

**ATSC Candidate Standard:  
Advanced Common Application Platform (ACAP)**

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The Advanced Television Systems Committee, Inc., is an international, non-profit organization developing voluntary standards for digital television. The ATSC member organizations represent the broadcast, broadcast equipment, motion picture, consumer electronics, computer, cable, satellite, and semiconductor industries.

Specifically, ATSC is working to coordinate television standards among different communications media focusing on digital television, interactive systems, and broadband multimedia communications. ATSC is also developing digital television implementation strategies and presenting educational seminars on the ATSC standards.

ATSC was formed in 1982 by the member organizations of the Joint Council on InterSociety Coordination (JCIC): the Electronic Industries Association (EIA), the Institute of Electrical and Electronic Engineers (IEEE), the National Association of Broadcasters (NAB), the National Cable Television Association (NCTA), and the Society of Motion Picture and Television Engineers (SMPTE). Currently, there are approximately 140 members representing the broadcast, broadcast equipment, motion picture, consumer electronics, computer, cable, satellite, and semiconductor industries.

ATSC Digital TV Standards include digital high definition television (HDTV), standard definition television (SDTV), data broadcasting, multichannel surround-sound audio, and satellite direct-to-home broadcasting.

### **About the Candidate Standard**

This specification is being put forth as a Candidate Standard by the T3/S2 Specialist Group on Advanced Common Application Platform. ATSC members and non-members are encouraged to review and implement this specification and return comments to [cs101-editor@atsc.org](mailto:cs101-editor@atsc.org). ATSC Members can also send comments directly to the T3/S2 Specialist Group. The ATSC believes this specification is stable. It is expected to progress to Proposed Standard after a duration of approximately 6 months as Candidate Standard.

### **Editor's Note**

This document is a work in process. As such, notes are included in some portions of the document indicating editorial items remaining to be addressed and substantive questions and/or open issues. These items will be addressed as part of the ongoing work on CS/101 that will occur during the Candidate Standard phase. Note also that this document is a reformatted version of the CS/101 Candidate Standard published on 1 October 2003 except for reformatting to address certain file compatibility issues.

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## **Candidate Standard: Advanced Common Application Platform (ACAP)**

### **1. SCOPE**

#### **1.1 Status**

This section describes the status of this document at the time of its publication. Other documents may supersede this document. The latest status of this document series is maintained by the ATSC. This specification is a working draft of the ACAP group.

#### **1.2 Purpose**

The present document defines the Advanced Common Application Platform, henceforth referred to as ACAP. ACAP is applicable for specifications and standards based on the ACAP APIs, content formats, and semantic guarantees.

The reader's attention is called to the possibility that compliance with this standard may require use of an invention covered by patent rights. By publication of this standard, no position is taken with respect to the validity of this claim, or of any patent rights in connection therewith. The patent holder has, however, filed a statement of willingness to grant a license under these rights on reasonable and nondiscriminatory terms and conditions to applicants desiring to obtain such a license. Details may be obtained from the publisher.

This specification is firstly intended to be used by entities writing terminal specifications and/or standards based on ACAP. Secondly it is intended for developers of applications that use the ACAP functionality and APIs. The ACAP specification aims to ensure interoperability between ACAP applications and different implementations of platforms supporting ACAP applications.

*Note:* This specification defines the interfaces visible to applications. Application developers should not assume that any related interface is available unless it is specifically listed. Terminal standards or implementations may have other interfaces present.

An ACAP Application is a collection of information which is processed by an application environment in order to interact with an end-user or otherwise alter the state of the application environment.

ACAP Applications are classified into two categories depending upon whether the initial application content processed is of a procedural or a declarative nature. These categories of applications are referred to as procedural (ACAP-J) and declarative (ACAP-X) applications, respectively. An example of an ACAP-J application is a Java TV™ Xlet composed of compiled Java™ byte code in conjunction with other multimedia content such as graphics, video, and audio. An example of an ACAP-X application is a multimedia document composed of XHTML markup, style rules, scripts, and embedded graphics, video, and audio.

*Note:* An ACAP application need not be purely procedural or declarative. In particular, an ACAP-J application may reference declarative content such as graphic content or may construct and cause the presentation of markup content. Similarly, ACAP-X applications often make use of script content, which is procedural in nature. Furthermore, an ACAP-X application may reference an embedded Java TV Xlet.

Application environments are similarly classified into two categories depending upon whether they process procedural or declarative applications. These categories are referred to as ACAP-J and ACAP-X environments, respectively. An example of an ACAP-J environment is a Java Virtual Machine and its associated Application Programming Interface (API) implementation. An example of an ACAP-X environment is an XHTML multimedia document browser, also known as a user agent.

### 1.3 Application

The architecture and facilities of the ACAP Standard are intended to apply to broadcast systems and receivers for terrestrial (over-the-air) broadcast and cable TV systems. In addition, the same architecture and facilities may be applied to other transport systems (such as satellite).

## 2. GENERAL CONSIDERATIONS

### 2.1 Format

ACAP is primarily based on GEM [1] and DASE [5], and includes additional functionality from OCAP [4]. GEM provides a framework for the definition of a GEM Terminal Specification. This document builds on GEM by adding specification elements in order to offer a higher degree of interoperability among different environments based on digital TV specifications from ATSC and SCTE.

It is expected that future versions of DASE and OCAP will be based on this specification.

### 2.2 Inclusion of GEM

This document includes GEM [1] in its entirety. To be fully compliant with this specification, equipment shall also be fully compliant with GEM [1].

### 2.3 Addition of Non-ACAP Interfaces

Terminal specifications based on ACAP may add public interfaces, provided that they are added in a namespace that does not conflict with ACAP. For example, OCAP [4] defines extensions to the ACAP-J applications environment in the Java packages `org.ocap` and `org.atsc`.

ACAP terminal specifications and ACAP terminals shall not require that such extension interfaces be called by ACAP applications in order to enable behavior that is normatively required by this specification.

### 2.4 Application Areas

In this version of this specification, the same application areas as GEM [1] Section 0.5 are considered.

### 2.5 Profiles

The informative text referenced from GEM [1] Section 0.6 describes the GEM approach to profiles. The profiles defined in this specification are modeled on a similar scheme.

This specification defines two profiles, an ACAP-J Profile and a combined ACAP-J and ACAP-X Profile. They are detailed in Section 16, "Detailed platform profile definitions."

### 3. DEFINITIONS AND ABBREVIATIONS

#### 3.1 Definitions from GEM

The definitions from GEM [1] Chapter 3 apply to this specification.

#### 3.2 Definitions Introduced by ACAP

For the purposes of the present document, the following terms and definitions apply:

**ACAP Application** An application that is written only to the interfaces and semantic guarantees defined in ACAP. A suitably signaled ACAP application will run on any terminal that complies to an ACAP terminal specification.

**ACAP Terminal** A terminal or other device that conforms to an ACAP Terminal Specification. Examples of ACAP terminals include an OCAP terminal (including the CableCard Module) and a terminal supporting the DASE PAE.

**ACAP Terminal Specification** An ACAP terminal specification is a specification that includes all normative and selected optional elements of its underlying ACAP specification, and provides additional specifications as required.

**Trusted Application** An application that is eligible to be trusted and to which is granted access to some sensitive resources.

#### 3.3 Abbreviations from GEM

The definitions from GEM [1] Chapter 4 apply to this specification.

#### 3.4 Abbreviations Introduced by ACAP

For the purposes of the present document, the following abbreviations apply:

**ACAP**           Advanced Common Application Platform

**ACAP-J**        ACAP Procedural (Java)

**ACAP-X**        ACAP Declarative (XHTML)

#### 3.5 Conformance Keywords

As used in this document, the conformance keyword *shall* denotes a mandatory provision of the Standard. The keyword *should* denotes a provision that is recommended but not mandatory. The keyword *may* denotes a feature whose presence does not preclude compliance, that may or may not be present at the option of the application or the system implementer.

##### 3.5.1 Section and Data Structure Syntax Notation

This document contains symbolic references to syntactic elements. These references are typographically distinguished by the use of a different font (e.g., *restricted*), may contain the underscore character (e.g., *sequence\_end\_code*) and may consist of character strings that are not English words (e.g., *dynrng*).

The formats of sections and data structures in this document are described using a C-like notational method employed in ISO/IEC 13818-1.



## 4. REFERENCES

### 4.1 Normative References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

The following comments apply to particular sources of documents:

- (1) Where the reference is to an ISO specification, it is considered to be a “non-specific” reference; additionally, officially published amendments and corrigenda are considered to automatically update the referenced document.
- (2) Where an ISBN number is provided for a referenced document, it is considered to be “specific reference”.
- (3) References to RFCs are considered to be “specific references”. An RFC being indicated obsoleted by another RFC is not considered significant.
- (4) URL references with note [4] are provided for convenience to access the document in electronic form.
- (5) URL references with note [5] are the normative method to access the reference.
- (6) ETSI specifications are available from the ETSI server at: <http://www.etsi.org>. However, the ETSI server provides the current edition of the specification and in every case this specification makes “specific” references which in the future may not be the current reference.

*Note:* The extent to which all or part of the following references are normative is specified at the locations in the main body of this specification where they are used. Listing a reference here does not imply that all of a reference is required.

Editor: expand descriptions of following references to use customary bibliographic citations; consider reordering by publishing agency/organization, e.g., ATSC references, ECMA references, ETSI references, etc. Remove references that aren't cited in text.

Reference	Edition	Description	Note
[1] GEM	1.0.1	Digital Video Broadcasting (DVB), Globally Executable MHP version 1.0.1, available as ETSI TS 102 819 V 1.2.1	(6)
[2] MHP 1.0	1.0.3	Digital Video Broadcasting (DVB), Multimedia Home Platform version 1.0.3, available as ETSI TS 101 812 V 1.3.1	(6)
[3] MHP 1.1	1.1.1	Digital Video Broadcasting (DVB), Multimedia Home Platform version 1.1.1, available as ETSI TS 102 812 V1.2.1	(6)
[4] OCAP 1.0	1.0	OpenCable Application Platform Specification, OCAP 1.0 Profile	
[5] A/100-1	1.0	DASE-1 Part 1: Introduction, Architecture, and Common Facilities, A/100-1, ATSC	
[6] A/52A		ATSC A/52A, “Digital Audio Compression (AC-3) Standard, Rev. A,” 20 August 2001	

[7]	A/53B		ATSC A.53B, "ATSC Digital Television Standard, Revision B, with Amendments 1 and 2," 7 August 2001 (Amendment 1 dated 23 May 2002; Amendment 2 dated 19 May 2003)	
[8]	SCTE 43		Digital Video System Characteristics Standard for Cable Television	
[9]	ISO 15706		Information and documentation - International Standard Audiovisual Number (ISAN)	
[10]	ISO 20925-1	(work in progress)	Information and documentation - Identifier for versions of audiovisual works (V-ISAN) - Part 1: Format and use.	
[11]	ATSC A/57A		ATSC A/57A, "Content Identification and Labeling for ATSC Transport," 1 July 2003	
[12]	OP-SC		OpenCable Security Specification	
[13]	ATSC T3-548	2001	Technical Group Report: "Advanced television Systems Committee Usage of the MPEG-2 Registration Descriptor," 9 October 2001	
[14]	ATSC T3-549	2001	Technical Group Report: "Collision Avoidance for Private Fields and Ranges," 9 October 2001	
[15]	ATSC T3-575	R13	Code Point Registry	
[16]	CORBA	2.1	Common Object Request Broker Architecture: Interoperable Object Protocol Specification	
[17]	EN 301 192	1.3.1	Digital Video Broadcast Specification for Data Broadcasting	
[18]	ETR 162	Edition 1	Digital Video Broadcasting (DVB); Allocation of Service Information (SI) codes for DVB systems	
[19]	ETS 300 468	Edition 2	Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB systems	
[20]	ISO 639.2	1.0	Code for the Representation of Names of Languages: Part 1	
[21]	ISO 8859-1	1.0	Information Technology: 8-Bit Single-Byte Coded Graphic Character Sets: Part 1: Latin Alphabet No. 1	
[22]	ISO 13818-1	Second Edition (2000)	Information Technology: Generic Coding of Moving Pictures and Associated Audio Information: Systems	
[23]	ISO 13818-6	First Edition (1998)	Information Technology: Generic Coding of Moving Pictures and Associated Audio Information: Extensions for Digital Storage Media Command and Control	
[24]	PNG	1.0.1	Portable Network Graphics	
[25]	RFC 1738		Universal Resource Locators (URL)	
[26]	RFC 1950		ZLIB Compressed Data Format Specification (Version 3.3)	
[27]	RFC 1951		DEFLATE Compressed Data Format Specification (Version 1.3)	
[28]	RFC 2045		Multipurpose Internet Mail Extensions (MIME) Part One: Format of Internet Message Bodies	
[29]	RFC 2396		Uniform Resource Identifiers (URI): Generic Syntax	
[30]	SCTE 40		Digital Cable Network Interface Standard	
[31]	SCTE 54		Digital Video Service Multiplex and Transport System Standard for Cable Television	
[32]	TR 101 162	1.0	Digital Broadcasting Systems for Television, Sound, and Data Services: Allocation of Service Information (SI) Codes for Digital Video Broadcasting (DVB) Systems	
[33]	CSS-BOX	Working Draft	CSS3 Module: The Box Model, W3C	
[34]	CSS-COLOR	Working Draft	CSS3 Module: Color, W3C	
[35]	CSS-TV	Candidate Recommendation	CSS TV Profile 1.0, W3C	
[36]	CSS-UI	Working Draft	CSS3 Module: Basic User INterface, W3C	

[37] A/100-8	1.0	DASE-1 Part 8: Conformance, A/100-8, ATSC	
[38] A/100-2	1.0	DASE-1 Part 2: Declarative Applications and Environments, A/100-2, ATSC	
[39] RFC 2616		Hypertext Transfer Protocol -- HTTP/1.1. R. Fielding, J. Gettys, J. Mogul, H. Frystyk, L. Masinter, P. Leach, T. Berners-Lee. June 1999	
[40] T3/S16-030	(work in progress)	ATSC T3/S16-030, "Interaction Channel Protocols," Working Draft	
[41] RFC 1034		Domain names - concepts and facilities. P.V. Mockapetris. Nov-01-1987.	
[42] RFC 1035		Domain names - implementation and specification. P.V. Mockapetris. Nov-01-1987.	
[43] A/100-4	1.0	ATSC DASE-1 Part 4, A/100-4, "Application Programming Interface," 9 March 2003	
[44] A/100-3	1.0	ATSC DASE-1 Part 3, A/100-3, "Procedural Applications and Environment," 9 March 2003	
[45] SCTE 65		Service Information Delivered Out-Of-Band for Digital Cable Television	
[46] SCTE 08		Cable and Satellite Extensions to ATSC System Information Standards	
[47] A/65B		ATSC A/65B, "Program and System Information Protocol for Terrestrial Broadcast and Cable, Rev. B," 18 March 2003	
[48] CSS	Recommendation	Cascading Style Sheets, Level 2, W3C	
[49] DOM2 EVENTS	Recommendation	Document Object Model (DOM) Level 2 Events, W3C	
[50] ECMAScript		ECMAScript Language Specification, 3rd Ed., ECMA-262, ECMA	
[51] MIME-MEDIA		Multimedia Internet Mail Extensions (MIME) Part Two: Media Types, RFC2046, IETF	
[52] A/94		ATSC A/94, "ATSC Data Application Reference Model," 16 August 2002	
[53] EIA-708-B		"Digital Television (DTV) Closed Captioning"	
[54] HTML	4.01	HTML 4.01 Specification, W3C	
[55] ISO/IEC 11172-3	1993	Information technology – Coding of moving pictures and associated audio for digital storage media at up to about 1.5 Mbits/s – Part 3: Audio	
[56] ETR 154	3.0	Digital Video Broadcasting (DVB); Implementation Guidelines for the use of MPEG-2 Systems	

## 4.2 Informative References

### 4.2.1 Informative References from MHP

GEM [1] Annex C is included in this specification.

