



دانشگاه صنعتی اصفهان
دانشکده مهندسی برق و کامپیوتر

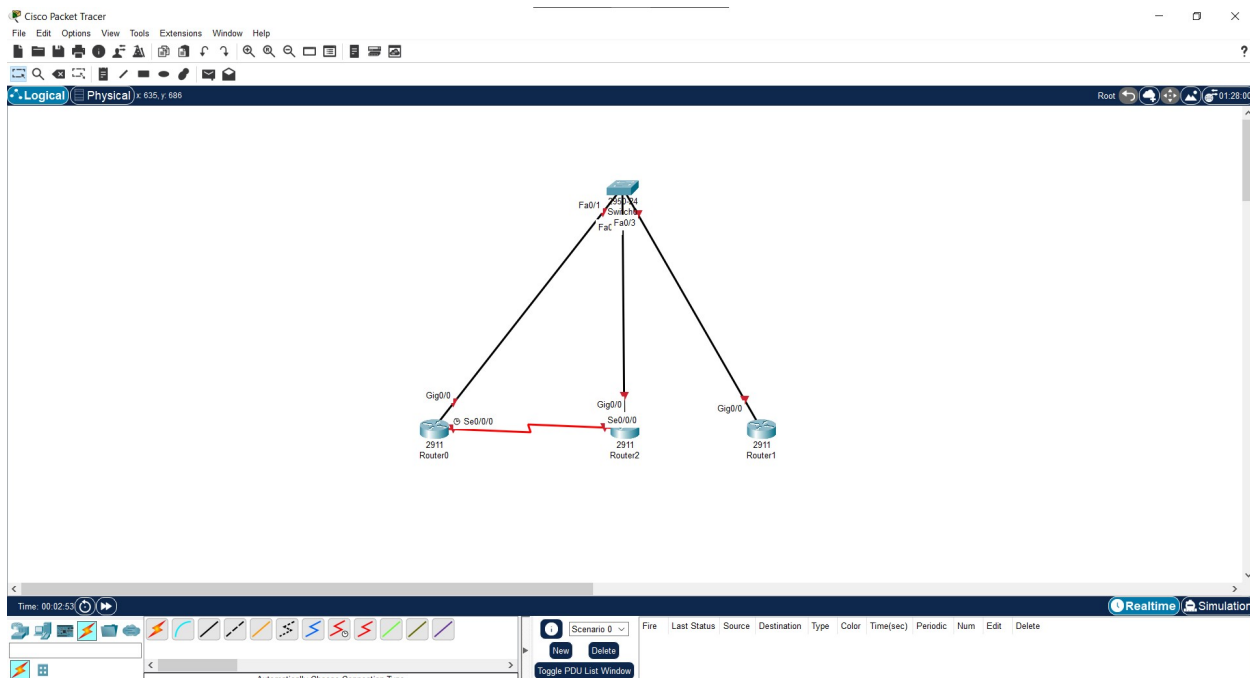
عنوان: تکلیف هفتم آزمایشگاه شبکه‌های کامپیوتری

نام و نام خانوادگی: علیرضا ابره فروش

شماره دانشجویی: ۹۸۱۶۶۰۳

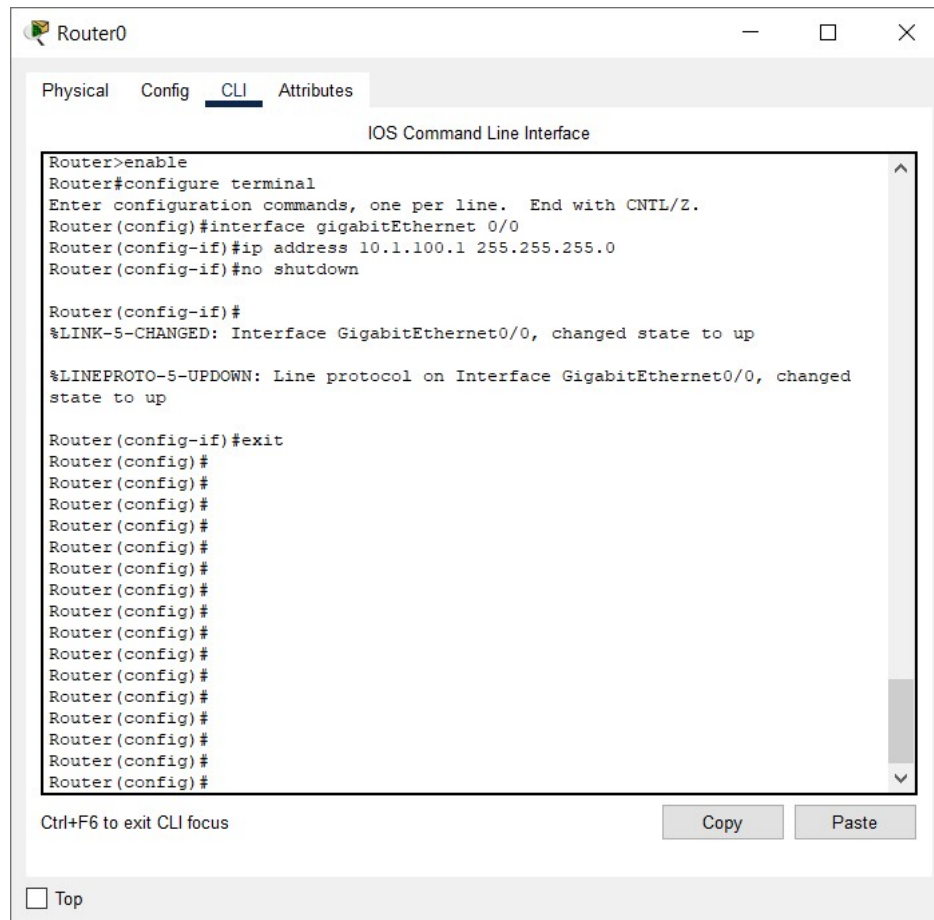
نیم سال تحصیلی: بهار ۱۴۰۱/۱۴۰۰

ابتدا سناریو را به شکل زیر می‌بندیم و تجهیزات اولیه را به روترها اضافه می‌کنیم.

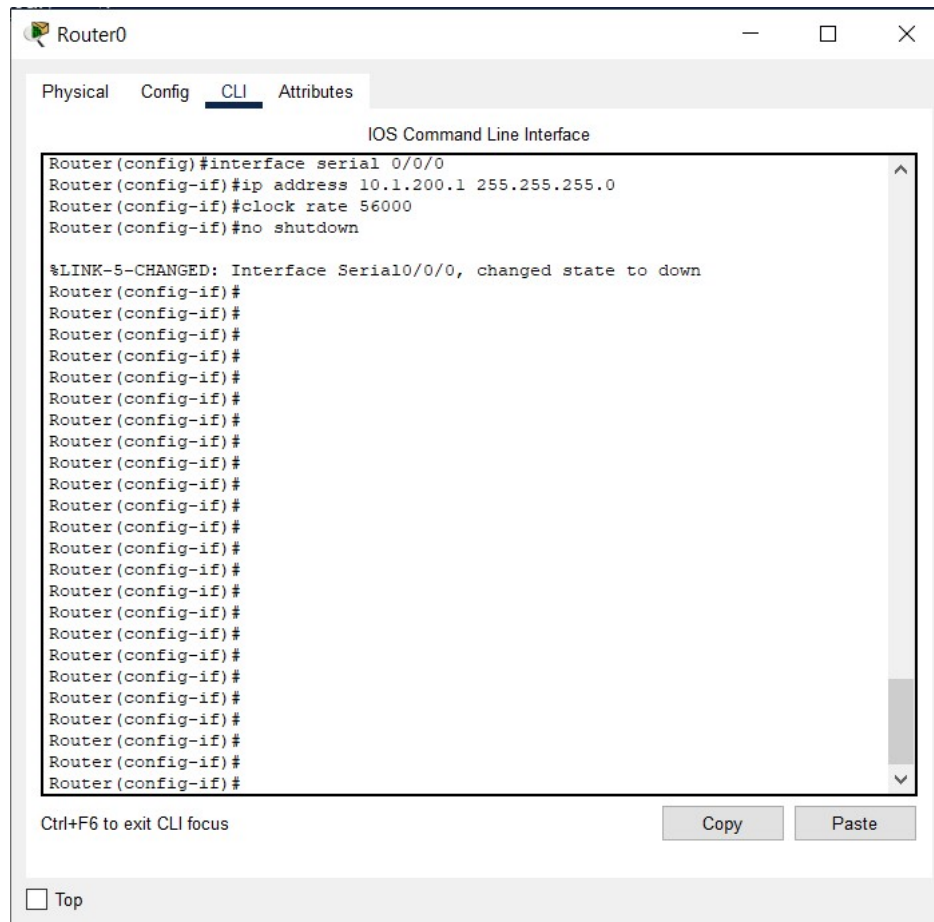


شکل ۱

اینترفیس‌های fast و serial را به این طریق پیکربندی می‌کنیم.



