Basic Routing

REFERENCE GUIDE
Forwarding and Routing
Static Routes
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Quick Reference to Commands

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show ip forwarding ......................................................... 5
show ip route ............................................................... 6
show ip route <ipv4net> longer-prefixes .................................... 8
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show ip route connected ......................................................... 11
show ip route forward ................................................................ 12
show ip route kernel ................................................................ 14
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show ip route summary ................................................................ 16
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Quick List of Examples

Use this list to help you locate examples you’d like to try or look at.

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Example 2-1  Creating a static route .................................................................................. 21
Example 2-2  Showing static routes in the routing table ................................................... 22
This guide describes basic routing and forwarding commands, such as commands for showing forwarding and routing tables in various ways. It also describes the available commands and provides configuration examples for static routes.

This preface provides information about using this guide. The following topics are covered:

- Intended Audience
- Organization of This Guide
- Document Conventions
- Vyatta Publications
Intended Audience

This guide is intended for experienced system and network administrators. Depending on the functionality to be used, readers should have specific knowledge in the following areas:

- Networking and data communications
- TCP/IP protocols
- General router configuration
- Routing protocols
- Network administration
- Network security

Organization of This Guide

This guide has the following aid to help you find the information you are looking for:

- Quick Reference to Commands
  Use this section to help you quickly locate a command.
- Quick List of Examples
  Use this list to help you locate examples you’d like to try or look at.

This guide has the following chapters:

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Document Conventions

This guide contains advisory paragraphs and uses typographic conventions.

Advisory Paragraphs

This guide uses the following advisory paragraphs:
Warnings alert you to situations that may pose a threat to personal safety, as in the following example:

**WARNING** Switch off power at the main breaker before attempting to connect the remote cable to the service power at the utility box.

Cautions alert you to situations that might cause harm to your system or damage to equipment, or that may affect service, as in the following example:

**CAUTION** Restarting a running system will interrupt service.

Notes provide information you might need to avoid problems or configuration errors:

**NOTE** You must create and configure network interfaces before enabling them for routing protocols.

### Typographic Conventions

This document uses the following typographic conventions:

<table>
<thead>
<tr>
<th><strong>Monospace</strong></th>
<th>Examples, command-line output, and representations of configuration nodes.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>bold</strong></td>
<td><strong>Monospace</strong></td>
</tr>
<tr>
<td><strong>bold</strong></td>
<td>Commands, keywords, and file names, when mentioned inline.</td>
</tr>
<tr>
<td></td>
<td>Objects in the user interface, such as tabs, buttons, screens, and panes.</td>
</tr>
<tr>
<td><strong>italics</strong></td>
<td>An argument or variable where you supply a value.</td>
</tr>
<tr>
<td><code>&lt;key&gt;</code></td>
<td>A key on your keyboard, such as <code>&lt;Enter&gt;</code>. Combinations of keys are joined by plus signs (“+”), as in <code>&lt;Ctrl&gt;+c</code>.</td>
</tr>
<tr>
<td>`arg1</td>
<td>arg2`</td>
</tr>
<tr>
<td><code>num1–numN</code></td>
<td>A inclusive range of numbers. An example is 1–65535, which means 1 through 65535, inclusive.</td>
</tr>
<tr>
<td><code>arg1..argN</code></td>
<td>A range of enumerated values. An example is eth0..eth3, which means eth0, eth1, eth2, or eth3.</td>
</tr>
<tr>
<td><code>arg[ arg...]</code></td>
<td>A value that can optionally represent a list of elements (a space-separated list in the first case and a comma-separated list in the second case).</td>
</tr>
</tbody>
</table>

Full product documentation is provided in the Vyatta technical library. To see what documentation is available for your release, see the Guide to Vyatta Documentation. This guide is posted with every release of Vyatta software and provides a great starting point for finding the information you need.
Chapter 1: Forwarding and Routing

This chapter describes commands for forwarding and basic routing.

This chapter presents the following topics:

- Forwarding and Routing Commands
Forwarding and Routing Commands

This chapter contains the following commands.

