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# CXL to Redfish Mapping Specification

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This document’s normative language is English. Translation into other languages is permitted.

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# 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/ThroughputReductionSupported` | |
| Identify Memory Device | LSA Size | `Memory` | `LabelStorageSizeBytes` | |
| 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. |
| Get Health Info | Dirty Shutdown Count | `MemoryMetrics` | `DirtyShutdownCount` | |
| Get Alert Configuration | Valid Alerts and Programmable Alerts | `MemoryMetrics` | `CXL/AlertCapabilities` | |
| Set Alert Configuration | Valid Alerts and Programmable Alerts | `MemoryMetrics` | `CXL/AlertCapabilities` | |
| Scan Media | N/A | `Memory` | `ScanMedia` action | |
| Get Security State | Security State | `Memory` | `SecurityStates` | |

| CXL command | CXL field | Redfish resource | Redfish property | Comment |
|---|---|---|---|---|
| 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 LD Count | `Port` | `CXL/MaxLogicalDeviceCount` | |
| Get Physical Port State | Port Information List, Negotiated Link Width | `Port` | `ActiveWidth` | |
| Get Physical Port State | Port Information List, Supported Link Speeds Vector | `Port` | `LinkConfiguration/CapableLinkSpeedGbps` | |

| CXL command | CXL field | Redfish resource | Redfish property | Comment |
|---|---|---|---|---|
| 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 | |
| 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 | `Port` | `CXL/QoSTelemetryCapabilities/TemporaryThroughputReductionSupported` | See Comment 1. |
| 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 | Egress Moderate Percentage | `Port` | `CXL/Congestion/EgressModeratePercentage` | |
| Get QoS Control | Egress Severe Percentage | `Port` | `CXL/Congestion/EgressSeverePercentage` | |
| 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` | |

| CXL command | CXL field | Redfish resource | Redfish property | Comment |
|---|---|---|---|---|
| Get QoS Allocated BW | QoS Allocation Fraction | `CXLLogicalDevice` | `QoS/AllocatedBandwidth` | |
| Get QoS BW Limit | QoS Limit Fraction | `CXLLogicalDevice` | `QoS/LimitPercent` | |
| MLD Port Event Record | All | `LogEntry` | | See Comment 2. |

> **Comment 1:** For an MLD, implementations shall represent Egress Port Congestion Supported and Temporary Throughput Reduction Supported in the `Port` resource. For an SLD, implementations shall represent Egress Port Congestion Supported and Temporary Throughput Reduction 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 |
|---|---|---|
| 1.0.0 | 2023-10-25 | Initial release. |