شکل ۲



شکل ۳

۳

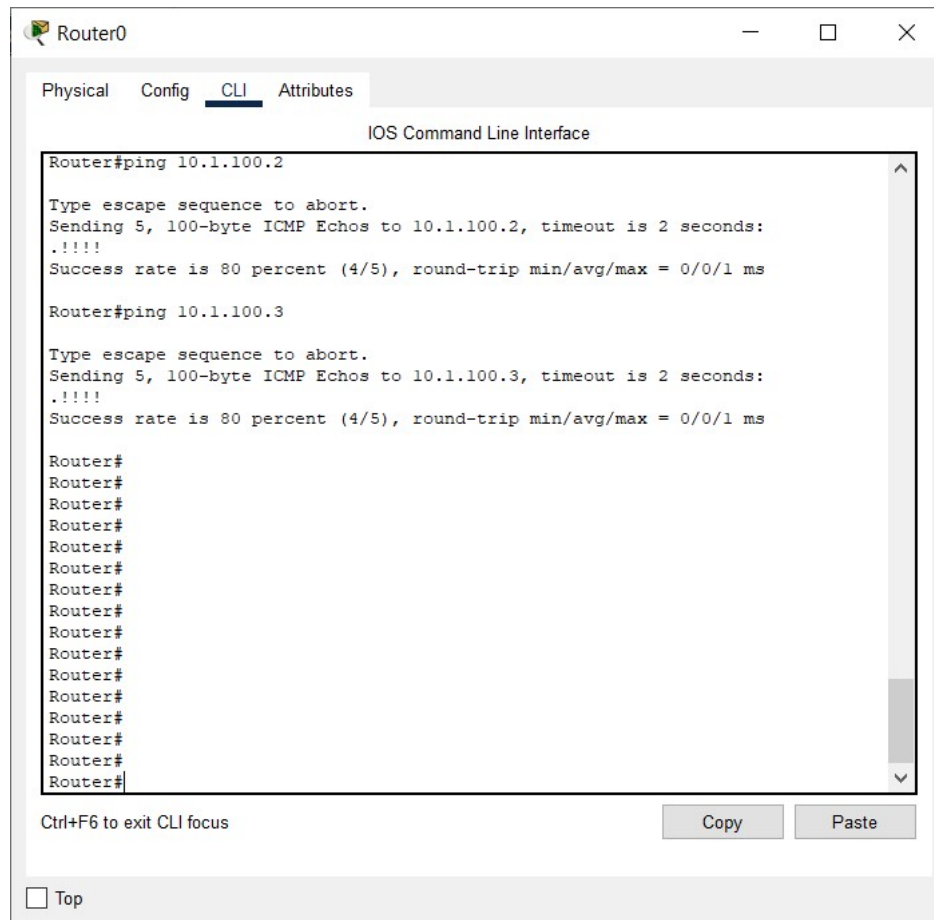
اینترفیس loopback را به شکل زیر ایجاد می کنیم.



۴

5

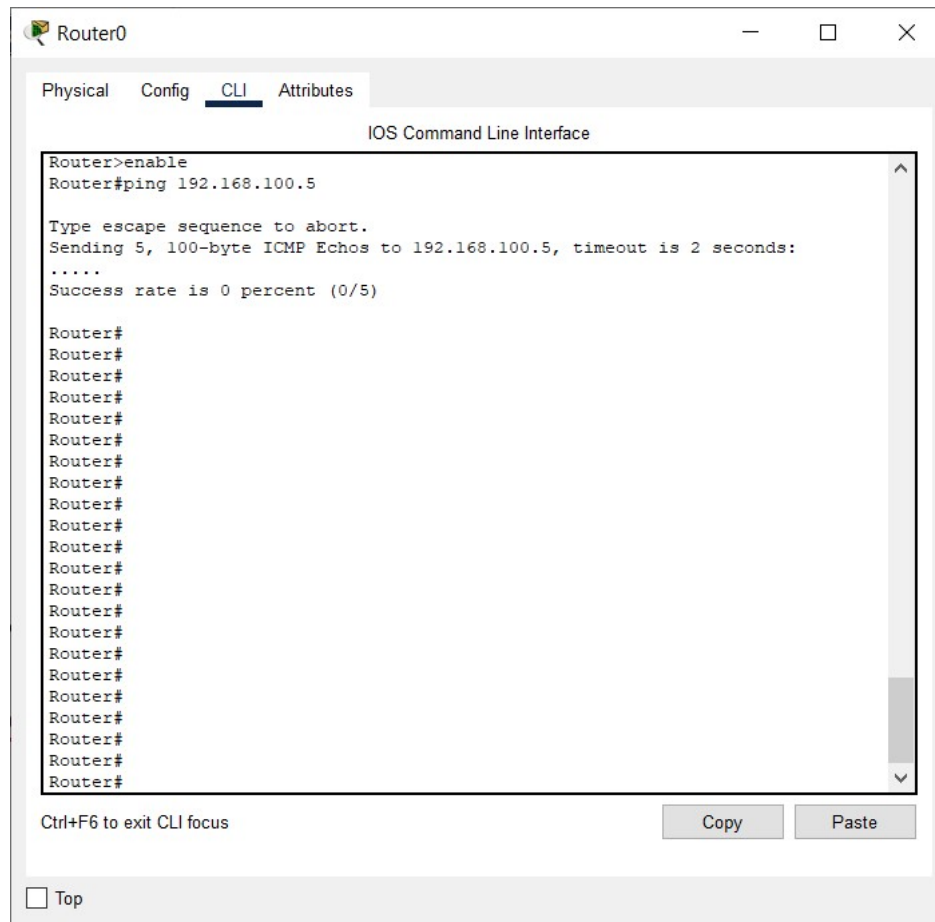
98166.3



شکل ۵

۶

روترها نمی‌توانند اینترفیس‌های loopback یکدیگر را پینگ کنند. چون رنج آن‌ها کاملاً متفاوت است.



