



IEEE Standard for Device Discovery, Connection Management, and Control Protocol for Time-Sensitive Networking System

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Abstract: This standard specifies the protocol, device discovery, connection management and device control procedures used to facilitate interoperability between audio and video based End Stations that use IEEE 1722 based Streams on IEEE 802® based networks.

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Introduction

This introduction is not a part of IEEE Std 1722.1™-2021, Device Discovery, Connection Management, and Control Protocol for Time-Sensitive Networking System.

Increasingly, entertainment media are digitally transported. Streaming audio/video and interactive applications over local area networks is becoming more common.

This standard builds on the work done by the IEEE 802.1™ AVB task group by providing a common audio/video transport protocol capable of supporting the needs of both consumer and professional audio/video applications.

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~~IEEE Standard for Device Discovery, Connection Management, and Control Protocol for IEEE 1722™ Based Devices~~

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1. Overview

A number of proprietary protocols exist for allowing End Stations on a local area network (LAN) to connect to each other and stream media over the network. There has been a need in the industry to come up with an industry standard way to connect and interoperate media based devices on a network. IEEE Std 1722™-[2016](#) ~~2011~~ has defined an industry standard way to transport media streams over a LAN and this standard will be the industry standard for connecting IEEE Std 1722-[2016](#) ~~2011~~ streaming End Stations.

This standard, ~~for~~ audio/video [bridging/time sensitive networking](#) discovery, enumeration, connection management and control ([ATDECC](#) ~~AVDECC~~), defines four independent steps that can be used to connect End Stations that use [IEEE](#) 1722-~~2011~~ transport Streams to transport Media Streams across a LAN. The steps are as follows:

- a) Discovery
- b) Enumeration

c) Connection Management

d) Control

These steps can be used together to form a system of End Stations that interoperate with each other in a standards compliant way. The application that will use these individual steps is called an [ATDECC](#) ~~AVDECC~~ Controller and is the third actor in the [ATDECC](#) ~~AVDECC~~ Talker, [ATDECC](#) ~~AVDECC~~ Listener, and [ATDECC](#) ~~AVDECC~~ Controller device relationship.

NOTE—IEEE Std 1722.1-2013 was known as audio/video discovery, enumeration, connection management and control (AVDECC) and referenced the work of the Audio/Video Bridging (AVB) task group of the 802.1 working group. The AVB task group has changed its name to the Time-Sensitive Networking (TSN) task group to show its application across more than just audio/video bridging. As a result, 1722.1 has similarly changed its name to show its application to more than just the audio/video space.

An [ATDECC](#) ~~AVDECC~~ Controller may exist within an [ATDECC](#) ~~AVDECC~~ Talker, or an [ATDECC](#) ~~AVDECC~~ Listener, or exist remotely within the network in a separate End Station. The [ATDECC](#) ~~AVDECC~~ Controller can use the individual steps to find, connect, and control entities on the network, but it may choose to not use all of the steps if the [ATDECC](#) ~~AVDECC~~ Controller already knows some of the information (e.g., hard coded values assigned by user/hardware switch or values from previous session establishment) that can be gained in using the steps. The only required step is connection management, because this is the step that establishes the bandwidth usage and reservations across the audio video bridging (AVB) domain.

The four steps are [broken down](#) ~~described~~ as follows:

- **Discovery** is the process of finding [ATDECC](#) ~~AVDECC~~ Entities on the LAN that have services that are useful to the other [ATDECC](#) ~~AVDECC~~ Entities on the network. The discovery process also covers the termination of the publication of those services on the network.

- **Enumeration** is the process of the collection of ~~collecting~~ information from the ATDECC ~~AVDECC~~ Entity that could help an ATDECC ~~AVDECC~~ Controller to use the capabilities of the ATDECC ~~AVDECC~~ Entity. This information can be used for connection management.
- **Connection management** is the process of connecting or disconnecting one or more Streams between two or more ATDECC ~~AVDECC~~ Entities.
- **Control** is the process of adjusting a parameter on the ATDECC ~~AVDECC~~ Entity from an ATDECC ~~AVDECC~~ Controller. There are a number of standard types of controls used in media devices like volume control, mute control, etc. A framework of basic commands allows the control process to be extended by ATDECC ~~AVDECC~~ Entities.

These four steps are the basis of this standard and will be described in detail in the following sections.

1.1. Scope

This standard specifies the protocol, device discovery, connection management, and device control procedures used to facilitate interoperability between systems ~~audio and video based End Stations~~ that use IEEE ~~1722 based Streams on IEEE~~ 802 time sensitive networking standards ~~@ based networks~~.

1.2. Purpose

This standard will facilitate interoperability between systems ~~End Stations~~ that stream time-sensitive media and data across local area networks which provide ~~providing~~ time synchronization and latency/bandwidth services. This standard defines the device discovery, connection management, stream setup, control, and teardown protocols.

1.3. Word usage

The word *shall* indicates mandatory requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted (*shall* equals *is required to*).^{2,3}

The word *should* indicates that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required (*should* equals *is recommended that*).

The word *may* is used to indicate a course of action permissible within the limits of the standard (*may* equals *is permitted to*).

The word *can* is used for statements of possibility and capability, whether material, physical, or causal (*can* equals *is able to*).

2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

This list of normative references is also maintained as part of the IEEE P1722.1 working group webpage and is available at <https://grouper.ieee.org/groups/1722/1/web/references.html>.

COLLADA–Digital Asset Schema Release 1.5.0 specification (April 2008).⁴⁺

² The use of the word *must* is deprecated and cannot be used when stating mandatory requirements, *must* is used only to describe unavoidable situations.

³ The use of *will* is deprecated and cannot be used when stating mandatory requirements, *will* is only used in statements of fact.

⁴https://www.khronos.org/files/collada_spec_1_5.pdf ~~Available at~~ http://www.khronos.org/files/collada_spec_1_5.pdf

High-bandwidth Digital Content Protection System — Interface Independent Adaptation. ⁵²

IEC 60958, Digital audio interface (all parts).

~~IEC 61883 4:2004, Consumer Audio/Video Equipment Digital Interface Part 4: MPEG2 TS Data Transmission.~~

~~IEC 61883 6:2005, Consumer Audio/Video Equipment Digital Interface Part 6: Audio and Music Data Transmission Protocol.~~

~~IEC 61883 8:2008, Consumer Audio/Video Equipment Digital Interface Part 8: Transmission of ITU-R BT.601 Style Digital Video Data.~~

IEEE Std 754TM-2008, IEEE Standard for Floating Point Arithmetic. ⁶⁷³⁴

IEEE Std 802.1ASTM-²⁰²⁰ ~~2011~~, IEEE standard for Local and Metropolitan Area Networks:— Timing and Synchronization for Time-Sensitive Applications in Bridged Local Area Networks.

IEEE Std 802.1BATM-2011, IEEE Standard for Local and Metropolitan Area Networks — Audio Video Bridging (AVB) Systems.

