HANOI UNIVERSITY

Faculty of Information Technology

CNE – Tutorial Guide

Week 12

Dynamic IPv6 Routing Configuration with OSPFv3 (multiarea)

I. OSPFv3 multiarea configuration

Multiarea OSPF requires a hierarchical network design and the main area is called the backbone area (area 0) and all other areas must connect to the backbone area.

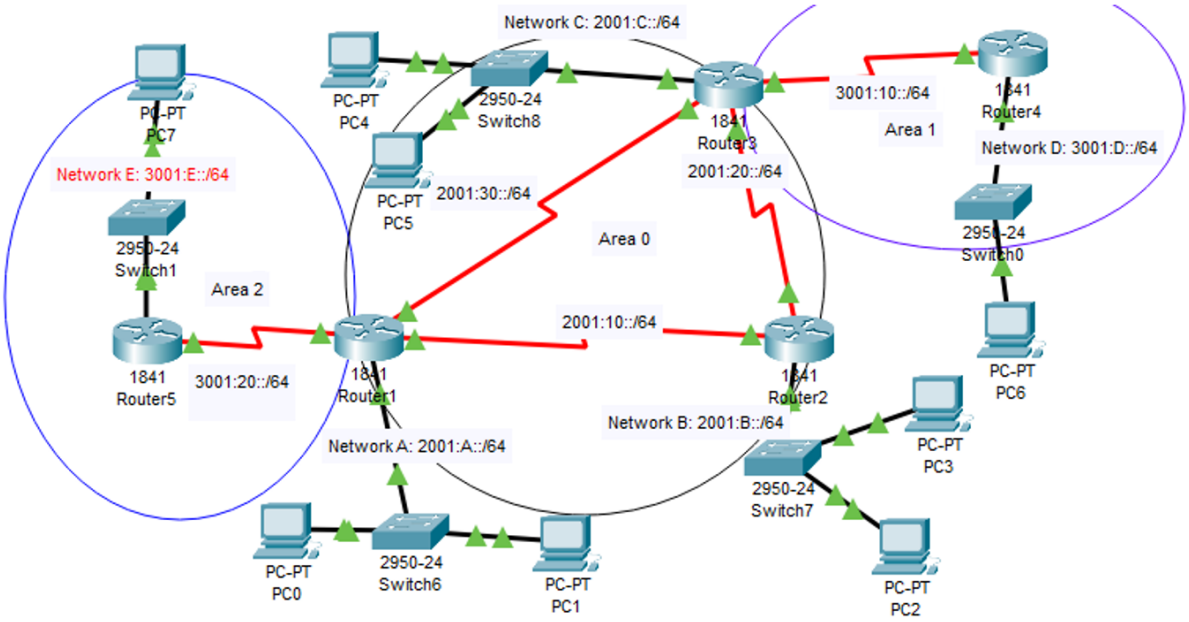
OSPFv3 Verification

There are various show commands that can be used to verify and display OSPFv3 configurations:

- `Show ipv6 ospf neighbor`
- `Show ipv6 ospf database`
- `Show ipv6 route`
- `Show ipv6 protocols`

II. Pratice with Packet tracer

In this tutorial we will do the dynamic IPv6 routing configuration with ospfv3 for single area. Let's make the network map as described in the following picture:



By defaut, 1841 router series don't have any serial ports.
Please add 4 serials port for Router 1, Router 2 and Router 3.
Please add 2 serials port for Router 4 and Router 5.

How to add Serial Ports to CISCO routers in Packet Tracer ?

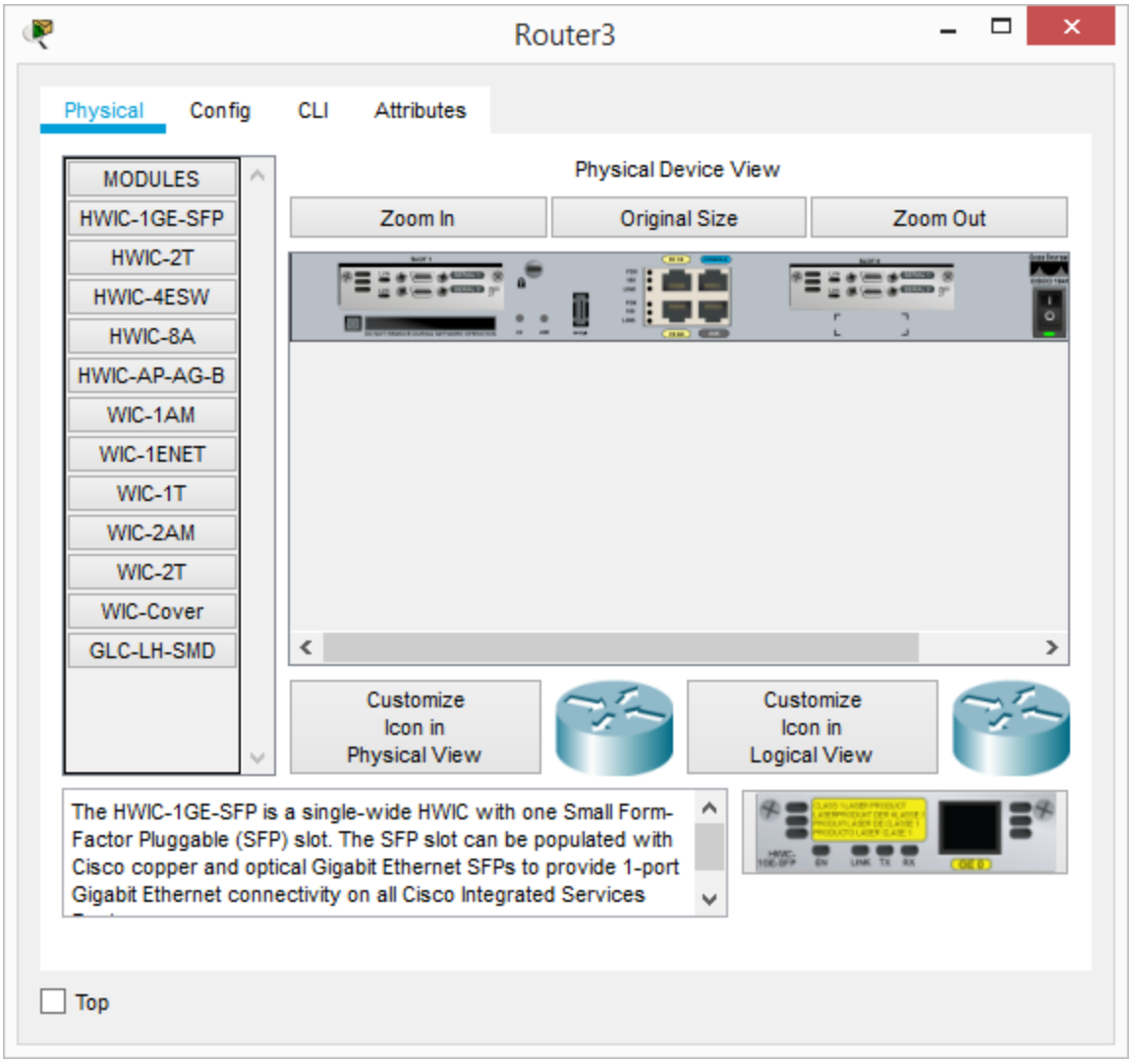
Router connects to the private network through its Fast Ethernet port and connects to the public network (to another router) through Serial port