**Configuration Commands**

None

**Operational Commands**

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
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<tr>
<td>clear ip prefix-list</td>
<td>Clears prefix list statistics or status.</td>
</tr>
<tr>
<td>clear ip route cache</td>
<td>Flushes the kernel route cache.</td>
</tr>
<tr>
<td>show ip forwarding</td>
<td>Displays IP forwarding status.</td>
</tr>
<tr>
<td>show ip route</td>
<td>Displays routes stored in the RIB and FIB.</td>
</tr>
<tr>
<td>show ip route &lt;ipv4net&gt; longer-prefixes</td>
<td>Displays prefixes longer than a specified prefix.</td>
</tr>
<tr>
<td>show ip route cache</td>
<td>Displays the kernel route cache.</td>
</tr>
<tr>
<td>show ip route connected</td>
<td>Displays directly connected routes.</td>
</tr>
<tr>
<td>show ip route forward</td>
<td>Displays routes stored in the FIB.</td>
</tr>
<tr>
<td>show ip route static</td>
<td>Displays static routes.</td>
</tr>
<tr>
<td>show ip route kernel</td>
<td>Displays kernel routes.</td>
</tr>
<tr>
<td>show ip route summary</td>
<td>Displays routes summary.</td>
</tr>
<tr>
<td>show ip route supernets-only</td>
<td>Displays supernet routes.</td>
</tr>
<tr>
<td>show table</td>
<td>Displays the system's routing table.</td>
</tr>
</tbody>
</table>
clear ip prefix-list

Clears prefix list statistics or status.

Syntax

clear ip prefix-list [list-name [ipv4net]]

Command Mode

Operational mode.

Parameters

<table>
<thead>
<tr>
<th>list-name</th>
<th>Optional. Clears statistics for the specified prefix list.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ipv4net</td>
<td>Optional. Clears statistics for the specified network.</td>
</tr>
</tbody>
</table>

Default

Statistics for all prefix-lists are cleared.

Usage Guidelines

Use this command to clear prefix list statistics or status.
clear ip route cache

Flushes the kernel route cache.

**Syntax**

`clear ip route cache [ipv4net]`

**Command Mode**

Operational mode.

**Parameters**

<table>
<thead>
<tr>
<th>ipv4net</th>
<th>Optional. Flushes the specified route from the kernel route cache.</th>
</tr>
</thead>
</table>

**Default**

Flushes the entire route cache.

**Usage Guidelines**

Use this command to flush the kernel route cache or to flush a specific route from the cache.
show ip forwarding

Displays IP forwarding status.

Syntax

show ip forwarding

Command Mode

Operational mode.

Parameters

None.

Default

None.

Usage Guidelines

Use this command to display the current IP forwarding status.

Examples

Example 1-1 shows how to display the status of IP forwarding.

Example 1-1  Displaying IP forwarding status

vyatta@vyatta:~$  show ip forwarding
IP forwarding is on
vyatta@vyatta:~$
**show ip route**

Displays routes stored in the RIB and FIB.

**Syntax**

```
show ip route [ipv4 | ipv4net]
```

**Command Mode**

Operational mode.

**Parameters**

- `ipv4` Optional. Displays routing information for the specified address.
- `ipv4net` Optional. Displays routing information for the specified prefix.

**Default**

Lists all routes in the RIB and FIB.

**Usage Guidelines**

Use this command to display active prefixes stored in the Routing Information Base (RIB), as well as those stored in the Forwarding Information Base (FIB).

The routes shown in the FIB can also be seen using the `show ip route forward` command (see page 12).

**Examples**

Example 1-2 shows how to display routes in the RIB and FIB

**Example 1-2  Displaying routes in the RIB and FIB**

```
vty@vtya:-$ show ip route
Codes: K - kernel route, C - connected, S - static, R - RIP, O - OSPF,
       I - ISIS, B - BGP, > - selected route, * - FIB route
S>* 0.0.0.0/0 [1/0] via 10.1.0.1, eth0
O  10.1.0.0/24 [110/10] is directly connected, eth0, 05:35:15
C>* 10.1.0.0/24 is directly connected, eth0
O>* 10.192.32.0/24 [110/20] via 10.1.0.45, eth0, 05:35:15
O>* 10.192.128.0/24 [110/11] via 10.1.0.66, eth0, 05:35:15
O>* 10.192.128.1/32 [110/11] via 10.1.0.66, eth0, 05:35:15
O>* 10.192.129.0/24 [110/11] via 10.1.0.66, eth0, 05:35:15
```
Example 1-3 shows information how to display information for the route to address 10.192.128.1.

Example 1-3  Displaying routing information about a specific address

vyatta@vyatta:~$ show ip route 10.192.128.1
Routing entry for 10.192.128.1/32
   Known via "ospf", distance 110, metric 11, best
   Last update 09:47:07 ago
   * 10.1.0.66, via eth0
vyatta@vyatta:~$
show ip route <ipv4net> longer-prefixes

Displays prefixes longer than a specified prefix.

