Chapter 17

DCBX and Flow Control

This chapter describes Data Center Bridging Capability Exchange (DCBX) configuration tasks. Sections in this chapter include:

- Section 17.1: Introduction
- Section 17.2: Overview
- Section 17.3: DCBX Configuration and Verification
- Section 17.4: Configuring Priority-Flow-Control (PFC)
- Section 17.5: Configuring PFC Watchdog
- Section 17.6: DCBX and Flow Control Commands

17.1 Introduction

EOS implements Link Layer Discovery Protocol (LLDP) and the Data Center Bridging Capability Exchange (DCBX) protocol to help automate the configuration of Data Center Bridging (DCB) parameters, including the Priority-Based Flow Control (PFC) standard, which allows an end-to-end flow-control feature.

This feature enables a switch to recognize when it is connected to an iSCSI device and automatically configure the switch link parameters (such as priority flow control) to provide optimal support for that device. DCBX can be used to prioritize the handling of iSCSI traffic to help ensure that packets are not dropped or delayed. DCBX is off by default.
17.2 Overview

17.2.1 Data Center Bridging Capability Exchange (DCBX)
DCBX works with LLDP to allow switches to exchange information about their data center bridging (DCB) capabilities and configuration and automatically negotiate common Priority-Based Flow Control (PFC) parameters. Data is exchanged in type-length-value (TLV) format. For DCBX to function on an interface LLDP must be enabled on that interface as well.

17.2.2 Priority-Based Flow Control (PFC)
PFC uses a new control packet defined in IEEE 802.1Qbb and is not compatible with 802.3x flow control (FC). An interface that is configured for PFC will be disabled for FC. When PFC is disabled on an interface, the FC configuration for the interface becomes active. Any FC frames received on a PFC configured interface are ignored.

Each priority is configured as either drop or no-drop. If a priority that is designated as no-drop is congested, the priority is paused. Drop priorities do not participate in pause.

When PFC is disabled, the interface defaults to the IEEE 802.3x flow control setting for the interface. PFC is disabled by default.

17.2.3 PFC Watchdog
The PFC watchdog identifies the egress queues that are unable to transmit packets for a long time due to receiving continuous PFC pause frames. On identifying such stuck tx-queue PFC watchdog error-disables the respective port with a error-disable reason of stuck-queue. When there is an error reported on a port the traffic is re-routed through a different port to the destination.

The PFC watchdog supports the following PFC watchdog configurations:
- PFC watchdog forced recovery of queues
- PFC watchdog polling interval configuration
- PFC Watchdog non-disruptive priorities configuration
- Displaying stuck queue and recovery counters
17.3 **DCBX Configuration and Verification**

### 17.3.1 Set the Priority Rank to the Traffic Class

The `dcbx application priority` command assigns a priority rank to the specified traffic class in the application priority table. This table is transmitted on each DCBX-enabled interface.

**Examples**

- These commands tell the DCBX peer that iSCSI frames (TCP ports 860 and 3260) should be assigned the given priority of 5.
  
  ```
  switch(config)# dcbx application tcp-sctp 860 priority 5  
  switch(config)# dcbx application tcp-sctp 3260 priority 5  
  ```

- These commands specify a different priority for the two iSCSI traffic ports.
  
  ```
  switch(config)# dcbx application tcp-sctp 860 priority 3  
  switch(config)# dcbx application tcp-sctp 3260 priority 4  
  ```

- This command is equivalent to the `dcbx application tcp-sctp` command. The DCBX peer that iSCSI frames are assigned are the given the priority 5.
  
  ```
  switch(config)# dcbx application iscsi priority 5  
  ```

- These commands prevent the peers from sending anything about the iSCSI frames.
  
  ```
  switch(config)# no dcbx application tcp-sctp 860 priority 5  
  switch(config)# no dcbx application tcp-sctp 3260 priority 5  
  ```

### 17.3.2 Configuring CEE DCBX Priority Group

The `priority-flow-control priority` command configures the enhanced transmission selection (ETS) to the specified QoS group, and sets the traffic class priority and the bandwidth percentage for the packets in the traffic class.

**Examples**

- This command configures the ETS to the QoS group map and assigns the CoS map value as 7 and sets traffic class priority to 5.
  
  ```
  switch(config)# dcbx ets qos map cos 7 traffic-class 5  
  ```

- This command configures the ETS to the traffic class and sets the traffic class priority as 7 and bandwidth value to 70 percent.
  
  ```
  switch(config)# dcbx ets traffic-class 7 bandwidth 70  
  ```

### 17.3.3 DCBX Verification

To display the DCBX status and the interfaces on which DCBX is enabled, use the `show dcbx` command.

**Examples**

- This command displays the DCBX status for Ethernet 50.
  
  ```
  switch# show dcbx Ethernet 50  
  Ethernet50:  
  IEEE DCBX is enabled and active  
  Last LLDPDU received on Thu Feb 14 12:06:01 2013  
  No priority flow control configuration TLV received  
  No application priority configuration TLV received  
  ```
17.4 Configuring Priority-Flow-Control (PFC)

17.4.1 Enable Priority-Flow-Control (PFC)

The `priority-flow-control` command enables Priority-Flow-Control (PFC) on an individual port.

**Examples**

- The `priority-flow-control` command in DCBX mode enables PFC on an interface.

```
switch(config)#interface ethernet 2
switch(config-if-Et2)#priority-flow-control on
```

17.4.2 Set the Priority Flow Control Priority

The `priority-flow-control priority` command in DCBX mode creates a priority group that pauses priority. Each priority is configured as either drop or no-drop. If a priority that is designated as no-drop is congested, the priority is paused. Drop priorities do not participate in pause.

