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Management Component Transport Protocol (MCTP) PCC Transport Binding Specification

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1 Foreword

The Management Component Transport Protocol (MCTP) Platform Communications Channel (PCC) Transport Binding Specification was prepared by the DMTF PMCI Working Group.

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2 Introduction

The Management Component Transport Protocol (MCTP) Platform Communications Channel (PCC) Transport Binding Specification defines a transport binding for facilitating communication between host software and on-chip embedded management controllers (i.e. Satellite Management Controller) via a PCC shared-memory interface.

The *MCTP Base Specification* describes the protocol and commands used for communication within and initialization of an MCTP network. The MCTP over PCC transport binding definition in this specification includes a packet format, physical address format, message routing, and discovery mechanisms for MCTP over PCC communications.

2.1 Document conventions

2.1.1 Typographical conventions

The following typographical conventions are used in this document:

- Document titles are marked in *italics*.
- Important terms that are used for the first time are marked in *italics*.
- Terms include a link to the term definition in the “Terms and definitions” clause, enabling easy navigation to the term definition.

3 Scope

This document provides the specifications for the Management Component Transport Protocol (MCTP) transport binding using PCC.

4 Normative references

The following referenced documents are indispensable for the application of this document. For dated or versioned references, only the edition cited (including any corrigenda or DMTF update versions) applies. For references without a date or version, the latest published edition of the referenced document (including any corrigenda or DMTF update versions) applies. Earlier versions may not provide sufficient support for this specification.

DMTF DSP0236, *Management Component Transport Protocol (MCTP) Base Specification* 1.3 https://www.dmtf.org/sites/default/files/standards/documents/DSP0236_1.3.X.pdf

DMTF DSP0239, *Management Component Transport Protocol (MCTP) IDs and Codes 1.8* https://www.dmtf.org/sites/default/files/standards/documents/DSP0239_1.8.X.pdf

IETF RFC4122, *A Universally Unique Identifier (UUID) URN Namespace*, July 2005 http://www.ietf.org/rfc/rfc4122.txt

DMTF DSP4004, *DMTF Release Process 2.4,* http://dmtf.org/sites/default/files/standards/documents/DSP4004_2.4.X.pdf

DMTF DSP0274, *Security Protocol and Data Model (SPDM) 1.2.1,* http://dmtf.org/sites/default/files/standards/documents/DSP0274_1.2.X.pdf

ISO/IEC Directives, Part 2, Rules for the structure and drafting of International Standards https://www.iso.org/sites/directives/current/part2/index.xhtml

Unified Extensible Firmware Interface Forum, *Advanced Configuration and Power Interface (ACPI) Specification,* (Release 6.5 or later) https://uefi.org/specifications

5 Terms and definitions

In this document, some terms have a specific meaning beyond the normal English meaning. Those terms are defined in this clause.

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.

Refer to DSP0236 for terms and definitions that are used across the MCTP specifications.

The following additional terms are used in this document.

Communications Subspace

The data payload region of a PCC Subspace Shared Memory Region.

MCTP PCC Endpoint

A PCC endpoint on which MCTP through PCC communication is supported.

MCTP Signature

An assigned 32-bit value required in the subspace shared memory regions’ header command field for MCTP messages on a PCC share memory subspace region.

PCC Signature

The first 32-bits of a PCC subspace is comprised of the value `0x50434300` (Little Endian) bitwise OR with the subspace ID (8-bit value) into the least significant byte of the PCC Signature field.

Platform Communications Channel Table (PCCT)

A table structure defined in ACPI specification (see ACPI, Chapter 14) whose entries are sub-space structures, each describing a PCC Subspace Shared Memory Region.

PCC Subspace Structure

An entry in a PCCT. Each PCC subspace structure describes the address of where the associated PCC subspace shared memory region is located, the location of the doorbell register associated with the PCC instance and the type of PCC

shared memory region. The type value indicates the layout of the subspace structure and the layout of the header of the PCC shared memory region. Please refer to ACPI, Chapter 14 for details.

PCC Subspace Shared Memory Region

Generically, the PCC subspace shared memory region is a region of memory referenced by a PCC subspace structure from within a PCCT. A PCC subspace shared memory region has a header whose layout is dictated by the type value set in the PCC subspace structure that references the PCC subspace shared memory region. The PCC subspace shared memory region is the information transport/interface between the host entity and the SatMC.

