SSE-F3548S/SSE-F3548SR

Data Centre Bridging Exchange

User's Guide

Revision 1.0

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Document Revision History

Date	Revision	Description
03/2/2020	1.0	Initial document.

Contents

1 DCBX Overview

DCBX is a discovery & capability exchange protocol that is capable of discoveing DCB compliant devices and exchange DCBX configuration information with them. Supermicro switches SSE-F3548S/SR support DCBX (Data centre Bridging Exchange) feature.

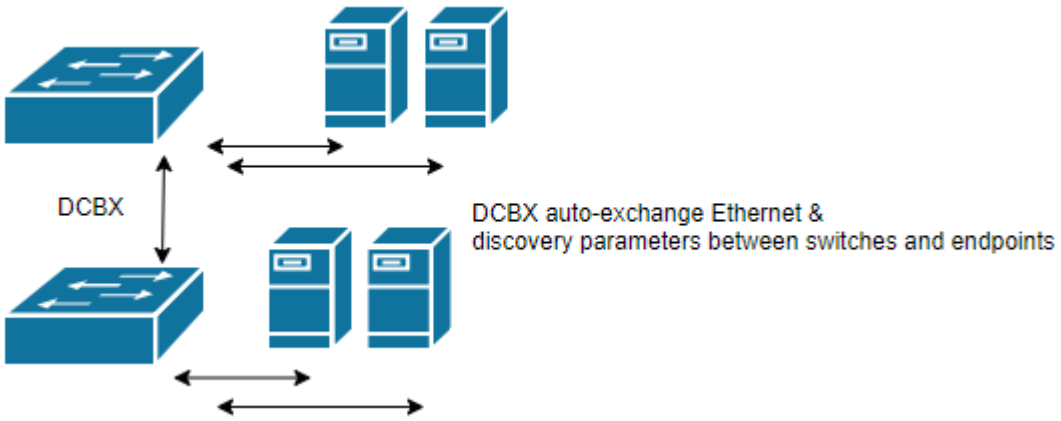
DCBX runs on the Physical Ethernet link between Supermicro switch (e.g SSE-F3548S) and Host Server's Network Card adapter (e.g. AOC-MH25G-m2S2T,AOC-S100G-m2C) that has DCBX capabilities.
DCBX protocol relies on the Link Layer Discovery Protocol (LLDP) to exchange DCBX information with its DCBX peer. DCBX peers (switch and the host adapter) negotiate the capabilities between them to send configuration values to the adapter. Auto PFC configuration from the switch to the host can be achieved with DCBX TLVs.

- DCBX capability on the switch remain disabled if the host network adapter does not support the DCBX.
- Please make sure that the DCBX feature is enabled on the host network adapter if it is not turned on by default.

2 DCBX Feature Benefits

Feature	Benefit Properties
Data Center Bridging Exchange (DCBX) Protocol	It Allows exchange of Ethernet parameters between switches and Host Adapters.
Congestion notification	Provides end to end congestion management for protocols that are capable of transmission rate limiting to avoid frame loss.
Enhanced transmission selection	Provides bandwidth management between traffic types.
Priority Based Flow Control (PFC)	Provides a link level flow control mechanism that can be controlled independently for each frame priority.