### 4.2.2 Informative References Defined by ACAP

The following informative references apply to this specification.

Reference	Edition	Description	Note
[57] A/95		ATSC A/95, "Transport Stream File System," 25 February 2003	

### 4.3 Reference Acquisition

Editor: Review for completeness based on actual references cited in Sections 4.1 and 4.2 above.

#### 4.3.1.1 ATSC Standards

Advanced Television Systems Committee (ATSC), 1750 K Street N.W., Suite 1200 Washington, DC 20006 USA; Phone: +1 202 872 9160; Fax: +1 202 872 9161; <http://www.atsc.org/>.

#### 4.3.1.2 ECMA Standards

ECMA, 114, rue du Rhône, CH-1204 Geneva, Switzerland; Phone: +41 22 849 60 00; Fax: +41 22 849 60 01; <http://www.ecma.ch/>.

#### 4.3.1.3 ETSI Standards

ETSI Secretariat, 650, route des Lucioles, 06921 Sophia-Antipolis Cedex, France; Phone: +33 (0)4 92 94 42 00; Fax: +33 (0)4 93 65 47 16; <http://www.etsi.org/>.

#### 4.3.1.4 W3C Standards

World Wide Web Consortium (W3C), Massachusetts Institute of Technology, Laboratory for Computer Science, 200 Technology Square, Cambridge, MA 02139, USA; Phone: +1 617 253 2613; Fax: +1 617 258 5999; <http://www.w3.org/>.

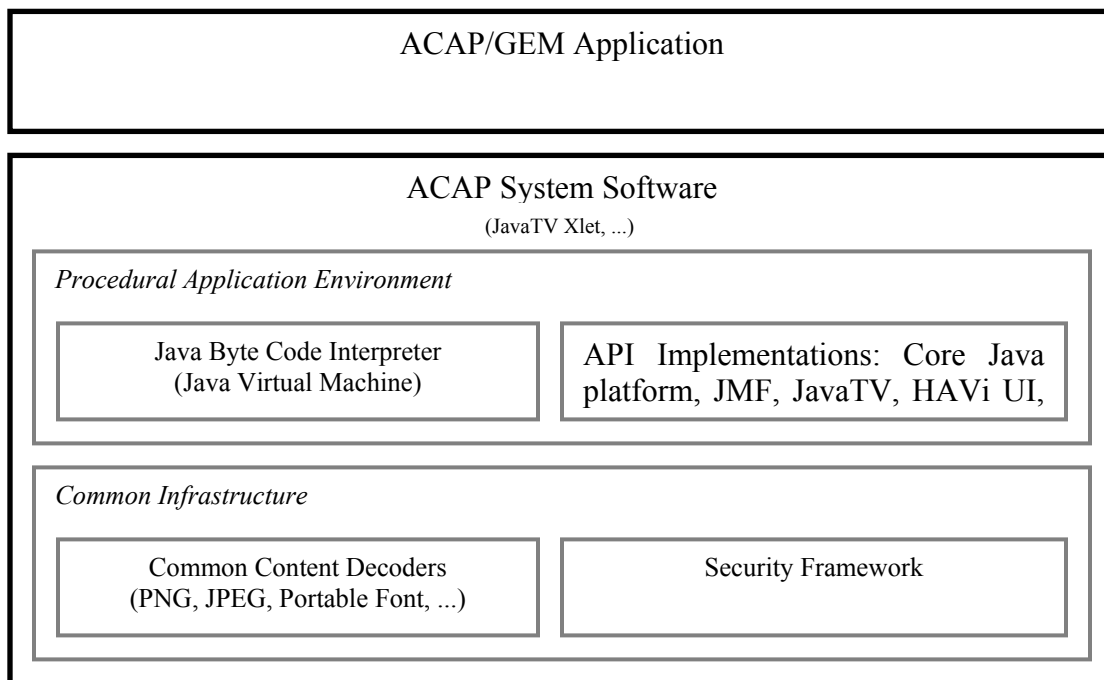
## 5. ARCHITECTURE

The architecture for ACAP is as specified in the MHP definition of the functional equivalent named “Arch” as specified in GEM [1] Clause 15.6. (See Section 17.1, “Compliance with GEM.”)

*Editor: Include table of functional equivalents as required by GEM 1.0.1.*

### 5.1 Support for ACAP-J Applications

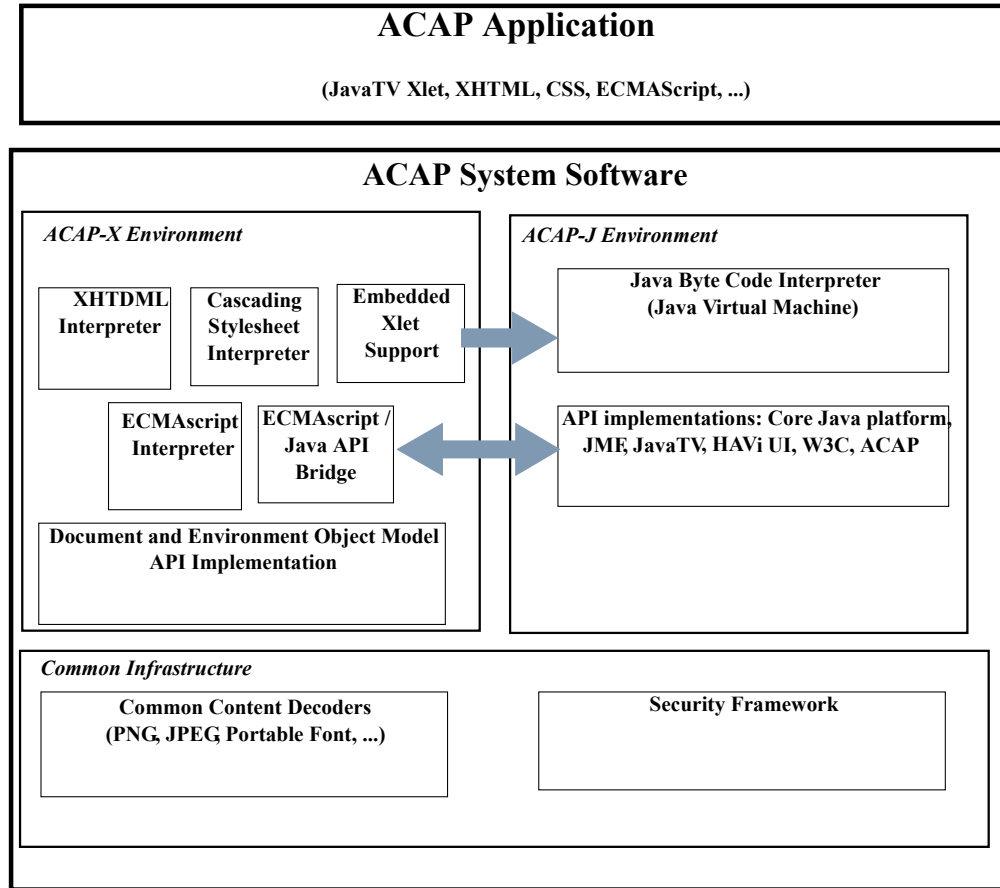
Where only ACAP-J applications are supported, the application and system software are as shown in **Figure 5-1** ACAP-J System Architecture..



**Figure 5-1** ACAP-J System Architecture.

### 5.2 Support of ACAP-X Applications

Where the optional ACAP-X applications are supported, the system application and systems software is as illustrated in **Figure 5-2** ACAP Application and System Software..



**Figure 5-2** ACAP Application and System Software.

Editor: Redraw for better presentation of figure.

## 6. COMMON CONTENT FORMATS

### 6.1 General

Chapter 7 of GEM [1] shall apply.

In this specification, support for PNG shall have an additional requirement beyond those requirements inherited from GEM, specifically that the tRNS chunk shall be supported for images where it is present and when it specifies one of the color types defined by PNG to be allowed to contain this chunk.

*Note:* The extent to which an ACAP terminal device can reproduce transparent colors is subject to those approximations defined by MHP [2], Section 15.1 “PNG Restrictions”. The above language does not modify these restrictions or impose additional requirements on the graphics hardware of an ACAP terminal device.

### 6.2 Static Formats

MPEG-1 Audio Layer 3 elementary stream data shall be supported as defined by ISO/IEC 11172-3 [55], as further constrained by ETR 154 [56].

### 6.3 Broadcast Streaming Formats

#### 6.3.1 Video

Video streamed over a terrestrial network shall be as defined by ATSC A/53B [7]. Video streamed over a cable network shall be as defined by SCTE 43 [8].

#### 6.3.2 Audio

Audio streamed over either terrestrial or cable networks shall be Dolby AC-3 data as defined by ATSC A/52A [6] and ATSC A/53B [7].

#### 6.3.3 Closed-Captioning

Closed captions shall be supported as defined by EIA-708-B [53]. For terrestrial networks, A/53B [7] shall also apply. For cable networks, NTSC Closed Caption data must be passed through the appropriate terminal outputs in accordance with ANSI/SCTE 43 (formerly DVS/258) [8]. Decoding and display of the NTSC Closed Caption data in the terminal is only required when the set-top terminal includes analog component (Y-Pb-Pr, RGB, YUV, etc.) or uncompressed digital outputs. In all cases, reconstruction of line-21 for analog NTSC outputs and pass-through of the content advisory information in a compressed SPTS on the IEEE-1394 interface is required.

*Note:* Products implementing this specification may need to comply with a number of other specifications or regulations for the support of closed captioning which are outside the scope of this specification.

## 7. ACAP-J APPLICATIONS AND ENVIRONMENT

This section defines the content of ACAP-J applications and the behavior and facilities required or permitted by an ACAP-J environment.

The definition of an ACAP-J application and environment is based on GEM [1] and OCAP [4]. When normative material is incorporated into this specification from GEM [1] and OCAP [4], the terms *GEM Application* and *OCAP Application* should be read in this specification as *ACAP-J application*; and *OCAP Execution Engine* should be read as an *ACAP-J environment*.

The content (MIME media) type used to label an ACAP-J application as an aggregate entity shall be application/acap-j.

### 7.1 Behavior

#### 7.1.1 Application Model

Chapter 9 of GEM [1] shall apply with the DVB-J model applying to ACAP-J applications.

### 7.2 Facilities

The content (MIME media) types specified in **Table 7-1** ACAP-J Content Types, may be used by an ACAP-J application and shall be supported by an implementation of an ACAP-J environment. In this table, the last column specifies zero or more file name extensions that should be used with files of this content type. The extension <x> designates a numeric value starting from zero (0) with no leading zeros. The extension N/A indicates that no extension is applicable since resources of this type are not named or do not appear in the broadcast file system or the content type describes a collection of resources. The extension others indicates that other, non-specific extensions are permitted.

**Table 7-1** ACAP-J Content Types

Content Type	See Section	Extensions
application/acap-certificate	12.4.1	.<x>
application/acap-digest	12.4.1	.hashfile
application/acap-j	7	N/A
application/acap-j-fontindex	7.2.2	.fontindex
application/acap-permission	6	.perm
application/acap-signature	12.4.1	.<x>
application/font-tdpfr	6	.pfr
application/java	7.2.1	.class
application/zip	7.2.3	.zip
audio/ac3	6.3.2	N/A
audio/mpeg	6	.mp2
image/jpeg	6	.jpg;.jpeg
image/mpeg	6	.mpg
image/png	6	.png
text/dvb.utf8	6	.txt; others
video/dvb.mpeg.drip	6	.drip
video/mpeg	6.3.1	N/A



video/mpv	6.3.1	N/A
-----------	-------	-----

An ACAP-J application shall contain at least one resource of content type `application/java`. The presence of resources of other content types in an ACAP-J application is strictly optional.

### 7.2.1 Java Content

An ACAP-J application shall use and an ACAP-J environment shall support Java Class Files as defined by MHP [2], Section 11, and as required by GEM [1], and as extended by the following subsections.

The content (MIME media) type used to label Java Class Files shall be `application/java`.

#### 7.2.1.1 Additional Java APIs

*Open Issue:* In the case that an ACAP terminal supports the ACAP-X environment, which entails support for HTTP, should `java.net.HttpURLConnection` support be required? If not, then should at least “http:” URL scheme support be required with `java.net.URLConnection()`?

##### 7.2.1.1.1 Closed Captioning

The `org.ocap.media` package as defined in Annex S of OCAP 1.0 [4].

##### 7.2.1.1.2 Locators

The `OcapLocator` class as defined in Annex G of OCAP 1.0 [4].

##### 7.2.1.1.3 Events

The `org.ocap.ui.event` package as defined in Annex E of OCAP 1.0 [4].

##### 7.2.1.1.4 Content Identification API

An object which implements the `javax.tv.service.guide.ProgramEvent` interface shall also implement the `org.atsc.si.ContentIdentifications` interface. An array of objects which implement `org.atsc.si.ContentIdentification` or the appropriate subinterface of `ContentIdentification` shall be returned by the method `getIdentifiers()` from the `ContentIdentifications` interface. In the case where the underlying program event does not contain content identifiers, the `getIdentifiers()` method shall return an empty array. An object which implements the `org.atsc.si.ISANIdentification` interface shall be a member of the array of `ContentIdentification` returned by the `getIdentifiers()` method when the underlying program event is identified with an ISAN identifier. An object which implements `VISANIdentification` shall be a member of the array of `ContentIdentification` returned by the `getIdentifiers()` method when the underlying program event is identified with a V-ISAN identifier. The format of the string returned by the `getISANIdentifier` method of `ISANIdentification` shall be conformant with ISO 15706 [9]. The format of the string returned by the `getVISANIdentifier` method of `VISANIdentification` shall be conformant with ISO 20925-1 [10].

*Note:* Content identification values carried by means of ATSC A/57A [11] may be present in the EIT, PMT, or both.

The Content Identification API is presented in Annex A, “Content Identification API.”

##### 7.2.1.1.5 Extended SI API

The `org.ocap.si` package as defined in Annex T, section T.3 of OCAP 1.0 [4].

### 7.2.1.2 Inter-Environment DOM Integration

If an ACAP System supports an ACAP-X environment, then it shall support the following additional packages, as further restricted below, in the ACAP-J environment:

- org.atsc.dom
- org.atsc.dom.environment
- org.atsc.dom.events
- org.atsc.dom.html
- org.atsc.dom.views
- org.w3c.dom
- org.w3c.dom.css
- org.w3c.dom.events
- org.w3c.dom.html2
- org.w3c.dom.views

Support for org.atsc.dom and its sub-packages as listed above shall adhere to A/100-4 [43], Sections 4.3 through 4.7, and shall be governed by the semantics defined by A/100-2 [38], Section 5.3.1.2, as further constrained by [<xref ACAP-X Script Content sub-section>](#).

Support for org.w3c.dom and its sub-packages as listed above shall adhere to A/100-3 [44], Section 5.1.1.2.6, except that support for org.w3c.dom.css shall be limited to the following interfaces:

- org.w3c.dom.css.CSSStyleDeclaration
- org.w3c.dom.css.ElementCSSInlineStyle

Furthermore, the following methods of org.w3c.dom.css.CSSStyleDeclaration shall not be used by an ACAP Application and need not be implemented by an ACAP System:

- getPropertyCSSValue(String)
- getParentRule()

If one of these methods is implemented by an ACAP System and invoked by an ACAP Application, then a runtime exception shall be raised.