[IEEE Std 802.1BATM-2011/Cor 1-2016, IEEE Standard for Local and Metropolitan Area Networks — Audio Video Bridging \(AVB\) Systems — Corrigendum 1: Technical and Editorial Corrections.](#)

IEEE Std 802.1QTM-²⁰¹⁸ ~~2011~~, IEEE Standard for Local and metropolitan area networks — Media Access Control (MAC) Bridges and Virtual Bridged Local Area Networks.

[IEEE Std 802.3TM, IEEE Standard for Ethernet.](#)

⁷⁸~~[https://www.digitl-cp.com/sites/default/files/static_page_files/DABB540C-1A4B-B294-D0008CB2D348FA19/HDCP %20Interface %20Independent %20Adaptation %20Specification %20Rev2_34.pdf](https://www.digitl-cp.com/sites/default/files/static_page_files/DABB540C-1A4B-B294-D0008CB2D348FA19/HDCP%20Interface%20Independent%20Adaptation%20Specification%20Rev2_34.pdf)~~

⁵²-IEEE publications are available from The Institute of Electrical and Electronics Engineers (<http://standards.ieee.org>)

³⁴-The IEEE standards or products referred to in this clause are trademarks of The Institute of Electrical and Electronics Engineers, Inc.

IEEE Std 1363aTM-2004, Standard Specifications For Public Key Cryptography—~~Amendment 1: Additional Techniques.~~

IEEE Std 1541TM-2002, IEEE Standard for Prefixes for Binary Multiples.

[IEEE Std 1588TM-2019, IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems](#)

IEEE Std 1722TM-~~2016~~ ~~2011~~, IEEE standard for Layer 2 Transport Protocol for Time Sensitive Applications in a Bridged ~~Local Area~~ Network.

[IIDC2 Digital Camera Control Specification Ver.1.0.0⁸](#)

RFC 2435, RTP Payload Format for JPEG-compressed Video. ² ~~5~~

[RFC 4291, IP Version 6 Addressing Architecture.](#)¹⁰

~~RFC 2616, Hypertext Transfer Protocol—HTTP/1.1.~~⁶

RFC 5371, RTP Payload Format for JPEG 2000 Video Streams. ¹¹ ~~7~~

RFC 6184, RTP Payload Format for H.264 Video. ¹² ~~8~~

[RFC 7231, Hypertext Transfer Protocol \(HTTP/1.1\): Semantics and Content.](#)¹³

W3C Portable Network Graphics (PNG) Specification (Second Edition). ¹⁴ ~~9~~

⁸ Available at http://jiia.org/en/standard_dl/ngcp-w-g/

² [https](https://tools.ietf.org/html/rfc2435) ~~Available at http://tools.ietf.org/html/rfc2435~~

¹⁰[https](https://tools.ietf.org/html/rfc4291) ~~Available at http://tools.ietf.org/html/~~ [rfc4291](#) ~~rfc2616~~

¹¹[https](https://tools.ietf.org/html/rfc5371) ~~Available at http://tools.ietf.org/html/rfc5371~~

¹²[https](https://tools.ietf.org/html/rfc6184) ~~Available at http://tools.ietf.org/html/rfc6184~~

¹³<https://tools.ietf.org/html/rfc7231>

¹⁴[https](https://www.w3.org/TR/PNG/) ~~Available at http://www.w3.org/TR/PNG/~~

3. Definitions, acronyms and abbreviations

3.1. Definitions

For the purposes of this document, the following terms and definitions apply. The *IEEE Standards Dictionary Online* should be consulted for terms not defined in this clause. ¹~~44~~

Active Stream: A data Stream associated with a stream reservation established using the Stream Reservation Protocol (SRP)⁷ which has data flowing from a Talker to one or more Listeners.

ADAT® Optical Interface: The Alesis Digital Audio Tape Optical Interface digital audio interconnect. ^{16,17}~~42,43~~

Audio Cluster: A group of audio channels in a stream.

Audio Map: A static mapping between an audio Stream's channels and an Audio Cluster's channels for Streams and Stream Ports.

Audio Unit: A Unit for processing audio.

AVB domain: [As defined in](#) ~~See~~ IEEE Std 802.1BA™.

AVB Interface: An AVB capable network interface capable of sourcing or sinking Streams and participating in an AVB domain.

¹⁵~~40~~ <https://www.w3.org/TR/SVG/>

¹ ~~44~~ — IEEE Standards Dictionary Online subscription is available at: http://www.ieee.org/portal/innovate/products/standard/standards_dictionary.html

¹⁶ ~~42~~ — ADAT® is a registered trademark owned by ALESIS CORPORATION CORPORATION CALIFORNIA 3630 Holdrege Avenue Los Angeles CALIFORNIA 90016.

¹⁷ ~~43~~ — This information is given for the convenience of users of this standard and does not constitute an endorsement by IEEE of the se products. Equivalent products may be used if they can be shown to lead to the same results.

ATDECC ~~AVDECC~~ Controller: Any entity defined by this standard that initiates exchanges with any other entity defined by this standard.

ATDECC ~~AVDECC~~ Entity: A logical object within an End Station which ~~that~~ can accept and respond to ATDECC ~~AVDECC~~ messages.

ATDECC ~~AVDECC~~ Entity Model: A collection of objects that define the internal structure of the ATDECC ~~AVDECC~~ Entity and the flow of media through it.

ATDECC ~~AVDECC~~ Listener: An ATDECC ~~AVDECC~~ Entity that can transmit or receive the ATDECC ~~AVDECC~~ protocol and is an AVTP Listener.

ATDECC ~~AVDECC~~ Proxy Client (APC): An End Station that implements the ATDECC ~~AVDECC~~ Proxy Client state machine.

ATDECC ~~AVDECC~~ Proxy Protocol (APP): The TCP protocol used to transport ATDECC ~~AVDECC~~ messages between an ATDECC ~~AVDECC~~ Proxy Client and an ATDECC ~~AVDECC~~ Proxy Server.

ATDECC ~~AVDECC~~ Proxy Server (APS): An End Station that implements the ATDECC ~~AVDECC~~ Proxy Server state machine.

ATDECC Responder: An ATDECC Entity that can transmit or receive the ATDECC protocol and is not an ATDECC Controller, ATDECC Listener or ATDECC Talker.

ATDECC ~~AVDECC~~ Talker: An ATDECC ~~AVDECC~~ Entity that can transmit or receive the ATDECC ~~AVDECC~~ protocol and is an AVTP Talker.

AVTP End Station: An End Station that can transmit or receive the IEEE Std 1722™ protocol.

AVTP gateway: A device that transports AVTP audio/video streams between an AVB network and another type of media, for example ~~(e.g.,~~ an IEEE Std 1394™ bus).

AVTP Listener: An End Station that implements a Listener as defined in IEEE Std 1722™.

AVTP Talker: An End Station that implements a Talker as defined in IEEE Std 1722™.