Data Center Bridging Exchange (DCBX) Protocol

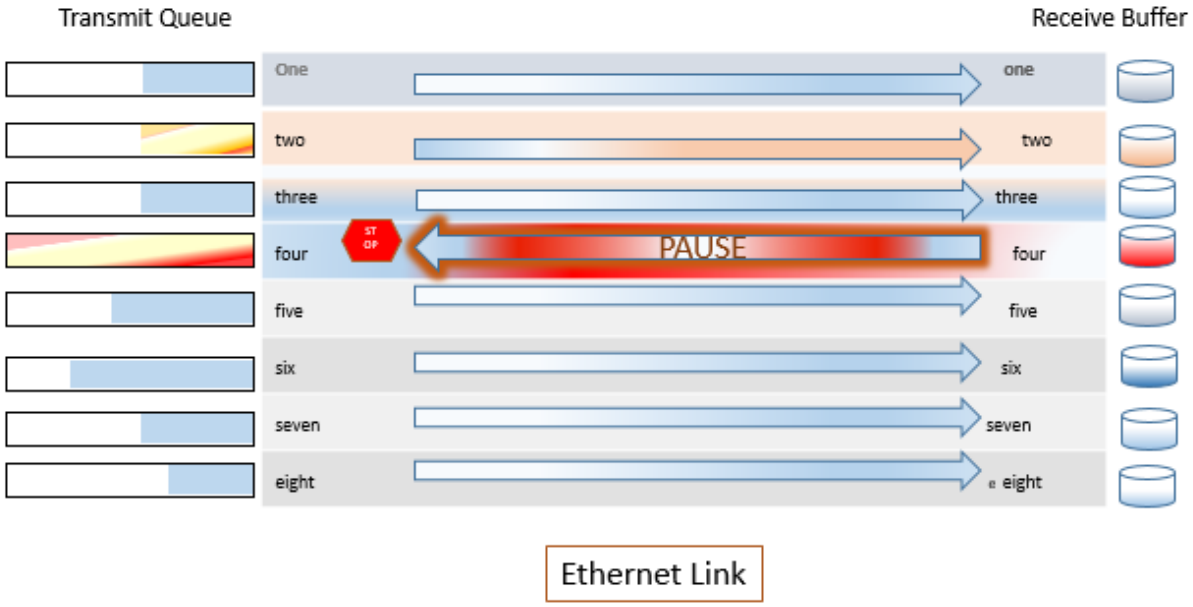


Congestion Notification, IEEE 802.1Qau is A congestion management mechanism that sends a congestion notification message to the source of the congestion. It tries to stop congestion at its source - where the "end host" originates the congestion and causing flow.

Enhanced Transmission Selection (**ETS)** IEEE 802.1Qaz is a bandwidth management mechanism which enables us to allocate port bandwidth in such a way that maximizes bandwidth utilization for all flows on a link. ETS allows a port to share and re-allocate BW dynamically among its flows while guaranteeing a minimum amount of bandwidth to each flow.

Priority-based flow control (PFC), IEEE standard 802.1Qbb, is a link-level flow control mechanism. Which is an enhancement to the Ethernet pause mechanism, operates on single priority rather than pausing all traffic on a link.

PFC creates eight logically divided virtual links from A physical link and provides the capability to use pause on a single virtual link without affecting traffic on the other virtual links. PFC allows us to pause traffic selectively according to its class.



PFC Priority based Flow Control (Figure A)

3 DCBX Configuration Steps

Configuring DCBX involves the steps listed below.

1. Enable LLDP.
2. Create cee-map.
    a. Create a name for Priority (optional).
    b. Mark the application-protocol packets with required priority.
    c. Create a name for Priority-group (optional).
    d. Map priority to priority-group.
    e. Allocate bandwidth to the priority-group.
3. Apply cee-map to the interface.
4. Configure TLVs (optional).

Commands to configure the above steps on Super Micro Switch are given below in detail.

3.1 Enable LLDP feature on the switch

DCBX protocol relies on Link Layer Discovery Protocol (LLDP) to exchange information with peer. So LLDP must be enabled for DCBX feature to work.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**Set lldp enable**	Enable and Configure LLDP
Step 3	**Exit**	Exit from configuration mode.

Example:

```
SMIS# configure terminal
SMIS(config)# set lldp enable
SMIS(config)# exit
```

3.2 Create cee-map

Converged Enhanced Ethernet map creates an association among application-protocol, priority, priority-group, and group-bandwidth. Four cee-maps can be created.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**cee-map <CEE-map-id(1-4))>**	Creates a cee-map.
Step 3	**Exit**	Exit from configuration mode.