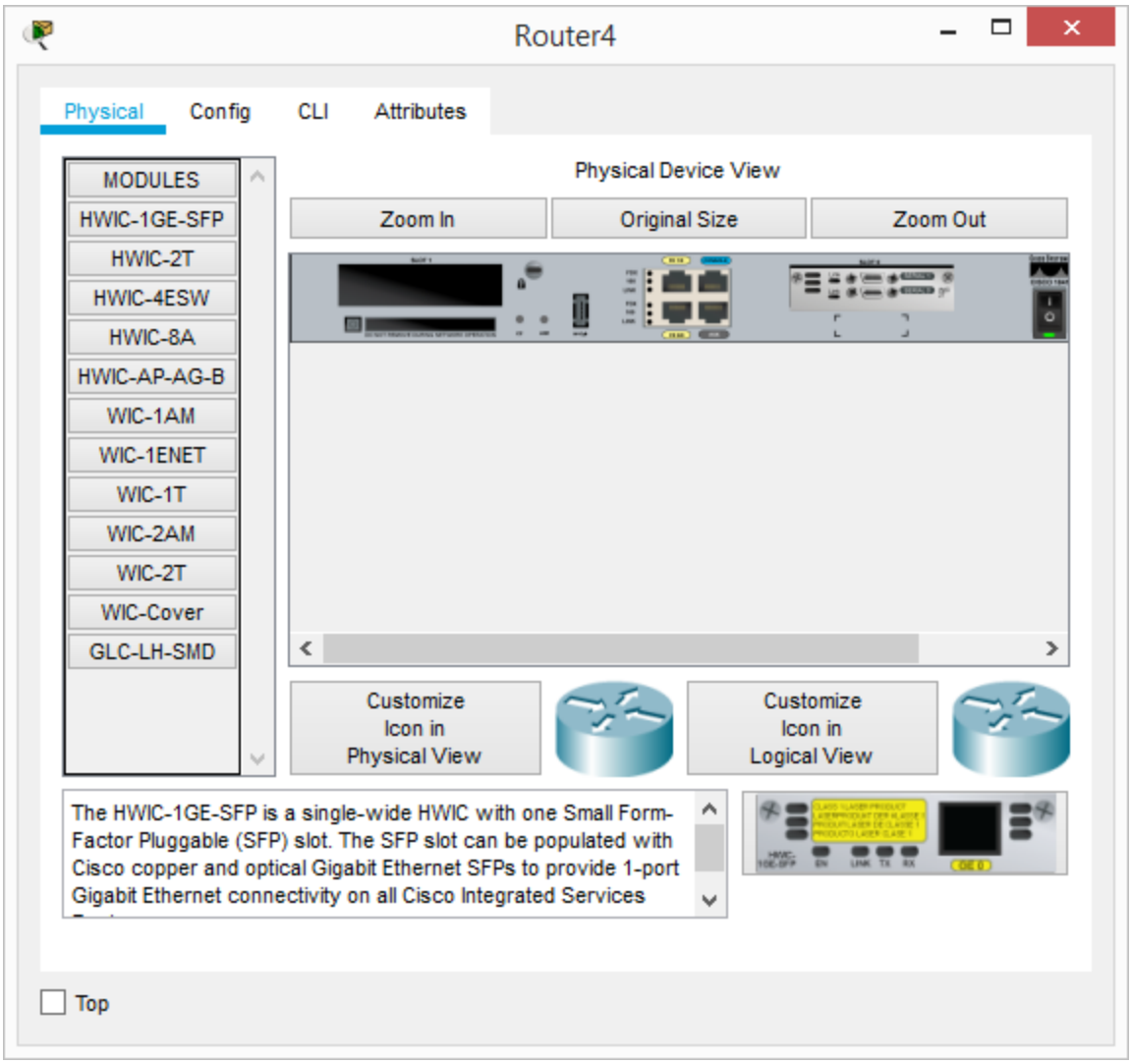
By default some Cisco routers doesn't have serial ports. Therefore we need to add serial ports to router.

