

Configure Policy-driven Dynamic Load Balancing

This chapter describes configuring the policy-driven Dynamic Load Balancing for Quality of Service.

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Policy-driven Dynamic Load Balancing

Dynamic Load Balancing (DLB) is an advanced hashing mechanism that

- enhances traditional ECMP forwarding,
- optimizes traffic distribution by considering the link load, and
- dynamically directs traffic over underutilized links

This occurs at the Layer 3 and is often implemented in modern networking hardware such as Cisco Nexus 9364E-SG2 Silicon One switches.

For more information about Dynamic Load Balancing, see Cisco Nexus 9000 Series NX-OS Unicast Routing Configuration Guide on Cisco.com.

Dynamic Load Balancing supports two modes:

- **Flowlet Load Balancing (FLB)**

  —In this mode, load balancing occurs at flowlet level based on DRE metrics. This is the default mode. Flowlets are bursts of packets from a flow, identified by their 5-tuple (or selected fields from the packet), that are separated by large enough gaps such that they can be routed independently without causing reordering.

- **Per-packet Load Balancing (PLB)**

  —In this mode, the load balancing decision occurs at a per-packet level instead of the flowlet level. Per-packet Load Balancing can be used for scenarios where the endpoints (for example, Smart NICs) allow for packet re-ordering. This mode distributes traffic packet by packet across all available links in a DLB ECMP group and spreads out the traffic, reducing network congestion.

Guidelines and limitations for policy-driven Dynamic Load Balancing

The guidelines and limitations for policy-driven DLB applicable through releases include:

- Starting from Cisco NX-OS Release 10.5(3)F, the policy-driven Dynamic Load Balancing (DLB) feature is introduced only on the N9364E-SG2 Silicon One switches.
- Starting from Cisco NX-OS Release 10.6(2)F, the policy-driven Dynamic Load Balancing (DLB) feature is supported on 9300-FX3, -GX, -GX2, and -HXA CloudScale TORs.
  - QOS policy with DLB action cannot be applied on Layer 2 ports.
  - QOS policy with DLB action is supported on physical interfaces (including break-out interfaces) and port-channel interfaces.
  - Stats collection per entry is enabled by default on QOS for CloudScale TORs, which can cause Layer 3 QOS TCAM exhaustion. To prevent this, use the **no-stats** keyword when applying QOS policy on CloudScale platforms. For example, `service-policy type qos input p1 no-stats`.

Configure policy-driven Dynamic Load Balancing

Use this procedure to configure QoS for policy-driven Dynamic Load Balancing (DLB).



Note Interface label is shared among the interfaces by default for the same policy. To get unique stats, use the policy with a different name. In total, 6 unique QoS policies can be applied on the Cisco Nexus 9364E-SG2 switches.

Procedure

Step 1 Use the **configure terminal** command to enter global configuration mode.

Example:

```
switch# configure terminal
switch(config)#
```

Step 2 Use the **class-map type qos match-all** *class-name* command to create a named object that represents a class of traffic. Class-map names can contain alphabetic, hyphen, or underscore characters; are case sensitive; and can be up to 40 characters.

Example:

```
switch(config)# class-map type qos match-all
        dlb-class
switch(config-cmap-qos)#
```

Step 3 Enter the **match dscp** *dscp-value* command to specify the DSCP value that matches for classifying packets into this class. You can configure a DSCP value in the range of 0 to 63 or the listed values.

Note
The QoS classification criteria such as IP precedence, DSCP, IP and IPv6 ACL, and IP RTP is supported. For more information, see the About Classification section from the Configuring Classification chapter.

Example:

```
switch(config-cmap-qos)# match dscp 26
switch(config-cmap-qos)#
```

Step 4 Use the **policy-map type qos** *policy-name* command to create a named object that represents a set of policies which are applied to a set of traffic classes. Policy-map names can contain alphabetic, hyphen, or underscore characters; are case sensitive; and can be up to 40 characters.

Example:

```
switch(config-cmap-qos)# policy-map type qos dlb-policy
switch(config-pmap-qos)#
```

Step 5 Use the **class** *class-name* command to associate a class map with the policy map and enter the configuration mode for the specified system class.

Note
The associated class map must be the same type as the policy map type.

Example:

```
switch(config-pmap-qos)# class dlb-class
switch(config-pmap-c-qos)#
```

Step 6 Use the **set dlb mode** [**flowlet** | **per-packet** | **global**] command to enable DLB mode for the ingress traffic.

When the DLB mode is set, the flows which match the **class-name** are load balanced dynamically. Rest of the flows use the regular ECMP.

- **flowlet**—sets the DLB mode to FLB. The policy-driven DLB mode should match with the mode set by the QoS policy. This option is only supported on Silicon One switches.
- **per-packet**—sets the DLB mode to PLB. The policy-driven DLB mode should match with the mode set by the QoS policy. This option is only supported on Silicon One switches.
- **global**—configures DLB mode global as one of the policy map actions when DLB is enabled for the flows. This option is supported only on 9300-FX3, GX, GX2, H1, and H2R CloudScale TOR switches.

  Note
  - This option is supported only when the DLB mode under **hardware profile dlb** is [**policy-driven** [**flowlet** | **per-packet**]
  - The DLB mode for the flows matching this policy is flowlet or per-packet based on the DLB mode configured under [**policy-driven** [**flowlet** | **per-packet**]. For more information, see *Configure Dynamic Load Balancing on CloudScale switches*section from the Configure Dynamic Load Balancing chapter in the Cisco Nexus 9000 Series NX-OS Unicast Routing Configuration Guide on Cisco.com.

For more information about the policy-driven mode, refer to Configure Dynamic Load Balancing in Cisco Nexus 9000 Series NX-OS Unicast Routing Configuration Guide on Cisco.com.

Example:

```
switch(config-pmap-c-qos)# set dlb mode per-packet
switch(config-pmap-c-qos)#
```

Step 7 Use the **interface** *interface slot/port* command to enter the interface configuration mode.

Note
The DLB policy must be applied only on interfaces and not at the system level.

Example:

```
switch(config-pmap-c-qos)# interface Ethernet1/1
switch(config-if)#
```

Step 8 Enter the **service-policy type qos input** *policy-name* command in the interface mode to add classification to the interface and ensure that the packets matching previously configured values, for example, DSCP, pick the respective DLB mode.

Example:

```
switch(config-if)# service-policy type qos input dlb-policy
switch(config-if)#
```

Verify policy-driven Dynamic Load Balancing configuration

Run the show commands listed in the table to view the required information of the policy-driven DLB configuration in QoS.

Table 1: Show commands

Command	Purpose
show policy-map type qos	Displays information about all configured policy maps, all policy maps of type qos show if any DLB mode is configured.
show policy-map interface *interface slot/port* **type qos**	Displays information about policy maps, with DLB mode configured, that are applied to the specified interface.
show running config	Displays the current configuration of QoS policies on the switch including the details about class maps, policy maps, and QoS-related configurations applied to interfaces.

Configuration example for Policy-driven Dynamic Load Balancing

This section provides a sample configuration where flows coming on interface Ethernet 1/1 with dscp value 26 undergo dynamic load balancing and all other flows use regular ECMP.

```
switch# configure terminal
switch(config)# class-map type qos match-all dlb-class
switch(config-cmap-qos)# match dscp 26
switch(config-cmap-qos)# policy-map type qos dlb-policy
switch(config-pmap-qos)# class dlb-class
```

```
switch(config-pmap-c-qos)# set dlb mode per-packet
switch(config-pmap-c-qos)# interface Ethernet1/1
switch(config-if)# service-policy type qos input dlb-policy
```