شکل ۶

The screenshot shows a Cisco Router CLI window titled "Router0". The window has tabs for "Physical", "Config", "CLI", and "Attributes". The "CLI" tab is active, displaying the "IOS Command Line Interface". The command "Router#show ip route" has been entered, and the output is displayed. The output includes a list of codes for various routing protocols and a list of routes. The routes are listed as follows:

```

Router#show ip route
Codes: L - local, C - connected, S - static, 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

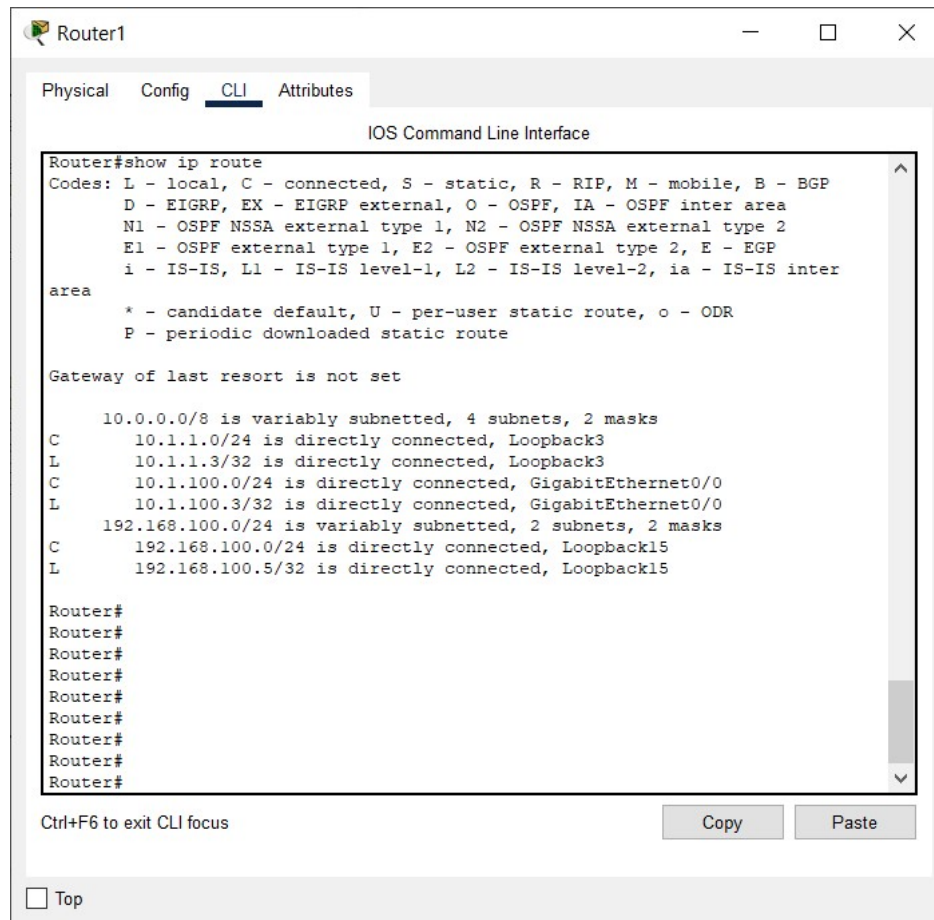
    10.0.0.0/8 is variably subnetted, 6 subnets, 2 masks
C       10.1.1.0/24 is directly connected, Loopback1
L       10.1.1.1/32 is directly connected, Loopback1
C       10.1.100.0/24 is directly connected, GigabitEthernet0/0
L       10.1.100.1/32 is directly connected, GigabitEthernet0/0
C       10.1.200.0/24 is directly connected, Serial0/0/0
L       10.1.200.1/32 is directly connected, Serial0/0/0

Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#

```

At the bottom of the window, there is a "Ctrl+F6 to exit CLI focus" message and two buttons: "Copy" and "Paste". A "Top" button is also visible at the bottom left.

شکل ۷



شکل ۸

```

Router2
Physical Config CLI Attributes
IOS Command Line Interface
Router#show ip route
Codes: L - local, C - connected, S - static, 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, 6 subnets, 2 masks
C       10.1.1.0/24 is directly connected, Loopback2
L       10.1.1.2/32 is directly connected, Loopback2
C       10.1.100.0/24 is directly connected, GigabitEthernet0/0
L       10.1.100.2/32 is directly connected, GigabitEthernet0/0
C       10.1.200.0/24 is directly connected, Serial0/0/0
L       10.1.200.2/32 is directly connected, Serial0/0/0

Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#