- first, open CISCO packet tracer
- then, drag and drop a type of router from the bottom of the interface in to the middle of the working area (i have used 1841 router here and I want to add 2 serial ports).
- Click the Router--> select Physical tab-->select WIC-2T -->switch off the Router-->add the Serial port to the router (drag and drop the serial port that is displayed in the right bottom corner to the 2 space given on the left and right of the router) -->switch on the Router

POWER OFF

POWER ON





IPv6 configuration

Here is the configuration at

Router 1:

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int fa0/0
Router(config-if)#ipv6 address 2001:A::1/64
Router(config-if)#no shut
Router(config-if)#int se0/0/0
Router(config-if)#ipv6 address 2001:10::1/64
Router(config-if)#clock rate 500000
Router(config-if)#no shut
Router(config-if)#int se0/0/1
Router(config-if)#ipv6 address 2001:30::1/64
Router(config-if)#clock rate 500000
Router(config-if)#no shut
Router(config-if)#int se0/1/0
Router(config-if)#ipv6 address 3001:20::1/64
```

```
Router(config-if)#clock rate 2000000
Router(config-if)#no shut
Router(config-if)#ex
```

At router2

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int fa0/0
Router(config-if)#ipv6 address 2001:B::1/64
Router(config-if)#no shut
Router(config-if)#int se0/0/0
Router(config-if)#ipv6 address 2001:10::2/64
Router(config-if)#clock rate 500000
Router(config-if)#no shut
Router(config-if)#int se0/0/1
Router(config-if)#ipv6 address 2001:20::1/64
Router(config-if)#clock rate 500000
Router(config-if)#no shut
Router(config-if)#ex
```

At router3

```
Router(config)#int fa0/0
Router(config-if)#ipv6 address 2001:C::1/64
Router(config-if)#no shut
Router(config-if)#int se0/0/0
Router(config-if)#ipv6 address 2001:30::2/64
Router(config-if)#clock rate 500000
Router(config-if)#no shut
Router(config-if)#int se0/0/1
Router(config-if)#ipv6 address 2001:20::2/64
Router(config-if)#clock rate 500000
Router(config-if)#no shut
Router(config-if)#int se0/1/0
Router(config-if)#ipv6 address 3001:10::1/64
Router(config-if)#clock rate 2000000
Router(config-if)#no shut
Router(config-if)#ex
```

At router4

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int fa0/0
Router(config-if)#ipv6 address 3001:D::1/64
Router(config-if)#no shut
Router(config-if)#int se0/0/0
Router(config-if)#ipv6 address 3001:10::2/64
Router(config-if)#clock rate 2000000
Router(config-if)#no shut
```

At router5

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int fa0/0
Router(config-if)#ipv6 address 3001:E::1/64
Router(config-if)#no shut
```

```
Router(config-if)#int se0/0/0
Router(config-if)#ipv6 address 3001:20::2/64
Router(config-if)#clock rate 2000000
Router(config-if)#no shut
Router(config-if)#ex
```

OSPFv3 for multiarea IPv6 routing configuration

At router 1:

```
Router(config)#ipv6 router ospf 1
% IPv6 routing not enabled
Router(config)#ipv6 unicast-routing
Router(config)#ipv6 router ospf 1
%OSPFv3-4-NORTRID: OSPFv3 process 1 could not pick a router-id, please configure manually
Router(config-rtr)#router-id 1.1.1.1
Router(config-rtr)#int se0/0/0
Router(config-if)#ipv6 ospf 1 area 0
Router(config-if)#int se0/0/1
Router(config-if)#ipv6 ospf 1 area 0
Router(config-if)#int fa0/0
Router(config-if)#ipv6 ospf 1 area 0
Router(config-if)#int se0/1/0
Router(config-if)#ipv6 ospf 1 area 2
```

At router 2:

```
Router(config)#ipv6 router ospf 1
% IPv6 routing not enabled
Router(config)#ipv6 unicast-routing
Router(config)#ipv6 router ospf 1
%OSPFv3-4-NORTRID: OSPFv3 process 1 could not pick a router-id, please configure manually
Router(config-rtr)#router-id 2.2.2.2
Router(config-rtr)#int se0/0/0
Router(config-if)#ipv6 ospf 1 area 0
Router(config-if)#int se0/0/1
Router(config-if)#ipv6 ospf 1 area 0
Router(config-if)#int fa0/0
Router(config-if)#ipv6 ospf 1 area 0
```

At router 3:

```
Router(config)#ipv6 router ospf 1
% IPv6 routing not enabled
Router(config)#ipv6 unicast-routing
Router(config)#ipv6 router ospf 1
%OSPFv3-4-NORTRID: OSPFv3 process 1 could not pick a router-id, please configure manually
Router(config-rtr)#router-id 3.3.3.3
Router(config-rtr)#int se0/0/0
Router(config-if)#ipv6 ospf 1 area 0
Router(config-if)#int se0/0/1
Router(config-if)#ipv6 ospf 1 area 0
Router(config-if)#int fa0/0
Router(config-if)#ipv6 ospf 1 area 0
Router(config-if)#int se0/1/0
Router(config-if)#ipv6 ospf 1 area 1
```

At router 4:

