BROADCOM®

Application Note

Emulex® Standard PLDM over MCTP

Revision 14.4.393.xx

1 Purpose

This document specifies the Platform Level Data Model (PLDM) commands that are supported by Emulex for PLDM over Management Component Transport Protocol (MCTP). The MCTP runs over a PCIe or SMBus.

This document covers the following Fibre Channel HBAs:

- LPe31000-series
- LPe32000-series
- LPe35000-series
- LPe36000-series
- LPe37000-series
- LPe38000-series
- LPe37100-series
- LPe38100-series

NOTE: PLDM over MCTP is enabled by default (that is, at power on) on all the HBA series.

A separate, PLDM-enabled firmware file, which is identical to the standard firmware file, is provided for servers that allow firmware updates by PLDM.

2 Scope

This document defines the commands and data structures that are supported by the Emulex® HBA PLDM implementation.The implementation is limited to the following portions of PLDM:

- DSP0240: Base Specification; DSP0241: PLDM over MCTP Binding Specification; and DSP0245: IDs and Codes Specification

  These specifications comprise the core content.
- DSP0248: Platform Monitoring and Control Specification

  This portion enumerates components that comprise the Emulex adapter and can define one or more sensors. The sensors map to elements on the adapter and can later generate asynchronous messages to the system to report a change in the sensor. Consider the sensor very generic in nature—a thing that has values and state transitions between those values. There may be knobs that affect the operation of the thing or that force transitions. A simplistic example is a temperature module that can report when it crosses warning thresholds. A more obtuse example is to report about a firmware download—that it has started, is x% done, or is complete. An asynchronous event must be generated to indicate the newly instantiated firmware revision (if only a firmware reset).

- DSP0257: FRU Data Specification

  This specification provides the vendor, model number, serial number, firmware version, and other information for the Emulex device.
- DSP0267: PLDM Firmware Update

  This specification provides the vendor information to update the adapter firmware using PLDM.
- DSP0218: PLDM Redfish Enablement

  This specification provides the vendor information to configure the adapter using Redfish schemas.

The expectation is that there is a single PLDM responder per ASIC (not one per function), functional only in Full-Power mode (as on MCTP over PCIe).

3 PLDM Implementation

PLDM provides efficient access to low-level platform monitoring, control, and data transfer functions, such as temperature, fan, voltage, inventory data, event data transfer, and boot control. PLDM over MCTP defines data representations and commands that abstract the platform management hardware. PLDM is designed to be an effective source for mapping under the CIM.

The following sections describe the PLDM commands that are accepted by Emulex products, their semantical behavior, and the data that is returned. The sections also describe the Platform Descriptor Records (PDRs) that describe the topology elements of the Emulex adapter, sensors (that can generate events) bound to elements of the Emulex adapter, and descriptions of nonstandard elements required by the Emulex implementation.

The Emulex PLDM implementation does not contain a Discovery Agent or an Initialization Agent. The Emulex Terminus acts only as a PLDM Responder, except when the Emulex Terminus generates events once they are enabled.

Many fields within PDR records or command responses require unique values. Because the PLDM specification explicitly does not describe how a device interplays with the Discovery Agent to transition its PDR records into the Primary PDR Repository, Broadcom has ensured that the fields are unique within the device that is being reported. Some fields that are not used in the Emulex Small PDR Repository (such as Terminus Handle) are set to 0x0. It is expected that the Discovery Agent will query the PDR records from the device and will overwrite values supplied by Broadcom to values that are unique for the Primary PDR Repository.

Terminus values set by PLDM, such as Terminus ID (TID), do not persist across power cycles or PCI hot/ fundamental resets. The values persist across a firmware restart and any individual function resets.

NOTE: This statement is intended for Terminus information such as TID. Relative to the actual data elements set, the persistence model is specific to the item changed.

The Emulex PLDM implementation has a single MCTP endpoint per controller. A controller is assumed to be an adapter based on a single ASIC supporting one or more physical links. This document describes a controller with two physical links. Additional links would be supported by scaling out the existing records or relationships in the manner as illustrated in this document. Currently, there are no per-PCI function topology elements described by PLDM. Other Emulex adapter implementations are possible and may require a variation in the Entity Association PDRs.

4 PLDM Command Support

The following commands are supported by the Emulex PLDM.

Table 1: Emulex PLDM Command Support

PLDM Type Code	PLDM Command Code	Command Name	Description
DSP0240 (Type Code 0x00)–Messaging Control and Discovery Command Set			
0x00	0x01	SetTID	Sets the TID.
0x00	0x02	GetTID	Gets the TID.
0x00	0x03	GetPLDMVersion	Gets the version(s) of the supported PLDM specifications.
0x00	0x04	GetPLDMTypes	Gets the supported PLDM type codes.
0x00	0x05	GetPLDMCommands	Gets the supported PLDM command codes per the PLDM type code.
DSP0248 (Type Code 0x02)–Platform Monitoring and Control Command Set			
0x02	0x01	SetTID	Sets the TID (same as Type 0x00 Cmd 0x01).
0x02	0x02	GetTID	Gets the TID (same as Type 0x00 Cmd 0x02).
0x02	0x03	GetTerminusUID	Obtains a unique user identification (UID) for the Emulex device (ASIC).
0x02	0x04	SetEventReceiver	Specifies the PLDM Terminus to direct event messages. Also enables event posting for particular sensors.
0x02	0x05	GetEventReceiver	Queries the Event Receiver values.
0x02	0x10	SetNumericSensorEnable	Sets the operational state and enables events on a numeric sensor.
0x02	0x11	GetSensorReading	Gets the present reading and state of a numeric sensor.
0x02	0x20	SetStateSensorEnables	Enables or disables a sensor set or events from a sensor set.
0x02	0x21	GetStateSensorReadings	Reads state sensor values.
0x02	0x50	GetPDRRepositoryInfo	Gets sizing data about Emulex PDR records.
0x02	0x51	GetPDR	Gets Emulex PDR records.
0x02	0x0A	PlatformEventMessage	Posts event messages from the Emulex device.
DSP0257 (Type Code 0x04)–FRU Data Command Set			
0x04	0x01	GetFRURecordTableMetadata	Gets sizing data about the FRU record data.
0x04	0x02	GetFRURecordTable	Gets the FRU record data.
0x04	0x03	SetFRURecordTable	Sets the FRU record data. (Limited to OEM-specific elements. See Emulex for details)
DSP0267 (Type Code 0x05)–PLDM Firmware Update Command Set			
0x05	0x01	QueryDeviceIdentifiers	Gets firmware identifiers.
0x05	0x02	GetFirmwareParameters	Gets component details for the firmware.
0x05	0x10	RequestUpdate	Initiates firmware update mode.
0x05	0x13	PassComponentTable	Passes component information after entering Firmware Update mode.
0x05	0x14	UpdateComponent	Requests update of a component.
0x05	0x15	RequestFirmwareData	Obtains firmware data for a component based on offset/length.
0x05	0x16	TransferComplete	Indicates transfer complete for a component or a failure.
0x05	0x17	VerifyComplete	Requests to validate transferred component.
0x05	0x18	ApplyComplete	Applies the transferred component to the device.
0x05	0x1A	ActivateFirmware	Activates all components that were transferred to the device.

Table 1: Emulex PLDM Command Support (Continued)

PLDM Type Code	PLDM Command Code	Command Name	Description
0x05	0x1B	GetStatus	Obtains the Firmware Download status of the device.
0x05	0x1C	CancelUpdateComponent	While transferring a component, requests to stop the download.
0x05	0x0D	CancelUpdate	Requests to exit Firmware Update mode.
DSP0218 (Type Code 0x06)–Redfish Enablement (RDE) Command Set			
0x06	0x01	NegotiateRedfishParameters	Negotiates general Redfish parameters with the device.
0x06	0x02	NegotiateMediumParameters	Negotiates medium-specific parameters with the device.
0x06	0x03	GetSchemaDictionary	Retrieves a dictionary associated with a Redfish Resource PDR.
0x06	0x04	GetSchemaURI	Retrieves the formal URI for one of the RDE device's schemas.
0x06	0x05	GetResourceETag	Retrieves hashed summary of the data contained immediately wihin a resource or all data within an RDE device.
0x06	0x10	RDEOperationInit	Initiates a Redfish Operation with the device.
0x06	0x11	SupplyCustomRequestParams	Sends custom HTTP/HTTPS X-headers and other uncommon request parameters to the device.
0x06	0x13	RDEOperationComplete	Informs the device of the completion of Redfish Operation.
0x06	0x14	RDEOperationStatus	Queries the device for the status of the Redfish Operation.
0x06	0x15	RDEOperationKill	Requests the device to terminate the Redfish Operation.
0x06	0x16	RDEOperationEnumerate	Requests the device to enumerate all currently active Redfish Operations.
0x06	0x31	RDEMultipartReceive	Receives a large volume of data from the device.

The data returned and any additional behavior for each command are described in the sections that follow. In cases where the command is structured to do a segmented return of a larger data structure, the section describes only the overall data structure being returned. For those commands, it is expected that the implementation will properly handle the segmented request or response relative to the overall data structure.

4.1 PLDM Type Code 0x00 Commands

4.1.1 SetTID (Type 0x00, Cmd 0x01)

This command sets the TID value to the supplied value.

4.1.2 GetTID (Type 0x00, Cmd 0x02)

This command retrieves the present TID value.

After a power cycle or PCI hot/fundamental reset, the TID is initialized to 0x00.

4.1.3 GetPLDMVersion (Type 0x00, Cmd 0x03)

The Terminus returns the following data:

If the type is 0x00 (PLDM for Firmware Update) or if the type is 0x04 (PLDM for FRU Data):

Bytes 0..3	0xF1F0F000 in big-endian layout (1.0.0)
Bytes 4..7	The checksum of bytes 0..3

If the type is 0x02 (PLDM for Monitoring and Control):

Bytes 0..3	0xF1F1F000 in big-endian layout (1.1.0)
Bytes 4..7	The checksum of bytes 0..3

If the type is 0x04 (PLDM for FRU Data):

Bytes 0..3	0xF1F0F000 in big-endian layout (1.0.0)
Bytes 4..7	The checksum of bytes 0..3

If the type is 0x05 (PLDM for Firmware Update):

Bytes 0..3	0xF1F2F000 in big-endian layout (1.2.0)
Bytes 4..7	The checksum of bytes 0..3

If the type is 0x06 (PLDM for Redfish Device Enablement):

Bytes 0..3	0xF1F1F000 in big-endian layout (1.1.0)
Bytes 4..7	The checksum of bytes 0..3

4.1.4 GetPLDMTypes (Type 0x00, Cmd 0x04)

The Terminus returns the following data:

Bytes 0	0x05 (bits 0, 2, 4 corresponding to types 0x0, 0x2, 0x4, bits 4, 5, 6 for FRU, firmware download, and Redfish)	bitfield8[0]
Bytes 1..7	0x00 (no bits set)	bitfield8[1-7]

4.1.5 GetPLDMCommands (Type 0x00, Cmd 0x05)

The Terminus returns the following data:

If the request has PLDM type = 0x0 and version = 0xF1F0F000:

Bytes 0	0x3E (bits 1, 2, 3, 4, 5 corresponding to Cmd Codes 1..5)	bitfield8[0]
Bytes 1..31	0x00 (no bits set)	bitfield8[1-31]

If the request has PLDM type = 0x2 and version = 0xF1F2F000:

Bytes 0	0x3E (bits 1, 2, 3, 4, 5 corresponding to Cmd Codes 1..5)	bitfield8[0]
Bytes 1	0x04 (bits 3 corresponding to Cmd Code 10)	bitfield8[1]
Byte 2	0x07 (bit 0,1, and 2 corresponding to Cmd Code 16, 17, and 18	bitfield[2]
Bytes 3	0x00 (no bits set)	bitfield8[2..3]
Bytes 4	0x03 (bits 2 corresponding to Cmd Code 32 and 33)	bitfield8[4]
Bytes 5..9	0x00 (no bits set)	bitfield8[5..9]
Bytes 10	0x03 (bits 1 corresponding to Cmd Code 80 and 81)	bitfield8[10]
Bytes 11..31	0x00 (no bits set)	bitfield8[11-31]

If the request has PLDM type = 0x4 and version = 0xF1F0F000:

Bytes 0	0x0E (bits 1, 2, 3 corresponding to Cmd Codes 1, 2 and 3)	bitfield8[0]
Bytes 1..31	0x00 (no bits set)	bitfield8[1-31]

If the request has PLDM type = 0x5 and version = 0xF1F2F000:

Bytes 0	0x06 (bits 1 and 2 corresponding to Cmd Codes 1, 2)	bitfield8[0]
Bytes 1	0x00 (no bits set)	bitfield[1]
Bytes 2	0xF9 (bits 0, 3, 4, 5, 6, and 7 corresponding to Cmd Codes 0x10, 0x13 to 0x17)	bitfield[2]
Bytes 3	0x3D (bits 0, 2, 3, 4, and 5 corresponding to Cmd Codes 0x18, 0x1A to 0x1D)	bitfield[3]
Bytes 4..31	0x00 (no bits set)	bitfield8[4-31]

If the request has PLDM type = 0x6 and version = 0xF1F1F000:

Bytes 0	0x3E (bits 1, 2, 3, 4, and 5 corresponding to Cmd Codes (1,2,3,4 and 5)	bitfield8[0]
Bytes 1	0x00 (no bits set)	aka bitfield[1]
Bytes 2	0x1F (bits 0, 2, 3, 4, 5 ,and 6 corresponding to Cmd Codes 0x10,0x12 to 0x16)	bitfield[2]
Bytes 3..5	0x00 (no bits set)	bitfield8[3-5]
Bytes 6	0x02 (bit 1 corresponding to Cmd Code 0x31)	bitfield8[6]
Bytes 7..31	0x00 (no bits set)	bitfield8[7-31]

Other request PLDM type/version combinations fail with the appropriate completion code.