```

Ctrl+F6 to exit CLI focus

Copy Paste

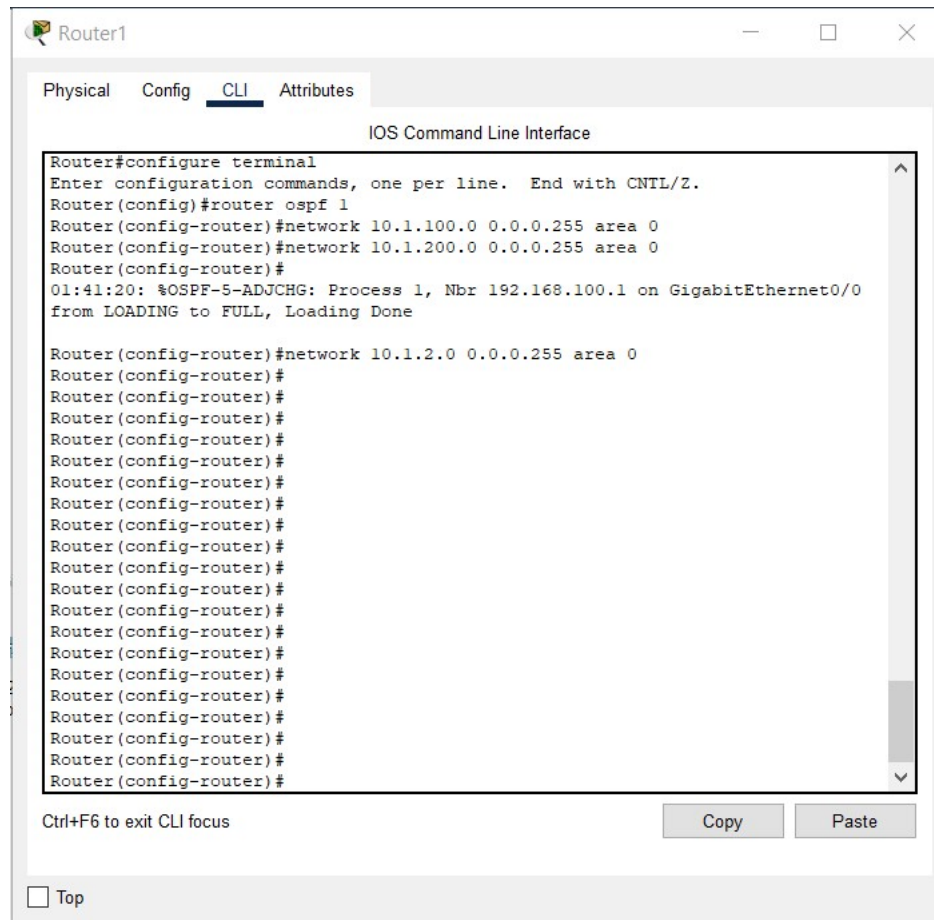
☐ Top

شکل ۹

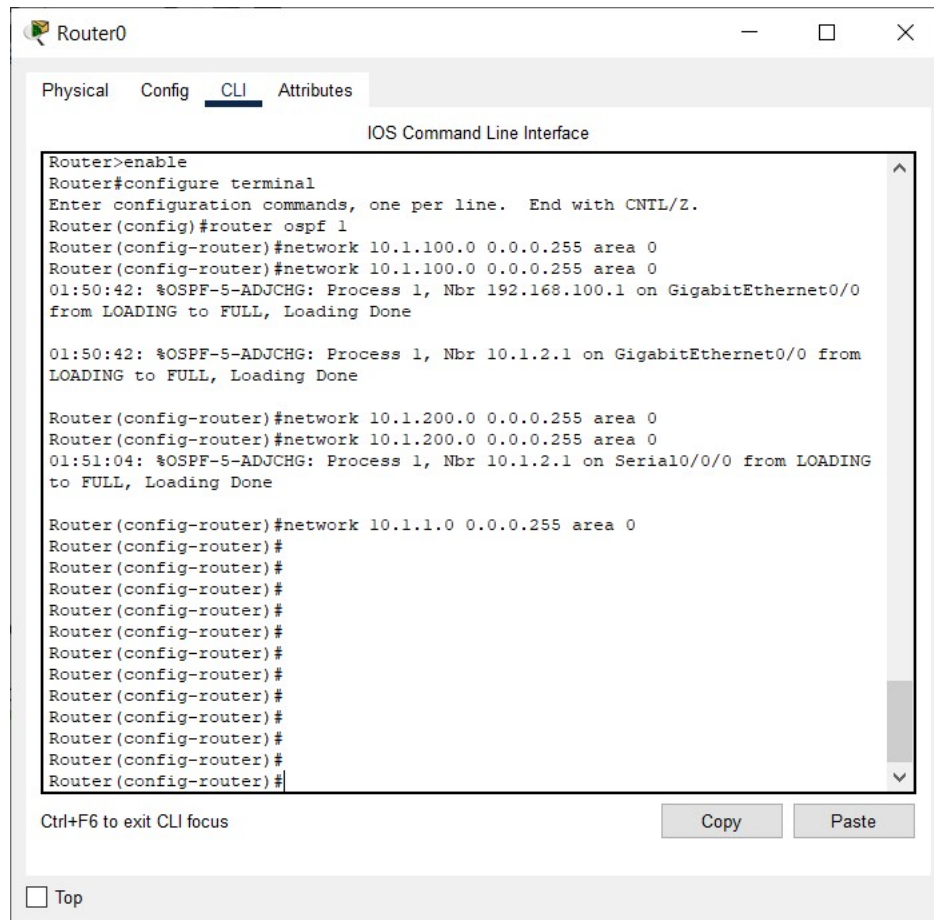
۸

به طریق زیر پروتکل OSPF را بر روی روتر پیکربندی می کنیم.



