SMPTE and Interop DCP Guidelines
Including Accessibility

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NOTICE

This document serves as an exchange of information, combining best practices developed by ISDCF and SMPTE. While this document is periodically updated, it is the responsibility of the reader to review the references provided for the latest revisions.

This document is available online at http://mkpe.com/smpte-dcp/

SMPTE DCP

The SMPTE DCP stage reflects the set of published SMPTE specifications as summarized and constrained by SMPTE ST429-2, D-Cinema Packaging – DCP Operational Constraints. SMPTE DCPs, KDMs, and Certificates shall follow the specifications in Table 1 below. While Table 1 lists the core specifications for SMPTE DCP requirements, developers should note that this list may not be complete. Normative references may apply, and DCI imposes additional requirements for both DCP and playback that are not contained in the SMPTE standards.

Players must be compatible with both SMPTE DCP and Interop DCP. Developers should note that there are distinct differences between SMPTE DCP and Interop DCP in the XML namespace, and in the partitions and ULs. In addition, there are differences in requirements for content, KDM and Certificate validation.

SMPTE standards may be purchased in the SMPTE store at https://store.smpte.org/

Specification	Document	Comments
Sound & Picture Track File	SMPTE 429-3	Three partitions required.
Track File Encryption	SMPTE 429-6	Similar to JPEG Interop but uses correct encrypted essence key and MIC value.
Constraints	SMPTE 429-2	Additional constraints such as: • All Reels must have picture and sound • Picture size constraints • Timed text rate • Hash element is required for encrypted track
Key Delivery Message	SMPTE 430-1	All elements required by the SMPTE spec and by DCI must be present and validated for playback to take place.
Certificate	SMPTE 430-2	DCI requirements must be met.
Extra-theater messages	SMPTE 430-3	
Asset Map	SMPTE 429-9	Filename is ASSETMAP.xml
Composition Playlist	SMPTE 429-7	Uses SMPTE namespace.
Subtitles	SMPTE 429-5 and SMPTE 428-7	Change to XML source format. Subtitle track file is now an MXF file that encapsulates XML source and aux data and supports encryption. No special packaging directory structure needed.
Sound	SMPTE 382M	ChannelAssignment label allows multiple channel assignments to be used.
JPEG 2000 Wrapping	SMPTE 422M	JPEG subdescriptor UL is now correct.
JPEG 2000 D-Cinema Application	SMPTE 429-4	
Packing List	SMPTE 429-8	The GroupID element was added to support delivery of “Asset Packages.”
Stereoscopic Picture Track File	SMPTE 429-10	StereoscopicPicture Sub Descriptor added to identify stereo essence.
Closed Captions	SMPTE 429-12 and SMPTE 428-10	

Table 1. SMPTE DCP

SMPTE DCP System Requirements

1. *The system is required to provide the capability for 16 channels of audio playback.* (DCI Specification v1.2, Section 7.5.6.1)

2. *The digital cinema server shall route Access Audio tracks (HI and VI-N) to owner-designated outputs.* (NATO Requirements v2.1, Section 4.3)

For more information:
DCI Specification: http://dcimovies.com/specification/
NATO System Requirements: http://www.natoonline.org/Digital.htm

SMPTE Closed Caption Communication Protocol

The CSP/RPL protocol is standardized by SMPTE and recommended for implementation in all players. The protocol provides the communication method between players and 3rd party closed caption systems, and is defined by these standards:

SMPTE standards may be purchased in the SMPTE store at https://store.smpte.org/

ST430-10 Digital Cinema Operations:
Auxiliary Content Synchronization Protocol (CSP)

ST430-11 Digital Cinema Operations:
Auxiliary Resource Presentation List (RPL)

Transitional 1, or JPEG Interop or Interop DCP (Legacy Format)

The Interop DCP is the legacy distribution format for digital cinema. While it is encouraged that distributions eventually migrate to SMPTE DCP format, players must continue to support Interop DCP format. Interop DCPs, KDMs and Certificates shall follow the specifications in Table 2 below. Note that that "mpeg_ii" stands for MPEG Interop Initiative, the name of the effort that led to Interop DCP. Also note that the Interop DCP stage does not include projector configuration (PCF) files.

Interop documents may be downloaded at ftp://ftp.digicine.com/Document_Release_2.0. Please note that we do not manage this site, but will forward requests for the password.

