



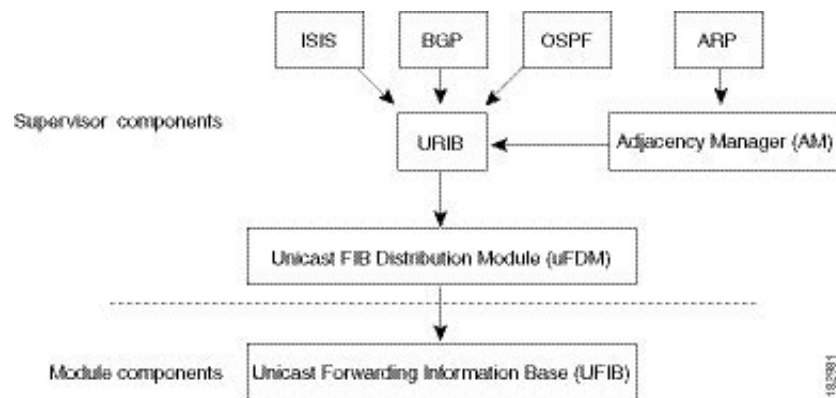
Managing the Unicast RIB and FIB

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About the Unicast RIB and FIB

The unicast Routing Information Base (IPv4 RIB and IPv6 RIB) and Forwarding Information Base (FIB) are part of the Cisco NX-OS forwarding architecture, as shown in the following figure.

Figure 1: Cisco NX-OS Forwarding Architecture



The unicast RIB exists on the active supervisor. It 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 bases (FIBs) on the modules 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).

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 on the supervisor module 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, on page 6](#) section.

You can then manually clear any inconsistencies. See the [Clearing Forwarding Information in the FIB, on page 6](#) section.

Guidelines and Limitations

Following is the guideline and limitation for the unicast RIB or FIB:

- Configuring port-channel or ECMP load-balance commands configures the same control block in the hardware.
 - If you configure port-channel load-balancing and decide to configure ECMP load-balancing, you must unconfigure port-channel load-balancing before issuing the ECMP load-balance command.
 - If you configure ECMP load-balancing and decide to configure port-channel load balancing, unconfigure ECMP load-balancing before issuing the port-channel load-balance command.

Otherwise, the load-share CLI throws an error when either config is being applied when the other config is already present.

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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

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

Command	Purpose
show forwarding {ipv4 ipv6} adjacency module <i>slot</i> Example: switch# show forwarding ipv6 adjacency module 2	Displays the adjacency information for IPv4 or IPv6.
show forwarding {ipv4 ipv6} route module <i>slot</i> Example: switch# show forwarding ipv6 route module 2	Displays the route table for IPv4 or IPv6.

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.



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:

Procedure

	Command or Action	Purpose
Step 1	ip load-sharing address {destination port destination source-destination [port source-destination]} [universal-id seed] [rotate rotate] [concatenation] Example: switch(config)# ip load-sharing address source-destination	Configures the unicast FIB load-sharing algorithm for data traffic. <ul style="list-style-type: none"> The universal-id option sets the random seed for the hash algorithm and shifts the flow from one link to another. <p>You do not need to configure the universal ID. Cisco NX-OS chooses the universal ID if you do not configure it. The <i>universal-id</i> range is from 1 to 4294967295.</p> <ul style="list-style-type: none"> The rotate option causes the hash algorithm to rotate the link picking

	Command or Action	Purpose
		<p>selection so that it does not continually choose the same link across all nodes in the network. It does so by influencing the bit pattern for the hash algorithm. This option shifts the flow from one link to another and load balances the already load-balanced (polarized) traffic from the first ECMP level across multiple links.</p> <p>If you specify a <i>rotate</i> value, the 64-bit stream is interpreted starting from that bit position in a cyclic rotation. The <i>rotate</i> range is from 1 to 63, and the default is 32.</p> <p>Note With multi-tier Layer 3 topology, polarization is possible. To avoid polarization, use a different rotate bit at each tier of the topology.</p> <p>Note To configure a rotation value for port channels, use the port-channel load-balance src-dst ip-l4port rotate rotate command. For more information on this command, see the <i>Cisco Nexus 3400-S NX-OS Interfaces Configuration Guide</i>.</p> <ul style="list-style-type: none"> The concatenation option ties together the hash tag values for ECMP and the hash tag values for port channels in order to use a stronger 64-bit hash. If you do not use this option, you can control ECMP load-balancing and port-channel load-balancing independently. The default is disabled.
Step 2	<p>(Optional) show ip load-sharing</p> <p>Example:</p> <pre>switch(config)# show ip load-sharing address source-destination</pre>	Displays the unicast FIB load-sharing algorithm for data traffic.
Step 3	<p>(Optional) show routing hash source-addr dest-addr [source-port dest-port] [vrf vrf-name]</p> <p>Example:</p>	Displays the route that the unicast RIB and unicast FIB use for a source and destination address pair. The source address and destination address format is x.x.x.x. The source port and

