AVnu PA1 Pro Audio Media Clocking Specification Revision 1.1

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1 Overview

There are a number of methods that can be used for synchronising media clocks on a local area network (LAN). This document defines the AVnu required method for providing interoperable and certified media clock synchronisation for Pro Audio devices.

2 Normative References

The following referenced documents are indispensable for the application of this document.

IEC 61883-6:2005, Consumer Audio/Video Equipment—Digital Interface—Part 6: Audio and Music Data Transmission Protocol.
IEEE Std 1722™-2011, IEEE standard for Layer 2 Transport Protocol for Time Sensitive Applications in a Bridged Network;
IEEE Std 1722.1™-2013, IEEE Draft Standard for Device Discovery, Connection Management and Control Protocol for IEEE 1722 Based Devices;

3 Terms, definitions and notation

This document makes extensive use of the terms and definitions contained in IEEE Std 1722.1™-2013.

AVnu ProA AM-824 Media Clock Stream Format	The Media Clock Stream format defined by AVnu for the Pro Audio market.
Media Clock Input	A Stream sink for a Media Clock Stream with it's associated STREAM_INPUT and CLOCK_SOURCE descriptors.
Media Clock Listener	An AVDECC Listener that receives a Media Clock Stream.
Media Clock Output	A Stream source for a Media Clock Stream with it's associated STREAM_OUTPUT descriptor.
Media Clock Stream	A Stream in the AVnu ProA AM-824 Media Clock Stream Format.
Media Clock Talker	An AVDECC Talker that transmits a Media Clock Stream.
Media Listener	An AVDECC Listener that receives a Media Stream
Media Stream	A Stream used to transfer audio from the Media Talker to one or more Media Listeners.
Media Talker	An AVDECC Talker that transmits a Media Stream

4 Abbreviations and acronyms

AVDECC	Audio/video discovery, enumeration, connection management and control (IEEE Std 1722.1™-2013)
AVTP	Audio/video transport protocol (IEEE Std 1722-2011)

5 General Requirements

5.1 Overview

This document defines four roles that a Pro Audio device may implement:

1) Media Clock Talker
2) Media Clock Listener
3) Media Talker
4) Media Listener

***Note**: A Pro Audio device which implements multiple roles may share the requirements between the roles, e.g. the same CLOCK_DOMAIN descriptor can be used for the Media Clock Talker, and the Media Listener.*

5.2 Media Clock Talker

A device implementing the role of Media Clock Talker shall implement:

1) An AVDECC Talker (IEEE Std 1722.1™-2013 Clause 5.5) also implementing:
   a) IEEE Std 1722.1™-2013 Clause 7.4.5 “READ_DESCRIPTOR Command”
   b) IEEE Std 1722.1™-2013 Clause 7.4.15 “SET_STREAM_INFO Command”
   c) IEEE Std 1722.1™-2013 Clause 7.4.16 “GET_STREAM_INFO Command”
2) At least one Stream source implementing the AVnu ProA AM-824 Media Clock Stream Format
3) For each Stream source implementing the AVnu ProA AM-824 Media Clock Stream Format:
   a) A STREAM_OUTPUT descriptor (IEEE Std 1722.1™-2013 Clause 7.2.6) with the CLOCK_SYNC_SOURCE flag set
4) A CLOCK_SOURCE descriptor (IEEE Std 1722.1™-2013 Clause 7.2.9) for each source of media clock in the device (INTERNAL for sources like local oscillators and EXTERNAL for sources like BNC word clock).
5) One or more CLOCK_DOMAIN descriptors (IEEE Std 1722.1™-2013 Clause 7.2.32) describing the possible clock sources for a media clock domain in the device.
6) Set the MEDIA_CLOCK_SOURCE flag in the **talker_capabilities** field of the ADP Entity Available message (IEEE Std 1722.1™-2013 Clause 6.2.1.12)

5.3 Media Clock Listener

A device implementing the role of Media Clock Listener shall implement:

1) An AVDECC Listener (IEEE Std 1722.1™-2013 Clause 5.6) also implementing:
   a) IEEE Std 1722.1™-2013 Clause 7.4.5 “READ_DESCRIPTOR Command”
   b) IEEE Std 1722.1™-2013 Clause 7.4.15 “SET_STREAM_INFO Command”
   c) IEEE Std 1722.1™-2013 Clause 7.4.16 “GET_STREAM_INFO Command”

