

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

IEEE Computer Society

Sponsored by the
Microprocessor Standards Committee

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

Sponsor

**Microprocessor Standards Committee
of the
IEEE Computer Society**

Approved 23 August 2013

IEEE-SA Standards Board

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.

Keywords: AVDECC, bridged LAN, IEC 61883, IEEE 802.1[™] AVB protocols, IEEE 802.1BA[™], IEEE 1722.1[™], IEEE Std 802.1AS[™]-2011, IEEE Std 802.1Q[™]-2011, IEEE Std 1722[™]-2011, LAN, QoS, time sensitive media streaming, time synchronization

The Institute of Electrical and Electronics Engineers, Inc.
3 Park Avenue, New York, NY 10016-5997, USA

Copyright © 2013 by The Institute of Electrical and Electronics Engineers, Inc.
All rights reserved. Published 10 October 2013. Printed in the United States of America.

IEEE is a registered trademark in the U.S. Patent & Trademark Office, owned by The Institute of Electrical and Electronics Engineers, Incorporated.

PDF: ISBN 978-0-7381-8624-5 STD98376
Print: ISBN 978-0-7381-8625-2 STDPD98376

IEEE prohibits discrimination, harassment, and bullying.

For more information, visit <http://www.ieee.org/web/aboutus/whatis/policies/p9-26.html>.

No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher.

Notice and Disclaimer of Liability Concerning the Use of IEEE Documents: IEEE Standards documents are developed within the IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Association (IEEE-SA) Standards Board. IEEE develops its standards through a consensus development process, approved by the American National Standards Institute, which brings together volunteers representing varied viewpoints and interests to achieve the final product. Volunteers are not necessarily members of the Institute and serve without compensation. While IEEE administers the process and establishes rules to promote fairness in the consensus development process, IEEE does not independently evaluate, test, or verify the accuracy of any of the information or the soundness of any judgments contained in its standards.

Use of an IEEE Standard is wholly voluntary. IEEE disclaims liability for any personal injury, property or other damage, of any nature whatsoever, whether special, indirect, consequential, or compensatory, directly or indirectly resulting from the publication, use of, or reliance upon any IEEE Standard document.

IEEE does not warrant or represent the accuracy or content of the material contained in its standards, and expressly disclaims any express or implied warranty, including any implied warranty of merchantability or fitness for a specific purpose, or that the use of the material contained in its standards is free from patent infringement. IEEE Standards documents are supplied “**AS IS.**”

The existence of an IEEE Standard does not imply that there are no other ways to produce, test, measure, purchase, market, or provide other goods and services related to the scope of the IEEE standard. Furthermore, the viewpoint expressed at the time a standard is approved and issued is subject to change brought about through developments in the state of the art and comments received from users of the standard. Every IEEE standard is subjected to review at least every ten years. When a document is more than ten years old and has not undergone a revision process, it is reasonable to conclude that its contents, although still of some value, do not wholly reflect the present state of the art. Users are cautioned to check to determine that they have the latest edition of any IEEE standard.

In publishing and making its standards available, IEEE is not suggesting or rendering professional or other services for, or on behalf of, any person or entity. Nor is IEEE undertaking to perform any duty owed by any other person or entity to another. Any person utilizing any IEEE Standards document, should rely upon his or her own independent judgment in the exercise of reasonable care in any given circumstances or, as appropriate, seek the advice of a competent professional in determining the appropriateness of a given IEEE standard.

Translations: The IEEE consensus development process involves the review of documents in English only. In the event that an IEEE standard is translated, only the English version published by IEEE should be considered the approved IEEE standard.

Official Statements: A statement, written or oral, that is not processed in accordance with the IEEE-SA Standards Board Operations Manual shall not be considered the official position of IEEE or any of its committees and shall not be considered to be, nor be relied upon as, a formal position of IEEE. At lectures, symposia, seminars, or educational courses, an individual presenting information on IEEE standards shall make it clear that his or her views should be considered the personal views of that individual rather than the formal position of IEEE.