Syntax

    show ip route ipv4net longer-prefixes

Command Mode

    Operational mode.

Parameters

    ipv4net          Mandatory. Displays all prefixes longer than the specified prefix.

Default

    None.

Usage Guidelines

    Use this command to display all prefixes in the Routing Information Base (RIB) that are longer than a given IP address or prefix.

Examples

    Example 1-4 shows how to list prefixes longer than the prefix 10.192.128.0/24.

Example 1-4   Displaying routes with longer prefixes

    vyatta@vyatta:-$ show ip route 10.192.128.0/24 longer-prefixes
    Codes: K - kernel route, C - connected, S - static, R - RIP, O - OSPF,
           I - ISIS, B - BGP, > - selected route, * - FIB route

    O>* 10.192.128.0/24 [110/11] via 10.1.0.66, eth0, 09:36:20
    O>* 10.192.128.1/32 [110/11] via 10.1.0.66, eth0, 09:36:20
    vyatta@vyatta:-$
show ip route cache

Displays the kernel route cache.

Syntax

show ip route cache [ipv4net]

Command Mode

Operational mode.

Parameters

<table>
<thead>
<tr>
<th>ipv4net</th>
<th>Optional. Displays kernel route cache information for the specified route.</th>
</tr>
</thead>
</table>

Default

Lists routes in the kernel route cache.

Usage Guidelines

Use this command to display information about routes stored in the kernel route cache. The route cache contains all paths currently in use by the cache. Multiple equal-cost paths are necessary before equal-cost-multi-path (ECMP) routing can be performed.

Examples

Example 1-5 shows how to list routes in the kernel route cache.

Example 1-5  Listing routes in the kernel route cache

vyatta@vyatta:~$ show ip route cache
local 10.1.0.62 from 10.1.0.1 dev lo  src 10.1.0.62
cache <local,src-direct>  users 1 age 42sec iif eth0
multicast 224.0.0.5 from 10.1.0.45 dev lo  src 10.1.0.62
cache <local,mc>  users 1 used 8 age 5sec iif eth0
local 10.1.0.62 from 69.59.150.131 dev lo  src 10.1.0.62
cache <local>  users 1 used 3 age 47sec iif eth0
10.1.0.1 from 10.1.0.62 dev eth0
cache users 1 age 42sec mtu 1500 advmss 1460 hoplimit 64
10.0.0.30 from 10.1.0.62 tos lowdelay via 10.1.0.1 dev eth0
cache users 2 age 0sec mtu 1500 advmss 1460 hoplimit 64
multicast 224.0.0.5 from 10.1.0.56 dev lo  src 10.1.0.62
cache <local,mc>  users 1 used 8 age 8sec iif eth0
multicast 224.0.0.5 from 10.1.0.66 dev lo  src 10.1.0.62
Example 1-6 shows how to display information about route 10.1.0.62 in the kernel route cache.

Example 1-6  Displaying information about a route in the kernel route cache

```bash
vyatta@vyatta:~$ show ip route cache 10.1.0.62
local 10.1.0.62 from 10.1.0.1 dev lo  src 10.1.0.62
  cache <local,src-direct>  users 1 used 3 age 9sec iif eth0
local 10.1.0.62 from 69.59.150.131 dev lo  src 10.1.0.62
  cache <local>  users 1 used 7 age 102sec iif eth0
local 10.1.0.62 from 10.0.0.30 tos lowdelay dev lo  src 10.1.0.62
  cache <local>  users 1 used 33 iif eth0
vyatta@vyatta:~$
```
**show ip route connected**

Displays directly connected routes.

**Syntax**

```
show ip route connected
```

**Command Mode**

Operational mode.

**Parameters**

None.

**Default**

None.

**Usage Guidelines**

Use this command to display routes directly connected to the local system.

**Examples**

Example 1-7 shows how to list directly connected routes.

```
Example 1-7   Displaying connected routes
vyatta@vyatta:~$   show ip route connected
Codes: K - kernel route, C - connected, S - static, R - RIP, O - OSPF,
       I - ISIS, B - BGP, > - selected route, * - FIB route

C>* 10.1.0.0/24 is directly connected, eth0
C>* 127.0.0.0/8 is directly connected, lo
C>* 172.16.234.0/25 is directly connected, eth1
vyatta@vyatta:~$
```
show ip route forward

Displays routes stored in the FIB.

Syntax

```
show ip route forward [ipv4net]
```

Command Mode

Operational mode.