Example:

```
SMIS# configure terminal
SMIS(config)# cee-map 1
SMIS(config-cee-map)# exit
SMIS(config)# exit

SMIS# show cee-map 1
```

3.2.1 Create a description for Priority (optional)

There are 8 priorities available and they are identified by number 0 - 7. Creating a description for the priority helps to easily identify the traffic assigned to that priority. This step is optional and doesn't affect the functionality. Description has to be created before assigning the cee-map to the interface.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**cee-map <CEE-map-id(1-4))>**	Creates a cee-map.
Step 3	**priority <pri(0-7)> description {<string(63)>}**	Creates a description for priority, which can be viewed in the show commands.
Step 4	**Exit**	Exit from configuration mode.

Example:

```
SMIS# configure terminal
SMIS(config)# cee-map 1
SMIS(config-cee-map)# priority 1 description "FTP traffic"
SMIS(config-cee-map)# exit
SMIS(config)# exit

SMIS# show cee-map 1
```

3.2.2 Mark the application-protocol packets with required priority

The application-protocol of interest can be assigned to required priority. There are 8 priorities available and they are identified by number 0 - 7. More than one application-protocol can be assigned to the same priority. The default application-protocol configuration after creating a cee-map is shown below.

Application-Protocol-ID	Type	Protocol-ID	Priority
1	ether-type	0x8906	3
2	ether-type	0x8914	3
3	tcp-udp	3260	4
4	ether-type	0x8915	3
5	tcp-udp	445	4

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**cee-map <CEE-map-id(1-4))>**	Creates a cee-map.
Step 3	**application-protocol <id(1-5)> type {ether-type|tcp-udp|sf2|sf3} protocol-id <proto-id> priority <prio(0-7)>**	Marks the packets based on the application-protocol with the configured priority.
Step 4	**Exit**	Exit from configuration mode.

Example:

```
SMIS# configure terminal
SMIS(config)# cee-map 1
SMIS(config-cee-map)# application-protocol 5 type tcp-udp protocol-id
22 priority 2
SMIS(config-cee-map)# exit
SMIS(config)# exit

SMIS# show cee-map 1
```

3.2.3 Create a name for Priority-group (optional)

CEE supports 9 priority-groups and they are identified by PGID number 0 – 7 and 15. Creating a description for the priority-group helps to easily identify the traffic assigned to that priority-group. This step is optional and doesn't affect the functionality. Description has to be created before assigning the cee-map to the interface.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**cee-map <CEE-map-id(1-4))>**	Creates a cee-map.
Step 3	**group <id(0-7,15)> description {<string(63)>}**	Creates a description for priority-group, which can be viewed in the show commands.
Step 4	**Exit**	Exit from configuration mode.

Example:

```
SMIS# configure terminal
SMIS(config)# cee-map 1
SMIS(config-cee-map)# group 0 description "Download Traffic"
SMIS(config-cee-map)# exit
SMIS(config)# exit

SMIS# show cee-map 1
```

3.2.4 Map priority to priority-group

Multiple priorities can be bundled together to form a priority-group. In other words, the traffic will be assigned to priority-group based on their priority. The priority-groups are identified by PGID number 0 – 7 and 15. There are 8 priorities available and they are identified by number 0 - 7. More than one priority can be assigned to a priority-group.

A default priority-to-priority-group mapping will be created when a cee-map is created. The default mapping is shown below.

```
Priority    Group PFC   Description
-----------------------------------------------
       0    0     No    LAN
       1    0     No
       2    0     No
       3    1     Yes   FCoE/FIP
       4    0     No
       5    0     No
       6    0     No
       7    0     No
```

Priority-group 15 is a special group; traffic shall be assigned to this group with no bandwidth limit, group-level PFC and members of this group are scheduled in strict priority order.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**cee-map <CEE-map-id(1-4))>**	Creates a cee-map.
Step 3	**pri2pg <group(0-7, 15)> <> <> <> <> <> <> <>**	Maps the priority 0-7 respectively to the priority-groups.