### 7.2.1.3 ACAP-X Permissions API

*Editor: incorporate definitions of ACAP-X specific permission types: CookiePermission, RuntimeCodeExtension-Permission, InterEnvironmentBridgePermission; required only if ACAP-X environment is supported.*

### 7.2.1.4 Integration of the JavaTV SI API

As defined in Annex T, Section T.2.1.2.1 of OCAP 1.0 [4].

### 7.2.1.5 Addition of Non-ACAP Interfaces

As discussed in Section 2.3 (“Addition of Non-ACAP Interfaces”), terminal specifications based on ACAP may add extensions to ACAP, provided that they are added in a namespace that does not conflict with ACAP. In the case of the ACAP-J environment, any such extensions must be done in a Java package that does not conflict with one specified by ACAP.

### 7.2.1.6 GEM Functional Equivalents (Informative)

As specified in Section 19.1, “Compliance with GEM”, the APIs from the MHP definitions of the following functional equivalents as specified in GEM [1] Clause 15.6 are required to be supported:

- “Application Signaling”, which introduces the org.dvb.application package.

### **7.2.2 Font Index Content**

An ACAP-J application may use and an ACAP-J environment shall support Font Index Files as defined by MHP [2], Annex D.2.2.2, and required by GEM [1].

The content (MIME media) type used to label Font Index Files shall be `application/acap-j-fontindex`.

### **7.2.3 Archive Content**

An ACAP-J application may use and an ACAP-J environment shall support ZIP Archive Files as defined by MHP [2], Section 11.3.1.4, and as required by GEM [1].

The content (MIME media) type used to label a ZIP Archive File shall be `application/zip`.

## **7.3 Addition of Non-ACAP Interfaces**

As discussed in Section 2.3 (“Addition of Non-ACAP Interfaces”), terminal specifications based on ACAP may add extensions to ACAP, provided that they are added in a namespace that does not conflict with ACAP. In the case of the ACAP-J environment, any such extensions must be done in a Java package that does not conflict with one specified by ACAP.

## 8. ACAP-X APPLICATIONS AND ENVIRONMENT

This section defines the content of ACAP-X applications and the behavior and facilities required or permitted by an ACAP-X environment.

The definition of an ACAP-X application and environment is based on DASE Declarative Applications and Environment as defined by A/100-2 [38] and other parts of ATSC Standard A/100. When normative material is incorporated into this specification from the ATSC Standard A/100, the terms *DASE Declarative Application* should be read in this specification as *ACAP-X application*; *DASE Declarative Environment* should be read as *ACAP-X environment*; and *DASE System* should be read as a combination of both *ACAP-J* and *ACAP-X environments*.

The content (MIME media) type used to label an ACAP-X application as an aggregate entity shall be application/acap-x.

### 8.1 Behavior

This section describes certain behavioral aspects of ACAP-X applications and implementations of an ACAP-X environment.

#### 8.1.1 Application Behavior

This section specifies restrictions and extensions on use and support for resource identifier schemes with respect to A/100-1 [5] and A/100-2 [38].

The description of application processing, decoding, and presentation specified in A/100-2 [38], Sections 4.1 through 4.3, shall apply to ACAP-X Applications and implementations of an ACAP-X environment with the following exceptions:

- The *Application Lifecycle*, including the application state model, shall adhere to GEM [1], Section 9.3, “DVB-HTML Model,” with the term *ACAP-X* substituted for the term *DVB-HTML*.

*Note:* The application lifecycle of a DASE Declarative Application is effectively replaced by DVB-HTML application lifecycle.

- Transitions in the lifecycle state model of an ACAP-X Application shall generate application lifecycle events as defined by Section 8.2.11.2.2.2 (“Application Lifecycle Event Types”).
- The *Application Display Model* shall adhere to GEM [1] Section 13, “Graphics Reference Model.”

Xlets embedded in ACAP-X applications shall be supported as defined in MHP 1.1 [3], Section 9.6.

##### 8.1.1.1 Clarifications

Regarding the interpretation of GEM [1], Section 9.3, “DVB-HTML Model,” an ACAP-X application that is initially signaled for prefetching rather than auto-start shall remain in the `LOADING` state until an `org.acap.trigger.start` environment trigger is received, at which point the application shall be transitioned to the `ACTIVE` state. See Section 8.1.4.2.2 for further information.

#### 8.1.2 Resource Identifier Schemes

This section specifies restrictions and extensions on use and support for resource identifier schemes with respect to A/100-1 [5] and A/100-2 [38].

An ACAP-X application may use and an ACAP-X environment shall support the *archive* scheme defined by A/100-1 [5], Section 5.1.2.3.1.1, and the *acap* and *exit* schemes as described below.

#### 8.1.2.1 Restrictions

##### 8.1.2.1.1 *ecmascript* scheme

The *ecmascript* scheme as specified by A/100-1 [5], Section 5.1.2.3.1.2, shall not be used by an ACAP-X application and need not be supported by an ACAP-X environment.

##### 8.1.2.1.2 *lid* scheme

The *lid* scheme as specified by A/100-1 [5], Section 5.1.2.3.1.3, shall not be used by an ACAP-X application and need not be supported by an ACAP-X environment.

##### 8.1.2.1.3 *tv* scheme

The *tv* scheme as specified by A/100-1 [5], Section 5.1.2.3.1.4, shall not be used by an ACAP-X application and need not be supported by an ACAP-X environment.

#### 8.1.2.2 Extensions

##### 8.1.2.2.1 *acap* scheme

An ACAP-X application may use and an ACAP-X environment shall support the *acap* scheme defined by Section 14.2.1.2, “Extended ACAP URI Scheme for ACAP-X.”

##### 8.1.2.2.2 *exit* scheme

An ACAP-X application may use and an ACAP-X environment shall support the *exit* scheme, the format of which consists of a scheme component and does not include a scheme specific component. The semantics of activating a URI that uses this scheme shall cause the ACAP-X application to be terminated.

*Note:* The *exit* scheme does not identify a resource per se, but denotes a semantic action.

### 8.1.3 Event Processing

This section specifies restrictions on use and support for event processing behavior with respect to A/100-1 [5] and A/100-2 [38].

#### 8.1.3.1 Restrictions

All DOM events that are emitted by an ACAP-X environment shall first be dispatched to the `EventTarget::dispatchEvent` method of the `Window` object of the affected document, and, thence, to the `HTMLDocument` object (i.e., the document node); that is, the capturing phase of downward event propagation shall begin with the `Window` object and descend from there to the affected document’s document node and thence to its descendent element nodes.

*Note:* See Section 8.2.11 (“Script Content”) and A/100-2 [38], Section 5.3, for further information about the `Window` and `HTMLDocument` objects.

After an unload HTML event is dispatched to a `Window` object, further HTML events shall not be dispatched to the `Window` object until a new document is loaded into the `Window`.

If a new document is to be loaded into a Window object, then that document shall not be presented and no event shall be dispatched to it until an unload HTML event is dispatched to the Window to signal the unloading of the Window's current document.

When dispatching an event to a Window object, the Window::document property shall reference the HTMLDocument object associated with the Window.

#### 8.1.4 Trigger Processing

This section specifies restrictions and extensions on use and support for trigger processing behavior with respect to A/100-1 [5] and A/100-2 [38].

*Note:* An ACAP application indicates its interest in receiving trigger events by registering DOM Event Listeners for specific trigger event types. See Section 8.2.11.2.2.4 for further information.

##### 8.1.4.1 Restrictions

The *script* event type defined by A/100-2 [38], Section 4.5, shall not be used by an ACAP-X application, and need not be supported by an ACAP-X environment. If a *script* event type is utilized by an ACAP-X application, then it shall be ignored regardless of whether or not it is supported.

##### 8.1.4.2 Extensions

An ACAP-X application may use and an ACAP-X environment shall support both asynchronous (“do-it-now”) and synchronized trigger events, where the concrete form of these triggers is transport dependent, but shall consist of the following information items:

- event type
- event time
- event payload

The *event type* shall take the form of a string capable of representing Unicode character data that denotes the type of trigger event.

The *event time* shall be a value that denotes one of the following: (1) “now” or (2) a media time. In the first of these cases, the trigger is considered to be asynchronous, and the associated trigger event shall be dispatched immediately upon reception; in the last of these cases, the indicated time shall be the time at which the related media stream's play time matches the event time.

The *event payload* shall take the form of a (possibly empty) string capable of representing Unicode character data, that denotes an arbitrary, application defined trigger payload.

The concrete representation and encoding of the above information items is dependent upon the ACAP-X application transport scenario in use.

*Note:* See Section <[insert link](#)> for further information on concrete representation and transport of triggers.

The set of possible trigger event types is divided into two categories: (1) environment triggers and (2) application triggers, as defined in the following sub-sections.

#### 8.1.4.2.1 Environment Triggers

A trigger in which the event type has the prefix `org.atsc.trigger` is defined to be an *environment* trigger. An environment trigger is dispatched to the application environment itself and not dispatched to the application.

If a trigger event type does have the prefix `org.atsc.trigger`, but the event type is not defined by this specification as an environment trigger, then the trigger shall be ignored and shall not be dispatched to the application environment.

*Note:* Even though environment triggers are not dispatched to an application, they do, in general, have a direct or indirect affect on a targeted application.

#### 8.1.4.2.2 `org.atsc.trigger.start` trigger

The environment trigger event type `org.atsc.trigger.start` is used to cause a prefetched application to become active. When received, it shall cause the application to be transitioned from the `LOADING` to the `ACTIVE` state, which, in turn, shall cause an `org.atsc.lifecycle.starting` event to be dispatched to the targeted application. If the application is not in the `LOADING` state upon trigger reception, then this environment trigger event shall be ignored.

An event payload is not defined for use with this trigger event type, and if present, shall be ignored.

#### 8.1.4.2.3 Application Triggers

A trigger in which the event type does not have the prefix `org.atsc.trigger` is defined to be an *application* trigger. Furthermore, an application trigger shall not have the prefix `org.atsc` unless such usage is defined by this specification or a future revision thereof. An application trigger is dispatched to the application in the form of a `TriggerEvent` object as described by Section 8.2.11.2.1.3 (“`TriggerEvent` object”) below.

*Note:* As of the initial release of the ACAP specification, no ACAP defined application trigger is specified.

## 8.2 Facilities

This section describes the content facilities that are either required in or available for use by an ACAP-X application and that must be supported by an ACAP-X environment.

*Note:* A *content facility* is a logical grouping of a set of MIME media types (content types).

The content (MIME media) types specified in **Table 8-1** “ACAP-X Content Types,” may be used by an ACAP-X application and shall be supported by an implementation of an ACAP-X environment. In this table, the last column specifies zero or more file name extensions that should be used with files of this content type. The extension `<x>` designates a numeric value starting from zero (0) with no leading zeros. The extension `N/A` indicates that no extension is applicable since resources of this type are not named or do not appear in the broadcast file system or the content type describes a collection of resources.

**Table 8-1** ACAP-X Content Types

Content Type	See Section	Extensions
application/acap-certificate	12.4.1	.<x>

application/acap-digest	12.4.1	.hashfile
application/acap-permission	0	.perm
application/acap-signature	12.4.1	.<x>
application/acap-x	8	N/A
application/acap-x-metadata	8.2.1	.xml
application/font-tdpfr	8.2.7	.pfr
application/xhtml+xml	8.2.9	.xht;.xhtml
application/zip	8.2.8	.zip
audio/ac3	8.2.6	N/A
audio/basic	8.2.4	.au
audio/mpeg	8.2.4	.mp2
image/jpeg	8.2.2	.jpg;.jpeg
image/mpeg	8.2.2	.mpg
image/png	8.2.2	.png
text/css	8.2.9.2.8	.css
text/ecmascript	8.2.11	.es
video/mng	8.2.3	.mng
video/mpeg	8.2.5	N/A
video/mpv	8.2.5	N/A

An ACAP-X application shall contain at least one resource of content type application/xhtml+xml. The presence of resources of other content types in an ACAP-X application is strictly optional.

When an ACAP-X application makes use of an embedded Xlet or the Inter-Environment Bridge, resources that adhere to the content types specified in Table 7.1 may also be present in an ACAP-X application's resource collection.

### 8.2.1 Application Metadata Content

An ACAP-X application may use and an ACAP-X environment shall support the Application Metadata Content facilities defined by A/100-1 [5], Section 6.1, as modified and extended below.

In the case that application metadata content is inconsistent with metadata information specified in application signaling, then the metadata information specified in application signaling shall be given precedence.

If an ACAP-X application does not include an application metadata resource or does not reference an application metadata resource as its root resource, then the information that is mandatory in an application metadata resource shall be implied from signaling information that accompanies the ACAP-X application. In this case, the behavior of an ACAP-X application shall be identical to an ACAP-X application that does include and reference such an implied application metadata resource as its root resource.



### 8.2.1.1 Modifications

#### 8.2.1.1.1 Content Type

The content (MIME media) type used to label an ACAP-X Application Metadata Resource shall be application/acap-x-metadata.

#### 8.2.1.1.2 Document Type Definition

The document type definition used to determine the validity of ACAP-X Application Metadata Content shall be as defined by Annex B, Section 4, “ACAP-X Application Metadata Document Type.”

#### 8.2.1.1.3 Document Type Declaration

The formal public identifier used by a document type declaration in an ACAP-X Application Metadata resource shall be as follows:

```
"-//ATSC//DTD ACAP-X Application Metadata 1.0//EN"
```

### 8.2.1.2 Extensions

#### 8.2.1.2.1 *entity* element

In addition to those values specified by A/100-1 [5], Section 6.1.1.6.9.1, the *entitytype* attribute of the *entity* element may take the following values, as further described below:

signature

In addition, the semantics of the entity types described by A/100-1 [5], Section 6.1.1.6.9.1, are further extended as described below.

#### 8.2.1.2.2 *initial* entity type

If an ACAP-X application includes an application metadata resource, then it shall be specified an *entity* element with an *entitytype* attribute with the value initial. Furthermore, the value of the *uri* attribute shall reference a resource that adheres to the ACAP-X markup content type as defined by Section 8.2.9 below.

#### 8.2.1.2.3 *permissionRequest* entity type

If an ACAP-X application includes a permission request file, then it shall be specified by an *entity* element with an *entitytype* attribute with the value permissionRequest. In this case, the value of the *uri* attribute shall reference a resource that adheres to the ACAP permission request file content type as defined by Section 12.4.2.1 below.

#### 8.2.1.2.4 *signature* entity type

If an ACAP-X application includes a signature file, then it shall be specified by an *entity* element with an *entitytype* attribute with the value signature. In this case, the value of the *uri* attribute shall reference a resource that adheres to the ACAP signature file content type as defined by Section 12.4.1 below.

#### 8.2.1.2.5 *identifier* element

An ACAP-X application may specify and an ACAP-X environment shall support *param* children elements of the *identifier* element such that the *name* attributes of these *param* elements are orgid

and *appid* and the value attributes of these *param* elements adhere to MHP [2], Section 14.5, “Text Encoding of Application Identifiers.”

*Note:* See MHP [2], Section 10.5, “Application Identification,” for further information on organization and application identifiers.

If an ACAP-X application includes an application metadata resource, then it shall specify exactly one *orgid* and exactly one *appid* using the *param* children of the *ident* element as described above.

If an ACAP-X application includes an application metadata resource, then it shall specify a value for the *uuid* attribute of the *identifier* element; however, that value may be zero (0). Notwithstanding the preceding, an ACAP-X application should specify a probabilistically unique, non-zero value for the *uuid* attribute.