Platform Entity

A generic term for any entity on the platform side of a PCC interface including but not limited to: a platform controller, a Satellite Management Controller, etc.

Satellite Management Controller

A microcontroller or processor that interpret and process management-related data, and initiate management-related actions on management devices. It may be part of SoC or can be outside of SoC.

Subspace ID

The index value into a PCCT of a PCC Subspace Structure

6 Symbols and abbreviated terms

Refer to DSP0236 for terms and definitions that are used across the MCTP specifications. For the purposes of this document, the following additional symbols and abbreviated terms apply.

ACPI

Advanced Configuration and Power Interface (specification, see ACPI)

AML

ACPI Machine Language

ASL

ACPI Source Language

MC

Management Controller

MCTP

Management Component Transport Protocol

OSPM

Operating System-directed Power Management

PCC

Platform Communications Channel (see ACPI, Chapter 14)

PCCT

Platform Communications Channel Table (see ACPI, Chapter 14)

SatMC

Satellite Management Controller

SPDM

Security Protocol and Data Model (see SPDM)

7 Conventions

7.1 Reserved and unassigned values

Unless otherwise specified, any reserved, unspecified, or unassigned values in enumerations or other numeric ranges are reserved for future definition by the DMTF.

Unless otherwise specified, numeric or bit fields that are designated as reserved shall be written as 0 (zero) and ignored when read.

7.2 Byte ordering

Unless otherwise specified, the byte ordering of multibyte numeric fields or multibyte bit fields in this specification shall be “Little Endian”: The lowest byte offset holds the least significant byte and higher offsets hold more significant bytes.

8 MCTP over PCC Transport

This document defines the medium-specific transport binding for transferring MCTP packets between endpoints using a PCC interface.

A MCTP over PCC compliant PCC device shall support MCTP over PCC communications on at least one PCC sideband interface.

8.1 PCC Overview

This is an informative section focused on an introduction to the general architectural structure of the Platform Communications Channel (PCC) feature documented in the ACPI specification. Its purpose is to establish context for the binding of MCTP to a PCC interface. This introduction focuses on an abstraction of the PCC structures. For a full description of PCC including operational flows, please refer to ACPI, Chapter 14.

Figure 1 illustrates an abstract view of the PCC entities used to implement a communications channel. Note the entities in this illustration are data structures in memory formatted using Little Endian format consistent with the PCC documentation.

