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CXL to Redfish Mapping Specification

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CONTENTS

Foreword

The CXL to Redfish Mapping Specification was prepared by DMTF's Redfish Forum.

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Introduction

CXL is a protocol and access technology designed to enable access to memory and other devices. It provides I/O, memory access, and caching protocol semantics via specified methodologies. It also has methods to manage these devices and a CXL fabric.

Redfish released data model additions to represent CXL components starting in the 2020.1 release of DSP8010 and completing the CXL 3.0 mapping in release 2022.3.

CXL provides several different methodologies for gathering this information:

- The CXL Component Command Interface (CCI) is used to retrieve information on devices as well as provide methods to configure them. This has a CXL mapping as well as an MCTP binding specification.
- The CXL Fabric Management API (FM-API) is used to configure and control the CXL fabric including routes and other necessary elements. This has a CXL mapping as well as an MCTP binding specification.
- CXL also normatively references PLDM, which can be enabled for accessing configuration information on CXL devices. Thus, PLDM for Platform Monitoring and Control (Type 2), PLDM for Redfish Device Enablement (Type 6), and PLDM for Firmware Update (Type 5) can be used to manage CXL devices.

This specification is normative for representing Redfish information about CXL devices and fabrics regardless of access method.

1 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

- DMTF DSP0266, *Redfish Specification*, https://www.dmtf.org/dsp/DSP0266
- DMTF DSP8010, *Redfish Schema Bundle*, https://www.dmtf.org/dsp/DSP8010
- *Compute Express Link (CXL) Specification, August 1, 2022, Revision 3.0, Version 1.0*, https://www.computeexpresslink.org/download-the-specification/

2 Terms, definitions, symbols, and abbreviated terms

Some terms and phrases in this document have specific meanings beyond their typical English meanings. This clause defines those terms and phrases.

The terms "shall" ("required"), "shall not", "should" ("recommended"), "should not" ("not recommended"), "may", "need not" ("not required"), "can" and "cannot" in this document are to be interpreted as described in ISO/IEC Directives, Part 2, Clause 7. The terms in parentheses are alternatives for the preceding term, for use in exceptional cases when the preceding term cannot be used for linguistic reasons. Note that ISO/IEC Directives, Part 2, Clause 7 specifies additional alternatives. Occurrences of such additional alternatives shall be interpreted in their normal English meaning.

The terms "clause", "subclause", "paragraph", and "annex" in this document are to be interpreted as described in ISO/IEC Directives, Part 2, Clause 6.

The terms "normative" and "informative" in this document are to be interpreted as described in ISO/IEC Directives, Part 2, Clause 3. In this document, clauses, subclauses, or annexes labeled "(informative)" do not contain normative content. Notes and examples are always informative elements.

The term "deprecated" in this document is to be interpreted as material that is not recommended for use in new development efforts. Existing and new implementations may use this material, but they should move to the favored approach. Deprecated material may be implemented in order to achieve backwards compatibility. Deprecated material should contain references to the last published version that included the deprecated material as normative material and to a description of the favored approach. Deprecated material may be removed from the next major version of the specification.

3 CXL CCI to Redfish mapping

Table 1 contains the mapping between CXL CCI commands and Redfish resources. Implementations shall map the CXL data from the **CXL command** and **CXL field** columns to its Redfish resource and property described in the **Redfish resource** and **Redfish property** columns and shall adhere to the numbered comments referenced in the **Comment** column. This mapping shall apply when mapping from CXL CCI commands to Redfish and mapping from Redfish back to CXL CCI commands.

Implementations shall map the following to HTTP operations:

- CXL "get" commands: HTTP `GET`.
- CXL "set" commands, but not marked as an action: HTTP `PATCH` or `PUT`.
- CXL "set" commands marked as actions: HTTP `POST`.

