



DiffServ Compliant Weighted Random Early Detection

This feature module describes the DiffServ Compliant Weighted Random Early Detection feature and includes the following sections:

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Feature Overview

The feature enables Weighted Random Early Detection (WRED) to use the differentiated services code point (DSCP) value when it calculates the drop probability for a packet. The DSCP value is the first six bits of the IP type of service (ToS) byte.

This feature adds two new commands, **random-detect dscp** and **dscp**. It also adds two new arguments, *dscp-based* and *prec-based*, to two existing WRED-related commands—the **random-detect** (interface) command and the **random-detect-group** command.

The *dscp-based* argument enables WRED to use the DSCP value of a packet when it calculates the drop probability for the packet. The *prec-based* argument enables WRED to use the IP Precedence value of a packet when it calculates the drop probability for the packet.

These arguments are optional (you need not use any of them to use the commands) but they are also mutually exclusive. That is, if you use the *dscp-based* argument, you cannot use the *prec-based* argument with the same command.

After enabling WRED to use the DSCP value, you can then use the new **random-detect dscp** command to change the minimum and maximum packet thresholds for that DSCP value.

Three scenarios for using these arguments are provided.

Usage Scenarios

The new *dscp-based* and *prec-based* arguments can be used whether you are using WRED at the interface level, at the per-virtual circuit (VC) level, or at the class level (as part of class-based weighted fair queueing (CBWFQ) with policy maps).

WRED at the Interface Level

At the interface level, if you want to have WRED use the DSCP value when it calculates the drop probability, you can use the *dscp-based* argument with the **random-detect** (interface) command to specify the DSCP value. Then use the **random-detect dscp** command to specify the minimum and maximum thresholds for the DSCP value.

WRED at the per-VC Level

At the per-VC level, if you want to have WRED use the DSCP value when it calculates the drop probability, you can use the *dscp-based* argument with the **random-detect-group** command. Then use the **dscp** command to specify the minimum and maximum thresholds for the DSCP value or the mark-probability denominator.

This configuration can then be applied to each VC in the network.

WRED at the Class Level

If you are using WRED at the class level (with CBWFQ), the *dscp-based* and *prec-based* arguments can be used within the policy map.

First, specify the policy map, the class, and the bandwidth. Then, if you want WRED to use the DSCP value when it calculates the drop probability, use the *dscp-based* argument with the **random-detect** (interface) command to specify the DSCP value. Then use the **random-detect dscp** command to modify the default minimum and maximum thresholds for the DSCP value.

This configuration can then be applied wherever policy maps are attached (for example, at the interface level, the per-VC level, or the shaper level).

Usage Points to Note

Remember the following points when using the new commands and the new arguments:

- If you use the *dscp-based* argument, WRED will use the DSCP value to calculate the drop probability.
- If you use the *prec-based* argument, WRED will use the IP Precedence value to calculate the drop probability.
- The *dscp-based* and *prec-based* arguments are mutually exclusive.
- If you do not specify either argument, WRED will use the IP Precedence value to calculate the drop probability (the default method).
- The **random-detect dscp** command must be used in conjunction with the **random-detect** (interface) command.
- The **random-detect dscp** command can only be used if you use the *dscp-based* argument with the **random-detect** (interface) command.

- The **dscp** command must be used in conjunction with the **random-detect-group** command.
- The **dscp** command can only be used if you use the *dscp-based* argument with the **random-detect-group** command.

Benefits

This feature extends the functionality of WRED to enable support for Differentiated Services (DiffServ) and Assured Forwarding (AF) Per Hop Behavior (PHB). This feature enables WRED to be compliant with the DiffServ standard and the AF PHB standard being developed by the Internet Engineering Task Force (IETF).

This feature enables customers to implement AF PHB by coloring packets according to DSCP values and then assigning preferential drop probabilities to those packets.

Restrictions

This feature can be used with IP packets only. It is not intended for use with Multiprotocol Label Switching (MPLS)-encapsulated packets.

Supported Platforms

This feature runs on any platform that runs Cisco IOS WRED software, including the following platforms:

- Cisco 800 series
- Cisco 1700 series
- Cisco 2600 series
- Cisco 3600 series
- Cisco 4500 series
- Cisco 7200
- Cisco 7500-RSP

Supported Standards, MIBs, and RFCs

Standards

The Differentiated Services and the Assured Forwarding Per-Hop Behavior standards are supported by this feature.

MIBs

The Class-Based Quality of Service MIB supports this feature. This MIB is actually the following two MIBs:

- CISCO-CLASS-BASED-QOS-MIB
- CISCO-CLASS-BASED-QOS-CAPABILITY-MIB

For descriptions of supported MIBs and how to use MIBs, see the Cisco MIB web site on Cisco.com at <http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml>.