**Example:** The following specifies an identifier element that satisfies the above requirements.

```
<identifier uuid="0">
  <param name="orgid" value="0x000023d2"/>
  <param name="appid" value="0x4020"/>
</identifier>
```

If an application metadata resource is implied and the transport scenario does not signal a UUID, then a UUID of zero (0) shall be implied.

*Open Issue:* Instead of implying a UUID of zero, should an algorithm be specified that maps a unique *orgid/appid* pair to a unique UUID?

#### 8.2.1.2.6 Permission capability

An ACAP-X application may use and an ACAP-X environment shall support a *permission* capability on the *cond* element in order to specify requirements or requests with respect to the granting of security permissions.

The *permission* capability admits the following parameters, as specified by child *param* elements of the *cond* element specifying this capability:

- *type*
- *target*
- *actions*

Exactly one *type* parameter shall be specified as a child of the *cond* element that specifies this capability; exactly zero or one *target* and zero or one *actions* parameters may be specified.

The semantics of a *permission* capability is as follows: if an application specifies a *permission* capability with a *qualifier* attribute whose value is required, and the ACAP System cannot or would not grant the indicated permission, then the application shall not be activated.

*Note:* Use of the *permission* capability does not constitute a request for authorization to access the target or actions of the named permission. A request for authorization to grant a permission is outside of the scope of the semantics of the *cond* element.

**Example:** The following specifies a *permission* capability on a *cond* element in order to indicate that access to read and write a file in the local filesystem is required in order to activate the application.

```
<cond qualifier="required" capability="permission">
  <param name="type" value="java.io.FilePermission"/>
  <param name="target" value="file.dat"/>
  <param name="actions" value="read,write"/>
</cond>
```

#### 8.2.1.2.6.1 type parameter

The *type* parameter of a *permission* capability shall specify either a fully qualified Java class name or a non-Java permission type name.

#### 8.2.1.2.6.2 target parameter

The *target* parameter of a *permission* capability specifies a target for the specifically named permission. The syntax and semantics of the *target* parameter are governed by the named permission.

#### 8.2.1.2.6.3 actions parameter

The *actions* parameter of a *permission* capability specifies one or more actions for the specifically named permission. The syntax and semantics of the actions parameter are governed by the named permission.

### 8.2.2 Graphics Content

An ACAP-X application may use and an ACAP-X environment shall support the Graphics Content facilities defined by A/100-1 [5], Section 6.2, as extended below, and shall do so in a manner consistent with GEM [1] Section 7.1.1, and with Section 17.1.1, “GEM errata,” of this document..

*Note:* The ACAP-X environment does not support the image/gif content type.

#### 8.2.2.1 Extensions

##### 8.2.2.1.1 image/mpeg

An ACAP-X application may use and an ACAP-X environment shall support the MPEG-2 I-Frame graphics content format as defined by GEM [1] Section 7.1.2. Application resources that employ this format shall be identified as image/mpeg and shall use the resource name extension “.mpg”.

An application entity identified as content type image/mpeg may be referenced in all contexts where a content type defined by A/100-1 [5], Section 6.2, “Graphics Content”, is permitted. In all other contexts, the use of content type image/mpeg is undefined.

### 8.2.3 Non-Streaming Video Content

An ACAP-X application may use and an ACAP-X environment shall support the *Non-Streaming Video* content facilities defined by A/100-1 [5], Section 6.3, as extended below.

### 8.2.3.1 Extensions

#### 8.2.3.1.1 video/dvb.mpeg.drip

The ACAP-X environment does not directly support the MPEG-2 Video “drip feed” content format as defined by GEM [1], Section 7.1.3. Nevertheless, because this non-streaming video content type is supported by the ACAP-J environment, it is possible to make use of this content type by employing appropriate ACAP-J APIs through either (1) the Inter-Environment API Bridge or (2) an embedded Xlet. If an ACAP-X application makes indirect use of resources of this content type, then such resources shall be identified as `video/dvb.mpeg.drip` and shall use the resource name extension “.drip”.

### 8.2.4 Non-Streaming Audio Content

An ACAP-X application may use and an ACAP-X environment shall support the Non-Streaming Audio content facilities defined by A/100-1 [5], Section 6.4, as extended below.

#### 8.2.4.1 Extensions

##### 8.2.4.1.1 audio/mpeg

An ACAP-X application may use and an ACAP-X environment shall support the MPEG-1 Audio Layers 1 and 2 content format as defined by MHP [2], Section 7.1.4. Application resources that employ this format shall be identified as `audio/mpeg` and shall use the resource name extension “.mp2”.

An application entity identified as content type `audio/mpeg` may be referenced in all contexts where a content type defined by A/100-1 [5], Section 6.4, “Non-Streaming Audio Content”, is permitted. In all other contexts, the use of content type `audio/mpeg` is undefined.

### 8.2.5 Streaming Video Content

An ACAP-X application may use and an ACAP-X environment shall support the *Streaming Video Content* facilities defined by A/100-1 [5], Section 6.5.

### 8.2.6 Streaming Audio Content

An ACAP-X application may use and an ACAP-X environment shall support the *Streaming Audio Content* facilities defined by A/100-1 [5], Section 6.6.

### 8.2.7 Font Content

An ACAP-X application may use and an ACAP-X environment shall support the *Font Content* facilities defined by A/100-1 [5], Section 6.7.

### 8.2.8 Archive Content

An ACAP-X application may use and an ACAP-X environment shall support the *Archive Content* facilities defined by A/100-1 [5], Section 6.8.

### 8.2.9 Markup Content

An ACAP-X application may use and an ACAP-X environment shall support the *Markup Content* facilities defined by A/100-2 [38], Section 5.1, as restricted and extended below.

## 8.2.9.1 Restrictions

This section describes restrictions upon the markup content facility defined by A/100-2 [38], Section 5.1.

## 8.2.9.1.1 Resource Content Type References

References to resources from markup content attributes that take the form of a URI shall be limited to those content types checked as supported in **Table 8-2** Markup Resource Content Type References". If a reference is made to a resource of a content type that is not supported in the referencing context, then the behavior of an ACAP-X environment is implementation dependent, and shall not be relied upon by an ACAP-X application. If a content type is not listed in this table, then it shall be construed as unsupported.

**Table 8-2** Markup Resource Content Type References

Element/Attribute	application/acap-j	application/acap-x	application/java	application/xhtml+xml	application/zip (note 3)	audio/ac3	audio/basic	audio/mpeg	image/{jpeg,mpeg,png}	text/css	text/ecmascript	video/mng	video/mpeg	video/mpv	Notes
a.href	✓	✓	x	✓	x	✓	x	x	x	x	x	x	✓	✓	
area.href	✓	✓	x	✓	x	✓	x	x	x	x	x	x	✓	✓	
Base.href															1
frame.longdesc	x	x	x	✓	x	x	x	x	x	x	x	x	x	x	
frame.src	x	x	x	✓	x	x	x	x	x	x	x	x	x	x	
img.longdesc	x	x	x	✓	x	x	x	x	x	x	x	x	x	x	
img.src	x	x	x	x	x	x	x	x	✓	x	x	✓	x	✓	
Input.src	x	x	x	x	x	x	x	x	✓	x	x	✓	x	✓	
link.href	x	x	x	✓	x	x	x	x	x	✓	x	x	x	x	
object.archive															2
object.classid	x	x	✓	x	x	x	x	x	x	x	x	x	x	x	
object.codebase															1
object.data	x	x	x	✓	x	✓	✓	✓	✓	x	x	✓	✓	✓	
script.src	x	x	x	x	x	x	x	x	x	x	✓	x	x	x	
style.src	x	x	x	x	x	x	x	x	x	✓	x	x	x	x	
Notes															
<ol style="list-style-type: none"> <li>1. The value of the <i>href</i> attribute of the <i>base</i> element does not reference a resource; rather, it serves as a means for resolving relative URIs that appear as attributes of other elements.</li> <li>2. No semantics are associated with the <i>archive</i> attribute of the <i>object</i> element in this version of the ACAP specification.</li> <li>3. Use of the <i>application/zip</i> content type is supported only indirectly through use of the <i>archive</i> URI scheme.</li> </ol>															

#### 8.2.9.1.2 Resource Access

References to a streaming video or audio resources from ACAP-X markup content shall not cause tuning to occur. References that imply tuning to access a resource shall behave as if the resource were unavailable.

#### 8.2.9.1.3 Document Type Declaration

An ACAP-X application shall not include or reference and an ACAP-X environment need not support a markup content entity whose document type declaration refers to a document type that is not an ACAP-X *Family Document Type* as defined by Annex B, Section 5, “ACAP-X Markup Document Type”

If a markup content entity of an application signaled as an ACAP-X application makes reference to a formal public identifier (FPI) in its document type declaration and that identifier references a document type that is not an ACAP-X Family Document Type, then the ACAP-X application shall be aborted.

#### 8.2.9.1.4 Namespace Declarations

A markup content document instance in an ACAP-X application should specify a default XML Namespace Declaration using the *xmlns* attribute in the root (document) element. If no default XML Namespace Declaration is specified, then <http://www.w3.org/1999/xhtml> shall be assumed to be the default namespace.

The use of any XML namespace prefix in a markup content document instance other than the *xml* prefix shall be accompanied by an appropriate XML namespace attribute.

#### 8.2.9.1.5 *legacy* application

An ACAP-X application shall not indicate that it is a legacy application by specifying a *legacy* application parameter with the value *true* in the application metadata resource. If an ACAP-X application is marked as a legacy application, then it shall not be activated by an ACAP-X environment.

*Note:* See A/100-1 [5], Section 6.1.1.6.13.4, for further information on the legacy application parameter.

#### 8.2.9.1.6 *intrinsic event* Attributes

An ACAP-X application shall not use and an ACAP-X environment need not support the following *intrinsic event* attributes:

- onclick
- ondblclick
- onmousedown
- onmouseup
- onmouseover
- onmousemove
- onmouseout
- onkeypress
- onkeydown
- onkeyup
- onfocus
- onblur

- onsubmit
- onreset
- onselect
- onchange
- onload
- onunload

*Note:* The functionality of these intrinsic event attributes may be obtained by use of DOM-2 Events functionality as specified by A/100-2 [38], Section 5.3.1.2.7.

If an ACAP-X application makes use of one of these attributes, then an ACAP-X environment shall not evaluate its script content, and may optionally present an error indication to the end-user.

#### 8.2.9.1.7 *name* attribute

Except for those element types that require the presence of a *name* attribute, the *name* attribute defined by A/100-2 [38], Section 5.1.1.5.2, for use with transcoded legacy documents shall not be used by an ACAP-X application and need not support the semantics for this attribute in this context in an ACAP-X environment.

#### 8.2.9.1.8 *a* (anchor) element

The ability for an *a* (anchor) element to target the top-level frame with video content defined by A/100-2 [38], Section 5.1.1.6.1.1.3, for use with transcoded legacy documents in order to terminate a declarative application, shall not be used by an ACAP-X application.

If an ACAP-X application does target the top-level frame with video content, then activating the anchor shall be ignored, producing no side effect.

The ability for an *a* (anchor) element to reference dynamically generated content via the *ecmascript* scheme defined by A/100-2 [38], Section 5.1.1.6.1.1.5, shall not be used by an ACAP-X application.

If an ACAP-X application does make use of this scheme, then activating the anchor shall be ignored, producing no side effect.

#### 8.2.9.1.9 *frame* element

The *src* attribute of a *frame* element shall be restricted to reference an application resource of content type `application/xhtml+xml`; furthermore, that resource shall be part of the current application.

If an entity of an ACAP-X application uses content type `application/xhtml+xml`, and the *src* attribute of a *frame* element references a destination resource that is not of content type `application/xhtml+xml`, then the user agent shall either (1) ignore the reference and produce no side effect, or (2) present feedback to the end-user that the reference will/does produce no effect.

#### 8.2.9.1.10 *object* element

##### 8.2.9.1.10.1 Active Content Object Element

The *object* element type may be used to reference active content objects as described by A/100-2 [38], Section 2.1.1.1.1.1, with the following restrictions.

The content type of the *object* element's immediate implementation, as referenced by the *classid* attribute, shall be restricted to `application/java` and shall adhere to those constraints defined by the ACAP-J environment.

The semantics of the *archive* attribute, if specified, shall be ignored by an ACAP-X environment.

*Note:* Use of the *archive* attribute is expected to be reintroduced in the future in order to support access to archive packaging of Java Xlets via a return channel.

The *codetype* attribute, if specified, shall be `application/java`.

The *height* and *width* specify the size of the Xlet's visible representation. If either height or width is zero or negative, then the ACAP-J method `javax.tv.graphics.TVContainer.getRootContainer()` shall return `null` for this embedded Xlet.

A *param* element with a *name* attribute of `appid` may be specified as a child of an active content *object* element, in which case the *value* attribute shall be a hexadecimal number prefixed with "0x" that corresponds to an application identifier listed in the ACAP-X application signaling. If more than one *param* element is specified, or the `appid` value does not correspond to any listed application identifier, then the embedded Xlet shall not be initialized.

*Note:* An *appid* parameter need not be specified. An explicit *appid* parameter is typically used to distinguish among multiple embedded Xlets for the purpose of supporting inter-Xlet communications.

#### 8.2.9.1.10.2 Trigger Object Element

The ability for an *object* element to serve as a special trigger object defined by A/100-2 [38], Section 5.1.1.6.8.2, shall not be used by an ACAP-X application.

If an ACAP-X application does make use of this form of the *object* element, then it shall be ignored, producing no side effect.

#### 8.2.9.1.11 *script* element

The time of evaluation of script content contained in or referenced by a *script* element is implementation dependent, except that it shall occur at a time no later than immediately prior to the dispatching of the `org.atsc.document.domstable` event to the Window object containing the document in which the *script* element appears.

The order of evaluation of script content contained in or referenced by more than one *script* element contained within a document shall be the same as pre-traversal element order.

In a multiple frameset document, the order of evaluation of script content contained in or referenced by *script* elements contained in documents referenced by *frame* elements is implementation dependent. However, any script content contained in or referenced by a *script* element contained in a document containing a *frameset* element shall occur prior to the evaluation of script content contained in or referenced by *script* elements contained in documents referenced by *frame* elements that occur in the same document as the *frameset* element.

#### 8.2.9.2 Extensions

This section describes extensions to the markup content facility defined by A/100-2 [38], Section 5.1.



### 8.2.9.2.1 Document Type Declaration

An ACAP-X application may use and an ACAP-X environment shall support references to document types that satisfy the definition of an *ACAP-X Family Document Type*, defined as follows:

The set of *ACAP-X Family Document Types* is defined to include the following:

- The ACAP-X Document Type (XDML) defined by Annex B in this specification.
- All future standard and non-standard (proprietary) ACAP-X Document Types such that (1) any non-standard element type or attribute is declared to use qualified names, the prefix of the qualified name is not *acap*, and the XML namespace associated with the qualified name is not “<http://www.atsc.org/acap#markup>”; (2) any alteration to an existing element’s content model is strictly backward compatible from the perspective of validating the element’s children.

The formal public identifier (FPI) used to label and reference an ACAP-X Family Document Type shall adhere to one of the following forms, where *x* and *y* indicate a major and minor version number of a specific standard XDML document type defined for use by a published edition of an ACAP specification:

- "-//ATSC//DTD XHTML ACAP-X XDML x.y//EN"
- "-//ATSC//DTD XHTML ACAP-X XDML x.y ProprietaryNameAndVersion//EN"
- "-//W3C//DTD XHTML Basic 1.0//EN"

Non-standard (proprietary) ACAP-X Family Document Types shall employ the second of the above forms and shall supply a non-empty value for *ProprietaryNameAndVersion*, which shall consist of at least two space separated tokens the last of which is a version number (preferably in *major.minor* form) and the remaining (initial) tokens designate a unique organization and or specification identity. The value(s) employed for the proprietary name should be chosen in such a manner as to minimize the probability of colliding with other names. The substring ACAP (in any combination of lower- and upper-case) shall not appear in the proprietary name.