Table 1 — CXL CCI to Redfish mapping

CXL command	CXL field	Redfish resource	Redfish property	Comment
Get Log Capabilities	Parameter Flags[3]: Persistent across cold reset	`LogService`	`Persistency`	See Comment 1.
Get Event Records	Flags[0]: Overflow	`LogService`	`Overflow`	See Comment 1.
Get Event Records	Overflow Error Count	`LogEntry`	`OverflowErrorCount`	See Comment 1.
Get Event Records	First Overflow Event Timestamp	`LogEntry`	`FirstOverflowTimestamp`	See Comment 1.
Get Event Records	Last Overflow Event Timestamp	`LogEntry`	`LastOverflowTimestamp`	See Comment 1.
Get FW Info	FW Slot Info	`PCIeDevice`	`StagedVersion`	
Get Timestamp	Timestamp	`PCIeDevice`	`CXLDevice/Timestamp`	
Set Timestamp	Timestamp	`PCIeDevice`	`CXLDevice/Timestamp`	
Identify Memory Device	Informational, Warning, Failure, and Fatal Event Log Size	`LogService`	`MaxNumberOfRecords`	See Comment 2.
Identify Memory Device	Poison List Maximum Media Error Records	`Memory`	`PoisonListMaxMediaErrorRecords`	
Identify Memory Device	Poison Handling Capabilities	`Memory`	`PoisonHandlingCapabilities`	

CXL command	CXL field	Redfish resource	Redfish property	Comment
Identify Memory Device	QoS Telemetry Capabilities[0]: Egress Port Congestion Supported	`PCIeDevice`	`CXLDevice/EgressPortCongestionSupported`	
Identify Memory Device	QoS Telemetry Capabilities[1]: Temporary Throughput Reduction Supported	`PCIeDevice`	`CXLDevice/TemporaryThroughputReductionSupported`	
Identify Memory Device	LSA Size	`Memory`	`LabelStorageSizeBytes`	
Get SLD QoS Control	QoS Telemetry Control[1]: Temporary Throughput Reduction Enable	`PCIeDevice`	`CXLDevice/TemporaryThroughputReductionEnabled`	
Set SLD QoS Control	QoS Telemetry Control[1]: Temporary Throughput Reduction Enable	`PCIeDevice`	`CXLDevice/TemporaryThroughputReductionEnabled`	
Get Partition Info	Active Volatile Capacity	`Memory`	`VolatileSizeLimitMiB`	
Get Partition Info	Next Volatile Capacity	`Memory`	`StagedVolatileSizeMiB`	
Get Partition Info	Next Persistent Capacity	`Memory`	`StagedPersistentSizeMiB`	
Set Partition Info	Next Volatile Capacity	`Memory`	`StagedVolatileSizeMiB`	
Set Partition Info	Next Persistent Capacity	`Memory`	`StagedPersistentSizeMiB`	
Get Health Info	Health Status	Many	`Status`	See Comment 3.
Get Health Info	Life Used	`MemoryMetrics`	`CapacityUtilizationPercent`	
Get Health Info	Corrected Volatile Error Count	`MemoryMetrics`	`CorrectedVolatileErrorCount`	
Get Health Info	Corrected Persistent Error Count	`MemoryMetrics`	`CorrectedPersistentErrorCount`	
Get Health Info	Additional Status[4]: Corrected Volatile Error Count	`Memory`	`Status/Conditions`	See Comment 4.
Get Health Info	Additional Status[5]: Corrected Persistent Error Count	`Memory`	`Status/Conditions`	See Comment 4.

CXL command	CXL field	Redfish resource	Redfish property	Comment
Get Health Info	Dirty Shutdown Count	`MemoryMetrics`	`DirtyShutdownCount`	
Get Alert Configuration	Valid Alerts and Programmable Alerts	`MemoryMetrics`	`CXL/AlertCapabilities`	
Scan Media	N/A	`Memory`	`ScanMedia` action	
Get Security State	Security State	`Memory`	`SecurityStates`	
Set Passphrase	Passphrase Type 00h: Master Passphrase	`Memory`	`SetMasterPassphrase` action	
Set Passphrase	Passphrase Type 01h: User Passphrase	`Memory`	`SetPassphrase` action	
Disable Passphrase	Passphrase Type 00h: Master Passphrase	`Memory`	`DisableMasterPassphrase` action	
Disable Passphrase	Passphrase Type 01h: User Passphrase	`Memory`	`DisablePassphrase` action	
Freeze Security State	N/A	`Memory`	`FreezeSecurityState` action	
Passphrase Secure Erase	All	`Memory`	`SecureEraseUnit` action	