	Command or Action	Purpose
	<pre>switch(config)# show routing hash 192.0.2.1 10.0.0.1</pre>	destination port range is from 1 to 65535. The VRF name can be any case-sensitive, alphanumeric string up to 64 characters.

Example

This example shows how to display the route selected for a source/destination pair:

```
switch# show routing hash 10.0.0.5 192.0.0.2
Load-share parameters used for software forwarding:
load-share mode: address source-destination port source-destination
Universal-id seed: 0xe05e2e85
Hash for VRF "default"
Hashing to path *172.0.0.2 (hash: 0x0e), for route:
```

Displaying Routing and Adjacency Information

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

Command	Purpose
<pre>show {ip ipv6} route [<i>route-type</i> interface <i>interface-type number</i> next-hop] switch# show ip route</pre>	Displays the unicast route table. The <i>route-type</i> argument can be a single route prefix or a direct, static, or dynamic route protocol. Use the ? command to see the supported interfaces.
<pre>show {ip ipv6} adjacency [<i>prefix</i> <i>interface-type</i> <i>number</i> [summary] non-best] [detail] [vrf <i>vrf-id</i>] Example: switch# show ip adjacency</pre>	Displays the adjacency table. The argument ranges are as follows: <ul style="list-style-type: none"> • <i>prefix</i>—Any IPv4 or IPv6 prefix address. • <i>interface-type number</i>—Use the ? command to see the supported interfaces. • <i>vrf-id</i>—Any case-sensitive, alphanumeric string up to 64 characters.
<pre>show {ip ipv6} routing [<i>route-type</i> interface <i>interface-type number</i> next-hop recursive-next-hop summary updated {since until} <i>time</i>] Example: switch# show routing summary</pre>	Displays the unicast route table. The <i>route-type</i> argument can be a single route prefix or a direct, static, or dynamic route protocol. Use the ? command to see the supported interfaces.

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:

Procedure

	Command or Action	Purpose
Step 1	test forwarding [ipv4 ipv6] [unicast inconsistency [vrf vrf-name] [module {slot all}]] Example: <pre>switch(config)# test forwarding inconsistency</pre>	Starts 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 through 26.
Step 2	test forwarding [ipv4 ipv6] [unicast inconsistency [vrf vrf-name] [module {slot all}]] stop Example: <pre>switch(config)# test forwarding inconsistency stop</pre>	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 through 26.
Step 3	show forwarding [ipv4 ipv6] [unicast inconsistency [vrfvrf-name] [module {slot all}]] Example: <pre>switch(config)# show forwarding inconsistency</pre>	Displays the results of 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 through 26.
Step 4	show consistency checker forwarding single-route {ipv4 IPv4 address ipv6 IPv6 address} [vrfvrf-name] Example: <pre>switch(config)# show consistency-checker forwarding single-route ipv4 10.1.1.100/252 vrf testvrf</pre>	

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 device.

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

Command	Purpose
<p>clear forwarding {<i>ipv4</i> <i>ipv6</i>} route {<i>*</i> <i>prefix</i>} [vrf <i>vrf-name</i>] module {<i>slot</i> all}</p> <p>Example:</p> <pre>switch# clear forwarding ipv4 route * module 1</pre>	<p>Clears one or more entries from the FIB. The route options are as follows:</p> <ul style="list-style-type: none"> • <i>*</i>—All routes. • <i>prefix</i>—Any IP or IPv6 prefix. <p>The <i>vrf-name</i> can be any case-sensitive, alphanumeric string up to 64 characters. The <i>slot</i> range is from 1 through 26.</p>

Configuring Maximum Routes for the Unicast RIB

You can configure the maximum number of routes allowed in the routing table.