Clock Domain: A source of a common clock signal within an [ATDECC](#) ~~AVDECC~~ Entity.

Clock Source: A source of timing information for a Clock Domain.

Configuration: A collection of objects that [define](#) ~~defines~~ the internal structure for a particular setup of the [ATDECC](#) ~~AVDECC~~ Entity.

Control: A collection of descriptive meta-data and associated values for an observable and/or changeable object within the [ATDECC](#) ~~AVDECC~~ Entity representing a processing element or a transducer.

Control Block: A grouping of Controls.

Doublet: Two octets of data.

End Station: [As defined in](#) ~~See~~ IEEE Std 802®.

Entity ID: The EUI-64 identifier of an [ATDECC](#) ~~AVDECC~~ Entity.

External Port: A Port that connects to a Jack.

Internal Port: A Port that is connected to another Internal Port within an [ATDECC](#) ~~AVDECC~~ Entity.

Jack: An ingress or egress point of a non-media-stream signal to or from an [ATDECC](#) ~~AVDECC~~ Entity.

Matrix: A collection of orthogonal Controls arranged in a two dimensional array. ~~z~~

Media component: Fundamental data within an IEEE Std 1722™ stream payload.

Memory Object: An addressable region of memory within an [ATDECC](#) ~~AVDECC~~ Entity.

Mixer: A Control that combines multiple signals into a single output signal.

Octlet: Eight octets of data.

Port: An ingress and egress point of a signal for a Unit.

Presentation time: A 32-bit unsigned field in units of 1 nanosecond.

Presentation time offset: A 64-bit signed field [which](#) ~~that~~ defines an offset time in nanoseconds.

Reserved field: A data field that is reserved for future standardization and is set to 0 when transmitted and ignored when received.

Sensor Cluster: An element of a Sensor Stream.

Sensor Map: A mapping between a Sensor Stream's components and the Sensor Clusters for Streams and Stream Ports that are located in the same Clock Domain.

Sensor Unit: A Unit for processing Sensors.

Signal Combiner: A Control for combining several signals into a single signal.

Signal Demultiplexer: A Control for demultiplexing a signal into multiple signals.

Signal Multiplexer: A Control for multiplexing multiple signals into a single signal.

Signal Selector: A Control for switchable signal routing.

Signal Splitter: A Control for splitting a signal into multiple sub-signals.

Signal Transcoder: A Control for transcoding from one unencoded or encoded signal to another encoded or unencoded signal.

Stream Port: A Port which is connected to a Stream.

Stream: A unidirectional flow of IEEE Std 1722™ frames with the same StreamID.

Stream sink: A component within an [ATDECC](#) ~~AVDECC~~ Entity that consumes a Stream.

Stream source: A component within an [ATDECC](#) ~~AVDECC~~ Entity that produces a Stream.

Unit: Processing for single Clock Domain.

Video Cluster: An element of a video Stream.

Video Map: A static mapping between a video Stream's components and the Video Clusters for Streams and Stream Ports.

Video Unit: A Unit for processing Video.

3.2. Acronyms and abbreviations

ACMP [ATDECC](#) ~~AVDECC~~ Connection Management Protocol

ACMPDU [ATDECC](#) ~~AVDECC~~ Connection Management Protocol Data Unit

ADP [ATDECC](#) ~~AVDECC~~ Discovery Protocol

ADPDU [ATDECC](#) ~~AVDECC~~ Discovery Protocol Data Unit

AECP [ATDECC](#) ~~AVDECC~~ Enumeration and Control Protocol

AECPDU [ATDECC](#) ~~AVDECC~~ Enumeration and Control Protocol Data Unit

AEM [ATDECC](#) ~~AVDECC~~ Entity Model

APC [ATDECC](#) ~~AVDECC~~ Proxy Client

APP [ATDECC](#) ~~AVDECC~~ Proxy Protocol

APS [ATDECC](#) ~~AVDECC~~ Proxy Server

ASCII American Standard Code for Information Interchange

AVB Audio/video bridging

[ATDECC](#) ~~AVDECC~~ Audio/video [bridging/time sensitive networking](#) discovery, enumeration, connection management, and control

AVTP Audio/video transport protocol

AVTPDU Audio/video transport protocol data unit

EUI IEEE Extended Unique Identifier

FIPS Federal Information Processing Standards^{18 44}

gPTP Generalized Precision Time Protocol

LAN Local area network

MAAP MAC address acquisition protocol

MAC Media access control

MIDI Musical Instrument Digital Interface^{19 45}

MPEG Moving Pictures Expert Group^{20 46}

MSRP Multiple Stream Reservation Protocol

OUI IEEE organizationally unique identifier

PDU Protocol Data Unit

S/PDIF The Sony/Philips Digital Interconnect Format digital audio interconnect.

SMPTE Society of Motion Picture and Television Engineers^{21 47}

SRP Stream Reservation Protocol

TCP Transmission Control Protocol^{22 48}

^{18 44}<http://itl.nist.gov/fipspubs>

^{19 45}<http://www.midi.org/>

^{20 46}<http://www.chiariglione.org/mpeg/>

^{21 47}<http://www.smpte.org/>

^{22 48}<http://tools.ietf.org/html/rfc1122>

VLAN Virtual Local Area Network

4. Other information

4.1 Word usage

~~In this document, the word *shall* is used to indicate a mandatory requirement. The word *should* is used to indicate a recommendation. The word *may* is used to indicate a permissible action. The word *can* is used for statements of possibility and capability.~~

4.1. Numerical values

Decimal, hexadecimal, and binary numbers are used within this standard. For clarity, decimal numbers are generally used to represent counts, hexadecimal numbers are used to represent addresses, and binary numbers are used to describe bit patterns within binary fields.

Decimal numbers are represented in their usual 0, 1, 2, ... format. Hexadecimal numbers are represented by a string of one or more hexadecimal (0 to 9, a to f) digits followed by the subscript "16". Binary numbers are represented by a string of one or more binary (0, 1) digits in left to right order where the left most bit is the most significant bit and the right most ~~it bit~~ is the least significant bit, followed by the subscript "2". Thus, the decimal number "26" may also be represented as "1a₁₆" or "11010₂".

The notational conventions have the following exceptions:

- MAC addresses and OUI/EUI values^{23, 49} are represented as strings of 8-bit hexadecimal numbers separated by hyphens and without a subscript, as for example "90-e0-f0-00-00-00-00-15", "90-e0-f0-00-00-15" or "90-e0-f0".

^{23, 49}Administration of standard OUI/EUI address assignments is the responsibility of the IEEE Registration Authority (IEEE RA). A full list of standard assignments, and the criteria for assignment, can be found on the IEEE RA website at <http://standards.ieee.org/develop/regauth/>.