*Note:* The value of the *ProprietaryNameAndVersion* tokens are further restricted by the syntactic constraints implied by an XML Formal Public Identifier (FPI).

### 8.2.9.2.2 *cite* attribute

For those element types that admit a *cite* attribute, the value of that attribute may be a URI that references a resource of content type `application/xhtml+xml`, as defined by Section 8.2.9.

### 8.2.9.2.3 *event* attributes

An ACAP-X application may use and an ACAP-X environment shall support the following event attributes, where the *acap* namespace prefix is bound to the namespace URI <http://www.atsc.org/acap#markup>:

- `acap:ondomstable`
- `acap:onload`
- `acap:onunload`

*Note:* For the purposes of defining the DTD for ACAP-X markup content and for use in actual instance documents, the namespace prefix employed by these attributes is fixed.

The values of these attributes shall adhere to the syntax of the *StatementList* non-terminal of ECMA SCRIPT [50], Section 12.1; in particular, it shall be syntactically valid for use as the content of the *Block* non-terminal.

Use of these event attributes shall have the same semantic effect as registering a DOM-2 event handler to receive the `org.atsc.document.domstable`, `load`, and `unload` event types, respectively.

*Note:* See Section 8.2.11.2.1.3 (“TriggerEvent object”) for further information on the `org.atsc.document.domstable`, `load`, and `unload` event types.

#### 8.2.9.2.4 *longdesc* attribute

For those element types that admit a *longdesc* attribute, the value of that attribute may be a URI that references a resource of content type `application/xhtml+xml`, as defined by Section 8.2.9.

#### 8.2.9.2.5 *a* (anchor) element

##### 8.2.9.2.5.1 Application Replacement and Launching

An ACAP-X application may use and an ACAP-X environment shall support references to content types `application/acap-j` and `application/acap-x` as the destination of an anchor (*a*) element, where the reference identifies an ACAP-J or ACAP-X application.

If an *a* (anchor) element’s destination content type is `application/acap-j` or `application/acap-x`, and a *target* attribute is specified with a value that designates the current top level frame of the application, then anchor activation shall cause (1) termination of the current application and (2) instantiation of a new ACAP-J or ACAP-X application instance.

The process of instantiating an application by activation of an anchor while terminating the activating applications is referred to as *application replacement*.

If an *a* (anchor) element’s destination content type is `application/acap-j` or `application/acap-x`, and no *target* attribute is specified or a *target* attribute is specified with a value of `_blank`, then anchor activation shall cause the instantiation of a new ACAP-J or ACAP-X application instance.

The process of instantiating an application by activation of an anchor without terminating the activating applications is referred to as *application launching*.

If an *a* (anchor) element’s destination content type is `application/acap-j` or `application/acap-x`, and a *target* attribute is specified with a value other than one that designates the top level frame of the application or the target `_blank`, then an attempt to perform anchor activation shall not replace the current application or launch a new application.

*Note:* See Section 14.2.1 (“ACAP URI Scheme”) for further information on referencing an ACAP application.

A query component may appear in a resource identifier used to reference an ACAP-J or ACAP-X application for the purpose of launching a new application or replacing the current application. The format of the optional query component shall be identical to that used by the `application/x-www-form-urlencoded` content type as described by HTML [54], Section 17.13.4 (“Form Content Types”).

In case the new or replacement application is an ACAP-X application, the unordered union of name and value pairs that appear in (1) the resource reference, (2) the application signaling, and (3) the application parameter elements of the ACAP-X application metadata resource, if specified, shall form the set of application parameters to the ACAP-X application, and shall be exposed to the application as a query component of the URL represented by the `Window::location` property of the application’s top-level `Window` object. If the same name appears in more than one of the above three locations, then the value used shall be determined according to a precedence

established by the order of locations specified here, with the resource reference given the highest precedence.

The same behavior shall apply for launching or replacement with an ACAP-J application, except that (1) no application metadata resource applies and (2) the application parameters are exposed through the `javax.tv.xlet.XletContext.getXletProperty(XletContext.ARGS)` method as described by MHP [2], Section 11.7.1.1.

#### 8.2.9.2.5.2 Service Selection

An ACAP-X application may use and an ACAP-X environment shall support references to content type `video/mpeg` as the destination of an anchor (*a*) element, where of the reference identifies a service (virtual channel) in an MPEG-2 transport stream.

If an *a* (anchor) element's destination content type is `video/mpeg`, then anchor activation shall cause service selection within the current service context.

*Note:* See Section 14.2.1 (“ACAP URI Scheme”) for further information on referencing a service.

*Note:* A side-effect of service selection may be that the activating application is terminated if the application is a service bound application and it is not signaled in the referenced service.

#### 8.2.9.2.5.3 Service Component Selection

An ACAP-X application may use and an ACAP-X environment shall support references to content type `video/mpv` and `audio/ac3` as the destination of an anchor (*a*) element, where of the reference identifies a service component (program element) in an MPEG-2 transport stream.

If an *a* (anchor) element's destination content type is `video/mpv` or `audio/ac3`, then anchor activation shall cause service component selection within the current service.

*Note:* See Section 14.2.1 (“ACAP URI Scheme”) for further information on referencing a service component.

#### 8.2.9.2.6 *area* element

An ACAP-X application may use and an ACAP-X environment shall support application replacement and launching, service selection, and service component selection by means of the *area* element in an identical manner to that of the *a* (anchor) element as described in Section 8.2.9.2.5 (“*a* (anchor) element”) above.

#### 8.2.9.2.7 *meta* element

The following metadata items are defined as extensions to the set of items defined by A/100-2 [38], Section 5.1.1.6.7:

Classpath

##### 8.2.9.2.7.1 Classpath Metadata Item

The class path to be used when loading application defined Java class files for use with embedded Xlets or the Inter-Environment Bridge may be specified by using a *meta* element with a *name* attribute with a value `Classpath`. In this case, the value of the *content* attribute shall be a form that corresponds to that specified by A/100-1 [5], Section 6.1.1.6.13.2.

If an ACAP-X application includes an application metadata resource (AMR) and the AMR specifies a *classpath* application parameter, then any value specified by a Classpath metadata item using a *meta* element shall be appended to the effective classpath.

#### 8.2.9.2.8 *object* element

If an *object* element's *data* attribute references a non-streaming audio resource as the object instance data and the *classid* attribute is not specified, then a *param* child element with the name *loop* and the value of either *true* or *false* may be specified in order to indicate that the non-streaming audio resource is to be repeatedly presented in a loop. If a *loop param* element child with the value *true* is not specified, then the non-streaming audio resource shall be presented only once.

### 8.2.10 Stylesheet Content

An ACAP-X application may use and an ACAP-X environment shall support the *Stylesheet Content* facilities defined by A/100-2 [38], Section 5.2, as restricted and extended below.

#### 8.2.10.1 Restrictions

The following subsections describe restrictions upon the stylesheet content facility defined by A/100-2 [38], Section 5.2.

##### 8.2.10.1.1 Resource Content Type References

References to resources from stylesheet content rules, properties, or descriptors that take the form of a URI shall be limited to those content types checked as supported in **Table 8-3** Stylesheet Resource Content Type References." If a reference is made to a resource of a content type that is not supported in the referencing context, then the behavior of an ACAP-X environment is implementation dependent, and shall not be relied upon by an ACAP-X application. If a content type is not listed in this table, then it shall be construed as unsupported.

**Table 8-3** Stylesheet Resource Content Type References

Property/ Descriptor	application/font-tdpfr	image/jpeg,mpeg,png	text/css	video/mng	video/mpeg	video/mpv
background-image	x	✓	x	✓	✓	✓
list-style-image	x	✓	x	✓	✓	✓
@font-face src	✓	x	x	x	x	x

##### 8.2.10.1.2 Media Types

An ACAP-X environment is not required to support the *atsc-tv* media type as defined by A/100-2 [38] Section 5.2.1.7.1.

### 8.2.10.1.3 Properties

#### 8.2.10.1.3.1 *atsc-nav-index* property

The *atsc-nav-index* property as defined by A/100-2 [38], Section 5.2.1.8.3.2, shall not be used by ACAP Applications; rather, the *nav-index* property should be used instead, as defined by Section 8.2.10.2.4.4, “*nav-index* property”.

#### 8.2.10.1.3.2 *atsc-nav- $\{left, right, up, down\}$* properties

The *atsc-nav- $\{left, right, up, down\}$*  properties as defined by A/100-2 [38], Section 5.2.1.8.3.3, shall not be used by ACAP Applications; rather, the *nav- $\{left, right, up, down\}$*  properties should be used instead, as defined by Section 8.2.10.2.4.5, “*nav- $\{left, right, up, down\}$  properties”.*

### 8.2.10.1.4 Property Values

#### 8.2.10.1.4.1 *<color>* property value

The *atsc-rgba()* functional notation as defined by A/100-2 [38], Section 5.2.1.8.4.1, shall not be used by ACAP Applications in those contexts that take a *<color>* property value; rather, the *rgba()* functional notation should be used instead, as defined by Section 8.2.10.2.5.1, “*<color>* property value type”.

## 8.2.10.2 Extensions

### 8.2.10.2.1 Font Face Rule

An ACAP-X application may use and an ACAP-X environment shall support the *units-per-em* font descriptor within an *@font-face* rule, as defined by CSS2 [48], Section 15.3.4.

### 8.2.10.2.2 Viewport Rule

An ACAP-X application may use and an ACAP-X environment shall support an *@viewport* rule, defined according to the following extensions to CSS [48], Appendix D, “The Grammar of CSS2”:

*viewport*

```
VIEWPORT_SYM S* '{ S* declaration [ ';' S* declaration ]* '}' S*
```

In this grammar production, *VIEWPORT\_SYM* denotes the lexical string “*@viewport*” (not including quotation marks) and *declaration* is as defined by CSS [48], Appendix D, Section D.1, “Grammar.” An instance of this production may appear in the same context as the *media non-terminal* as specified by the *stylesheet* production of CSS [48], Appendix D, Section D.1.

Only one *@viewport* rule shall apply to an XHTML document instance hierarchy presented by an ACAP-X application. If multiple *@viewport* rules are present, then the priority for determining the applicable rule shall be in accordance with CSS [48], Section 6.4, “The Cascade.”

The collection of declarations contained within an *@viewport* rule constitute a *viewport descriptor set*. Only the declarations that appear in the applicable rule shall be used to determine the *viewport descriptor set*. Each *viewport descriptor* is expressed as a name and a value pair using the syntax of the *declaration* production of CSS [48], Appendix D, Section D.1. The following sub-sections define the permissible descriptors that may be used by an ACAP-X application.

The purpose of the @viewport rule and its viewport descriptor set is to describe a reference region within the *canvas*, to establish a logical (user) coordinate space within this region, and to determine the bounds of the *initial containing block* within this coordinate space.

*Note:* In this specification, the canvas is considered to be coterminous with the graphics plane, as defined by Section 13, “Graphics Reference Model”.

*Note:* See CSS [48], Section 2.3.1, “The Canvas,” Section 9.1.1, “The Viewport,” and Section 9.1.2, “Containing Blocks,” for further information on *canvas*, *viewport*, and *initial containing block*, respectively.

If no @viewport rule is applicable when presenting an XHTML document instance hierarchy, then the viewport and the initial containing block shall be considered to be coterminous with and have the same horizontal and vertical resolution as the graphics plane.

**Example:** The following specifies a viewport that occupies one-fourth (1/4) of the graphics plane and is centered within the graphics plane. The logical (user) coordinate space of the viewport is 288x360 pixels, and the initial containing block is a 200x200 pixel square centered within the viewport.

```
@viewport {
  region : inset-rect(25%,25%,25%,25%);
  resolution : 288 360;
  initial-container : inset-rect(80,44,80,44)
}
```

#### 8.2.10.2.2.1 Viewport Descriptors

The following descriptors may be specified in an @viewport rule:

- initial-container
- region
- resolution

*Note:* As used in this subsection, the term *descriptor* is unrelated to the term as used in the MPEG-2 context.

##### 8.2.10.2.2.1.1 *initial-container* descriptor

An ACAP-X application may use and an ACAP-X environment shall support the *initial-container* viewport descriptor, as defined below.

Name:	<b>initial-container</b>
Value:	auto   <shape>
Initial:	auto
Applies to:	the viewport
Inherited:	N/A
Percentages:	relative to viewport’s extent
Media:	visual

Values of <shape> are limited to rect() and inset-rect(); the semantics of all values are specified below.

**auto** – The initial container block’s computed origin and extent are the same as the viewport’s origin and extent.

**rect(top, right, bottom, left)** – Each of the four arguments can be a <length> or a <percentage>. All length values are offsets relative to the origin of the viewport, which is its top left vertex. All <percentage> values are computed relative to the viewport’s extent. The computed width and height of the initial container block are determined by subtracting the left from the right for the width, and similarly top from bottom for the height. However, if this computation results in a negative value, it is considered to be zero.

**inset-rect(top, right, bottom, left)** – Like rect(), except that the values are offsets relative to the respective edges of the viewport.

When specifying a <length> or a <percentage> as an argument to a shape function, the value may be negative.

The units of values specified as a <length> shall be restricted to pixels only. If no unit is specified, then pixels shall be assumed to be the units. Furthermore, values specified as pixels shall be interpreted in the viewport’s logical (user) coordinate space, which may not be the same as the graphics plane’s coordinate space.

Visible marks produced by formatting a markup content resource in an ACAP-X application may appear outside of the initial container block; however, all marks are clipped by the viewport region.

*Note:* Visible marks may be placed outside the initial container block by using absolute position style properties, in which case they are interpreted as relative to the viewport’s origin, and not the initial container block’s origin.

#### 8.2.10.2.2.1.2 *region* descriptor

An ACAP-X application may use and an ACAP-X environment shall support the *region* viewport descriptor, as defined below.

Name:	<b>region</b>
Value:	auto   <shape>
Initial:	auto
Applies to:	the viewport
Inherited:	N/A
Percentages:	relative to graphics plane’s extent
Media:	visual

Values of <shape> are limited to rect() and inset-rect(); the semantics of all values are specified below.

**auto** – The viewport’s computed origin and extent are the same as the graphics plane’s origin and extent.

**rect(top, right, bottom, left)** – Each of the four arguments can be a <length> or a <percentage>. All length values are offsets relative to the origin of the graphics plane, which is its top left vertex. All <percentage> values are computed relative to the graphics plane’s extent. The computed width and height of the viewport are determined by subtracting the left from the right for the width, and similarly top from bottom for the height. However, if this computation results in a negative value, it is considered to be zero.

**inset-rect(top, right, bottom, left)** – Like `rect()`, except that the values are offsets relative to the respective edges of the graphics plane.

When specifying a `<length>` or a `<percentage>` as an argument to a shape function, the value may be negative.

All visible marks produced by formatting a markup content resource in an ACAP-X application shall be clipped to the region established by the *region* viewport descriptor. This descriptor effectively establishes the origin and extent of the *viewport* within the coordinate space of the *canvas* (i.e., the graphics plane).

#### 8.2.10.2.2.1.3 *resolution* descriptor

An ACAP-X application may use and an ACAP-X environment shall support the *resolution* *viewport* descriptor, as defined below.

