

Configuring Weighted Random Early Detection

This module describes the tasks for configuring Weighted Random Early Detection (WRED) on a router.

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About Weighted Random Early Detection

Random Early Detection (RED) is a congestion avoidance mechanism that takes advantage of the congestion control mechanism of TCP. By randomly dropping packets prior to periods of high congestion, RED tells the packet source to decrease its transmission rate. WRED drops packets selectively based on IP precedence. Edge routers assign IP precedences to packets as they enter the network. (WRED is useful on any output interface where you expect to have congestion. However, WRED is usually used in the core routers of a network, rather than at the edge.) WRED uses these precedences to determine how it treats different types of traffic.

When a packet arrives, the following events occur:

1. The average queue size is calculated.
2. If the average is less than the minimum queue threshold, the arriving packet is queued.
3. If the average is between the minimum queue threshold for that type of traffic and the maximum threshold for the interface, the packet is either dropped or queued, depending on the packet drop probability for that type of traffic.
4. If the average queue size is greater than the maximum threshold, the packet is dropped.

Note WRED is useful with adaptive traffic such as TCP/IP. With TCP, dropped packets indicate congestion, so the packet source will reduce its transmission rate. With other protocols, packet sources may not respond or may resend dropped packets at the same rate. Thus, dropping packets does not decrease congestion. WRED treats non-IP traffic as precedence 0, the lowest precedence. Therefore, non-IP traffic is more likely to be dropped than IP traffic.

When you enable WRED with the **random-detect** interface configuration command, the parameters are set to their default values. The weight factor is 9. For all precedences, the mark probability denominator is 10, and maximum threshold is based on the output buffering capacity and the transmission speed for the interface.

The default minimum threshold depends on the precedence. The minimum threshold for IP Precedence 0 corresponds to half of the maximum threshold. The values for the remaining precedences fall between half the maximum threshold and the maximum threshold at evenly spaced intervals.

Note The default WRED parameter values are based on the best available data. We recommend that you do not change the parameters from their default values unless you have determined that your applications will benefit from the changed values.

How to Configure WRED

Enabling WRED

Command	Purpose
`Router(config-if)# random-detect`	Enables WRED.

Changing WRED Parameters

Command	Purpose
`Router(config-if)# random-detect exponential-weighting-constant` *exponent*	Configures the weight factor used in calculating the average queue length.
`Router(config-if)# random-detect precedence` *precedence min-threshold max-threshold mark-prob-denominator*	Configures parameters for packets with a specific IP Precedence. The minimum threshold for IP Precedence 0 corresponds to half the maximum threshold for the interface. Repeat this command for each precedence. To configure RED, rather than WRED, use the same parameters for each precedence.

Monitoring WRED

Command	Purpose
`Router# show queue` *interface-type interface-number*	Displays the header information of the packets inside a queue.

Command	Purpose
`Router# show queueing interface interface-number [vc [[vpi/] vci]]`	Displays the WRED statistics of a specific virtual circuit (VC) on an interface.
`Router# show queueing random-detect`	Displays the queueing configuration for WRED.
`Router# show interfaces [type slot | port-adapter | port]`	Displays WRED configuration on an interface.

WRED Configuration Examples

Example WRED Configuration

The following example enables WRED with default parameter values:

```
interface Serial5/0
 description to qos1-75a
 ip address 200.200.14.250 255.255.255.252
 random-detect
```

Use the **show interfaces** command output to verify the configuration. Notice that the "Queueing strategy" report lists "random early detection (RED)."

```
Router# show interfaces serial 5/0
Serial5/0 is up, line protocol is up
  Hardware is M4T
  Description: to qos1-75a
  Internet address is 200.200.14.250/30
  MTU 1500 bytes, BW 128 Kbit, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 237/255
  Encapsulation HDLC, crc 16, loopback not set
  Keepalive not set
  Last input 00:00:15, output 00:00:00, output hang never
  Last clearing of "show interface" counters 00:05:08
  Input queue: 0/75/0 (size/max/drops); Total output drops: 1036
  Queueing strategy: random early detection(RED)
  5 minutes input rate 0 bits/sec, 2 packets/sec
  5 minutes output rate 119000 bits/sec, 126 packets/sec
     594 packets input, 37115 bytes, 0 no buffer
     Received 5 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     37525 packets output, 4428684 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions     DCD=up  DSR=up  DTR=up  RTS=up  CTS=up
```

