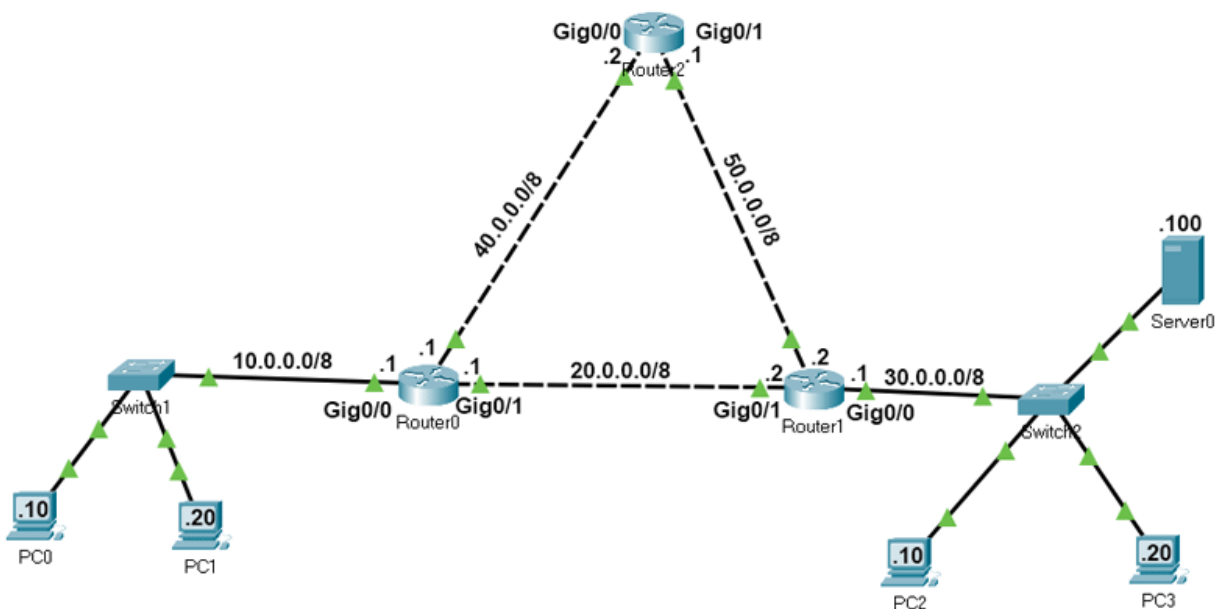


# Static and Dynamic Routing Configuration Guide with Examples

This lecture explains how to configure static and dynamic routing on routers. Learn how to create and manage static and dynamic routes on routers through a packet tracer example. Static routes are the routes you manually add to the router's routing table. The process of adding static routes to the routing table is known as static routing. Dynamic routing is all about configuring a network using dynamic routing protocols. Let's take a packet tracer example to understand how to use static and dynamic routing to create and add a static and dynamic route to the routing table.

## Setting up a practice lab

Create a packet tracer lab as shown in the following image or download the following pre-created lab and load it on Packet Tracer.



In this lab, each network has two routes to reach. We will configure one route as the main route and another route as the backup route. If the link bandwidth of all routes is the same, we use the route that has the least number of routers as the main route. If the link

bandwidth and the number of routers are the same, we can use any route as the main route and another route as the backup route.

If we specify two routes for the same destination, the router automatically selects the best route for the destination and adds the route to the routing table. If you manually want to select a route that the router should add to the routing table, you have to set the AD value of the route lower than other routes. For example, if you use the following commands to create two static routes for network 30.0.0/8, the route will place the first route to the routing table.

```
#ip route 30.0.0.0 255.0.0.0 20.0.0.2 10
#ip route 30.0.0.0 255.0.0.0 40.0.0.2 20
```

If the first route fails, the router automatically adds the second route to the routing table.

### Creating, adding, verifying static routes

Routers automatically learn their connected networks. We only need to add routes for the networks that are not available on the router's interfaces. For example, network 10.0.0.0/8, 20.0.0.0/8 and 40.0.0.0/8 are directly connected to Router0. Thus, we don't need to configure routes for these networks. Network 30.0.0.0/8 and network 50.0.0.0/8 are not available on Router0. We have to create and add routes only for these networks.