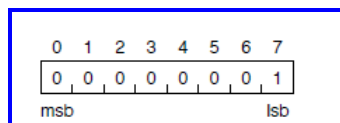
4.2. Bit, octet, doublet, and quadlet ordering

All Audio Video Transport Protocol Data Units (AVTPDUs) consist of an integral number of octets, which are numbered starting from 0 and increasing in the order that they are put into a Data Link Service Data Unit. The bits in each octet are numbered from 0 to 7, where 7 is the low-order bit.

When consecutive octets are used to represent a binary number, the lower octet number has the most significant value. When the encoding of (an element of) an AVTPDU is represented using a diagram in this clause, the following representations are used:

- a) Octet 0 is shown toward the top of the page, higher numbered octets being toward the bottom.
- b) Where more than one octet appears on a given line, octets are shown with the lowest numbered octet to the left, higher numbered octets being to the right.
- c) Within an octet, bits are shown with bit 0 to the left and bit 7 to the right.

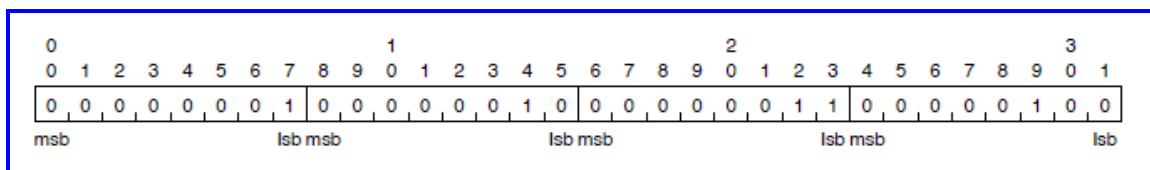
Figure 4-1 represents a decimal value of 1, a hexadecimal value of 01₁₆, and a binary value of 00000001₂ with the only bit in the octet set to one of the least significant bit, bit 7.



(New)

Figure 4-1—Bit ordering within an octet

A quadlet is a series of four octets. Within a quadlet, the most significant octet is shown as the left-most octet and the least significant octet is shown as the right-most, as shown in Figure 4-2.

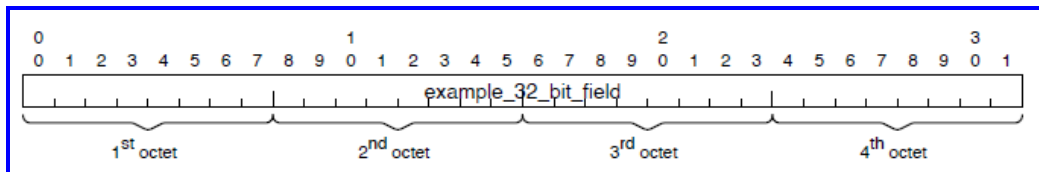


(New)

Figure 4-2—Octet ordering within a quadlet

[Figure 4-2 represents a quadlet holding a four-octet array with values of 1, 2, 3, and 4 decimal for each octet.](#)

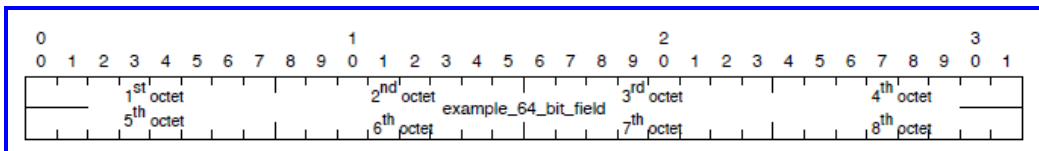
[A quadlet may contain bit fields of any length between 1 bit and 32 bits. When a field spans more than one octet, the point where it spans the octet is shown as a large tick mark as shown in Figure 4-3.](#)



[\(New\)](#)

[Figure 4-3—Example 32 bit field diagram](#)

[The 64 bit fields that need to be contained in more than one quadlet are shown as a series of eight octets in Figure 4-4.](#)



[\(New\)](#)

[Figure 4-4—Example 64 bit field diagram](#)

[4.3. Field value conventions](#)

[This document describes values of fields. For clarity, names can be associated with each of these defined values, as illustrated in Table 4-1. A symbolic name, consisting of uppercase letters with underscore separators, allows other portions of this document to reference the value by its symbolic name, rather than by a numerical value.](#)

Table 4-1—Wrap field values

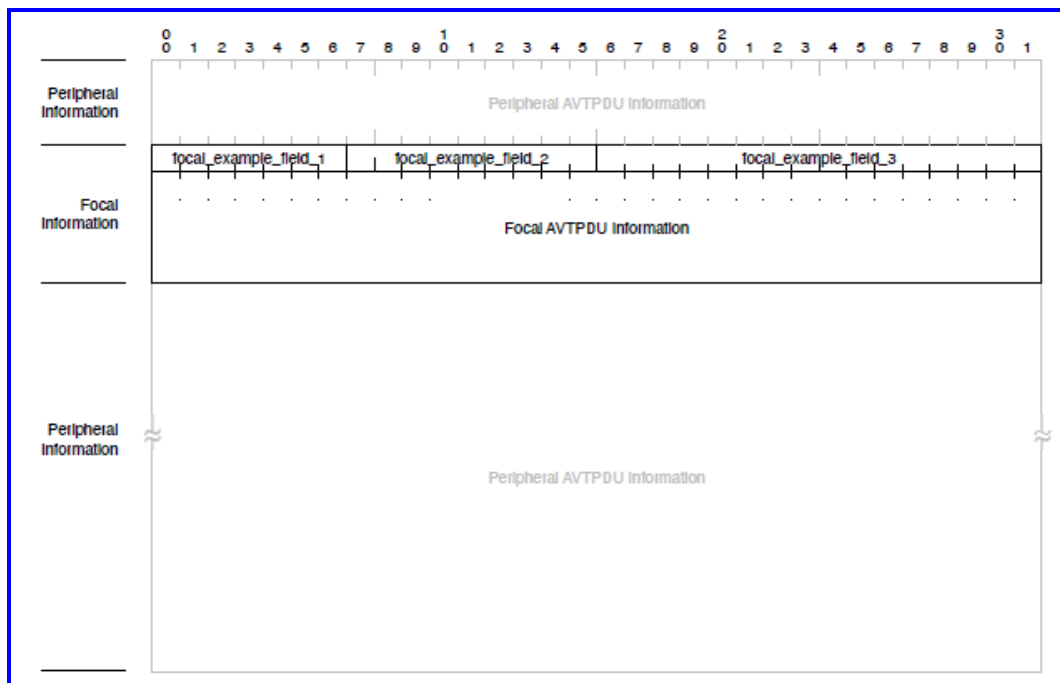
Value	Name	Description
0	WRAP_AVOID	Frame is discarded at the wrap point
1	WRAP_ALLOW	Frame passes through wrap points
2 to 3	—	Reserved

(New)

A field value of TRUE shall always be interpreted as being equivalent to a numeric value of one (1) unless otherwise indicated. A field value of FALSE shall always be interpreted as being equivalent to a numeric value of zero (0) unless otherwise indicated.