RFCs

- RFC 2474, *Definition of the Differentiated Services Field in IPv4 and IPv6 Headers*
- RFC 2475, *An Architecture for Differentiated Services Framework*
- RFC 2597, *Assured Forwarding PHB*
- RFC 2598, *An Expedited Forwarding PHB*

Configuration Tasks

See the following sections for configuration tasks for the DiffServ Compliant Weighted Random Early Detection feature. Each task in the list is identified as optional or required.

- Configuring WRED to Use the DSCP Value (Required)
- Verifying the DSCP Value Configuration (Optional)

Configuring WRED to Use the DSCP Value

The commands used to configure WRED to use the DSCP value vary according to whether WRED is used at the interface level, the per-VC level, or the class level.

WRED at the Interface Level

To configure WRED to use the DSCP value when it calculates the drop probability, use the following commands beginning in interface configuration mode:

	Command	Purpose
Step 1	Router(config-if)# random-detect <i>dscp-based</i>	Indicates that WRED is to use the DSCP value when it calculates the drop probability for the packet.
Step 2	Router(config-if)# random-detect dscp <i>dscpvalue</i> <i>min-threshold max-threshold</i> <i>[mark-probability-denominator]</i>	Specifies the minimum and maximum thresholds, and, optionally, the mark-probability denominator for the specified DSCP value.

WRED at the per-VC Level

To configure WRED to use the DSCP value when it calculates the drop probability, use the following command beginning in global configuration mode:

	Command	Purpose
Step 1	Router(config-if)# random-detect-group <i>group-name</i> <i>dscp-based</i>	Indicates that WRED is to use the DSCP value when it calculates the drop probability for the packet.
Step 2	Router(cfg-red-grp)# dscp <i>dscpvalue</i> <i>min-threshold</i> <i>max-threshold</i> [<i>mark-probability-denominator</i>]	Specifies the DSCP value, the minimum and maximum packet thresholds and, optionally, the mark-probability denominator for the DSCP value.
Step 3	Router(config-atm-vc)# random-detect [attach <i>group-name</i>]	Enables per-VC WRED or per-VC VIP-Distributed Weighted Random Early Detection (DWRED).

WRED at the Class Level

To configure WRED to use the DSCP value when it calculates the drop probability, use the following commands beginning in interface configuration mode. These are the commands to use at the class level, within policy maps.

	Command	Purpose
Step 1	Router(config-if)# class-map <i>class-map-name</i>	Creates a class map to be used for matching packets to a specified class.
Step 2	Router(config-cmap)# match <i>match-criterion</i>	Configures the match criteria for a class map. For additional information on the Modular Quality of Service Command-Line Interface (Modular QoS CLI), including information on match criteria in class maps, see the Modular QoS CLI document on Cisco.com.
Step 3	Router(config-if)# policy-map <i>policy-map</i>	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
Step 4	Router(config-pmap)# class <i>class-map-name</i>	Specifies the quality of service (QoS) actions for the default class.
Step 5	Router(config-pmap-c)# bandwidth { <i>bandwidth-kbps</i> percent <i>percent</i> }	Specifies or modifies the bandwidth allocated for a class belonging to a policy map.
Step 6	Router(config-pmap-c)# random-detect dscp-based	Indicates that WRED is to use the DSCP value when it calculates the drop probability for the packet.

	Command	Purpose
Step 7	Router(config-pmap-c)# random-detect dscp <i>dscpvalue</i> <i>min-threshold max-threshold</i> <i>[mark-probability-denominator]</i>	Specifies the minimum and maximum packet thresholds and, optionally, the mark-probability denominator for the DSCP value.
Step 8	Router(config-if)# service-policy output <i>policy-map</i>	Attaches a policy map to an output interface or VC to be used as the service policy for that interface or VC.

Verifying the DSCP Value Configuration

To verify the DSCP value configuration, use either of the following commands in global configuration mode:

Command	Purpose
Router# show queueing interface	Displays the queueing statistics of an interface or VC.
Router# show policy-map interface	Displays the configuration of classes configured for service policies on the specified interface or permanent virtual circuit (PVC).