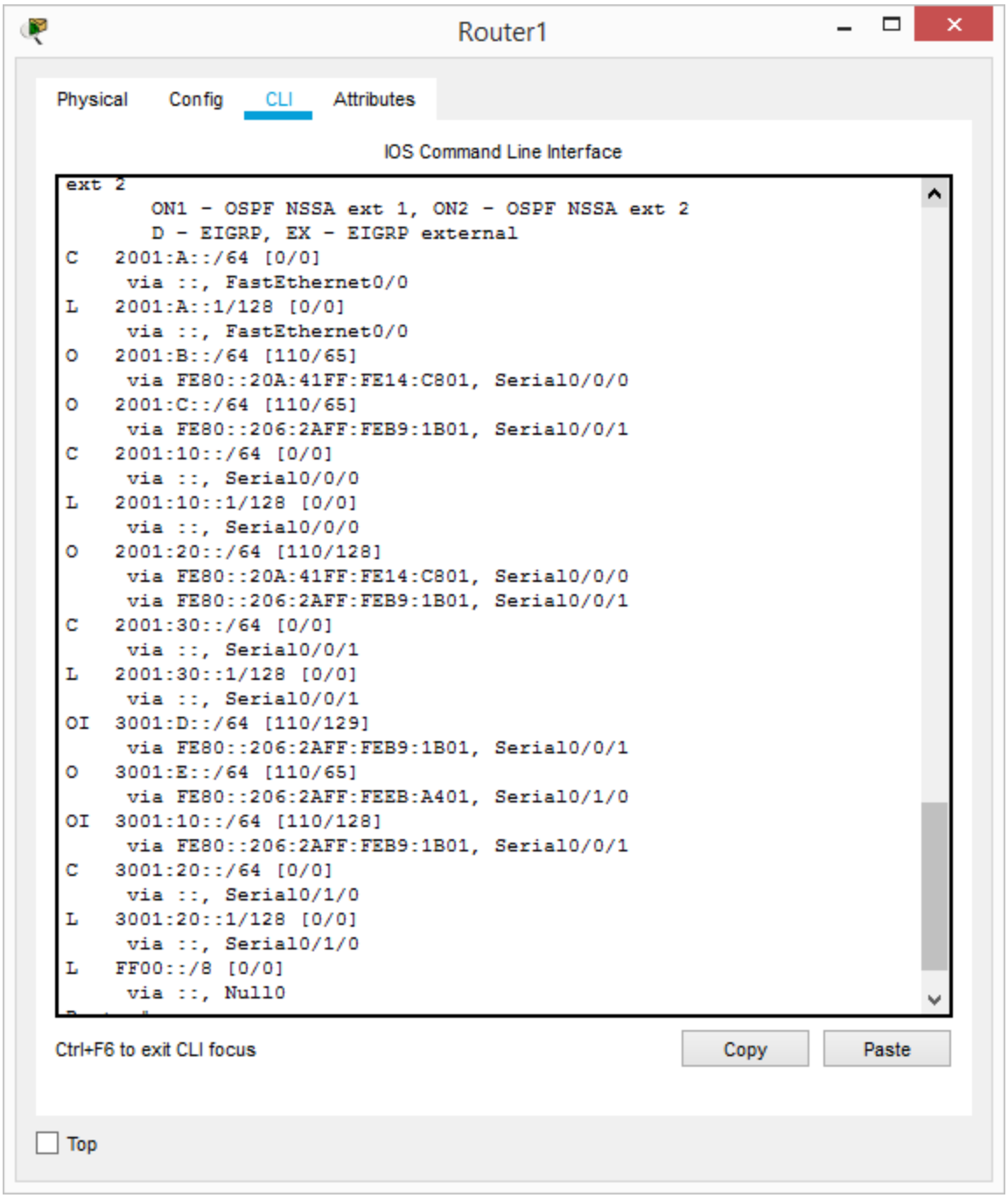
```
Router(config)#ipv6 router ospf 1
% IPv6 routing not enabled
Router(config)#ipv6 unicast-routing
```

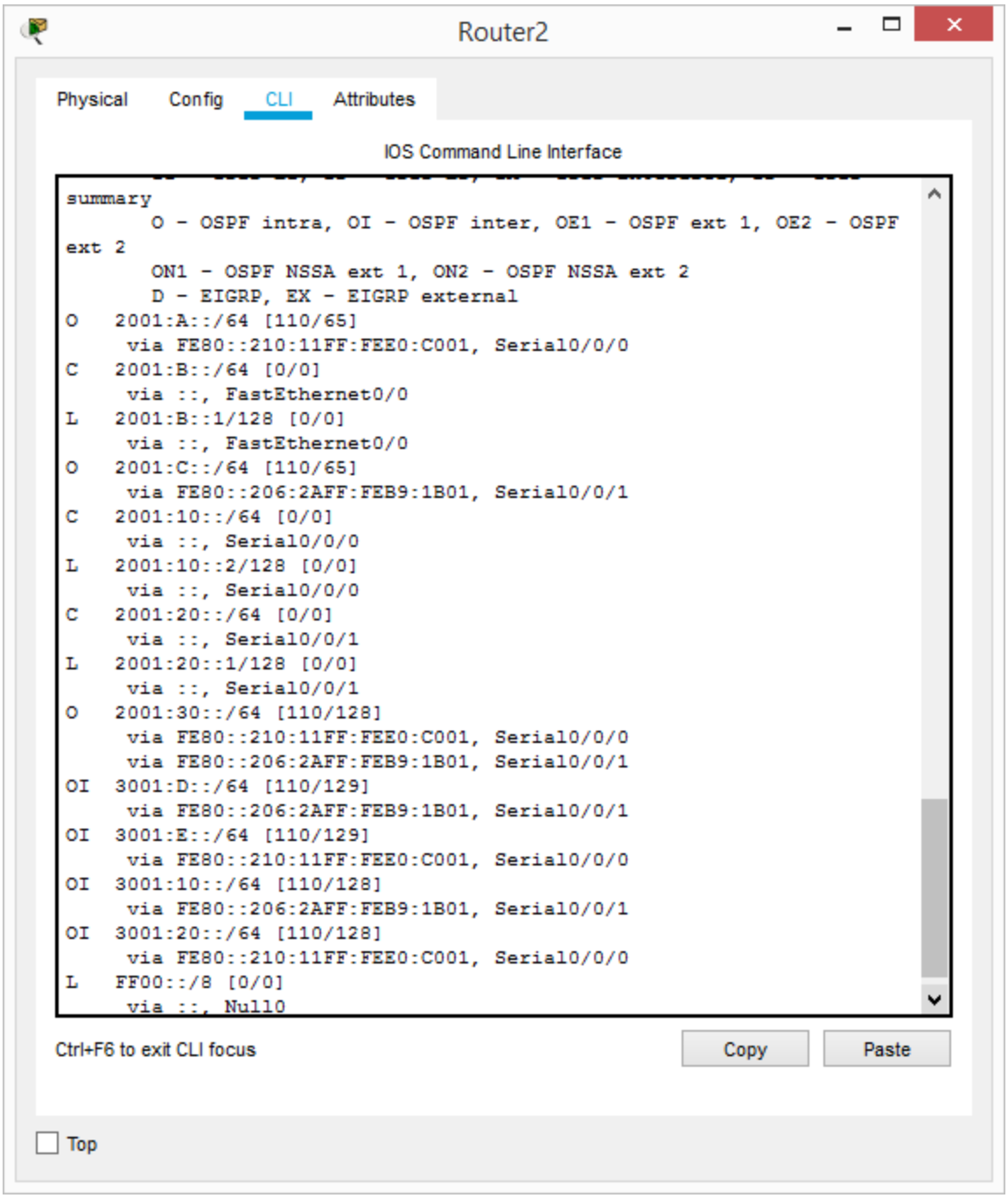
```
Router(config)#ipv6 router ospf 1
%OSPFv3-4-NORTRID: OSPFv3 process 1 could not pick a router-id, please configure manually
Router(config-rtr)#router-id 4.4.4.4
Router(config-rtr)#int se0/0/0
Router(config-if)#ipv6 ospf 1 area 1
Router(config-if)#int fa0/0
Router(config-if)#ipv6 ospf 1 area 1
```