Step 4	**end**	Exit from configuration mode.

Example:

```
SMIS# configure terminal
SMIS(config)# cee-map 1
SMIS(config-cee-map)# pri2pg 1 1 1 2 2 7 1 15
SMIS(config-cee-map)# end

SMIS# show cee-map 1
```

3.2.5 Allocate bandwidth to the priority-group

The 100% of bandwidth has to be divided as required and allocated among the 8 priority-groups. The total bandwidth allocated to 7 groups has to be 100.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**cee-map <CEE-map-id(1-4))>**	Creates a cee-map.
Step 3	**group-bandwidth <bandwidth(0-100)> <> <> <> <> <> <> <>**	Allocates the bandwidth respectively to the priority-groups 0 - 7.
Step 4	**end**	Exit from configuration mode.

Example:

```
SMIS# configure terminal
SMIS(config)# cee-map 1
SMIS(config-cee-map)# group-bandwidth 10 10 10 20 10 10 10 20
SMIS(config-cee-map)# end

SMIS# show cee-map 1
```

3.2.6 Enable PFC

Priority Flow Control (PFC) can be enabled for traffics based on priorities or priority-groups. PFC can be enabled/disabled in a cee-map before applying it to an interface.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**cee-map <CEE-map-id(1-4))>**	Creates a cee-map.
Step 3	**PFC priority <pri(0-7)> {enable|disable}**	Enable/disable PFC for priority.
	PFC group <id(0-7)> {enable|disable}	Enable/disable PFC for priority-group.
Step 4	**end**	Exit from configuration mode.

Example:

```
SMIS# configure terminal
SMIS(config)# cee-map 1
SMIS(config-cee-map)# pfc priority 1 enable
SMIS(config-cee-map)# pfc group 2 enable
SMIS(config-cee-map)# end
```

```
SMIS# show cee-map 1

Use disable option to disable the PFC.
SMIS# configure terminal
SMIS(config)# cee-map 1
SMIS(config-cee-map)# pfc priority 1 disable
SMIS(config-cee-map)# pfc group 2 disable
SMIS(config-cee-map)# end
```

3.3 Apply cee-map to the interface

After the cee-map configuration is complete, it has to be applied to the physical interface for it to take effect. Same cee-map can be applied to multiple interfaces.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**interface <interface-type> <interface-id>**	Enters the interface configuration mode. *Interface-type* –may be any of the following: fx-ethernet – fx cx-ethernet – cx
Step 3	**CEE <CEE-map-id(1-4))>**	Applies the cee-map.
Step 4	**dcbx cee**	Enables DCBX.
Step 5	**end**	Exit from configuration mode.

Example:

```
SMIS# configure terminal
SMIS(config)# interface fx-ethernet 0/1
SMIS(config-if)# cee 1
SMIS(config-if)# dcbx cee
SMIS(config-if)# end

SMIS# show interface fx-ethernet 0/1
```

3.4 Configure TLVs (optional)

Information such as DCBX control state, configuration, etc are exchanged between DCBX peers using Type Length Value (TLV) over LLDP protocol. Local operational configuration of each DCBX parameter is handled by DCBX state machine by comparing and synchronizing with the settings of its DCBX peer. TLV configuration are setup specific or NIC specific. The example show below are only for illustration purpose.