Specification	Document	Comments
Sound & Picture Track File	mpeg_ii_track.doc (v2.7)	Some ULs are not listed in any Registry. Only two partitions allowed. Undocumented change from MPEG to JPEG encoding.
Track File Encryption	mpeg_ii_track_file_encryption.doc (v5)	Key indicating encrypted essence in KLV triplet is not registered. Files may not have proper MIC value.
Constraints	mpeg_ii_pack_constraints.doc (v2.6)	
Key Delivery Message	SMPTE 430-1	Some fields required by DCI are not populated or are ignored upon playback. Note that the `ContentAuthenticator` field is not used.
Certificate	SMPTE 430-2	Certificate rules may not be enforced.
Extra-theater messages	SMPTE 430-3	
Asset Map	mpeg_ii_am_spec.doc (v3.4)	Filename is ASSETMAP
Composition Playlist	mpeg_ii_cpl_spec.doc (v2.4)	
Subtitles	TI_sub-titling_2504760b.pdf	Subtitle track file is an XML file that cannot be encrypted. Requires special directory structure to deliver.
Sound	S382M-GC-aesbwf-20040808.zip	Supports only a single, fixed, 6- channel mapping
JPEG 2000 Wrapping	MXF J2K-v3e 200509231.doc	JPEG Subdescriptor UL is not registered.
JPEG 2000 D-Cinema Constraints	MXF JPEG 2000 Application for D- Cinema (SMPTE 3285B)	Very similar to final SMPTE specification.
Packing List	mpeg_ii_pkl_spec.doc (v2.4)	
Stereoscopic Picture Track File	3D_Interop_Single_File_2007_18_05_v1_ 5.doc	Similar to SMPTE 429-10, but uses Digicine namespace for CPL and uses unregistered JPEG subdescriptor UL.
Closed Captions	ClosedCaption_Interop_2007_11_16_v1_9(clean) .pdf	

Table 2. Interop DCP

INTEROP DCP 16-channel Audio Packaging Guide

This is an ISDCF Recommendation, revised March 1, 2011, available at http://www.isdcf.com/ISDCF/Technical_Documents.html.

The audio channel ordering shown in Table 3 below is recommended for use in all Interop DCP compositions. Note that audio channel numbers for Interop DCP map one-to-one to the audio outputs of a player. For this reason, Table 3 also identifies the recommended audio wiring in cinemas.

Container Channel	Configuration			General Loudspeaker Position
	5.1	7.1 SDDS	7.1 DS	
1	L	L	L	Left
2	R	R	R	Right
3	C	C	C	Center
4	LFE	LFE	LFE	Low frequency effects
5	Ls	Ls	Lss	Left surround (or left side surround)
6	Rs	Rs	Rss	Right surround (or right side surround)
7	HI			Hearing impaired (with emphasis on dialog)
8	VI-N			Visually impaired narrative (audio description)
9	--	Lc	--	Left center
10	--	Rc	--	Right center
11	--	--	Lrs	Left rear surround
12	--	--	Rrs	Right rear surround
13	Motion Data			Synchronous signal (currently used by D-Box)
14	--	--	--	*Unused at this time*
15	--	--	--	*Unused at this time*
16	--	--	--	*Unused at this time*

Table 3. Interop 16-Channel Default Audio Assignments

Note 0. While Table 3 above is a recommendation meant to capture and encourage common practice, it is not guaranteed that all Interop DCPs past , present, or future will follow this recommendation.

Note 1. Not all channels need to be present in a given DCP. For instance, only the first 8 channels should be used when delivering 5.1 + HI/VI content. In all cases, an even number of channels shall be used.

Note 2. While some labels are reused across all configurations for convenience, the corresponding channel may not carry the identical signal. For instance, the signal labeled "Lss" in a 7.1DS mix may not be identical to the signal labeled "Ls" in the 5.1 mix for the same title.

Note 3. Due to the absence of channel or configuration labels, the actual channel configuration may not always be inferred by channel count and preferably be indicated through other means, e.g.name of the CPL.

Note 4. Theatre equipment is responsible for rendering the audio channels to the appropriate combination of auditorium speakers. In particular, theatre equipment may choose to render the left surround channel (Ls) of a 5.1 content to all left surround speakers, including back left surround speakers.

Note 5. Delivery of a 7.1DS CPL (without a matching 5.1 CPL in the same delivery) to a 5.1 theatre is not recommended since theatre playback equipment is not guaranteed to accurately render a 7.1DS to a 5.1 auditorium.

Note 6. Content using the 5.1 configuration may contain a back surround signal matrix-encoded in the Ls and Rs signals – see the 5.1 w/ Surround EX soundfield configuration below.