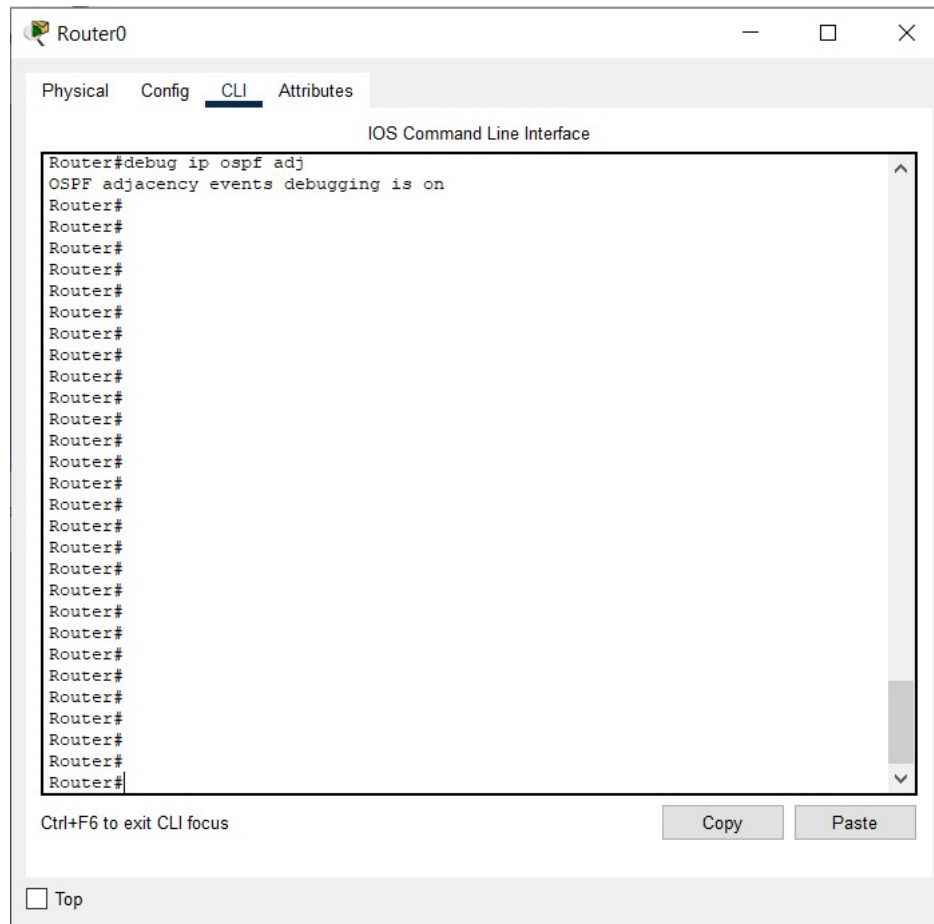


شکل ۱۱



شکل ۱۲

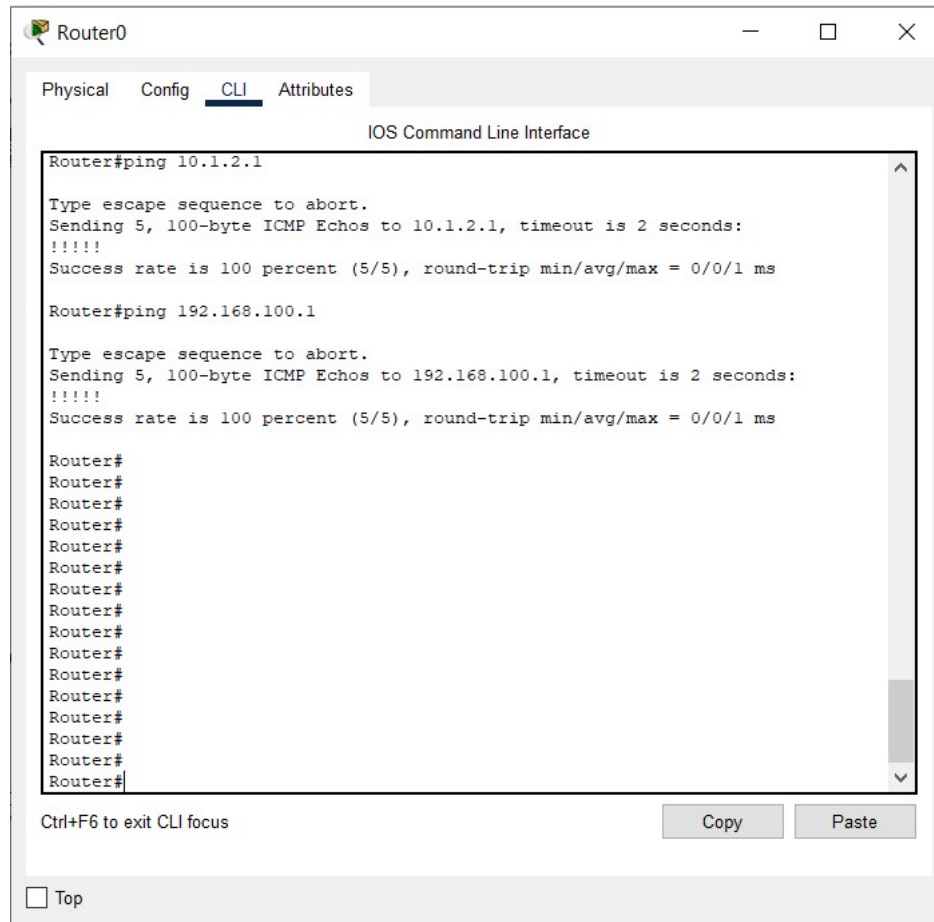
۹



شکل ۱۳

۱۰

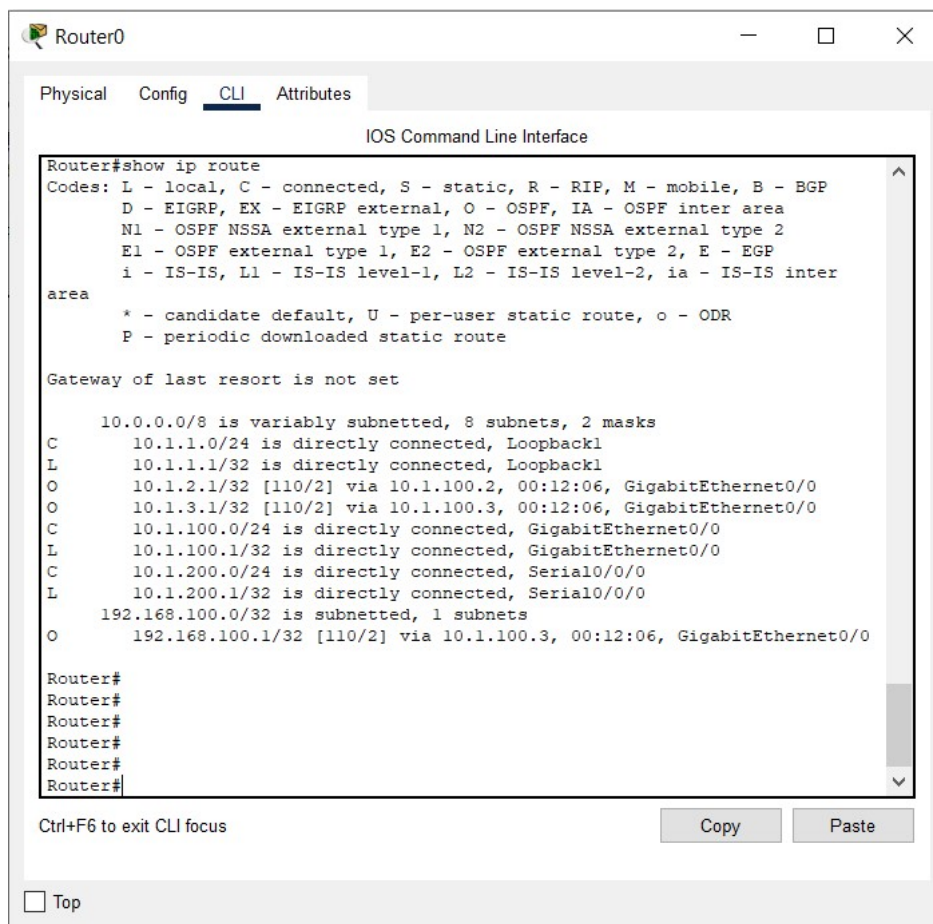
روترها به اینترفیس های loopback یکدیگر نیز دسترسی دارند.



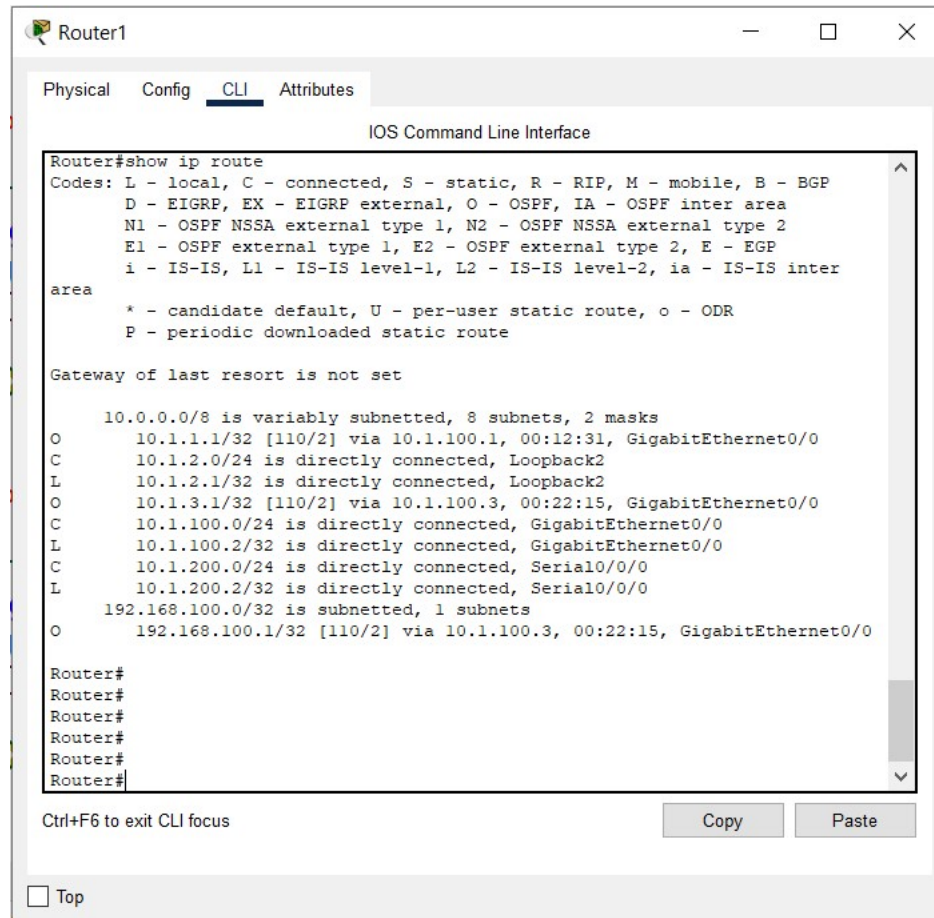
شکل ۱۴

۱۱

جدول مسیریابی روترها به شکل زیر است.



شکل ۱۵



شکل ۱۶

```

Router2
Physical Config CLI Attributes
IOS Command Line Interface
Router#show ip route
Codes: L - local, C - connected, S - static, 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, 7 subnets, 2 masks
O    10.1.1.1/32 [110/2] via 10.1.100.1, 00:12:53, GigabitEthernet0/0
O    10.1.2.1/32 [110/2] via 10.1.100.2, 00:22:19, GigabitEthernet0/0
C    10.1.3.0/24 is directly connected, Loopback3
L    10.1.3.1/32 is directly connected, Loopback3
C    10.1.100.0/24 is directly connected, GigabitEthernet0/0
L    10.1.100.3/32 is directly connected, GigabitEthernet0/0
O    10.1.200.0/24 [110/65] via 10.1.100.2, 00:13:15, GigabitEthernet0/0
    [110/65] via 10.1.100.1, 00:13:15, GigabitEthernet0/0
192.168.100.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.168.100.0/24 is directly connected, Loopback11
L    192.168.100.1/32 is directly connected, Loopback11

Router#
Router#
Router#
Router#
Router#

Ctrl+F6 to exit CLI focus
Copy Paste
Top

```

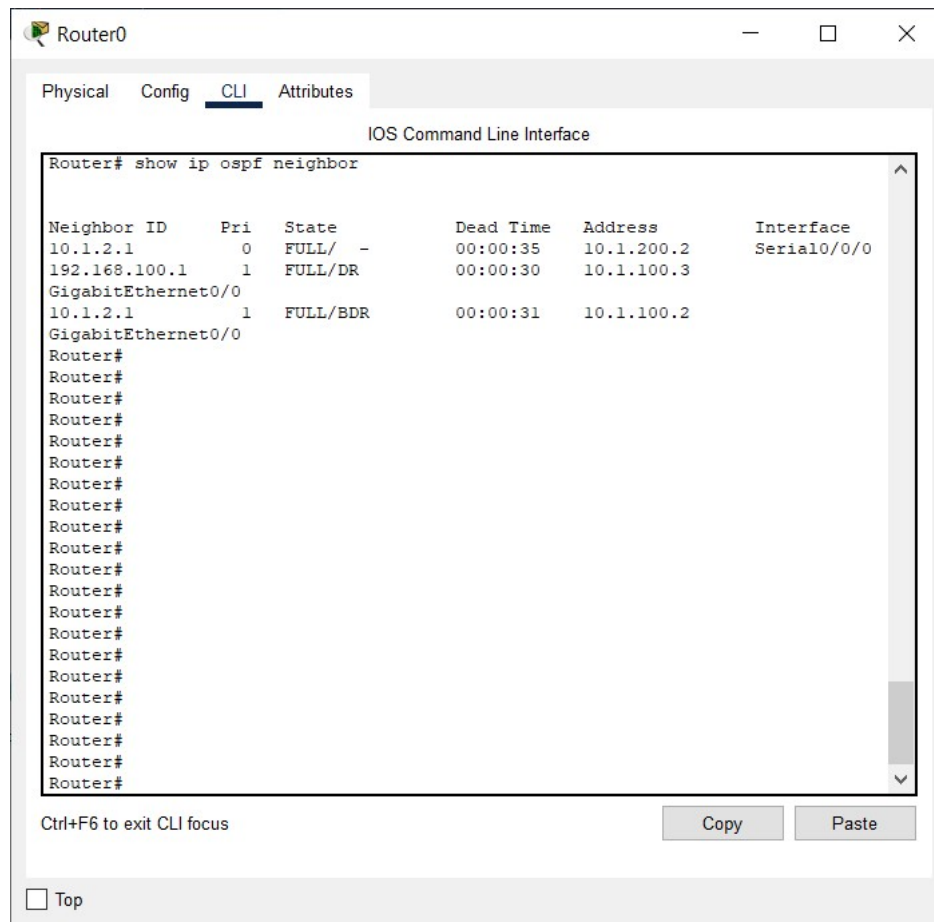
شکل ۱۷

۱۲

با دستور `show ospf neighbor` می توان router id را دید. اگر دستی ست نشده باشد، آدرس آی پی loopback ای که به روتر وصل است router id است. اگر چند loopback داشته باشد، آدرسی که بزرگ تر است.

