



# CHAPTER 1

## Managing the Unicast RIB and FIB

This chapter describes how to manage routes in the unicast Routing Information Base (RIB) and the Forwarding Information Base (FIB) on the Cisco NX-OS switch.

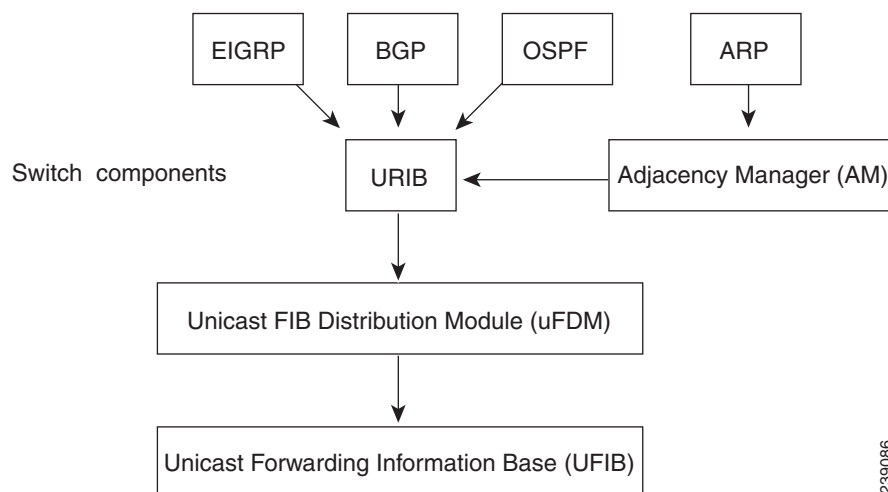
This chapter includes the following sections:

- [Information About the Unicast RIB and FIB, page 1-1](#)
- [Licensing Requirements for the Unicast RIB and FIB, page 1-3](#)
- [Managing the Unicast RIB and FIB, page 1-3](#)
- [Verifying the Unicast RIB and FIB Configuration, page 1-8](#)
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## Information About the Unicast RIB and FIB

The unicast RIB (IPv4 RIB) and FIB are part of the Cisco NX-OS forwarding architecture, as shown in [Figure 1-1](#).

**Figure 1-1** Cisco NX-OS Forwarding Architecture



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The unicast RIB maintains the routing table with directly connected routes, static routes, and routes learned from dynamic unicast routing protocols. The unicast RIB also collects adjacency information from sources such as the Address Resolution Protocol (ARP). The unicast RIB determines the best next hop for a given route and populates the unicast forwarding information base (FIBs) by using the services of the unicast FIB distribution module (FDM).

Each dynamic routing protocol must update the unicast RIB for any route that has timed out. The unicast RIB then deletes that route and recalculates the best next hop for that route (if an alternate path is available).

This section includes the following topics:

- [Layer 3 Consistency Checker, page 1-2](#)
- [FIB Tables, page 1-2](#)
- [Virtualization Support, page 1-2](#)

## **Layer 3 Consistency Checker**

In rare instances, an inconsistency can occur between the unicast RIB and the FIB on each module. Cisco NX-OS supports the Layer 3 consistency checker. This feature detects inconsistencies between the unicast IPv4 RIB and the FIB on each interface module. Inconsistencies include the following:

- Missing prefix
- Extra prefix
- Wrong next-hop address
- Incorrect Layer 2 rewrite string in the ARP or neighbor discovery (ND) cache

The Layer 3 consistency checker compares the FIB entries to the latest adjacency information from the Adjacency Manager (AM) and logs any inconsistencies. The consistency checker then compares the unicast RIB prefixes to the module FIB and logs any inconsistencies. See the “[Triggering the Layer 3 Consistency Checker](#)” section on page 1-6.

You can then manually clear any inconsistencies. See the “[Clearing Forwarding Information in the FIB](#)” section on page 1-7.

## **FIB Tables**

The hardware provides two tables, a TCAM table and a Hash table. The TCAM table is shared between the longest prefix match (LPM) route and the /32 unicast route. The Hash table is shared between the /32 unicast entries and the multicast entries. Each table has approximately 8000 routes.