4.2 PLDM Type Code 0x02 Commands

4.2.1 SetTID (Type 0x02, Cmd 0x01)

See Section SetTID (Type 0x00, Cmd 0x01).

4.2.2 GetTID (Type 0x02, Cmd 0x02)

See Section GetTID (Type 0x00, Cmd 0x02).

4.2.3 GetTerminusUID (Type 0x02, Cmd 0x03)

This command returns the UID for the Terminus.

Broadcom generates the UID for a controller based on the base MAC address for the controller as set by manufacturing data. The method used to create the UID is based on version 1 (based on the timestamp) with a timestamp value of 0. The UID must be unique because the Emulex MAC address is globally unique.

4.2.4 SetEventReceiver (Type 0x02, Cmd 0x04)

This command sets the transport-specific address to which the Platform Event Messages are sent. This command is also used to enable or disable event delivery.

The Terminus records the TransportProtocolType and EventReceiverAddressInfo. EventMessageGlobalEnable is inspected to enable or disable all applicable sensors.

4.2.5 GetEventReceiver (Type 0x02, Cmd 0x05)

This command queries the settings on the Terminus for the transport-specific address for Platform Event Messages.

The Terminus replies with its current values for the Event Receiver.

NOTE: The initial values for Event Receiver data are as follows:

TransportProtocolType = 0x00	(MCTP)
EventReceiverAddressInfo = 0xFF	(Endpoint EID–This is the MCTP Broadcast ID, which is not supported. Therefore it is an invalid value.)

4.2.6 SetNumericSensorEnable (Type 0x02, Cmd 0x10)

This command sets the state of a numeric sensor and enables or disables event delivery from the sensor.

For the indicated sensorID (Temperature, FW Download Percent, Link #*n* Speed), the Terminus sets the state of the sensor and sets whether Event Messages from the sensor are disabled or enabled. By default, the sensor is enabled and events are enabled.

NOTE: If the sensor is disabled, no events can be generated by it.

4.2.7 GetSensorReading (Type 0x02, Cmd 0x11)

This command queries the value of a particular numeric sensor.

The Terminus replies with its current values for the indicated numeric sensor. The rearmEventState is ignored because the sensor re-arm is automatic.

NOTE: If a state set is disabled; presentState, previousState, and eventState must be set to 0x0 (no data).

Supported sensors are:

- Temperature
- Link #1 Speed
- Link #2 Speed
- Link #3 Speed
- Link #4 Speed
- Link #1 SFP Temperature
- Link #2 SFP Temperature
- Link #3 SFP Temperature
- Link #4 SFP Temperature

4.2.7.1 GetSensorReading: Temperature Numeric Sensor

The following fields are returned if the Temperature Numeric Sensor (SensorID # 0x21) is queried:

sensorDataSize	0x00	enum for “sint8”.
sensorOperationalState=0x*nn*		Set to the current state. Values are 0x0 (enum for “enabled”) or 0x1 (enum for “disabled”). The initial value is “enabled”. This field can be updated by SetNumericSensorEnable.
sensorEventMessageEnable=*nn*		Set to the current state. Values are 0x0 (enum for “enabled”) or 0x1 (enum for “disabled”). The initial value is “enabled”. This field can be updated by SetNumericSensorEnable.
presentState=0x*nn*		Set to the current state. Values are 0x1 (“Normal”) or 0x7 (“Upper Warning”) based on the current temperature level.
previousState=0x*nn*		Set to the previous state value. Initially equal to presentState.
eventState=0x*nn*		Set to the same value as presentState.
presentReading=0x*nn*		Set to the current temperature value.

4.2.7.2 GetSensorReading: Link #1 Numeric Sensor

The following fields are returned if the Link #1 Speed Numeric Sensor (SensorID # 0x31) is queried:

sensorDataSize	0x02	enum for “uint16”.
sensorOperationalState=0x*nn*		Set to the current state. Values are 0x0 (enum for “enabled”) or 0x1 (enum for “disabled”). The initial value is “enabled”. This field can be updated by SetNumericSensorEnable.
sensorEventMessageEnable=*nn*		Set to the current state. Values are 0x0 (enum for “enabled”) or 0x1 (enum for “disabled”). The initial value is “enabled”. This field can be updated by SetNumericSensorEnable.
presentState=0x*nn*		Set to the current state. Values are 0x1 (“Normal”) or 0x7 (“Upper Warning”) based on the current temperature level.
previousState=0x*nn*		Set to the previous state value. Initially equal to presentState.
eventState=0x*nn*		Set to the same value as presentState.
presentReading=0x*nnnn*		Set to the current Link #1 Speed.

4.2.7.3 GetSensorReading: Link #2 Speed Numeric Sensor

The following fields are returned if the Link #2 Speed Numeric Sensor (SensorID # 0x32) is queried:

sensorDataSize	0x02	enum for “uint16”.
sensorOperationalState=0x*nn*		Set to the current state. Values are 0x0 (enum for “enabled”) or 0x1 (enum for “disabled”). The initial value is “enabled”. This field can be updated by SetNumericSensorEnable.
sensorEventMessageEnable=*nn*		Set to the current state. Values are 0x0 (enum for “enabled”) or 0x1 (enum for “disabled”). The initial value is “enabled”. This field can be updated by SetNumericSensorEnable.
presentState=0x*nn*		Set to the current state. Value is always set to 0x1 (“Normal”).
previousState=0x*nn*		Set to the previous state value. Initially equal to presentState.
eventState=0x*nn*		Set to the same value as presentState.
presentReading=0x*nnnn*		Set to the current Link #2 Speed.

For a 4-port card, the adapter firmware also reports the speed for links 3 and 4.

4.2.7.4 GetSensorReading: Link #3 Speed Numeric Sensor

The following fields are returned if the Link #3 Speed Numeric Sensor (SensorID # 0x33) is queried:

sensorDataSize	0x02	enum for “uint16".
sensorOperationalState=0x*nn*		Set to the current state. Values are 0x0 (enum for “enabled") or 0x1 (enum for “disabled "). The initial value is “enabled”. This field can be updated by SetNumericSensorEnable.
sensorEventMessageEnable=*nn*		Set to the current state. Values are 0x0 (enum for “enabled") or 0x1 (enum for “disabled"). The initial value is “enabled”. This field can be updated by SetNumericSensorEnable.
presentState=0x*nn*		Set to the current state. Value is always set to 0x1 (“Normal").
previousState=0x*nn*		Set to the previous state value. Initially equal to presentState.
eventState=0x*nn*		Set to the same value as presentState.
presentReading=0xnnnn		Set to the current Link #3 Speed.

4.2.7.5 GetSensorReading: Link #4 Speed Numeric Sensor

The following fields are returned if the Link #4 Speed Numeric Sensor (SensorID # 0x34) is queried:

sensorDataSize	0x02	enum for “uint16".
sensorOperationalState=0x*nn*		Set to the current state. Values are 0x0 (enum for “enabled") or 0x1 (enum for “disabled"). The initial value is “enabled”. This field can be updated by SetNumericSensorEnable.
sensorEventMessageEnable=*nn*		Set to the current state. Values are 0x0 (enum for “enabled") or 0x1 (enum for “disabled"). The initial value is “enabled”. This field can be updated by SetNumericSensorEnable.
presentState=0x*nn*		Set to the current state. Value is always set to 0x1 (“Normal")
previousState=0x*nn*		Set to the previous state value. Initially equal to presentState.
eventState=0x*nn*		Set to the same value as presentState.
presentReading=0x*nnnn*		Set to the current Link #4 Speed.

4.2.7.6 GetSensorReading: Link #1 SFP Temperature Numeric Sensor

The following fields are returned if the Link #1 SFP Temperature Numeric Sensor (SensorID # 0x51) is queried:

sensorDataSize	0x00	enum for “unsigned int8".
sensorOperationalState=0x*nn*		Set to the current state. Values are 0x0 (enum for “enabled") or 0x1 (enum for “disabled"). The initial value is “enabled”. This field can be updated by SetNumericSensorEnable.
sensorEventMessageEnable=*nn*		Set to the current state. Values are 0x0 (enum for “enabled") or 0x1 (enum for “disabled"). The initial value is “enabled”. This field can be updated by SetNumericSensorEnable.
presentState=0x*nn*		Set to the current state. Values are 0x1 (“Normal") or 0x7 (“Upper Warning") based on current temperature level.
previousState=0x*nn*		Set to the previous state value. Initially equal to presentState.
eventState=0x*nn*		Set to the same value as presentState.
presentReading=0x*nn*		Set to the current temperature value.

4.2.7.7 GetSensorReading: Link #2 SFP Temperature Numeric Sensor

The following fields are returned if the Link #2 SFP Temperature Numeric Sensor (SensorID # 0x52) is queried:

sensorDataSize	0x00	enum for “unsigned int8".
sensorOperationalState=0x*nn*		Set to the current state. Values are 0x0 (enum for “enabled") or 0x1 (enum for “disabled"). The initial value is “enabled”. This field can be updated by SetNumericSensorEnable.
sensorEventMessageEnable=*nn*		Set to the current state. Values are 0x0 (enum for “enabled") or 0x1 (enum for “disabled"). The initial value is “enabled”. This field can be updated by SetNumericSensorEnable.
presentState=0x*nn*		Set to the current state. Values are 0x1 (“Normal") or 0x7 (“Upper Warning") based on current temperature level.
previousState=0x*nn*		Set to the previous state value. Initially equal to presentState.
eventState=0x*nn*		Set to the same value as presentState.
presentReading=0x*nn*		Set to the current temperature value.

4.2.7.8 GetSensorReading: Link #3 SFP Temperature Numeric Sensor

The following fields are returned if the Link #3 SFP Temperature Numeric Sensor (SensorID # 0x53) is queried:

sensorDataSize	0x00	enum for “unsigned int 8".
sensorOperationalState=0x*nn*		Set to the current state. Values are 0x0 (enum for “enabled") or 0x1 (enum for “disabled"). The initial value is “enabled”. This field can be updated by SetNumericSensorEnable.
sensorEventMessageEnable=*nn*		Set to the current state. Values are 0x0 (enum for “enabled") or 0x1 (enum for “disabled"). The initial value is “enabled”. This field can be updated by SetNumericSensorEnable.
presentState=0x*nn*		Set to the current state. Values are 0x1 (“Normal") or 0x7 (“Upper Warning") based on current temperature level.
previousState=0x*nn*		Set to the previous state value. Initially equal to presentState.
eventState=0x*nn*		Set to the same value as presentState.
presentReading=0x*nn*		Set to the current temperature value.