Comments on Standards: Comments for revision of IEEE Standards documents are welcome from any interested party, regardless of membership affiliation with IEEE. However, IEEE does not provide consulting information or advice pertaining to IEEE Standards documents. Suggestions for changes in documents should be in the form of a proposed change of text, together with appropriate supporting comments. Since IEEE standards represent a consensus of concerned interests, it is important to ensure that any responses to comments and questions also receive the concurrence of a balance of interests. For this reason, IEEE and the members of its societies and Standards Coordinating Committees are not able to provide an instant response to comments or questions except in those cases where the matter has previously been addressed. Any person who would like to participate in evaluating comments or revisions to an IEEE standard is welcome to join the relevant IEEE working group at <http://standards.ieee.org/develop/wg/>.

Comments on standards should be submitted to the following address:

Secretary, IEEE-SA Standards Board
445 Hoes Lane
Piscataway, NJ 08854
USA

Photocopies: Authorization to photocopy portions of any individual standard for internal or personal use is granted by The Institute of Electrical and Electronics Engineers, Inc., provided that the appropriate fee is paid to Copyright Clearance Center. To arrange for payment of licensing fee, please contact Copyright Clearance Center, Customer Service, 222 Rosewood Drive, Danvers, MA 01923 USA; +1 978 750 8400. Permission to photocopy portions of any individual standard for educational classroom use can also be obtained through the Copyright Clearance Center.

Notice to users

Laws and regulations

Users of IEEE Standards documents should consult all applicable laws and regulations. Compliance with the provisions of any IEEE Standards document does not imply compliance to any applicable regulatory requirements. Implementers of the standard are responsible for observing or referring to the applicable regulatory requirements. IEEE does not, by the publication of its standards, intend to urge action that is not in compliance with applicable laws, and these documents may not be construed as doing so.

Copyrights

This document is copyrighted by the IEEE. It is made available for a wide variety of both public and private uses. These include both use, by reference, in laws and regulations, and use in private self-regulation, standardization, and the promotion of engineering practices and methods. By making this document available for use and adoption by public authorities and private users, the IEEE does not waive any rights in copyright to this document.

Updating of IEEE documents

Users of IEEE Standards documents should be aware that these documents may be superseded at any time by the issuance of new editions or may be amended from time to time through the issuance of amendments, corrigenda, or errata. An official IEEE document at any point in time consists of the current edition of the document together with any amendments, corrigenda, or errata then in effect. In order to determine whether a given document is the current edition and whether it has been amended through the issuance of amendments, corrigenda, or errata, visit the IEEE-SA Website at <http://standards.ieee.org/index.html> or contact the IEEE at the address listed previously. For more information about the IEEE Standards Association or the IEEE standards development process, visit IEEE-SA Website at <http://standards.ieee.org/index.html>.

Errata

Errata, if any, for this and all other standards can be accessed at the following URL: <http://standards.ieee.org/findstds/errata/index.html>. Users are encouraged to check this URL for errata periodically.

Patents

Attention is called to the possibility that implementation of this standard may require use of subject matter covered by patent rights. By publication of this standard, no position is taken by the IEEE with respect to the existence or validity of any patent rights in connection therewith. If a patent holder or patent applicant has filed a statement of assurance via an Accepted Letter of Assurance, then the statement is listed on the IEEE-SA Website at <http://standards.ieee.org/about/sasb/patcom/patents.html>. Letters of Assurance may indicate whether the Submitter is willing or unwilling to grant licenses under patent rights without compensation or under reasonable rates, with reasonable terms and conditions that are demonstrably free of any unfair discrimination to applicants desiring to obtain such licenses.

Essential Patent Claims may exist for which a Letter of Assurance has not been received. The IEEE is not responsible for identifying Essential Patent Claims for which a license may be required, for conducting inquiries into the legal validity or scope of Patents Claims, or determining whether any licensing terms or conditions provided in connection with submission of a Letter of Assurance, if any, or in any licensing agreements are reasonable or non-discriminatory. Users of this standard are expressly advised that determination of the validity of any patent rights, and the risk of infringement of such rights, is entirely their own responsibility. Further information may be obtained from the IEEE Standards Association.