Configuration Examples

This section provides the following configuration examples:

- WRED Configured to Use the DSCP Value Example
- DSCP Value Configuration Verification Example

WRED Configured to Use the DSCP Value Example

The following example configures WRED to use the DSCP value 8. The minimum threshold for the DSCP value 8 is 24 and the maximum threshold is 40. This configuration was performed at the interface level.

```
(config-if)# interface seo/0
(config-if)# random-detect dscp-based
(config-if)# random-detect dscp 8 24 40
```

The following example enables WRED to use the DSCP value 9. The minimum threshold for the DSCP value 9 is 20 and the maximum threshold is 50. This configuration can be attached to other VCs, as required.

```
(config)# random-detect-group sanjose dscp-based
(cfg-red-grp)# dscp 9 20 50
(config-subif-vc)# random-detect attach sanjose
```

The following example enables WRED to use the DSCP value 8 for class c1. The minimum threshold for the DSCP value 8 is 24 and the maximum threshold is 40. The last line attaches the service policy to the output interface or VC p1.

```
(config-if)# class-map c1
(config-cmap)# match access-group 101
(config-if)# policy-map p1
(config-pmap)# class c1
(config-pmap-c)# bandwidth 48
(config-pmap-c)# random-detect dscp-based
(config-pmap-c)# random-detect dscp 8 24 40
(config-if)# service-policy output p1
```

DSCP Value Configuration Verification Example

When WRED has been configured to use the DSCP value when it calculates the drop probability of a packet, all 64 entries of the DSCP table are initialized with the appropriate default values. The examples in the following section are samples of the **show queueing interface** command (for WRED at either the interface or per-VC level) and the **show policy interface** command (for WRED at the class level).

These examples display packet statistics along with the 64 entries of the DSCP table, confirming that WRED has been enabled to use the DSCP value when it calculates the drop probability for a packet.

WRED at the interface :

router# **show queueing interface s2/1**

Interface Serial2/1 queueing strategy: random early detection (WRED)

Exp-weight-constant: 9 (1/512)

Mean queue depth: 36

Dscp (Prec)	Random drop pkts/bytes	Tail drop pkts/bytes	Minimum threshold	Maximum threshold	Mark probability
0(0)	160/39360	8/1968	20	40	1/10
1	0/0	0/0	22	40	1/10
2	0/0	0/0	24	40	1/10
3	0/0	0/0	26	40	1/10
4	0/0	0/0	28	40	1/10
5	0/0	0/0	30	40	1/10
6	0/0	0/0	32	40	1/10
7	0/0	0/0	34	40	1/10
8(1)	156/38376	8/1968	22	40	1/10
9	0/0	0/0	22	40	1/10
10	0/0	0/0	24	40	1/10
11	0/0	0/0	26	40	1/10
12	0/0	0/0	28	40	1/10
13	0/0	0/0	30	40	1/10
14	0/0	0/0	32	40	1/10
15	0/0	0/0	34	40	1/10
16(2)	164/40344	24/5904	24	40	1/10
17	0/0	0/0	22	40	1/10
18	0/0	0/0	24	40	1/10
19	0/0	0/0	26	40	1/10
20	0/0	0/0	28	40	1/10
21	0/0	0/0	30	40	1/10
22	0/0	0/0	32	40	1/10
23	0/0	0/0	34	40	1/10
24(3)	203/49938	8/1968	26	40	1/10
25	0/0	0/0	22	40	1/10

```

26          0/0          0/0          24          40          1/10
27          0/0          0/0          26          40          1/10
28          0/0          0/0          28          40          1/10
29          0/0          0/0          30          40          1/10
30          0/0          0/0          32          40          1/10
31          0/0          0/0          34          40          1/10
32(4)       0/0          0/0          28          40          1/10
33          0/0          0/0          22          40          1/10
34          0/0          0/0          24          40          1/10
35          0/0          0/0          26          40          1/10
36          0/0          0/0          28          40          1/10
37          0/0          0/0          30          40          1/10
38          0/0          0/0          32          40          1/10
39          0/0          0/0          34          40          1/10
40(5)       0/0          0/0          30          40          1/10
41          0/0          0/0          22          40          1/10
42          0/0          0/0          24          40          1/10
43          0/0          0/0          26          40          1/10
44          0/0          0/0          28          40          1/10
45          0/0          0/0          30          40          1/10
46          0/0          0/0          36          40          1/10
47          0/0          0/0          34          40          1/10
48(6)       0/0          0/0          32          40          1/10
49          0/0          0/0          22          40          1/10
50          0/0          0/0          24          40          1/10
51          0/0          0/0          26          40          1/10
52          0/0          0/0          28          40          1/10
53          0/0          0/0          30          40          1/10
54          0/0          0/0          32          40          1/10
55          0/0          0/0          34          40          1/10
56(7)       0/0          0/0          34          40          1/10
57          0/0          0/0          22          40          1/10
58          0/0          0/0          24          40          1/10
59          0/0          0/0          26          40          1/10
60          0/0          0/0          28          40          1/10
61          0/0          0/0          30          40          1/10
62          0/0          0/0          32          40          1/10
63          0/0          0/0          34          40          1/10
rsvp       0/0          0/0          36          40          1/10