4.2.7.9 GetSensorReading: Link #4 SFP Temperature Numeric Sensor

The following fields are returned if the Link #4 SFP Temperature Numeric Sensor (SensorID # 0x54) is queried:

sensorDataSize	0x00	enum for “unsigned int8".
sensorOperationalState=0x*nn*		Set to the current state. Values are 0x0 (enum for “enabled") or 0x1 (enum for “disabled"). The initial value is “enabled”. This field can be updated by SetNumericSensorEnable.
sensorEventMessageEnable=*nn*		Set to the current state. Values are 0x0 (enum for “enabled") or 0x1 (enum for “disabled"). The initial value is “enabled”. This field can be updated by SetNumericSensorEnable.
presentState=0x*nn*		Set to the current state. Values are 0x1 (“Normal") or 0x7 (“Upper Warning") based on current temperature level.
previousState=0x*nn*		Set to the previous state value. Initially equal to presentState.
eventState=0x*nn*		Set to the same value as presentState.
presentReading=0x*nn*		Set to the current temperature value.

4.2.8 SetStateSensorEnables (Type 0x02, Cmd 0x20)

This command enables/disables a sensor set, or it enables/disables events from a sensor set.

The Terminus adjusts the targeted sensor (based on the SensorID), it changes the state of the indicated state set, and it enables/disables the event posting attribute of the state set.

4.2.9 GetStateSensorReadings (Type 0x02, Cmd 0x21)

This command reads one or more of the state sets on a sensor. The Terminus ignores the rearmEventState field. The sensor re-arm is automatic.

The Terminus returns one of the following responses based on the SensorID queried.

NOTE: If a state set is disabled, presentState, previousState, and eventState must be set to 0x0 (no data).

4.2.9.1 GetStateSensorReadings: Controller Device State Sensor

The following fields are returned if the Controller Device State Sensor (SensorID # 0x80) is queried:

CompositeSensorCount	0x08	The number of state sets in the sensor.
StateFields:		
State Set (#1)		(Health State)
sensorOperationalState=0x*nn*		Set to the current state. Values are 0x0 (enum for “enabled”) or 0x1 (enum for “disabled”). The initial value is “enabled”. This field can be updated by SetStateSensorEnables.
presentState=0x*nn*		Set to the current state. Values are 0x1 (“Normal”) or 0x7 (“Upper Warning”) based on the current temperature level.
previousState=0x*nn*		Set to the previous state value. Initially equal to presentState.
eventState=0x*nn*		Set to the same value as presentState.
State Set (#2)		(Availability)
sensorOperationalState=0x*nn*		Set to the current state. Values are 0x0 (enum for “enabled”) or 0x1 (enum for “disabled”). The initial value is “enabled”. This field can be updated by SetStateSensorEnables.
presentState=0x01		Set to the current state. Value is 0x1 (“Enabled”).
previousState=0x01		Set to the previous state value. Initially equal to presentState.
eventState=0x01		Set to the same value as presentState.
State Set (#3)		(Predictive Condition)
sensorOperationalState=0x*nn*		Set to the current state. Values are 0x0 (enum for “enabled”) or 0x1 (enum for “disabled”). The initial value is “enabled”. This field can be updated by SetStateSensorEnables.
presentState=0x01		Set to the current state. Value is 0x1 (“Normal”).
previousState=0x01		Set to the previous state value. Initially equal to presentState.
eventState=0x01		Set to the same value as presentState.
State Set (#4)		(Configuration State)
sensorOperationalState=0x*nn*		Set to the current state. Values are 0x0 (enum for “enabled”) or 0x1 (enum for “disabled”). The initial value is “enabled”. This field can be updated by SetStateSensorEnables.
presentState=0x01		Set to the current state. Value is 0x1 (“Valid Config”).

previousState=0x01	Set to the previous state value. Initially equal to presentState.
eventState=0x01	Set to the same value as presentState.
State Set (#5)	(Changed Configuration)
sensorOperationalState=0x*nn*	Set to the current state. Values are 0x0 (enum for “enabled”) or 0x1 (enum for “disabled”). The initial value is “enabled”. This field can be updated by SetStateSensorEnables.
presentState=0x01	Set to the current state. Value is 0x1 (“Normal”).
previousState=0x01	Set to the previous state value. Initially equal to presentState.
eventState=0x01	Set to the same value as presentState.
State Set (#6)	(Version)
sensorOperationalState=0x*nn*	Set to the current state. Values are 0x0 (enum for “enabled”) or 0x1 (enum for “disabled”). The initial value is “enabled”. This field can be updated by SetStateSensorEnables.
presentState=0x*nn*	Set to the current state. Values are 0x1 (“Normal”) or 0x2 (“Version Change Detected–no conflict”).
previousState=0x*nn*	Set to the previous state value. Initially equal to presentState.
eventState=0x*nn*	Set to the same value as presentState.
State Set (#7)	(Device Power State)
sensorOperationalState=0x*nn*	Set to the current state. Values are 0x0 (enum for “enabled”) or 0x1 (enum for “disabled”). The initial value is “enabled”. This field can be updated by SetStateSensorEnables.
presentState=0x01	Set to the current state. Value is 0x1 (“D0”).
previousState=0x01	Set to the previous state value. Initially equal to presentState.
eventState=0x01	Set to the same value as presentState.
State Set (#8)	(Emulex FW Download State)
sensorOperationalState=0x*nn*	Set to the current state. Values are 0x0 (enum for “enabled”) or 0x1 (enum for “disabled”). The initial value is “enabled”. This field can be updated by SetStateSensorEnables.
presentState=0x*nn*	Set to the current state. Will initially be 0x1 (“Firmware Update Not Started”). Will change based on the firmware update action.
previousState=0x*nn*	Set to the previous state value. Initially equal to presentState.
eventState=0x*nn*	Set to the same value as presentState.

4.2.9.2 GetStateSensorReadings: Link #n State Sensor

The following fields are returned if the Link #1 State Sensor (SensorID # 0x81) or the Link #2 State Sensor (SensorID # 0x82) or in case of a 4-port adapter, Link #3 State Sensor (SensorID #0x83) or Link #4 State Sensor (SensorID #0x84) is queried. Values reported are relative to the respective Link #.

CompositeSensorCount	0x03	The number of state sets in the sensor.
StateFields:		
State Set (#1)		(Link State)
sensorOperationalState=0x*nn*		Set to the current state. Values are 0x0 (enum for “enabled”) or 0x1 (enum for “disabled”). The initial value is “enabled”. This field can be updated by SetStateSensorEnables.
presentState=0x*nn*		Set to the current state. Values are 0x1 (“Connected”) or 0x2 (“Disconnected”).
previousState=0x*nn*		Set to the previous state value. Initially equal to presentState.
eventState=0x*nn*		Set to the same value as presentState.
State Set (#2)		(Communication Leash Status)
sensorOperationalState=0x*nn*		Set to the current state. Values are 0x0 (enum for “enabled”) or 0x1 (enum for “disabled”). The initial value is “enabled”. This field can be updated by SetStateSensorEnables.
presentState=0x*nn*		Set to the current state (presence of the SFP). Values are 0x1 (“Leash Connected”) or 0x2 (“Leash Disconnected”).
previousState=0x*nn*		Set to the previous state value. Initially equal to presentState.
eventState=0x*nn*		Set to the same value as presentState.
State Set (#3)		(Emulex Link Duplex State)
sensorOperationalState=0x*nn*		Set to the current state. Values are 0x0 (enum for “enabled”) or 0x1 (enum for “disabled”). The initial value is “enabled”. This field can be updated by SetStateSensorEnables.
presentState=0x*nn*		Set to the current state. Values are 0x1 (“Full Duplex”) or 0x2 (“Half Duplex”).
previousState=0x*nn*		Set to the previous state value. Initially equal to presentState.
eventState=0x*nn*		Set to the same value as presentState.

4.2.10 GetPDRRepositoryInfo (Type 0x02, Cmd 0x50)

This command is used to size the PDR data to be returned by the Emulex device.

The Terminus returns the following fields:

RepositoryState	0x00	enum for “available”.
UpdateTime	nTS104n	Set to the creation timestamp. Pick a time in the past.
OEMUpdateTime	nTS104n	Set to the same value as UpdateTime.
recordCount	0x*nnnnnnnn*	Set to the count of PDR records.
repositorySize	0x*nnnnnnnn*	Set to the sum of the lengths of all PDR records.
largestRecordSize	0x*nnnnnnnn*	Set to the size of the largest PDR record.
dataTransferHandleTimeout	0x*nn*	<TBD>

4.2.11 GetPDR (Type 0x02, Cmd 0x51)

This command retrieves individual PDR records from the Emulex device. The Terminus returns the Entity Association PDRs first, followed by the remainder of the PDR records.

4.2.12 PlatformEventMessage (Type 0x02, Cmd 0x0A)

The following event messages can be generated for the applicable sensors.

4.2.12.1 PlatformEventMessage: Temperature Event

The Terminus returns the following fields:

FormatVersion	0x01	
TID	0x*nn*	Set to the current TID value.
EventClass	0x00	enum for “sensorEvent”.
eventData:		
sensorID	0x0021	Sensor ID for Temperature.
sensorEventClass	0x02	enum for “numericSensorState”.
When reporting cross over/above the warning threshold:		
eventState	0x08	enum for “UpperWarning”.
previousEventState	0x01	enum for “Normal”
When reporting cross below the warning threshold:		
eventState	0x01	enum for “Normal”.
PreviousEventState	0x08	enum for “UpperWarning”.
sensorDataSize	0x01	enum for “sint8”.
presentReading	0x*nn*	Set to the temperature value.

4.2.12.2 PlatformEventMessage: Link Speed Change Event

Link Speed Change events are generated whenever the link speed changes. If the link state transitions to “down”, an event is generated with a “0” speed. When the link state transitions to “up”, an event is generated to indicate the link speed.

The Terminus returns the following fields:

FormatVersion	0x01	
TID	0x*nn*	Set to the current TID value.
EventClass	0x00	enum for “sensorEvent”.
eventData:		
If event on Link #1:		
sensorID	0x0031	Sensor ID for Link #1 Speed.
If event on Link #2:		
sensorID	0x0032	Sensor ID for Link #2 Speed.
If event on Link #3:		
sensorID	0x0033	Sensor ID for Link #3 Speed.
If event on Link #4:		
sensorID	0x0034	Sensor ID for Link #4 Speed.
sensorEventClass	0x02	enum for “numericSensorState”.
eventState	0x01	enum for “Normal”.
PreviousEventState	0x01	enum for “Normal”.
sensorDataSize	0x01	enum for “sint8”.
presentReading	0x*nn*	Set to the link speed (units 1Gb/s) on the appropriate link #.

4.2.12.3 PlatformEventMessage: Controller Device State Event

This event message is used to report changes in one of the state sets contained within the Controller Device State Sensor. The following state sets exist:

- Health State
  An event for this state set is generated under the following conditions:
  – If the temperature becomes equal to or greater than the warning threshold, report 0x7 (“UpperWarning”).
  – If the temperature becomes less than the warning threshold, report 0x1 (“Normal”).

  NOTE: Initially set to 0x1 (“Normal”) or 0x7 (“Upper Warning”) based on the existing temperature versus the warning threshold.
- Availability
  No event is generated. The Emulex state is fixed.

  NOTE: Initially set to 0x1 (“Enabled”).
- Predictive Condition
  No event is generated. The Emulex state is fixed.

  NOTE: Initially set to 0x1 (“Normal”).
- Configuration State
  No event is generated. The Emulex state is fixed.

  NOTE: Initially set to 0x1 (“Valid Config”).
- Changed Configuration
  No event is generated. The Emulex state is fixed.

  NOTE: Initially set to 0x1 (“Normal”).
- Version
  An event for this state set is generated under the following conditions:
  – If a firmware reset occurs, prior to initiating the reset, it reports 0x2 (“Version Change Detected–no conflict”).
  NOTE: This assumes that host-directed resets are done to instantiate the firmware.

  NOTE: Initially set to 0x1 (“Normal”).
- Device Power State
  No event is generated. The Emulex state is fixed. For the HBA, MCTP over PCIe is available only in the D0 state.

