

Micro-Burst Monitoring

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Micro-Burst Monitoring

The micro-burst monitoring feature allows you to monitor traffic to detect unexpected data bursts within a very small time window (microseconds). This allows you to detect traffic in the network that are at risk for data loss and for network congestion.

A micro-burst is detected when the buffer utilization in an egress queue rises above the configured rise-threshold (measured in bytes or percentage). The burst for the queue ends when the queue buffer utilization falls below the configured fall-threshold (measured in bytes or percentage).

The feature provides timestamp and instantaneous buffer utilization information about the various queues where micro-burst monitoring is enabled.

Depending on the switch, you can enable the micro-burst detection per-queue or per-switch.

Guidelines and Limitations for Micro-Burst Monitoring

The following are the guidelines and limitations for micro-burst monitoring:

- From Cisco NX-OS Release 10.1(x), micro-burst monitoring is supported on Cisco Nexus 9500 platform switches.
- Micro-burst monitoring and detection is supported on the following platforms:
  - Cisco Nexus 9300-FX switches
  - Cisco Nexus 9300-FX2 switches
  - Cisco Nexus 9300-FX3 switches

- Cisco Nexus 9300-GX switches
- Cisco Nexus 9300-GX2 switches
- Cisco Nexus 9300-H2R switches
- Cisco Nexus X9700-FX line card
- Cisco Nexus X9716D-GX line card
- Cisco Nexus 9364C-H1 switches

On these switches, micro-burst monitoring is supported on both unicast and multicast egress queues. It is not supported on CPU, or span queues.

In addition, early detection of long bursts is supported. For bursts lasting more than 5 seconds, an early burst start record is displayed after 5 seconds from the start of the burst and is updated when the burst actually ends. This is not supported for Cisco Nexus 9300-FX and newer platform switches. The newer platform switches detect microburst only after the buffer usage falls below the fall threshold.



Note On these switches, micro-burst duration is not affected by the number of queues configured.

- **show** commands with the **internal** keyword are not supported.
- On switches that contain a Network Forwarding Engine (NFE2), micro-burst monitoring requires IO FPGA version 0x9 or later.

  For more information about EPLD programming to upgrade the FPGA, see the *Cisco Nexus 9000 Series FPGA/EPLD Upgrade Release Notes*.
- The following are guidelines for micro-burst duration on non-modular switches that contain a Network Forwarding Engine (NFE2):



Note Micro-burst duration is the duration of the burst that can be detected. For example, when micro-burst monitoring is configured for 1 - 3 queues, micro-bursts that exceed 0.64 microseconds are detected. Increasing the number of queues that are configured for micro-burst monitoring increases the duration of the burst that can be detected. This does not apply to Cisco Nexus 9300-FX, 9300-FX2, and newer platform switches.

1 - 3 queues	0.64 microsecond duration
8 queues with 10 ports each	9.0 microsecond duration
10 queues with 132 ports each	140 microsecond (0.14 millisecond) duration

- By default, the switch stores a maximum of 1000 burst records. The maximum number of records is configurable within a range of 200 - 2000 records.

- At least, 20 burst records are stored for each queue even when the maximum number of burst records has been reached.
- When the maximum number of burst records has been reached, the oldest record is deleted to allow the storage of a new record.
- You can use the **hardware qos burst-detect max-records** *number-of-records* command to configure the maximum number of burst records to store.
- You can use the **show hardware qos burst-detect max-records** command to display the maximum number of burst records that can be stored.

- Too many back to back burst records while traffic is being drained from queues might result in jitter.

  To avoid jitter, configure the fall-threshold to be less than the rise-threshold. As a best practice, configure the fall-threshold to be approximately 20% of the rise-threshold value (bytes).
- Beginning with Cisco NX-OS Release 10.2(3)F, micro-burst monitoring is supported on Cisco Nexus 9300-FX3 FEX.
- Beginning with Cisco NX-OS Release 10.3(3)F, micro-burst monitoring feature provides the following capabilities:
  - Micro-Burst configuration can be done in units of percentage apart from bytes on Cisco Nexus 9300-FX/FX2/FX3/GX/GX2 switches and Cisco Nexus 9500 platform switches with N9K-X9700-FX line card.
  - Micro-Burst records are exported to Network Insights Resources (NIR) apart from uburst bytes database using software telemetry on Cisco Nexus 9300-FX/FX2/FX3/GX/GX2 platform switches.

Configuring Micro-Burst Detection Per-Queue

You can enable micro-burst detection for all interfaces on the device.



Note This procedure is for all Cisco Nexus 9000 Series switches that support per-queue thresholds.