**Examples**

- The `priority-flow-control priority` command in DCBX mode creates a priority group that pauses priority 5 on Ethernet 2.

```
switch(config)#interface ethernet 2
switch(config-if-Et2)#priority-flow-control on
switch(config-if-Et2)# priority-flow-control priority 5 no-drop
```

- To enable lossy behavior, use the drop option of the `priority-flow-control priority` command.

```
switch(config)#interface ethernet 2
switch(config-if-Et2)#priority-flow-control on
switch(config-if-Et2)#priority-flow-control priority 5 drop
```

17.4.3 Disable Priority-Flow-Control (PFC)

To disable priority flow control (PFC) on the configuration mode interface and restore the default packet drop setting on the interface, use the `priority-flow-control priority` command.

**Example**

- To disable PFC, use the `no priority-flow-control` command.

```
switch (config)#interface ethernet 2
switch(config-if-Et2)#no priority-flow-control
```
17.5 Configuring PFC Watchdog

17.5.1 Enabling PFC Watchdog

The `priority-flow-control pause watchdog default timeout` command starts monitoring all the egress queues which have guaranteed bandwidth enabled and for the priorities on which PFC is enabled.

**Note**

To enable PFC watchdog, user is required to configure guaranteed bandwidth on the tx-queue to be monitored. Also, PFC must be enabled on the port for the traffic flowing into the queue that is being monitored.

**Example**

- These commands enable the PFC watchdog monitoring on tx-queue 3 of Ethernet 1/1, and configures a PFC congestion timeout of 10 seconds which will error-disable the port if the queue is stuck.

```
switch# config
switch(config)# interface Ethernet1/1
switch(config-if-Et1/1)# priority-flow-control on
switch(config-if-Et1/1)# priority-flow-control priority 3 no-drop
switch(config-if-Et1/1)# tx-queue 3
switch(config-if-Et1/1-txq-3)# bandwidth guaranteed 100
switch(config-if-Et1/1-txq-3)# exit
switch(config-if-Et1/1)# exit
switch(config)# priority-flow-control pause watchdog default timeout 10
```

17.5.2 Enabling PFC Watchdog Queue Recovery

The `priority-flow-control pause watchdog default recovery-time forced` command recovers a stuck queue after the PFC storm ceases. PFC watchdog supports the following two recovery methods.

- Auto Recovery – recover queue(s) after the PFC storm ceases.
- Forced Recovery – recover queue(s) after a fixed duration, irrespective of PFC storm being received.

**Note**

The default recovery mode is “auto”.

**Example**

- This command recovers a stuck queue after a fixed duration of 10 seconds.

```
switch(config)# priority-flow-control pause watchdog default recovery-time 10 forced
```

17.5.3 Configuring PFC Watchdog Polling Interval

The `priority-flow-control pause watchdog default polling-interval` command configures the frequency at which queues should be checked for stuck or recovery detection. By default, polling interval is calculated internally or it considers the value configured through CLI.

**Note**

Configuring a very low polling interval may increase load on the CPU.
Example

- This command configures a polling interval of 10 seconds on the switch.

```
switch(config)# priority-flow-control pause watchdog default polling-interval 10
```

17.5.4 Displaying Stuck Queue and Recovery Counters

The `show priority-flow-control counters watchdog` command displays the value of number of times a queue is identified as stuck and recovered. These counters are maintained only for those queues that have PFC watchdog functionality enabled. These counters are cleared when either PFC or PFC watchdog configuration is disabled. Alternatively, `show interfaces priority-flow-control counters watchdog` command can be used to display the counters.

Example

- This command displays the value of number of times the queue was stuck and recovered for all the interfaces.

```
switch# show priority-flow-control counters watchdog
Port       TxQ   Total times stuck   Total times recovered
---------- ----    -------------       -------------
Et1/1      UC2             2             2
Et1/1      UC3             3             3
Et2/1      UC2            12            12
Et2/1      UC3            31            30
```

- This command displays the value of number of times the queue was stuck and recovered for a specific interface. In this case it is Et1/1.

```
switch# show priority-flow-control interfaces Ethernet 1/1 counters watchdog
Port       TxQ   Total times stuck   Total times recovered
---------- ----    -------------       -------------
Et1/1      UC2             2             2
Et1/1      UC3             3             3
```

17.5.5 PFC Watchdog Non-disruptive Priorities

The PFC Watchdog acts to drop the traffic entering or leaving the port at the stuck PFC priority. Later when the queue recovers, this action is reversed. While applying these actions, some traffic (for all priorities) is dropped on that port. In such case, the `priority-flow-control pause watchdog hardware non-disruptive priority` command can be used to avoid the traffic drop on ports at stuck queues.

This traffic drop can be avoided by configuring specific PFC priorities as non-disruptive. When queues corresponding to these priorities are stuck/recovered, the traffic for other priorities are not impacted.

Example

- This command configures the specific PFC priorities as non-disruptive, and the priority is set to 3.

```
switch(config)# priority-flow-control pause watchdog hardware non-disruptive priority 3
```

- This command configures all the ports, having a subset of non-disruptive priorities as a part of their no-drop priorities, start in non-disruptive mode.

```
switch(config)# priority-flow-control pause watchdog hardware port non-disruptive-only
```
17.5.6 Displaying PFC Watchdog Information

The `show priority-flow-control` command displays the PFC watchdog status information. Note, if the PFC watchdog default timeout value is non-zero then PFC watchdog is active on the switch.

