HANOI UNIVERSITY

Faculty of Information Technology

CNE – Tutorial Guide

Week 11

Dynamic IPv6 Routing Configuration with OSPFv3 (single area)

I. OSPFv3

Introduction to OSPFv3

Open Shortest Path First (OSPF) is a routing protocol for IP. It is a link-state protocol, as opposed to a distance-vector protocol. A link-state protocol makes routing decisions based on the states of the links that connect source and destination machines. The state of a link is a description of that interface and the relationship to its neighboring networking devices. The interface information includes the IPv6 prefix of the interface, the network mask, the type of network it is connected to, the routers connected to that network, and so forth. This information is propagated in various type of link-state advertisements (LSAs).
OSPFv3, which is described in RFC 2740, supports IPv6.

OSPFv3 configuration requirements:

1. **Enable IPv6 unicast routing**

- IPv4 packet forwarding is enabled by default, whereas IPv6 packet forwarding is disabled by default.
- To enable IPv6 packet forwarding, use the ipv6 unicast-routing command in global configuration mode before enabling OSPF.
- Once IPv6 packet forwarding is enabled, we can now enable the IPv6 OSPF routing process.

2. **Enable the OSPFv3 routing process**

- OSPFv3 continues to use an IPv4 32-bit address for the router ID. Because there are no IPv4 addresses configured on the routers, you are required to manually assign the router ID using the **router-id** command.
- Enabling OSPFv3 with **ipv6 ospf *process-id* area *area-id*** will enable the routing process and its associated configuration to be created.

- Unlike OSPFv2, you do not enter network statements. Each interface must be enabled using **ipv6 ospf *process-id* area *area-id*** in interface-configuration mode.

```
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 10
Router(config-if)#int se0/0/1
Router(config-if)#ipv6 ospf 1 area 10
Router(config-if)#int fa0/0
Router(config-if)#ipv6 ospf 1 area 10
```

3. Enable OSPFv3 on the interface

```
Router(config-rtr)#int se0/0/0
Router(config-if)#ipv6 ospf 1 area 10
Router(config-if)#int se0/0/1
Router(config-if)#ipv6 ospf 1 area 10
Router(config-if)#int fa0/0
Router(config-if)#ipv6 ospf 1 area 10
```