Parameters

<table>
<thead>
<tr>
<th>ipv4net</th>
<th>Optional. Displays information from the kernel forwarding table for the specified route.</th>
</tr>
</thead>
</table>

Default

Lists routes in the FIB.

Usage Guidelines

Use this command to display the FIB.

The FIB contains multiple equal-cost paths if existed. Multiple equal-cost paths are necessary before equal-cost multi-path (ECMP) routing or WAN load balancing can be performed.

Examples

Example 1-8 shows how to display routes recorded in the FIB.

Example 1-8  Displaying routes in the FIB

```
vytta@vyatta:~$ show ip route forward
default via 10.1.0.1 dev eth0  proto zebra
10.1.0.0/24 dev eth0  proto kernel  scope link  src 10.1.0.62
10.192.32.0/24 via 10.1.0.45 dev eth0  proto zebra  metric 20
10.192.128.0/24 via 10.1.0.66 dev eth0  proto zebra  metric 11
10.192.128.1 via 10.1.0.66 dev eth0  proto zebra  metric 11
10.192.129.0/24 via 10.1.0.66 dev eth0  proto zebra  metric 11
10.192.130.0/24 via 10.1.0.66 dev eth0  proto zebra  metric 11
10.192.131.0/24 via 10.1.0.66 dev eth0  proto zebra  metric 11
172.16.0.0/24 via 10.1.0.4 dev eth0  proto zebra  metric 11
172.16.1.0/24 via 10.1.0.4 dev eth0  proto zebra  metric 11
172.16.2.0/24 via 10.1.0.4 dev eth0  proto zebra  metric 11
172.16.3.0/24 via 10.1.0.4 dev eth0  proto zebra  metric 11
```
Example 1-9 shows how to display information from the FIB about route 10.1.0.0/24.

Example 1-9  Displaying information about a route in the FIB

    vyatta@vyatta:~$ show ip route forward 10.1.0.0/24
    10.1.0.0/24 dev eth0  proto kernel  scope link  src 10.1.0.62
    vyatta@vyatta:~$
**show ip route kernel**

Displays kernel routes.

**Syntax**

```
show ip route kernel
```

**Command Mode**

Operational mode.

**Parameters**

None.

**Default**

None.

**Usage Guidelines**

Use this command to display kernel routes. Kernel routes are routes that have been added through means other than by using the Vyatta CLI; for example by using the operating system route command, as in the following:

```
route add -net 10.172.24.0 netmask 255.255.255.0 gw 10.1.0.1
```

**Examples**

Example 1-10 shows how to display kernel routes.

**Example 1-10  Displaying kernel routes**

```
vyatta@vyatta:$  show ip route kernel
Codes: K - kernel route, C - connected, S - static, R - RIP, O - OSPF,
        I - ISIS, B - BGP, > - selected route, * - FIB route

K>* 10.172.24.0/24 via 10.1.0.1, eth0
vyatta@vyatta:$
```
**show ip route static**

Displays static routes.

**Syntax**

```
show ip route static
```

**Command Mode**

Operational mode.

**Parameters**

None.

**Default**

None.

**Usage Guidelines**

Use this command to display static routes in the Routing Information Base (RIB).

**Examples**

Example 1-11 shows how to list static routes.

**Example 1-11  Displaying static routes**

```
vtyta@vyatta:~$ show ip route static
Codes: K - kernel route, C - connected, S - static, R - RIP, O - OSPF,
       I - ISIS, B - BGP, > - selected route, * - FIB route

S>* 0.0.0.0/0 [1/0] via 10.1.0.1, eth0
S>* 192.94.202.0/24 [1/0] via 172.16.234.27, eth1
vyatta@vyatta:~$
```
show ip route summary

Displays routes summary.

**Syntax**

```
show ip route summary
```

**Command Mode**

Operational mode.

**Parameters**

None.

**Default**

None.

**Usage Guidelines**

Use this command to display a summary of the various routes by route source.

**Examples**

Example 1-12 shows how to display a summary of routes.

**Example 1-12  Displaying a summary of routes**

```
vyatta@vyatta:-$ show ip route summary
Route Source         Routes               FIB
connected            4                    4
static               2                    2
ospf                 1                    0
ebgp                 0                    0
ibgp                 289016               289011
------
Totals               289023               289017
```

[edit]

vyatta@vyatta:-$
show ip route supernets-only

Displays supernet routes.

Syntax

show ip route supernets-only

Command Mode

Operational mode.

Parameters

None.

Default

None.

Usage Guidelines

Use this command to display supernet routes.