  NOTE: Initially set to 0x1 (“D0”).
- Emulex FW Download State
  An event for this state set is generated under the following conditions:
  – Initially when the event is enabled. It reports 0x1 (“Firmware Update Not Started”).
  – Whenever one of the following FW Update transitions occurs, it reports the new state:
    - 0x1 (not started) -> 0x2 (“Firmware Update Started”)
    - 0x2 (started) -> 0x3 (“Firmware Update Stopped”)
    - 0x2 (started) -> 0x5 (“Firmware Update Failed”)
    - 0x2 (started) -> 0x7 (“Firmware Written Successfully, Awaiting Activation”)
    - 0x3 (update stopped) -> 0x2 (“Firmware Update Started”)
    - 0x5 (update failed) -> 0x2 (“Firmware Update Started”)
    - 0x7 (done, ready to activate) -> 0x2 (“Firmware Update Started”)

  NOTE: Initially set to 0x1 (“Firmware Update Not Started”).

NOTE: Not all products can accurately detect each and every state. Therefore it is not unusual for the download state to persist for some time. If the download state transitions to an active/in-progress state, the device generates (assuming the event is enabled) Firmware Download Percentage Events.

NOTE: If the device is unable to accurately detect the Firmware Download state, the Controller State Sensor does not include the OEM State Set for the Firmware Download state, and the Numerical Sensor for Firmware Download Percentage is also not returned to the system.

The Terminus returns the following fields:

FormatVersion	0x01	
TID	0x*nn*	Set to the current TID value.
EventClass	0x00	enum for “sensorEvent”.
eventData:		
sensorID	0x0080	The sensor ID for the Controller Device State.
sensorEventClass	0x01	enum for “StateSensorState”.
sensorOffset	0x0*n*	Set to the offset/index of the state set being reported.
eventState	0x*nn*	Set to the state value being transitioned to.
previousEventState	0x*nn*	Set to the prior event state value.

4.2.12.4 PlatformEventMessage: Link #n State Event

This event message reports changes in one of the state sets contained within the Link #1 State Sensor or the Link #2 State Sensor or Link #3 State Sensor or Link #4 State Sensor (for a 4-port adapter). The following state sets exist:

- Link State
  An event for this state set is generated under the following conditions:
  – On any Link Up/Down transition. The event reports the ending state.

  NOTE: Initially set to 0x2 (“Disconnected”).
- Communication Leash Status
  This state reports the presence of the SFP if supported by the stock keeping unit (SKU).

  NOTE: Initially set to 0x1 (“Leash Connected”).
- Emulex Link Duplex
  An event for this state set is generated under the following conditions:
  – Any change between Full Duplex or Half Duplex operation. The event reports the ending state.

  NOTE: Initially set to 0x1 (“Full Duplex”).

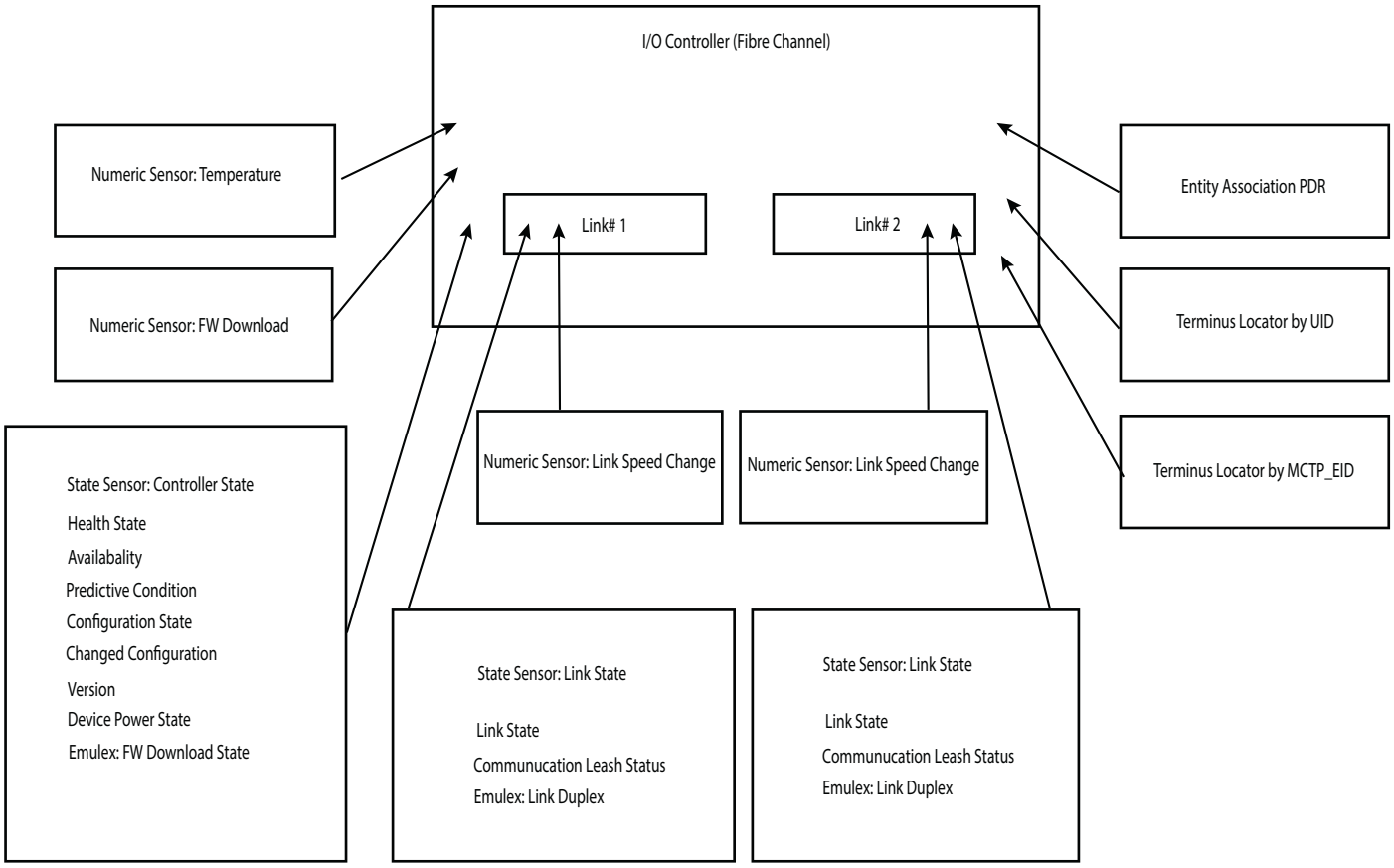
The Terminus returns the following fields:

FormatVersion	0x01	
TID	0x*nn*	Set to the current TID value.
EventClass	0x00	enum for “sensorEvent”.
eventData:		
If for Link #1		
sensorID	0x0081	Sensor ID for Link #1 State.
If for Link #2		
sensorID	0x0082	Sensor ID for Link #2 State.
If for Link #3		
sensorID	0x0083	Sensor ID for Link #3 State.
If for Link #4		
sensorID	0x0084	Sensor ID for Link #4 State.
sensorEventClass	0x01	enum for “StateSensorState”.
sensorOffset	0x0n	Set to offset/index of the state set being reported.
eventState	0x*nn*	Set to the state value being transitioned to.
previousEventState	0x*nn*	Set to the prior event state value.

4.3 PLDM Type Code 0x02 PDR Records

The PDRs in this section describe what the following figure pictorially represent.

Figure 1: PDR Records



NOTE: If the product supports additional Links, the topology will reflect additional Link instances.

The following PDRs are generated by the Emulex PLDM. Some PDRs are specific to an SKU type, and only the applicable PDRs are returned:

Table 2: Emulex-Generated PDRs

Emulex Record Handle	Emulex Container ID	Type	Instance Number	Contained in Container ID	Description
0x00000001.. 0x0000000F	Type 0x0F: Entity Association PDRs				Creates the base “topology tree objects” associated with the device that subsequent PDRs can reference.
0x00000001	0x0002	EntityType: 0x0091: Physical + I/O Controller (145/ 0x91)	1	0x0000 Unknown, so use value 0x0	This PDR is the Controller (ASIC) association PDR for an Emulex add-in card if it is an FC-based adapter. Thus the selection of I/O controller. Contains two entities that map to physical FC links.
0x00000010.. 0x0000001F	Type 0x01: Terminus Locator PDRs				Reports Connection or Endpoint information to locate the Emulex device.
0x00000010	N/A	LocatorType 0x00	N/A	0x0002	Locator PDR based on the UID.
0x00000011	N/A	LocatorType 0x01	N/A	0x0002	Locator PDR based on the MCTP EID.
0x00000020.. 0x0000007F	Type 0x02: Numeric Sensor PDRs				PDR that describes each sensor supported.
0x00000021	N/A	SensorID 0x21	1	0x0002	Temperature Sensor.
0x00000031	N/A	SensorID 0x31	1	0x0002	Link #1 Speed Sensor.
0x00000032	N/A	SensorID 0x32	2	0x0002	Link #2 Speed Sensor.
0x00000033	N/A	SensorID 0x33	3	0x0002	Link #3 Speed Sensor (applicable for a 4-port adapter only).
0x00000034	N/A	SensorID 0x34	4	0x0002	Link #4 Speed Sensor (applicable for a 4-port adapter only).
0x00000051	N/A	SensorID 0x51	1	0x0002	Link #1 SFP Temperature Sensor.
0x00000052	N/A	SensorID 0x52	2	0x0002	Link #1 SFP Temperature Sensor.
0x00000053	N/A	SensorID 0x53	3	0x0002	Link #1 SFP Temperature Sensor.
0x00000054	N/A	SensorID 0x54	4	0x0002	Link #1 SFP Temperature Sensor.
0x00000080.. 0x000000FF	Type 0x04: State Sensor PDRs				PDR that describes each sensor supported.
0x00000080	N/A	SensorID 0x80	N/A	0x0002	Controller Device State.
0x00000081	N/A	SensorID 0x81	N/A	0x0002	Link #1 State.

Table 2: Emulex-Generated PDRs (Continued)

Emulex Record Handle	Emulex Container ID	Type	Instance Number	Contained in Container ID	Description
0x00000082	N/A	SensorID 0x82	N/A	0x0002	Link #2 State.
0x00000083	N/A	SensorID 0x83	N/A	0x0002	Link #3 State (applicable for a 4-port adapter only).
0x00000084	N/A	SensorID 0x84	N/A	0x0002	Link #4 State (applicable for a 4-port adapter only).
0x00000100.. 0x0000011F	Type 0x06: Sensor Auxiliary Names PDRs				Provides “name” strings (per language) to identify the sensors.
0x00000100	N/A	SensorID 0x21	N/A	N/A	Temperature Sensor Names.
0x00000110	N/A	SensorID 0x31	N/A	N/A	Link #1 Speed.
0x00000111	N/A	SensorID 0x32	N/A	N/A	Link #2 Speed.
0x00000112	N/A	SensorID 0x33	N/A	N/A	Link #3 Speed.
0x00000113	N/A	SensorID 0x34	N/A	N/A	Link #4 Speed.
0x00000120.. 0x0000013F	Type 0x7: OEM Unit PDR				Describes units that are nonstandard.
					(none)
0x00000140.. 0x0000015F	Type 0x08: OEM State Set PDR				Describes OEM-specific state sets.
0x00000140	N/A	N/A	N/A	0x0002	Firmware Download State.
0x00000141	N/A	N/A	N/A	0x0002	Link Duplex State.
0x00000180	Type 0x14: FRU Record Set PDRs				Describes the FRU Data Record that can be obtained from the Emulex device.
0x00000180	N/A	FRURecordSet Identifier 0x0001	N/A	0x0002	Specifies the relationship with FRU Record for Controller.
0x00000041.. 0x00000047	Type 0x16: Redfish Get PDRs				Describes Redfish PDRs.
0x00000041	0	N/A	1	0	Specifies the Redfish resource PDR.
0x00000042	0	N/A	1	0	Specifies the Redfish network adapter PDR.
0x00000043	0	N/A	1	200U	Specifies the Redfish Port collection PDR.
0x00000044	0	N/A	1	300U	Specifies the Redfish Port PDR.
0x00000045	0	N/A	1	200U	Specifies the Redfish Network Device Collection PDR.
0x00000046	0	N/A	1	500U	Specifies the Redfish Network Device Function PDR.
0x00000047	0	N/A	1	200U	Specifies the Network Action PDR.

4.3.1 Entity Association PDRs (PDR Type 0x0F)

The Emulex adapter supplies one or more Entity Association PDRs. It is mandatory to define at least one “container” corresponding to the add-in card. Multiple Entity PDRs may be necessary if Broadcom elects to break out components, such as the ASICs, into separate “containers” that reference the main container.