```

WRED at the vc :

router# **show queueing interface atm3/0**

Interface ATM3/0.1 VC 0/101

Queueing strategy: random early detection (WRED)

Exp-weight-constant: 9 (1/512)

Mean queue depth: 0

Total output drops per VC: 0

Dscp (Prec)	Random drop pkts/bytes	Tail drop pkts/bytes	Minimum threshold	Maximum threshold	Mark probability
0(0)	0/0	0/0	20	40	1/10
1	0/0	0/0	22	40	1/10
2	0/0	0/0	24	40	1/10
3	0/0	0/0	26	40	1/10
4	0/0	0/0	28	40	1/10
5	0/0	0/0	30	40	1/10
6	0/0	0/0	32	40	1/10
7	0/0	0/0	34	40	1/10
8(1)	0/0	0/0	22	40	1/10
9	0/0	0/0	22	40	1/10
10	0/0	0/0	24	40	1/10

11	0/0	0/0	26	40	1/10
12	0/0	0/0	28	40	1/10
13	0/0	0/0	30	40	1/10
14	0/0	0/0	32	40	1/10
15	0/0	0/0	34	40	1/10
16(2)	0/0	0/0	24	40	1/10
17	0/0	0/0	22	40	1/10
18	0/0	0/0	24	40	1/10
19	0/0	0/0	26	40	1/10
20	0/0	0/0	28	40	1/10
21	0/0	0/0	30	40	1/10
22	0/0	0/0	32	40	1/10
23	0/0	0/0	34	40	1/10
24(3)	0/0	0/0	26	40	1/10
25	0/0	0/0	22	40	1/10
26	0/0	0/0	24	40	1/10
27	0/0	0/0	26	40	1/10
28	0/0	0/0	28	40	1/10
29	0/0	0/0	30	40	1/10
30	0/0	0/0	32	40	1/10
31	0/0	0/0	34	40	1/10
32(4)	0/0	0/0	28	40	1/10
33	0/0	0/0	22	40	1/10
34	0/0	0/0	24	40	1/10
35	0/0	0/0	26	40	1/10
36	0/0	0/0	28	40	1/10
37	0/0	0/0	30	40	1/10
38	0/0	0/0	32	40	1/10
39	0/0	0/0	34	40	1/10
40(5)	0/0	0/0	30	40	1/10
41	0/0	0/0	22	40	1/10
42	0/0	0/0	24	40	1/10
43	0/0	0/0	26	40	1/10
44	0/0	0/0	28	40	1/10
45	0/0	0/0	30	40	1/10
46	0/0	0/0	36	40	1/10
47	0/0	0/0	34	40	1/10
48(6)	0/0	0/0	32	40	1/10
49	0/0	0/0	22	40	1/10
50	0/0	0/0	24	40	1/10
51	0/0	0/0	26	40	1/10
52	0/0	0/0	28	40	1/10
53	0/0	0/0	30	40	1/10
54	0/0	0/0	32	40	1/10
55	0/0	0/0	34	40	1/10
56(7)	0/0	0/0	34	40	1/10
57	0/0	0/0	22	40	1/10
58	0/0	0/0	24	40	1/10
59	0/0	0/0	26	40	1/10
60	0/0	0/0	28	40	1/10
61	0/0	0/0	30	40	1/10
62	0/0	0/0	32	40	1/10
63	0/0	0/0	34	40	1/10
rsvp	0/0	0/0	36	40	1/10

WRED inside a class

The examples illustrate the one when service-policy is attached to the interface but the same display and default values will be seen if WRED is configured inside a policy-map that is attached at the vc or within the map-class :

qos4-72c# show policy interface s2/1

```

Serial2/1
output : p1
Class c1
  Weighted Fair Queueing
    Output Queue: Conversation 265
    Bandwidth 20 (%)
    (pkts matched/bytes matched) 168174/41370804
    (pkts discards/bytes discards/tail drops) 20438/5027748/0
    mean queue depth: 39