Participants

At the time this IEEE standard was completed, the IEEE Standard Device Discovery, Connection Management and Control Protocol for IEEE 1722 Based Devices Working Group had the following membership:

Matthew Xavier Mora, *Chair*
Michael Johas Teener, *Vice Chair*
Don Pannell, *Secretary*
Ashley Butterworth, *Co-Editor*
Jeffrey Koftinoff, *Co-Editor*

Bob Abraham
Torrey Atcitty
Eliot Blennerhassett
Robert Boatright
Philippe Boucachard
Alexander Busch
Debin Chen
George Claseman
Guy Fedorkow
Bob Feng
Richard Foss
Philip Foulkes
John Nels Fuller
Aaron Gelter

John Grant
Duncan Gray
Kevin Gross
Craig Gunther
Joern Hennenberg
Alison Hughes
Osedum P. Igumbor
Girault Jones, Jr.
Max Kicherer
Yong Kim
Matt Klein
Hans Lau
James R. Leitch
Tom Mathey
Gail McCoy

Lee Minich
David Olsen
Nathan O'Neill
Xavier Miguelez Ortiz
Chris Pane
Don Pannell
Nagaprasad Ramachandra
Vincent Rowley
Bennet Sikes
Rob Silfvast
Kevin Stanton
Lalin Theverapperuma
Stephen Turner
Niel Warren

The following members of the individual balloting committee voted on this standard. Balloters may have voted for approval, disapproval, or abstention.

Thomas Alexander
Martin J. Bishop
Christian Boiger
Ashley Butterworth
Keith Chow
Rodney Cummings
James Davis
Richard Eckard
Andre Fournier
James Gilb
Patrick Gonia
Sudheer Grandhi
Randall Groves
Michael Gundlach
Craig Gunther
Jerome Henry
Marco Hernandez
Werner Hoelzl
Osedum Igumbor
Atsushi Ito
Anthony Jeffree
Michael Johas Teener

Girault Jones
Chol Kang
Piotr Karocki
Stuart Kerry
Yuri Khersonsky
Yongbum Kim
Jeff Koftinoff
Bruce Kraemer
Thomas Kurihara
Geoff Ladwig
Jan-Ray Liao
Shen Loh
Greg Luri
Jeffery Masters
Michael McInnis
Matthew Xavier Mora
Jose Morales
Michael S. Newman
Charles Ngethe
Satoshi Obara
David Olsen
Satoshi Oyama

Chris Pane
Maximilian Riegel
Jeff Rockower
Benjamin Rolfe
Dan Romascanu
Randall Safier
Peter Saunderson
Bartien Sayogo
Gil Shultz
Kevin Stanton
Walter Struppler
William Taylor
David Thompson
Kazuyoshi Tsukada
Stephen Turner
Dmitri Varsanofiev
Prabodh Varshney
John Vergis
Haiming Wang
Colin Whitby-Stevens
Forrest Wright
Oren Yuen

When the IEEE-SA Standards Board approved this standard on 23 August 2013, it had the following membership:

John Kulick, *Chair*
David J. Law, *Vice Chair*
Richard H. Hulett, *Past Chair*
Konstantinos Karachalios, *Secretary*

Masayuki Ariyoshi
Peter Balma
Farooq Bari
Ted Burse
Wael William Diab
Stephen Dukes
Jean-Philippe Faure
Alexander Gelman

Mark Halpin
Gary Hoffman
Paul Houzé
Jim Hughes
Michael Janezic
Joseph L. Koepfinger*
David J. Law
Oleg Logvinov

Ron Petersen
Gary Robinson
Jon Walter Rosdahl
Adrian Stephens
Peter Sutherland
Yatin Trivedi
Phil Winston
Yu Yuan

*Member Emeritus

Also included are the following nonvoting IEEE-SA Standards Board liaisons:

Richard DeBlasio, DOE Representative
Michael Janezic, NIST Representative

Michelle D. Turner
IEEE Standards Program Manager, Document Development

Joan Woolery
IEEE Standards Program Manager, Technical Program Development

Introduction

This introduction is not part of IEEE Std 1722.1™-2013, IEEE Standard for Device Discovery, Connection Management, and Control Protocol for IEEE 1722™ Based Devices.