The following table lists the connected networks of each router.

Router	Available networks on local interfaces	Networks available on other routers' interfaces
Router0	10.0.0.0/8, 20.0.0.0/8, 40.0.0.0/8	30.0.0.0/8, 50.0.0.0/8
Router1	20.0.0.0/8, 30.0.0.0/8, 50.0.0.0/8	10.0.0.0/8, 40.0.0.0/8
Router2	40.0.0.0/8, 50.0.0.0/8	10.0.0.0/8, 20.0.0.0/8, 30.0.0.0/8

Let's create static routes on each router for networks that are not available on the router.

### ***Router0 requirements***

- Create two routes for network 30.0.0.0/8 and configure the first route (via -Router1) as the main route and the second route (via-Router2) as a backup route.
- Create two routes for the host 30.0.0.100/8 and configure the first route (via -Router2) as the main route and the second route (via-Router1) as a backup route.
- Create two routes for network 50.0.0.0/8 and configure the first route (via -Router2) as the main route and the second route (via-Router1) as a backup route.
- Verify the router adds only main routes to the routing table.

### ***Router0 configuration***

Access the CLI prompt of Router0 and run the following commands.

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 30.0.0.0 255.0.0.0 20.0.0.2 10
Router(config)#ip route 30.0.0.0 255.0.0.0 40.0.0.2 20
Router(config)#ip route 30.0.0.100 255.255.255.255 40.0.0.2 10
Router(config)#ip route 30.0.0.100 255.255.255.255 20.0.0.2 20
Router(config)#ip route 50.0.0.0 255.0.0.0 40.0.0.2 10
Router(config)#ip route 50.0.0.0 255.0.0.0 20.0.0.2 20
Router(config)#exit
Router#show ip route static
30.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
S 30.0.0.0/8 [10/0] via 20.0.0.2
S 30.0.0.100/32 [10/0] via 40.0.0.2
S 50.0.0.0/8 [10/0] via 40.0.0.2
Router#
```

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 30.0.0.0 255.0.0.0 20.0.0.2 10 Primary route
Router(config)#ip route 30.0.0.0 255.0.0.0 40.0.0.2 20 Backup route
Router(config)#ip route 30.0.0.100 255.255.255.255 40.0.0.2 10 Primary route
Router(config)#ip route 30.0.0.100 255.255.255.255 20.0.0.2 20 Backup route
Router(config)#ip route 50.0.0.0 255.0.0.0 40.0.0.2 10 Primary route
Router(config)#ip route 50.0.0.0 255.0.0.0 20.0.0.2 20 Backup route
Router(config)#exit
Router#show ip route static
      30.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
S       30.0.0.0/8 [10/0] via 20.0.0.2
S       30.0.0.100/32 [10/0] via 40.0.0.2
S       50.0.0.0/8 [10/0] via 40.0.0.2
Router#
```

Router adds only primary routes to the routing table.

### Router1 requirements

- Create two routes for network 10.0.0.0/8 and configure the first route (via -Router0) as the main route and the second route (via-Router1) as a backup route.
- Create two routes for network 40.0.0.0/8 and configure the first route (via -Router0) as the main route and the second route (via-Router2) as a backup route.
- Verify the router adds only main routes to the routing table.