4. Configure passive interfaces

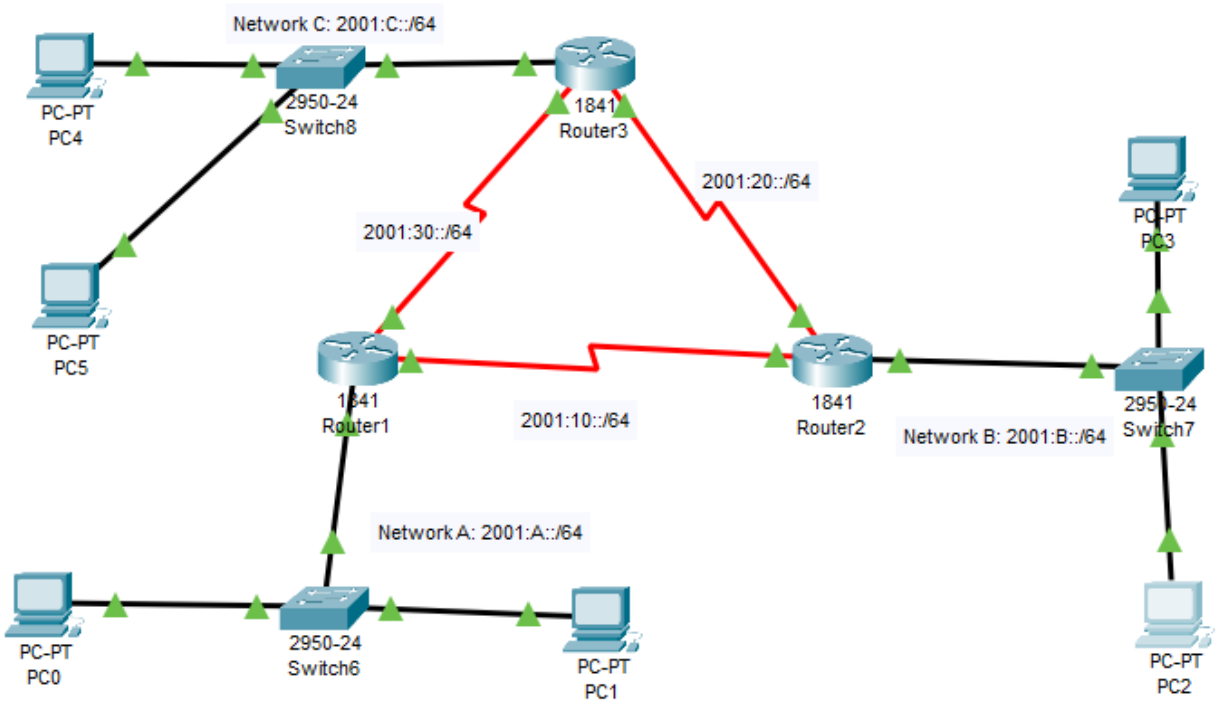
OSPFv3 Verification

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 folling picture:



By defaut, 1841 router series don't have any serial ports.