```

Dscp (Prec)	Random drop pkts/bytes	Tail drop pkts/bytes	Minimum threshold	Maximum threshold	Mark probability
0(0)	2362/581052	1996/491016	20	40	1/10
1	0/0	0/0	22	40	1/10
2	0/0	0/0	24	40	1/10
3	0/0	0/0	26	40	1/10
4	2159/531114	196/48216	28	40	1/10
5	2114/520044	1185/291510	30	40	1/10
6	1972/485112	318/78228	32	40	1/10
7	1912/470352	344/84624	34	40	1/10
8(1)	2428/597288	619/152274	22	40	1/10
9	2423/596058	438/107748	22	40	1/10
10	0/0	0/0	24	40	1/10
11	0/0	0/0	26	40	1/10
12	0/0	0/0	28	40	1/10
13	0/0	0/0	30	40	1/10
14	0/0	0/0	32	40	1/10
15	0/0	0/0	34	40	1/10
16(2)	0/0	0/0	24	40	1/10
17	0/0	0/0	22	40	1/10
18	0/0	0/0	24	40	1/10
19	0/0	0/0	26	40	1/10
20	0/0	0/0	28	40	1/10
21	0/0	0/0	30	40	1/10
22	0/0	0/0	32	40	1/10
23	0/0	0/0	34	40	1/10
24(3)	0/0	0/0	26	40	1/10
25	0/0	0/0	22	40	1/10
26	0/0	0/0	24	40	1/10
27	0/0	0/0	26	40	1/10
28	0/0	0/0	28	40	1/10
29	0/0	0/0	30	40	1/10
30	0/0	0/0	32	40	1/10
31	0/0	0/0	34	40	1/10
32(4)	0/0	0/0	28	40	1/10
33	0/0	0/0	22	40	1/10
34	0/0	0/0	24	40	1/10
35	0/0	0/0	26	40	1/10
36	0/0	0/0	28	40	1/10
37	0/0	0/0	30	40	1/10
38	0/0	0/0	32	40	1/10
39	0/0	0/0	34	40	1/10
40(5)	0/0	0/0	30	40	1/10
41	0/0	0/0	22	40	1/10
42	0/0	0/0	24	40	1/10
43	0/0	0/0	26	40	1/10
44	0/0	0/0	28	40	1/10
45	0/0	0/0	30	40	1/10
46	0/0	0/0	36	40	1/10
47	0/0	0/0	34	40	1/10
48(6)	0/0	0/0	32	40	1/10
49	0/0	0/0	22	40	1/10
50	0/0	0/0	24	40	1/10
51	0/0	0/0	26	40	1/10

52	0/0	0/0	28	40	1/10
53	0/0	0/0	30	40	1/10
54	0/0	0/0	32	40	1/10
55	0/0	0/0	34	40	1/10
56(7)	0/0	0/0	34	40	1/10
57	0/0	0/0	22	40	1/10
58	0/0	0/0	24	40	1/10
59	0/0	0/0	26	40	1/10
60	0/0	0/0	28	40	1/10
61	0/0	0/0	30	40	1/10
62	0/0	0/0	32	40	1/10
63	0/0	0/0	34	40	1/10
rsvp	0/0	0/0	36	40	1/10

Command Reference

This section documents the following new or modified commands. All other commands used with this feature are documented in the Cisco IOS Release 12.1 command reference publications.

- **dscp**
- **random-detect dscp**
- **random-detect (interface)**
- **random-detect-group**

dscp

To change the minimum and maximum packet thresholds for the differentiated services code point (DSCP) value, use the **dscp** command in `cfg-red-grp` configuration mode. To return the minimum and maximum packet thresholds to the default for the DSCP value, use the **no** form of this command.

dscp *dscpvalue min-threshold max-threshold [mark-probability-denominator]*

no dscp *dscpvalue min-threshold max-threshold [mark-probability-denominator]*

Syntax Description

<i>dscpvalue</i>	Specifies the DSCP value. The DSCP value can be a number from 0 to 63, or it can be one of the following keywords: ef , af11 , af12 , af13 , af21 , af22 , af23 , af31 , af32 , af33 , af41 , af42 , af43 , cs1 , cs2 , cs3 , cs4 , cs5 , or cs7 .
<i>min-threshold</i>	Minimum threshold in number of packets. The value range of this argument is 1 to 4096. When the average queue length reaches the minimum threshold, Weighted Random Early Detection (WRED) randomly drops some packets with the specified DSCP value.
<i>max-threshold</i>	Maximum threshold in number of packets. The value range of this argument is the value of the <i>min-threshold</i> argument to 4096. When the average queue length exceeds the maximum threshold, WRED drops all packets with the specified DSCP value.
<i>mark-probability-denominator</i>	(Optional) Denominator for the fraction of packets dropped when the average queue depth is at the maximum threshold. For example, if the denominator is 512, one out of every 512 packets is dropped when the average queue is at the maximum threshold. The value range is 1 to 65536. The default is 10; one out of every ten packets is dropped at the maximum threshold.

Defaults

If WRED is using the DSCP value to calculate the drop probability of a packet, all 64 entries of the DSCP table are initialized with the default settings shown in Table 1.