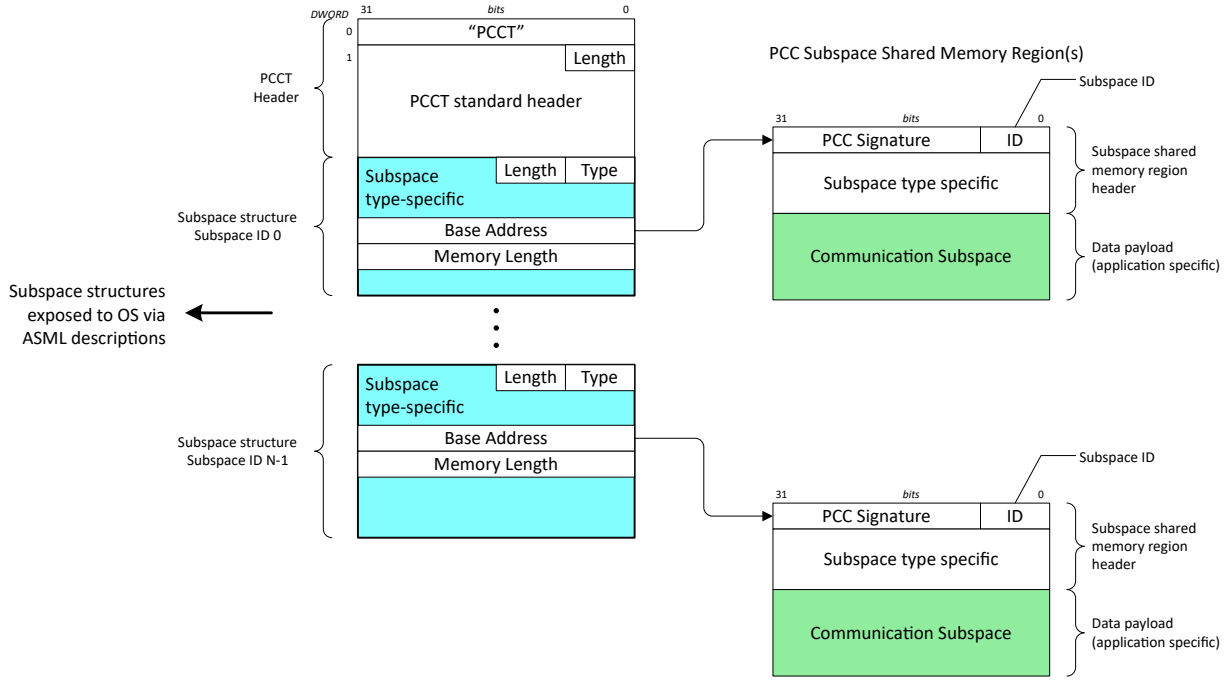

Figure 1 — PCC Interface Building Blocks (Abstracted)

The Platform Communications Channel feature in ACPI is rooted in a structure called a PCC Table (PCCT). The PCCT is a contiguous memory structure comprised of a table header that includes a length of the entire table followed by a

list of sub-space structures. Each subspace structure has a type and length. Note: subspace structures of different types may have different sizes.

Each subspace structure has an implicit ID value which corresponds to its order in the PCCT; the first subspace structure has a subspace ID of 0, the second a subspace ID of 1 and so-on. Each subspace structure has a memory pointer to a subspace shared memory region and a length field whose value represents the entire size of the subspace shared memory region.

The subspace shared memory region is comprised of a header and a communications subspace, which is the memory region used to pass information between entities using PCC to communicate.

The subspace type field value determines both the format of the subspace structure in the PCCT, it also determines the structure of the header of the subspace shared memory region.

System firmware exposes subspace structures in the PCCT to the OS via standardized AML tables. Host software (OSPM) utilizes the fields in the subspace structure to interact with its peer and the system specific interrupt or doorbell mechanisms to exchange data through the PCC subspace shared memory region. See ACPI, Chapter 14 for details.

8.2 MCTP Endpoint ID Use and MCTP Bus Owner

8.2.1 MCTP Endpoints

A single PCC instance shall serve as a communication channel between at most two MCTP capable entities, nominally host software and an embedded management controller/SatMC. The SatMC may provide one or more MCTP Endpoints for use over the PCC transport. An instantiation may implement statically defined EIDs or dynamically assigned EIDs.

8.2.2 MCTP Bus Owner and MCTP Discovery

The SatMC side of a PCC channel shall implement the MCTP Bus Owner function for the PCC transport. It is responsible for distributing EIDs to Endpoints for instantiations that provide support for dynamically assigned EIDs.

MCTP to PCC binding is strictly a peer-to-peer, two-party network.

8.3 PCC Structures for MCTP Packet Binding

MCTP binding to PCC uses the Extended PCC subspaces. The Extended PCC subspaces are comprised of two subspace structures, named Type 3 and Type 4. The shared memory regions associated with each Type are used for transmitting MCTP messages between the host (OSPM) and a platform entity (SatMC). A Type 3 shared memory region is used for host transmission of MCTP messages to the platform entity. A Type 4 shared memory region is used for platform entity transmission of MCTP messages to the host.

For example, the host would use an instance of Type 3 shared memory subspace to transmit an MCTP Get Version request to the platform entity and expect the response to arrive on an instance of the Type 4 shared memory space.

Note, the upper layer protocol using MCTP will determine which entity is the requester and which is the responder.

The structure of the Extended PCC shared memory regions for Type 3 and Type 4 are identical, see Figure 2 for details.

8.4 Packet Format Encapsulation

The Extended PCC Subspace is a region of shared memory that will carry the MCTP messages between entities. Figure 2 is an illustration of how an MCTP message, including the MCTP transport header is instantiated in an Extended PCC subspace shared memory region.