**Example**

- This command displays the PFC watchdog default timeout value, in this show example the timeout value is 3.0 which means the PFC watchdog is active.

  ```
  switch# show priority-flow-control
  The hardware supports PFC on priorities 0 1 2 3 4 5 6 7
  The PFC watchdog default timeout is 3.0
  Port   Enabled Priorities Active Note
  Et1/1   Yes       34      Yes    DCBX disabled
  Et1/2   Yes       34      Yes    DCBX disabled
  Et1/3   Yes       34      Yes    DCBX disabled
  Et1/4   Yes       34      Yes    DCBX disabled
  ```

The `show interface status errdisabled` command displays the port which is error-disabled due to stuck-queue condition.

**Example**

- This command displays the interface Ethernet Eth1/1 status as errdisabled and the reason.

  ```
  switch# show interface Eth1/1 status errdisabled
  Port            Name          Status         Reason
  ---------- ---------------- ----------------- ---------
  Et1/1                        errdisabled    stuck-queue
  ```

The `show priority-flow-control status` command displays the current PFC watchdog details.

**Example**

- This command displays the PFC watchdog configuration details at global and interface level.

  ```
  switch #show priority-flow-control status
  The hardware supports PFC on priorities 0 1 2 3 4 5 6 7
  The PFC watchdog timeout is 1.0 second(s)
  The PFC watchdog recovery-time is 2.0 second(s) (auto)
  The PFC watchdog polling-interval is 0.1 second(s)
  The PFC watchdog non-disruptive priorities are 3 4
  The PFC watchdog port non-disruptive-only is False
  E: PFC Enabled, D: PFC Disabled, A: PFC Active, W: PFC Watchdog Enabled
  Port     Status  Priorities Note
  Et1/1    E A W    1     7   DCBX disabled
  Et1/2    E A -              DCBX disabled
  Et1/3    D - -
  Et1/4    D - -
  Et2/1    D - -
  ```
17.6 DCBX and Flow Control Commands

Configuration Commands
- `dcbx application priority`
- `dcbx ets`
- `dcbx mode`
- `no priority-flow-control`
- `platform fm6000 pfc-wm`
- `priority-flow-control`
- `priority-flow-control pause watchdog action`
- `priority-flow-control pause watchdog default`
- `priority-flow-control pause watchdog hardware`
- `priority-flow-control priority`

Show Commands
- `show dcbx`
- `show dcbx application-priority-configuration`
- `show dcbx priority-flow-control-configuration`
- `show dcbx status`
- `show interfaces priority-flow-control`
- `show platform fm6000 pfc-wm`
- `show priority-flow-control`
**dcbx application priority**

The **dcbx application priority** command assigns a priority rank to the specified traffic class in the application priority table. This table is transmitted on each DCBX-enabled interface.

The **no dcbx application priority** and **default dcbx application priority** commands remove the specified DCBX traffic class – priority assignment by deleting the corresponding **dcbx application priority** command from **running-config**. When the command does not specify a traffic class, all DCBX traffic class priority assignments are removed.

**Command Mode**

Global Configuration

**Command Syntax**

```
dcbx application APPLICATION_TYPE priority rank
no dcbx application [APPLICATION_TYPE priority]
default dcbx application [APPLICATION_TYPE priority]
```

**Parameters**

- **APPLICATION_TYPE** traffic class receiving the priority assignment. Options include:
  - ether ethertype_number Ethernet traffic. *Ethertype_number* varies from 1536 to 65535.
  - iscsi TCP/SCTP traffic. Port number varies from 1 to 3260.
  - tcp-sctp port_number TCP/SCTP traffic. Port number varies from 1 to 65535.
  - tcp-sctp-udp port_number TCP/SCTP/UDP traffic. Port number varies from 1 to 65535.
  - udp port_number UDP traffic. Port number varies from 1 to 65535.
- **rank** priority assigned to traffic class. Values range from 0 to 7.

**Examples**

- These commands tell the DCBX peer that iSCSI frames (TCP ports 860 and 3260) should be assigned the given priority of 5.
  ```
  switch(config)#dcbx application tcp-sctp 860 priority 5
  switch(config)#dcbx application tcp-sctp 3260 priority 5
  ```

- These commands specify a different priority for the two iSCSI traffic ports.
  ```
  switch(config)# dcbx application tcp-sctp 860 priority 3
  switch(config)# dcbx application tcp-sctp 3260 priority 4
  ```

- This command is equivalent to the **dcbx application tcp-sctp** command. The DCBX peer that iSCSI frames are assigned to is given priority 5.
  ```
  switch(config)#dcbx application iscsi priority 5
  switch(config)#
  ```

- These commands prevent the peers from sending anything about the iSCSI frames.
  ```
  switch(config)#no dcbx application tcp-sctp 860 priority
  switch(config)#no dcbx application tcp-sctp 3260 priority
  ```
**dcbx ets**

The `dcbx ets` command configures the enhanced transmission selection (ETS) to the specified QoS group, and sets the traffic class priority and the bandwidth percentage for the packets in the traffic class.

The `no dcbx ets` and `default dcbx ets` commands remove the specified DCBX traffic class – priority assignment by deleting the corresponding `dcbx ets` command from the *running-config*.

**Command Mode**

Global Configuration

**Command Syntax**

```
dcbx ets [qos map cos <value> traffic-class <value> | traffic-class <value> bandwidth <value>]
no dcbx ets [qos map cos <value> traffic-class <value> | traffic-class <value> bandwidth <value>]
default dcbx ets [qos map cos <value> traffic-class <value> | traffic-class <value> bandwidth <value>]
```

**Parameters**

- `qos` QoS to configure. (The sub options include)
  - `map` QoS map to configure.
  - `cos` CoS value assigned to port. Value ranges from 0 to 7. Default value is 0.
  - `traffic-class` Assigns the traffic-class priority to the QoS map. The value ranges from 0 to 7.
- `traffic-class` Assigns the traffic class priority. The value ranges from 0 to 7. (The sub options include)
  - `bandwidth` The percentage of bandwidth assigned to the packets received from traffic class. The value ranges from 0 to 100 in percentage. The default value is 0.

