

SMPTE STANDARD

D-Cinema Operations — Auxiliary Content Synchronization Protocol



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Foreword

SMPTE (the Society of Motion Picture and Television Engineers) is an internationally-recognized standards developing organization. Headquartered and incorporated in the United States of America, SMPTE has members in over 80 countries on six continents. SMPTE's Engineering Documents, including Standards, Recommended Practices, and Engineering Guidelines, are prepared by SMPTE's Technology Committees. Participation in these Committees is open to all with a bona fide interest in their work. SMPTE cooperates closely with other standards-developing organizations, including ISO, IEC and ITU.

SMPTE Engineering Documents are drafted in accordance with the rules given in Part XIII of its Administrative Practices.

SMPTE ST 430-10 was prepared by Technology Committee 21DC.

Intellectual Property

At the time of publication no notice had been received by SMPTE claiming patent rights essential to the implementation of this Standard. However, attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. SMPTE shall not be held responsible for identifying any or all such patent rights.

1 Scope

This document defines a protocol for synchronizing auxiliary resources in a composition playlist to the playback timeline.

2 Conformance Notation

Normative text is text that describes elements of the design that are indispensable or contains the conformance language keywords: "shall", "should", or "may". Informative text is text that is potentially helpful to the user, but not indispensable, and can be removed, changed, or added editorially without affecting interoperability. Informative text does not contain any conformance keywords.

All text in this document is, by default, normative, except: the Introduction, any section explicitly labeled as "Informative" or individual paragraphs that start with "Note:"

The keywords "shall" and "shall not" indicate requirements strictly to be followed in order to conform to the document and from which no deviation is permitted.

The keywords, "should" and "should not" indicate 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; or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited.

The keywords "may" and "need not" indicate courses of action permissible within the limits of the document.

The keyword "reserved" indicates a provision that is not defined at this time, shall not be used, and may be defined in the future. The keyword "forbidden" indicates "reserved" and in addition indicates that the provision will never be defined in the future.

A conformant implementation according to this document is one that includes all mandatory provisions ("shall") and, if implemented, all recommended provisions ("should") as described. A conformant implementation need not implement optional provisions ("may") and need not implement them as described.

Unless otherwise specified, the order of precedence of the types of normative information in this document shall be as follows: Normative prose shall be the authoritative definition; Tables shall be next; followed by formal languages; then figures; and then any other language forms.

3 Normative References

Note: All references in this document to other SMPTE documents use the current numbering style (e.g. SMPTE ST 336:2007) although, during a transitional phase, the document as published (printed or PDF) may bear an older designation (such as SMPTE 336M-2007). Documents with the same root number (e.g. 336) and publication year (e.g. 2007) are functionally identical.

The following standards contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below.

[336] SMPTE ST 336:2007, Data Encoding Protocol Using Key-Length-Value

[IANA] Internet Assigned Numbers Authority. See www.iana.org/assignments/port-numbers

[CPL] SMPTE ST 429-7:2006, D-Cinema Packaging — Composition Playlist

[RPL] SMPTE ST 430-11:2010, D-Cinema Operations — Auxiliary Resource Presentation List

4 Glossary

The following paragraphs define the acronyms used in this document.

ACS:	Auxiliary Content Server
BER:	Basic Encoding Rules
CSP:	Auxiliary Content Synchronization Protocol (this document)
DCS:	Digital Cinema Server
HTTP:	Hypertext Transfer Protocol
KLV:	Key Length Value
RRP:	Request-Response Pair
Show:	An ordered sequence of compositions
RPL:	Auxiliary Resource Presentation List
TCP:	Transmission Control Protocol
UInt8:	8-bit unsigned integer
UInt32:	32-bit unsigned integer
UInt64:	64-bit unsigned integer
Int64:	64-bit signed integer
UUID:	Universally Unique Identifier
URI:	Uniform Resource Identifier
URL:	Uniform Resource Locator

5 Overview (Informative)

This document defines a protocol for synchronizing auxiliary resources in an Auxiliary Resource Presentation List (RPL) to the playback timeline. This protocol is intended for use between a Digital Cinema Server (DCS) and one or more Auxiliary Content Servers (ACS). Examples of such servers are:

- Caption servers
- Special effects servers (e.g. lightning strobe, chair rumble)
- Secondary display servers

5.1 Composition Playlist Resources

The Composition Playlist defines the resources to be presented during playout. At a minimum, these resources will consist of video and/or audio but may also contain subtitles, several types of captions, and other possible tracks. While each resource track is referred to by a single ID, the actual resource may consist of many files; e.g. font file, XML files, image files, etc.

