.70.1
  6    0 ms      1 ms      0 ms      10.10.1.2

Trace complete.
```

We can observe that by decreasing the bandwidth between E and F the route A-B-E-D-F is now possible.

3.6 Link failure and the consequent reaction

Router A:

```
Gateway of last resort is not set

     10.0.0.0/8 is variably subnetted, 9 subnets, 2 masks
C       10.10.0.0/24 is directly connected, FastEthernet0/0
O       10.10.1.0/24 [110/46] via 10.10.10.2, 00:00:58, FastEthernet1/0
C       10.10.10.0/30 is directly connected, FastEthernet1/0
O       10.10.20.0/30 [110/20] via 10.10.10.2, 4294967289:4294967239:4294967258, FastEthernet1/0
O       10.10.30.0/30 [110/20] via 10.10.10.2, 00:00:58, FastEthernet1/0
O       10.10.40.0/30 [110/30] via 10.10.10.2, 4294967289:4294967239:4294967258, FastEthernet1/0
O       10.10.50.0/30 [110/120] via 10.10.10.2, 00:00:58, FastEthernet1/0
O       10.10.60.0/30 [110/25] via 10.10.10.2, 00:00:58, FastEthernet1/0
O       10.10.70.0/30 [110/45] via 10.10.10.2, 00:00:58, FastEthernet1/0
```

The metric (path cost) for 10.10.1.0/24 network is:

10.10.1.0/24 [110/46] via 10.10.10.2, 00:00:58, FastEthernet1/0.

PC0 ping after deleting B-E connection:

```
C:\>ping -t 10.10.1.2

Pinging 10.10.1.2 with 32 bytes of data:

Request timed out.
Reply from 10.10.1.2: bytes=32 time<1ms TTL=123
Reply from 10.10.1.2: bytes=32 time<1ms TTL=123
Reply from 10.10.1.2: bytes=32 time<1ms TTL=123
Reply from 10.10.1.2: bytes=32 time=1ms TTL=123
Reply from 10.10.1.2: bytes=32 time<1ms TTL=123
Reply from 10.10.1.2: bytes=32 time<1ms TTL=123
Reply from 10.10.1.2: bytes=32 time<1ms TTL=123
Reply from 10.10.1.2: bytes=32 time=5ms TTL=123
Reply from 10.10.1.2: bytes=32 time<1ms TTL=123
Reply from 10.10.1.2: bytes=32 time<1ms TTL=123
Reply from 10.10.1.2: bytes=32 time<1ms TTL=123
Reply from 10.10.1.2: bytes=32 time<1ms TTL=123
Request timed out.
Reply from 10.10.1.2: bytes=32 time<1ms TTL=123
Reply from 10.10.1.2: bytes=32 time=1ms TTL=123
Reply from 10.10.1.2: bytes=32 time=1ms TTL=123
Reply from 10.10.1.2: bytes=32 time<1ms TTL=123
Reply from 10.10.1.2: bytes=32 time<1ms TTL=123
Reply from 10.10.1.2: bytes=32 time<1ms TTL=123
Reply from 10.10.1.2: bytes=32 time<1ms TTL=123
Reply from 10.10.1.2: bytes=32 time<1ms TTL=123

Ping statistics for 10.10.1.2:
    Packets: Sent = 22, Received = 20, Lost = 2 (10% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 5ms, Average = 0ms