4.4. AVTPDU Diagram Conventions

This document uses black and gray coloring in the AVTPDU diagrams to indicate the focus of discussion within the diagram. Figure 4-5 shows an example of the usage of black and grayed coloring.



(New)

Figure 4-5—Example Diagram Showing Grayed Fields

In Figure 4-5 items that are focal to the text of the section are shown in black. In this example, the fields focal example field 1, focal example field 2, and focal example field 3 would be described and discussed in the section text. The items labeled "Peripheral AVTPDU Information" are grayed-out to show that they are described elsewhere. The diagram shows them to provide context to the focal items.

5. General requirements

5.1. Overview

Audio/video [bridging/time sensitive networking](#) discovery, enumeration, connection management, and control ([ATDECC](#) ~~AVDECC~~) defines high-level communication protocols between [ATDECC](#) ~~AVDECC~~ Entities, which allows them to discover other [ATDECC](#) ~~AVDECC~~ Entities, enumerate their capabilities, manage audio/video bridging (AVB) streams, control media parameters, and allows [ATDECC](#) ~~AVDECC~~ Entities that encounter errors to report their health and diagnostic status to [ATDECC](#) ~~AVDECC~~ Controllers.

This standard defines four roles ~~which that~~ an [ATDECC](#) ~~AVDECC~~ Entity may implement:

- [ATDECC](#) ~~AVDECC~~ Controller
- [ATDECC](#) ~~AVDECC~~ Talker
- [ATDECC](#) ~~AVDECC~~ Listener
- [ATDECC](#) ~~AVDECC~~ Responder

5.2. [ATDECC](#) ~~AVDECC~~ End Station

An [ATDECC](#) ~~AVDECC~~ End Station is a device that has one or more network ports and has one or more [ATDECC](#) ~~AVDECC~~ Entities.

Figure 5-1 shows the possible interaction of the various parts of an [ATDECC](#) ~~AVDECC~~ End Station.

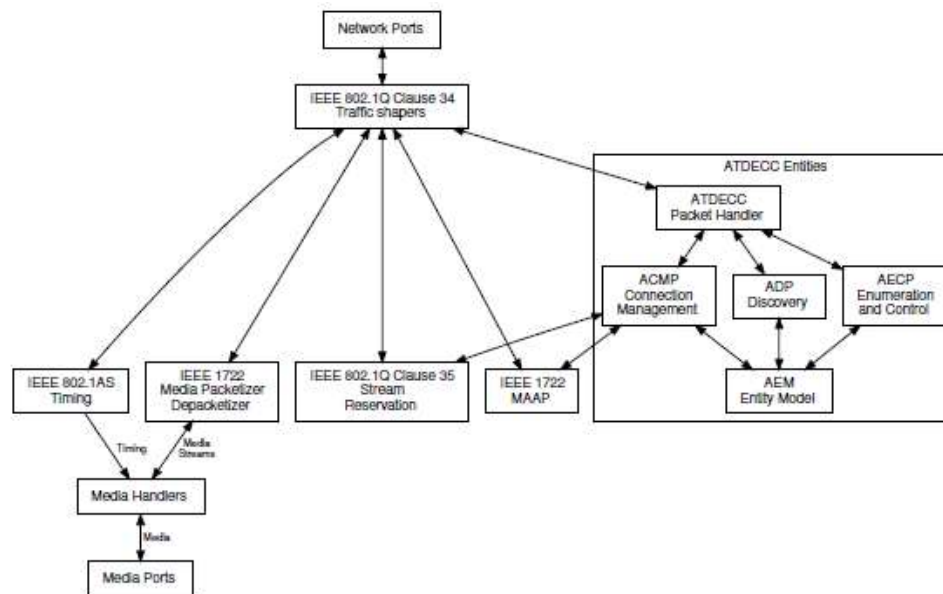


Figure 5-1 — ATDECC ~~AVDECC~~ End Station

5.2.1. Requirements and options

An ATDECC ~~AVDECC~~ End Station shall implement:

- at least one ATDECC ~~AVDECC~~ Entity
- at least one network interface
- IEEE 1722 control ~~Audio/Video Transport Protocol (AVTP)~~ data unit (AVTPDU) packetization and depacketization

An ATDECC ~~AVDECC~~ End Station may implement:

- multiple ATDECC ~~AVDECC~~ Entities
- one or more network interfaces that implement an appropriate AVB profile as defined in IEEE Std 802.1BA-2011 and corrected by IEEE Std 802.1BA™-2011/Cor 1-2016.

- IEEE 802.1AS time synchronization
- IEEE 1722 stream AVTPDU packetization
- IEEE 1722 stream AVTPDU depacketization
- IEEE 1722 multicast address allocation protocol (MAAP)
- IEEE 802.1Q Clause 34 FQTSS Traffic Shaping
- IEEE 802.1Q Clause 35 Stream Reservation Protocol

5.3. ATDECC ~~AVDECC~~ Entity

An ATDECC ~~AVDECC~~ Entity uses one or more of the following ATDECC ~~AVDECC~~ protocols for discovering or controlling other ATDECC ~~AVDECC~~ Entities or for being discovered or controlled by other ATDECC ~~AVDECC~~ Entities:

- ATDECC ~~AVDECC~~ discovery protocol (ADP)
- ATDECC ~~AVDECC~~ connection management protocol (ACMP)
- ATDECC ~~AVDECC~~ enumeration and control protocol (AECp)

5.3.1. Requirements and options

An ATDECC ~~AVDECC~~ Entity shall:

- Have a single Entity ID that is assigned by the manufacturer or via an ATDECC ~~AVDECC~~ Proxy Server.
- Implement at least one of the ATDECC ~~AVDECC~~ Controller, ATDECC ~~AVDECC~~ Talker, ATDECC ~~AVDECC~~ Listener, or the ATDECC ~~AVDECC~~ Responder role.