### Router1 configuration

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 10.0.0.0 255.0.0.0 20.0.0.1 10
Router(config)#ip route 10.0.0.0 255.0.0.0 50.0.0.1 20
Router(config)#ip route 40.0.0.0 255.0.0.0 20.0.0.1 10
Router(config)#ip route 40.0.0.0 255.0.0.0 50.0.0.1 20
Router(config)#exit
Router#show ip route static
S 10.0.0.0/8 [10/0] via 20.0.0.1
S 40.0.0.0/8 [10/0] via 20.0.0.1
Router#
```

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 10.0.0.0 255.0.0.0 20.0.0.1 10 main route
Router(config)#ip route 10.0.0.0 255.0.0.0 50.0.0.1 20 backup route
Router(config)#ip route 40.0.0.0 255.0.0.0 20.0.0.1 10 main route
Router(config)#ip route 40.0.0.0 255.0.0.0 50.0.0.1 20 backup route
Router(config)#exit
Router#show ip route static
S    10.0.0.0/8 [10/0] via 20.0.0.1 } Only main routes are
S    40.0.0.0/8 [10/0] via 20.0.0.1 } added to the routing table.

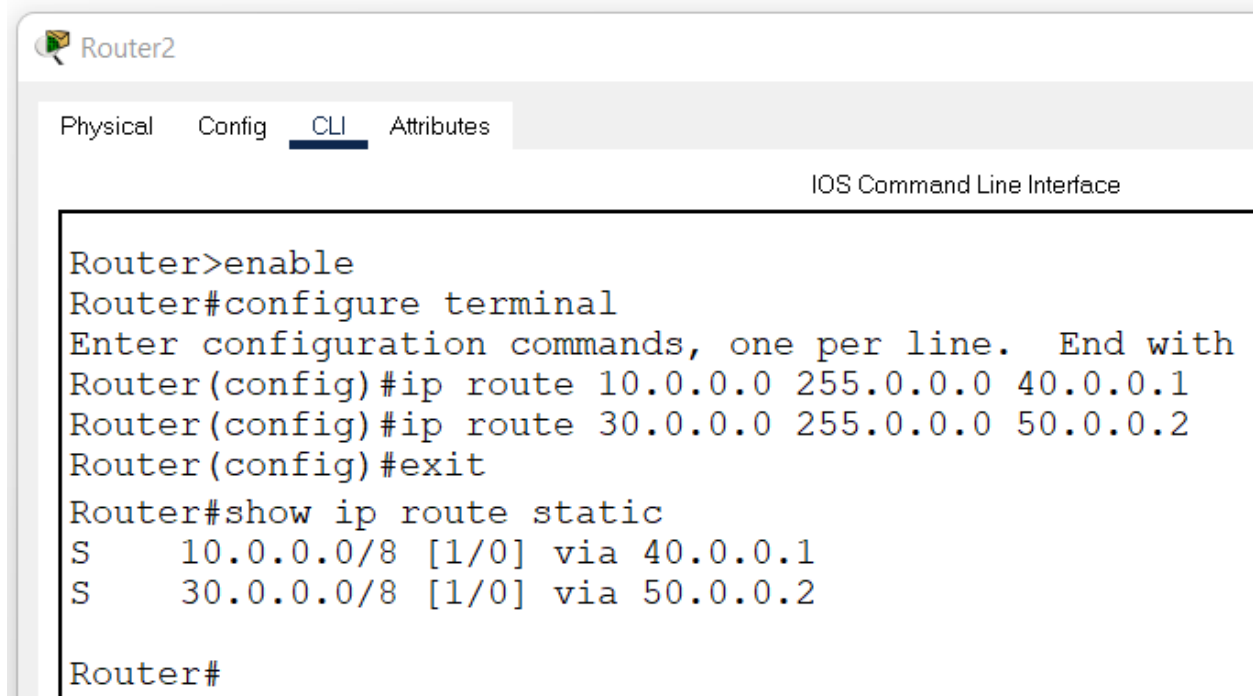
Router#
```

### ***Router2 requirements***

Create static routes for network 10.0.0.0/8 and network 30.0.0.0/8 and verify the router adds both routes to the routing table.

### ***Router2 configuration***

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 10.0.0.0 255.0.0.0 40.0.0.1
Router(config)#ip route 30.0.0.0 255.0.0.0 50.0.0.2
Router(config)#exit
Router#show ip route static
S 10.0.0.0/8 [1/0] via 40.0.0.1
S 30.0.0.0/8 [1/0] via 50.0.0.2
Router#
```



```
Router2
Physical  Config  CLI  Attributes
IOS Command Line Interface

Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with
Router(config)#ip route 10.0.0.0 255.0.0.0 40.0.0.1
Router(config)#ip route 30.0.0.0 255.0.0.0 50.0.0.2
Router(config)#exit
Router#show ip route static
S    10.0.0.0/8 [1/0] via 40.0.0.1
S    30.0.0.0/8 [1/0] via 50.0.0.2