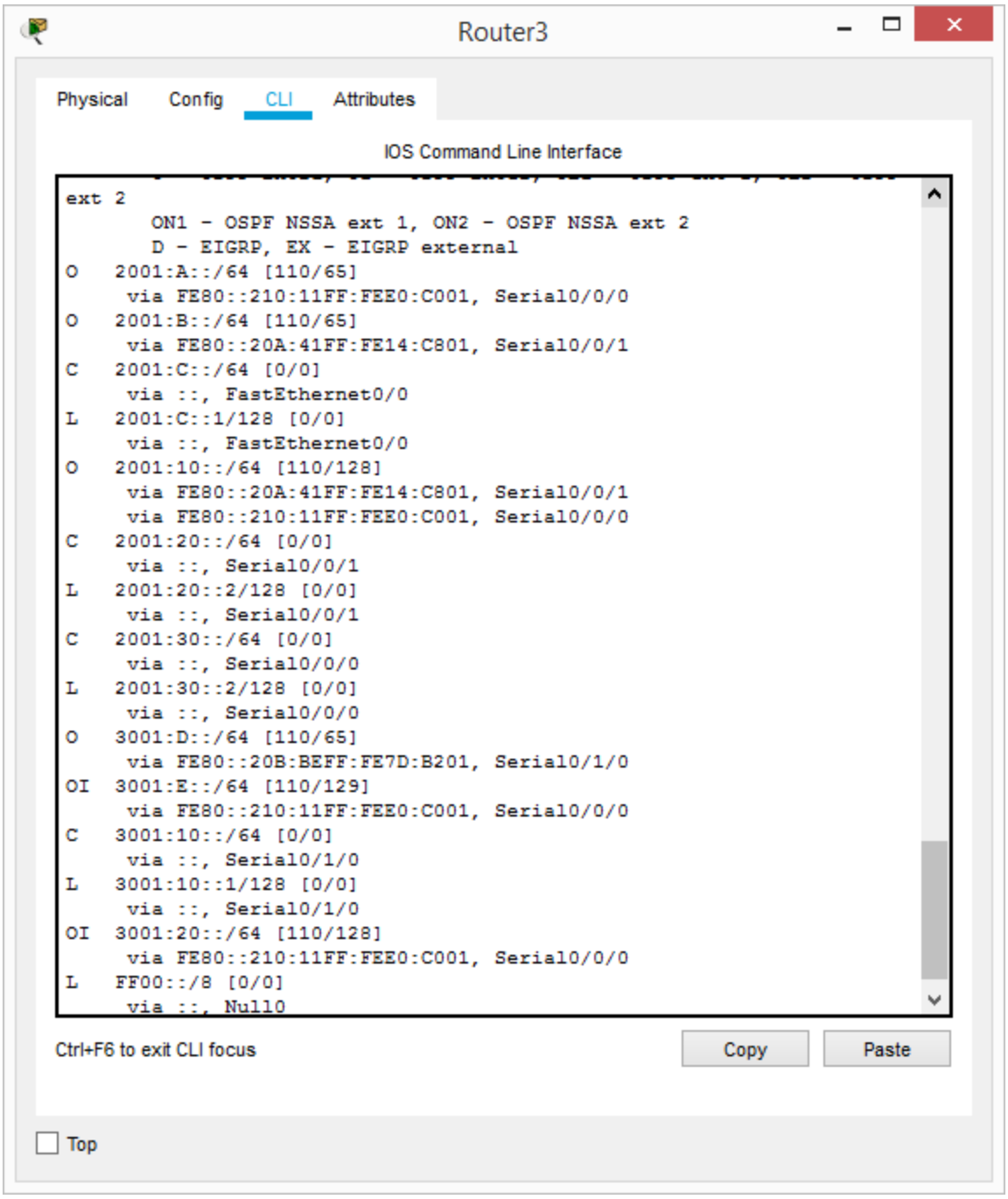
At router 5:

