

Configuring a Gateway of Last Resort Using IP Commands

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Introduction

Default routes are used to direct packets addressed to networks not explicitly listed in the routing table.

Default routes are invaluable in topologies where learning all the more specific networks is not desirable, as in case of stub networks, or not feasible due to limited system resources such as memory and processing power.

This document explains how to configure a default route, or gateway of last resort. These IP commands are used:

- **ip default-gateway**
- **ip default-network**
- **and ip route 0.0.0.0 0.0.0.0**

Prerequisites

Requirements

There are no specific requirements for this document.

Components Used

This document is not restricted to specific software and hardware versions. The command outputs shown are from the Cisco 2500 Series routers running Cisco IOS® Software Release 12.2(24a).

The information presented in this document was created from devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If you are working in a live network, ensure that you understand the potential impact of any command before using it.

Conventions

For more information on document conventions, see the Cisco Technical Tips Conventions.

ip default-gateway

The **ip default-gateway** command differs from the other two commands. It should only be used when **ip routing** is disabled on the Cisco router.

For instance, if the router is a host in the IP world, you can use this command to define a default gateway for it. You might also use this command when your low end Cisco router is in boot mode in order to TFTP a Cisco IOS® Software image to the router. In boot mode, the router does not have **ip routing** enabled.

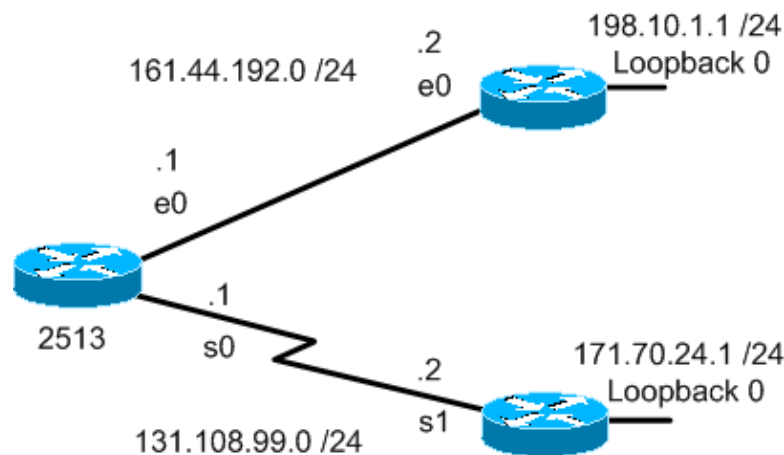
This example defines the router on IP address 172.16.15.4 as the default route:

```
ip default-gateway 172.16.15.4
```

ip default-network

Unlike the **ip default-gateway** command, you can use **ip default-network** when **ip routing** is enabled on the Cisco router. When you configure **ip default-network** the router considers routes to that network for installation as the gateway of last resort on the router.

For every network configured with **ip default-network**, if a router has a route to that network, that route is flagged as a candidate default route. This network diagram displays the routing table taken from router 2513:



```
2513#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, su - IS-IS summary, 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
```

```
    161.44.0.0/24 is subnetted, 1 subnets
C       161.44.192.0 is directly connected, Ethernet0
    131.108.0.0/24 is subnetted, 1 subnets
C       131.108.99.0 is directly connected, Serial0
S       198.10.1.0/24 [1/0] via 161.44.192.2
```

Note the static route to 198.10.1.0 via 161.44.192.2 and that the gateway of last resort is not set. If you configure **ip default-network 198.10.1.0**, the routing table changes to this:

```
2513#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, su - IS-IS summary, 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 161.44.192.2 to network 198.10.1.0
```

```
      161.44.0.0/24 is subnetted, 1 subnets
C      161.44.192.0 is directly connected, Ethernet0
      131.108.0.0/24 is subnetted, 1 subnets
C      131.108.99.0 is directly connected, Serial0
S*    198.10.1.0/24 [1/0] via 161.44.192.2
R1#
2513#show ip protocols
2513#
```

The gateway of last resort is now set as 161.44.192.2. This result is independent of any routing protocol, as shown by the **show ip protocols** command at the bottom of the output.