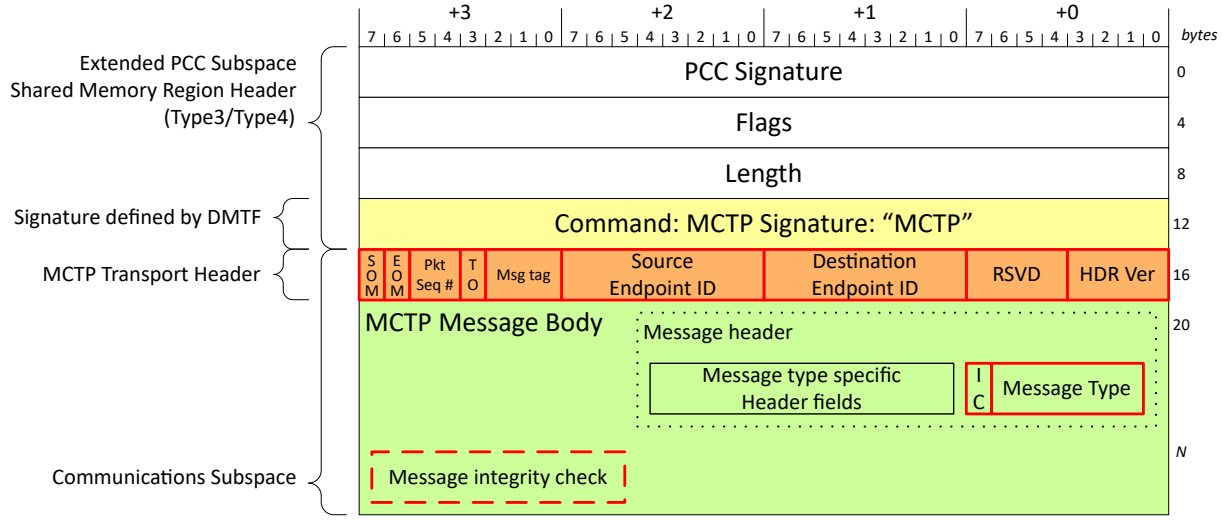

Figure 2 — MCTP binding to Extended PCC Subspace Shared Memory Region

The length of the Extended PCC subspace shared memory region is reported in the referencing Type 3 or Type 4 subspace structure in the PCCT. The shared memory region is aligned to 4-byte boundary.

The **Extended Subspace Shared Memory Region Header** contains:

- For details on most header fields refer to ACPI, Chapter 14 for details.
- The length of the header is 16 bytes.
- **PCC Signature**. The format of the PCC signature is specified by the PCC standard. It includes the ASCII character values for `"PCC"` bitwise OR with the subspace ID of the referencing subspace structure in the PCCT in byte 0.
- **Flags**. This field is defined by the PCC standard
- **Length**. The value of this field is defined in the PCC standard. The value in this field covers the Command field and the number of valid bytes in the Communications Subspace region. For an MCTP payload, this includes:
  - Command field (4 bytes), plus
  - MCTP transport header (4 bytes), plus
  - The length of the actual MCTP message body in the shared memory region.
- **Command**. For this binding, this field shall be set to the ASCII characters: `"MCTP"` (i.e. Little Endian: `0x4D435440`).

The **Communications Subspace** contains:

- The length of the available Communications Subspace region that was allocated by the system is determined by:
  - The reported (in the subspace structure in the PCCT) length of the entire subspace,
  - Minus the size of the Extended subspace shared memory region header (16 bytes)
- The 4 bytes at offset 0 of the Communications Subspace shall be the standard MCTP transport header
- The MCTP message body begins at offset 4 of the Communications Subspace (which is offset 20 of the Extended Subspace shared memory region). The MCTP message body length can be calculated from:
  - `PCC subspace header.length - 8`, where `8` is the combined length of the command field in the header and the MCTP transport header.

The system shall minimally allocate a shared memory region sufficient large to accommodate the MCTP baseline transmission unit size (64 bytes). For example, the minimum size for an Extended Subspace Shared Memory region supporting MCTP messaging spans the Extended Subspace memory region header (16 bytes), the MCTP transport header (4 bytes) plus 64 bytes for the MCTP baseline transmission unit (`16 + 4 + 64 = 84` bytes).

Implementation Note
Extended Subspace Shared Memory regions should be allocated sufficiently large so that full application layer messages can transit through the memory-based channel without requiring segmentation and reassembly. Note that 128 or 256 bytes of message size data space can be sufficient for most applications. Protocol layers, such as SPDM, have large request and response messages. However, these protocol layers may also have application protocol layer chunking mechanisms that don't require the MCTP layer to perform packetization and re-assembly.