The main “add-in” card Entity Association PDR contains the following fields:

Hdr: RecordHandle	0x00000001	Emulex-specific PDR ID–for the Entity Association PDR for the network or I/O controller.
Hdr: PDRHeaderVersion	0x01	
Hdr PDRType	0x0F	Entity Association PDR.
Hdr RecordChangeNumber	0x0000	
Hdr DataLength	0x*nnnn*	Size of PDR data.
ContainerID	0x0002	Emulex-specific unique container ID.
AssociationType	0x00	Assumed enum for physical to physical=0; logical=1 based on “P/L bit” references.
ContainerEntityType	0x0091	Emulex entity type: bit15=P/L, which is 0 for Physical; bits14:0 are the Entity ID, which is 145/0x91 for “I/O Controller”.
ContainerEntityInstanceNumber	0x0001	Emulex instance: always the first instance.
ContainerEntityContainerID	0x0000	
ContainedEntityCount	0x0002	
Contained Entity (#1)	(FC link #1)	
Type=0x0002 (Physical(0)/Network (2/0x02))	InstanceNumber =0x0001	ContainerID=0x0002
Contained Entity (#2)	(FC link #2)	
Type=0x0002 (Physical(0)/Network (2/0x02))	InstanceNumber =0x0002	ContainerID=0x0002

A 4-port adapter will return the following additional entities:

Contained Entity (#3)	(FC link #3)	
Type=0x0002 (Physical(0)/Network (2/0x02))	InstanceNumber =0x0003	ContainerID=0x0002
Contained Entity (#2)	(FC link #4)	
Type=0x0002 (Physical(0)/Network (2/0x02))	InstanceNumber =0x0004	ContainerID=0x0002

4.3.2 Terminus Locator PDRs (PDR Type 0x01)

The Emulex adapter supplies two Terminus Locator PDRs. One is based on the Emulex UID, and the other is based on the MCTP_EID.

NOTE: MCTP may be on top of PCIe or SMBus.

4.3.2.1 Terminus Locator PDR (PDR Type 0x01) Based on the UID

The Terminus Locator PDR (UID) for the main add-in card contains the following fields:

Hdr: RecordHandle	0x00000010	Emulex-specific PDR ID–for the Terminus Locator PDR for the network or I/O controller.
Hdr: PDRHeaderVersion	0x01	
Hdr PDRType	0x01	Terminus Locator PDR.
Hdr RecordChangeNumber	0x0000	
Hdr DataLength	0x*nnnn*	Size of the PDR data.
PLDMTerminusHandle	0x0000	Unique handle–all set to 0x0000.
Validity	0x01	notValid=0, valid=1.
TID	0x*nn*	Set to the current value of the Emulex TID.
containerID	0x0002	Value from the Controller Entity Association PDR.
terminusLocatorType	0x00	enum for “UID”.
terminusLocatorValueSize	0x*nn*	Set to the size in bytes of the terminusInstance and deviceUID fields.
terminusInstance	0x01	Emulex PLDM instance number–always 1.
deviceUID	<uid>	Set to the UUID for the Emulex device, based on the base MAC address.

4.3.2.2 Terminus Locator PDR (PDR Type 0x01) Based on the MCTP_EID

The Terminus Locator PDR (UID) for the main add-in card contains the following fields:

Hdr: RecordHandle	0x00000011	Emulex-specific PDR ID–for the Terminus Locator PDR for the network or I/O controller.
Hdr: PDRHeaderVersion	0x01	
Hdr PDRType	0x01	Terminus Locator PDR.
Hdr RecordChangeNumber	0x0000	
Hdr DataLength	0x*nnnn*	Size of the PDR data.
PLDMTerminusHandle	0x0000	Unique handle–all set to 0x0000.
Validity	0x01	notValid=0, valid=1.
TID	0x*nn*	Set to the current value of the Emulex TID.
containerID	0x0002	Value from the Controller Entity Association PDR.
terminusLocatorType	0x01	enum for “MCTP_EID”.
terminusLocatorValueSize	0x*nn*	Set to the size in bytes of the EID field.
EID	0x*nn*	Set to the EID for the Emulex device from MCTP.

4.3.3 Numeric Sensor PDRs (PDR Type 0x02)

The Emulex adapter supplies the following Numeric Sensor PDRs as appropriate for the SKU.

Supported sensors are:

- Temperature
- Link #1 Speed
- Link #2 Speed
- Link #3 Speed
- Link #4 Speed
- Link #1 SFP Temperature
- Link #2 SFP Temperature
- Link #3 SFP Temperature
- Link #4 SFP Temperature

4.3.3.1 Numeric Sensor PDR: Temperature

The Numeric Sensor PDR for Temperature reporting contains the following data:

Hdr: RecordHandle	0x00000021	Emulex-specific PDR ID–for the Temperature Numeric Sensor PDR.
Hdr: PDRHeaderVersion	0x01	
Hdr PDRType	0x02	Numeric Sensor PDR.
Hdr RecordChangeNumber	0x0000	
Hdr DataLength	0x*nnnn*	Size of the PDR data.
PLDMTerminusHandle	0x0000	Unique handle–all set to 0x0000.
SensorID	0x21	
EntityType	0x0091	Set to the value in the Controller Entity Association PDR.
EntityInstanceNumber	0x0001	Set to the value in the Controller Entity Association PDR.
containerID	0x0002	Set to the value in the Controller Entity Association PDR.
SensorInit	0x00	enum for “noInit”.
SensorAuxiliaryNamesPDR	0x01	enum for “true”–does have a Sensor Auxiliary Names PDR.
baseUnit	0x02	Unit is “Degree C”.
unitModifier	0x00	Power of 10 multiplier (for example: =”1”).
rateUnit	0x00	enum for “none”.
baseOEMUnitHandle	0x00	Not used.
auxUnit	0x00	enum for “none”.
auxUnitModifier	0x00	Power of 10 multiplier (for example. = “1”).
auxRateUnit	0x00	enum for “none”
rel	0x00	enum for multipledBy–as driving to “*1” scenario.
auxOEMUnitHandle	0x00	Not used.
isLinear	0x01	enum for “true”.
sensorDataSize	0x01	enum for “sint8”.
resolution	R:0x00000001	Resolution of 1–no change to reading.
offset	R:0x00000000	Constant value always added to the sensor value.
accuracy	0x0000	+/– accuracy–no deviation.

plusTolerance	0x00	+ variation–no deviation.
minusTolerance	0x00	– variation–no deviation.
hysteresis	0x00	0 = no hysteresis, specified at sint8 (same as SensorDataSize).
SupportedThresholds	0x00	no bits set–no thresholds supported.
thresholdAndHysteresisVolatility	0x00	0 = non-volatile; thresholds set regardless of state.
stateTransitionInterval	R:0x00000001	1s = length of time for the sensor to enable state change in seconds.
updateInterval	R:0x00000001	1s = recommending polling update interval.
maxReadable	0x80	128: maximum value that could be returned. Size based on “sint8”.
minReadable	0x00	Minimum value that could be returned. Size based on “sint8”.
rangeFieldFormat	0x01	enum for “sint8”.
rangeFieldSupport	0x26	Bit 1 set = NormalMax and warnHigh supported.
nominalValue	0x00	Unsupported; size based on “sint8”.
normalMax	0x*nn*	Set to the temperature warning threshold; size based on “sint8”
normalMin	0x00	Unsupported; size based on “sint8”.
warningHigh	0x*nn*	Set to the temperature warning threshold; size based on “sint8”.
warningLow	0x00	Unsupported; size based on “sint8”.
criticalHigh	0x*nn*	Unsupported; size based on “sint8”.
criticalLow	0x00	Unsupported; size based on “sint8”.
fatalHigh	0x*nn*	Unsupported; size based on “sint8”.
fatalLow	0x00	Unsupported; size based on “sint8”.

4.3.3.2 Numeric Sensor PDR: Link #1 Speed

NOTE: Because units are nonstandard, Gb/s or Mb/s has been chosen as the reporting unit. However, to keep records small (8-bit values not 16), Gb/s is used.

The Numeric Sensor PDR for Link #1 speed reporting contains the following fields:

Hdr: RecordHandle	0x00000031	Emulex-specific PDR ID–for the Link #1 Speed Numeric Sensor PDR.
Hdr: PDRHeaderVersion	0x01	
Hdr PDRType	0x02	Numeric Sensor PDR.
Hdr RecordChangeNumber	0x0000	
Hdr DataLength	0x*nnnn*	Size of the PDR data.
PLDMTerminusHandle	0x0000	Unique handle–all set to 0x0000.
SensorID	0x31	
EntityType	0x0002	Physical (0)/Network (2/0x02): set to the contained link value in the Controllers Entity Association PDR.
EntityInstanceNumber	0x0001	Set to the Link #.
containerID	0x0002	Set to the value in the Controller Entity Association PDR.
SensorInit	0x00	enum for “noInit”.
SensorAuxiliaryNamesPDR	0x01	enum for “true”–does have a Sensor Auxiliary Names PDR.
baseUnit	0x3C	Unit is “Bits”.
unitModifier	0x07	Power of 10 multiplier (for example 10^7 = 10Mbits).
rateUnit	0x03	enum for “Per Second”.
baseOEMUnitHandle	0x00	Unused.
auxUnit	0x00	enum for “none”.
auxUnitModifier	0x00	Power of 10 multiplier (for example. = “1”).
auxRateUnit	0x00	enum for “none”.
rel	0x00	enum for multipledBy–as driving to “*1” scenario.
auxOEMUnitHandle	0x00	Not used.
isLinear	0x01	enum for “true”.
sensorDataSize	0x02	enum for “uint16”.
resolution	R:0x00000001	Resolution of 1–no change to reading.
offset	R:0x00000000	Constant value always added to the sensor value.
accuracy	0x0000	+/– accuracy–no deviation.
plusTolerance	0x00	+ Variation–no deviation.
minusTolerance	0x00	– Variation–no deviation.
hysteresis	0x0000	0 = no hysteresis, specified at uint16 (same as SensorDataSize).
SupportedThresholds	0x00	No bits set–no thresholds supported.
thresholdAndHysteresisVolatility	0x00	0 = non-volatile; thresholds set regardless of state.
stateTransitionInterval	R:0x00000001	1s = length of time for the sensor to enable state change in seconds.
updateInterval	R:0x0000000A	10s = Recommended polling update interval.
maxReadable	0x2710	10000: maximum value (10000 = 100Gb/s) that could be returned; size based on “uint16”.
minReadable	0x0000	Minimum value that could be returned. Size based on “uint16”.

rangeFieldFormat	0x02	Enum for “uint16”.
rangeFieldSupport	0x00	No bits set–no range fields supported.
nominalValue	0x0000	Unsupported; size based on “uint16”.
normalMax	0x0000	Unsupported; size based on “uint16”.
normalMin	0x0000	Unsupported; size based on “uint16”.
warningHigh	0x0000	Unsupported; size based on “uint16”.
warningLow	0x0000	Unsupported; size based on “uint16”.
criticalHigh	0x0000	Unsupported; size based on “uint16”.
criticalLow	0x0000	Unsupported; size based on “uint16”.
fatalHigh	0x0000	Unsupported; size based on “uint16”.
fatalLow	0x0000	Unsupported; size based on “uint16”.

4.3.3.3 Numeric Sensor PDR: Link #2 Speed

The Numeric Sensor PDR for Link #2 speed reporting contains the same fields as the Link #1 Speed Numeric Sensor PDR, with the following changes:

Hdr: RecordHandle	0x00000032	Emulex-specific PDR ID–for the Link #2 Speed Numeric Sensor PDR.
SensorID	0x32	
EntityInstanceNumber	0x0002	Set to the Link #.

4.3.3.4 Numeric Sensor PDR: Link #3 Speed

The Numeric Sensor PDR for Link #3 speed reporting contains the same fields as the Link #1 Speed Numeric Sensor PDR, with the following changes:

Hdr: RecordHandle	0x00000033	Emulex-specific PDR ID–for the Link #3 Speed Numeric Sensor PDR.
SensorID	0x33	
EntityInstanceNumber	0x0003	Set to the Link #.

4.3.3.5 Numeric Sensor PDR: Link #4 Speed

The Numeric Sensor PDR for Link #4 speed reporting contains the same fields as the Link #1 Speed Numeric Sensor PDR, with the following changes:

Hdr: RecordHandle	0x00000034	Emulex-specific PDR ID–for the Link #4 Speed Numeric Sensor PDR.
SensorID	0x34	
EntityInstanceNumber	0x0004	Set to the Link #.