> **Comment 1:** A `LogEntry` resource is used to capture CXL event records. The `CXLEntryType` property shall contain the specific CXL entry type, and the `EntryType` property shall contain `CXL`. Overflow information is captured in properties of the `LogEntry` prior to the overflow condition.

> **Comment 2:** A `Memory` resource can only contain a single `LogService`. This `LogService` resource shall contain the informational, warning, failure, and fatal event records as `LogEntry` resources. The `MaxNumberOfRecords` shall contain the sum of the informational, warning, failure, and fatal log sizes.

> **Comment 3:** Redfish resources contain a `Status` property to show the health and state of a device. The `Conditions` property within the `Status` property is used to show why the `Health` property contains a value other than `OK`.

> **Comment 4:** The `Conditions` property within the `Status` property of the `Memory` resource shall contain messages to indicate either the Corrected Volatile Error Count or Corrected Persistent Error Count flags are set.

4 CXL FM-API to Redfish mapping

Table 2 contains the mapping between CXL FM-API commands and Redfish resources. Implementations shall map the CXL data from the **CXL command** and **CXL field** columns to its Redfish resource and property described in the **Redfish resource** and **Redfish property** columns and shall adhere to the numbered comments referenced in the **Comment** column. This mapping shall apply when mapping from CXL FM-API commands to Redfish and mapping from Redfish back to CXL FM-API commands.

Implementations shall map the following to HTTP operations:

- CXL "get" commands: HTTP `GET`.
- CXL "set" commands, but not marked as an action: HTTP `PATCH` or `PUT`.
- CXL "set" commands marked as actions: HTTP `POST`.

Table 2 — CXL FM-API to Redfish mapping

CXL command	CXL field	Redfish resource	Redfish property	Comment
Identify Switch Device	All	`Switch`	`SwitchType`	Shall contain `CXL`.
Identify Switch Device	Number of VCSs	`Switch`	`CXL/MaxVCSSupported`	
Identify Switch Device	Total Number of vPPBs	`Switch`	`CXL/TotalNumbervPPBs`	
Identify Switch Device	Number of HDM Decoders	`Switch`	`CXL/VCS/HDMDecoders`	
Get Physical Port State	Port Information List, Current Port Configuration State	`Port`	`CXL/CurrentPortConfigurationState`	
Get Physical Port State	Port Information List, Connected Device Mode	`Port`	`CXL/ConnectedDeviceMode`	
Get Physical Port State	Port Information List, Connected Device Type	`Port`	`CXL/ConnectedDeviceType`	
Get Physical Port State	Port Information List, Supported CXL Modes	`Port`	`CXL/SupportedCXLModes`	
Get Physical Port State	Port Information List, Supported LD Count	`Port`	`CXL/MaxLogicalDeviceCount`	
Get Physical Port State	Port Information List, Negotiated Link Width	`Port`	`ActiveWidth`	