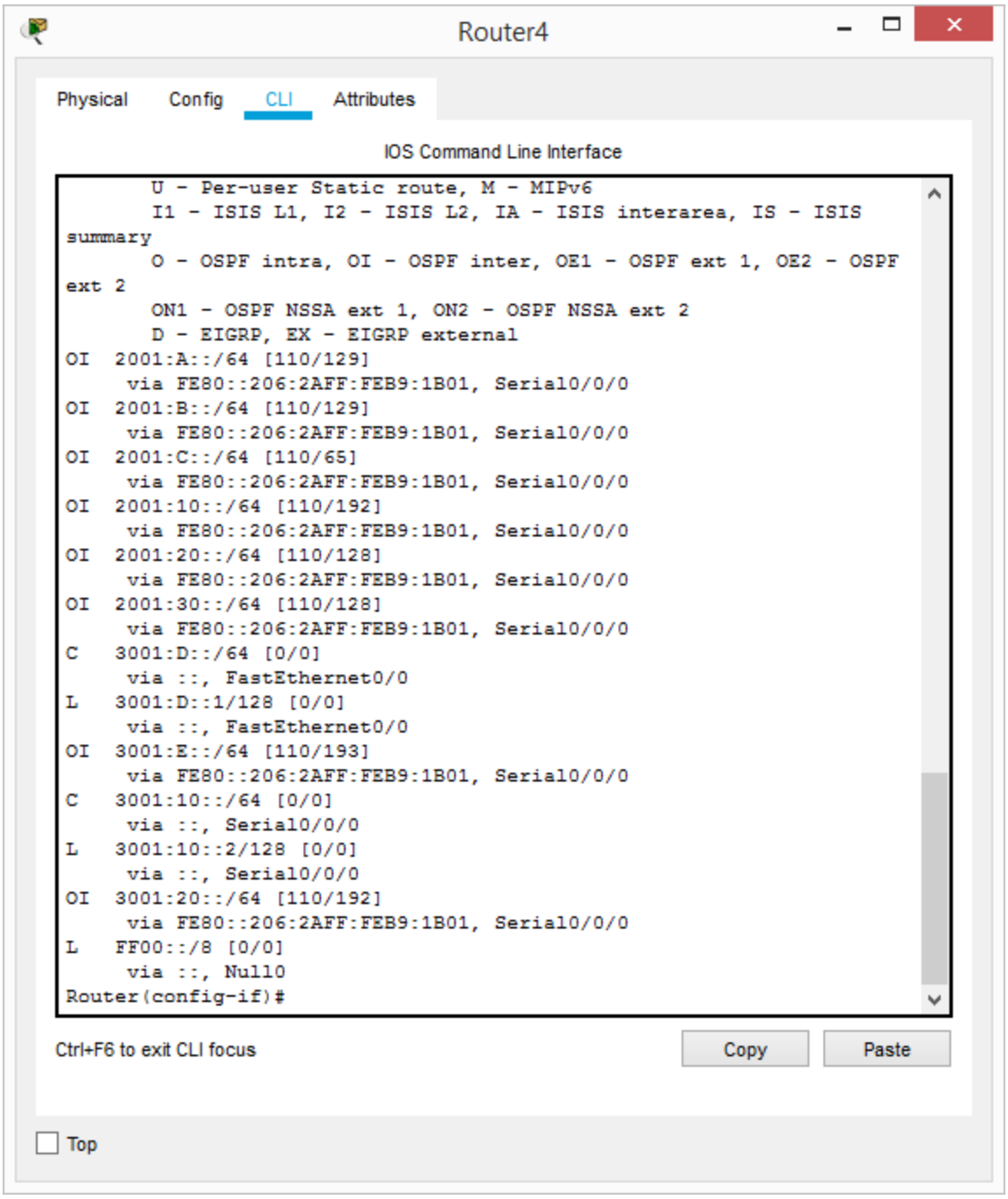
```
Router(config)#ipv6 router ospf 1
% IPv6 routing not enabled
Router(config)#ipv6 unicast-routing
Router(config)#ipv6 router ospf 1
%OSPFv3-4-NORTRID: OSPFv3 process 1 could not pick a router-id, please configure manually
Router(config-rtr)#router-id 5.5.5.5
Router(config-rtr)#int se0/0/0
Router(config-if)#ipv6 ospf 1 area 2
Router(config-if)#int fa0/0
Router(config-if)#ipv6 ospf 1 area 2
```

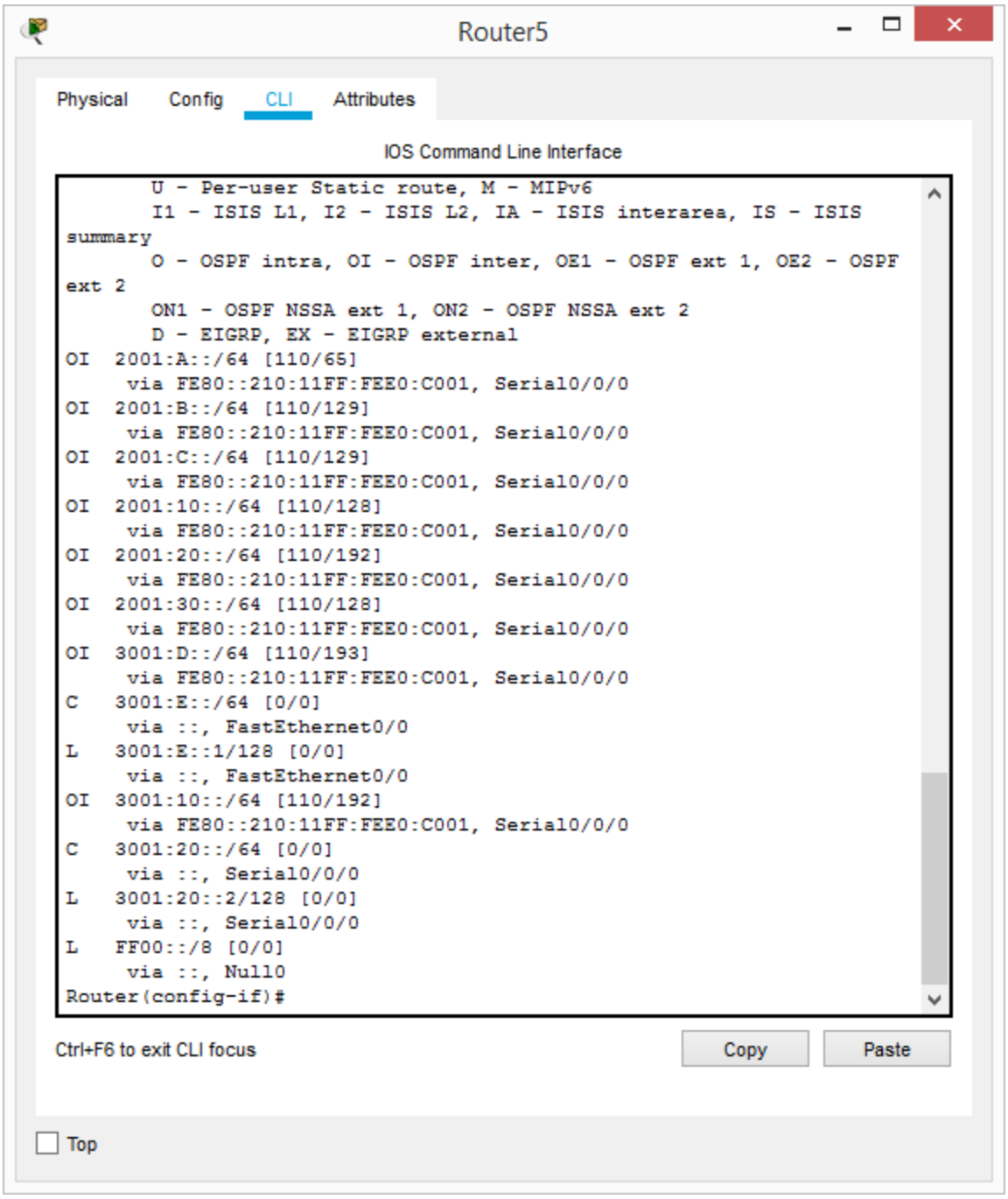
Because we used dynamic routing (OSPFv3), the routing table is automatically updated.
You can check by the command show ipv6 route