Supernet routes are routes that have a subnet mask that is less specific than the natural classful mask.

Examples

Example 1-13 shows how to list supernet routes.

Example 1-13  Displaying supernet routes

vyatta@vyatta:-$  show ip route supernets-only
Codes: K - kernel route, C - connected, S - static, R - RIP, O - OSPF,
       I - ISIS, B - BGP, > - selected route, * - FIB route

S>* 0.0.0.0/0 [1/0] via 10.1.0.1, eth0
vyatta@vyatta:-$
**show table**

Displays the system’s routing table.

**Syntax**

```
show table
```

**Command Mode**

Operational mode.

**Parameters**

None.

**Default**

None.

**Usage Guidelines**

Use this command to display the system’s routing table.

**Examples**

Example 1-14 shows how to display the routing table.

**Example 1-14  Displaying the routing table**

```
vtyatta@vyatta:-$ show table
table 0
vyatta@vyatta:-$
```
Chapter 2: Static Routes

This chapter explains how to set static routes using the Vyatta system.

This chapter presents the following topics:

• Static Route Configuration
• Static Route Commands
Static Route Configuration

This section presents the following topics:

• Static Routes Overview
• Configuring Static Routes
• Floating Static Routes

Static Routes Overview

A static route is a manually configured route, which, in general, cannot be updated dynamically from information the Vyatta system learns about the network topology. However, if a link fails, the router will remove routes, including static routes, from the Routing Information Base (RIB) that used this interface to reach the next hop.

In general, static routes should only be used for very simple network topologies, or to override the behavior of a dynamic routing protocol for a small number of routes.

The collection of all routes the router has learned from its configuration or from its dynamic routing protocols is stored in its Routing Information Base (RIB).

Unicast routes are directly used to determine the forwarding table used for unicast packet forwarding.
Configuring Static Routes

In this example, a sample configurations are presented for basic static routes. When you are finished, the system will be configured as shown in Figure 2-1. In this example, a static route is created that says, in effect, “any packets destined for the 11.0.0.0/8 network should be forwarded to 172.16.0.26”.

This section includes the following examples:

- Example 2-1 Creating a static route

Example 2-1 creates a static route to network 11.0.0.0/8 directed towards 172.16.0.26.

To create a static route, perform the following steps in configuration mode:

**Example 2-1  Creating a static route**

<table>
<thead>
<tr>
<th>Step</th>
<th>Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create a static route to R2.</td>
<td>vyatta@R1#  set protocols static route 11.0.0.0/8 next-hop 172.16.0.26 [edit]</td>
</tr>
<tr>
<td>Commit the configuration.</td>
<td>vyatta@R1#  commit [edit]</td>
</tr>
</tbody>
</table>
Floating Static Routes

Usually, static routes have a relatively short administrative distance—typically 1, and usually shorter than the administrative distances for dynamic (learned) routes. A “floating” static route is a static route with an administrative distance greater than that for dynamic routes.

You can configure a static route to be a floating route by setting the administrative distance higher than the distance applied to the routes in your dynamic routing protocol. This renders the static route less desirable than a dynamic route. At the same time, if the dynamic route is lost, the static route is available to take over traffic, which can be forwarded through the static route as an alternate path.

Monitoring Static Route Information

This section presents the following topic:
- Static Route Operational Commands
- Showing Static Routes in the Routing Table

Static Route Operational Commands

You can use the following operational command to monitor static routes.

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>show ip route</td>
<td>Displays information about routes stored in the routing table.</td>
</tr>
</tbody>
</table>

This section presents the following examples:
- Example 2-2 Showing static routes in the routing table

Showing Static Routes in the Routing Table

To display route information, use the `show ip route` command. To show just static routes, use the `show ip route static` filter, as shown in Example 2-2.

Example 2-2   Showing static routes in the routing table

```
vyatta@R1:~$ show ip route static
Codes: K - kernel route, C - connected, S - static, R - RIP, O - OSPF,
       I - ISIS, B - BGP, > - selected route, * - FIB route
```
S>* 0.0.0.0/0 [1/0] via 10.1.0.1, eth0
S>* 10.7.0.48/28 [1/0] via 10.6.0.57, eth1
vyatta@R1:~$
## Static Route Commands

This chapter contains the following commands.

