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). The burst for the queue ends when the queue buffer utilization falls below the configured fall-threshold (measured in bytes).

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	IO FPGA Version
Cisco Nexus 9200	86 µsec 96 µsec	0x16 or later 0x10 or later 0x15 or later 0x6 or later 0x14 or later
Cisco Nexus 9300	73 µsec 78 µsec	0x8 or later 0x9 or later
Cisco Nexus 9300-EX		
Cisco Nexus 9300-FX		
Cisco Nexus 9300-FX2		
Cisco Nexus 9332C		
Cisco Nexus 9364C		

On these switches, micro-burst monitoring is supported on both unicast and multicast egress 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, 9300-FX2, and 9364C platform switches.

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.
- Micro-burst monitoring is available with switches that contain the Network Forwarding Engine (NFE2). The minimum micro-burst that can be detected is 0.64 microseconds for 1 - 3 queues.

  On these switches, micro-burst monitoring is supported on unicast egress queues. It is not supported on multicast, CPU, or span queues.
- 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
Cisco Nexus 92304QC	0x10 or later
Cisco Nexus 9272Q	0x15 or later

Switch	IO FPGA Version
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).

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 9336C-FX2-E switches from Release 10.1(2)
- Cisco Nexus 9300-EX/FX2 platform switches
- Cisco Nexus 9300-GX platform switches from Release 9.3(3)
- Cisco Nexus 9336C-FX switches
- Cisco Nexus 93360YC-FX2 and Cisco Nexus 93216TC-FX2 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:
	`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:**	Configures the class map of type queuing and then enters policy-map class queuing mode.

	Command or Action	Purpose
	`switch(config-pmap-que)# class type queuing c-out-def` `switch(config-pmap-c-que)#`	
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.

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

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 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:** `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.
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.

	Command or Action	Purpose
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.

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
```

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 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
```

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
```