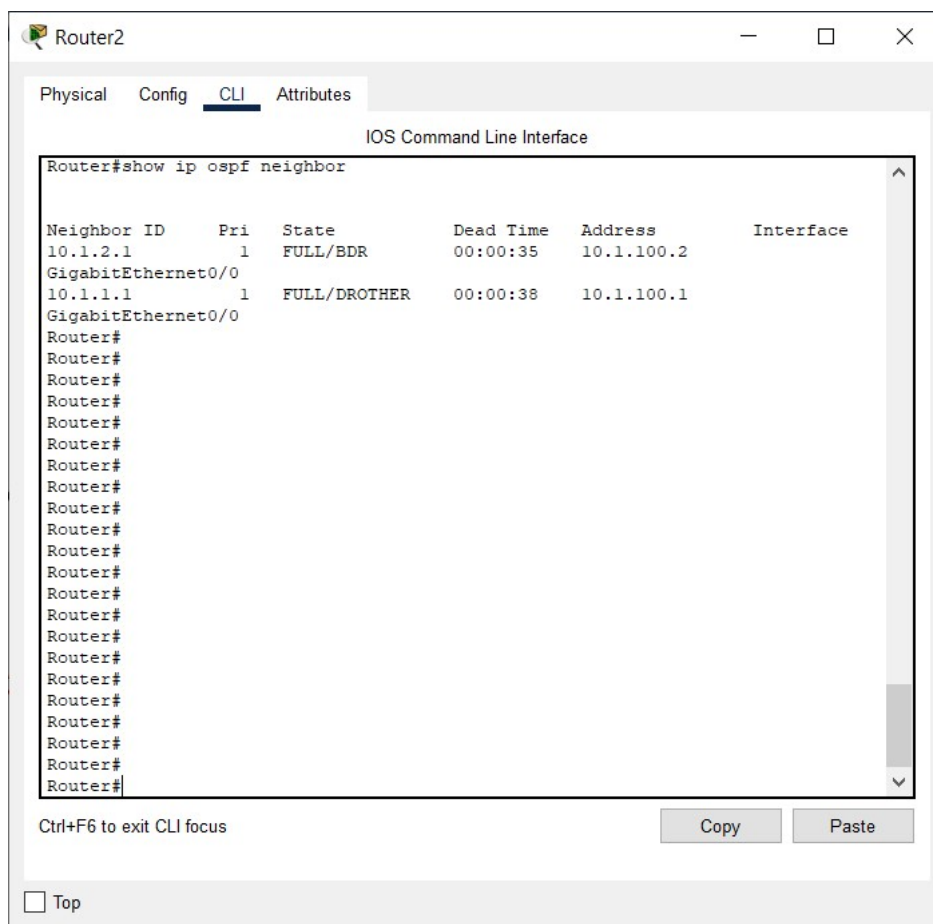
۱۳

مسیریاب شماره ی ۲ (سوم) DR است.