You can enable independent micro-burst thresholds per queue on the following switches:

- Cisco Nexus X9716D-GX platform switch from Release 10.2(1)F
- Cisco Nexus 9336C-FX2-E switches from Release 10.1(2)
- Cisco Nexus 9300-FX3 platform switches
- Cisco Nexus 9300-GX/GX2/H2R platform switches
- Cisco Nexus 9336C-FX switch
- Cisco Nexus 93360YC-FX2 and Cisco Nexus 93216TC-FX2 switches from Release 9.3(7)

The parameters are defined under the individual queues in the queuing policy-maps.

SUMMARY STEPS

1. **configure terminal**
2. **policy-map type queuing** *policy-map-name*
3. **class type queuing** *class-name*
4. **burst-detect rise-threshold** *rise-threshold-bytes* **bytes fall-threshold** *fall-threshold-bytes* **bytes**
5. **exit**
6. **exit**
7. **interface ethernet** *slot/port*
8. **service-policy type queuing output** *policy-map-name*

DETAILED STEPS

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**policy-map type queuing** *policy-map-name*
	Example:
	`switch(config)# policy-map type queuing xyz`
	`switch(config-pmap-que)#`
		Configures the policy map of type queuing and then enters policy-map mode for the policy-map name you specify.

Step 3	**class type queuing** *class-name*
	Example:
	`switch(config-pmap-que)# class type queuing c-out-def`
	`switch(config-pmap-c-que)#`
		Configures the class map of type queuing and then enters policy-map class queuing mode.

Step 4	**burst-detect rise-threshold** *rise-threshold-bytes* **bytes fall-threshold** *fall-threshold-bytes* **bytes** **Example:** `switch(config-pmap-c-que)# burst-detect rise-threshold 208 bytes fall-threshold 208 bytes`	Specifies the rise-threshold and the fall-threshold for micro-burst detection. Beginning with Cisco NX-OS Release 10.3(3)F, the **rise-threshold** and **fall-threshold** for micro-burst detection can be specified even in percentage.. For example: `switch(config)# burst-detect rise-threshold 60 percent fall-threshold 40 percent`

Step 5	**exit**
	Example:
	`switch(config-pmap-c-que)# exit`
	`switch(config-pmap-que)#`
		Exits policy-map queue mode.

	Command or Action	Purpose

Step 6	**exit**
	Example:
	`switch(config-pmap-que)# exit`
	`switch(config)#`
		Exits policy-map queue mode.

Step 7	**interface ethernet** *slot/port*
	Example:
	`switch(config)# interface ethernet 1/1`
	`switch(config-if)#`
		Configures the interface.

Step 8	**service-policy type queuing output** *policy-map-name* **Example:** `switch(config-if)# service-policy type queuing output custom-out-8q-uburst`	Adds the policy map to the input or output packets of the system.

Configuring Micro-Burst Detection Per-Switch

You can enable micro-burst detection for all interfaces on the device.

Note This procedure is for all Cisco Nexus 9000 Series switches that support per-switch thresholds.

For the following switches, you have to enable thresholds per switch:

- Cisco Nexus 9300-FX switches
- Cisco Nexus 9500 Platform Switches with N9K-X9700-FX line card

Therefore, the threshold is defined globally and applied to any queues where micro-burst detection is enabled in the queuing policy.

SUMMARY STEPS

1. **configure terminal**
2. **hardware qos burst-detect rise-threshold** *rise-threshold-bytes* **bytes** | **percentfall-threshold** *fall-threshold-bytes* **bytes**
3. **policy-map type queuing** *policy-map-name*
4. **class type queuing** *class-name*
5. **burst-detect enable**
6. **exit**
7. **exit**
8. **interface ethernet** *slot/port*
9. **service-policy type queuing output** *policy-map-name*

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `switch# configure terminal`	Enters global configuration mode.
Step 2	**hardware qos burst-detect rise-threshold** *rise-threshold-bytes* **bytes** | **percentfall-threshold** *fall-threshold-bytes* **bytes** **Example:** `switch(config)# hardware qos burst-detect rise-threshold 10000 bytes fall-threshold 2000 bytes`	Specifies the rise-threshold and the fall-threshold for micro-burst detection. Beginning with Cisco NX-OS Release 10.3(3)F, the **rise-threshold** and **fall-threshold** for micro-burst detection can be specified even in percentage. For example: `switch(config)# hardware qos burst-detect rise-threshold 60 percent fall-threshold 40 percent`
Step 3	**policy-map type queuing** *policy-map-name* **Example:** `switch(config)# policy-map type queuing custom-out-8q-uburst`	Configures the policy map of type queuing and then enters policy-map mode for the policy-map name you specify.
Step 4	**class type queuing** *class-name* **Example:** `switch(config-pmap-que)# class type queuing c-out-8q-q-default`	Configures the class map of type queuing and then enters policy-map class queuing mode.
Step 5	**burst-detect enable** **Example:** `switch(config-pmap-c-que)# burst-detect enable`	Enable micro-burst detection on the queue.
Step 6	**exit** **Example:** `switch(config-pmap-c-que)# exit`	Exits policy-map class queue mode.
Step 7	**exit** **Example:** `switch(config-pmap-que)# exit`	Exits policy-map queue mode.