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.

Contents

1. Overview	1
1.1 Scope	2
1.2 Purpose	2
2. Normative references.....	3
3. Definitions, acronyms, and abbreviations.....	4
3.1 Definitions	4
3.2 Acronyms and abbreviations	6
4. Other information	8
4.1 Word usage	8
4.2 Numerical values	8
5. General requirements.....	8
5.1 Overview	8
5.2 AVDECC End Station	9
5.2.1 Requirements and options	10
5.3 AVDECC Entity	10
5.3.1 Requirements and options	10
5.4 AVDECC Controller	12
5.4.1 Requirements and options	12
5.4.2 Multiple Controllers	16
5.4.3 Controller behavior	16
5.5 AVDECC Talker	17
5.5.1 Requirements and options	17
5.6 AVDECC Listener.....	20
5.6.1 Requirements and options	20
5.7 AVDECC Responder.....	22
5.7.1 Requirements and options	22
5.8 AVDECC Proxy Server requirements and options.....	24
5.9 AVDECC Proxy Client requirements and options	25
6. AVDECC Entity Discovery.....	25
6.1 Overview	25
6.2 AVDECC Discovery Protocol.....	25
6.2.1 AVDECC Discovery Protocol Data Unit format.....	25
6.2.2 Protocol specification	33
6.2.3 Global state machine variables.....	33
6.2.4 Advertise Entity State Machine.....	34
6.2.5 Advertise Interface State Machine	35
6.2.6 Discovery State machine	37
7. AVDECC Entity Model.....	40
7.1 Overview	40
7.2 Descriptors.....	42
7.2.1 ENTITY Descriptor.....	44
7.2.2 CONFIGURATION Descriptor	46
7.2.3 AUDIO_UNIT Descriptor.....	47
7.2.4 VIDEO_UNIT Descriptor	49
7.2.5 SENSOR_UNIT Descriptor	51

7.2.6	STREAM_INPUT and STREAM_OUTPUT Descriptor	53
7.2.7	JACK_INPUT and JACK_OUTPUT Descriptor	55
7.2.8	AVB_INTERFACE Descriptor	57
7.2.9	CLOCK_SOURCE Descriptor	59
7.2.10	MEMORY_OBJECT Descriptor	60
7.2.11	LOCALE Descriptor	62
7.2.12	STRINGS Descriptor	63
7.2.13	STREAM_PORT_INPUT and STREAM_PORT_OUTPUT Descriptor	63
7.2.14	EXTERNAL_PORT_INPUT and EXTERNAL_PORT_OUTPUT Descriptor	65
7.2.15	INTERNAL_PORT_INPUT and INTERNAL_PORT_OUTPUT Descriptor	66
7.2.16	AUDIO_CLUSTER Descriptor	67
7.2.17	VIDEO_CLUSTER Descriptor	69
7.2.18	SENSOR_CLUSTER Descriptor	73
7.2.19	AUDIO_MAP Descriptor	75
7.2.20	VIDEO_MAP Descriptor	77
7.2.21	SENSOR_MAP Descriptor	78
7.2.22	CONTROL Descriptor	79
7.2.23	SIGNAL_SELECTOR Descriptor	82
7.2.24	MIXER Descriptor	85
7.2.25	MATRIX Descriptor	87
7.2.26	MATRIX_SIGNAL Descriptor	89
7.2.27	SIGNAL_SPLITTER Descriptor	91
7.2.28	SIGNAL_COMBINER Descriptor	93
7.2.29	SIGNAL_DEMULTIPLEXER Descriptor	96
7.2.30	SIGNAL_MULTIPLEXER Descriptor	98
7.2.31	SIGNAL_TRANSCODER Descriptor	101
7.2.32	CLOCK_DOMAIN Descriptor	104
7.2.33	CONTROL_BLOCK Descriptor	104
7.3	Descriptor Field Value Types	105
7.3.1	Sampling Rates	105
7.3.2	Stream Formats	107
7.3.3	Control Value Units	115
7.3.4	Control Types	123
7.3.5	Control Values	143
7.3.6	Localized String Reference	151
7.3.7	Video Cluster Formats Specific	151
7.3.8	Video Cluster Pixel Aspect Ratio	158
7.3.9	Video Cluster Frame Size	159
7.3.10	Video Cluster Color Space	159
7.3.11	Sensor Cluster Format	160
7.4	Commands and Responses	162
7.4.1	ACQUIRE_ENTITY Command	166
7.4.2	LOCK_ENTITY Command	168
7.4.3	ENTITY_AVAILABLE Command	169
7.4.4	CONTROLLER_AVAILABLE Command	169
7.4.5	READ_DESCRIPTOR Command	170
7.4.6	WRITE_DESCRIPTOR Command	171
7.4.7	SET_CONFIGURATION Command	172
7.4.8	GET_CONFIGURATION Command	173
7.4.9	SET_STREAM_FORMAT Command	174
7.4.10	GET_STREAM_FORMAT Command	175
7.4.11	SET_VIDEO_FORMAT Command	176
7.4.12	GET_VIDEO_FORMAT Command	177
7.4.13	SET_SENSOR_FORMAT Command	178
7.4.14	GET_SENSOR_FORMAT Command	179
7.4.15	SET_STREAM_INFO Command	180