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

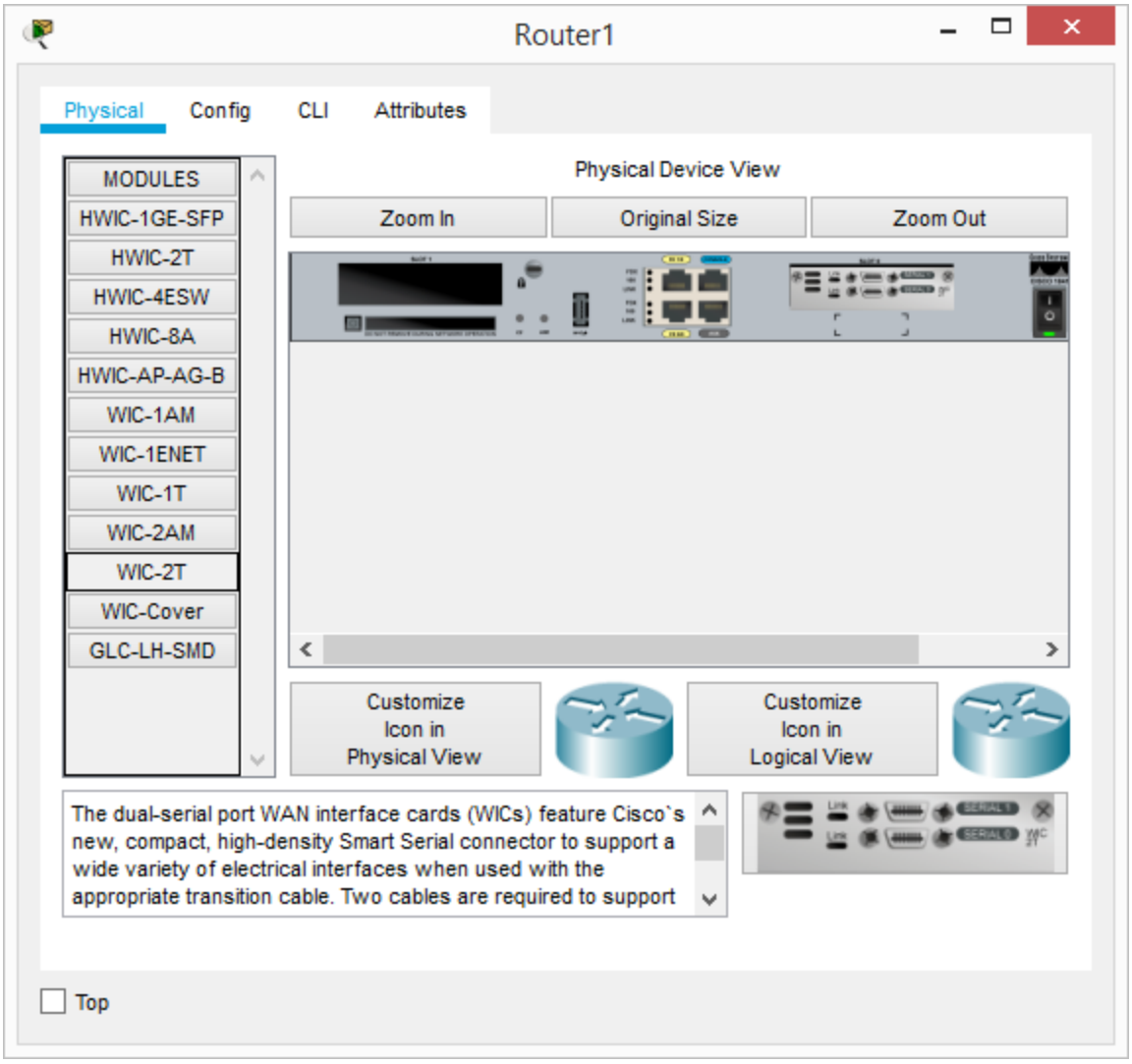
Router connects to the private network through its Fast Ethernet port and connects to the public network (to another router) through Serial port