4.3.3.6 Numeric Sensor PDR: Link #1 SFP Temperature

The Numeric Sensor PDR for Link #1 SFP temperature reporting contains the following fields:

Hdr: RecordHandle	0x00000051	Emulex-specific PDR ID–for the Link #1 SFP Temperature Numeric Sensor PDR.
Hdr: PDRHeaderVersion	0x01	
Hdr PDRType	0x02	Numeric Sensor PDR.
Hdr RecordChangeNumber	0x0000	
Hdr DataLength	0x*nnnn*	Size of the PDR data.
PLDMTerminusHandle	0x0000	Unique handle–all set to 0x0000.
SensorID	0x51	
EntityType	0x0002	Physical (0)/Network (2/0x02): set to the contained link value in the Controllers Entity Association PDR.
EntityInstanceNumber	0x0001	Set to the Link #.
containerID	0x0002	Set to the value in the Controller Entity Association PDR.
SensorInit	0x00	enum for “noInit”.
SensorAuxiliaryNamesPDR	0x01	enum for “true”–does have a Sensor Auxiliary Names PDR.
baseUnit	0x3C	Unit is “Bits”.
unitModifier	0x07	Power of 10 multiplier (for example 10^7 = 10Mbits).
rateUnit	0x03	enum for “Per Second”.
baseOEMUnitHandle	0x00	Unused.
auxUnit	0x00	enum for “none”.
auxUnitModifier	0x00	Power of 10 multiplier (for example. = “1”).
auxRateUnit	0x00	enum for “none”.
rel	0x00	enum for multipledBy–as driving to “*1” scenario.
auxOEMUnitHandle	0x00	Not used.
isLinear	0x01	enum for “true”.
sensorDataSize	0x00	enum for “unsigned int8”.
resolution	R:0x00000001	Resolution of 1–no change to reading.
offset	R:0x00000000	Constant value always added to the sensor value.
accuracy	0x0000	+/– accuracy–no deviation.
plusTolerance	0x00	+ Variation–no deviation.
minusTolerance	0x00	– Variation–no deviation.
hysteresis	0x0000	0 = no hysteresis, specified at uint16 (same as SensorDataSize).
SupportedThresholds	0x00	No bits set–no thresholds supported.
thresholdAndHysteresisVolatility	0x00	0 = non-volatile; thresholds set regardless of state.
stateTransitionInterval	R:0x00000001	1s = length of time for the sensor to enable state change in seconds.
updateInterval	R:0x0000000A	10s = Recommended polling update interval.
maxReadable	0x80	128 degree.
minReadable	0x0000	Minimum value that could be returned. Size based on “uint8”.
rangeFieldFormat	0x00	Enum for “uint8”.
rangeFieldSupport	0x0A	Bit1: Normal, Bit3: Critical.
nominalValue	0x0000	Unsupported; size based on “uint8”.

normalMax	0x0000	Unsupported; size based on “uint8”.
normalMin	0x0000	Unsupported; size based on “uint8”.
warningHigh	0x0000	Unsupported; size based on “uint8”.
warningLow	0x0000	Unsupported; size based on “uint8”.
criticalHigh	0x0000	Unsupported; size based on “uint8”.
criticalLow	0x0000	Unsupported; size based on “uint8”.
fatalHigh	0x0000	Unsupported; size based on “uint8”.
fatalLow	0x0000	Unsupported; size based on “uint8”.

4.3.3.7 Numeric Sensor PDR: Link #2 SFP Temperature

The Numeric Sensor PDR for Link #2 SFP temperature reporting contains the same fields as the Link #1 SFP temperature Numeric Sensor PDR, with the following changes:

Hdr: RecordHandle	0x00000052	Emulex-specific PDR ID–for the Link #2 SFP Temperature Numeric Sensor PDR.
SensorID	0x52	
EntityInstanceNumber	0x0002	Set to the Link #.

4.3.3.8 Numeric Sensor PDR: Link #3 SFP Temperature

The Numeric Sensor PDR for Link #3 SFP temperature reporting contains the same fields as the Link #1 SFP temperature Numeric Sensor PDR, with the following changes:

Hdr: RecordHandle	0x00000053	Emulex-specific PDR ID–for the Link #3 SFP Temperature Numeric Sensor PDR.
SensorID	0x53	
EntityInstanceNumber	0x0003	Set to the Link #.

4.3.3.9 Numeric Sensor PDR: Link #4 SFP Temperature

The Numeric Sensor PDR for Link #4 SFP temperature reporting contains the same fields as the Link #1 SFP temperature Numeric Sensor PDR, with the following changes:

Hdr: RecordHandle	0x00000054	Emulex-specific PDR ID–for the Link #4 SFP Temperature Numeric Sensor PDR.
SensorID	0x54	
EntityInstanceNumber	0x0004	Set to the Link #.

4.3.4 State Sensor PDRs (PDR Type 0x04)

The Emulex adapter supplies the following State Sensor PDRs as appropriate for the SKU.

Supported sensors are:

- Controller Device State
- Link #1 State
- Link #2 State
- Link #3 State
- Link #4 State

4.3.4.1 State Sensor PDR: Controller Device State

The State Sensor PDR for controller device state reporting contains the following fields:

Hdr: RecordHandle	0x00000080	Emulex-specific PDR ID–for the Controller State Sensor PDR.
Hdr: PDRHeaderVersion	0x01	
Hdr PDRType	0x04	State Sensor PDR.
Hdr RecordChangeNumber	0x0000	
Hdr DataLength	0x*nnnn*	Size of the PDR data.
PLDMTerminusHandle	0x0000	Unique handle–all set to 0x0000.
SensorID	0x80	
EntityType	0x0091	Set to the value in the Controller Entity Association PDR.
EntityInstanceNumber	0x0001	Set to the value in the Controller Entity Association PDR.
containerID	0x0002	Set to the value in the Controller Entity Association PDR.
SensorInit	0x00	enum for “noInit”.
SensorAuxiliaryNamesPDR	0x00	enum for “false”–does not have a Sensor Auxiliary Names PDR.
compositeSensorCount	0x08	Eight sets of possibleStates.
possibleStates (#1):		
stateSetID=0x0001 (Health State)		possibleStatesSize=2 (2 bytes to cover 10 states)
possibleStates (#2):		
stateSetID=0x0002 (Availability)		possibleStatesSize=3 (3 bytes to cover 16 states)
possibleStates (#3):		
stateSetID=0x0003 (Predictive Condition)		possibleStatesSize=1 (1 byte to cover 2 states)
possibleStates (#4):		
stateSetID=0x000F (Configuration State)		possibleStatesSize=1 (1 byte to cover 4 states)
possibleStates (#5):		
stateSetID=0x0010 (Changed Configuration)		possibleStatesSize=1 (1 byte to cover 2 states)
possibleStates (#6):		
stateSetID=0x0012 (Version)		possibleStatesSize=1 (1 byte to cover 3 states)
possibleStates (#7):		
stateSetID=0x0102 (Device Power State)		possibleStatesSize=1 (1 byte to cover 4 states)

possibleStates (#8):		
stateSetID=0x1140 (Emulex FW Download State)		possibleStatesSize=1 (1 byte to cover 7 states)

4.3.4.2 State Sensor PDR: Link #1 State

The State Sensor PDR for Link #1 state reporting contains the following fields:

Hdr: RecordHandle	0x00000081	Emulex-specific PDR ID–for the Link #1 State Sensor PDR.
Hdr: PDRHeaderVersion	0x01	
Hdr PDRType	0x04	State Sensor PDR.
Hdr RecordChangeNumber	0x0000	
Hdr DataLength	0x*nnnn*	Size of the PDR data.
PLDMTerminusHandle	0x0000	Unique handle–all set to 0x0000.
SensorID	0x81	
EntityType	0x0002	Physical (0)/Network (2/0x02): set to the contained link value in the Controller Entity Association PDR.
EntityInstanceNumber	0x0001	Set to the Link #.
containerID	0x0002	Set to the value in the Controller Entity Association PDR.
SensorInit	0x00	enum for “noInit”.
SensorAuxiliaryNamesPDR	0x00	enum for “false”–does not have a Sensor Auxiliary Names PDR.
compositeSensorCount	0x03	Three sets of possibleStates.
possibleStates (#1):		
stateSetID=0x0021 (Link State)		possibleStatesSize=1 (1 byte to cover 2 states)
possibleStates (#2):		
stateSetID=0x0065 (Communication Leash Status)		possibleStatesSize=1 (1 byte to cover 2 states) **NOTE:** This reports the presence or not of the SFP.
possibleStates (#3):		
stateSetID=0x1141 (Emulex Link Duplex state)		possibleStatesSize=1 (1 byte to cover 2 states)

4.3.4.3 State Sensor PDR: Link #2 State

The State Sensor PDR for Link #2 state reporting contains the same data as the Link #1 State Sensor PDR, with the following changes:

Hdr: RecordHandle	0x00000082	Emulex-specific PDR ID–for the Link #2 State Sensor PDR.
SensorID	0x82	
EntityInstanceNumber	0x0002	Set to the Link #.

4.3.4.4 State Sensor PDR: Link #3 State

The State Sensor PDR for Link #3 state reporting contains the same data as the Link #1 State Sensor PDR, with the following changes:

Hdr: RecordHandle	0x00000083	Emulex-specific PDR ID–for the Link #3 State Sensor PDR.
SensorID	0x83	
EntityInstanceNumber	0x0003	Set to the Link #.

4.3.4.5 State Sensor PDR: Link #4 State

The State Sensor PDR for Link #4 state reporting contains the same data as the Link #1 State Sensor PDR, with the following changes:

Hdr: RecordHandle	0x00000084	Emulex-specific PDR ID–for the Link #4 State Sensor PDR.
SensorID	0x84	
EntityInstanceNumber	0x0004	Set to the Link #.

4.3.5 Sensor Auxiliary Names PDRs (PDR Type 0x06)

The Emulex adapter provides a Sensor Auxiliary Names PDR for each sensor PDR that is reported.

Supported sensors are:

- Temperature
- Link #1 Speed
- Link #2 Speed
- Link #3 Speed
- Link #4 Speed

4.3.5.1 Sensor Auxiliary Names PDR: Temperature

The Sensor Auxiliary Names PDR for temperature reporting contains the following fields:

Hdr: RecordHandle	0x00000100	Emulex-specific PDR ID–for the Sensor Auxiliary Names PDR for the Temperature.
Hdr: PDRHeaderVersion	0x01	
Hdr PDRType	0x06	Sensor Auxiliary Names PDR.
Hdr RecordChangeNumber	0x0000	
Hdr DataLength	0x*nnnn*	Size of the PDR data.

PLDMTerminusHandle	0x0000	Unique handle–all set to 0x0000.
SensorID	0x0021	Sensor ID for Temperature.
SensorCount	0x01	Not a composite sensor.
nameString Count	0x01	Only one language/name field (for now).
Name (#1)		
nameLanguageTag=”en		“sensorName=”Temperature”

4.3.5.2 Sensor Auxiliary Names PDR: Link #1 Speed

The Sensor Auxiliary Names PDR for Link #1 speed reporting contains the following fields:

Hdr: RecordHandle	0x00000110	Emulex-specific PDR ID–for the Sensor Auxiliary Names PDR for the Link #1 speed.
Hdr: PDRHeaderVersion	0x01	
Hdr PDRType	0x06	Sensor Auxiliary Names PDR.
Hdr RecordChangeNumber	0x0000	
Hdr DataLength	0x*nnnn*	Size of the PDR data.
PLDMTerminusHandle	0x0000	Unique handle–all set to 0x0000.
SensorID	0x0031	Sensor ID for the Link #1 speed.
SensorCount	0x01	Not a composite sensor.
nameString Count	0x01	Only one language/name field (for now).
Name (#1)		
nameLanguageTag=”en		“sensorName=”Link Speed”

4.3.5.3 Sensor Auxiliary Names PDR: Link #2 Speed

The Sensor Auxiliary Names PDR for Link #2 speed reporting contains the same data as the Link #1 speed Sensor Auxiliary Names PDR, with the following changes:

Hdr: RecordHandle	0x00000111	Emulex-specific PDR ID–for the Sensor Auxiliary Names PDR for the Link #2 speed.
SensorID	0x0032	Sensor ID for the Link #2 speed.