Apply CEE-map and enable DCBX before configuring TLVs.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**interface <interface-type> <interface-id>**	Enters the interface configuration mode. *Interface-type* –may be any of the following: fx-ethernet – fx cx-ethernet – cx
Step 3	**CEE <CEE-map-id(1-4))>**	Applies the cee-map.
Step 4	**dcbx cee**	Enables DCBX.
Step 5	**LLDP TLV-select DCBX-CEE-PFC [advertise {on|off}] [willing {0|1}] [enable {0|1 }]**	Configures DCBX-CEE-PFC TLV.
Step 6	**LLDP TLV-select DCBX-CEE-pg [advertise {on|off}] [willing {0|1}] [enable {0|1}]**	Configures DCBX-CEE-pg TLV.
Step 7	**LLDP TLV-select basic-TLV { [port-descr] [sys-name] [sys-descr] [sys-capab] [m gmt-addr {all | IPV4 <ucast_addr> | IPV6 <ip6_addr>}]}**	Configures basic-TLV.
Step 8	**LLDP TLV-select dot1tlv {[port-VLAN-id] [protocol-VLAN-id {all |<VLAN-id>}] [V LAN-name {all | <VLAN-id>}]}**	Configures dot1tlv.
Step 9	**LLDP TLV-select dot3tlv {[MACphy-config] [link-aggregation] [max-framesize]}**	Configures dot3tlv.
Step 10	**end**	Exit from configuration mode.

Example:

```
SMIS# configure terminal
SMIS(config)# interface fx-ethernet 0/1
SMIS(config-if)# cee 1
SMIS(config-if)# dcbx cee
SMIS(config-if)# lldp tlv-select dcbx-cee-pfc advertise on willing 1
enable 0
SMIS(config-if)# lldp tlv-select dcbx-cee-pg  advertise on willing 1
enable 0
SMIS(config-if)# end

Use the no form of the command to remove the configuration; shown
below are some example.
SMIS(config-if)# no lldp tlv-select dcbx-cee-pfc
SMIS(config-if)# no lldp tlv-select dcbx-cee-pg
SMIS(config-if)# no lldp tlv-select basic-tlv port-descr
SMIS(config-if)# no lldp tlv-select basic-tlv sys-name
```

```
SMIS(config-if)# no lldp tlv-select basic-tlv sys-capab
SMIS(config-if)# no lldp tlv-select basic-tlv mgmt-addr all
SMIS(config-if)# no lldp tlv-select basic-tlv
```

4 Show commands for CEE-MAP and DCBX

Use ‘show interface’ command to check whether DCBX is enabled/disabled for the intrerface.

show cee-map [<cee-map-id(1-4)>]

Example:

```
SMIS# show interface cx-ethernet 0/1
```

Cx0/1 up, line protocol is up (connected)
Bridge Port Type: Customer Bridge Port

Hardware Address is 0c:c4:7a:2c:19:63
MTU 1500 bytes, Full duplex, 100 Gbps, FEC is on, No-Negotiation
HOL Block Prevention enabled.
Input flow-control is off,output flow-control is off
DCBX is Enable
PFC is controlled by DCBX protocol

Link Up/Down Trap is enabled

Reception Counters
Octets : 1028282
Unicast Packets : 7
Unicast Packets Rate : 0/Sec
Broadcast Packets : 0
Broadcast Packets Rate : 0/Sec
Multicast Packets : 13741
Multicast Packets Rate : 0/Sec
Pause Frames : 0
Undersize Frames : 0
Oversize Frames : 0
CRC Error Frames : 0
Discarded Packets : 0
Error Packets : 0
Unknown Protocol : 0

Transmission Counters
Octets : 219288
Unicast Packets : 9
Unicast Packets Rate : 0/Sec
Broadcast Packets : 1
Broadcast Packets Rate : 0/Sec
Multicast Packets : 2539
Multicast Packets Rate : 0/Sec
Pause Frames : 0
Discarded Packets : 0
Error Packets : 0

Use 'show cee-map' to check the CEE-MAP configuration. This command displays the application-protocol to priority mapping, priority to priority-group mapping, and bandwidth allocation for the priority-groups.

show cee-map [<cee-map-id(1-4)>]