<table>
<thead>
<tr>
<th><strong>Configuration Commands</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><code>protocols static interface-route &lt;subnet&gt; blackhole</code></td>
<td>Allows you to configure a “black-hole” route for an interface-based static route.</td>
</tr>
<tr>
<td><code>protocols static interface-route &lt;subnet&gt; next-hop-interface &lt;ethx&gt;</code></td>
<td>Allows you to configure the next-hop interface for an interface-based static route.</td>
</tr>
<tr>
<td><code>protocols static route &lt;subnet&gt; blackhole</code></td>
<td>Allows you to configure a “black-hole” static route.</td>
</tr>
<tr>
<td><code>protocols static route &lt;subnet&gt; next-hop &lt;address&gt;</code></td>
<td>Allows you to configure the next hop for a static route.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Operational Commands</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><code>show ip route static</code></td>
<td>Displays static routes. See page 15.</td>
</tr>
</tbody>
</table>
protocols static interface-route <subnet> blackhole

Allows you to configure a “black-hole” route for an interface-based static route.

Syntax

set protocols static interface-route subnet blackhole [distance distance]
delete protocols static interface-route subnet blackhole [distance]
show protocols static interface-route subnet blackhole [distance]

Command Mode

Configuration mode.

Configuration Statement

protocols {
  static {
    interface-route ipv4net {
      blackhole {
        distance: 1-255
      }
    }
  }
}

Parameters

subnet Mandatory. Multi-node. Defines an interface-based static route. The format is a destination subnet of the form address/prefix.

You can define multiple interface-based routes by creating multiple interface-route configuration nodes.

distance Optional. Defines the black-hole distance for this route. The range is 1 to 255. The default is 1.

Default

None.

Usage Guidelines

Use this command to configure interface-based “black-hole” static routes on the router. A black-hole route is a route for which the system silently discard packets that are matched.

Use the set form of this command to set a black-hole route.
Use the **delete** form of this command to remove a black-hole route.

Use the **show** form of this command to view black-hole route configuration.
protocols static interface-route <subnet> next-hop-interface <ethx>

Allows you to configure the next-hop interface for an interface-based static route.

Syntax

set protocols static interface-route subnet next-hop-interface ethx [distance distance]
delete protocols static interface-route subnet next-hop-interface ethx [distance]
show protocols static interface-route subnet next-hop-interface ethx [distance]

Command Mode

Configuration mode.

Configuration Statement

protocols {
  static {
    interface-route ipv4net {
      next-hop-interface eth0..eth23 {
        distance 1-255
      }
    }
  }
}

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>subnet</td>
<td>Mandatory. Multi-node. Defines an interface-based static route. The format is a destination subnet of the form address/prefix. You can define multiple interface-based routes by creating multiple interface-route configuration nodes.</td>
</tr>
<tr>
<td>ethx</td>
<td>Mandatory. The next-hop Ethernet interface.</td>
</tr>
<tr>
<td>distance</td>
<td>Optional. Sets the next-hop distance for this route. Routes with a smaller distance are selected before those with a larger distance. The range is 1 to 255. The default is 1.</td>
</tr>
</tbody>
</table>

Default

None.
Usage Guidelines

Use this command to configure interface-based static routes on the router.
Use the **set** form of this command to specify the next-hop interface for the route.
Use the **delete** form of this command to remove the next-hop interface.
Use the **show** form of this command to view the next-hop interface for the route.
protocols static route <subnet> blackhole

Allows you to configure a “black-hole” static route.

Syntax

```
set protocols static route subnet blackhole [distance distance]
delete protocols static route subnet blackhole [distance]
show protocols static route subnet blackhole [distance]
```

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
    static {
        route ipv4net {
            blackhole {
                distance 1-255
            }
        }
    }
}
```

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>subnet</td>
<td>Mandatory. Multi-node. Defines a static route. The format is a destination subnet of the form address/prefix. You can define multiple static routes by creating multiple route configuration nodes.</td>
</tr>
<tr>
<td>distance</td>
<td>Optional. Defines the black-hole distance for this route. Routes with a smaller distance are selected before those with a larger distance. The range is 1 to 255. The default is 1.</td>
</tr>
</tbody>
</table>

Default

None.
Usage Guidelines

Use this command to configure a “black-hole” static route on the router. A black-hole route is a route for which the system silently discard packets that are matched.

Use the **set** form of this command to set a black-hole route.

Use the **delete** form of this command to remove a black-hole route.

Use the **show** form of this command to view black-hole route configuration.
protocols static route <subnet> next-hop <address>

Allows you to configure the next hop for a static route.

**Syntax**

```
set protocols static route subnet next-hop address [distance distance]
delete protocols static route subnet next-hop address [distance]
show protocols static route subnet next-hop address [distance]
```

**Command Mode**

Configuration mode.

**Configuration Statement**