Name:	<b>resolution</b>
Value:	auto   <code>&lt;number&gt;</code> <code>&lt;number&gt;</code>
Initial:	auto
Applies to:	the viewport
Inherited:	N/A
Percentages:	N/A
Media:	visual

The semantics of the values of this descriptor are specified below:

**auto** – The viewport’s logical (user) coordinate space has the same horizontal and vertical resolution as the coordinate space of the graphics plane (*canvas*); that is, an identity scale transform applies when mapping from the viewport coordinate space to the graphics plane coordinate space.

**`<number>` `<number>`** – The horizontal resolution ( $h_{res}$ ) of the viewport’s logical (user) coordinate space is determined by the first `<number>`, while the vertical resolution ( $v_{res}$ ) is determined by the second `<number>`; that is, the following scale transform applies when mapping the viewport coordinate space to the graphics plane coordinate space, where  $w$  and  $h$  represent the width and height of the viewport as determined by the *region* descriptor:

#### 8.2.10.2.3 Media Types

An ACAP-X application may use and an ACAP-X environment shall support the *all* media type, as defined by CSS2 [48], and the *tv* media type, as defined by CSS-TV [35].

The following statement in CSS2 [48], Section 7.3, shall be considered to not apply to the *all* media type: “A user agent that claims to support a media type by name must implement all of the properties that apply to that media type.”

*Note:* Supporting the *all* media type effectively means that style declarations that appear in the context of an `@media all` rule are construed as applying to all media.

*Note:* The *tv* media type is also defined by CSS2 [48], however, this specification does not make use of that definition of the *tv* media type. Rather, this specification interprets the *tv* media type only with respect to its definition in CSS-TV [35].



#### 8.2.10.2.4 Properties

An ACAP-X application may use and an ACAP-X environment shall support the following style properties as defined in this section:

- `acap-dynamic-refresh`
- `crop`
- `nav-index`
- `nav-left`
- `nav-right`
- `nav-up`
- `nav-down`
- `opacity`

In addition to defining additional properties, the following subsections extend the value space or value semantics of certain properties.

##### 8.2.10.2.4.1 *acap-dynamic-refresh* property

An ACAP-X application may use and an ACAP-X environment shall support the *acap-dynamic-refresh* property, as defined by A/100-2 [38], Section 5.2.1.8.3.1, with the name *acap-dynamic-refresh* being substituted for the name *atsc-dynamic-refresh*.

##### 8.2.10.2.4.2 *crop* property

An ACAP-X application may use and an ACAP-X environment shall support the *crop* property, as defined by CSS-BOX [33], Section 12.

*Note:* The *crop* property is intended to satisfy the functionality provided by the *clip-video* property of DVB-HTML as defined in MHP 1.1 [3].

For convenience sake, the definition of the *crop* property as specified in CSS-BOX [33] is as follows: “This property allows a replaced element to be just a rectangular area of an object, instead of the whole object.”

The *crop* property adds a step when determining the *intrinsic width* and *height* of an element. When the layout algorithms reference the “intrinsic width” (and/or height), they are referring to the computed intrinsic width and height. The computed intrinsic width and height of an element are the result of applying the *crop* to the actual intrinsic width and height of the element.

Name	<b>crop</b>
Value	auto   <i>&lt;shape&gt;</i>
Initial	Auto
Applies to:	replaced elements
Inherited:	No
Percentages:	relative to intrinsic size
Media	visual
Computed value	specified value

Values of *<shape>* are limited to `rect()` and `inset-rect()`; the semantics of all values are specified below.

**auto** – The element’s computed intrinsic width and height are the same as its actual intrinsic width and height.

**rect(top, right, bottom, left)** – Each of the four arguments can be a <length> or a <percentage>. All percentage values are computed relative to the intrinsic dimensions of the element. Values are offsets relative to the top left of the element. The computed intrinsic width and height of the element are determined by subtracting the left from the right for the width, and similarly top from bottom for the height. However, if this computation results in a negative value, it is considered to be zero.

**inset-rect(top, right, bottom, left)** – Like `rect()`, except that the values are offsets relative to the respective edges of the element.

#### 8.2.10.2.4.3 *font* property

An ACAP-X application may use and an ACAP-X environment shall support the following system font names as values for the font property in accordance with CSS2 [48], Section 15.2.5:

- caption
- icon
- menu
- message-box
- small-caption
- status-bar

The mapping from these system font names to actual system font resources is implementation dependent.

#### 8.2.10.2.4.4 *nav-index* property

An ACAP-X application may use and an ACAP-X environment shall support the *nav-index* property, as defined by CSS-UI [36], Section 9.2.2.

*Note:* The *nav-index* property is intended to satisfy the functionality provided by the *atsc-nav-index* property of A/100-2 [38] and the *nav-index* property defined by DVB-HTML as defined in MHP 1.1 [3].

For convenience sake, the definition of the *nav-index* property as specified in CSS-UI [36] is as follows: “This property specifies the position of the current element in the sequential navigation order for the current document.”

The sequential navigation order defines the order in which elements will receive focus when navigated by the user via an input device. The sequential navigation order may include elements nested within other elements.

Name	<b>nav-index</b>
Value	auto   <number>   inherit
Initial	auto
Applies to:	all enabled elements
Inherited:	no
Percentages:	N/A
Media	interactive

The semantics of all values are specified below.

**auto** – The element's sequential navigation order is assigned automatically by the user agent.

**<number>** – The number (which is non-zero and positive) indicates the sequential navigation order for the element. ‘1’ means first. Elements with the same *nav-index* value are navigated in document order when that *nav-index* value is being navigated.

Elements that may receive focus should be navigated by user agents according to the following rules:

1. Those elements that support the *nav-index* property and assign a positive value to it are navigated first. Navigation proceeds from the element with the lowest *nav-index* value to the element with the highest value. Values need not be sequential nor must they begin with any particular value. Elements that have identical *nav-index* values should be navigated in the order they appear in the character stream.
2. Those elements that do not support the *nav-index* property or support it and assign it a value of ‘auto’ are navigated next. These elements are navigated in the order they appear in the character stream.
3. Elements that are disabled do not participate in the sequential navigation order.

The actual key sequence that causes sequential navigation or element activation depends on the configuration of the user agent (e.g., the “tab” key is often used for sequential navigation, and the “enter” key is used to activate a selected element).

User agents may also define key sequences to navigate the sequential navigation order in reverse. When the end (or beginning) of the tabbing order is reached, user agents may circle back to the beginning (or end). “shift-tab” is often used for reverse sequential navigation.

#### 8.2.10.2.4.5 *nav-{left,right,up,down}* properties

An ACAP-X application may use and an ACAP-X environment shall support the *nav-left*, *nav-right*, *nav-up*, and *nav-down* properties, as defined by CSS-UI [36], Section 9.2.3.

*Note:* The *nav-\** properties are intended to satisfy an essential subset of the functionality provided by the *atsc-nav-\** properties defined by A/100-2 [38], Section 5.2.1.8.3.3, and the *nav-\** properties defined by MHP 1.1 [3], Section 8.8.5.10.

For convenience sake, the definition of the *nav-left*, *nav-right*, *nav-up*, and *nav-down* properties as specified in CSS-UI [36] is as follows:

Name	<b>nav-left, nav-right, nav-up, nav-down</b>
Value	auto   <i>&lt;uri&gt;</i>   inherit
Initial	Auto
Applies to:	all enabled elements
Inherited:	No
Percentages:	N/A
Media	interactive

The semantics of all values are specified below.

**auto** – The user agent automatically determines which element to navigate the focus to in response to directional navigational input.

**<uri>** – The *<uri>* should indicate (through the use of a fragment identifier) the element to which the focus is to be navigated to in response to directional navigation input respective to the specific property.

User agents for devices with keyboards with arrow keys may respond to the four directional arrow keys (up arrow, right arrow, down arrow, left arrow) by navigating the focus according to four respective *nav-\** directional navigation properties (*nav-up*, *nav-right*, *nav-down*, *nav-left*).

#### 8.2.10.2.4.6 *opacity* property

An ACAP-X application may use and an ACAP-X environment shall support the opacity property, as defined by CSS-COLOR [34], Section 3.2.

For convenience sake, the definition of the opacity property as specified in CSS-COLOR [34] is as follows:

Name	<b>opacity</b>
Value	< <i>alphavalue</i> >   inherit
Initial	1.0
Applies to:	all elements
Inherited:	no
Percentages:	N/A
Media	interactive

The semantics of all values are specified below.

**<alphavalue>** – The uniform opacity setting to be applied across an entire object. Any values outside the range 0.0 (fully transparent) to 1.0 (fully opaque) will be clamped to this range. If the object is a container element, then the effect is as if the contents of the container element were blended against the current background using a mask where the value of each pixel of the mask is <*alphavalue*>.

#### 8.2.10.2.5 Property Value Types

The following subsections describe additional property value types or extensions to existing property values types.

##### 8.2.10.2.5.1 <*color*> property value type

An ACAP-X application may use and an ACAP-X environment shall support the `rgba()` functional notation and the `transparent` keyword defined by CSS-COLOR [34], Sections 4.2.2 and 4.2.3, respectively, as a value in those contexts that specify use of the <*color*> property value as defined by [CSS2], Section 4.3.6.

*Note:* The `rgba()` functional notation is intended to satisfy the functionality provided by the `atsc-rgba()` functional notation defined by A/100-2 [38], Section 5.2.1.8.4.1.

*Note:* The `transparent` keyword can be considered a shorthand for `rgba(0,0,0,0)`.

For convenience sake, the definition of the `rgba()` functional notation as specified in CSS-COLOR [34] is as follows. “The format of an RGBA value in the functional notation is 'rgba(' followed by a comma-separated list of three numerical values (either three integer values or three percentage values), followed by an <*alphavalue*>, followed by ')'. The integer value 255 corresponds to 100 percent; e.g., `rgba(255,255,255,0.8) = rgba(100%,100%,100%,0.8)`. Whitespace characters are allowed around the numerical values.

### 8.2.11 Script Content

An ACAP-X application may use and an ACAP-X environment shall support the *Script Content* facilities defined by A/100-2 [38], Section 5.3, as restricted and extended below.

#### 8.2.11.1 Restrictions

The following subsections describe restrictions upon the script content facility defined by A/100-2 [38], Section 5.3.

##### 8.2.11.1.1 HTML Module Objects

###### 8.2.11.1.1.1 HTMLDocument object

The following methods of the HTMLDocument host object as defined by A/100-2 [38], Section 5.3.1.2.3.3, shall not be used by an ACAP-X application:

- write(DOMString)
- writeln(DOMString)

If an attempt is made by an ACAP application to resolve a reference to the one of the above methods, then a run-time exception shall be raised.

During the construction of an HTMLDocument node instance and prior to the dispatch of the org.acap.document.domstable event, the HTMLDocument node and all descendant nodes shall be read-only. After the entire document is parsed and corresponding node construction has completed and immediately prior to dispatching the org.acap.document.domstable event, the HTMLDocument node and all descendant nodes shall be reverted to mutable, unless they are otherwise required to be immutable.

###### 8.2.11.1.1.2 HTMLFormElement object

The HTMLFormElementExt interface extension to HTMLFormElement as defined by A/100-2 [38], Section 5.3.1.2.3.4, shall not be used by an ACAP-X application.

If an attempt is made by an ACAP application to resolve a reference to the above interface, then a run-time exception shall be raised.

###### 8.2.11.1.1.3 HTMLImageElement object

The property HTMLImageElementExt::lowsrc extension to HTMLImageElement as defined by A/100-2 [38], Section 5.3.1.2.3.5, shall not be used by an ACAP-X application.

If an attempt is made by an ACAP application to resolve a reference to the above property, then a run-time exception shall be raised.

###### 8.2.11.1.1.4 HTMLObjectElement object

The property HTMLObjectElementExt::lowsrc extension to HTMLObjectElement as defined by A/100-2 [38], Section 5.3.1.2.3.7, shall not be used by an ACAP-X application.

If an attempt is made by an ACAP application to resolve a reference to the above property, then a run-time exception shall be raised.

The HTMLTriggerObjectElementExt interface extension to HTMLObjectElement as defined by A/100-2 [38], Section 5.3.1.2.3.7, shall not be used by an ACAP-X application.

If an attempt is made by an ACAP application to resolve a reference to the above interface, then a run-time exception shall be raised.

#### 8.2.11.1.2 StyleSheets Module Objects

The following interfaces and host object as defined by A/100-2 [38], Sections 5.3.1.2.5 and 5.3.1.2.6, shall not be used by an ACAP-X application and need not be supported by an ACAP-X environment:

- Counter
- CSSCharsetRule
- CSSFontFaceRule
- CSSImportRule
- CSSMediaRule
- CSSPrimitiveValue
- CSSRule
- CSSRuleList
- CSSStyleRule
- CSSStyleSheet
- CSSUnknownRule
- CSSValue
- CSSValueList
- DocumentCSS
- DocumentStyle
- DOMImplementationCSS
- LinkStyle
- MediaList
- Rect
- RGBColor
- StyleSheet
- StyleSheetList
- ViewCSS

*Note:* The only stylesheet related interfaces and host objects required to be supported after removing the above are: `CSSStyleDeclaration` and `ElementCSSInlineStyle`.

In addition, the method `CSSStyleDeclaration::getPropertyCSSValue` and the property `CSSStyleDeclaration::parentRule` shall not be used by an ACAP-X application.

If an attempt is made by an ACAP application to resolve a reference to one of the above interfaces and host objects, methods, or properties, then a run-time exception shall be raised.

#### 8.2.11.1.3 Event Types

This section describes restrictions to the *Event Set Module Objects* specified by A/100-2 [38], Section 5.3.1.2.8.

##### 8.2.11.1.3.1 HTML Event Types

As described in A/100-2 [38], Section 5.3.1.2.1.4.1, the `HTMLEvents` feature string shall return *true* when the `DOMImplementation::hasFeature` method is invoked. As a consequence, the event types defined by DOM2-EVENTS [49], Section 1.6.5, “HTML Event Types,” shall be generated at the appropriate times by an ACAP-X environment and dispatched to registered event listeners.

An HTML event shall be instantiated and dispatched as an Event object as described in DOM2-EVENTS [49], Section 1.6.5.

*Note:* When creating an Event object that corresponds with an HTML event type, the *eventType* argument of the DocumentEvent::createEvent method is “HTMLEvent” as describe in DOM2-EVENTS [49], Section 1.6.5.

The following subsections describe additional restrictions on specific HTML event types.

#### 8.2.11.1.3.1.1 load event

The dispatching of the load event shall follow in time the initiation of playback of any media object that is referenced by an *img* or *object* element in the document to which this event is to be dispatched and the media objects are automatically started without explicit user or application defined programmatic action.

#### 8.2.11.1.3.1.2 unload event

The dispatching of the unload event shall follow in time the cessation of playback of any media object that is referenced by an *img* or *object* element in the document to which this event is to be dispatched and the media objects were automatically started without explicit user or application defined programmatic action.

#### 8.2.11.1.4 Environment Module Objects

This section describes restrictions on certain *Environment Module* objects.

##### 8.2.11.1.4.1 Navigator object

The following properties of the Navigator host object as defined by A/100-2 [38], Section 5.3.1.2.9.3, shall not be used by an ACAP-X application and need not be supported by an ACAP-X environment:

ddeBackChannel

- ddeContentLevel
- ddeSourceId
- ddeEnabled
- ddeReleasable

If an attempt is made by an ACAP application to resolve a reference to one of the above properties, then a run-time exception shall be raised.

#### 8.2.11.2 Extensions

##### 8.2.11.2.1 Event Module Objects

This section describes extensions to the Events Module specified by A/100-2 [38], Section 5.3.1.2.7.

