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 Restrictions for Link Level Flow Control

- Link-level flow control (LLFC) is not supported on the Cisco Nexus 9300 Series switches.
- Ethernet interfaces do not auto-detect the link-level flow control capability. You must configure the capability explicitly.
- 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.
- On each Ethernet interface, the switch can enable either PFC or LLFC, but not both.
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
- LLFC configured to receive and transmit PAUSE frames.

### Switch B
- LLFC configured to receive PAUSE frames.
- LLFC configured to transmit PAUSE frames.

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switch A can transmit 802.3x PAUSE frames and honor 802.3x PAUSE frames. Switch B can only receive 802.3x PAUSE frames.</td>
</tr>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

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## How to Configure Link Level Flow Control

### Configuring Link Level Flow Control Receive

#### SUMMARY STEPS

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

#### DETAILED STEPS

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td>Step 2</td>
<td>interface ethernet 1/1</td>
<td>Configures an interface type and enters interface configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config)# interface ethernet 1/1</td>
<td></td>
</tr>
<tr>
<td>Step 3</td>
<td>flowcontrol receive on</td>
<td>Enables the interface to receive and process pause frames.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config-if)# flowcontrol receive on</td>
<td></td>
</tr>
</tbody>
</table>
### 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. `configure terminal`
2. `interface ethernet 1/1`
3. `flowcontrol send on`
4. `exit`

### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
</tr>
<tr>
<td><code>configure terminal</code></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td><code>Device# configure terminal</code></td>
<td></td>
</tr>
<tr>
<td>Step 2</td>
<td>Command or Action</td>
</tr>
<tr>
<td>--------</td>
<td>-------------------</td>
</tr>
<tr>
<td></td>
<td>interface ethernet 1/1</td>
</tr>
<tr>
<td></td>
<td>Example: Device(config)# interface ethernet 1/1</td>
</tr>
<tr>
<td>Step 3</td>
<td>flowcontrol send on</td>
</tr>
<tr>
<td></td>
<td>Example: Device(config-if)# flowcontrol transmit on</td>
</tr>
<tr>
<td>Step 4</td>
<td>exit</td>
</tr>
<tr>
<td></td>
<td>Example: Device(config-if)# exit</td>
</tr>
</tbody>
</table>

## 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
```

### Example: Configuring a No-Drop Policy

**Configuring a No-Drop Policy**

The following example shows how to configure a no-drop policy and attach the policy to a session policy:

```
Device# configure terminal
Device(config)# class-map type network-qos class1
Device(config-cmap-nq)# match qos-group 1
Device(config-cmap-nq)# policy-map type network-qos my_network_policy
Device(config-pmap-nq)# class type network-qos qos-class1
Device(config-pmap-nq-c)# pause pfc-cos 2
Device(config-pmap-ng-c)# system qos
Device(config-sys-qos)# service-policy type network-qos my_network_policy
Device# show running ipqos
```
Classifying Traffic to a No-Drop Class
The following example shows how to create a QoS policy to map all the traffic to the no-drop class:

```
Device# configure terminal
Device(config)# class-map type qos class1
Device(config-cmap-qos)# match cos 2
Device(config-cmap-qos)# policy-map type qos my_qos_policy
Device(config-pmap-qos)# class type qos class1
Device(config-pmap-c-qos)# set qos-group 1
Device(config-pmap-c-qos)# system qos
Device(config-sys-qos)# service-policy type qos input my_qos_policy
```