A discoverable [ATDECC](#) ~~AVDECC~~ Entity is an [ATDECC](#) ~~AVDECC~~ Entity that is capable of advertising itself on a local area network (LAN). An [ATDECC](#) ~~AVDECC~~ Entity that is to be discoverable on a network shall implement:

- 6.2.4 “[Advertising](#) ~~Advertise~~ Entity State [Machine](#)”
- 6.2.5 “[Advertising](#) ~~Advertise~~ Interface State [Machine](#)”
- [6.2.7 “Discovery Interface State Machine”](#)

An [ATDECC](#) ~~AVDECC~~ Entity that is to be discoverable on a network may implement:

7.5.1 “Identification Notification”

An [ATDECC](#) ~~AVDECC~~ Entity [which](#) ~~that~~ has a need to discover other [ATDECC](#) ~~AVDECC~~ Entities on a LAN shall implement:

- 6.2.6 “Discovery State Machine”

An [ATDECC](#) ~~AVDECC~~ Entity that implements [9.3.5](#) ~~9.2.2.3.1~~ “[ATDECC](#) ~~AVDECC~~ Entity Model Entity State Machine” that implements 7.4.5 “READ_DESCRIPTOR Command” [shall](#) ~~may~~ implement:

- 7.2.1 “ENTITY Descriptor”

An [ATDECC](#) ~~AVDECC~~ Entity that implements ~~9.2.2.3.~~ [5](#) “[ATDECC](#) ~~AVDECC~~ Entity Model Entity State Machine” that implements 7.4.5 “READ_DESCRIPTOR Command” [may](#) ~~shall~~ implement:

- 7.2.2 “CONFIGURATION Descriptor”
- 7.2.3 “AUDIO_UNIT Descriptor”
- 7.2.4 “VIDEO_UNIT Descriptor”
- 7.2.5 “SENSOR_UNIT Descriptor”

- 7.2.6 “STREAM_INPUT and STREAM_OUTPUT Descriptor”
- 7.2.7 “JACK_INPUT and JACK_OUTPUT Descriptor”
- 7.2.8 “AVB_INTERFACE Descriptor”
- 7.2.9 “CLOCK_SOURCE Descriptor”
- 7.2.10 “MEMORY_OBJECT Descriptor”
- 7.2.11 “LOCALE Descriptor”
- 7.2.12 “STRINGS Descriptor”
- 7.2.13 “STREAM_PORT_INPUT and STREAM_PORT_OUTPUT Descriptor”
- 7.2.14 “EXTERNAL_PORT_INPUT and EXTERNAL_PORT_OUTPUT Descriptor”
- 7.2.15 “INTERNAL_PORT_INPUT and INTERNAL_PORT_OUTPUT Descriptor”
- 7.2.16 “AUDIO_CLUSTER Descriptor”
- 7.2.17 “VIDEO_CLUSTER Descriptor”
- 7.2.18 “SENSOR_CLUSTER Descriptor”
- 7.2.19 “AUDIO_MAP Descriptor”
- 7.2.20 “VIDEO_MAP Descriptor”
- 7.2.21 “SENSOR_MAP Descriptor”
- 7.2.22 “CONTROL Descriptor”
- 7.2.23 “SIGNAL_SELECTOR Descriptor”
- 7.2.24 “MIXER Descriptor”
- 7.2.25 “MATRIX Descriptor”

– 7.2.26 “MATRIX_SIGNAL Descriptor”

– 7.2.27 “SIGNAL_SPLITTER Descriptor”

– 7.2.28 “SIGNAL_COMBINER Descriptor”

7.2.29 “SIGNAL_DEMULTIPLEXER Descriptor”

– 7.2.30 “SIGNAL_MULTIPLEXER Descriptor”

– 7.2.31 “SIGNAL_TRANSCODER Descriptor”

– 7.2.32 “CLOCK_DOMAIN Descriptor”

– 7.2.33 “CONTROL_BLOCK Descriptor”

[– 7.2.34 “TIMING Descriptor”](#)

[– 7.2.35 “PTP_INSTANCE Descriptor”](#)

[– 7.2.36 “PTP_PORT Descriptor”](#)

5.4. [ATDECC](#) ~~AVDECC~~ Controller

An [ATDECC](#) ~~AVDECC~~ Entity that has the role of [ATDECC](#) ~~AVDECC~~ Controller initiates commands to and receives responses from other [ATDECC](#) ~~AVDECC~~ Entities.

5.4.1. Requirements and options

An [ATDECC](#) ~~AVDECC~~ Controller shall use [ATDECC](#) ~~AVDECC~~ messages transported via IEEE 1722 AVTPDUs or via an [ATDECC](#) ~~AVDECC~~ Proxy Server (APS).

An [ATDECC](#) ~~AVDECC~~ Controller shall implement:

– [9.3](#) ~~9.2.1.2~~ “[ATDECC](#) ~~AVDECC~~ Entity Model format”

– [9.3.3](#) ~~9.2.2.1~~ “[ATDECC](#) ~~AVDECC~~ Entity Model Commands”

- [9.3.4](#) [9.2.2.2](#) “[ATDECC](#) ~~AVDECC~~ Entity Model Responses”
- [9.3.6](#) [9.2.2.3.2](#) “[ATDECC](#) ~~AVDECC~~ Entity Model Controller State Machine”, implementing ~~the~~ following:
 - 7.4.1 “ACQUIRE_ENTITY Command”
 - 7.4.2 “LOCK_ENTITY Command”
 - 7.4.3 “ENTITY_AVAILABLE Command”
 - 7.4.4 “CONTROLLER_AVAILABLE Command”

An [ATDECC](#) ~~AVDECC~~ Controller may implement:

- [8.2.3](#) [8.2.2.4](#) “ACMP Controller State Machine”
- [9.3.6](#) [9.2.2.3.2](#) “[ATDECC](#) ~~AVDECC~~ Entity Model Controller State Machine”, implementing zero or more of the following:
 - 7.4.5 “READ_DESCRIPTOR Command”
 - 7.4.6 “WRITE_DESCRIPTOR Command”
 - 7.4.7 “SET_CONFIGURATION Command”
 - 7.4.8 “GET_CONFIGURATION Command”
 - 7.4.9 “SET_STREAM_FORMAT Command”
 - 7.4.10 “GET_STREAM_FORMAT Command”
 - 7.4.11 “SET_VIDEO_FORMAT Command”
 - 7.4.12 “GET_VIDEO_FORMAT Command”
 - 7.4.13 “SET_SENSOR_FORMAT Command”

- 7.4.14 “GET_SENSOR_FORMAT Command”
- 7.4.15 “SET_STREAM_INFO Command”
- 7.4.16 “GET_STREAM_INFO Command”
- 7.4.17 “SET_NAME Command”
- 7.4.18 “GET_NAME Command”
- 7.4.19 “SET_ASSOCIATION_ID Command”
- 7.4.20 “GET_ASSOCIATION_ID Command”
- 7.4.21 “SET_SAMPLING_RATE Command”
- 7.4.22 “GET_SAMPLING_RATE Command”
- 7.4.23 “SET_CLOCK_SOURCE Command”
- 7.4.24 “GET_CLOCK_SOURCE Command”
- 7.4.25 “SET_CONTROL Command”
- 7.4.26 “GET_CONTROL Command”
- 7.4.27 “INCREMENT_CONTROL Command”
- 7.4.28 “DECREMENT_CONTROL Command”
- 7.4.29 “SET_SIGNAL_SELECTOR Command”
- 7.4.30 “GET_SIGNAL_SELECTOR Command”
- 7.4.31 “SET_MIXER Command”
- 7.4.32 “GET_MIXER Command”
- 7.4.33 “SET_MATRIX Command”