8.4.1 MCTP Transport Header

The MCTP Transport header fields are used consistent with DSP0236.

8.4.2 MCTP Message over PCC

Table 2 summarizes the MCTP message body definitions for the MCTP to PCC binding.

Table 2 — MCTP Message Body Field Encoding for PCC Transport

Field	Description
IC	Shall be set to zero.
Message Type	There are no PCC-specific MCTP message types. MCTP binding to PCC is used as a generic transport of any defined MCTP message type available in the DSP0239 specification.

8.5 Supported Media

This physical transport binding has been designed to work with the following media as defined in DSP0239 and listed in Table 2. Use of this binding with other types of physical media is not covered by this specification. Refer to DSP0239 for all supported physical media by MCTP transport bindings.

An implementation that is compliant with this specification shall at least support one of the PCC media listed in Table 3.

Table 3 — Supported Media

Physical Media Identifier	Description
0x1A	PCC compatible

8.6 MCTP Messages Timing Requirements

Table 4 lists MCTP-specific timing requirements for MCTP Control messages and operation on the PCC medium. All MCTP Control Messages over PCC shall comply to the timing specification listed in Table 4.

Table 4 — Timing Specifications for MCTP Control Messages on UCIe

Timing Specification	Symbol	Min	Max	Description
Endpoint ID reclaim	Treclaim	–	5 sec	Maximum interval that an endpoint is allowed to be non-responsive to MCTP control messages before its EID may be reclaimed by the bus owner. A bus owner shall wait at least for this interval before an EID of the non-responsive endpoint is reclaimed.
Number of request retries	MN1	2	See Description column	Total of three tries, minimum: the original try plus two retries. The maximum number of retries for a given request is limited by the requirement that all retries shall occur within MT4, max of the initial request.
Request-to-response time	MT1	–	120 ms	This interval is measured at the responder from the end of the reception of an MCTP control request to the beginning of the transmission of the corresponding MCTP control response. This requirement is tested under the condition where the responder can successfully transmit the response on the first try.

Timing Specification	Symbol	Min	Max	Description
Time-out waiting for a response	MT2	MT1 max[1] + 6 ms	MT4, min[1]	This interval at the requester sets the minimum amount of time that a requester should wait before retrying a MCTP control request. This interval is measured at the requester from the end of the successful transmission of the MCTP control request to the beginning of the reception of the corresponding MCTP control response. NOTE: This specification does not preclude an implementation from adjusting the minimum time-out waiting for a response to a smaller number than MT2 based on the measured response times from responders. The mechanism for doing so is outside the scope of this specification.
Instance ID expiration interval	MT4	5 sec [2]	6 sec	Interval after which the instance ID for a given response will expire and become reusable if a response has not been received for the request. This is also the maximum time that a responder tracks an instance ID for a given request from a given requester.

NOTE 1: Unless otherwise specified, this timing applies to the mandatory and optional MCTP commands.

NOTE 2: If a requester is reset, it may produce the same sequence number for a request as one that was previously issued. To guard against this, it is recommended that sequence number expiration be implemented. Any request from a given requester that is received more than MT4 seconds after a previous, matching request should be treated as a new request, not a retry.

Annex A

(informative)

Notation

Examples of notations used in this document are as follows: list into text needed

- 2:N In field descriptions, this will typically be used to represent a range of byte offsets starting from byte two and continuing to and including byte N. The lowest offset is on the left, the highest is on the right.
- (6) Parentheses around a single number can be used in message field descriptions to indicate a byte field that may be present or absent.
- (3:6) Parentheses around a field consisting of a range of bytes indicates the entire range may be present or absent. The lowest offset is on the left, the highest is on the right.
- PCIe Underlined, blue text is typically used to indicate a reference to a document or specification called out in Clause 2, “Normative References” or to items hyperlinked within the document.
- rsvd Abbreviation for Reserved. Case insensitive.
- [4] Square brackets around a number are typically used to indicate a bit offset. Bit offsets are given as 0-based values (that is, the least significant bit [LSb] offset = 0).
- [7:5] A range of bit offsets. The most significant bit is on the left, the least significant bit is on the right.
- 1b The lower case “b” following a number consisting of 0s and 1s is used to indicate the number is being given in binary format.
- 0x12 A leading “0x” is used to indicate a number given in hexadecimal format.

Annex B

(informative)

Change Log

Version	Date	Description