Control-C
^C
```

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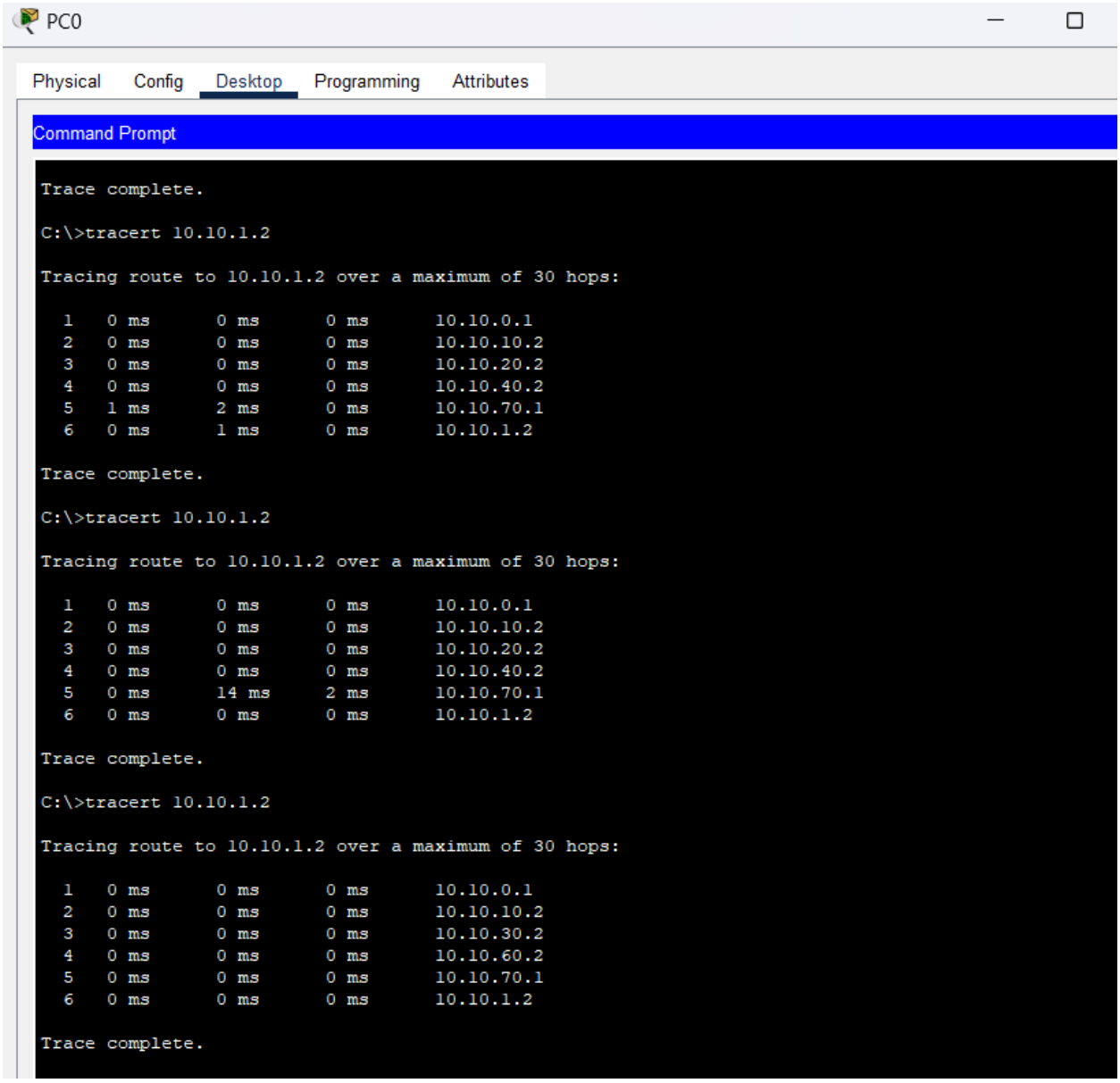
Tracert 10.10.1.2 results:

```
Control-C
^C
C:\>tracert 10.10.1.2

Tracing route to 10.10.1.2 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      10.10.0.1
  2    0 ms      0 ms      0 ms      10.10.10.2
  3    0 ms      0 ms      0 ms      10.10.20.2
  4    0 ms      0 ms      0 ms      10.10.40.2
  5    1 ms      0 ms      0 ms      10.10.70.1
  6    0 ms      0 ms      0 ms      10.10.1.2

Trace complete.
```

The router path cost from A changed to 10.10.1.0/24 [110/51] via 10.10.10.2, 00:13:09, FastEthernet1/0.

It increased from 46 to 51.

```
Gateway of last resort is not set

     10.0.0.0/8 is variably subnetted, 8 subnets, 2 masks
C       10.10.0.0/24 is directly connected, FastEthernet0/0
O       10.10.1.0/24 [110/51] via 10.10.10.2, 00:13:09, FastEthernet1/0
C       10.10.10.0/30 is directly connected, FastEthernet1/0
O       10.10.20.0/30 [110/20] via 10.10.10.2, 4294967288:00:4294967252, FastEthernet1/0
O       10.10.40.0/30 [110/30] via 10.10.10.2, 4294967288:00:4294967252, FastEthernet1/0
O       10.10.50.0/30 [110/135] via 10.10.10.2, 00:13:09, FastEthernet1/0
O       10.10.60.0/30 [110/35] via 10.10.10.2, 00:13:09, FastEthernet1/0
O       10.10.70.0/30 [110/50] via 10.10.10.2, 00:13:09, FastEthernet1/0
```



At aproximately 1 minute after making the connection the routing path changed to the A-B-E-D-F again.