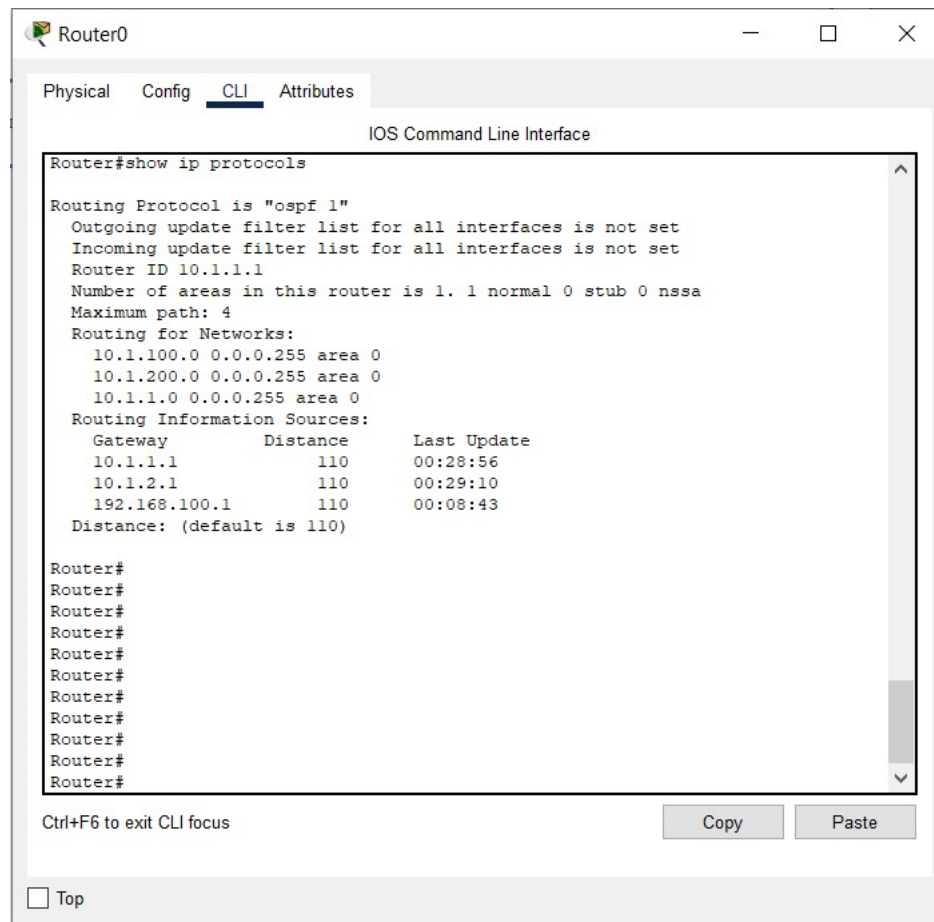


شکل ۱۸

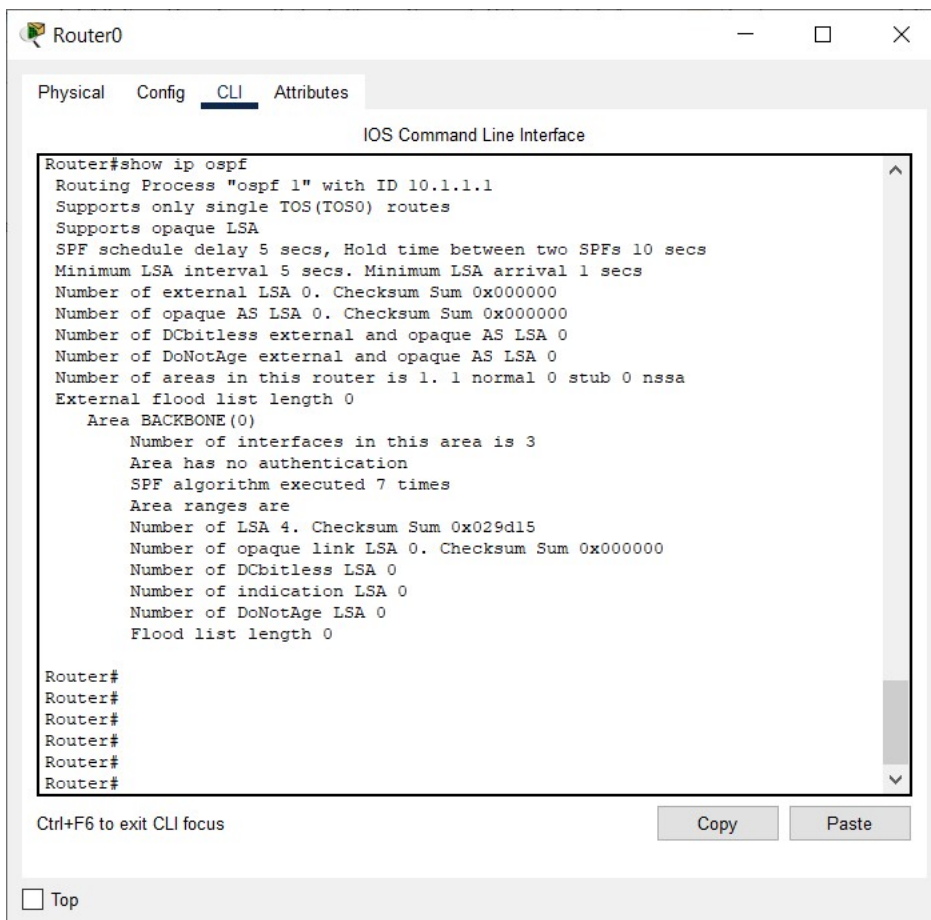




شکل ۲۰



شکل ۲۱



The screenshot shows a window titled "Router0" with tabs for "Physical", "Config", "CLI", and "Attributes". The "CLI" tab is active, displaying the "IOS Command Line Interface". The command "Router#show ip ospf" has been entered, and its output is shown below. The output details the OSPF configuration, including the process ID (10.1.1.1), supported features (single TOS, opaque LSA), SPF schedule delay (5 secs), LSA intervals (5 secs), and the number of external, opaque, and DCbitless LSAs. It also shows the area configuration for Area BACKBONE(0), including the number of interfaces (3), authentication status, SPF algorithm execution count, and various LSA counts.

```

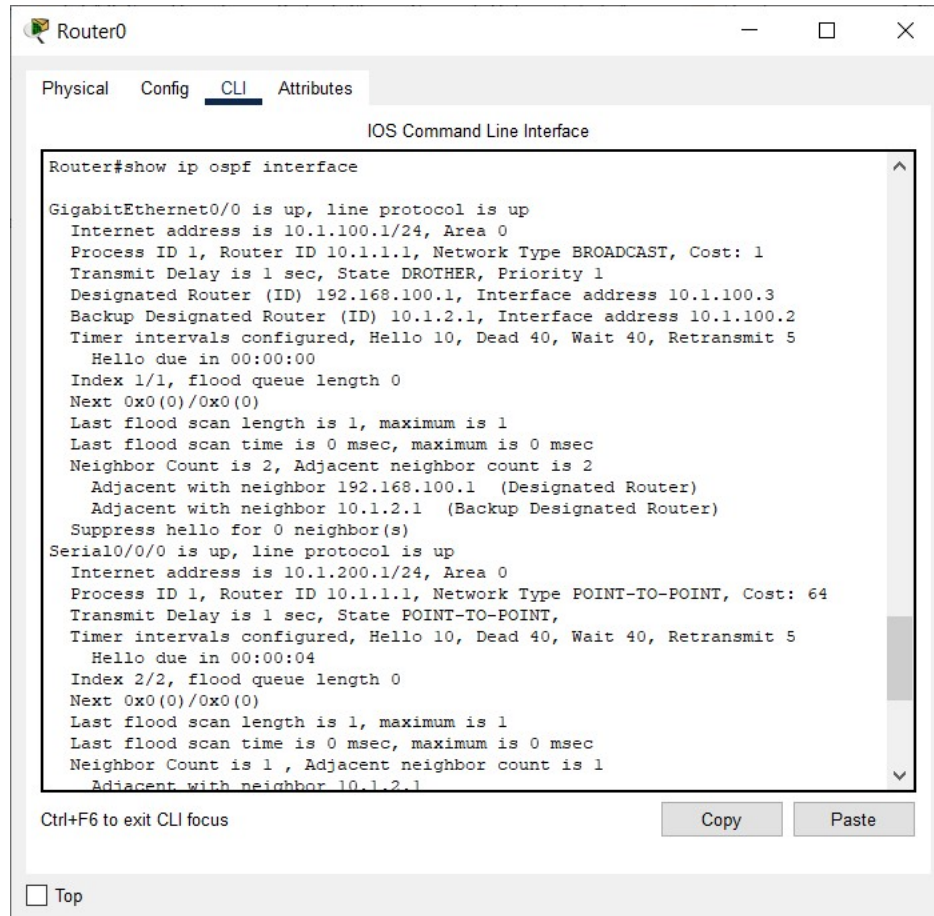
Router#show ip ospf
Routing Process "ospf 1" with ID 10.1.1.1
Supports only single TOS(TOS0) routes
Supports opaque LSA
SPF schedule delay 5 secs, Hold time between two SPFs 10 secs
Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs
Number of external LSA 0. Checksum Sum 0x000000
Number of opaque AS LSA 0. Checksum Sum 0x000000
Number of DCbitless external and opaque AS LSA 0
Number of DoNotAge external and opaque AS LSA 0
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
External flood list length 0
  Area BACKBONE(0)
    Number of interfaces in this area is 3
    Area has no authentication
    SPF algorithm executed 7 times
    Area ranges are
    Number of LSA 4. Checksum Sum 0x029d15
    Number of opaque link LSA 0. Checksum Sum 0x000000
    Number of DCbitless LSA 0
    Number of indication LSA 0
    Number of DoNotAge LSA 0
    Flood list length 0

Router#
Router#
Router#
Router#
Router#
Router#

```

Below the CLI window, there is a "Ctrl+F6 to exit CLI focus" label and two buttons: "Copy" and "Paste". At the bottom left, there is a "Top" button.

شکل ۲۲



شکل ۲۳

۱۶ و ۱۷

The screenshot shows a Cisco Router CLI window titled "Router0". The "CLI" tab is selected. The window displays the following text:

```

Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface GigabitEthernet 0/0
Router(config-if)#bandwidth 2000
Router(config-if)#
02:32:07: OSPF: Build router LSA for area 0, router ID 10.1.1.1, seq
0xffffffff8000000a

Router(config-if)#end
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#show ip route
Codes: L - local, C - connected, S - static, 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, 8 subnets, 2 masks
C       10.1.1.0/24 is directly connected, Loopback1
L       10.1.1.1/32 is directly connected, Loopback1
O       10.1.2.1/32 [110/51] via 10.1.100.2, 00:00:03, GigabitEthernet0/0
O       10.1.3.1/32 [110/51] via 10.1.100.3, 00:00:03, GigabitEthernet0/0
C       10.1.100.0/24 is directly connected, GigabitEthernet0/0
  
```

At the bottom of the window, there is a "Ctrl+F6 to exit CLI focus" label, "Copy" and "Paste" buttons, and a "Top" button.