Note 7. A discrete 6.1 configuration is not defined in Interop.

Note 8: SMPTE sound labels should not be used for Interop-DCPs. (With channel labeling some equipment may not be able to recognize the labels with Interop-DCP packages, and may not play.)

Soundfield Configurations

Figure 1 below depicts the soundfields for the configurations described above.

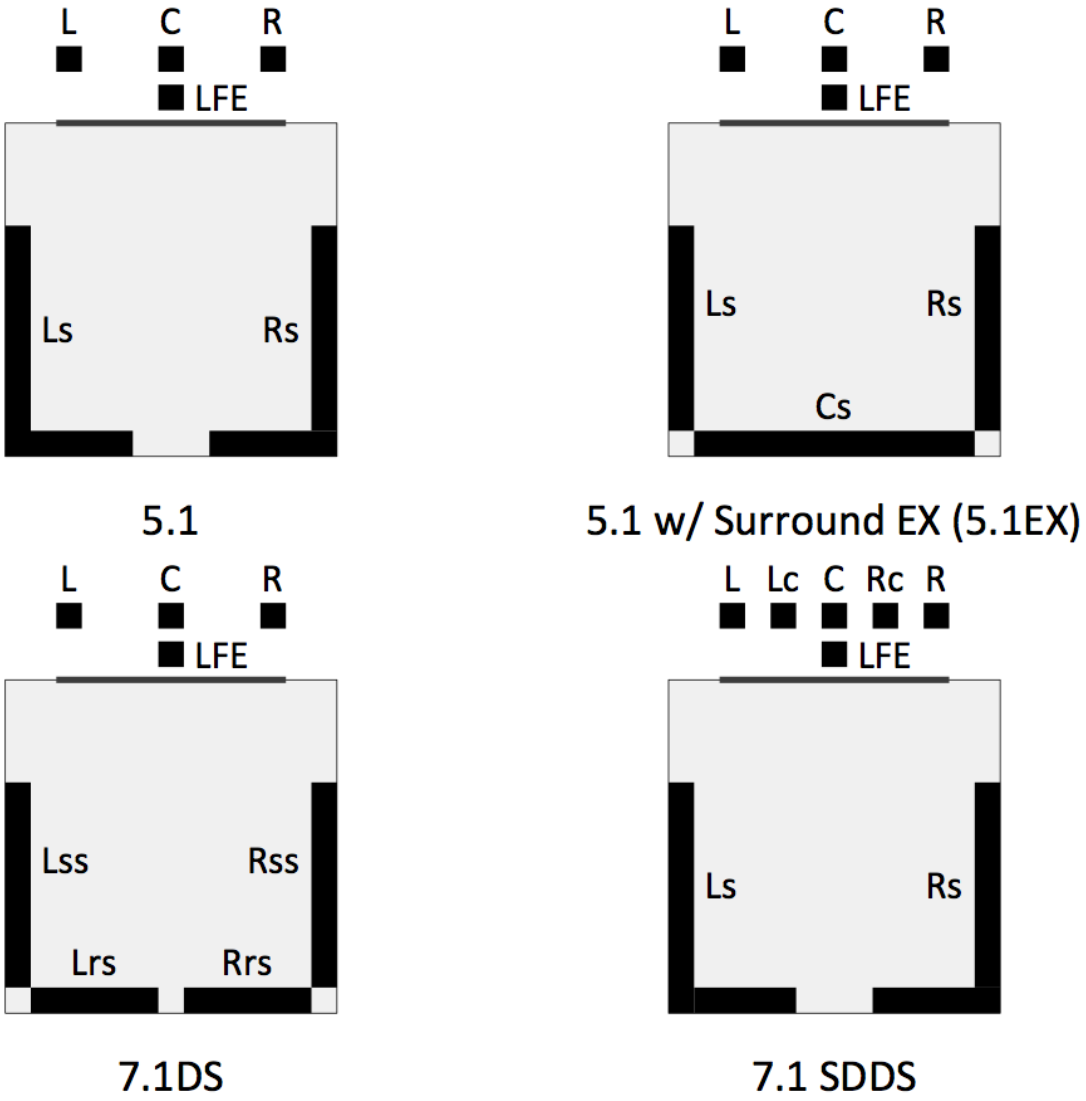

Figure 1. Soundfields

Note 1. The Ls and Rs component of the 5.1 soundfield may not extend to the back of the auditorium in all situations.

Note 2. The Ls and Rs component of the 7.1 DS soundfield may extend to the back of the auditorium in some situations.