Step 8	**interface ethernet** *slot/port*
	Example:
	`switch(config)# interface ethernet 1/1`
	`switch(config-if)#`
		Configures the interface.

	Command or Action	Purpose
Step 9	**service-policy type queuing output** *policy-map-name* **Example:** `switch(config-if)# service-policy type queuing output custom-out-8q-uburst`	Adds the policy map to the input or output packets of the system.

Clearing Micro-Burst Detection

You can clear micro-burst detection for all interfaces or a selected interface.

Note Even after removing the queuing policy from an interface, previous micro-burst statistics remain. Use the **clear queuing burst-detect** command to clear the remaining records.

Procedure

	Command or Action	Purpose
Step 1	**clear queuing burst-detect** [*slot*] [**interface** *port* [**queue** *queue-id*]] **Example:**	Clears micro-burst information from all interfaces or the specified interface.

Example

- Example for an interface:

```
clear queuing burst-detect interface Eth1/2
```

- Example for a queue:

```
clear queuing burst-detect interface Eth1/2 queue 7
```

- Example for FEX:

```
clear queuing burst-detect fex 101
```

Verifying Micro-Burst Detection

The following displays micro-burst monitoring information:

Command	Purpose
show queuing burst-detect	Displays micro-burst counters information for all interfaces.

- Example for an interface:

```
show queuing burst-detect interface Eth 1/2
```

- Example for a queue:

```
show queuing burst-detect interface Eth 1/2 queue 7
```

- Example for FEX:

```
show queuing burst-detect fex 101
```

Example of Micro-Burst Detection Output

Example output of TOR switch.

```
belv6# show queuing burst-detect detail
slot  1
=======
-------------------------------------------------------------------------------------------------------------------------------------------
         Microburst Statistics

Flags: E - Early start record, U - Unicast, M - Multicast
-------------------------------------------------------------------------------------------------------------------------------------------
Ethernet|Queue| Start |        Start Time       | Peak  |         Peak Time       |  End  |        End Time         |Duration
Intfc   |     | Depth |                         | Depth |                         | Depth |                         |
        |     |(bytes)|                         |(bytes)|                         |(bytes)|                         |
-------------------------------------------------------------------------------------------------------------------------------------------
 Eth1/36| U0  | 310128 |2011/01/11 22:31:51:081725|310128|2011/01/11 22:31:51:081725|    0|2011/01/11 22:31:51:081918|193.14 us
 Eth1/36| U0  | 311168 |2011/01/11 22:31:51:181765|311168|2011/01/11 22:31:51:181765|    0|2011/01/11 22:31:51:181959|193.90 us
 Eth1/36| U0  | 283712 |2011/01/11 22:31:51:281825|283712|2011/01/11 22:31:51:281825|    0|2011/01/11 22:31:51:282018|193.63 us
 Eth1/36| U0  | 283712 |2011/01/11 22:31:51:381862|283712|2011/01/11 22:31:51:381862|    0|2011/01/11 22:31:51:382056|193.42 us
 Eth1/36| U0  | 312000 |2011/01/11 22:31:51:481885|312000|2011/01/11 22:31:51:481885|    0|2011/01/11 22:31:51:482080|194.42 us
 Eth1/36| U0  | 221312 |2011/01/11 22:31:51:581974|221312|2011/01/11 22:31:51:581974|    0|2011/01/11 22:31:51:582168|193.58 us
 Eth1/36| U0  | 291616 |2011/01/11 22:31:51:681964|291616|2011/01/11 22:31:51:681964|    0|2011/01/11 22:31:51:682157|193.10 us
 Eth1/36| U0  | 190112 |2011/01/11 22:31:51:782067|190112|2011/01/11 22:31:51:782067|18512|2011/01/11 22:31:51:782154| 86.22 us
 Eth1/36| U0  |  70512 |2011/01/11 22:31:51:882167|  70512|2011/01/11 22:31:51:882167|    0|2011/01/11 22:31:51:882253| 85.74 us
 Eth1/36| U0  | 185328 |2011/01/11 22:31:52:082111|185328|2011/01/11 22:31:52:082111|    0|2011/01/11 22:31:52:082304|193.09 us
 Eth1/36| U0  | 243856 |2011/01/11 22:31:52:182158|243856|2011/01/11 22:31:52:182158|    0|2011/01/11 22:31:52:182352|193.34 us
 Eth1/36| U0  | 138112 |2011/01/11 22:31:52:282293|138112|2011/01/11 22:31:52:282293|    0|2011/01/11 22:31:52:282380| 86.53 us
 Eth1/36| U0  | 242112 |2011/01/11 22:31:52:382284|242112|2011/01/11 22:31:52:382284|    0|2011/01/11 22:31:52:382478|193.55 us
 Eth1/36| U0  | 136448 |2011/01/11 22:31:52:482264|195312|2011/01/11 22:31:52:482348|    0|2011/01/11 22:31:52:482542|278.16 us
 Eth1/36| U0  | 299312 |2011/01/11 22:31:52:582334|299312|2011/01/11 22:31:52:582334|    0|2011/01/11 22:31:52:582612|278.12 us
 Eth1/36| U0  | 184912 |2011/01/11 22:31:52:682432|184912|2011/01/11 22:31:52:682432|13312|2011/01/11 22:31:52:682517| 85.42 us
 Eth1/36| U0  | 148304 |2011/01/11 22:31:52:782387|148304|2011/01/11 22:31:52:782387|    0|2011/01/11 22:31:52:782580|192.94 us
 Eth1/36| U0  | 226512 |2011/01/11 22:31:52:882492|226512|2011/01/11 22:31:52:882492|    0|2011/01/11 22:31:52:882685|193.37 us
```