Use the **show queue** command output to view the current contents of the interface queue. Notice that there is only a single queue into which packets from all IP precedences are placed after dropping has taken place. The output has been truncated to show only three of the five packets.

```
Router# show queue serial 5/0
```

```
Output queue for Serial5/0 is 5/0
Packet 1, linktype: ip, length: 118, flags: 0x288
  source: 190.1.3.4, destination: 190.1.2.2, id: 0x0001, ttl: 254,
  TOS: 128 prot: 17, source port 11111, destination port 22222
    data: 0x2B67 0x56CE 0x005E 0xE89A 0xCBA9 0x8765 0x4321
          0x0FED 0xCBA9 0x8765 0x4321 0x0FED 0xCBA9 0x8765
Packet 2, linktype: ip, length: 118, flags: 0x288
  source: 190.1.3.5, destination: 190.1.2.2, id: 0x0001, ttl: 254,
  TOS: 160 prot: 17, source port 11111, destination port 22222
    data: 0x2B67 0x56CE 0x005E 0xE89A 0xCBA9 0x8765 0x4321
          0x0FED 0xCBA9 0x8765 0x4321 0x0FED 0xCBA9 0x8765
Packet 3, linktype: ip, length: 118, flags: 0x280
  source: 190.1.3.6, destination: 190.1.2.2, id: 0x0001, ttl: 254,
  TOS: 192 prot: 17, source port 11111, destination port 22222
    data: 0x2B67 0x56CE 0x005E 0xE89A 0xCBA9 0x8765 0x4321
          0x0FED 0xCBA9 0x8765 0x4321 0x0FED 0xCBA9 0x8765
```

Use the **show queueing** command output to view the current settings for each of the precedences. Also notice that the default minimum thresholds are spaced evenly between half and the entire maximum threshold. Thresholds are specified in terms of packet count.

```
Router# show queueing
Current random-detect configuration:
     Serial5/0
       Queueing strategy:random early detection (WRED)
       Exp-weight-constant:9 (1/512)
       Mean queue depth:28

       Class   Random       Tail    Minimum    Maximum     Mark
                 drop       drop  threshold  threshold  probability
         0        330          0         20         40     1/10
         1        267          0         22         40     1/10
         2        217          0         24         40     1/10
         3        156          0         26         40     1/10
         4         61          0         28         40     1/10
         5          6          0         31         40     1/10
         6          0          0         33         40     1/10
         7          0          0         35         40     1/10
        rsvp        0          0         37         40     1/10
```

Example Parameter-Setting WRED

The following example enables WRED on the interface and specifies parameters for the different IP precedences:

```
interface Hssi0/0/0
 description 45Mbps to R1
 ip address 10.200.14.250 255.255.255.252
 random-detect
 random-detect precedence 0 32 256 100
 random-detect precedence 1 64 256 100
 random-detect precedence 2 96 256 100
 random-detect precedence 3 120 256 100
 random-detect precedence 4 140 256 100
 random-detect precedence 5 170 256 100
 random-detect precedence 6 290 256 100
 random-detect precedence 7 210 256 100
 random-detect precedence rsvp 230 256 100
```

Feature Information for Configuring Weighted Random Early Detection

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 1: Feature Information for Configuring Weighted Random Early Detection

Feature Name	Releases	Feature Information
Class-Based Weighted Fair Queueing (CBWFQ) and Weighted Random Early Detection (WRED)	Cisco IOS XE Release 2.1	This feature was introduced on Cisco ASR 1000 Series Routers. **Note** For information about CBWFQ, see the "Configuring Weighted Fair Queueing" module.
Random Early Detection (RED)	Cisco IOS XE Release 2.1	This feature was introduced on Cisco ASR 1000 Series Routers.
Weighted Random Early Detection	Cisco IOS XE Release 2.1	This feature was introduced on Cisco ASR 1000 Series Routers.
Weighted RED (WRED)	Cisco IOS XE Release 2.1	This feature was introduced on Cisco ASR 1000 Series Routers.