Digital Cinema Naming Convention

The preferred method to communicate the nature of essence is to view the metadata that is within the composition files. However, few, if any, products allow the user to do this. (Server and TMS manufacturers, are you listening?) To compensate, an effort evolved to convey this information in the **ContentTitleText** element of the **Composition Playlist (CPL)** in both SMPTE DCP and Interop DCP. The output of this effort, the Digital Cinema Naming Convention, recommends the methodology for generating this field. The Digital Cinema Naming Convention is illustrated in Figure 2 below, and described in detail at http://DigitalCinemaNamingConvention.com.

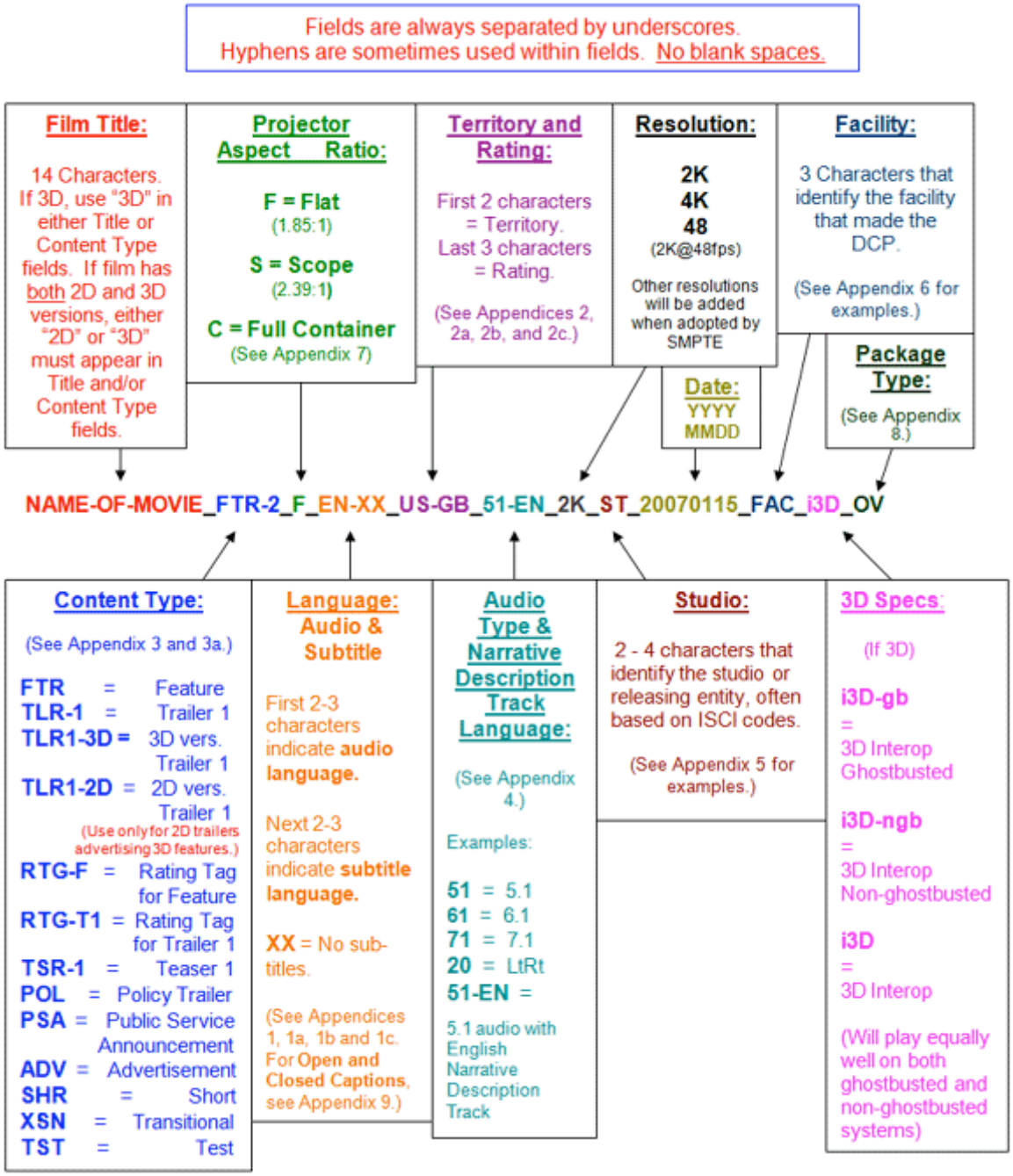

Figure 2. Digital Cinema Naming Convention