Procedure

	Command or Action	Purpose
Step 1	<p>configure terminal</p> <p>Example:</p> <pre>switch# configure terminal switch(config)#</pre>	Enters global configuration mode.
Step 2	<p>vrf context <i>vrf-name</i></p> <p>Example:</p> <pre>switch(config)# vrf context Red switch(config-vrf)#</pre>	Creates a VRF and enters VRF configuration mode.
Step 3	<p>ip4 unicast</p> <p>Example:</p> <pre>switch(config-vrf)# ip4 unicast switch(config-vrf-af-ipv4)#</pre>	Enters address-family configuration mode.
Step 4	<p>maximum routes <i>max-routes</i> [<i>threshold</i> reinstall <i>threshold</i>] warning -only]</p> <p>Example:</p> <pre>switch(config-vrf-af-ipv4)# maximum routes 250 90</pre>	<p>Configures the maximum number of routes allowed in the routing table. The range is from 1 to 4294967295.</p> <p>You can optionally specify the following:</p> <ul style="list-style-type: none"> • <i>threshold</i>—Percentage of maximum routes that triggers a warning message. The range is from 1 to 100. • warning-only—Logs a warning message when the maximum number of routes is exceeded. • reinstall <i>threshold</i>—Reinstalls routes that previously exceeded the maximum route

	Command or Action	Purpose
		limit and were rejected and specifies the threshold value at which to reinstall them. The threshold range is from 1 to 100.
Step 5	(Optional) copy running-config startup-config Example: <pre>switch(config-vrf-af-ipv4)# copy running-config startup-config</pre>	Saves this configuration change.

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
show routing {ipv6} memory estimate routes num-routes next-hops num-nexthops Example: <pre>switch# show routing memory estimate routes 5000 next-hops 2</pre>	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.

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 configuration mode:

Command	Purpose
<pre>clear {ip ip4 ipv6} route {* {route prefix/length} [next-hop interface]} [vrf vrf-name]</pre> <p>Example:</p> <pre>switch(config)# clear ip route 10.2.2.2</pre>	<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"> • <i>*</i>—All routes. • <i>route</i>—An individual IP or IPv6 route. • <i>prefix/length</i>—Any IP or IPv6 prefix. • <i>next-hop</i>—The next-hop address. • <i>interface</i>—The interface to reach the next-hop address. <p>The <i>vrf-name</i> can be an case-sensitive, alphanumeric string up to 64 characters.</p>
<pre>clear routing [multicast unicast] [ip ip4 ipv6] {* {route prefix/length} [next-hop interface]} [vrf vrf-name]</pre> <p>Example:</p> <pre>switch(config)# clear routing ip 10.2.2.2</pre>	<p>Clears one or more routes from the unicast RIB. The route options are as follows:</p> <ul style="list-style-type: none"> • <i>*</i>—All routes. • <i>route</i>—An individual IP or IPv6 route. • <i>prefix/length</i>—Any IP or IPv6 prefix. • <i>next-hop</i>—The next-hop address. • <i>interface</i>—The interface to reach the next-hop address. <p>The <i>vrf-name</i> can be an case-sensitive, alphanumeric string up to 64 characters.</p>

Verifying the Unicast RIB and FIB Configuration

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

Command	Purpose
show forwarding adjacency	Displays the adjacency table on a module.
show forwarding distribution {clients fib-state}	Displays the FIB distribution information.
show forwarding interfaces module slot	Displays the FIB information for a module.
show forwarding {ip ipv4 ipv6} route	Displays routes in the FIB.
show {ip ipv6} adjacency	Displays the adjacency table.
show {ip ipv6} route	Displays the IPv4 or IPv6 routes from the unicast RIB.
show routing	Displays routes from the unicast RIB.

Additional References

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

Related Documents

Related Topic	Document Title
Configuring EEM	<i>Cisco Nexus 3400-S NX-OS System Management Configuration Guide</i>