4.3.5.4 Sensor Auxiliary Names PDR: Link #3 Speed

The Sensor Auxiliary Names PDR for Link #3 speed reporting contains the same data as the Link #1 speed Sensor Auxiliary Names PDR, with the following changes:

Hdr: RecordHandle	0x00000112	Emulex-specific PDR ID–for the Sensor Auxiliary Names PDR for the Link #3 speed.
SensorID	0x0033	Sensor ID for the Link #3 speed.

4.3.5.5 Sensor Auxiliary Names PDR: Link #4 Speed

The Sensor Auxiliary Names PDR for Link #4 speed reporting contains the same data as the Link #1 speed Sensor Auxiliary Names PDR, with the following changes:

Hdr: RecordHandle	0x00000113	Emulex-specific PDR ID–for the Sensor Auxiliary Names PDR for the Link #4 speed.
SensorID	0x0034	Sensor ID for the Link #4 speed.

4.3.6 OEM Unit PDRs (PDR Type 0x07)

The Emulex adapter generates OEM Unit PDRs for any unit not defined in the standards.

4.3.7 OEM State Set PDRs (PDR Type 0x08)

The Emulex adapter supplies the following OEM State Set PDRs as appropriate for the SKU.

Supported sensors are:

- Emulex Firmware Download State
- Emulex Link Duplex State

4.3.7.1 OEM State Set PDR: Firmware Download State

The OEM State Set PDR for Firmware Download State reporting contains the following fields:

Hdr: RecordHandle	0x00000140	Emulex-specific PDR ID–for the Firmware Download State Set PDR.
Hdr: PDRHeaderVersion	0x01	
Hdr PDRType	0x08	OEM State Set PDR.
Hdr RecordChangeNumber	0x0000	
Hdr DataLength	0x*nnnn*	Size of the PDR data.
PLDMTerminusHandle	0x0000	Unique handle–all set to 0x0000.
OEMStateSetIDHandle	0x1140	Set to the Emulex OEM State Set identifier OR'd with 0x1000 to make OEM-specific.
vendorIANA	0x0000006C	Emulex IANA number.
OEMStateSetID	0x0140	Emulex State Set ID for the FW Download State.
unspecifiedValueHint	0x00	enum for “treatAsUnspecified”.
stateCount	0x07	For the seven states below.
StateValue Record (#1)		
minStateValue=0x01		Lowest state value.
maxStateValue=0x01		Largest state value; only one string for a state.
stringCount=0x01		Only one language string (for now).
String (#1)		
stateLanguageTag=”en		“stateName=”Firmware Update Not Started”
StateValue Record (#2)		
minStateValue=0x02		Lowest state value.
maxStateValue=0x02		Largest state value; only one string for a state.
stringCount=0x01		Only one language string (for now).

String (#1)	
stateLanguageTag=”en	“stateName=”Firmware Update Started”
StateValue Record (#3)	
minStateValue=0x03	Lowest state value.
maxStateValue=0x03	Largest state value; only one string for a state.
stringCount=0x01	Only one language string (for now).
String (#1)	
stateLanguageTag=”en	“stateName=”Firmware Update Stopped”
StateValue Record (#4)	
minStateValue=0x04	Lowest state value.
maxStateValue=0x04	Largest state value; only one string for a state.
stringCount=0x01	Only one language string (for now).
String (#1)	
stateLanguageTag=”en	“stateName=”Firmware Updated Successfully”
StateValue Record (#5)	
minStateValue=0x05	Lowest state value.
maxStateValue=0x05	Largest state value; only one string for a state.
stringCount=0x01	Only one language string (for now).
String (#1)	
stateLanguageTag=”en	“stateName=”Firmware Update Failed”
StateValue Record (#6)	
minStateValue=0x06	Lowest state value.
maxStateValue=0x06	Largest state value; only one string for a state.
stringCount=0x01	Only one language string (for now).
String (#1)	
stateLanguageTag=”en	“stateName=”Firmware Update In Progress”
StateValue Record (#7)	
minStateValue=0x07	Lowest state value.
maxStateValue=0x07	Largest state value; only one string for a state.
stringCount=0x01	Only one language string (for now).
String (#1)	
stateLanguageTag=”en	“stateName=”Firmware Written Successfully, Awaiting Activation”

4.3.7.2 OEM State Set PDR: Link Duplex State

The OEM State Set PDR for Link Duplex State reporting contains the following fields:

Hdr: RecordHandle	0x00000141	Emulex-specific PDR ID–for the Link Duplex State Set PDR.
Hdr: PDRHeaderVersion	0x01	
Hdr PDRType	0x08	OEM State Set PDR.
Hdr RecordChangeNumber	0x0000	
Hdr DataLength	0xnnnn	Size of the PDR data.
PLDMTerminusHandle	0x0000	Unique handle–all set to 0x0000.
OEMStateSetIDHandle	0x1141	Set to the Emulex OEM State Set identifier OR'd with 0x1000 to make OEM-specific.
vendorIANA	0x0000006C	Emulex IANA number.
OEMStateSetID	0x0141	Emulex State Set ID for the FW Download State.
unspecifiedValueHint	0x00	enum for “treatAsUnspecified”.
stateCount	0x02	For the two states below.
StateValue Record (#1)		
minStateValue=0x01		Lowest state value.
maxStateValue=0x01		Largest state value; only one string for a state.
stringCount=0x01		Only one language string (for now).
String (#1)		
stateLanguageTag=”en		“stateName=”Full Duplex”
StateValue Record (#2)		
minStateValue=0x02		Lowest state value.
maxStateValue=0x02		Largest state value; only one string for a state.
stringCount=0x01		Only one language string (for now).
String (#1)		
stateLanguageTag=”en		“stateName=”Half Duplex”

4.3.8 FRU Record Set PDRs (PDR Type 0x14)

This PDR specifies the binding of the FRU Record Data set with the PLDM object to which it corresponds.

The FRU Record Set PDR contains the following fields:

Hdr: RecordHandle	0x00000180	Emulex-specific PDR ID–for the FRU Record Set PDR for the network or I/O controller.
Hdr: PDRHeaderVersion	0x01	
Hdr PDRType	0x14	FRU Record Set PDR.
Hdr RecordChangeNumber	0x0000	
Hdr DataLength	0x*nnnn*	Size of the PDR data.
PLDMTerminusHandle	0x0000	Unique handle–all set to 0x0000.
FRURecordSetIdentifier	0x0001	Set to an Emulex/Terminus-specific value for the FRU Record.
EntityType	0x0091	Emulex entity type from the Controller Entity Association PDR.
EntityInstanceNumber	0x0001	Emulex entity instance # from the Controller Entity Association PDR.
ContainerID	0x0002	Emulex container ID from the Controller Entity Association PDR.

4.3.9 Redfish Get PDRs (PDR Type 0x16)

The description of the various Redfish Get PDRs are given below:

The Redfish Get PDRs contain the following fields:

Redfish Network Interface PDR:		
Hdr: RecordHandle	0x00000041	Redfish Network Interface Record Handle.
PDR: Resource ID	100U	
PDR: Resource Flags	0x1	Root PDR.
PDR: Container RID	0x0	External.
PDR: Major Schema Version	1.2.1	
PDR: Major Schema Dictionary Length	845	Decimal.
PDR: Major Schema Dictionary Signature 0xcf0e31b0U		
Redfish Network Adapter Collection PDR:		
Hdr: RecordHandle	0x00000042	Redfish Network Adapter Collection Record Handle.
PDR: Resource ID	200U	
PDR: Resource Flags	0x1	Root PDR.
PDR: Container RID	0x0	External.
PDR: Major Schema Version	1.7.0	
PDR: Major Schema Dictionary Length	3747	Decimal.
PDR: Major Schema Dictionary Signature 0xf7b2a75dU		
Redfish Network Port Collection PDR:		
Hdr: RecordHandle	0x00000043	Redfish Network Port Collection Record Handle.
PDR: Resource ID	300U	
PDR: Resource Flags	0x1	Root PDR.
PDR: Container RID	0x0	External.
PDR: Major Schema Version	1.0.0	
PDR: Major Schema Dictionary Length	6083	Decimal.
PDR: Major Schema Dictionary Signature 0xbcf5a14eU		
Redfish Network Port PDR (one per port):		
Hdr: RecordHandle	0x00000044	Redfish Network Port Record Handle.
PDR: Resource ID	401U	
PDR: Resource Flags	0x2	Contained PDR.
PDR: Container RID	0x0	External.
PDR: Major Schema Version	1.4.0	
PDR: Major Schema Dictionary Length	6083	Decimal.
PDR: Major Schema Dictionary Signature 0x5175e579U		
Redfish Network Device Collection PDR:		
Hdr: RecordHandle	0x00000045	Redfish Network Device Collection Record Handle.
PDR: Resource ID	500U	

PDR: Resource Flags	0x4	Collection PDR.
PDR: Container RID	0x0	External.
PDR: Major Schema Version	1.0.0	
PDR: Major Schema Dictionary Length	159	Decimal.
PDR: Major Schema Dictionary Signature 0xe4ec485U		
Redfish Network Device Function PDR (one per port):		
Hdr: RecordHandle	0x00000046	Redfish Network Device Function Handle.
PDR: Resource ID	601U	
PDR: Resource Flags	0x2	Contained PDR.
PDR: Container RID	0x0	External.
PDR: Major Schema Version	1.6.0	
PDR: Major Schema Dictionary Length	2974	Decimal.
PDR: Major Schema Dictionary Signature 0x3542e333U		
Redfish Action PDR:		
Hdr: RecordHandle	0x00000047	Redfish Action PDR.
PDR: Resource ID	200U	

4.4 PLDM Type Code 0x04 Commands

4.4.1 GetFRURecordTableMetadata (Type 0x04, Cmd 0x01)

The Terminus returns the following fields:

FRUDataMajorVersion	0x01
FRUDataMinorVersion	0x00
FRUTableMaximumSize	0x00000000 (SetFRURecordTable not supported)
FRUTableLength	Length of the FRU Record Table described in GetFRURecordTable.
Total Number of Record Set IDs	Based on the FRU Record Table data described in GetFRURecordTable.
Total number of records in table	1
Integrity Checksum	CRC

4.4.2 GetFRURecordTable (Type 0x04, Cmd 0x02)

This section provides an indication of how revision 14.2 Emulex branded Fibre Channel HBA firmware responds to inquiries described in the DMTF standard DSP0257 rev 1.0.0: Platform Level Data Model (PLDM) for FRU Data Specification. This information can be used to properly interpret the responses of HBAs equipped with this firmware.

NOTE: Broadcom retains the right, over time, to modify this table and/or to add additional FRU functionality. Any such changes must comply with DSP0257. For example, an additional field might be added to one of the FRU record sets, causing the number of FRU fields to be incremented and the additional field Type/Length/Value to be returned. To avoid misinterpretation of the data, follow the DSP0257 guidelines on field counts and record lengths.

The Terminus returns the FRU Record Data Table as shown in Table 3.