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 space given) -->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)#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)#ex
```

OSPFv3 for dynamic 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 10
Router(config-if)#int se0/0/1
Router(config-if)#ipv6 ospf 1 area 10
Router(config-if)#int fa0/0
Router(config-if)#ipv6 ospf 1 area 10
```

At router 2:

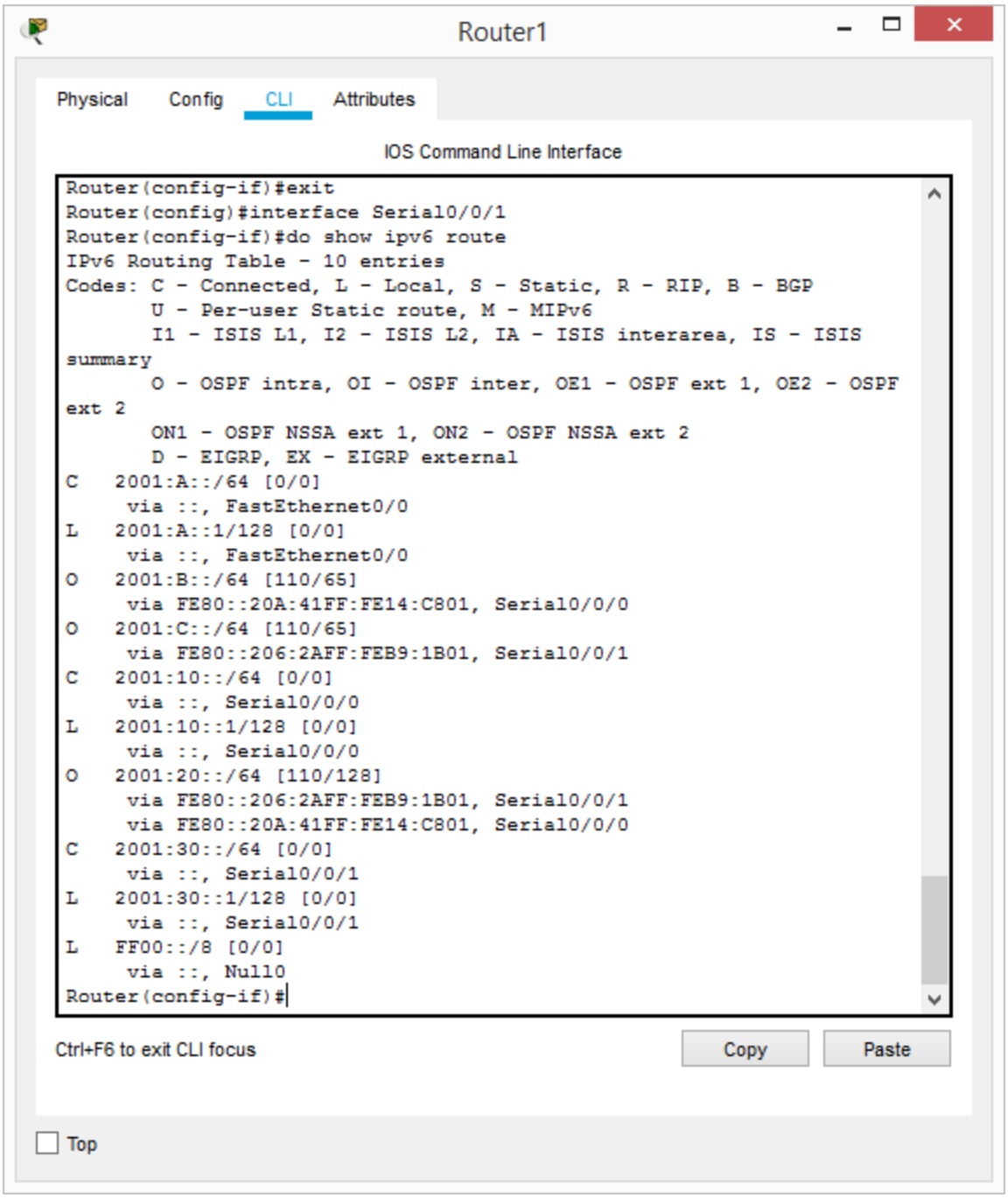
```
Router(config)#ipv6 router ospf 1
```