- 7.4.34 “GET_MATRIX Command”
- 7.4.35 “START_STREAMING Command”
- 7.4.36 “STOP_STREAMING Command”
- 7.4.37 “REGISTER_UN SOLICITED_NOTIFICATION Command”
- 7.4.38 “DEREGISTER_UN SOLICITED_NOTIFICATION Command”
- 7.4.39 “IDENTIFY_NOTIFICATION Unsolicited Response”
- 7.4.40 “GET_AVB_INFO Command”
- 7.4.41 “GET_AS_PATH Command”
- 7.4.42 “GET_COUNTERS Command”
- 7.4.43 “REBOOT Command”
- 7.4.44 “GET_AUDIO_MAP Command”
- 7.4.45 “ADD_AUDIO_MAPPINGS Command”
- 7.4.46 “REMOVE_AUDIO_MAPPINGS Command”
- 7.4.47 “GET_VIDEO_MAP Command”
- 7.4.48 “ADD_VIDEO_MAPPINGS Command”
- 7.4.49 “REMOVE_VIDEO_MAPPINGS Command”
- 7.4.50 “GET_SENSOR_MAP Command”
- 7.4.51 “ADD_SENSOR_MAPPINGS Command”
- 7.4.52 “REMOVE_SENSOR_MAPPINGS Command”
- 7.4.53 “START_OPERATION Command”

- 7.4.54 “ABORT_OPERATION Command”
- 7.4.55 “OPERATION_STATUS Unsolicited Response”
- 7.4.56 “AUTH_ADD_KEY Command”
- 7.4.57 “AUTH_DELETE_KEY Command”
- 7.4.58 “AUTH_GET_KEY_LIST Command”
- 7.4.59 “AUTH_GET_KEY Command”
- 7.4.60 “AUTH_ADD_KEY_TO_CHAIN Command”
- 7.4.61 “AUTH_DELETE_KEY_FROM_CHAIN Command”
- 7.4.62 “AUTH_GET_KEYCHAIN_LIST Command”
- 7.4.63 “AUTH_GET_IDENTITY Command”
- 7.4.64 “AUTH_ADD_TOKEN Command”
- 7.4.65 “AUTH_DELETE_TOKEN Command”
- 7.4.66 “AUTHENTICATE Command”
- 7.4.67 “DEAUTHENTICATE Command”
- 7.4.68 “ENABLE_TRANSPORT_SECURITY Command”
- 7.4.69 “DISABLE_TRANSPORT_SECURITY Command”
- 7.4.70 “ENABLE_STREAM_ENCRYPTION Command”
- 7.4.71 “DISABLE_STREAM_ENCRYPTION Command”
- 7.4.72 “SET_MEMORY_OBJECT_LENGTH Command”
- 7.4.73 “GET_MEMORY_OBJECT_LENGTH Command”

- 7.4.74 "SET_STREAM_BACKUP Command"
- 7.4.75 "GET_STREAM_BACKUP Command"
- [7.4.76 "GET_DYNAMIC_INFO Command"](#)
- [7.4.77 "SET_MAX_TRANSIT_TIME Command"](#)
- [7.4.78 "GET_MAX_TRANSIT_TIME Command"](#)
- [7.4.79 "SET_SAMPLING_RATE_RANGE Command"](#)
- [7.4.80 "GET_SAMPLING_RATE_RANGE Command"](#)
- [7.4.81 "SET_PTP_INSTANCE_INFO Command"](#)
- [7.4.82 "GET_PTP_INSTANCE_INFO Command"](#)
- [7.4.83 "GET_PTP_INSTANCE_EXTENDED_INFO Command"](#)
- [7.4.84 "GET_PTP_INSTANCE_GRANDMASTER_INFO Command"](#)
- [7.4.85 "GET_PTP_INSTANCE_PATH_COUNT Command"](#)
- [7.4.86 "GET_PTP_INSTANCE_PATH_TRACE Command"](#)
- [7.4.87 "GET_PTP_INSTANCE_PERF_MON_COUNT Command"](#)
- [7.4.88 "GET_PTP_INSTANCE_PERF_MON_RECORD Command"](#)
- [7.4.89 "SET_PTP_PORT_INITIAL_INTERVALS Command"](#)
- [7.4.90 "GET_PTP_PORT_INITIAL_INTERVALS Command"](#)
- [7.4.91 "GET_PTP_PORT_CURRENT_INTERVALS Command"](#)
- [7.4.92 "SET_PTP_PORT_REMOTE_INTERVALS Command"](#)
- [7.4.93 "GET_PTP_PORT_REMOTE_INTERVALS Command"](#)

- [7.4.94 "SET_PTP_PORT_INFO Command"](#)
- [7.4.95 "GET_PTP_PORT_INFO Command"](#)
- [7.4.96 "SET_PTP_PORT_OVERRIDES Command"](#)
- [7.4.97 "GET_PTP_PORT_OVERRIDES Command"](#)
- [7.4.98 "GET_PTP_PORT_PDELAY_MON_COUNT Command"](#)
- [7.4.99 "GET_PTP_PORT_PDELAY_MON_RECORD Command"](#)
- [7.4.100 "GET_PTP_PORT_PERF_MON_COUNT Command"](#)
- [7.4.101 "GET_PTP_PORT_PERF_MON_RECORD Command"](#)
- [7.4.102 "GET_PATH_LATENCY Command"](#)
- [9.3.5](#) ~~9.2.2.3.1~~ ["ATDECC ~~AVDECC~~ Entity Model Entity State Machine"](#), implementing zero or more of the following:
 - 7.4.1 "ACQUIRE_ENTITY Command"
 - 7.4.2 "LOCK_ENTITY Command"
 - 7.4.3 "ENTITY_AVAILABLE Command"
 - 7.4.4 "CONTROLLER_AVAILABLE Command"
 - 7.4.5 "READ_DESCRIPTOR Command"
 - 7.4.6 "WRITE_DESCRIPTOR Command"
 - 7.4.7 "SET_CONFIGURATION Command"
 - 7.4.8 "GET_CONFIGURATION Command"
 - 7.4.17 "SET_NAME Command"

- 7.4.18 “GET_NAME Command”
- 7.4.19 “SET_ASSOCIATION_ID Command”
- 7.4.20 “GET_ASSOCIATION_ID Command”
- 7.4.21 “SET_SAMPLING_RATE Command”
- 7.4.22 “GET_SAMPLING_RATE Command”
- 7.4.23 “SET_CLOCK_SOURCE Command”
- 7.4.24 “GET_CLOCK_SOURCE Command”
- 7.4.25 “SET_CONTROL Command”
- 7.4.26 “GET_CONTROL Command”
- 7.4.27 “INCREMENT_CONTROL Command”
- 7.4.28 “DECREMENT_CONTROL Command”
- 7.4.29 “SET_SIGNAL_SELECTOR Command”
- 7.4.30 “GET_SIGNAL_SELECTOR Command”
- 7.4.31 “SET_MIXER Command”
- 7.4.32 “GET_MIXER Command”
- 7.4.33 “SET_MATRIX Command”
- 7.4.34 “GET_MATRIX Command”
- 7.4.37 “REGISTER_UN SOLICITED_NOTIFICATION Command”
- 7.4.38 “DEREGISTER_UN SOLICITED_NOTIFICATION Command”
- 7.4.39 “IDENTIFY_NOTIFICATION Unsolicited Response”