```
protocols {
    static {
        route ipv4net {
            next-hop ipv4 {
                distance 1-255
            }
        }
    }
}
```

**Parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>subnet</td>
<td>Mandatory. Multi-node. Defines a static route. The format is a destination subnet of the form <code>address/prefix</code>. You can define multiple static routes by creating multiple <code>route</code> configuration nodes.</td>
</tr>
<tr>
<td>address</td>
<td>Mandatory. The address of the next-hop router.</td>
</tr>
<tr>
<td>distance</td>
<td>Optional. Defines the next-hop distance for this route. Routes with a smaller distance are selected before those with a larger distance. The range is 1 to 255. The default is 1.</td>
</tr>
</tbody>
</table>

**Default**

None.
Usage Guidelines

Use this command to configure static routes on the router.
Use the set form of this command to specify the next hop for the route.
Use the delete form of this command to remove the static route next hop.
Use the show form of this command to view static route next-hop configuration.
## Glossary of Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACL</td>
<td>access control list</td>
</tr>
<tr>
<td>ADSL</td>
<td>Asymmetric Digital Subscriber Line</td>
</tr>
<tr>
<td>API</td>
<td>Application Programming Interface</td>
</tr>
<tr>
<td>AS</td>
<td>autonomous system</td>
</tr>
<tr>
<td>ARP</td>
<td>Address Resolution Protocol</td>
</tr>
<tr>
<td>BGP</td>
<td>Border Gateway Protocol</td>
</tr>
<tr>
<td>BIOS</td>
<td>Basic Input Output System</td>
</tr>
<tr>
<td>BPDU</td>
<td>Bridge Protocol Data Unit</td>
</tr>
<tr>
<td>CA</td>
<td>certificate authority</td>
</tr>
<tr>
<td>CHAP</td>
<td>Challenge Handshake Authentication Protocol</td>
</tr>
<tr>
<td>CLI</td>
<td>command-line interface</td>
</tr>
<tr>
<td>DDNS</td>
<td>dynamic DNS</td>
</tr>
<tr>
<td>DHCP</td>
<td>Dynamic Host Configuration Protocol</td>
</tr>
<tr>
<td>DLCI</td>
<td>data-link connection identifier</td>
</tr>
<tr>
<td>DMI</td>
<td>desktop management interface</td>
</tr>
<tr>
<td>DMZ</td>
<td>demilitarized zone</td>
</tr>
<tr>
<td>DN</td>
<td>distinguished name</td>
</tr>
<tr>
<td>DNS</td>
<td>Domain Name System</td>
</tr>
<tr>
<td>DSCP</td>
<td>Differentiated Services Code Point</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>DSL</td>
<td>Digital Subscriber Line</td>
</tr>
<tr>
<td>eBGP</td>
<td>external BGP</td>
</tr>
<tr>
<td>EGP</td>
<td>Exterior Gateway Protocol</td>
</tr>
<tr>
<td>ECMP</td>
<td>equal-cost multipath</td>
</tr>
<tr>
<td>ESP</td>
<td>Encapsulating Security Payload</td>
</tr>
<tr>
<td>FIB</td>
<td>Forwarding Information Base</td>
</tr>
<tr>
<td>FTP</td>
<td>File Transfer Protocol</td>
</tr>
<tr>
<td>GRE</td>
<td>Generic Routing Encapsulation</td>
</tr>
<tr>
<td>HDLC</td>
<td>High-Level Data Link Control</td>
</tr>
<tr>
<td>I/O</td>
<td>Input/Output</td>
</tr>
<tr>
<td>ICMP</td>
<td>Internet Control Message Protocol</td>
</tr>
<tr>
<td>IDS</td>
<td>Intrusion Detection System</td>
</tr>
<tr>
<td>IEEE</td>
<td>Institute of Electrical and Electronics Engineers</td>
</tr>
<tr>
<td>IGP</td>
<td>Interior Gateway Protocol</td>
</tr>
<tr>
<td>IPS</td>
<td>Intrusion Protection System</td>
</tr>
<tr>