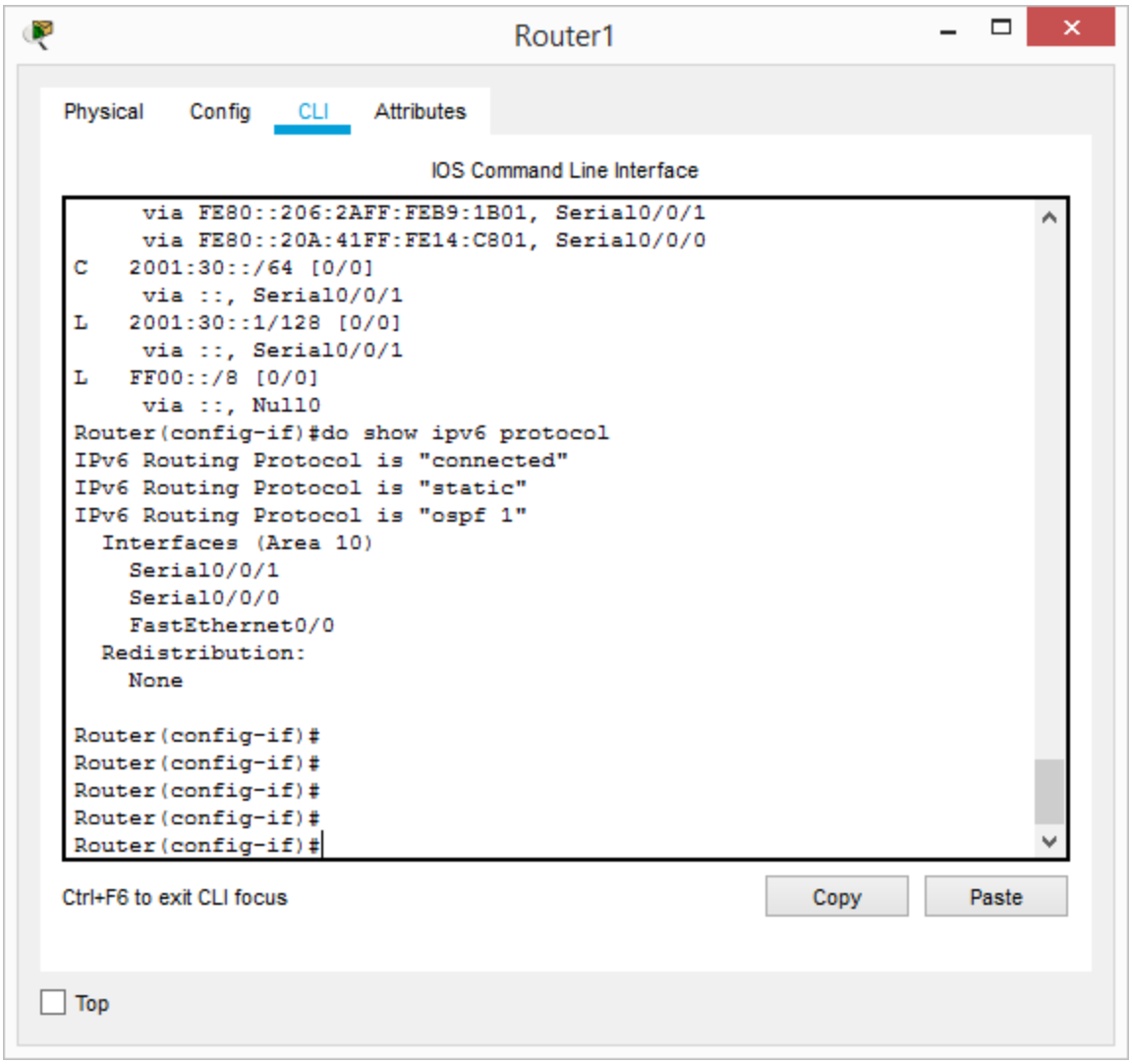
```
% IPv6 routing not enabled
Router(config)#ipv6 unicast-routing
Router(config)#ipv6 router ospf 1
%OSPFv3-4-NORTRID: OSPFv3 process 1 could not pick a router-id, please configure manually
Router(config-rtr)#router-id 2.2.2.2
Router(config-rtr)#int se0/0/0
Router(config-if)#ipv6 ospf 1 area 10
Router(config-if)#int se0/0/1
Router(config-if)#ipv6 ospf 1 area 10
Router(config-if)#int fa0/0
Router(config-if)#ipv6 ospf 1 area 10
```