Router#
```

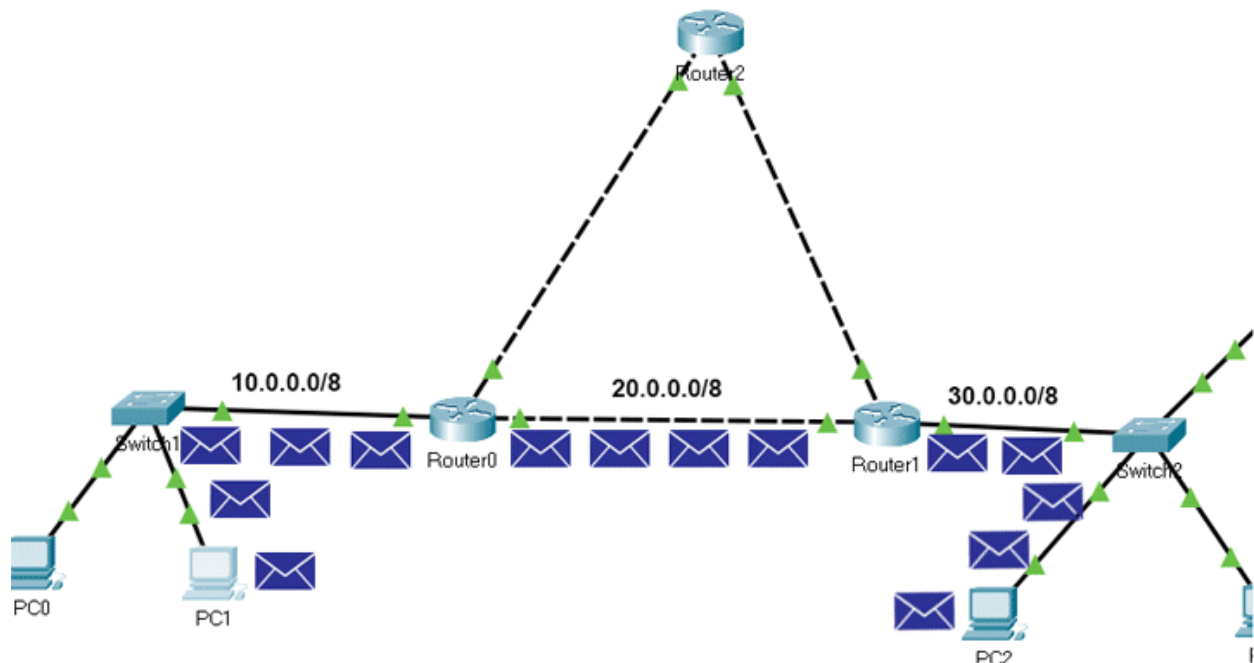
### Verifying static routing

On Router0, we configured two routes for network 30.0.0.0/8. These routes are via Router1 and via Router2. We set the first route (via-Router1) as the main route and the second route as the backup route. We can verify this configuration in two ways.

By sending ping requests to a PC of network 30.0.0.0/8 and tracing the path they take to reach the network 30.0.0.0/8. For this, you can use **'tracert'** command on a PC of network 10.0.0.0/8. The **'tracert'** command sends ping requests to the destination host and tracks the path they take to reach the destination.

By listing the routing table entries on Router0. Since a router uses the routing table to forward data packets, you can check the routing table to figure out the route the router uses to forward data packets for each destination.

The following image shows the above testing.



Router0

Physical Config CLI Attributes

IOS Command Line Interface

```
Router>enable
Router#show ip route static
    30.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
S      30.0.0.0/8 [10/0] via 20.0.0.2
S      30.0.0.100/32 [10/0] via 40.0.0.2
S      50.0.0.0/8 [10/0] via 40.0.0.2

Router#
```

PC1

Physical Config Desktop Programming Attributes

Command Prompt

```
C:\>tracert 30.0.0.20

Tracing route to 30.0.0.20 over a maximum of 30 hops:

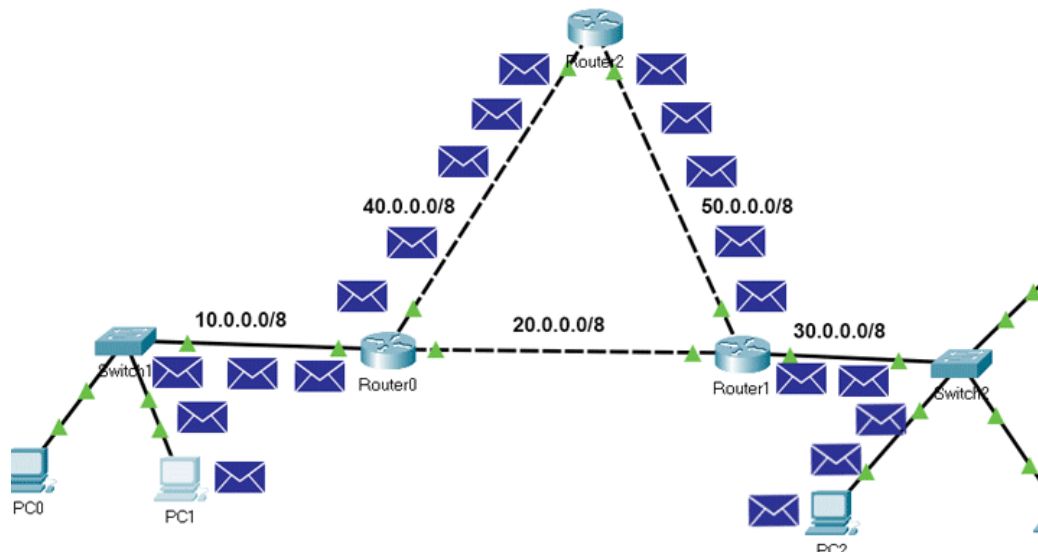
  1  0 ms      0 ms      0 ms      10.0.0.1
  2  0 ms      0 ms      0 ms      20.0.0.2
  3  *          0 ms      0 ms      30.0.0.20

Trace complete.

C:\>
```

We also configured a separate static host route for the host 30.0.0.100/8. The router must use this route to forward data packets to the host 30.0.0.100/8. To verify this, you can do the same testing for the host 30.0.0.100/8.

The following image shows this testing.



```
Router0
Physical Config CLI Attributes
IOS Command Line Interface

Router>enable
Router#show ip route static
    30.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
S      30.0.0.0/8 [10/0] via 20.0.0.2
S      30.0.0.100/32 [10/0] via 40.0.0.2
S      50.0.0.0/8 [10/0] via 40.0.0.2

Router#
```

```
PC1
Physical Config Desktop Programming Attributes

Packet Tracer PC Command Line 1.0
C:\>tracert 30.0.0.100

Tracing route to 30.0.0.100 over a maximum of 30 hops:

  1  1 ms    0 ms    0 ms    10.0.0.1
  2  *        0 ms    0 ms    40.0.0.2
  3  *        *      0 ms    20.0.0.2
  4  *        0 ms    0 ms    30.0.0.100