<td>IKE</td>
<td>Internet Key Exchange</td>
</tr>
<tr>
<td>IP</td>
<td>Internet Protocol</td>
</tr>
<tr>
<td>IPOA</td>
<td>IP over ATM</td>
</tr>
<tr>
<td>IPsec</td>
<td>IP security</td>
</tr>
<tr>
<td>IPv4</td>
<td>IP Version 4</td>
</tr>
<tr>
<td>IPv6</td>
<td>IP Version 6</td>
</tr>
<tr>
<td>ISP</td>
<td>Internet Service Provider</td>
</tr>
<tr>
<td>L2TP</td>
<td>Layer 2 Tunneling Protocol</td>
</tr>
<tr>
<td>LACP</td>
<td>Link Aggregation Control Protocol</td>
</tr>
<tr>
<td>LAN</td>
<td>local area network</td>
</tr>
<tr>
<td>LDAP</td>
<td>Lightweight Directory Access Protocol</td>
</tr>
<tr>
<td>MAC</td>
<td>medium access control</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>------------------------------------</td>
</tr>
<tr>
<td>MIB</td>
<td>Management Information Base</td>
</tr>
<tr>
<td>MLPPP</td>
<td>multilink PPP</td>
</tr>
<tr>
<td>MRRU</td>
<td>maximum received reconstructed unit</td>
</tr>
<tr>
<td>MTU</td>
<td>maximum transmission unit</td>
</tr>
<tr>
<td>NAT</td>
<td>Network Address Translation</td>
</tr>
<tr>
<td>ND</td>
<td>Neighbor Discovery</td>
</tr>
<tr>
<td>NIC</td>
<td>network interface card</td>
</tr>
<tr>
<td>NTP</td>
<td>Network Time Protocol</td>
</tr>
<tr>
<td>OSPF</td>
<td>Open Shortest Path First</td>
</tr>
<tr>
<td>OSPFv2</td>
<td>OSPF Version 2</td>
</tr>
<tr>
<td>OSPFv3</td>
<td>OSPF Version 3</td>
</tr>
<tr>
<td>PAM</td>
<td>Pluggable Authentication Module</td>
</tr>
<tr>
<td>PAP</td>
<td>Password Authentication Protocol</td>
</tr>
<tr>
<td>PAT</td>
<td>Port Address Translation</td>
</tr>
<tr>
<td>PCI</td>
<td>peripheral component interconnect</td>
</tr>
<tr>
<td>PKI</td>
<td>Public Key Infrastructure</td>
</tr>
<tr>
<td>PPP</td>
<td>Point-to-Point Protocol</td>
</tr>
<tr>
<td>PPPoA</td>
<td>PPP over ATM</td>
</tr>
<tr>
<td>PPPoE</td>
<td>PPP over Ethernet</td>
</tr>
<tr>
<td>PPTP</td>
<td>Point-to-Point Tunneling Protocol</td>
</tr>
<tr>
<td>PVC</td>
<td>permanent virtual circuit</td>
</tr>
<tr>
<td>QoS</td>
<td>quality of service</td>
</tr>
<tr>
<td>RADIUS</td>
<td>Remote Authentication Dial-In User Service</td>
</tr>
<tr>
<td>RIB</td>
<td>Routing Information Base</td>
</tr>
<tr>
<td>RIP</td>
<td>Routing Information Protocol</td>
</tr>
<tr>
<td>RIPng</td>
<td>RIP next generation</td>
</tr>
<tr>
<td>Rx</td>
<td>receive</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>SNMP</td>
<td>Simple Network Management Protocol</td>
</tr>
<tr>
<td>SMTP</td>
<td>Simple Mail Transfer Protocol</td>
</tr>
<tr>
<td>SONET</td>
<td>Synchronous Optical Network</td>
</tr>
<tr>
<td>SSH</td>
<td>Secure Shell</td>
</tr>
<tr>
<td>STP</td>
<td>Spanning Tree Protocol</td>
</tr>
<tr>
<td>TACACS+</td>
<td>Terminal Access Controller Access Control System Plus</td>
</tr>
<tr>
<td>TCP</td>
<td>Transmission Control Protocol</td>
</tr>
<tr>
<td>ToS</td>
<td>Type of Service</td>
</tr>
<tr>
<td>Tx</td>
<td>transmit</td>
</tr>
<tr>
<td>UDP</td>
<td>User Datagram Protocol</td>
</tr>
<tr>
<td>vif</td>
<td>virtual interface</td>
</tr>
<tr>
<td>VLAN</td>
<td>virtual LAN</td>
</tr>
<tr>
<td>VPN</td>
<td>Virtual Private Network</td>
</tr>
<tr>
<td>VRRP</td>
<td>Virtual Router Redundancy Protocol</td>
</tr>
<tr>
<td>WAN</td>
<td>wide area network</td>
</tr>
</tbody>
</table>