**Examples**

- This command configures the ETS to the QoS group map and assigns the CoS map value as 7 and sets the traffic class priority to 5.
  
  ```
  switch(config)#dcbx ets qos map cos 7 traffic-class 5
  ```

- This command configures the ETS to the traffic class and sets the traffic class priority value to 7 and sets the bandwidth value to 70 percent.
  
  ```
  switch(config)#dcbx ets traffic-class 7 bandwidth 70
  ```
**dcbx mode**

The **dcbx mode** command enables DCBX mode on the configuration mode interface. The switch supports IEEE P802.1Qaz. When DCBX is enabled, two TLVs are added to outgoing LLDPDU, which instruct the peer on the interface to configure PFC (priority flow control) and the application priority table in the same way as the switch.

The **no dcbx mode**, **default dcbx mode**, and **dcbx mode none** commands disable DCBX on the configuration mode interface by removing the corresponding **dcbx mode** command from **running-config**.

**Command Mode**

Interface-Ethernet Configuration

**Command Syntax**

```plaintext
  dcbx mode MODE_NAME
  no dcbx mode
  default dcbx mode
```

**Parameters**

- **MODE_NAME** Specifies the DCBX version. Options include:
  - **ieee** IEEE version.
  - **cee** Converged Enhanced Ethernet version.
  - **none** DCBX is disabled.

**Examples**

- These commands enable interface Ethernet 2 to use IEEE DCBX.
  ```plaintext
  switch(config)#interface ethernet 2
  switch(config-if-Et2)#dcbx mode ieee
  switch(config-if-Et2)#
  ```

- These commands disable DCBX on interface Ethernet 5.
  ```plaintext
  switch(config)#interface ethernet 2
  switch(config-if-Et2)#dcbx mode none
  switch(config-if-Et2)
  ```
no priority-flow-control

The `no priority-flow-control` and `default priority-flow-control` commands disable the priority flow control (PFC) on the configuration mode interface and restore the default packet drop setting on the interface, which takes effect when PFC is re-enabled. The commands delete all corresponding `priority-flow-control` commands from `running-config`.

**Command Mode**

Interface-Ethernet Configuration

**Command Syntax**

```
no priority-flow-control
default priority-flow-control
```

**Examples**

- These commands disable priority flow control (PFC) on Ethernet interface 3.

  ```
  switch(config)#interface Ethernet 3
  switch(config-if-Et3)#no priority-flow-control
  switch(config-if-Et3)#
  ```
platform fm6000 pfc-wm

The **platform fm6000 pfc-wm** command configures the hardware buffer space allocated to the PFC (Priority Flow Control) RX-Private buffer. The command provides options to configure the buffer size and specify when PFC frames are sent to request that a neighbor stop sending traffic. The default values are as follows:

- RX-Private: 18400 bytes
- on (watermark): 9280 bytes
- off (watermark): 1600 bytes

Values that are entered in the command are rounded up to the closest multiple of 16. The **RX-Private** value must be greater than the **off** value, which must be larger than the **on** value.

The **no platform fm6000 pfc-wm** and default **platform fm6000 pfc-wm** commands restore the default settings by removing the **platform fm6000 pfc-wm** command from **running-config**.

**Command Mode**

Global Configuration

**Command Syntax**

```
platform fm6000 pfc-wm [RX-PRIVATE_SIZE] [PFC-ON_WM] [PFC-OFF_WM]
o platform fm6000 pfc-wm
default platform fm6000 pfc-wm
```

The **platform fm6000 pfc-wm** command must explicitly configure at least one parameter.

**Parameters**

- **RX-PRIVATE_SIZE**  
  Specifies size of rx-private buffer. Options include:
  - <no parameter>  
    rx-private buffer retains previously configured size.
  - **rx-private <18268 to 102400>**  
    Size of rx-private buffer (bytes).

- **PFC-ON_WM**  
  Buffer capacity that triggers the switch to send PFC frames. Options include:
  - <no parameter>  
    Parameter retains previously configured value.
  - **on <9134 to 102400>**  
    Buffer capacity that triggers PFC frames (bytes).

- **PFC-OFF_WM**  
  Buffer capacity that triggers the switch to stop PFC frame transmissions. Options include:
  - <no parameter>  
    Parameter retains previously configured value.
  - **off <1536 to 102400>**  
    Buffer capacity that turns off PFC frames.

**Related Commands**

- **show platform fm6000 pfc-wm** displays the PFC RX-Private buffer memory allocations

**Example**

- This command configures the rx-private hardware buffer.
  ```
  switch(config)#platform fm6000 pfc-wm rx-private 24800 on 16000 off 3200
  switch(config)#
  ```
priority-flow-control

The **priority-flow-control** command enables priority flow control (PFC) on the configuration mode interface to pause selected traffic classes.

The **no priority-flow-control** and **default priority-flow-control** commands disable PFC on the configuration mode interface by deleting the corresponding **priority-flow-control** command from **running-config**. The **priority-flow-control priority** command also disables PFC on the configuration mode interface.