Table 1 dscp Default Settings

DSCP (Precedence)	Minimum Threshold	Maximum Threshold	Mark Probability
0(0)	20	40	1/10
1	22	40	1/10
2	24	40	1/10
3	26	40	1/10
4	28	40	1/10
5	30	40	1/10
6	32	40	1/10
7	34	40	1/10
8(1)	22	40	1/10

Table 1 *dscp Default Settings (continued)*

DSCP (Precedence)	Minimum Threshold	Maximum Threshold	Mark Probability
9	22	40	1/10
10	24	40	1/10
11	26	40	1/10
12	28	40	1/10
13	30	40	1/10
14	32	40	1/10
15	34	40	1/10
16(2)	24	40	1/10
17	22	40	1/10
18	24	40	1/10
19	26	40	1/10
20	28	40	1/10
21	30	40	1/10
22	32	40	1/10
23	34	40	1/10
24(3)	26	40	1/10
25	22	40	1/10
26	24	40	1/10
27	26	40	1/10
28	28	40	1/10
29	30	40	1/10
30	32	40	1/10
31	34	40	1/10
32(4)	28	40	1/10
33	22	40	1/10
34	24	40	1/10
35	26	40	1/10
36	28	40	1/10
37	30	40	1/10
38	32	40	1/10
39	34	40	1/10
40(5)	30	40	1/10
41	22	40	1/10
42	24	40	1/10
43	26	40	1/10
44	28	40	1/10

Table 1 *dscp Default Settings (continued)*

DSCP (Precedence)	Minimum Threshold	Maximum Threshold	Mark Probability
45	30	40	1/10
46	36	40	1/10
47	34	40	1/10
48(6)	32	40	1/10
49	22	40	1/10
50	24	40	1/10
51	26	40	1/10
52	28	40	1/10
53	30	40	1/10
54	32	40	1/10
55	34	40	1/10
56(7)	34	40	1/10
57	22	40	1/10
58	24	40	1/10
59	26	40	1/10
60	28	40	1/10
61	30	40	1/10
62	32	40	1/10
63	34	40	1/10
rsvp	36	40	1/10

Command Modes `cfg-red-grp` configuration

Command History	Release	Modification
	12.1(5)T	This command was introduced.

Usage Guidelines This command must be used in conjunction with the **random-detect-group** command. Additionally, the **dscp** command is available only if you specified the *dscp-based* argument when using the **random-detect-group** command.

Examples The following example enables WRED to use the DSCP value 8. The minimum threshold for the DSCP value 8 is 20, the maximum threshold is 40, and the mark probability is 10.

```
dscp 8 20 40 10
```

Related Commands

Command	Description
random-detect-group	Enables per-VC WRED or per-VC DWRED.
show queueing	Lists all or selected configured queueing strategies.
show queueing interface	Displays the queueing statistics of an interface or VC.

random-detect dscp

To change the minimum and maximum packet thresholds for the differentiated services code point (DSCP) value, use the **random-detect dscp** interface configuration command. To return the minimum and maximum packet thresholds to the default for the DSCP value, use the **no** form of this command.

random-detect dscp *dscpvalue min-threshold max-threshold [mark-probability-denominator]*

no random-detect dscp *dscpvalue min-threshold max-threshold [mark-probability-denominator]*

Syntax Description

<i>dscpvalue</i>	Specifies the DSCP value. The DSCP value can be a number from 0 to 63, or it can be one of the following keywords: ef , af11 , af12 , af13 , af21 , af22 , af23 , af31 , af32 , af33 , af41 , af42 , af43 , cs1 , cs2 , cs3 , cs4 , cs5 , or cs7 .
<i>min-threshold</i>	Minimum threshold in number of packets. The value range of this argument is 1 to 4096. When the average queue length reaches the minimum threshold, Weighted Random Early Detection (WRED) randomly drops some packets with the specified DSCP value.
<i>max-threshold</i>	Maximum threshold in number of packets. The value range of this argument is the value of the <i>min-threshold</i> argument to 4096. When the average queue length exceeds the maximum threshold, WRED drops all packets with the specified DSCP value.
<i>mark-probability-denominator</i>	(Optional) Denominator for the fraction of packets dropped when the average queue depth is at the maximum threshold. For example, if the denominator is 512, one out of every 512 packets is dropped when the average queue is at the maximum threshold. The value range is 1 to 65536. The default is 10; one out of every ten packets is dropped at the maximum threshold.

Defaults

If WRED is using the DSCP value to calculate the drop probability of a packet, all 64 entries of the DSCP table are initialized with the default settings shown in Table 2.

