



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:

Switches	Minimum Burst Interval
Cisco Nexus 9200	86 μ sec
	96 μ sec

Switches	Minimum Burst Interval
Cisco Nexus 9300	73 μ sec 78 μ sec
Cisco Nexus 9300-EX	
Cisco Nexus 9300-FX	
Cisco Nexus 9300-FX2	
Cisco Nexus 9300-FX3	
Cisco Nexus 9300-GX	
Cisco Nexus 9300-GX2	
Cisco Nexus 9300-H	
Cisco Nexus 9400	
N9K-X9700-FX line card	
Cisco Nexus 9332C	
Cisco Nexus 9364C	
Cisco Nexus X9716D-GX	

On these switches, micro-burst monitoring is supported on both unicast and multicast egress queues. On these switches, micro-burst monitoring is supported on unicast egress queues. It is not supported on multicast, 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, 9332C, 9364C 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.

Beginning with Cisco NX-OS Release 7.0(3)I5(1), micro-burst monitoring on Cisco Nexus 9200 or 9300-EX platform switches require the following IO FPGA versions:

Switch	IO FPGA Version
Cisco Nexus 92160YC-X	0x16 or later

Switch	IO FPGA Version
Cisco Nexus 92304QC	0x10 or later
Cisco Nexus 9272Q	0x15 or later
Cisco Nexus 9232C	0x6 or later
Cisco Nexus 9236C	0x14 or later
Cisco Nexus 93180YC-EX	0x8 or later
Cisco Nexus 93108TC-EX	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 9364C 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, C9332C, and C9364C 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, 9332D-GX2B, and 9364D-GX2A switches from Release 10.1(2)
- Cisco Nexus 9300-EX//FX3 platform switches
- Cisco Nexus 9300-GX/GX2/H platform switches
- Cisco Nexus 9400 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

	Command or Action	Purpose
Step 1	configure terminal Example: <pre>switch# configure terminal switch(config)#</pre>	Enters global configuration mode.
Step 2	policy-map type queuing <i>policy-map-name</i> Example: <pre>switch(config)# policy-map type queuing xyz switch(config-pmap-que)#</pre>	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 <i>class-name</i> Example: <pre>switch(config-pmap-que)# class type queuing c-out-def switch(config-pmap-c-que)#</pre>	Configures the class map of type queuing and then enters policy-map class queuing mode.
Step 4	burst-detect rise-threshold <i>rise-threshold-bytes</i> bytes fall-threshold <i>fall-threshold-bytes</i> bytes Example: <pre>switch(config-pmap-c-que)# burst-detect rise-threshold 208 bytes fall-threshold 208 bytes</pre>	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: <pre>switch(config)# burst-detect rise-threshold 60 percent fall-threshold 40 percent</pre>
Step 5	exit Example: <pre>switch(config-pmap-c-que)# exit switch(config-pmap-que)#</pre>	Exits policy-map queue mode.
Step 6	exit Example: <pre>switch(config-pmap-que)# exit switch(config)#</pre>	Exits policy-map queue mode.
Step 7	interface ethernet <i>slot/port</i> Example: <pre>switch(config)# interface ethernet 1/1 switch(config-if)#</pre>	Configures the interface.
Step 8	service-policy type queuing output <i>policy-map-name</i> Example:	Adds the policy map to the input or output packets of the system.

	Command or Action	Purpose
	<code>switch(config-if)# service-policy type queuing output custom-out-8q-uburst</code>	

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 9200 switches
- Cisco Nexus 9300-FX switches
- Cisco Nexus 9332C switches
- Cisco Nexus 9364C 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

	Command or Action	Purpose
Step 1	configure terminal Example: <code>switch# configure terminal</code>	Enters global configuration mode.

	Command or Action	Purpose
Step 2	<p>hardware qos burst-detect rise-threshold <i>rise-threshold-bytes bytes</i> percentfall-threshold <i>fall-threshold-bytes bytes</i></p> <p>Example:</p> <pre>switch(config)# hardware qos burst-detect rise-threshold 10000 bytes fall-threshold 2000 bytes</pre>	<p>Specifies the rise-threshold and the fall-threshold for micro-burst detection.</p> <p>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:</p> <pre>switch(config)# hardware qos burst-detect rise-threshold 60 percent fall-threshold 40 percent</pre>
Step 3	<p>policy-map type queuing <i>policy-map-name</i></p> <p>Example:</p> <pre>switch(config)# policy-map type queuing custom-out-8q-uburst</pre>	Configures the policy map of type queuing and then enters policy-map mode for the policy-map name you specify.
Step 4	<p>class type queuing <i>class-name</i></p> <p>Example:</p> <pre>switch(config-pmap-que)# class type queuing c-out-8q-q-default</pre>	Configures the class map of type queuing and then enters policy-map class queuing mode.
Step 5	<p>burst-detect enable</p> <p>Example:</p> <pre>switch(config-pmap-c-que)# burst-detect enable</pre>	Enable micro-burst detection on the queue.
Step 6	<p>exit</p> <p>Example:</p> <pre>switch(config-pmap-c-que)# exit</pre>	Exits policy-map class queue mode.
Step 7	<p>exit</p> <p>Example:</p> <pre>switch(config-pmap-que)# exit</pre>	Exits policy-map queue mode.
Step 8	<p>interface ethernet <i>slot/port</i></p> <p>Example:</p> <pre>switch(config)# interface ethernet 1/1 switch(config-if)#</pre>	Configures the interface.
Step 9	<p>service-policy type queuing output <i>policy-map-name</i></p> <p>Example:</p> <pre>switch(config-if)# service-policy type queuing output custom-out-8q-uburst</pre>	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 [<i>slot</i>] [interface <i>port</i> [queue <i>queue-id</i>]] 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 Intfc	Queue	Start Depth (bytes)	Start Time	Peak Depth (bytes)	Peak Time	End Depth (bytes)	End Time	Duration
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	201616	2011/01/11 22:31:51:681964	201616	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	245856	2011/01/11 22:31:52:182158	245856	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	105312	2011/01/11 22:31:52:482348	0	2011/01/11 22:31:52:482542	278.16 us
Eth1/36	U0	209312	2011/01/11 22:31:52:582334	209312	2011/01/11 22:31:52:582334	0	2011/01/11 22:31:52:582528	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 Interface	Queue	Start Time	Peak Depth (in bytes)	Peak Time	Duration
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:

Example of Micro-Burst Detection Output

```
config# show queuing burst-detect nlr
```

```
slot 1
=====
```

```
-----
```

Microburst Statistics

Flags: E - Early start record, U - Unicast, M - Multicast

Ethernet Interface	Queue	Start Depth	End Depth	End Time	Start Time	Duration	Peak Depth	Peak Time
		(bytes)	(bytes)				(bytes)	

Eth1/6	U6	416	416	2023/06/28 13:11:45:005626	2023/06/28 13:11:45:005625	0005625	3120	2023/06/28 13:11:45:005627
							1.11 us	
Eth1/6	U6	416	416	2023/06/28 13:11:45:005058	2023/06/28 13:11:45:005057	005059	3120	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
```