##### 8.2.11.2.1.1 ApplicationEvent object

An ACAP-X application may use and an ACAP-X environment shall support an ApplicationEvent object that implements the following interface:

```
interface ApplicationEvent : Event
{
```

```
/* read-write properties */
attribute DOMString detail;
/* methods */
void initApplicationEvent(in DOMString type, in DOMString detail);
};
```

#### 8.2.11.2.1.1.1 ApplicationEvent::detail

The value of this mutable, string valued property is not defined, but may be used by application dependent logic for passing information between intermediate targets during the event capture phase.

#### 8.2.11.2.1.1.2 ApplicationEvent::initApplicationEvent

The `initApplicationEvent` method is used to initialize the value of a `ApplicationEvent` created through the `DocumentEvent` interface. This method may only be called before the `ApplicationEvent` has been dispatched via the `dispatchEvent` method, though it may be called multiple times during that phase if necessary. If called multiple times, the final invocation takes precedence. This method has no effect if called after the event has been dispatched.

#### 8.2.11.2.1.2 TimerEvent object

An ACAP-X application may use and an ACAP-X environment shall support a `TimerEvent` object that implements the following interface:

```
interface TimerEvent : Event
{
/* read-write properties */
attribute DOMString detail;
attribute unsigned long interval;
/* methods */
void initTimerEvent(in DOMString detail, in unsigned long interval);
};
```

#### 8.2.11.2.1.2.1 TimerEvent::detail

An application supplied string used to provide detail and linkage from the registration of the timer to timer event handler. This property is considered opaque by the user agent.

#### 8.2.11.2.1.2.2 TimerEvent::interval

This mutable, integer valued property indicates the timer restart interval in milliseconds. The default action of a timer event causes the timer to be restarted with this interval. This default action may be canceled by either (1) initializing or setting the value of this interval to zero or (2) invoking the method `Event::preventDefault` on the `TimerEvent` object.

#### 8.2.11.2.1.2.3 TimerEvent::initTimerEvent

The `initTimerEvent` method is used to initialize the value of a `TimerEvent` created through the `DocumentEvent` interface. This method may only be called before the `TimerEvent` has been dispatched via the `dispatchEvent` method, though it may be called multiple times during that phase



if necessary. If called multiple times, the final invocation takes precedence. This method has no effect if called after the event has been dispatched.

#### 8.2.11.2.1.3 TriggerEvent object

An ACAP-X application may use and an ACAP-X environment shall support a TriggerEvent object that implements the following interface.

```
interface TriggerEvent : Event
{
    /* constants */
    const unsigned long TIME_NONE = 0;
    const unsigned long TIME_NPT = 1;
    /* read-only properties */
    readonly attribute unsigned long timeType;
    readonly attribute DOMString time;
    /* read-write properties */
    attribute DOMString detail;
    /* methods */
    void initTriggerEvent(in DOMString type,
        in unsigned long timeType, in DOMString time, in DOMString detail);
};
```

[Open Issue: Should the event ID of DSM-CC based synchronized triggers be exposed to the application?](#)

A TriggerEvent object shall be constructed by means of the DocumentEvent::createEvent method, where the eventType argument to this method shall be “org.atsc.trigger”.

**Example:** The following ECMAScript fragment creates a TriggerEvent object corresponding to an asynchronous trigger event, initializes the object, then dispatches it to the Window object, which, in turn dispatches it to the document and its descendant element hierarchy. The type property of the event is “org.xyz.myTriggerEvent”; the detail property is “payload”.

```
var e = document.createEvent ( "org.atsc.trigger" );
e.initTriggerEvent ( "org.xyz.myTrigger", TriggerEvent.TIME_NONE, null, "payload" );
window.dispatchEvent ( e );
```

##### 8.2.11.2.1.3.1 TriggerEvent::timeType

This immutable, enumerated valued property shall contain one the values TIME\_NONE or TIME\_NPT. This property determines how to interpret the value of TriggerEvent::time.

If the value of this property is TIME\_NONE, then the value of TriggerEvent::time shall be either null or an empty string.

If the value of this property is TIME\_NPT, then the value of TriggerEvent::time shall be the string representation of an integer normal play time value.

#### 8.2.11.2.1.3.2 TriggerEvent::time

This immutable, string valued property shall contain a string representation of a trigger's time, if the trigger is a synchronized trigger, or null, if the trigger is asynchronous. See Section 8.2.11.2.1.3.1 for information on the interpretation of a non-null value.

#### 8.2.11.2.1.3.3 TriggerEvent::detail

This mutable, string valued property shall contain a string representation of a trigger's payload. The syntax and semantics of this string are application defined, and considered opaque by the user agent.

#### 8.2.11.2.1.3.4 TriggerEvent::initTriggerEvent

The `initTriggerEvent` method is used to initialize the value of a `TriggerEvent` created through the `DocumentEvent` interface. This method may only be called before the `TriggerEvent` has been dispatched via the `dispatchEvent` method, though it may be called multiple times during that phase if necessary. If called multiple times, the final invocation takes precedence. This method has no effect if called after the event has been dispatched.

The `type` parameter of this method shall be used to initialize the `type` property of the object. The `detail` parameter of this method shall be used to initialize the `detail` property of the object. The `bubbles` and `cancelable` properties of the object shall be initialized to `false`.

### 8.2.11.2.2 Event Types

This section describes extensions to the *Event Set Module Objects* specified by A/100-2 [38], Section 5.3.1.2.8.

#### 8.2.11.2.2.1 HTML Event Types

In addition to the events defined by DOM2-EVENTS [49], Section 1.6.5, "HTML Event Types", the following event type shall be generated and dispatched by an ACAP-X environment as an HTML event type:

- `org.atsc.document.domstable`

##### 8.2.11.2.2.1.1 `org.atsc.document.domstable` event

The `org.atsc.document.domstable` event is used to indicate the completed construction of a document instance (i.e., its DOM instance).

Name:	<b><code>org.atsc.document.domstable</code></b>
Bubbles:	no
Cancelable:	no
Default Action:	none
Context:	none

This event shall be generated by an ACAP-X environment and dispatched to the `Window` object associated with the document being constructed.

This event signals the completed construction of the current document instance. After receipt of this event, any modification to the document instance is restricted to programmatic control by script content.

The dispatching of this event shall precede in time the dispatching of any other HTML event type; however, both application lifecycle events and timer events may be dispatched prior to the dispatching of the `org.atsc.document.domstable` event.

The target of the `org.atsc.document.domstable` event type shall be the `frameset` element node of a multiple-frame document; otherwise, the target shall be the `body` element node.

#### 8.2.11.2.2.2 Application Lifecycle Event Types

This section specifies the following application lifecycle event types:

- `org.atsc.application.started`
- `org.atsc.application.suspending`
- `org.atsc.application.resumed`
- `org.atsc.application.terminating`

An ACAP-X environment shall dispatch these events to the top-level `Window` object of the application to which they apply as described in the following subsections.

The target of all application lifecycle events shall be the top-level `Window` object of the ACAP-X application.

An ACAP-X application is not notified of a transition to the `LOADING` or `KILLED` states.

##### 8.2.11.2.2.2.1 `org.atsc.application.started` event

The `org.atsc.application.started` event is used to indicate that an ACAP-X application has just been activated. More specifically, the application has just transitioned from the `LOADING` state to the `ACTIVE` state as defined by the application lifecycle state model.

Name:            **`org.atsc.application.started`**  
 Bubbles:         no  
 Cancelable:     no  
 Default Action: none  
 Context:         none

The dispatching of `org.atsc.application.started` event shall precede the dispatching of the HTML load event.

The dispatching of the `org.atsc.application.started` event shall precede in time the initiation of playback of any media object that is referenced by an *img* or *object* element in the document to which this event is to be dispatched and the media objects are automatically started without explicit user or application defined programmatic action.

##### 8.2.11.2.2.2.2 `org.atsc.application.suspending` event

The `org.atsc.application.suspending` event is used to indicate that an ACAP-X application is about to be suspended. More specifically, the application is about to be transitioned to the `PAUSED` state as defined by the application lifecycle state model.

Name:            **`org.atsc.application.suspending`**  
 Bubbles:         no  
 Cancelable:     no  
 Default Action: none  
 Context:         none

An ACAP-X application shall strictly limit the type and amount of processing performed in an event handler registered for this event type. An implementation dependent time limit of no less than one second may be enforced on such processing by an ACAP-X environment, after which the application may be forcibly suspended.

An `org.atsc.application.suspending` event shall not be dispatched to an application if no prior `org.atsc.application.started` event was dispatched to the application.

#### 8.2.11.2.2.3 `org.atsc.application.resumed` event

The `org.atsc.application.resumed` event is used to indicate that a previously paused (suspended) ACAP-X application has just been resumed. More specifically, the application has just transitioned from the PAUSED state to the ACTIVE state as defined by the application lifecycle state model.

Name: **org.atsc.application.resumed**  
Bubbles: no  
Cancelable: no  
Default Action: none  
Context: none

An `org.atsc.application.resumed` event shall not be dispatched to an application if no prior `org.atsc.application.suspending` event was dispatched to the application.

#### 8.2.11.2.2.4 `org.atsc.application.terminating` event

The `org.atsc.application.terminating` event is used to indicate that an ACAP-X application has been signaled for graceful destruction. More specifically, the application has just transitioned to the DESTROYED state as defined by the application lifecycle state model.

Name: **org.atsc.application.terminating**  
Bubbles: no  
Cancelable: no  
Default Action: none  
Context: none

An ACAP-X application shall strictly limit the type and amount of processing performed in an event handler registered for this event type. An implementation dependent time limit of no less than one second may be enforced on such processing by an ACAP-X environment, after which the application may be forcibly terminated (killed).

An `org.atsc.application.terminating` event shall not be dispatched to an application if no prior `org.atsc.application.started` event was dispatched to the application.

The dispatching of the `org.atsc.application.terminating` event shall follow in time the cessation of playback of any media object that is referenced by an *img* or *object* element in the document to which this event is to be dispatched and the media objects were automatically started without explicit user or application defined programmatic action.

#### 8.2.11.2.2.3 Timer Event Types

The `org.atsc.timer` event is used to indicate the firing of a timer event.

Name: **org.atsc.timer**  
Bubbles: no  
Cancelable: yes  
Default Action: restart timer with same timer id using *interval* property to determine interval  
Context: *detail*

A timer event shall be generated by an ACAP-X environment when a timer is fired as a side effect of invoking the `Window::startTimer()` method as described in Section 8.2.11.2.3.1.1 (“`TimerDispatcher::startTimer`”) below. It shall be dispatched to the `Window` object on which the `startTimer` method was invoked.

A timer event shall be instantiated and dispatched as a `TimerEvent` object as described in Section 8.2.11.2.1.2 (“`TimerEvent` object”) above.

The target of a `org.atsc.timer` event shall be the `HTMLDocument` node of the document associated with the `Window` object in which the timer is started.

#### 8.2.11.2.2.4 Trigger Event Types

The `org.atsc.trigger` event is used to indicate the dispatch of a generic trigger.

Name: **org.atsc.trigger**  
Bubbles: No  
Cancelable: No  
Default Action: None  
Context: *detail*

A generic trigger event is never generated automatically by an ACAP-X environment. This event may be programmatically constructed and dispatched by application defined script content to a `Window` object as determined by the ACAP-X application.

In addition to the generic trigger type defined above, application defined trigger types shall be generated by an ACAP-X environment upon receipt of an asynchronous trigger or upon the firing of a synchronized trigger as describe in Section 8.1.4 (“`Trigger Processing`”) above.

A trigger event shall be instantiated and dispatched as a `TriggerEvent` object as described in Section 8.2.11.2.1.3 (“`TriggerEvent` object”) above.

The target of both the generic `org.atsc.trigger` event type as well as application defined trigger types shall be the `HTMLDocument` node of the document associated with the top-level `Window` object of the ACAP-X application which the trigger is associated.

#### 8.2.11.2.3 Environment Module Objects

This section describes extensions on certain Environment Module objects.

##### 8.2.11.2.3.1 Window Object

An ACAP-X application may use and an ACAP-X environment shall support the `DOM-2 EventTarget` interface on each `Window` object. Furthermore, the event flow for dispatched events shall start with the `Window` object and proceed as described in Section 8.1.3 (“`Event Processing`”) above.

An ACAP-X application may use and an ACAP-X environment shall support the following extension interface on each `Window` object:

```
interface TimerDispatcher
{
    /* methods */
    TimerId startTimer(in DOMString detail, in unsigned long interval);
    void cancelTimer(in TimerId id);
};
```

#### 8.2.11.2.3.1.1 TimerDispatcher::startTimer

This number valued method shall cause the repeated dispatch of an `org.atsc.timer` event to occur every *interval* milliseconds, returning a unique, opaque numeric identifier which may be subsequently used by `Window::cancelTimer`.

The *detail* parameter is application defined and is considered to be opaque to the user agent.

The value of the *interval* parameter may be zero, in which case a single timer event is asynchronously dispatched, and is not repeated unless the `TimerEvent::interval` property is modified by an event handler to be non-zero and the default action is not canceled.

#### 8.2.11.2.4 Inter-Environment Bridge

An ACAP-X application may use and an ACAP-X environment shall support an interface between the ACAP-X and ACAP-J environments as specified in MHP 1.1 [3], Section 8.10.2, as further amended by this section, with the term *ACAP-J* substituted for *DVB-J* and the term *ACAP-X* substituted for *DVB-HTML*.

Any use of this functionality by an ACAP-X application shall be subject to security considerations defined by Section 8.3.2, “Inter-Environment Bridge Access”.

##### 8.2.11.2.4.1 Packages Object

The Packages object described MHP 1.1 [3], Section 8.10.2, shall have a set of properties consisting of an ECMAScript object for each root package name that has been loaded into the class loader associated with the ACAP-X application or is present in the underlying ACAP-J implementation.

##### 8.2.11.2.4.2 Package Object

Each ECMAScript object representing a Java package shall have a set of properties consisting of an ECMAScript object for each top-level class and subpackage in the Java package. It shall also have the methods specified for the `java.lang.Package` class.

*Open Issue:* The `java.lang.Package` class was introduced in JDK1.2, and is not present in GEM/MHP. Need to determine what equivalent functionality to expose on ECMAScript side if any.

##### 8.2.11.2.4.3 Java Class Object

Each ECMAScript object representing a Java class shall have a property of the type Function for each public, static method name in the Java class. It shall also have an internal property, `[[Constructor]]`, which allows it to be used by the ECMAScript new operator. When invoked, the function attempts to find the best matching signature among the corresponding Java methods or constructors using the rules specified in MHP 1.1 [3] Section 8.10.2.7. If a compatible method is found, the arguments are converted according to MHP 1.1 [3], Section 8.10.2.9, and the return values as specified in MHP 1.1 [3], Section 8.10.2.11.

#### 8.2.11.2.4.4 Java Method Object

Each ECMAScript object representing a Java method shall implement a `[[Call]]` function that invokes the Java method. The arguments are matched against the signature of the Java method as specified in MHP 1.1 [3], Section 8.10.2.7. If the method is compatible, the arguments are converted according to MHP 1.1 [3], Section 8.10.2.9, and the return values as specified in MHP 1.1 [3], Section 8.10.2.11.

