Configuring Link Level Flow Control

This chapter contains the following sections:

Link Level Flow Control

Link-level flow control is a congestion management technique that pauses data transmission until the congestion in the system is resolved. When a receiving device becomes congested, it communicates with the transmitter by sending a PAUSE frame. When the transmitting device receives a Pause frame it stops the transmission of any further data frames for a short period of time. The link-level flow control feature applies to all the traffic on the link. The transmit and receive directions are separately configurable. By default, link-level flow control is disabled for both directions.

Guidelines and Limitations for Link Level Flow Control

- Ethernet interfaces do not auto-detect the link-level flow control capability. You must configure the capability explicitly.

- When both link-level flow control (LLFC) and priority flow control (PFC) are enabled, LLFC takes precedence.

- Enabling link level flow control requires a part of the buffer to be reserved. This reduces the available shared buffer space.

- Flow control is not supported on 40G ports.

- Data Center Bridging Exchange Protocol (DCBX) is not supported.

- Configuration time quanta of the pause frames is not supported.

- Setting of pause threshold values is restricted.

- Configuring Link Level Flow Control on the interfaces will flap the interfaces which results in a momentary traffic loss.

- When a no-drop QoS group is configured, you must ensure that packets received on ports that do not have flow control send-on configured are not classified to a no-drop QoS group.

- Only a no-drop QoS group is capable of generating link level pause frames.

- It is recommended to use default buffer sizes for no-drop classes because if the buffer size is specified through CLI, it will allocate the same buffer size for all ports irrespective of the link speed, and MTU size.

- It is recommended to change the LLFC configuration when there is no traffic, otherwise packets already in the MMU of the system may not get the expected treatment.

- When configuring a no-drop class for QoS you must use QoS-Group 1 and map the QoS Group 1 to the no-drop class.

Information About Link Level Flow Control

Link Level Flow Control on Interfaces

When link level flow control is configured the system changes the interface state to Down if the specified interface is in UP state and then applies the flow control configuration. After the configuration is successfully applied to the interface, the system restores the interface to the UP state.

Link Level Flow Control on Ports

During a port shutdown event, the flow-control settings on an interface are retained, however no traffic is received or transmitted on the link. During a port startup event the flow-control settings are reinstated on to the hardware.

Mismatched Link Level Flow Control Configurations

The transmit and receive directions can be configured separately, and each device on the network can have a different Link Level Flow Control (LLFC) configuration. The following table describes how devices with mis-matched configurations interact.

Switch A	Switch B	Description
LLFC configured to receive and transmit PAUSE frames.	LLFC configured to receive PAUSE frames.	Switch A can transmit 802.3x PAUSE frames and honor 802.3x PAUSE frames. Switch B can only receive 802.3x PAUSE frames.

Switch A	Switch B	Description
LLFC configured to receive and transmit PAUSE frames.	LLFC configured to transmit PAUSE frames.	Switch A can transmit 802.3x PAUSE frames and honor 802.3x PAUSE frames. Switch B can transmit 802.3x PAUSE frames but will drop all received PAUSE frames.

How to Configure Link Level Flow Control

Configuring Link Level Flow Control Receive

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface ethernet 1/1**
4. **flowcontrol receive on**
5. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface ethernet 1/1** **Example:** `Device(config)# interface ethernet 1/1`	Configures an interface type and enters interface configuration mode.
Step 4	**flowcontrol receive on** **Example:** `Device(config-if)# flowcontrol receive on`	Enables the interface to receive and process pause frames.

	Command or Action	Purpose
Step 5	**exit** **Example:** `Device(config-if)# exit`	Exits interface configuration mode.

Configuring Link Level Flow Control Transmit

To configure link-level flow control transmit on an interface, you enable flow control on the interface, configure a network-qos type QoS policy to enable a no-drop QoS group, and apply a qos type QoS policy to classify the traffic that requires no-drop behavior to the no-drop class.

You must ensure that bandwidth is allocated for the No-Drop QoS class using a queuing policy when you define a no-drop class. For more information, see the "Configuring Type Queuing Policies" section.

> **Note** When a no-drop QoS Group is configured you must ensure that packets received on ports that do not have flow-control send-on configured, are not classified to a no-drop QoS group. This is required as any ingress port that does not have flow-control send-on configured, can not generate a link level pause frame and there is no way to request the transmitting device to stop the transmission. Therefore, if flow-control send-on is not configured on all the interfaces you should not use a system policy to classify the packets to the no-drop QoS group. Instead, you should apply an interface QoS policy to the interfaces that having flow-control send-on enabled.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface ethernet 1/1**
4. **flowcontrol send on**
5. **exit**
6. **class-map type** *network-qos* *class-name*
7. **match qos-group** *group-number*
8. **policy-map type** *network-qos* *policy-map-name*
9. **class type** *network-qos* *class-name*
10. **pause no-drop**
11. **system qos**
12. **service-policy type network-qos** *policy-name*
13. **exit**
14. **show running ipqos**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:**	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
	`Device> enable`	
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface ethernet 1/1** **Example:** `Device(config)# interface ethernet 1/1`	Configures an interface type and enters interface configuration mode.
Step 4	**flowcontrol send on** **Example:** `Device(config-if)# flowcontrol send on`	Enables the interface to send pause frames to remote devices.
Step 5	**exit** **Example:** `Device(config-if)# exit`	Exits interface configuration mode and returns to global configuration mode.
Step 6	**class-map type** *network-qos* *class-name* **Example:** `Device(config)# class-map type network-qos class1`	Creates a network-qos class, and places the device in network-qos class-map configuration mode.
Step 7	**match qos-group** *group-number* **Example:** `Device(config-cmap-nq)# match qos-group 1`	Specifies the qos-group on which LLFC pause no-drop needs to be enabled.
Step 8	**policy-map type** *network-qos* *policy-map-name* **Example:** `Device(config-cmap-nq)# policy-map type network-qos my_network_policy`	Creates a network-qos policy map, and places the device in network-qos policy-map configuration mode.
Step 9	**class type** *network-qos* *class-name* **Example:** `Device(config-pmap-nq)# class type network-qos class1`	Specifies the network-qos class map to use for matching, for this policy, and and places the device in network-qos policy-map-class configuration mode.
Step 10	**pause no-drop** **Example:**	Specifies the pause characteristics for this class.

	Command or Action	Purpose
	`Device(config-pmap-nq-c)# pause no-drop`	
Step 11	**system qos** **Example:** `Device(config-pmap-nq-c)# system qos`	Enters QoS system configuration mode.

Step 12	**service-policy type network-qos** *policy-name*
	
	Example:
	
	`Device(config-sys-qos)# service-policy type`
	`network-qos my_network_policy`
		Applies a QoS policy map to the network.

Step 13	**exit** **Example:** `Device(config-sys-qos)# exit`	Exits QoS system configuration mode and returns to global configuration mode.
Step 14	**show running ipqos** **Example:** `Device# show running ipqos`	Shows the running configuration for the IP QoS Manager.

Configuration Examples for Link Level Flow Control

Example: Configuring Link Level Flow Control Receive

Configuring Link Level Flow Control Receive

The following example shows how to configure Link Level Flow Control receive on the device:

```
Device# configure terminal
Device(config)# interface ethernet 1/1
Device(config-if)# flowcontrol receive on
Device(config-if)# exit
```