CXL command	CXL field	Redfish resource	Redfish property	Comment
Get Physical Port State	Port Information List, Supported Link Speeds Vector	`Port`	`LinkConfiguration/CapableLinkSpeedGbps`	
Get Physical Port State	Port Information List, Max Link Speed	`Port`	`MaxSpeedGbps`	
Get Physical Port State	Port Information List, Current Link Speed	`Port`	`CurrentSpeedGbps`	
Physical Port Control	Port Opcode 02h: Reset PPB	`Port`	`ResetPPB` action	
Physical Port Control	Port Opcode 00h and 01h: Assert and Deassert PERST	`Port`	`Reset` action	`ForceRestart` shall assert then deassert PERST.
Get LD Info	Memory Size	`MemoryDomain`	`MemorySizeMiB`	
Get LD Info	LD Count	`PCIeDevice`	`CXLDevice/MaxNumberLogicalDevices`	
Get LD Info	QoS Telemetry Capabilities[0]: Egress Port Congestion Supported	`Port`	`CXL/QoSTelemetryCapabilities/EgressPortBackpressureSupported`	See Comment 1.
Get LD Info	QoS Telemetry Capabilities[1]: Temporary Throughput Reduction Supported	`PCIeDevice`	`CXLDevice/TemporaryThroughputReductionSupported`	
Get LD Allocations	Memory Granularity	`MemoryDomain`	`MemoryChunkIncrementMiB`	
Get LD Allocations	Memory Granularity, LD Allocation List	`CXLLogicalDevice`	`MemorySizeMiB`	
Get QoS Control	QoS Telemetry Control[0]: Egress Port Congestion Enable	`Port`	`CXL/Congestion/CongestionTelemetryEnabled`	
Get QoS Control	QoS Telemetry Control[1]: Temporary Throughput Reduction Enable	`PCIeDevice`	`CXLDevice/TemporaryThroughputReductionEnabled`	
Get QoS Control	Egress Moderate Percentage	`Port`	`CXL/Congestion/EgressModeratePercentage`	
Get QoS Control	Egress Severe Percentage	`Port`	`CXL/Congestion/EgressSeverePercentage`	

CXL command	CXL field	Redfish resource	Redfish property	Comment
Get QoS Control	Backpressure Sample Interval	`Port`	`CXL/Congestion/BackpressureSampleInterval`	
Get QoS Control	ReqCmpBasis	`Port`	`CXL/Congestion/MaxSustainedRequestCmpBias`	
Get QoS Control	Completion Collection Interval	`Port`	`CXL/Congestion/CompletionCollectionInterval`	
Get QoS Status	Backpressure Average Percentage	`PortMetrics`	`CXL/BackpressureAveragePercentage`	
Get QoS Allocated BW	QoS Allocation Fraction	`CXLLogicalDevice`	`QoS/AllocatedBandwidth`	
Get QoS BW Limit	QoS Limit Fraction	`CXLLogicalDevice`	`QoS/LimitPercent`	
Set QoS Control	QoS Telemetry Control[1]: Temporary Throughput Reduction Enable	`PCIeDevice`	`CXLDevice/TemporaryThroughputReductionEnabled`	
MLD Port Event Record	All	`LogEntry`		See Comment 2.

> **Comment 1:** For an MLD, implementations shall represent Egress Port Congestion Supported in the `Port` resource. For an SLD, implementations shall represent Egress Port Congestion Supported in the `PCIeDevice` resource.

> **Comment 2:** A `LogEntry` resource is used to capture CXL event records. The `CXLEntryType` property shall contain the specific CXL entry type, and the `EntryType` property shall contain `CXL`. Overflow information is captured in properties of the `LogEntry` prior to the overflow condition.

5 ANNEX A (informative) Change log

Version	Date	Description
1.2.0	2024-04-03	Updated the mapping of the Temporary Throughput Reduction Supported property to always use the `PCIeDevice` resource.
		Added mapping to `CXLDevice/TemporaryThroughputReductionEnabled` in the **CXL CCI to Redfish mapping** and **CXL FM-API to Redfish mapping** sections.
1.1.0	2023-11-30	Made many changes for style consistency, grammar, and general clarity. Except for the following additions, no normative changes were made. Any clarifications that inadvertently altered the normative behavior are considered errata and will be corrected in future revisions to the specification.
		Added mapping to `CXL/SupportedCXLModes` in the **CXL FM-API to Redfish mapping** section.
		Added mapping to the `Reset` action in the `Port` resource in the **CXL FM-API to Redfish mapping** section.
		Removed errant entry for 'Set Alert Configuration' in the **CXL CCI to Redfish mapping** section.
1.0.0	2023-09-13	Initial release.