**Command Mode**

Interface-Ethernet Configuration

**Command Syntax**

```plaintext
priority-flow-control on
no priority-flow-control [on]
default priority-flow-control [on]
```

**Example**

- These commands enable PFC on Ethernet interface 3.
  ```plaintext
  switch(config)# interface Ethernet 3
  switch(config-if-Et3)#priority-flow-control on
  switch(config-if-Et3)#
  ```

- These commands disable PFC on Ethernet interface 3.
  ```plaintext
  switch(config)# interface Ethernet 3
  switch(config-if-Et3)# no priority-flow-control
  switch(config-if-Et3)#
  ```
priority-flow-control pause watchdog action

The `priority-flow-control pause watchdog action` command either drops the traffic on a stuck queue, or error disables the port which has a stuck queue, or notifies if there is no action on the stuck queue. The following actions are performed based on the queue status.

The `no priority-flow-control pause watchdog action` command removes the specified priority-flow-control pause watchdog action configuration by deleting the corresponding `priority-flow-control pause watchdog action` command from `running-config`.

**Command Mode**

Global Configuration

**Command Syntax**

```
priority-flow-control pause watchdog action
no priority-flow-control pause watchdog action
```

**Parameters**

- `action` PFC watchdog action for stuck transmit queues. Options include.
  - `drop` Drop traffic on the stuck queue.
  - `errdisable` Error disable port which has the stuck transmit queue.
  - `notify-only` No action on the stuck queue.

**Guidelines**

Before enabling the PFC watchdog configuration, configure the guaranteed bandwidth on the tx-queue to be monitored. Also, enable the PFC on the port for the PFC priorities for the traffic flowing into the queue that is being monitored.

**Example**

- These commands enables the `pfc-watchdog monitoring` on tx-queue 3 of Ethernet 1/1, and configures a PFC watchdog action drop and drops the traffic if the queue is a stuck queue.

```
switch# config
switch(config)# interface Ethernet1/1
switch(config-if-Et1/1)# priority-flow-control on
switch(config-if-Et1/1)# priority-flow-control priority 3 no-drop
switch(config-if-Et1/1)# tx-queue 3
switch(config-if-Et1/1-txq-3)# bandwidth guaranteed 100
switch(config-if-Et1/1-txq-3)# exit
switch(config-if-Et1/1)# exit
switch(config)# priority-flow-control pause watchdog action drop
```
priority-flow-control pause watchdog default

The `priority-flow-control pause watchdog default` command monitors all the egress queues which have guaranteed bandwidth enabled and for the priorities on which PFC is enabled. Guaranteed bandwidth is needed to ensure starvation due to higher priority traffic is not wrongly flagged as a stuck-queue due to congestion. The stuck duration after which the port needs to be error disabled is also configurable.

The `no priority-flow-control pause watchdog default` command removes the specified priority-flow-control pause watchdog configuration by deleting the corresponding `priority-flow-control pause watchdog` command from `running-config`.

Command Mode
Global Configuration

Command Syntax

```
priority-flow-control pause watchdog default
no priority-flow-control pause watchdog default
```

Parameters
- **default** Specifies the default value. Options include.
  - `polling-interval` Configures the interval at which the watchdog should poll the queues. The polling interval value ranges from 0.005 to 30 seconds.
  - `recovery-time` Configures recovery-time after which stuck queue should recover and start forwarding. The recovery-time value ranges from 0.01 to 60 seconds.
    - `forced` Force recover any stuck queue(s) after the recovery-time interval, irrespective of whether PFC frames are being received or not.
  - `timeout` Configures timeout after which port should be errdisabled or should start dropping on congested priorities. The timeout value ranges from 0.01 to 60 seconds.

Guidelines

Before enabling the PFC watchdog configuration, configure the guaranteed bandwidth on the tx-queue to be monitored. Also, enable the PFC on the port for the PFC priorities for the traffic flowing into the queue that is being monitored.

- **Polling Interval Discrepancy**

For user configured polling-interval to be valid, it must satisfy the following conditions

When the recovery-mode is auto and timeout, recovery-time, and polling-interval are non-default, polling-interval <= min (timeout, recovery-time) / 2,

When recovery-mode is forced or recovery-time is not configured, polling-interval <= (timeout / 2)

For better functioning of PFC Watchdog, when user configured polling interval is too large compared to either timeout or recovery time values, Watchdog will use auto calculated value instead of user configured value until the discrepancy is resolved. Also, CLI warning and syslog messages are generated to inform user of the discrepancy.

- **CLI Warnings**

When there is discrepancy between timeout and polling-interval, the format of the message is as shown below

```
! User configured polling interval <user-cfgd polling-interval> second(s) is greater than half of timeout <user-cfgd timeout> second(s). Setting polling-interval to <to-be-used polling-interval> second(s)
```
Chapter 17: DCBX and Flow Control

When there is discrepancy between recovery-time and polling-interval, the format of the message is as shown below

! User configured polling interval <user-cfgd polling-interval> second(s) is greater than half of recovery-time <user-cfgd recovery-time> second(s). Setting polling-interval to <to-be-used polling-interval> second(s)

Examples

• These commands enables the **pfc-watchdog monitoring** on tx-queue 3 of Ethernet 1/1, and configures a PFC congestion timeout of 10 seconds which will error-disable the port if the queue is stuck.

  ```
  switch# config
  switch(config)# interface Ethernet1/1
  switch(config-if-Et1/1)# priority-flow-control on
  switch(config-if-Et1/1)# priority-flow-control priority 3 no-drop
  switch(config-if-Et1/1)# tx-queue 3
  switch(config-if-Et1/1-txq-3)# bandwidth guaranteed 100
  switch(config-if-Et1/1-txq-3)# exit
  switch(config-if-Et1/1)# exit
  switch(config)# priority-flow-control pause watchdog default timeout 10
  ```