2) At least one Stream sink implementing the AVnu ProA AM-824 Media Clock Stream Format
3) For each Stream sink implementing the AVnu ProA AM-824 Media Clock Stream Format:
   a) A STREAM_INPUT descriptor (IEEE Std 1722.1™-2013 Clause 7.2.9) with the CLOCK_SYNC_SOURCE flag set
   b) A CLOCK_SOURCE descriptor (IEEE Std 1722.1™-2013 Clause 7.2.9) with a **clock_source_type** of INPUT_STREAM and a **clock_location_index** set to the **descriptor_index** of the associated STREAM_INPUT descriptor (above).
4) One or more CLOCK_DOMAIN descriptors (IEEE Std 1722.1™-2013 Clause 7.2.32) which includes the CLOCK_SOURCE descriptors of the Stream sinks implementing the AVnu Media Clock Stream Format.
5) Set the MEDIA_CLOCK_SINK flag in the **listener_capabilities** field of the ADP Entity Available message (IEEE Std 1722.1™-2013 Clause 6.2.1.14)

A device implementing the role of Media Clock Listener may implement:
1) IEEE Std 1722.1™-2013 Clause 7.4.74 “SET_STREAM_BACKUP Command”
2) IEEE Std 1722.1™-2013 Clause 7.4.75 “GET_STREAM_BACKUP Command”

5.4 Media Talker

A device implementing the role of Media Talker shall implement:
1) An AVDECC Talker (IEEE STD 1722.1™-2013 Clause 5.5) also implementing:
   a) IEEE STD 1722.1™-2013 Clause 7.4.5 “READ_DESCRIPTOR Command”
   b) IEEE STD 1722.1™-2013 Clause 7.4.15 “SET_STREAM_INFO Command”
   c) IEEE STD 1722.1™-2013 Clause 7.4.16 “GET_STREAM_INFO Command”
   d) IEEE STD 1722.1™-2013 Clause 7.4.23 “SET_CLOCK_SOURCE Command”
   e) IEEE STD 1722.1™-2013 Clause 7.4.24 “GET_CLOCK_SOURCE Command”
   f) IEEE STD 1722.1™-2013 Clause 7.4.35 “START_STREAMING Command”
   g) IEEE STD 1722.1™-2013 Clause 7.4.36 “STOP_STREAMING Command”
2) The role of Media Clock Listener

A device implementing the role of Media Talker may implement:
1) The role of Media Clock Talker

5.5 Media Listener

A device implementing the role of Media Listener shall implement:
1) An AVDECC Listener (IEEE STD 1722.1™-2013 Clause 5.6) also implementing:
   a) IEEE STD 1722.1™-2013 Clause 7.4.5 “READ_DESCRIPTOR Command”
   b) IEEE STD 1722.1™-2013 Clause 7.4.15 “SET_STREAM_INFO Command”
   c) IEEE STD 1722.1™-2013 Clause 7.4.16 “GET_STREAM_INFO Command”
   d) IEEE STD 1722.1™-2013 Clause 7.4.23 “SET_CLOCK_SOURCE Command”
   e) IEEE STD 1722.1™-2013 Clause 7.4.24 “GET_CLOCK_SOURCE Command”
   f) IEEE STD 1722.1™-2013 Clause 7.4.35 “START_STREAMING Command”
   g) IEEE STD 1722.1™-2013 Clause 7.4.36 “STOP_STREAMING Command”
2) If not implementing the role of Media Talker:
   a) For every Stream sink:
      i) A STREAM_INPUT descriptor (IEEE STD 1722.1™-2013 Clause 7.2.9) with the CLOCK_SYNC_SOURCE flag set
      ii) A CLOCK_SOURCE descriptor (IEEE STD 1722.1™-2013 Clause 7.2.9) with a **clock_source_type** of INPUT_STREAM and a **clock_location_index** set to the **descriptor_index** of the associated STREAM_INPUT descriptor (above).

   b) One or more CLOCK_DOMAIN descriptors (IEEE STD 1722.1™-2013 Clause 7.2.32) which includes the CLOCK_SOURCE descriptors of the Stream sinks
   c) Automatically change the selected clock source of the clock domain to a Stream sink with an Active Stream.
3) If the device has more than one Media Stream sink within a clock domain, (i.e. more than one STREAM_INPUT descriptor with the same **clock_domain_index** field value connected to the same AUDIO_UNIT via a STREAM_PORT_INPUT):
   a) Implement the role of Media Clock Talker