## **Virtualization Support**

The Unicast RIB and FIB support Virtual Routing and Forwarding instances (VRFs). By default, Cisco NX-OS places you in the default VRF unless you specifically configure another VRF. For more information, see [Chapter 1, “Configuring Layer 3 Virtualization.”](#)

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## Licensing Requirements for the Unicast RIB and FIB

The following table shows the licensing requirements for this feature:

Product	License Requirement
Cisco NX-OS	The unicast RIB and FIB require no license. Any feature not included in a license package is bundled with the Cisco NX-OS system images and is provided at no extra charge to you. For a complete explanation of the Cisco NX-OS licensing scheme, see the <i>Cisco NX-OS Licensing Guide</i> .

## Managing the Unicast RIB and FIB

This section includes the following topics:

- [Displaying Module FIB Information, page 1-3](#)
- [Configuring Load Sharing in the Unicast FIB, page 1-4](#)
- [Displaying Routing and Adjacency Information, page 1-5](#)
- [Triggering the Layer 3 Consistency Checker, page 1-6](#)
- [Clearing Forwarding Information in the FIB, page 1-7](#)
- [Estimating Memory Requirements for Routes, page 1-7](#)
- [Clearing Routes in the Unicast RIB, page 1-8](#)



### Note

If you are familiar with the Cisco IOS CLI, be aware that the Cisco NX-OS commands for this feature might differ from the Cisco IOS commands that you would use.

## Displaying Module FIB Information

You can display the FIB information on a switch.

### DETAILED STEPS

To display the FIB information on a switch, use the following commands in any mode:

Command	Purpose
<b>show ip fib adjacency</b>  <b>Example:</b> switch# show ip fib adjacency	Displays the adjacency information for IPv4.
<b>show forwarding ipv4 adjacency</b>  <b>Example:</b> switch# show forwarding ipv4 adjacency	Displays the adjacency information for IPv4.

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Command	Purpose
<b>show ip fib interfaces</b>  <b>Example:</b> switch# show ip fib interfaces	Displays the FIB interface information for IPv4.
<b>show ip fib route</b>  <b>Example:</b> switch# show ip fib route	Displays the route table for IPv4.
<b>show forwarding ipv4 route</b>  <b>Example:</b> switch# show forwarding ipv4 route	Displays the route table for IPv4.

This example shows the FIB contents on a switch:

```
switch# show ip fib route
```

```
IPv4 routes for table default/base
```

```
-----+-----+-----
Prefix          | Next-hop      | Interface
-----+-----+-----
0.0.0.0/32      | Drop          | Null0
255.255.255.255/32 | Receive      | sup-eth1
```

## Configuring Load Sharing in the Unicast FIB

Dynamic routing protocols, such as Open Shortest Path First (OSPF), support load balancing with equal-cost multipath (ECMP). The routing protocol determines its best routes based on the metrics configured for the protocol and installs up to the protocol-configured maximum paths in the unicast RIB. The unicast RIB compares the administrative distances of all routing protocol paths in the RIB and selects a best path set from all of the path sets installed by the routing protocols. The unicast RIB installs this best path set into the FIB for use by the forwarding plane.

The forwarding plane uses a load-sharing algorithm to select one of the installed paths in the FIB to use for a given data packet.

You can globally configure the following load-sharing settings:

- **load-share mode**—Selects the best path based on the destination address and port or the source and the destination address and port.
- **Universal ID**—Sets the random seed for the hash algorithm. You do not need to configure the Universal ID. Cisco NX-OS chooses the Universal ID if you do not configure it.



### Note

Load sharing uses the same path for all packets in a given flow. A flow is defined by the load-sharing method that you configure. For example, if you configure source-destination load sharing, then all packets with the same source IP address and destination IP address pair follow the same path.

To configure the unicast FIB load-sharing algorithm, use the following command in global configuration mode:

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Command	Purpose
<pre>ip load-sharing address {destination port destination   source-destination [port source-destination]} [universal-id seed]</pre> <p><b>Example:</b> switch(config)# ip load-sharing address source-destination</p>	Configures the unicast FIB load-sharing algorithm for data traffic. The <i>universal-id</i> range is from 1 to 4294967295.

To display the unicast FIB load-sharing algorithm, use the following command in any mode:

Command	Purpose
<pre>show ip load-sharing</pre> <p><b>Example:</b> switch(config)# show ip load-sharing</p>	Displays the unicast FIB load-sharing algorithm for data traffic.