7.4.16 GET_STREAM_INFO Command	183
7.4.17 SET_NAME Command	185
7.4.18 GET_NAME Command.....	186
7.4.19 SET_ASSOCIATION_ID Command	187
7.4.20 GET_ASSOCIATION_ID Command.....	188
7.4.21 SET_SAMPLING_RATE Command	188
7.4.22 GET_SAMPLING_RATE Command.....	189
7.4.23 SET_CLOCK_SOURCE Command.....	190
7.4.24 GET_CLOCK_SOURCE Command	191
7.4.25 SET_CONTROL Command	192
7.4.26 GET_CONTROL Command.....	193
7.4.27 INCREMENT_CONTROL Command	194
7.4.28 DECREMENT_CONTROL Command	196
7.4.29 SET_SIGNAL_SELECTOR Command.....	197
7.4.30 GET_SIGNAL_SELECTOR Command.....	198
7.4.31 SET_MIXER Command	199
7.4.32 GET_MIXER Command.....	200
7.4.33 SET_MATRIX Command	201
7.4.34 GET_MATRIX Command.....	203
7.4.35 START_STREAMING Command	205
7.4.36 STOP_STREAMING Command	206
7.4.37 REGISTER_UN SOLICITED_NOTIFICATION Command	207
7.4.38 DEREGISTER_UN SOLICITED_NOTIFICATION Command.....	207
7.4.39 IDENTIFY_NOTIFICATION Unsolicited Response.....	207
7.4.40 GET_AVB_INFO Command.....	208
7.4.41 GET_AS_PATH Command	210
7.4.42 GET_COUNTERS Command	212
7.4.43 REBOOT Command	218
7.4.44 GET_AUDIO_MAP Command	219
7.4.45 ADD_AUDIO_MAPPINGS Command.....	221
7.4.46 REMOVE_AUDIO_MAPPINGS Command.....	222
7.4.47 GET_VIDEO_MAP Command.....	222
7.4.48 ADD_VIDEO_MAPPINGS Command	224
7.4.49 REMOVE_VIDEO_MAPPINGS Command	225
7.4.50 GET_SENSOR_MAP Command.....	226
7.4.51 ADD_SENSOR_MAPPINGS Command	227
7.4.52 REMOVE_SENSOR_MAPPINGS Command	228
7.4.53 START_OPERATION Command	228
7.4.54 ABORT_OPERATION Command	230
7.4.55 OPERATION_STATUS Unsolicited Response.....	230
7.4.56 AUTH_ADD_KEY Command	231
7.4.57 AUTH_DELETE_KEY Command	233
7.4.58 AUTH_GET_KEY_LIST Command.....	233
7.4.59 AUTH_GET_KEY Command	234
7.4.60 AUTH_ADD_KEY_TO_CHAIN Command.....	235
7.4.61 AUTH_DELETE_KEY_FROM_CHAIN Command	236
7.4.62 AUTH_GET_KEYCHAIN_LIST Command	237
7.4.63 AUTH_GET_IDENTITY Command.....	238
7.4.64 AUTH_ADD_TOKEN Command	240
7.4.65 AUTH_DELETE_TOKEN Command.....	241
7.4.66 AUTHENTICATE Command.....	241
7.4.67 DEAUTHENTICATE Command	243
7.4.68 ENABLE_TRANSPORT_SECURITY Command.....	244
7.4.69 DISABLE_TRANSPORT_SECURITY Command	244
7.4.70 ENABLE_STREAM_ENCRYPTION Command	245
7.4.71 DISABLE_STREAM_ENCRYPTION Command	246