• These commands enables the **pfc-watchdog monitoring** on tx-queue 3 of Ethernet 1/1, and configures a PFC forced recovery-time interval of 30 seconds after which the stuck queue(s) are recovered, irrespective of whether PFC frames are being received or not.

  ```
  switch# config
  switch(config)# interface Ethernet1/1
  switch(config-if-Et1/1)# priority-flow-control on
  switch(config-if-Et1/1)# priority-flow-control priority 3 no-drop
  switch(config-if-Et1/1)# tx-queue 3
  switch(config-if-Et1/1-txq-3)# bandwidth guaranteed 100
  switch(config-if-Et1/1-txq-3)# exit
  switch(config-if-Et1/1)# exit
  switch(config)# priority-flow-control pause watchdog default recovery-time 30 forced
  ```

• These commands enables the **pfc-watchdog monitoring** on tx-queue 3 of Ethernet 1/1, and configures a PFC polling-interval of 20 seconds after which queue is polled.

  ```
  switch# config
  switch(config)# interface Ethernet1/1
  switch(config-if-Et1/1)# priority-flow-control on
  switch(config-if-Et1/1)# priority-flow-control priority 3 no-drop
  switch(config-if-Et1/1)# tx-queue 3
  switch(config-if-Et1/1-txq-3)# bandwidth guaranteed 100
  switch(config-if-Et1/1-txq-3)# exit
  switch(config-if-Et1/1)# exit
  switch(config)# priority-flow-control pause watchdog default polling-interval 20
  ```
priority-flow-control pause watchdog hardware

The `priority-flow-control pause watchdog hardware` command configures specific PFC priorities as non-disruptive. This will avoid traffic drop on queues corresponding to these priorities are stuck/recovered, the traffic for other priorities are not impacted.

The `no priority-flow-control pause watchdog hardware` command removes the specified priority-flow-control pause watchdog non-disruptive configuration by deleting the corresponding `priority-flow-control pause watchdog hardware` command from `running-config`.

**Command Mode**
Global Configuration

**Command Syntax**

```
priority-flow-control pause watchdog hardware
no priority-flow-control pause watchdog hardware
```

**Parameters**
- `hardware` Configure PFC priority through hardware. Options include.
  - `non-disruptive` PFC watchdog non-disruptive configuration. The priority value ranges from 0 to 7.

**Guidelines**
Before enabling the PFC watchdog configuration, configure the guaranteed bandwidth on the tx-queue to be monitored. Also, enable the PFC on the port for the PFC priorities for the traffic flowing into the queue that is being monitored.

**Example**
- These commands enables the `pfc-watchdog monitoring` on tx-queue 3 of Ethernet 1/1, and configures PFC priorities as non-disruptive on PFC priorities 3 and 4.

```bash
switch# config
switch(config)# interface Ethernet1/1
switch(config-if-Et1/1)# priority-flow-control on
switch(config-if-Et1/1)# priority-flow-control priority 3 no-drop
switch(config-if-Et1/1)# tx-queue 3
switch(config-if-Et1/1-txq-3)# bandwidth guaranteed 100
switch(config-if-Et1/1-txq-3)# exit
switch(config-if-Et1/1)# exit
switch(config)# priority-flow-control pause watchdog hardware non-disruptive priority 3 4
```
priority-flow-control priority

The `priority-flow-control priority` command configures the packet resolution setting on the configuration mode interface. This setting determines if packets are dropped when priority flow control (PFC) is enabled on the interface. Packets are dropped by default.

The `no priority-flow-control priority` and `default priority-flow-control priority` commands restore the default packet drop setting on the configuration mode interface by deleting the corresponding `priority-flow-control priority` command from `running-config`. The `priority-flow-control priority` command also restores the default setting on the configuration mode interface.

**Command Mode**

Interface-Ethernet Configuration

**Command Syntax**

```
priority-flow-control priority pack-drop
no priority-flow-control priority
default priority-flow-control priority
```

**Parameters**

- `pack-drop` denotes the interfaces. Options include:
  - `drop` Packets are dropped. Default setting.
  - `no drop` Packets are not dropped.

**Examples**

- These commands in DCBX mode create a priority group that pauses dot1p priority 5 on Ethernet 2.
  ```
  switch(config)#interface ethernet 2
  switch(config-if-Et2)#priority-flow-control on
  switch(config-if-Et2)# priority-flow-control priority 5 no-drop
  ```
- These commands enable lossy behavior.
  ```
  switch(config)#interface ethernet 2
  switch(config-if-Et2)#priority-flow-control on
  switch(config-if-Et2)#priority-flow-control priority 5 drop
  ```
- These commands remove the priority group that pauses dot1p priority 5 on Ethernet 2.
  ```
  switch(config)#interface ethernet 2
  switch(config-if-Et2)# priority-flow-control on
  switch(config-if-Et2)# no priority-flow-control priority
  ```
show dcbx

The `show dcbx` command list DCBX status and the interfaces on which DCBX is enabled.

**Command Mode**

EXEC

**Command Syntax**

```
show dcbx [INTERFACE]
```

**Parameters**

- `INTERFACE` Interface type and number. Options include:
  - `<no parameter>` all configured DCBX interfaces.
  - `ethernet e-num` Ethernet interface specified by `e-num`.

**Examples**

- This command displays the DCBX status for Ethernet 50.
  
  ```
  switch#show dcbx Ethernet 50
  Ethernet50:
  IEEE DCBX is enabled and active
  Last LLDPDU received on Thu Feb 14 12:06:01 2013
  No priority flow control configuration TLV received
  No application priority configuration TLV received
  switch#
  ```

- This command displays the DCBX status for Ethernet 50 when Priority Flow Control (PFC) is not enabled.
  