At router 1:

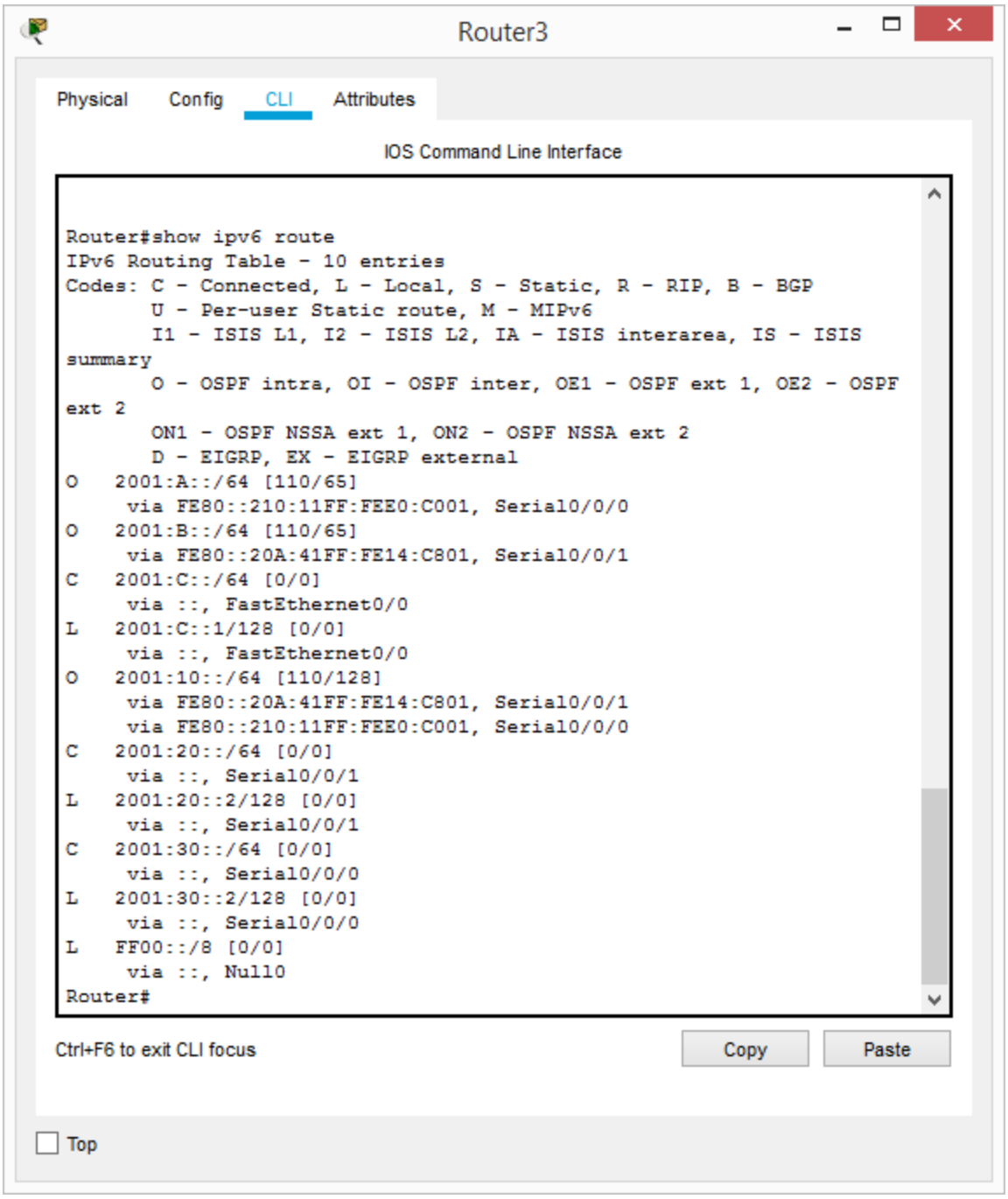
```
Router(config)#ipv6 router ospf 1
% IPv6 routing not enabled
Router(config)#ipv6 unicast-routing
Router(config)#ipv6 router ospf 1
%OSPFv3-4-NORTRID: OSPFv3 process 1 could not pick a router-id, please configure manually
Router(config-rtr)#router-id 3.3.3.3
Router(config-rtr)#int se0/0/0
Router(config-if)#ipv6 ospf 1 area 10
Router(config-if)#int se0/0/1
Router(config-if)#ipv6 ospf 1 area 10
Router(config-if)#int fa0/0
Router(config-if)#ipv6 ospf 1 area 10
```