7.4.72 SET_MEMORY_OBJECT_LENGTH Command	247
7.4.73 GET_MEMORY_OBJECT_LENGTH Command	248
7.4.74 SET_STREAM_BACKUP Command	249
7.4.75 GET_STREAM_BACKUP Command	250
7.5 Notifications	251
7.5.1 Identification Notification	251
7.5.2 Unsolicited Notifications	253
7.6 Security	255
7.6.1 Key management	255
7.6.2 Controller Authorization	258
7.6.3 Transport Security Control	259
7.6.4 Stream Encryption Control	259
7.6.5 Entity Model Verification	259
8. Connection management	268
8.1 Overview	268
8.2 AVDECC Connection Management Protocol	268
8.2.1 AVDECC Connection Management Protocol Data Unit format	268
8.2.2 Protocol Specification	273
9. Enumeration and control	289
9.1 Overview	289
9.2 AVDECC Enumeration and Control Protocol	289
9.2.1 AVDECC Enumeration and Control Protocol Data Unit format	289
9.2.2 Protocol Operation	300
Annex A (informative) Bibliography	325
Annex B (normative) Reserved AVDECC MAC addresses	326
B.1 Overview	326
Annex C (normative) AVDECC Proxy Protocol	327
C.1 Overview	327
C.2 DNS-SD Service Name	327
C.3 DNS-SD TXT Record	328
C.4 APPDU format	328
C.5 Protocol Description	331
Annex D (informative) Memory Object Uploads	343
D.1 Overview	343
D.2 Memory Object Upload Entity State Machine	343
D.3 Memory Object Upload Controller State Machine	348
Annex E (informative) XML Representation of AVDECC Entity Models	352
E.1 Overview	352

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

IMPORTANT NOTICE: IEEE Standards documents are not intended to ensure safety, health, or environmental protection, or ensure against interference with or from other devices or networks. Implementers of IEEE Standards documents are responsible for determining and complying with all appropriate safety, security, environmental, health, and interference protection practices and all applicable laws and regulations.

This IEEE document is made available for use subject to important notices and legal disclaimers. These notices and disclaimers appear in all publications containing this document and may be found under the heading “Important Notice” or “Important Notices and Disclaimers Concerning IEEE Documents.” They can also be obtained on request from IEEE or viewed at <http://standards.ieee.org/IPR/disclaimers.html>.

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™-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 1722-2011 streaming End Stations.

This standard, for audio/video discovery, enumeration, connection management and control (AVDECC), defines four independent steps that can be used to connect End Stations that use 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 AVDECC Controller and is the third actor in the AVDECC Talker, AVDECC Listener, and AVDECC Controller device relationship.

An AVDECC Controller may exist within an AVDECC Talker or an AVDECC Listener, or exist remotely within the network in a separate End Station. The 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 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 described as follows:

- **Discovery** is the process of finding AVDECC Entities on the LAN that have services that are useful to the other 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 collecting information from the AVDECC Entity that could help an AVDECC Controller to use the capabilities of the 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 AVDECC Entities.
- **Control** is the process of adjusting a parameter on the AVDECC Entity from an 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 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 audio and video based End Stations that use IEEE 1722 based Streams on IEEE 802® based networks.

1.2 Purpose

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