You can add another candidate default route by configuring another instance of **ip default-network**:

```
2513#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
2513(config)#ip route 171.70.24.0 255.255.255.0 131.108.99.2
2513(config)#ip default-network 171.70.24.0
2513(config)#^Z
```

```
2513#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, su - IS-IS summary, 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 161.44.192.2 to network 198.10.1.0
```

```
      171.70.0.0/16 is variably subnetted, 2 subnets, 2 masks
S      171.70.0.0/16 [1/0] via 171.70.24.0
S      171.70.24.0/24 [1/0] via 131.108.99.2
      161.44.0.0/24 is subnetted, 1 subnets
C      161.44.192.0 is directly connected, Ethernet0
      131.108.0.0/24 is subnetted, 1 subnets
C      131.108.99.0 is directly connected, Serial0
S*    198.10.1.0/24 [1/0] via 161.44.192.2
```

After the **ip default-network** command was entered in the output above, the network was not flagged as a default network. The Flag a Default Network section explains why.

Flag a Default Network

Note: The **ip default-network** command is classful. This means that if the router has a route to the subnet indicated by this command, it installs the route to the major net. At this point neither network has been flagged as the default network. The **ip default-network** command must be issued again, using the major net, in order to flag the candidate default route.

```

2513#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
2513(config)#ip default-network 171.70.0.0
2513(config)#^Z

2513#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, su - IS-IS summary, 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 171.70.24.0 to network 171.70.0.0

*    171.70.0.0/16 is variably subnetted, 2 subnets, 2 masks
S*    171.70.0.0/16 [1/0] via 171.70.24.0
S    171.70.24.0/24 [1/0] via 131.108.99.2
    161.44.0.0/24 is subnetted, 1 subnets
C    161.44.192.0 is directly connected, Ethernet0
    131.108.0.0/24 is subnetted, 1 subnets
C    131.108.99.0 is directly connected, Serial0
S*   198.10.1.0/24 [1/0] via 161.44.192.2

```

If the original static route had been to the major network, the extra step of configuring the default network twice would not have been necessary.

There are still no IP protocols running here. Without any dynamic protocols running, you can configure your router to choose from a number of candidate default routes based on whether the routing table has routes to networks other than 0.0.0.0/0. The **ip default-network** command allows you to configure robustness into the selection of a gateway of last resort. Rather than configuring static routes to specific next-hops, you can have the router choose a default route to a particular network by checking in the routing table.

If you lose the route to a particular network, the router selects the other candidate default. You can remove the lost route by removing the static route in the configuration as follows:

```

2513#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.

2513(config)#no ip route 171.70.24.0 255.255.255.0 131.108.99.2
2513(config)#^Z
2513#
%SYS-5-CONFIG_I: Configured from console by console

```

After you remove the static route to the default network, the routing table looks like this:

```

2513#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, su - IS-IS summary, 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 161.44.192.2 to network 198.10.1.0

    161.44.0.0/24 is subnetted, 1 subnets
C    161.44.192.0 is directly connected, Ethernet0
    131.108.0.0/24 is subnetted, 1 subnets

```

```
C      131.108.99.0 is directly connected, Serial0
S*    198.10.1.0/24 [1/0] via 161.44.192.2
2513#
```

Use Different Routing Protocols

Gateways of last resort selected using the **ip default-network** command are propagated differently depending on which routing protocol is propagating the default route. For IGRP and EIGRP to propagate the route, the network specified by the **ip default-network** command must be known to IGRP or EIGRP. This means the network must be an IGRP- or EIGRP-derived network in the routing table, or the static route used to generate the route to the network must be redistributed into IGRP or EIGRP, or advertised into these protocols using the **network** command.