شکل ۲۴

The screenshot shows a Cisco Router CLI window titled "Router1". The "CLI" tab is selected. The command history shows the following sequence of commands and their outputs:

```

Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface GigabitEthernet 0/0
Router(config-if)#bandwidth 2000
Router(config-if)#end
Router#
%SYS-5-CONFIG_I: Configured from console by console

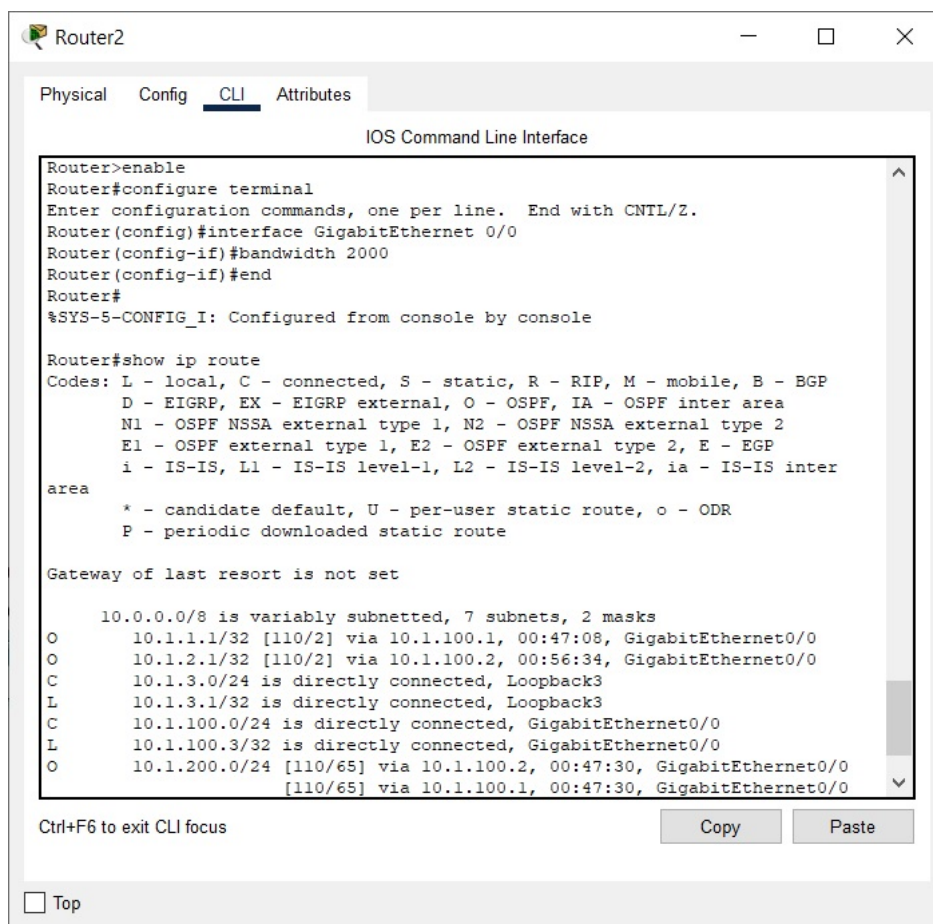
Router#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       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, 8 subnets, 2 masks
O       10.1.1.1/32 [110/S1] via 10.1.100.1, 00:00:00, GigabitEthernet0/0
C       10.1.2.0/24 is directly connected, Loopback2
L       10.1.2.1/32 is directly connected, Loopback2
O       10.1.3.1/32 [110/S1] via 10.1.100.3, 00:00:00, GigabitEthernet0/0
C       10.1.100.0/24 is directly connected, GigabitEthernet0/0
L       10.1.100.2/32 is directly connected, GigabitEthernet0/0
C       10.1.200.0/24 is directly connected, Serial10/0/0
L       10.1.200.2/32 is directly connected, Serial10/0/0
  
```

At the bottom of the window, there is a "Ctrl+F6 to exit CLI focus" message and "Copy" and "Paste" buttons. A "Top" button is also visible at the bottom left.

شکل ۲۵



شکل ۲۶

۱۷

txt file

Building configuration...

Current configuration : 1075 bytes

!

version 15.1

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

!

hostname Router

!

!

!

!

```
!  
!  
!  
!  
no ip cef  
no ipv6 cef  
!  
!  
!  
!  
license udi pid CISC02911/K9 sn FTX15240UTI-  
!  
!  
!  
!  
!  
!  
!  
!  
!  
spanning-tree mode pvst  
!  
!  
!  
!  
!  
interface Loopback1  
  ip address 10.1.1.1 255.255.255.0  
!  
interface GigabitEthernet0/0  
  bandwidth 2000  
  ip address 10.1.100.1 255.255.255.0  
  duplex auto  
  speed auto  
!  
interface GigabitEthernet0/1  
  no ip address  
  duplex auto  
  speed auto  
  shutdown  
!  
interface GigabitEthernet0/2
```

```
no ip address
duplex auto
speed auto
shutdown
!
interface Serial0/0/0
ip address 10.1.200.1 255.255.255.0
clock rate 56000
!
interface Serial0/0/1
no ip address
clock rate 2000000
shutdown
!
interface Vlan1
no ip address
shutdown
!
router ospf 1
log-adjacency-changes
network 10.1.100.0 0.0.0.255 area 0
network 10.1.200.0 0.0.0.255 area 0
network 10.1.1.0 0.0.0.255 area 0
!
ip classless
!
ip flow-export version 9
!
!
!
!
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
login
!
!
!
end
```

txt file

Building configuration...

Current configuration : 1057 bytes

!

version 15.1

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

!

hostname Router

!

!

!

!

!

!

!

!

no ip cef

no ipv6 cef

!

!

!

!

license udi pid CISC02911/K9 sn FTX1524YXQA-

!

!

!

!

!

!

!

!

!

!

!

spanning-tree mode pvst

!

!

!

!

!

```
!  
interface Loopback2  
  ip address 10.1.2.1 255.255.255.0  
!  
interface GigabitEthernet0/0  
  bandwidth 2000  
  ip address 10.1.100.2 255.255.255.0  
  duplex auto  
  speed auto  
!  
interface GigabitEthernet0/1  
  no ip address  
  duplex auto  
  speed auto  
  shutdown  
!  
interface GigabitEthernet0/2  
  no ip address  
  duplex auto  
  speed auto  
  shutdown  
!  
interface Serial0/0/0  
  ip address 10.1.200.2 255.255.255.0  
!  
interface Serial0/0/1  
  no ip address  
  clock rate 2000000  
  shutdown  
!  
interface Vlan1  
  no ip address  
  shutdown  
!  
router ospf 1  
  log-adjacency-changes  
  network 10.1.100.0 0.0.0.255 area 0  
  network 10.1.200.0 0.0.0.255 area 0  
  network 10.1.2.0 0.0.0.255 area 0  
!  
ip classless  
!  
ip flow-export version 9  
!  
!
```

```
!  
!  
!  
!  
!  
!  
line con 0  
!  
line aux 0  
!  
line vty 0 4  
  login  
!  
!  
!  
end
```

txt file

Building configuration...

Current configuration : 1169 bytes

```
!  
version 15.1  
no service timestamps log datetime msec  
no service timestamps debug datetime msec  
no service password-encryption  
!  
hostname Router  
!  
!  
!  
!  
!  
!  
!  
no ip cef  
no ipv6 cef  
!  
!  
!  
!  
license udi pid CISCO2911/K9 sn FTX1524YWK3-  
!
```



```
!  
!  
!  
!  
!  
!  
!  
!  
!  
!  
spanning-tree mode pvst  
!  
!  
!  
!  
!  
interface Loopback3  
  ip address 10.1.3.1 255.255.255.0  
!  
interface Loopback11  
  ip address 192.168.100.1 255.255.255.0  
!  
interface Loopback15  
  no ip address  
!  
interface GigabitEthernet0/0  
  bandwidth 2000  
  ip address 10.1.100.3 255.255.255.0  
  duplex auto  
  speed auto  
!  
interface GigabitEthernet0/1  
  no ip address  
  duplex auto  
  speed auto  
  shutdown  
!  
interface GigabitEthernet0/2  
  no ip address  
  duplex auto  
  speed auto  
  shutdown  
!  
interface Serial0/0/0
```

```
no ip address
clock rate 2000000
shutdown
!
interface Serial0/0/1
no ip address
clock rate 2000000
shutdown
!
interface Vlan1
no ip address
shutdown
!
router ospf 1
log-adjacency-changes
network 10.1.100.0 0.0.0.255 area 0
network 10.1.3.0 0.0.0.255 area 0
network 192.168.100.0 0.0.0.255 area 0
!
ip classless
!
ip flow-export version 9
!
!
!
!
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
login
!
!
!
end
```

منابع