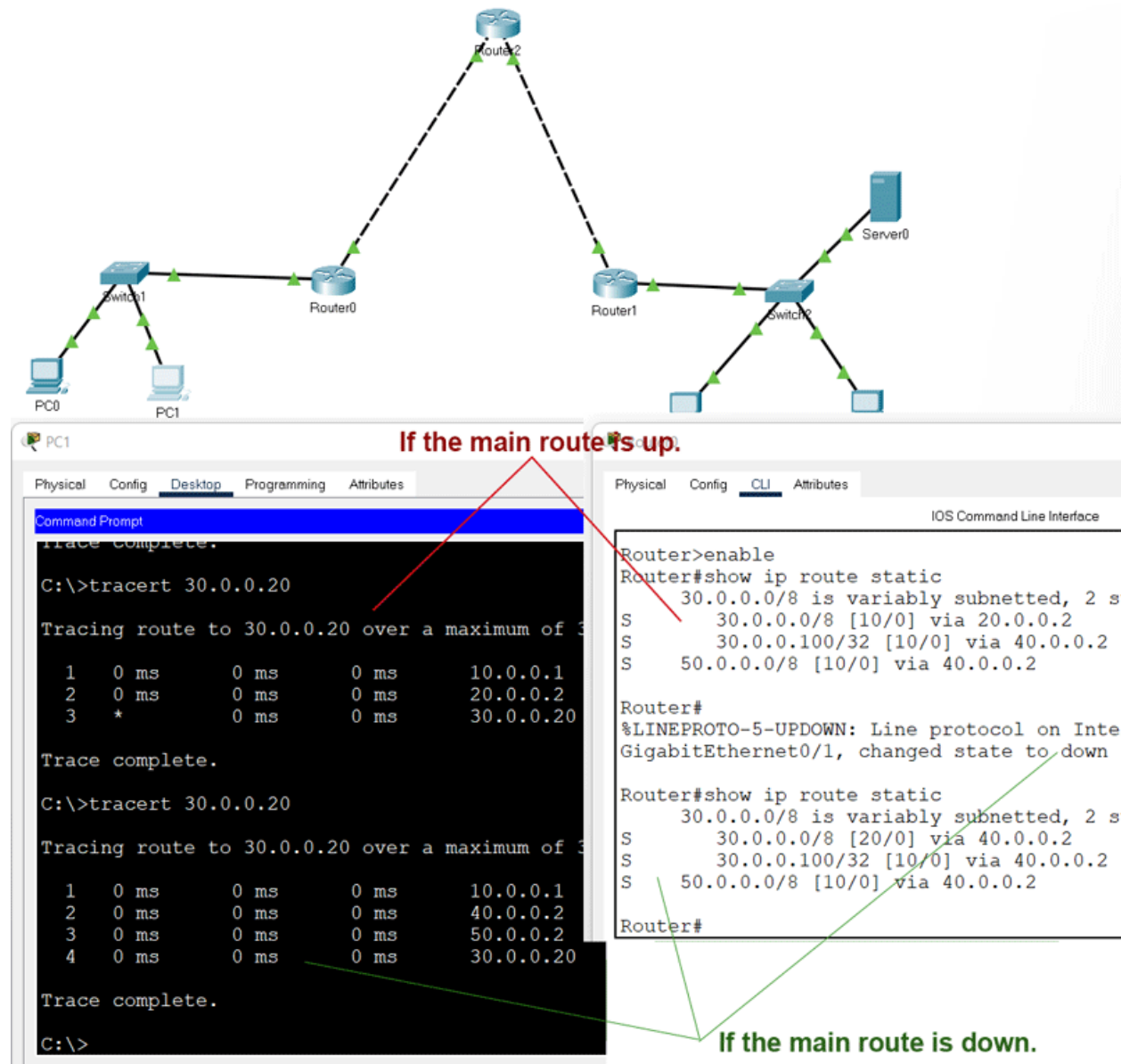
Trace complete.