  ```
  switch#show dcbx Ethernet 50
  Ethernet50:
  IEEE DCBX is enabled and active
  Last LLDPDU received on Thu Feb 14 12:08:29 2013
  - PFC configuration: willing
    not capable of bypassing MACsec
    supports PFC on up to 4 traffic classes
    PFC enabled on priorities: 5 7
  - WARNING: peer PFC configuration does not match the local PFC configuration
  - Application priority configuration:
    2 application priorities configured:
    tcp-sctp 860 priority 5
    tcp-sctp 3260 priority 5
  switch#
  ```
show dcbx application-priority-configuration

The `show dcbx application-priority-configuration` command displays the DCBX peer application priority configuration.

**Command Mode**

EXEC

**Command Syntax**

```
show dcbx [INTERFACE] application-priority-configuration
```

**Parameters**

- **INTERFACE**  Interface type and number. Options include:
  - <no parameter>  All configured DCBX interfaces.
  - `ethernet e-num`  Ethernet interface specified by `e-num`.

**Guidelines**

This command and the `show priority-flow-control` command function identically.

**Examples**

- This command displays the DCBX peer application priority configuration for all DCBX-enabled interfaces.

  ```
  switch# show dcbx application-priority-configuration
  Ethernet1:
  Last LLDPDU received on Thu Feb 14 10:52:20 2013
  No application priority configuration TLV received
  Ethernet2:
  Last LLDPDU received on Thu Feb 14 10:52:20 2013
  No application priority configuration TLV received
  ...
  Ethernet50:
  Last LLDPDU received on Thu Feb 14 12:08:29 2013
  - Application priority configuration:
    2 application priorities configured:
    tcp-sctp 860 priority 5
    tcp-sctp 3260 priority 5
  switch#
  ```
show dcbx priority-flow-control-configuration

The `show dcbx priority-flow-control-configuration` command displays the IEEE DCBX peer priority flow control configurations.

**Command Mode**

EXEC

**Command Syntax**

```
show dcbx [INTERFACE] priority-flow-control-configuration
```

**Parameters**

- `INTERFACE` Interface type and number. Options include:
  - `<no parameter>` all configured DCBX interfaces.
  - `ethernet e-num` Ethernet interface specified by `e-num`.

**Examples**

- This command displays the DCBX peer priority flow control configuration for the DCBX-enabled interfaces on the device.
  ```
  switch# show dcbx priority-flow-control-configuration
  Ethernet1:
  Last LLDPDU received on Thu Feb 14 10:52:20 2013
  No priority flow control configuration TLV received
  Ethernet2:
  Last LLDPDU received on Thu Feb 14 10:52:20 2013
  No priority flow control configuration TLV received
  ...
  Ethernet50:
  Last LLDPDU received on Thu Feb 14 12:11:29 2013
  - PFC configuration: willing
  - not capable of bypassing MACsec
  - supports PFC on up to 4 traffic classes
  - PFC enabled on priorities: 5 7
  WARNING: peer PFC configuration does not match the local PFC configuration
  ```
  switch#
show dcbx status

The `show dcbx status` command displays the DCBX status on the interfaces on which DCBX is enabled.

**Command Mode**

EXEC

**Command Syntax**

```
show dcbx [INTERFACE] status
```

**Parameters**

- `INTERFACE` Interface type and number. Options include:
  - `<no parameter>` all configured DCBX interfaces.
  - `ethernet e-num` Ethernet interface specified by `e-num`.

**Examples**

- This command displays the DCBX status for the DCBX-enabled interfaces.

  ```
  switch# show dcbx status
  Ethernet1:  
    Last LLDPDU received on Thu Feb 14 10:52:20 2013
  Ethernet2:  
    Last LLDPDU received on Thu Feb 14 10:52:20 2013
  Ethernet50: 
    IEEE DCBX is enabled and active
    Last LLDPDU received on Thu Feb 14 12:11:54 2013
  switch#
  ```
show interfaces priority-flow-control

The show interfaces priority-flow-control command displays the status of PFC on all interfaces.

Command Mode
EXEC

Command Syntax

\[
\text{show interfaces} \ [\text{INTERFACE}] \ \text{priority-flow-control} \ [\text{INFO\_LEVEL}]
\]

Parameters
- **INTERFACE** Interface type and numbers. Options include:
  - <no parameter> Display information for all interfaces.
  - ethernet \( e\_range \) Ethernet interface range specified by \( e\_range \).
  - loopback \( l\_range \) Loopback interface specified by \( l\_range \).
  - management \( m\_range \) Management interface range specified by \( m\_range \).
  - port-channel \( p\_range \) Port-Channel Interface range specified by \( p\_range \).
  - vlan \( v\_range \) VLAN interface range specified by \( v\_range \).
  - vxlan \( vx\_range \) VXLAN interface range specified by \( vx\_range \).

Valid range formats include number, number range, or comma-delimited list of numbers and ranges.

- **INFO\_LEVEL** specifies the type of information displayed. Options include:
  - <no parameter> Displays information about all DCBX neighbor interfaces.
  - status Displays the DCBX status.
  - counters Displays the DCBX counters.

Guidelines
This command and the show priority-flow-control command function identically.