RIP advertises a route to 0.0.0.0 if a gateway of last resort is selected using the **ip default-network** command. This network specified in the **ip default-network** command need not be explicitly advertised under RIP. For example, note that the gateway of last resort on this router was learned using the combination of the **ip route** and **ip default-network** commands. If you enable RIP on this router, RIP advertises a route to 0.0.0.0 (although not to the Ethernet0 network because of split-horizon):

```
2513(config)#router rip
2513(config-router)#network 161.44.0.0
2513(config-router)#network 131.108.0.0
2513(config-router)#^Z
2513#
%SYS-5-CONFIG_I: Configured from console by console
2513#debug ip rip

*Mar  2 07:39:35.504: RIP: sending v1 update to 255.255.255.255 via Ethernet0 (161.44.192.1)
*Mar  2 07:39:35.508: RIP: build update entries
*Mar  2 07:39:35.508:   network 131.108.0.0 metric 1
*Mar  2 07:39:35.512: RIP: sending v1 update to 255.255.255.255 via Serial0 (131.108.99.1)
*Mar  2 07:39:35.516: RIP: build update entries
*Mar  2 07:39:35.520:   subnet 0.0.0.0 metric 1
*Mar  2 07:39:35.524:   network 161.44.0.0 metric 1
```

The default route announced using the **ip default-network** command is not propagated by Open Shortest Path First (OSPF). For more detailed information on behavior of default routes with OSPF, refer to [How Does OSPF Generate Default Routes?](#).

The default route announced using the **ip default-network** command is not propagated by IS-IS.

ip route 0.0.0.0 0.0.0.0

Creating a static route to network 0.0.0.0 0.0.0.0 is another way to set the gateway of last resort on a router. As with the **ip default-network** command, using the static route to 0.0.0.0 is not dependent on any routing protocols. However, **ip routing** must be enabled on the router.

Note: IGRP does not understand a route to 0.0.0.0. Therefore, it cannot propagate default routes created using the **ip route 0.0.0.0 0.0.0.0** command. Use the **ip default-network** command to have IGRP propagate a default route.

EIGRP propagates a route to network 0.0.0.0, but the static route must be redistributed into the routing protocol.

In earlier versions of RIP, the default route created using the **ip route 0.0.0.0 0.0.0.0** was automatically advertised by RIP routers. In Cisco IOS Software Release 12.0T and later, RIP does not advertise the default route if the route is not learned via RIP. It may be necessary to redistribute the route into RIP.

The default routes created using the **ip route 0.0.0.0 0.0.0.0** command are not propagated by OSPF and IS-IS. Additionally, this default cannot be redistributed into OSPF or IS-IS using the **redistribute** command. Use the **default-information originate** command to generate a default route into an IS-IS or OSPF routing domain. For more detailed information on behavior of default routes with OSPF, refer to [How Does OSPF Generate Default Routes?](#)

This is an example of configuring a gateway of last resort using the **ip route 0.0.0.0 0.0.0.0** command:

```
router-3#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
router-3(config)#ip route 0.0.0.0 0.0.0.0 170.170.3.4
router-3(config)#^Z
router-3#

router-3#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, * - candidate default
U - per-user static route, o - ODR

Gateway of last resort is 170.170.3.4 to network 0.0.0.0

170.170.0.0/24 is subnetted, 2 subnets
C 170.170.2.0 is directly connected, Serial0
C 170.170.3.0 is directly connected, Ethernet0
S* 0.0.0.0/0 [1/0] via 170.170.3.4
router-3#
router-3#
```

Note: If you configure multiple networks as candidate default routes using the **ip default-network** command, the network that has the lowest administrative distance is chosen as the network for the gateway of last resort. If all the networks have the same administrative distance then the network listed first in the routing table (**show ip route** lists the routing table) is chosen as the network for the gateway of last resort. If you use both the **ip default-network** and **ip route 0.0.0.0 0.0.0.0** commands to configure candidate default networks, and the network used by the **ip default-network** command is known statically, the network defined with the **ip default-network** command takes precedence and is chosen for the gateway of last resort. Otherwise if the network used by the **ip default-network** command is derived by a routing protocol, the **ip route 0.0.0.0 0.0.0.0** command, which has a lower administrative distance, takes precedence and is chosen for the gateway of last resort. If you use multiple **ip route 0.0.0.0 0.0.0.0** commands to configure a default route, traffic is load-balanced over the multiple routes.

Summary

Use the **ip default-gateway** command when **ip routing** is disabled on a Cisco router. Use the **ip default-network** and **ip route 0.0.0.0 0.0.0.0** commands to set the gateway of last resort on Cisco routers that have **ip routing** enabled. The way in which routing protocols propagate the default route information varies for each protocol.

Related Information

- [IP Routed Protocols Technology Support Page](#)
 - [Technical Support – Cisco Systems](#)
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