Network Insights Resources Examples

Beginning with Cisco NX-OS Release 10.3(3)F, the Nexus Dashboard Insight, formally called Network Insights Resources(NIR), is supported on Cisco Nexus 9300-FX/FX2/FX3/FXP/GX/GX2 switches.

The following examples displays how the micro-burst records are exported to Nexus Dashboard Insight at frequency of 1 minute using software telemetry:

Example of **show queuing burst-detect nir** command:

```
config# show queuing burst-detect nir

slot  1
```

```
=======

--------------------------------------------------------------------------------------------------------------

          Microburst Statistics

Flags: E - Early start record, U - Unicast, M - Multicast
--------------------------------------------------------------------------------------------------------------
Ethernet |Queue|         Start Time         |Peak Depth|          Peak Time         |Duration
Interface|     |                            |(in bytes)|                            |
--------------------------------------------------------------------------------------------------------------

  Eth1/56|  U2  | 2022/05/09 15:41:31:899758 |    9984  | 2022/05/09 15:41:31:899764 |
    6.88 us
  Eth1/56|  U2  | 2022/05/09 15:41:31:899765 | 7714304  | 2022/05/09 15:41:32:070481 |
     9.97 s
  Eth1/56|  U2  | 2022/05/09 16:45:06:763271 |    2912  | 2022/05/09 16:45:06:763272 |
    1.90 us
```

Example of **show queuing burst-detect nir detail** command:

```
config# show queuing burst-detect nir

slot  1
=======

--------------------------------------------------------------------------------------------------------------

          Microburst Statistics

Flags: E - Early start record, U - Unicast, M - Multicast
--------------------------------------------------------------------------------------------------------------
Ethernet |Queue|Start Depth|         Start Time          |Peak Depth|          Peak Time
      |End Depth|         End Time           |Duration
Interface|     |  (bytes)  |                            | (bytes)  |
      | (bytes) |                            |
--------------------------------------------------------------------------------------------------------------

   Eth1/6|  U6  |     416   | 2023/06/28 13:11:45:005625 |    3120  | 2023/06/28
13:11:45:005626 |     416 | 2023/06/28 13:11:45:005627 |        1.11 us
   Eth1/6|  U6  |     416   | 2023/06/28 13:11:45:005057 |    3120  | 2023/06/28
13:11:45:005058 |     416 | 2023/06/28 13:11:45:005059 |        1.44 us
```

Example of telemetry configuration on the switch to receive micro-burst data:

```
telemetry
destination-group 1
ip address receiver_ip_address port receiver_port protocol grpc encoding GPB-compact
sensor-group 1
data-source native
path microburst
subscription 1
dst-grp 1
snsr-grp 1 sample-interval 0
```