Table 3: MCTP PLDM FRU Record Table Definitions

Field			**Value**
FRU Record Set ID			0x0001 (Emulex-Specific Unique Number–for Generic PLDM: General FRU Record)
FRU Record Type			0x1 (General FRU Record)
Number of FRU Fields			14
Encoding Type for FRU Fields			0x01 (ASCII)
#	**Type**	**Length**	**Value**
1	0x01 (Chassis Type)	0x0	“”
2	0x02 (Model)	0x0	“”
3	0x03 (Part Number)	Length of Value string	“LPe32002” (example)
4	0x04 (Serial Number)	Length of Value string	“<serial number>”
5	0x05 (Manufacturer)	8	“BROADCOM”
6	0x06 (Manufacture Date)	13	“2019-05-04-18” (example)
7	0x07 (Vendor)	8	“BROADCOM”
8	0x08 (Name)	Length of Value string	“LPe32002” (example)
9	0x09 (SKU)	0x0	“”
10	0x0A (Version)	2	“<version>”
11	0x0B (Asset Tag)	0x0	“”
12	0x0C (Description)	Length of Value string	“Emulex LPe32002 2-Port 32Gb Fibre Channel Adapter” (example)
13	0x0D (Eng Change Lvl)	0x0	“”
#	**Type**	**Length**	**Value**
14	0x0E (Other_Info)	Length of Value string	“<string>” (for Broadcom use)
FRU Record Set ID			0x0003 (Emulex-Specific Unique Number–for Emulex PLDM FRU Table–CHIP)
FRU Record Type			0xFE (OEM FRU Record)
Number of FRU Fields			3
Encoding Type for FRU Fields			0x01 (ASCII)
#	**Type**	**Length**	**Value**
1	0x01 (Vendor IANA)	4	0x0000006C
2	0x02 (OEM)	Length of Value string	“FW Version: 12.6.192.11” (example)
3	0x03 (OEM)	Length of Value string	“PCIe Link Speed: XXX” (example)

Table 3: MCTP PLDM FRU Record Table Definitions (Continued)

Field			Value
FRU Record Set ID			0x0004 (Emulex-Specific Unique Number–for Emulex PLDM FRU Table–Port 0)
FRU Record Type			0xFE (OEM FRU Record)
Number of FRU Fields			8
Encoding Type for FRU Fields			0x01 (ASCII)
#	**Type**	**Length**	**Value**
1	0x01 (Vendor IANA)	4	0x0000006C
2	0x81 (OEM)	12	“Port Name: 0” (name dependent on SKU)
3	0x82 (OEM)	13	“Link Type: FC”
4	0x83 (OEM)	22	“WWNN: 20000000C9142356” (example)
5	0x84 (OEM)	22	“WWPN: 10000000C9142356” (example)
6	0x85 (OEM)	30	“Factory WWNN: 20000000C9142356” (example)
7	0x86 (OEM)	30	“Factory WWPN: 10000000C9142356” (example)
8	0x87 (OEM)	Length of Value string	“FC Link Speed Capabilities: 32/16/8” (example)
FRU Record Set ID			0x0005 (Emulex-Specific Unique Number–for Emulex PLDM FRU Table–Port 1) (if present)
FRU Record Type			0xFE (OEM FRU Record)
Number of FRU Fields			8
Encoding Type for FRU Fields			0x01 (ASCII)
#	**Type**	**Length**	**Value**
1	0x01 (Vendor IANA)	4	0x0000006C
2	0x81 (OEM)	12	“Port Name: 1” (name dependent on SKU)
3	0x82 (OEM)	13	“Link Type: FC”
4	0x83 (OEM)	22	“WWNN: 20000000C9142357” (example)
5	0x84 (OEM)	22	“WWPN: 10000000C9142357” (example)
6	0x85 (OEM)	30	“Factory WWNN: 20000000C9142357” (example)
7	0x86 (OEM)	30	“Factory WWPN: 10000000C9142357” (example)
8	0x87 (OEM)	Length of Value string	“FC Link Speed Capabilities: 32/16/8” (example)

Table 3: MCTP PLDM FRU Record Table Definitions (Continued)

Field			Value
FRU Record Set ID			0x0006 (Emulex-Specific Unique Number–for Emulex PLDM FRU Table–Port 2) (if present)
FRU Record Type			0xFE (OEM FRU Record)
Number of FRU Fields			8
Encoding Type for FRU Fields			0x01 (ASCII)
#	**Type**	**Length**	**Value**
1	0x01 (Vendor IANA)	4	0x0000006C
2	0x81 (OEM)	12	“Port Name: 2” (name dependent on SKU)
3	0x82 (OEM)	13	“Link Type: FC”
4	0x83 (OEM)	22	“WWNN: 20000000C9142358” (example)
5	0x84 (OEM)	22	“WWPN: 10000000C9142358” (example)
6	0x85 (OEM)	30	“Factory WWNN: 20000000C9142358” (example)
7	0x86 (OEM)	30	“Factory WWPN: 10000000C9142358” (example)
8	0x87 (OEM)	Length of Value string	“FC Link Speed Capabilities: 32/16/8” (example)
FRU Record Set ID			0x0007 (Emulex-Specific Unique Number–for Emulex PLDM FRU Table–Port 3) (if present)
FRU Record Type			0xFE (OEM FRU Record)
Number of FRU Fields			8
Encoding Type for FRU Fields			0x01 (ASCII)
#	**Type**	**Length**	**Value**
1	1 (Vendor IANA)	4	0x0000006C
2	0x01 (Vendor IANA)	12	“Port Name: 3” (name dependent on SKU)
3	0x81 (OEM)	13	“Link Type: FC”
4	0x82 (OEM)	22	“WWNN: 20000000C9142359” (example)
5	0x83 (OEM)	22	“WWPN: 10000000C9142359” (example)
6	0x84 (OEM)	30	“Factory WWNN: 20000000C9142359” (example)
7	0x85 (OEM)	30	“Factory WWPN: 10000000C9142359” (example)
8	0x86 (OEM)	Length of Value string	“FC Link Speed Capabilities: 32/16/8” (example)

5 Packet Examples for PLDM Messages Using MCTP/PCIe

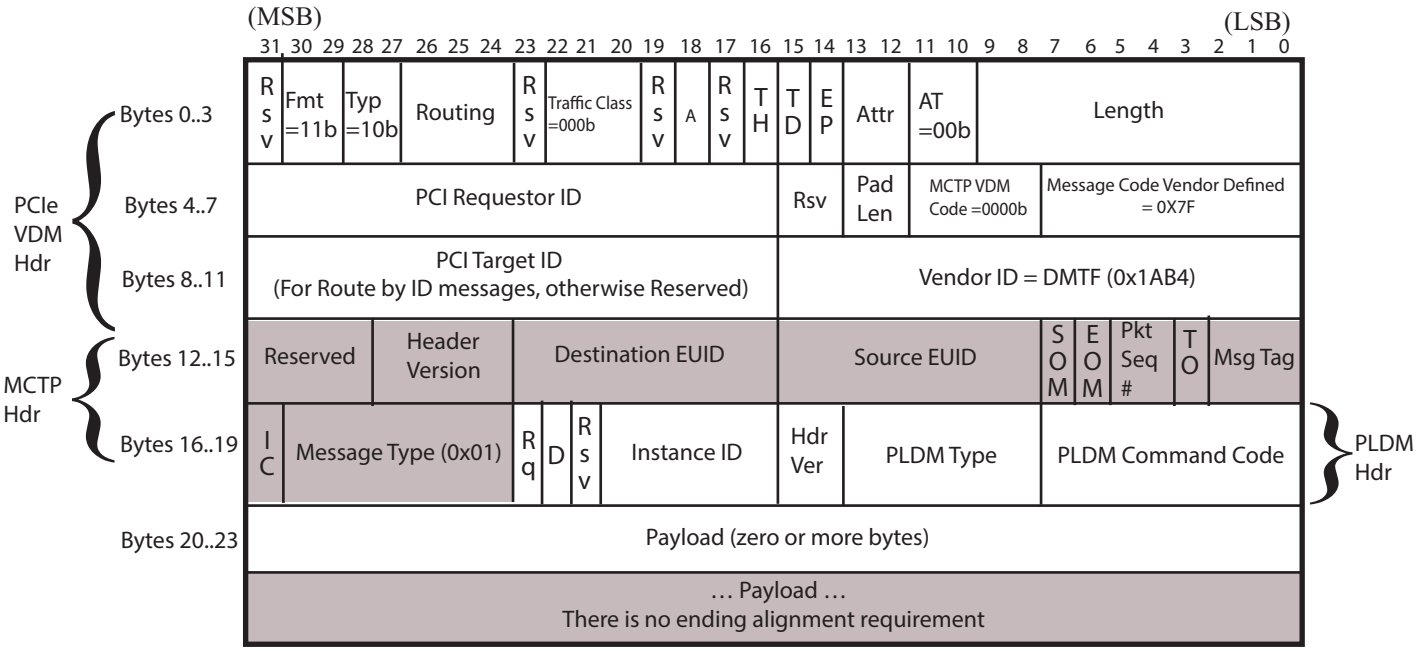
This section provides illustrations of the total PCIe packet format, which contains the PCIe VDM header for MCTP, the MCTP header, and the PLDM request or PLDM response.

NOTE: PLDM messages might be fragmented into multiple MCTP messages.

The PLDM request on MCTP on a PCIe packet is illustrated in Figure 2.

NOTE: The structure is a big-endian byte stream.

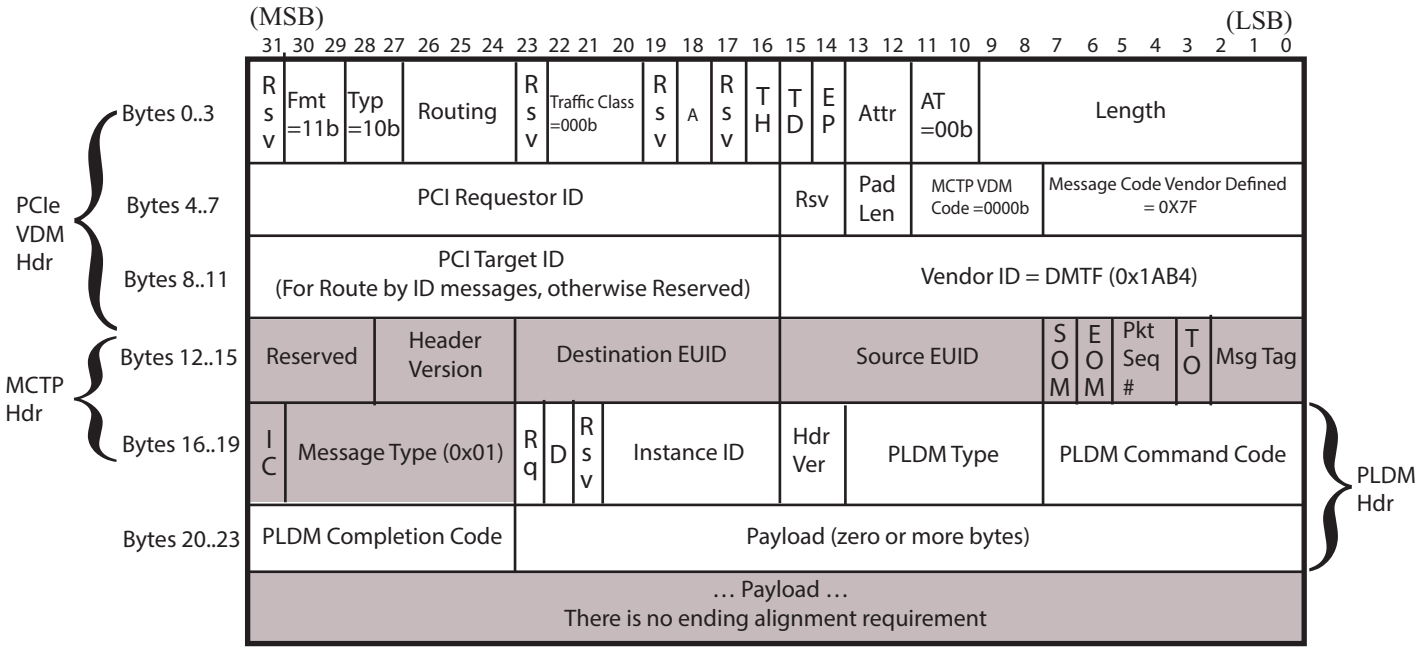
Figure 2: PCIe Packet Using MCTP–PLDM Request Format



The PLDM response (which has one more bytes in the PLDM header) on MCTP on a PCIe packet is illustrated in Figure 3.

NOTE: The structure is a big-endian byte stream.

Figure 3: PCIe Packet Using MCTP–PLDM Response Format



6 References

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DMTF DSP0236 Management Component Transport Protocol (MCTP) Base Specification Version 1.2.0 January 24, 2013	www.dmtf.org/sites/default/files/standards/documents/DSP0236_1.2.0.pdf
DMTF DSP0256 Management Component Transport Protocol (MCTP) Host Interface Specification Version 1.0.0 July 21, 2010	www.dmtf.org/sites/default/files/standards/documents/DSP0256_1.0.0.pdf
DMTF DSP0238 Management Component Transport Protocol (MCTP) PCIe VDM Transport Binding Specification Version 1.0.1 December 11, 2009	www.dmtf.org/sites/default/files/standards/documents/DSP0238_1.0.1.pdf
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DMTF DSP0241 Platform Level Data Model (PLDM) over MCTP Binding Specification Version 1.0.0 April 23, 2009	www.dmtf.org/sites/default/files/standards/documents/DSP0241_1.0.0.pdf
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