C:\>
```



We also configured a backup route for network 30.0.0.0/8. The router must put the backup route to the routing table and use it to forward data packets to network 30.0.0.0/8 when the main route fails. To verify this, we have to simulate the failure of the main route.

To simulate the failure of the main route, you can delete the link between Router0 and Router1. After deleting the link, do the same testing again for the network 30.0.0.0/8.



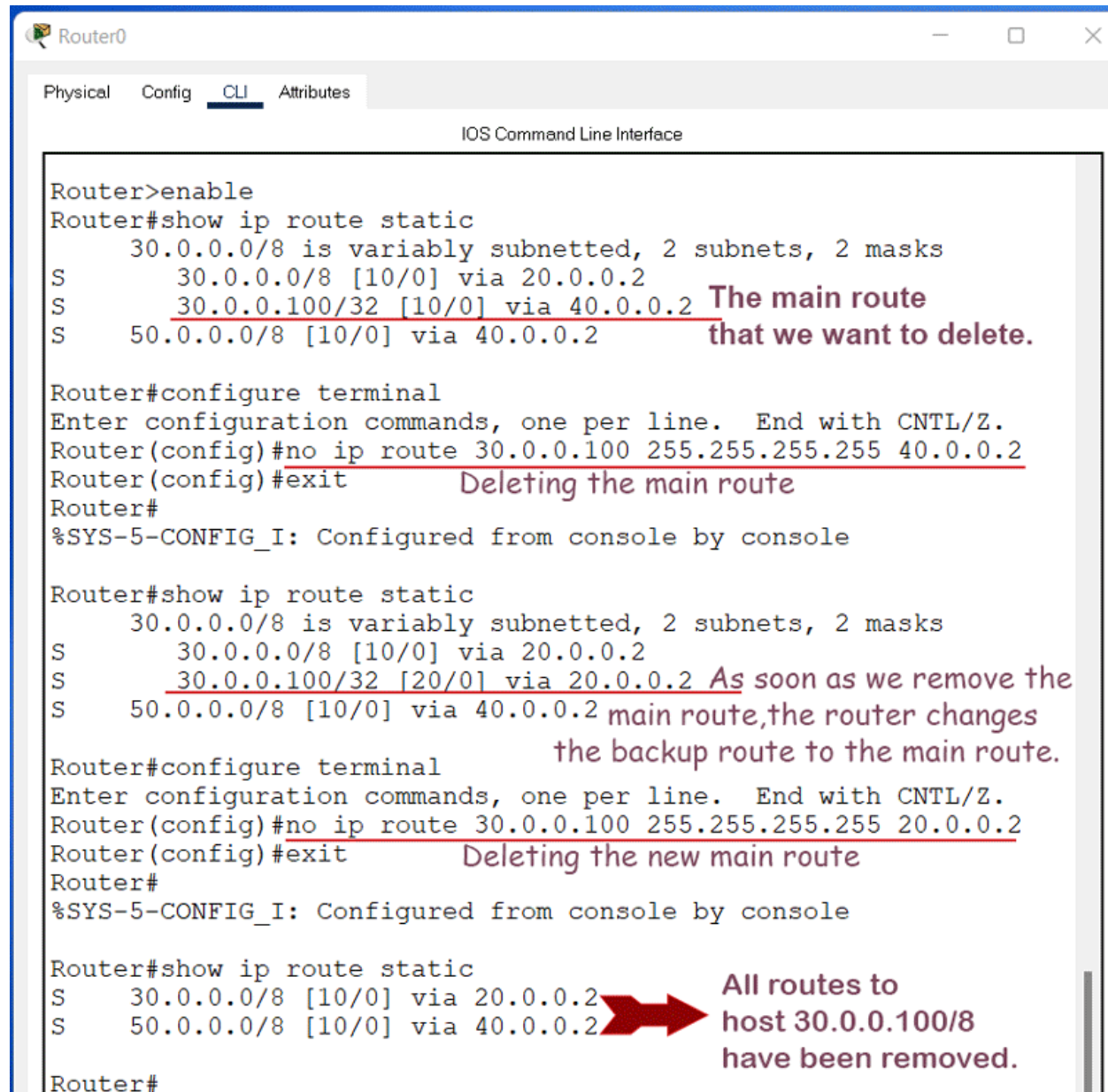
## Deleting a static route

To delete a static route, use the following steps.

- Use the '**show ip route static**' command to print all static routes.
- Note down the route you want to delete.
- Use the '**no ip route**' command to delete the route.

If you have a backup route, the backup route becomes the main route when you delete the main route.

In our example, we have a backup route and a main route for the host 30.0.0.100/8. The following image shows how to delete both routes.



```
Router0
Physical Config CLI Attributes
IOS Command Line Interface

Router>enable
Router#show ip route static
    30.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
S       30.0.0.0/8 [10/0] via 20.0.0.2
S       30.0.0.100/32 [10/0] via 40.0.0.2 The main route
S       50.0.0.0/8 [10/0] via 40.0.0.2 that we want to delete.

Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#no ip route 30.0.0.100 255.255.255.255 40.0.0.2
Router(config)#exit Deleting the main route
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#show ip route static
    30.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
S       30.0.0.0/8 [10/0] via 20.0.0.2
S       30.0.0.100/32 [20/0] via 20.0.0.2 As soon as we remove the
S       50.0.0.0/8 [10/0] via 40.0.0.2 main route, the router changes
the backup route to the main route.

Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#no ip route 30.0.0.100 255.255.255.255 20.0.0.2
Router(config)#exit Deleting the new main route
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#show ip route static
S       30.0.0.0/8 [10/0] via 20.0.0.2
S       50.0.0.0/8 [10/0] via 40.0.0.2
Router#
```

**All routes to host 30.0.0.100/8 have been removed.**

That's all for this lecture. In this lecture, we discussed static routing and learned how to create, add, and manage static routes on the router.