Table 2 random-detect dscp Default Settings

DSCP (Precedence)	Minimum Threshold	Maximum Threshold	Mark Probability
0(0)	20	40	1/10
1	22	40	1/10
2	24	40	1/10
3	26	40	1/10
4	28	40	1/10
5	30	40	1/10
6	32	40	1/10
7	34	40	1/10
8(1)	22	40	1/10

Table 2 random-detect dscp Default Settings

DSCP (Precedence)	Minimum Threshold	Maximum Threshold	Mark Probability
9	22	40	1/10
10	24	40	1/10
11	26	40	1/10
12	28	40	1/10
13	30	40	1/10
14	32	40	1/10
15	34	40	1/10
16(2)	24	40	1/10
17	22	40	1/10
18	24	40	1/10
19	26	40	1/10
20	28	40	1/10
21	30	40	1/10
22	32	40	1/10
23	34	40	1/10
24(3)	26	40	1/10
25	22	40	1/10
26	24	40	1/10
27	26	40	1/10
28	28	40	1/10
29	30	40	1/10
30	32	40	1/10
31	34	40	1/10
32(4)	28	40	1/10
33	22	40	1/10
34	24	40	1/10
35	26	40	1/10
36	28	40	1/10
37	30	40	1/10
38	32	40	1/10
39	34	40	1/10
40(5)	30	40	1/10
41	22	40	1/10
42	24	40	1/10
43	26	40	1/10
44	28	40	1/10

Table 2 random-detect dscp Default Settings

DSCP (Precedence)	Minimum Threshold	Maximum Threshold	Mark Probability
45	30	40	1/10
46	36	40	1/10
47	34	40	1/10
48(6)	32	40	1/10
49	22	40	1/10
50	24	40	1/10
51	26	40	1/10
52	28	40	1/10
53	30	40	1/10
54	32	40	1/10
55	34	40	1/10
56(7)	34	40	1/10
57	22	40	1/10
58	24	40	1/10
59	26	40	1/10
60	28	40	1/10
61	30	40	1/10
62	32	40	1/10
63	34	40	1/10
rsvp	36	40	1/10

Command Modes

Interface configuration

Command History

Release	Modification
12.1(5)T	This command was introduced.

Usage Guidelines

The **random-detect dscp** command allows you to specify the DSCP value. The DSCP value can be a number from 0 to 63, or it can be one of the following keywords: **ef**, **af11**, **af12**, **af13**, **af21**, **af22**, **af23**, **af31**, **af32**, **af33**, **af41**, **af42**, **af43**, **cs1**, **cs2**, **cs3**, **cs4**, **cs5**, or **cs7**.

This command must be used in conjunction with the **random-detect** (interface) command.

Additionally, the **random-detect dscp** command is available only if you specified the *dscp-based* argument when using the **random-detect** (interface) command.

Examples

The following example enables WRED to use the DSCP value 8. The minimum threshold for the DSCP value 8 is 20, the maximum threshold is 40, and the mark probability is 10.

```
random-detect dscp 8 20 40 10
```

Related Commands

Command	Description
random-detect (interface)	Enables WRED or DWRED.
show queueing	Lists all or selected configured queueing strategies.
show queueing interface	Displays the queueing statistics of an interface or VC.

random-detect (interface)

To enable Weighted Random Early Detection (WRED) or VIP-Distributed WRED (DWRED), use the **random-detect** interface configuration command. To configure WRED as class policy in a policy map, use the **random-detect** interface and policy-map class configuration command. To disable WRED or DWRED, use the **no** form of this command.

random-detect [*dscp-based* | *prec-based*]

no random-detect [*dscp-based* | *prec-based*]

Syntax Description

<i>dscp-based</i>	(Optional) Specifies that WRED is to use the differentiated services code point (DSCP) value when it calculates the drop probability for a packet.
<i>prec-based</i>	(Optional) Specifies that WRED is to use the IP Precedence value when it calculates the drop probability for a packet.

Defaults

WRED and DWRED are disabled by default.

If you choose not to use either the *dscp-based* or the *prec-based* argument, WRED uses the IP Precedence value (the default method) to calculate drop probability for the packet.

Command Modes

Interface configuration when used on an interface.

Policy-map class configuration when used to specify class policy in a policy map.

Command History

Release	Modification
11.1 CC	This command was introduced.
12.1(5)T	Arguments were added to support Differentiated Services (DiffServ) and Assured Forwarding (AF) Per-Hop Behavior (PHB).

Usage Guidelines

This command includes two optional arguments, *dscp-based* and *prec-based*, that determine the method WRED uses to calculate the drop probability of a packet.