A device implementing the role of Media Listener may implement:

1) The role of Media Clock Listener
2) The role of Media Clock Talker
3) IEEE STD 1722.1™-2013 Clause 7.4.74 “SET_STREAM_BACKUP Command”
4) IEEE STD 1722.1™-2013 Clause 7.4.75 “GET_STREAM_BACKUP Command”

6 Media Clock Streams

6.1 Overview

The Media Clock Stream is used to synchronise the presentation of samples across the AVTP Presentation Time Reference Plane (IEEE Std 1722-2011 Clause 5.5) by synchronising the frequency at which Media Talkers transfer samples across the Ingress Time Reference Plane and at which Media Listeners transfer samples across the Presentation Time Reference Plane.

6.2 AVnu ProA AM-824 Media Clock Stream Format

The AVnu ProA AM-824 Media Clock Stream Format is an IEEE Std 1722-2011, IEC 61883-6 single channel AM-824 24 bit Multi Bit Linear Audio format (MBLA). See IEEE Std 1722-2011 Clause 6.2 and IEC 61883-6 sections 10,11 and 12.

The AVnu ProA AM-824 Media Clock Stream shall contain valid AM824 MBLA labels and may contain valid audio.

6.3 Media Talker Synchronisation

A Media Talker shall synchronise the sampling frequency of its output Media Stream(s) with the sampling frequency of the Media Clock Stream that it is either:

1) Receiving
2) Generating, if it is a Media Clock Talker providing a Media Clock Stream.

The Media Talker shall generate presentation timestamps for the Media Stream from the presentation timestamps in the Media Clock Stream that conforms to Equation 1.

$$eq.1: \quad n \times P_s - \frac{P_s}{4} < T_{offset} < n \times P_s + \frac{P_s}{4}$$

Where:

- T_{offset} is the timestamp offset in nanoseconds between the presentation timestamp of the Media Stream and the presentation timestamp of the Media Clock Stream.
- n is a positive integer chosen for the implementation.
- P_s is the nominal sample period of the Media Clock Stream. (ie. 1 Sample / 48000 Hz for a 48kHz Media format) in nanoseconds.

Annex A (Informative) Controllers

To configure the media and Media Clock connections, an AVDECC Controller is required to be present on the network. Through the use of persistent state and the AVDECC Fast Connect mechanism (IEEE STD 1722.1™-2013 Clause 8.2.2.1.1) the AVDECC Controller does not need to always be present after the initial setup.

To configure a Media Clock connection graph an AVDECC Controller would:

1) Discover all of the AVDECC Entities (may be an AVDECC Talker, an AVDECC Listener or an AVDECC Talker and AVDECC Listener in one) present on the network
2) Enumerate the AVDECC Entity Model of all of the discovered AVDECC Entities, the controller may assume that following the rules of the **entity_model_id** (IEEE STD 1722.1™-2013 Clause 6.2.1.9) any AVDECC Entity with the same **entity_model_id** has the same AVDECC Entity Model and doesn't need to be fully re-enumerated but should use the appropriate commands (GET_CLOCK_SOURCE, GET_SAMPLING_RATE, etc) to get the specific settings for that AVDECC Entity.
3) Determine what are the possible Media Clock Outputs on the network being supplied by Media Clock Talkers and provide a mechanism for selecting the Media Clock Output(s) to be used
4) Configure the Media Clock Output of the Media Clock Talker to use the appropriate clock source if necessary with the SET_CLOCK_SOURCE command (IEEE STD 1722.1™-2013 Clause 7.4.23)
5) Configure each Media Clock Listener to use the selected Media Clock Output by setting the appropriate clock source for each clock domain with the SET_CLOCK_SOURCE command (IEEE STD 1722.1™-2013 Clause 7.4.23) and by connecting the Media Clock Inputs to the Media Clock Outputs with ACMP (IEEE STD 1722.1™-2013 Clause 8).
6) If the AVDECC Entities support it, configure the backup Media Clock Stream source information with the SET_STREAM_BACKUP command (IEEE STD 1722.1™-2013 Clause 7.4.74)