- 7.4.40 “GET_AVB_INFO Command”
- 7.4.41 “GET_AS_PATH Command”
- 7.4.42 “GET_COUNTERS Command”
- 7.4.43 “REBOOT Command”
- 7.4.53 “START_OPERATION Command”
- 7.4.54 “ABORT_OPERATION Command”
- 7.4.55 “OPERATION_STATUS Unsolicited Response”
- 7.4.56 “AUTH_ADD_KEY Command”
- 7.4.57 “AUTH_DELETE_KEY Command”
- 7.4.58 “AUTH_GET_KEY_LIST Command”
- 7.4.59 “AUTH_GET_KEY Command”
- 7.4.60 “AUTH_ADD_KEY_TO_CHAIN Command”
- 7.4.61 “AUTH_DELETE_KEY_FROM_CHAIN Command”
- 7.4.62 “AUTH_GET_KEYCHAIN_LIST Command”
- 7.4.63 “AUTH_GET_IDENTITY Command”
- 7.4.64 “AUTH_ADD_TOKEN Command”
- 7.4.65 “AUTH_DELETE_TOKEN Command”
- 7.4.66 “AUTHENTICATE Command”
- 7.4.67 “DEAUTHENTICATE Command”
- 7.4.68 “ENABLE_TRANSPORT_SECURITY Command”

- 7.4.69 “DISABLE_TRANSPORT_SECURITY Command”
- 7.4.72 “SET_MEMORY_OBJECT_LENGTH Command”
- 7.4.73 “GET_MEMORY_OBJECT_LENGTH Command”
- 7.4.74 “SET_STREAM_BACKUP Command”
- 7.4.75 “GET_STREAM_BACKUP Command”
- [7.4.76 “GET_DYNAMIC_INFO Command”](#)
- [7.4.77 “SET_MAX_TRANSIT_TIME Command”](#)
- [7.4.78 “GET_MAX_TRANSIT_TIME Command”](#)
- [7.4.79 “SET_SAMPLING_RATE_RANGE Command”](#)
- [7.4.80 “GET_SAMPLING_RATE_RANGE Command”](#)
- [7.4.81 “SET_PTP_INSTANCE_INFO Command”](#)
- [7.4.82 “GET_PTP_INSTANCE_INFO Command”](#)
- [7.4.83 “GET_PTP_INSTANCE_EXTENDED_INFO Command”](#)
- [7.4.84 “GET_PTP_INSTANCE_GRANDMASTER_INFO Command”](#)
- [7.4.85 “GET_PTP_INSTANCE_PATH_COUNT Command”](#)
- [7.4.86 “GET_PTP_INSTANCE_PATH_TRACE Command”](#)
- [7.4.87 “GET_PTP_INSTANCE_PERF_MON_COUNT Command”](#)
- [7.4.88 “GET_PTP_INSTANCE_PERF_MON_RECORD Command”](#)
- [7.4.89 “SET_PTP_PORT_INITIAL_INTERVALS Command”](#)
- [7.4.90 “GET_PTP_PORT_INITIAL_INTERVALS Command”](#)

- [7.4.91 "GET_PTP_PORT_CURRENT_INTERVALS Command"](#)
- [7.4.92 "SET_PTP_PORT_REMOTE_INTERVALS Command"](#)
- [7.4.93 "GET_PTP_PORT_REMOTE_INTERVALS Command"](#)
- [7.4.94 "SET_PTP_PORT_INFO Command"](#)
- [7.4.95 "GET_PTP_PORT_INFO Command"](#)
- [7.4.96 "SET_PTP_PORT_OVERRIDES Command"](#)
- [7.4.97 "GET_PTP_PORT_OVERRIDES Command"](#)
- [7.4.98 "GET_PTP_PORT_PDELAY_MON_COUNT Command"](#)
- [7.4.99 "GET_PTP_PORT_PDELAY_MON_RECORD Command"](#)
- [7.4.100 "GET_PTP_PORT_PERF_MON_COUNT Command"](#)
- [7.4.101 "GET_PTP_PORT_PERF_MON_RECORD Command"](#)
- [7.4.102 "GET_PATH_LATENCY Command"](#)
- [9.4.6](#) ~~9.2.2.6.2~~ "Address Access Controller State Machine"
- [9.5.6](#) ~~9.2.2.9.2~~ "Legacy A/VC Controller State Machine"
- [9.6.6](#) ~~9.2.2.12.2~~ "Vendor Unique Controller State Machine"

5.4.2. Multiple Controllers

There may be multiple [ATDECC](#) ~~AVDECC~~ Controllers on a single LAN at the same time. These Controllers may discover and interact with any [ATDECC](#) ~~AVDECC~~ entities on the network.

When an [ATDECC](#) ~~AVDECC~~ Controller needs exclusive control of an [ATDECC](#) ~~AVDECC~~ Entity for changing or limiting changing the state of the [ATDECC](#) ~~AVDECC~~ Entity, the [ATDECC](#) ~~AVDECC~~ Controller uses the ACQUIRE_ENTITY or LOCK_ENTITY [ATDECC](#) ~~AVDECC~~ Entity Model (AEM) AACP commands. While an [ATDECC](#) ~~AVDECC~~ Entity has been acquired with the ACQUIRE_ENTITY command or locked with the LOCK_ENTITY command, another [ATDECC](#) ~~AVDECC~~ Controller is not allowed to perform any modifications to the [ATDECC](#) ~~AVDECC~~ Entity, however it may read values or descriptors from the [ATDECC](#) ~~AVDECC~~ Entity Model. Typically, an [ATDECC](#) ~~AVDECC~~ Controller would only use the LOCK_ENTITY command on another [ATDECC](#) ~~AVDECC~~ Entity for the time needed to complete a single atomic operation, where as it would use the ACQUIRE_ENTITY command on the [ATDECC](#) ~~AVDECC~~ Entity for long-term exclusive control of the [ATDECC](#) ~~AVDECC~~ Entity.

5.4.3. Controller behavior

5.4.3.1. How to handle gPTP Domain and SRP Domain changes

When the [ATDECC](#) ~~AVDECC~~ Controller itself is participating in an AVB domain and is actively filtering entities [which](#) ~~that~~ are in that AVB domain, and the generalized precision time protocol (gPTP, IEEE Std 802.1AS-2011) grandmaster of that AVB domain changes, then the [ATDECC](#) ~~AVDECC~~ Controller needs to make a decision on what Entities are still in the same AVB domain as the [ATDECC](#) ~~AVDECC~~ Controller since the grandmaster change may have been triggered by a network topology change that resulted in one or more Entities being removed from the AVB domain.