5.2 Resource Loading

While the audio and video tracks in the Composition Playlist can be streamed in real time on a frame-by-frame basis, auxiliary content resources may have files that need to be preloaded (e.g. font files). Auxiliary content resources may be preloaded into the ACS to ensure that all concurrent files are ready to be used.

5.3 Protocol Description

Prior to playback, the DCS will create a new Auxiliary Resource Presentation list (RPL) file, whose location will be sent to the ACS. The ACS will use HTTP to connect back to the DCS to acquire the RPL and the first set of resources that needs to be cached. After the ACS has finished caching resources, it will indicate its status as OK. Once playback starts, the DCS will enable resource output and send timeline updates to the ACS which will render the resource associated with the current timeline value.

6 Communications Protocol

6.1 Control Protocol

The Control Protocol is a TCP-based protocol used to instruct the ACS which resources should be played with the timeline and when to play the referenced resources. The protocol operates in a master/slave fashion with the DCS sending requests and the ACS sending synchronous responses. As outlined in Annex B, the connection is first initiated by the ACS.

The SMPTE standardized messages in this protocol shall use well-known port 4170 which has been reserved for D-Cinema Auxiliary Content Synchronization Protocol RRs by the Internet Assigned Numbers Authority (see [IANA]).

6.1.1 Connection Establishment

The DCS shall listen for a connection on TCP port 4170. On connection initiation, the DCS must send the Announce request (See 7.2.1) to the ACS. On successful receipt of the Announce response, the DCS may send subsequent requests depending on whether resources need to be presented for the next payout.

- The DCS may send no future messages past the Announce request to the ACS if the next show or composition does not require auxiliary resources.
- The DCS shall send the Announce message regardless of whether communications to the ACS is necessary for the next payout.

6.1.2 Message Structure: Key Length Value (KLV)

Request and Response messages shall be Key Length Value (KLV) encoded using Fixed Length Pack encoding according to SMPTE ST 336 [336]. The Fixed Length Universal Label (UL) Key is given in Annex A of this document. As a Fixed Length Pack, each individual item in the Value field comprises only an item value. The KLV Length field shall be a long-form BER value encoded with a fixed length of 4 bytes total.

Example: For a KLV packet having a Value field that is 12 bytes in length, the Length field would be encoded as the following 4 bytes, 0x83 0x00 0x00 0x0C (hexadecimal).

Each Request-Response Pair (RRP) represents two message types and thus KLV UL "value" registration is required twice for each defined RRP (see Annex A).

6.2 General Message Elements

For each message type, the following shall apply:

- The message type is denoted within the opening KLV “Key” field (16 bytes).
- “Length” is a BER-encoded four byte field which describes the length of the message in bytes.
- “Request_ID” shall be an application level tag for the Request, which shall be echoed in the corresponding Response. A non-zero Request_ID value shall be set by the DCS, which should select unique values (e.g. a sequencing counter) for each connection it manages. (Request_ID generation means is left to implementers and is out of the scope of this specification.)
- Multi-byte integer values shall be sent as big-endian data; i.e., the most significant byte is transmitted first.

6.3 General Message Requirements

RRP transactions shall be synchronous (i.e., each pairing shall be opened and closed before a new RRP is opened between the same two entities). To avoid hang-ups, ACS implementations shall have a maximum round-trip Request-to-Response latency of 2 seconds. Latency shall be measured from the end of the “Request” message receipt to the start of the “Response” message transmission. If the ACS is too busy to accept or process a request, it shall send the corresponding response with the General Status Response Key of the Status Response set to ACS Busy.

Should the ACS fail to respond (at all) after the 2 second time limit, the DCS may consider this a communications failure condition and may close the TCP connection.

6.4 Status Responses

Each response message shall contain a general status response value. The Status Response element is represented by the following structure:

Item Name	Type	Len	Meaning
General Status Response Key	Uint8	1	General Status Response
Response Text Length	BER Length	4	Response Text Length
Response Text Value	Text	Var	Response Text Value

6.4.1 General Status Response Key

The General Status Response element identifies the general response for the response message. Possible response values are as follows:

Element	Meaning	UINT8 Value
RRP successful	Request successfully processed	0
RRP failed	ACS unable to process Request	1
RRP Invalid	Invalid parameter or Request structure	2
ACS Busy	ACS too busy to process Request	3
Lease Timeout	Lease not valid for last transaction	4
Playout ID Mismatch	RPL and CSP Playout ID mismatch	5
General Error	General Error response	6
Recoverable Error	Recoverable Error	7
RPL Error	Error parsing RPL	8
Resource Error	Error parsing resource file	9
Processing	ACS busy getting or interpreting resources	10
Reserved	Reserved Response Elements	11-255