## Displaying Routing and Adjacency Information

You can display the routing and adjacency information.

To display the routing and adjacency information, use the following commands in any mode:

Command	Purpose
<pre>show ip route [route-type   interface int-type number   next-hop]</pre> <p><b>Example:</b> switch# show ip route</p>	Displays the unicast route table. The <i>route-type</i> argument can be a single route prefix, direct, static, or a dynamic route protocol. Use the ? command to see the supported interfaces.
<pre>show ip adjacency [prefix   interface-type number [summary]   non-best] [detail] [vrf vrf-id]</pre> <p><b>Example:</b> switch# show ip adjacency</p>	Displays the adjacency table. The argument ranges are as follows: <ul style="list-style-type: none"> <li><i>prefix</i>—Any IPv4 prefix address.</li> <li><i>interface-type number</i>—Use the ? command to see the supported interfaces.</li> <li><i>vrf-id</i>—Any case-sensitive, alphanumeric string up to 32 characters.</li> </ul>
<pre>show ip routing [route-type   interface int-type number   next-hop   recursive-next-hop   summary   updated {since   until} time]</pre> <p><b>Example:</b> switch# show routing summary</p>	Displays the unicast route table. The <i>route-type</i> argument can be a single route prefix, direct, static, or a dynamic route protocol. Use the ? command to see the supported interfaces.

This example displays the unicast route table:

```
switch# show ip route
IP Route Table for VRF "default"
'*' denotes best ucast next-hop
```

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```

''' denotes best mcast next-hop
'[x/y]' denotes [preference/metric]

192.168.0.2/24, ubest/mbest: 1/0, attached
    *via 192.168.0.32, Eth1/5, [0/0], 22:34:09, direct
192.168.0.32/32, ubest/mbest: 1/0, attached
    *via 192.168.0.32, Eth1/5, [0/0], 22:34:09, local

```

This example shows the adjacency information:

```

switch# show ip adjacency

IP Adjacency Table for VRF default
Total number of entries: 2
Address          Age          MAC Address   Pref Source   Interface     Best
10.1.1.1         02:20:54    00e0.b06a.71eb 50  arp        mgmt0         Yes
10.1.1.253      00:06:27    0014.5e0b.81d1 50  arp        mgmt0         Yes

```

## Triggering the Layer 3 Consistency Checker

You can manually trigger the Layer 3 consistency checker.

To manually trigger the Layer 3 consistency checker, use the following commands in global configuration mode:

Command	Purpose
<pre> <b>test</b> [ipv4] [unicast] forwarding <b>inconsistency</b> [vrf vrf-name] [module {slot  all}] </pre> <p><b>Example:</b>  switch(config)# test forwarding  inconsistency</p>	<p>Starts a Layer 3 consistency check. The <i>vrf-name</i> can be any case-sensitive, alphanumeric string up to 32 characters. The <i>slot</i> range is from 1 to 10.</p>

To stop the Layer 3 consistency checker, use the following commands in global configuration mode:

Command	Purpose
<pre> <b>test forwarding</b> [ipv4] [unicast] <b>inconsistency</b> [vrf vrf-name] [module {slot  all}] <b>stop</b> </pre> <p><b>Example:</b>  switch(config)# test forwarding  inconsistency stop</p>	<p>Stops a Layer 3 consistency check. The <i>vrf-name</i> can be any case-sensitive, alphanumeric string up to 64 characters. The <i>slot</i> range is from 1 to 10.</p>

To display the Layer 3 inconsistencies, use the following commands in any mode:

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Command	Purpose
<pre>show forwarding [ipv4] inconsistency [vrf vrf-name] [module {slot  all}]</pre> <p><b>Example:</b> switch(config)# show forwarding inconsistency</p>	Displays the results of a Layer 3 consistency check. The <i>vrf-name</i> can be any case-sensitive, alphanumeric string up to 32 characters. The <i>slot</i> range is from 1 to 10.

## Clearing Forwarding Information in the FIB

You can clear one or more entries in the FIB. Clearing a FIB entry does not affect the unicast RIB.



**Caution**

The **clear forwarding** command disrupts forwarding on the switch.

To clear an entry in the FIB, including a Layer 3 inconsistency, use the following command in any mode:

Command	Purpose
<pre>clear forwarding {ipv4} route {*   prefix} [vrf vrf-name] [module {slot  all}]</pre> <p><b>Example:</b> switch(config)# clear forwarding ipv4 route *</p>	<p>Clears one or more entries from the FIB. The route options are as follows:</p> <ul style="list-style-type: none"> <li>*—All routes.</li> <li><i>prefix</i>—Any IP prefix.</li> </ul> <p>The <i>vrf-name</i> can be any case-sensitive, alphanumeric string up to 32 characters. The <i>slot</i> range is from 1 to 10.</p>

## Estimating Memory Requirements for Routes

You can estimate the memory that a number of routes and next-hop addresses will use.

To estimate the memory requirements for routes, use the following command in any mode:

Command	Purpose
<pre>show routing memory estimate routes num-routes next-hops num-nexthops</pre> <p><b>Example:</b> switch# show routing memory estimate routes 1000 next-hops 1</p>	Displays the memory requirements for routes. The <i>num-routes</i> range is from 1000 to 1000000. The <i>num-nexthops</i> range is from 1 to 16.

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## Clearing Routes in the Unicast RIB

You can clear one or more routes from the unicast RIB.



**Caution**

The \* keyword is severely disruptive to routing.

To clear one or more entries in the unicast RIB, use the following commands in any mode:

Command	Purpose
<pre><b>clear ip route</b> [*   {route   prefix/length}[next-hop interface}] [vrf vrf-name]</pre> <p><b>Example:</b> switch(config)# clear ip route 10.2.2.2</p>	<p>Clears one or more routes from both the unicast RIB and all the module FIBs. The route options are as follows:</p> <ul style="list-style-type: none"> <li>*—All routes.</li> <li><i>route</i>—An individual IP route.</li> <li><i>prefix/length</i>—Any IP prefix.</li> <li><i>next-hop</i>—The next-hop address</li> <li><i>interface</i>—The interface to reach the next-hop address.</li> </ul> <p>The <i>vrf-name</i> can be any case-sensitive, alphanumeric string up to 32 characters.</p>
<pre><b>clear routing</b> [multicast   unicast] [ip   ipv4] [*   {route   prefix/length}[next-hop interface}] [vrf vrf-name]</pre> <p><b>Example:</b> switch(config)# clear routing ip 10.2.2.2</p>	<p>Clears one or more routes from the unicast RIB. The route options are as follows:</p> <ul style="list-style-type: none"> <li>*—All routes.</li> <li><i>route</i>—An individual IP route.</li> <li><i>prefix/length</i>—Any IP prefix.</li> <li><i>next-hop</i>—The next-hop address</li> <li><i>interface</i>—The interface to reach the next-hop address.</li> </ul> <p>The <i>vrf-name</i> can be any case-sensitive, alphanumeric string up to 32 characters.</p>

## Verifying the Unicast RIB and FIB Configuration

To display the unicast RIB and FIB configuration information, perform one of the following tasks:

Command	Purpose
<b>show forwarding adjacency</b>	Displays the adjacency table on a module.
<b>show forwarding distribution</b> {clients   fib-state}	Displays the FIB distribution information.
<b>show forwarding interfaces module slot</b>	Displays the FIB information for a module.
<b>show forwarding ipv4 route</b>	Displays routes in the FIB.



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Command	Purpose
<code>show hardware forwarding dynamic-allocation status</code>	Displays information about the TCAM allocation.
<code>show ip adjacency</code>	Displays the adjacency table.
<code>show ip route</code>	Displays IPv4 routes from the unicast RIB.
<code>show routing</code>	Displays routes from the unicast RIB.

## Additional References

For additional information related to managing unicast RIB and FIB, see the following sections:

- [Related Documents, page 1-9](#)
- [Feature History for Unicast RIB and FIB, page 1-9](#)

## Related Documents

Related Topic	Document Title
Unicast RIB and FIB CLI commands	<i>Cisco Nexus 5000 Series Command Reference, Cisco NX-OS Releases 4.x, 5.x</i>

## Feature History for Unicast RIB and FIB

[Table 1-1](#) lists the release history for this feature.

**Table 1-1** Feature History for Unicast RIB and FIB

Feature Name	Releases	Feature Information
Unicast RIB and FIB	5.0(3)N1(1)	This feature was introduced.

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