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

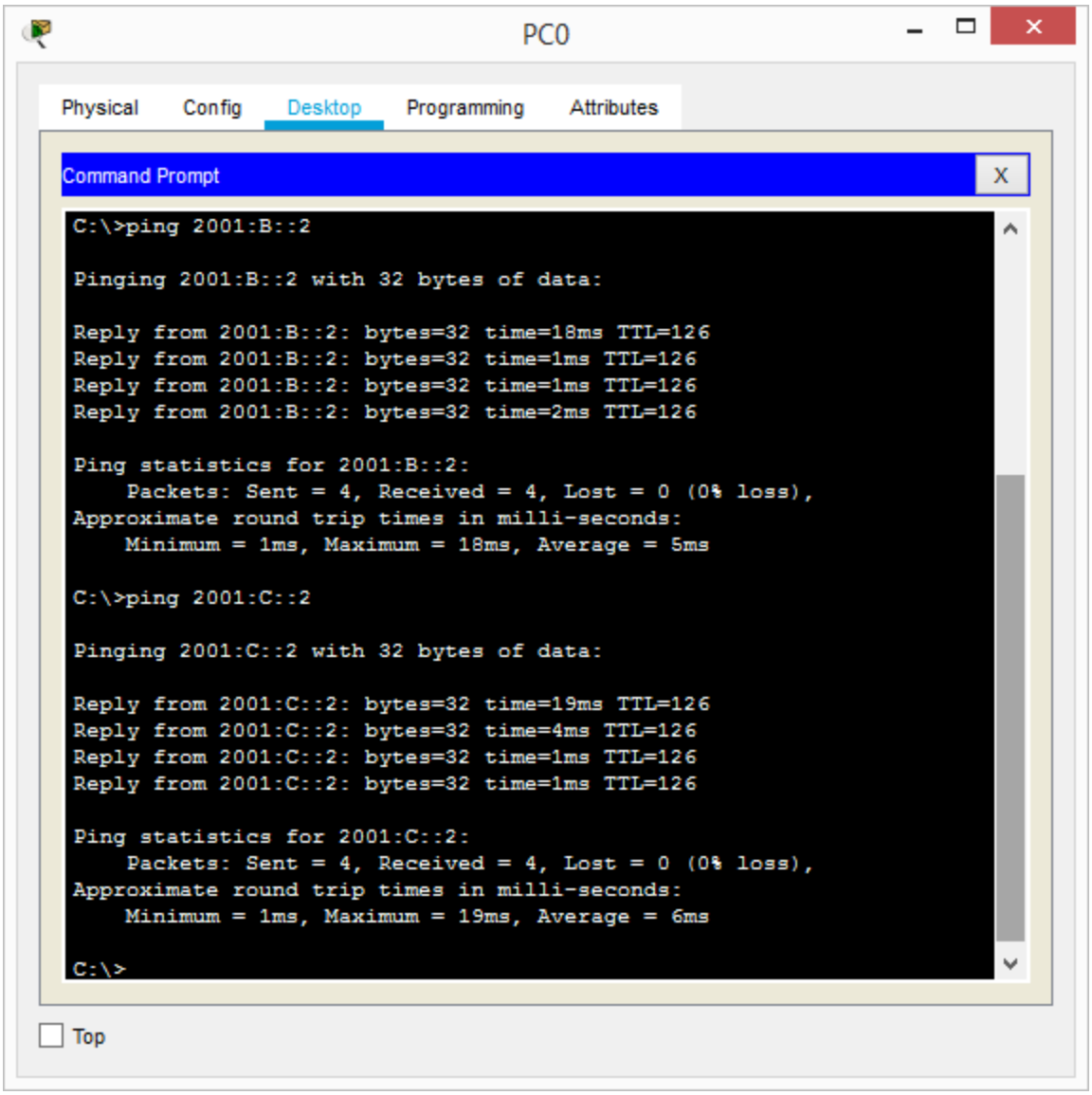

Router1
Physical
Config
CLI
Attributes
IOS Command Line Interface
Router(config-if)#exit
Router(config)#interface Serial0/0/1
Router(config-if)#do show ipv6 route
IPv6 Routing Table - 10 entries
Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
U - Per-user Static route, M - MIPv6
I1 - ISIS 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
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::206:2AFF:FEB9:1B01, Serial0/0/1
via FE80::20A:41FF:FE14:C801, Serial0/0/0
C 2001:30::/64 [0/0]
via ::, Serial0/0/1
L 2001:30::1/128 [0/0]
via ::, Serial0/0/1
L FF00::/8 [0/0]
via ::, Null0
Router(config-if)#
Ctrl+F6 to exit CLI focus
Copy
Paste
Top


Router1
Physical
Config
CLI
Attributes
IOS Command Line Interface
via FE80::206:2AFF:FEB9:1B01, Serial0/0/1
via FE80::20A:41FF:FE14:C801, Serial0/0/0
C 2001:30::/64 [0/0]
via ::, Serial0/0/1
L 2001:30::1/128 [0/0]
via ::, Serial0/0/1
L FF00::/8 [0/0]
via ::, Null0
Router(config-if)#do show ipv6 protocol
IPv6 Routing Protocol is "connected"
IPv6 Routing Protocol is "static"
IPv6 Routing Protocol is "ospf 1"
Interfaces (Area 10)
Serial0/0/1
Serial0/0/0
FastEthernet0/0
Redistribution:
None
Router(config-if)#
Router(config-if)#
Router(config-if)#
Router(config-if)#
Router(config-if)#
Ctrl+F6 to exit CLI focus
Copy
Paste
Top


Router2
Physical
Config
CLI
Attributes
IOS Command Line Interface
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::206:2AFF:FEB9:1B01, Serial0/0/1
via FE80::210:11FF:FEE0:C001, Serial0/0/0
L FF00::/8 [0/0]
via ::, Null0
Router#
Ctrl+F6 to exit CLI focus
Copy
Paste
Top



We still can ping from PC0 (Network A) to PC2 (Network B) and PC4 (Network C):



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