Router1
Physical
Config
CLI
Attributes
IOS Command Line Interface
ext 2
ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
D - EIGRP, EX - EIGRP external
C 2001:A::/64 [0/0]
via ::, FastEthernet0/0
L 2001:A::1/128 [0/0]
via ::, FastEthernet0/0
O 2001:B::/64 [110/65]
via FE80::20A:41FF:FE14:C801, Serial0/0/0
O 2001:C::/64 [110/65]
via FE80::206:2AFF:FEB9:1B01, Serial0/0/1
C 2001:10::/64 [0/0]
via ::, Serial0/0/0
L 2001:10::1/128 [0/0]
via ::, Serial0/0/0
O 2001:20::/64 [110/128]
via FE80::20A:41FF:FE14:C801, Serial0/0/0
via FE80::206:2AFF:FEB9:1B01, Serial0/0/1
C 2001:30::/64 [0/0]
via ::, Serial0/0/1
L 2001:30::1/128 [0/0]
via ::, Serial0/0/1
OI 3001:D::/64 [110/129]
via FE80::206:2AFF:FEB9:1B01, Serial0/0/1
O 3001:E::/64 [110/65]
via FE80::206:2AFF:FEEB:A401, Serial0/1/0
OI 3001:10::/64 [110/128]
via FE80::206:2AFF:FEB9:1B01, Serial0/0/1
C 3001:20::/64 [0/0]
via ::, Serial0/1/0
L 3001:20::1/128 [0/0]
via ::, Serial0/1/0
L FF00::/8 [0/0]
via ::, Null0
Ctrl+F6 to exit CLI focus
Copy
Paste
Top