Examples
- This command displays the PFC for all interfaces.

```
switch#show interfaces priority-flow-control
The hardware supports PFC on priorities 0 1 2 3 4 5 6 7

<table>
<thead>
<tr>
<th>Port</th>
<th>Enabled</th>
<th>Priorities</th>
<th>Active</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Et1</td>
<td>No</td>
<td>0</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Et2</td>
<td>No</td>
<td>0</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>...</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Et50</td>
<td>Yes</td>
<td>5</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>...</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Port</th>
<th>RxPfc</th>
<th>TxPfc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Et1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Et2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>...</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Et50</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>...</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

switch#
show platform fm6000 pfc-wm

The `show platform fm6000 pfc-wm` command displays the buffer space allocated to the RX-Private buffer and buffer levels that trigger PFC frame transmission activities.

**Command Mode**
Privileged EXEC

**Command Syntax**

```
show platform fm6000 pfc-wm
```

**Related Commands**

- `priority-flow-control priority` specifies the PFC RX-Private buffer memory allocation.

**Example**

- This command displays the rx-private hardware buffer memory allocation.

```
switch#show platform fm6000 pfc-wm
Pfc_Rx_Private_WM: 24800 Bytes
Pfc_On_WM: 16000 Bytes
Pfc_Off_WM: 3200 Bytes
switch#
```
**show priority-flow-control**

The `show priority-flow-control` command displays the status and other PFC and PFC watchdog information on all interfaces if no specific interface is specified.

**Command Mode**

`EXEC`

**Command Syntax**

`show priority-flow-control [status | counters | interfaces]`

**Parameters**

- `Interfaces` specifies the interface for which the information is displayed. Options include:
  - `Ethernet` hardware Ethernet interface
  - `Loopback` Loopback interface
  - `Management` Management interface
  - `Port-Channel` Lag interface
  - `Recirc-Channel` Recirculation interface
  - `Tunnel` Tunnel interface
  - `Vlan` VLAN interface
  - `Vxlan` Vxlan Tunnel Interface
- `status` displays the interface PFC status.
- `counters` displays the interface PFC counters. Options include:
  - `detail` displays the DCBX counters for each priority class. This option is available only on Trident switches.
  - `watchdog` displays the PFC watchdog counters.

**Examples**

- This command displays the PFC status on all interfaces.

  ```
  switch# show priority-flow-control
  The hardware supports PFC on priorities 0 1 2 3 4 5 6 7
  Port   Enabled Priorities Active Note
  Et1    No          No
  Et2    No          No
  ...
  Et50   Yes         5  Yes
  ...
  Port   RxPfc      TxPfc
  Et1    0           0
  Et2    0           0
  ...
  Et50   0           0
  ...
  ```
This command displays the PFC watchdog status. If PFC watchdog default timeout is non-zero (in this case it’s 3.0) then PFC watchdog is actively running on the switch.

```bash
switch# show priority-flow-control
The hardware supports PFC on priorities 0 1 2 3 4 5 6 7
The PFC watchdog default timeout is 3.0
```

<table>
<thead>
<tr>
<th>Port</th>
<th>Enabled</th>
<th>Priorities</th>
<th>Active</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Et1/1</td>
<td>Yes</td>
<td>34</td>
<td>Yes</td>
<td>DCBX disabled</td>
</tr>
<tr>
<td>Et1/2</td>
<td>Yes</td>
<td>34</td>
<td>Yes</td>
<td>DCBX disabled</td>
</tr>
<tr>
<td>Et1/3</td>
<td>Yes</td>
<td>34</td>
<td>Yes</td>
<td>DCBX disabled</td>
</tr>
<tr>
<td>Et1/4</td>
<td>Yes</td>
<td>34</td>
<td>Yes</td>
<td>DCBX disabled</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This command displays the current value of these counters for all the interfaces being monitored by PFC watchdog. Alternatively, `show interfaces priority-flow-control counters watchdog` command can be used for the same.

```bash
switch # show priority-flow-control counters watchdog
```

<table>
<thead>
<tr>
<th>Port</th>
<th>TxQ</th>
<th>Total times stuck</th>
<th>Total times recovered</th>
</tr>
</thead>
<tbody>
<tr>
<td>------</td>
<td>----</td>
<td>-------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>Et1/1</td>
<td>UC2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Et1/1</td>
<td>UC3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Et2/1</td>
<td>UC2</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Et2/1</td>
<td>UC3</td>
<td>31</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This command displays the current value of these counters for a specific subset of interfaces. Alternatively, `show interfaces <name> priority-flow-control counters watchdog` command can be used for the same.

```bash
switch # show priority-flow-control interfaces Ethernet 1/1 counters watchdog
```

<table>
<thead>
<tr>
<th>Port</th>
<th>TxQ</th>
<th>Total times stuck</th>
<th>Total times recovered</th>
</tr>
</thead>
<tbody>
<tr>
<td>------</td>
<td>----</td>
<td>-------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>Et1/1</td>
<td>UC2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Et1/1</td>
<td>UC3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This command displays the configuration details of PFC watchdog at global and interface level.

```bash
switch # show priority-flow-control status
```

- The hardware supports PFC on priorities 0 1 2 3 4 5 6 7
- The PFC watchdog timeout is 1.0 second(s)
- The PFC watchdog recovery-time is 2.0 second(s) (auto)
- The PFC watchdog polling-interval is 0.1 second(s)
- The PFC watchdog non-disruptive priorities are 3 4
- The PFC watchdog port non-disruptive-only is False

<table>
<thead>
<tr>
<th>Port</th>
<th>Status</th>
<th>Priorities</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Et1/1</td>
<td>E</td>
<td>A W 1 7</td>
<td>DCBX disabled</td>
</tr>
<tr>
<td>Et1/2</td>
<td>E</td>
<td>A -</td>
<td>DCBX disabled</td>
</tr>
<tr>
<td>Et1/3</td>
<td>D</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Et1/4</td>
<td>D</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Et2/1</td>
<td>D</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>