Example:

```
SMIS# show cee-map 1

CEE-Map 1

Ports : fx 0/1
Priority  Group  PFC  Description
----------------------------------
       0      1   No  LAN
       1      1  Yes
       2      1   No
       3      2  Yes  FCoE/FIP
       4      2   No
       5      7   No
       6      1   No
       7     15   No

Group  Bandwidht(%)  PFC  Description
---------------------------------------
    0            10   No  LAN
    1            10  Yes  SAN
    2            10   No
```

```
        3             20    No
        4             10    No
        5             10    No
        6             10    No
        7             20    No
        15           MAX    No

    Application-Protocol-ID   Type       Protocol-ID    Priority
    ------------------------------------------------------------
                          1   ether-type 0x8906         3
                          2   ether-type 0x8914         3
                          3   tcp-udp    3260           4
```

Use 'show lldp dcbx' command to check the current status/result of DCBX (CEE) use the below show command.

show lldp dcbx interface [<interface-type> <interface-id>]

Example:

```
SMIS# show lldp dcbx interface fx-ethernet 0/1
Fx0/1:
DCBX Control Message Exchange Information
-----------------------------------------
Status: Non-synchronized

Peer message seq#: 16777216 (acknowledged: 0)
Local message seq#: 2 (acknowledged: 16777216)

DCBX Feature Information
----------------------------------------
Feature: PG, Priority Groups
Type/subtype: 2/0
Enabled: Yes
Advertisement: Yes
Willing: No
Error: No
Operation status: Operational
Config (operation/desired/peer):
         PG0...10 / 10 / 10
         PG1...10 / 10 / 10
         PG2...10 / 10 / 10
         PG3...20 / 20 / 20
         PG4...10 / 10 / 10
         PG5...10 / 10 / 10
         PG6...10 / 10 / 10
         PG7...20 / 20 / 20
         PG15...MAX / MAX / MAX
```

```
         #TCs...8 / 8 / 8

Feature: PFC, Priority-based Flow Control
Type/subtype: 3/0
Enabled: Yes
Advertisement: Yes
Willing: No
Error: No
Operation status: Operational
Config (operation/desired.pg/peer):
         Pri0...1 / 0.1 / 1
         Pri1...0 / 0.0 / 0
         Pri2...0 / 0.0 / 0
         Pri3...1 / 1.0 / 1
         Pri4...0 / 0.0 / 0
         Pri5...0 / 0.0 / 0
         Pri6...0 / 0.0 / 0
         Pri7...1 / 0.1 / 1
         #TCs...8 / 8 / 8

Feature: Application Protocol
Type/subtype: 4/0
Enabled: Yes
Advertisement: Yes
Willing: No
Error: No
Operation status: Operational
Config (operation/desired/peer):
         Operation Config
         Type       Protocol-ID    Priority
         ---------------------------------
         ether-type 0x8906         3
         ether-type 0x8914         3
         tcp-udp    3260           4

         Desired Config
         Type       Protocol-ID    Priority
         ---------------------------------
         ether-type 0x8906         3
         ether-type 0x8914         3
         tcp-udp    3260
```

Other related show commands:

```
SMIS# show lldp neighbors
SMIS# show lldp neighbors detail
SMIS# show lldp traffic
SMIS# show lldp traffic [<iftype> <ifnum>]
```

5 Sample DCBX Configuration

The sample configuration shown below is only for illustration purpose. As the DCBX configurations are setup specific, the configuration below doesn't guarantee any function.

```
SMIS # show running-config

ip address dhcp

vlan 1
 ports fx 0/1-48 untagged
 ports cx 0/1-6 untagged
exit

set lldp enable

cee-map 2
  pri2pg 1 2 4 2 2 4 4 1
  pfc priority 1 enable
  group-bandwidth 10 10 10 20 10 10 10 20
  pfc group 2 enable
exit
cee-map 4
  pri2pg 0 1 2 3 4 5 6 7
  pfc priority 1 enable
  pfc priority 3 disable
  group-bandwidth 25 75 0 0 0 0 0 0
  pfc group 0 enable
exit

interface Fx 0/6
 cee 2
 dcbx cee

interface Cx 0/1
 cee 4
 dcbx cee
 exit

SMIS#
```

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