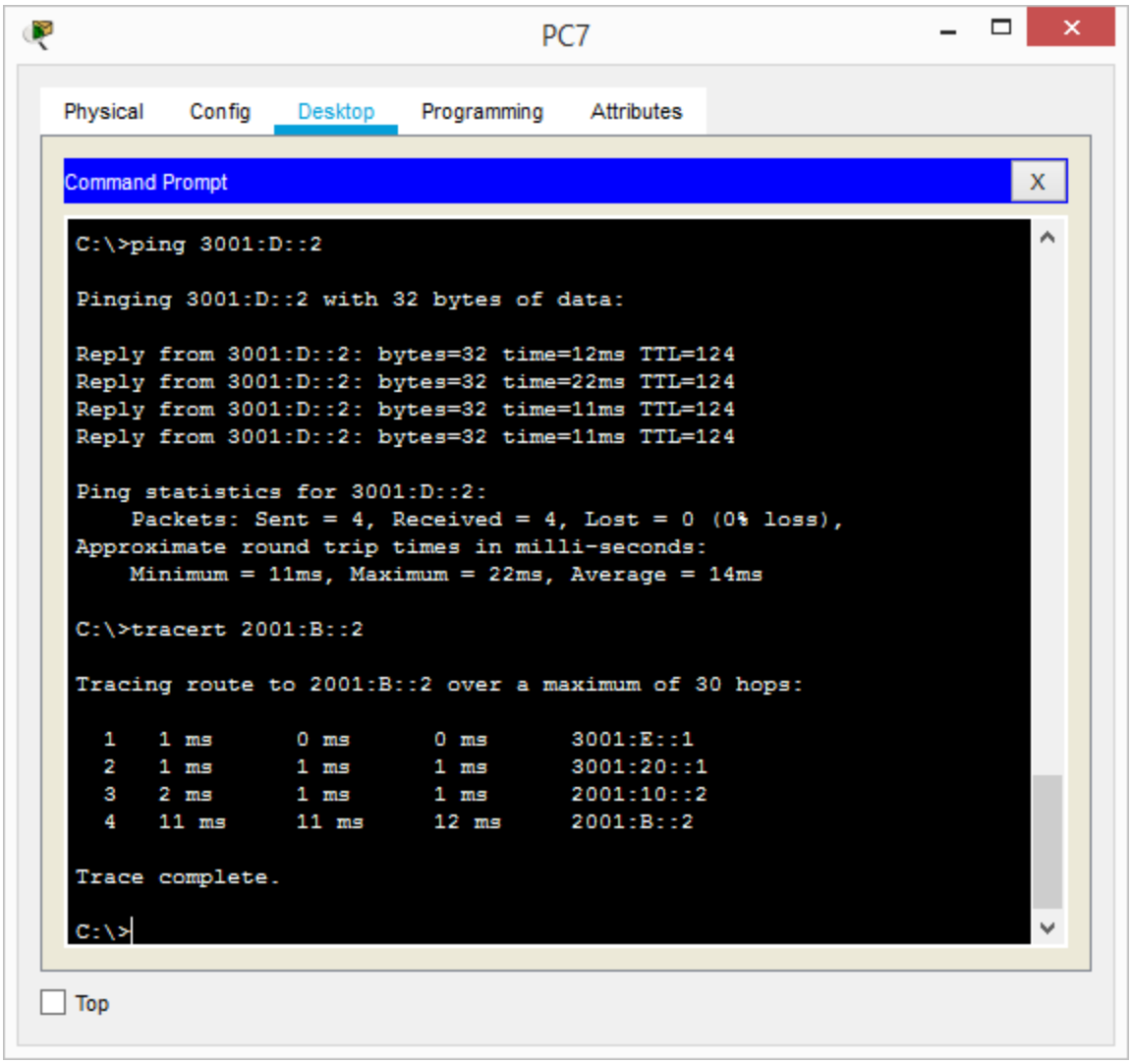

Router2
Physical
Config
CLI
Attributes
IOS Command Line Interface
summary
O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
D - EIGRP, EX - EIGRP external
O 2001:A::/64 [110/65]
via FE80::210:11FF:FEE0:C001, Serial0/0/0
C 2001:B::/64 [0/0]
via ::, FastEthernet0/0
L 2001:B::1/128 [0/0]
via ::, FastEthernet0/0
O 2001:C::/64 [110/65]
via FE80::206:2AFF:FEB9:1B01, Serial0/0/1
C 2001:10::/64 [0/0]
via ::, Serial0/0/0
L 2001:10::2/128 [0/0]
via ::, Serial0/0/0
C 2001:20::/64 [0/0]
via ::, Serial0/0/1
L 2001:20::1/128 [0/0]
via ::, Serial0/0/1
O 2001:30::/64 [110/128]
via FE80::210:11FF:FEE0:C001, Serial0/0/0
via FE80::206:2AFF:FEB9:1B01, Serial0/0/1
OI 3001:D::/64 [110/129]
via FE80::206:2AFF:FEB9:1B01, Serial0/0/1
OI 3001:E::/64 [110/129]
via FE80::210:11FF:FEE0:C001, Serial0/0/0
OI 3001:10::/64 [110/128]
via FE80::206:2AFF:FEB9:1B01, Serial0/0/1
OI 3001:20::/64 [110/128]
via FE80::210:11FF:FEE0:C001, Serial0/0/0
L FF00::/8 [0/0]
via ::, Null0
Ctrl+F6 to exit CLI focus
Copy
Paste
Top


Router3
Physical
Config
CLI
Attributes
IOS Command Line Interface
ext 2
ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
D - EIGRP, EX - EIGRP external
O 2001:A::/64 [110/65]
via FE80::210:11FF:FEE0:C001, Serial0/0/0
O 2001:B::/64 [110/65]
via FE80::20A:41FF:FE14:C801, Serial0/0/1
C 2001:C::/64 [0/0]
via ::, FastEthernet0/0
L 2001:C::1/128 [0/0]
via ::, FastEthernet0/0
O 2001:10::/64 [110/128]
via FE80::20A:41FF:FE14:C801, Serial0/0/1
via FE80::210:11FF:FEE0:C001, Serial0/0/0
C 2001:20::/64 [0/0]
via ::, Serial0/0/1
L 2001:20::2/128 [0/0]
via ::, Serial0/0/1
C 2001:30::/64 [0/0]
via ::, Serial0/0/0
L 2001:30::2/128 [0/0]
via ::, Serial0/0/0
O 3001:D::/64 [110/65]
via FE80::20B:BEFF:FE7D:B201, Serial0/1/0
OI 3001:E::/64 [110/129]
via FE80::210:11FF:FEE0:C001, Serial0/0/0
C 3001:10::/64 [0/0]
via ::, Serial0/1/0
L 3001:10::1/128 [0/0]
via ::, Serial0/1/0
OI 3001:20::/64 [110/128]
via FE80::210:11FF:FEE0:C001, Serial0/0/0
L FF00::/8 [0/0]
via ::, Null0
Ctrl+F6 to exit CLI focus
Copy
Paste
Top


Router4
Physical
Config
CLI
Attributes
IOS Command Line Interface
U - Per-user Static route, M - MIPv6
I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary
O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
D - EIGRP, EX - EIGRP external
OI 2001:A::/64 [110/129]
via FE80::206:2AFF:FEB9:1B01, Serial0/0/0
OI 2001:B::/64 [110/129]
via FE80::206:2AFF:FEB9:1B01, Serial0/0/0
OI 2001:C::/64 [110/65]
via FE80::206:2AFF:FEB9:1B01, Serial0/0/0
OI 2001:10::/64 [110/192]
via FE80::206:2AFF:FEB9:1B01, Serial0/0/0
OI 2001:20::/64 [110/128]
via FE80::206:2AFF:FEB9:1B01, Serial0/0/0
OI 2001:30::/64 [110/128]
via FE80::206:2AFF:FEB9:1B01, Serial0/0/0
C 3001:D::/64 [0/0]
via ::, FastEthernet0/0
L 3001:D::1/128 [0/0]
via ::, FastEthernet0/0
OI 3001:E::/64 [110/193]
via FE80::206:2AFF:FEB9:1B01, Serial0/0/0
C 3001:10::/64 [0/0]
via ::, Serial0/0/0
L 3001:10::2/128 [0/0]
via ::, Serial0/0/0
OI 3001:20::/64 [110/192]
via FE80::206:2AFF:FEB9:1B01, Serial0/0/0
L FF00::/8 [0/0]
via ::, Null0
Router(config-if)#
Ctrl+F6 to exit CLI focus
Copy
Paste
Top



We still can ping from PC7 (Network E) to PC6 (Network D):



Reference:
https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/iproute_ospf/configuration/xe-16/iro-xe-16-book/ip6-route-ospfv3-xe.html