Note the following points when deciding which method to instruct WRED to use:

- With the *dscp-based* argument, WRED uses the DSCP value (that is, the first six bits of the IP type of service (ToS) byte) to calculate the drop probability.
- With the *prec-based* argument, WRED will use the IP Precedence value to calculate the drop probability.
- The *dscp-based* and *prec-based* arguments are mutually exclusive.
- If neither argument is specified, WRED uses the IP Precedence value to calculate the drop probability (the default method).

Examples

The following example enables WRED to use the DSCP value 8. The minimum threshold for the DSCP value 8 is 24 and the maximum threshold is 40. This configuration was performed at the interface level.

```
(config-if)# interface seo/0
(config-if)# random-detect dscp-based
(config-if)# random-detect dscp 8 24 40
```

The following example enables WRED to use the DSCP value 8 for class c1. The minimum threshold for DSCP value 8 is 24 and the maximum threshold is 40. The last line attaches the service policy to the output interface or virtual circuit (VC) p1.

```
(config-if)# class-map c1
(config-cmap)# match access-group 101
(config-if)# policy-map p1
(config-pmap)# class c1
(config-pmap-c)# bandwidth 48
(config-pmap-c)# random-detect dscp-based
(config-pmap-c)# random-detect dscp 8 24 40
(config-if)# service-policy output p1
```

Related Commands

Command	Description
random-detect dscp	Configures the minimum and maximum packet thresholds, and optionally, the mark-probability denominator for the DSCP value.
random-detect exponential-weighting-constant	Configures the WRED and DWRED exponential weight factor for the average queue size calculation.
random-detect flow	Enables flow-based WRED.
random-detect precedence	Configures WRED and DWRED parameters for a particular IP Precedence.
show interfaces	Displays statistics for all interfaces configured on the router or access server.
show queueing	Lists all or selected configured queueing strategies.
show tech-support rsvp	Generates a report of all RSVP-related information.

random-detect-group

To define the Weighted Random Early Detection (WRED) or VIP-Distributed WRED (DWRED) parameter group, use the **random-detect-group** global configuration command. To delete the WRED or DWRED parameter group, use the **no** form of this command.

random-detect-group *group-name* [*dscp-based* | *prec-based*]

no random-detect-group *group-name* [*dscp-based* | *prec-based*]

Syntax Description

<i>group-name</i>	Name for the WRED or DWRED parameter group.
<i>dscp-based</i>	(Optional) Specifies that WRED is to use the differentiated services code point (DSCP) value when it calculates the drop probability for a packet.
<i>prec-based</i>	(Optional) Specifies that WRED is to use the IP Precedence value when it calculates the drop probability for a packet.

Defaults

No WRED or DWRED parameter group exists.

If you choose not to use either the *dscp-based* or the *prec-based* argument, WRED uses the IP Precedence value (the default method) to calculate drop probability for the packet.

Command Modes

Global configuration

Command History

Release	Modification
11.1(22)CC	This command was introduced.
12.1(5)T	Arguments were added to support Differentiated Services (DiffServ) and Assured Forwarding (AF) Per-Hop Behavior (PHB).

Usage Guidelines

This command includes two optional arguments, *dscp-based* and *prec-based*, that determine the method WRED uses to calculate the drop probability of a packet.

Note the following points when deciding which method to instruct WRED to use:

- With the *dscp-based* argument, WRED uses the DSCP value (that is, the first six bits of the IP type of service (ToS) byte) to calculate the drop probability.
- With the *prec-based* argument, WRED will use the IP Precedence value to calculate the drop probability.
- The *dscp-based* and *prec-based* arguments are mutually exclusive.
- If neither argument is specified, WRED uses the IP Precedence value to calculate the drop probability (the default method).

Examples

The following example defines the WRED parameter group called sanjose:

```
random-detect-group sanjose
  dscp 0 10 100
  dscp 4 20 100
  dscp 5 22 100
  dscp 10 10 100
  dscp 12 20 100
  dscp 14 30 100
```

The following example enables WRED to use the DSCP value 9. The minimum threshold for the DSCP value 9 is 20 and the maximum threshold is 50. This configuration can be attached to other VCs, as required.

```
(config)# random-detect-group sanjose dscp-based
(cfg-red-grp)# dscp 9 20 50
(config-subif-vc)# random-detect attach sanjose
```

Related Commands

Command	Description
dscp	Configures the minimum and maximum packet thresholds, and optionally, the mark-probability denominator for the DSCP value.
exponential-weighting-constant	Configures the exponential weight factor for the average queue size calculation for a WRED parameter group.
precedence (WRED group)	Configures a WRED group for a particular IP Precedence.
random-detect-group	Enables per-VC WRED or per-VC DWRED.
show queueing	Lists all or selected configured queueing strategies.
show queueing interface	Displays the queueing statistics of an interface or VC.

■ random-detect-group