#### 8.2.11.2.4.5 Behavior of Java Objects in ECMAScript

The ECMAScript objects representing Java entities shall behave as host objects as defined in the ECMAScript specification. **Table 8-4** ECMAScript Internal Properties for Java Entities, lists the requirements on the internal properties of ECMAScript objects representing Java entities

**Table 8-4** ECMAScript Internal Properties for Java Entities

Property	Requirements
<code>[[Prototype]]</code>	Shall be null.
<code>[[Class]]</code>	Implementation dependent.
<code>[[Value]]</code>	Implementation dependent.
<code>[[Get]]</code>	Per ECMAScript specification for native objects.
<code>[[Put]]</code>	Per ECMAScript specification for native objects.
<code>[[CanPut]]</code>	Per ECMAScript specification for native objects.
<code>[[HasProperty]]</code>	Per ECMAScript specification for native objects.
<code>[[Delete]]</code>	Per ECMAScript specification for native objects.
<code>[[DefaultValue]]</code>	Shall be implemented as specified below.
<code>[[Construct]]</code>	When the corresponding Java object is an instantiable class., an instance of the class shall be constructed if the argument list matches a constructor. If no match is found, it throws a <code>TypeError</code> exception. For objects corresponding to a Java object that is not an instantiable class, e.g. an abstract class, it is undefined.
<code>[[Call]]</code>	For an object corresponding to a Java method (or overloaded methods), <code>[[Call]]</code> shall be implemented to invoke a method as described above. Otherwise it is undefined.
<code>[[HasInstance]]</code>	Shall be undefined on all objects corresponding to Java entities
<code>[[Scope]]</code>	Implementation dependent.
<code>[[Match]]</code>	Shall be undefined on all objects corresponding to Java entities

All properties specified herein on objects representing Java entities shall have the `ReadOnly` ECMAScript attribute, with the following exception. During the execution of an ECMAScript subclass constructor described in Section 8.2.11.2.4.8, the properties on the current object shall not have the `ReadOnly` attribute.

*Note:* The lack of `[[Prototype]]` or `[[HasInstance]]` means that ECMAScript `instanceof()` is not useful on objects representing Java entities. Instead `java.lang.Class.isInstance()` should be used for querying the inheritance of Java objects.

*Note:* Because the behavior of type conversion operators is unchanged from that specified in ECMAScript [50], Section 9, invoking `ToBoolean` on a `java.lang.Boolean` always returns `true`, since that is the value returned for all objects. And because the behavior of `[[DefaultValue]]` is unchanged, `ToNumber` on a

`java.lang.Object` returns the result of `toString()`, since that is the value returned for all objects.

#### 8.2.11.2.4.6 Explicit Method Selection

The mechanism for explicit method selection specified in MHP 1.1 [3], Section 8.10.2.5 is not supported by the ACAP-X application environment. Instead, a set of three methods are provided to allow particular methods to be explicitly retrieved so that it may be invoked.

The ECMAScript object corresponding to a Java object shall have a function that returns an object representing the corresponding Java method. It behaves as a Java method with the signature:

Method `getMethod(String methodName, String methodSignature)`

The ECMAScript object corresponding to a Java class shall have a function for retrieving static methods that returns an object representing the corresponding Java method:

Method `getStaticMethod(String methodName, String methodSignature)`

In addition, it shall provide function for retrieving constructors that returns an object representing the corresponding Java constructor:

Constructor `getConstructor(String methodSignature)`.

The signature string argument is a comma separated list of formal Java type specifiers. The signature must exactly match the argument list portion, i.e. that portion between the parentheses, of the string returned by `java.lang.reflect.Method.toString()` or `java.lang.reflect.Constructor.toString()`.

#### 8.2.11.2.4.7 Method Signature Matching

An implementation is required to match signatures of both static and non-static methods when the invocation is attempted on an ECMAScript object representing an instance of a Java class. The second item in the bulleted list in MHP 1.1 [3], Section 8.2.10.7 is amended to read:

“be static when the invocation is attempted on the class, and may be static or non-static when invoked on an instance.”

#### 8.2.11.2.4.8 Subclassing

`Subtype` is a function-valued property on the `Global` object which allows one to subclass an existing Java class. It returns an ECMAScript object that corresponds to the Java class representing the subclass. If the function is invoked to create a subclass of a final class, a `TypeError` exception is thrown.

Invoking `new` on the returned object constructs an instance of the subclass. During the creation of the instance, the constructor that was passed to `Subtype` is invoked on an object representing the Java object with the parent constructors invoked. The ECMAScript constructor function may then add function-valued properties for the methods implemented in ECMAScript. As specified in Section 8.2.11.2.4.5, properties corresponding to Java methods are writable only during this constructors invocation.

Method invocation from Java is performed as follows:



- If the method appears on a superclass and is final, that method is invoked.
- Otherwise, if the ECMAScript object has a function-valued property with the method name, that function is invoked.
- Otherwise, if the Java method is implemented on a superclass, that method is invoked.
- Otherwise, a Java runtime exception is thrown.

In the example of subclassing in MHP 1.1 [3], Section 8.10.2.10, the line

```
this.ActionPerformed = arg1;
```

is amended to read

```
this.SetAction(arg1);
```

#### 8.2.11.2.4.9 Exceptions

Exceptions thrown by Java called from ECMAScript are not converted to ECMAScript exceptions. They appear in ECMAScript as a Java object.

ECMAScript functions that throw exceptions when called from Java should throw subclasses of `java.lang.exception` or `java.lang.error` if they wish specific behavior on from the Java caller. If such a function throws another type of object, it appears in Java as a Java runtime exception with a message of "ECMAScript".

Where MHP 1.1 [3], Section 8.10.2 specifies that an object of type `DVBException` is thrown, an ECMAScript `TypeError` shall be thrown instead.

#### 8.2.11.2.4.10 Security

Per MHP 1.1 [3], Section 8.10.2.3, the Java runtime shall enforce the MHP security model when ECMAScript calls into Java. Hence, an implementation is required to maintain all contextual information needed by the Java Security model through multiple layers of calls between languages in both directions.

#### 8.2.11.2.4.11 Unicode Escapes

As described in ECMA SCRIPT [50], Section 6, ECMAScript identifiers, strings and characters may contain Unicode escape sequences that start with a `\` followed by a single `u`, whereas Java allows a `\` followed by one or more instances of the letter `u`. An ACAP-X environment is required to normalize these representations for purposes of comparisons so that regardless of the original or intermediate representation, equivalent Unicode sequences are considered equivalent when used in strings, characters and identifiers.

### 8.3 ACAP-X Security Specifics

#### 8.3.1 Cookie Access

Access to cookie state information items shall be controlled by the `acap:cookie` permission request as described by Section 12.4.2.3.1 below.

#### 8.3.2 Inter-Environment Bridge Access

Access to the inter-environment bridge shall be controlled by the `acap:bridge` permission request as described by Section 12.4.2.3.3 below.

### 8.3.3 Runtime Code Extension Access

Access to the runtime code extension mechanisms shall be controlled by the `acap:rce` permission request as described by Section 12.4.2.3.2 below.

## 8.4 ACAP-X Transport Specifics

The following metadata items shall be signaled in all ACAP-X application transport scenarios:

- application identifier
- root directory
- root resource

The *application identifier* metadata item shall specify a UUID, an organization identifier, and an organization specific application identifier. See Section 8.2.1.2.5 above for further information.

The *root directory* metadata item shall specify a directory either as an absolute URI or an absolute directory within some implied file system namespace, as determined by the transport scenario. This directory shall serve as the default *base* directory for relative references to resources that do not otherwise specify or imply a base directory.

The *root resource* metadata item shall specify a relative or absolute reference to the resource that represents the ACAP-X application's root entity. If the reference is a relative reference, then it shall be resolved relative to the *root directory* metadata item. If it is an absolute directory with an implied file system namespace, and that implied file system is a broadcast object carousel, then it shall be interpreted as a file pathname starting with the root directory of the object carousel.

The *root resource* metadata item shall reference either an application metadata resource or a markup content resource as defined by this specification. If a markup content resource is referenced as the root resource, then an application metadata resource shall be implied as described in Section 8.1.1 ("Application Behavior") above.

### 8.4.1 ACAP-X Transport Binding

When delivered within an ATSC or Digital Cable Television compliant transport stream, an ACAP-X application shall be signaled and as described by Section 10 ("Transport and Signaling").

This specification does not preclude the use of other transport bindings for other delivery mechanisms.

#### 8.4.1.1 Bounded Resource Encapsulation

A bounded resource (i.e., a resource of definite length) that is included in an ACAP-X application shall be encapsulated as a DSM-CC U-U BIOP::File object that makes use of any form of an interoperable object reference (IOR) as permitted by Section 10.2.1.2 below.

#### 8.4.1.2 Unbounded Resource Encapsulation

An unbounded resource (i.e., a resource of indefinite length) that is referenced by an ACAP-X application is limited to the streaming audio and stream video content types permitted by Sections 8.2.6 and 8.2.5 above. These resources are limited to elementary streams carried directly by the MPEG-2 transport stream, and are not transported by the DSM-CC UU Object Carousel.

### 8.4.1.3 Trigger Encapsulation

An asynchronous or synchronized trigger that is targeted to an ACAP-X application shall be encapsulated as a combination of (1) DSM-CC U-U BIOP::StreamEventMessage object as defined by MHP [2], Table B.30, that makes use of any form of an interoperable object reference (IOR) as permitted by Section 10.2.1.2 below, and (2) DSM-CC Stream Event Descriptor as defined by Section 10.2.7.4.1 below.

The mapping defined in **Table 8-5** ACAP-X Trigger Event Transport Binding, from the generic trigger event information items described by Section 8.1.4 above shall apply:

**Table 8-5** ACAP-X Trigger Event Transport Binding

Trigger Event Item	Mapping
event type	eventName_data field of BIOP::StreamEventMessage object
event time	eventNPT field of stream event descriptor
event payload	privateDataByte[] field of stream event descriptor

The BIOP::StreamEventMessage objects that provide mappings between event ids and event types shall appear in the root application directory of the object carousel.

If multiple ACAP-X applications are delivered in a single object carousel instance and each application is targeted for distinct trigger events, then the root application directories of these applications should be distinct. If they are not distinct, then each application shall receive copies of all triggers for which there is a matching event id value.

## 9. MONITOR APPLICATION SUPPORT

For ACAP receivers connected to cable networks, the monitor application, unbound applications and their supporting infrastructure shall be included as defined in OCAP 1.0 [4]. A non-exclusive list of the relevant sections of that document includes the following:

- Section 10.2.2.1 Unbound Applications
- Section 10.2.2.3 Application Manager Responsibilities
- Section 10.2.2.4 Application Priority
- Section 10.2.2.5 Host Device Resident Applications
- Section 11.2.2 Extensions to DVB-MHP (Normative)
- Section 13.2.2 Extensions to DVB-MHP (Normative)
- Section 18.2.1 Normative
- Section 19 Baseline Functionality
- Section 20 “Monitor Application”
- Annex G “OCAP 1.0 Application API”
- Annex P “OCAP 1.0 Service API”
- Annex R “Hardware POD API”
- Annex S “Media API”
- Annex Q “OCAP 1.0 System API”
- Annex K “OCAP User Input Event API”
- Annex A “XAIT Document Type Definition”

*Note:* It is expected that this reference and list will be updated during the candidate specification phase.

## 10. TRANSPORT AND SIGNALING

### 10.1 Introduction

This section of the specification describes the transport design. The scope is just those aspects of the transport protocol that relate to applications. The material of this section is normative unless the text indicates otherwise.

#### 10.1.1 Notation

To make the sections more legible, the text adopts a consistent convention for structures. The structure name consists of word fragments that begin with an upper case letter. There are no spaces between fragments nor there these underscores. For example:

```
TransportDescriptor() {
    DescriptorCode.    //8 bits. The code identifies the structure
    DataLength.       //8 bits. The length of the octet sequence that represents the structure data.
    for i=0;i<N-1;i++ {
        Octet
    }
}
```

If the construct is a constant, the letters are upper case and there are underscores between fragments. An example of the convention is `SOME_CONSTANT_VALUE`. The appendix adopts the same conventions. If the construct name of the appendix and that of the specification it references differ just with respect to the above conventions, the readership should assume that the constructs are identical.

### 10.2 Object Carousel Protocol

This section presents the normative requirements of the object carousel. The material adopts the same structure as the companion annex, but includes just normative language.

#### 10.2.1 Message Template

The implementation shall support the message template described in section B.2.3 of MHP [2].

##### 10.2.1.1 Interoperable Object Protocol

The message set of the object carousel builds on the schema of the Broadcast Interoperable Object Protocol. This protocol extends the Interoperable Object Protocol to account for the nature of broadcast.

##### 10.2.1.2 Interoperable Object References

The implementation shall support Broadcast Interoperable Object References as described in section B.2.3.7 of MHP [2]. The Profile Body shall be as described in section B.2.3.7.1 of MHP. The Lite Options shall be as described in section B.2.3.7.2 of MHP.

*Editor: incorporate text describing HTTPProfileBody as defined by MHP1.1 and extended as required to support “https” scheme; this mechanism is required for ACAP-X environment use only.*

### 10.2.1.2.1 HTTP Profile

If the implementation supports the ACAP-X application environment, the implementation shall support the HTTPProfileBody described below. The Interoperable Object Reference of the File message may include zero or one HTTPProfileBody instance or (see below) zero or one HTTPSProfileBody instance. If the HTTPProfileBody is present in other object carousel messages, the implementation shall ignore it.

The profile describes the location of the file contents on the interaction channel. The profile contains the components (host, port, and path) which allow the implementation to construct the schema:

- [http://host:port/path\\_segments](http://host:port/path_segments)

The HTTPProfileBody is given in **Table 10-1** Semantics of the HTTPProfileBody.”

**Table 10-1** Semantics of the HTTPProfileBody

HTTPProfileBody {	
ProfileIdTag	// 4 bytes. The value is <tbid>.
ProfileDataLength	// 4 bytes
ProfileDataByteOrder	// 1 byte
VersionMajor	// 1 byte
VersionMinor	// 1 byte
HostDataLength	// 1 byte
for (k=0;k<N1;k++) {	
HostData	// 1 byte
}	
Port	// 2 bytes
ObjectKeyLength	// 2 bytes
for (k=0;k<N2;k++) {	
ObjectKeyData	// 1 byte
}	
}	

Open Issue: We must request that a ProfileIdTag value be assigned.

The semantics of the profile fields are:

**ProfileDataByteOrder** – The field shall be 0x00 to indicate big endian order.

**VersionMajor** – The field indicates the major portion of the protocolversion. The implementation shall ignore it, as the implementation must support http1.1. The field is present to anticipate future versions of the protocol.

**VersionMinor** – The field indicates the minor portion of the protocol version. The implementation shall ignore it, as the implementation must support http1.1. The field is present to anticipate future versions of the protocol.

**HostData** – The character sequence specifies the host to which the client http messages will be sent. The schema may be either the fully qualified domain name, or the decimal shorthand (e.g “129.145.166.188”). The character encoding is UTF-8.

**Port** – The field is an unsigned integer that specifies the port at which the service side listens. The value 0xFFFF is reserved to mean to adopt the default port. (The default port for http, specified in rfc2616, is 80.)

**ObjectKeyData** – The field is the character sequence that represents the path that identifies the service side implementation. The character encoding is that described in “Uniform Resource Identifiers (URI): Generic Syntax” (RFC2396). The implementation shall support the fragment identifier construct of section 4.1 of RFC2396 and support the query construct of section 5.0 and section 5.2 of RFC2396.

An HTTPProfileBody IOR may be used in conjunction with a BIOPProfileBody, in which case the priority for determining which IOR entry to use shall be as follows:

1. If there is no timestamp descriptor in the File message, then use the HTTPProfileBody to perform an unconditional GET using HTTP, and, if the request is successful, then use the resource returned by the HTTP response. If the request is not successful, then use the resource referenced by the BIOPProfileBody.
2. If there is a timestamp descriptor in the File message, then use the HTTPProfileBody to perform a conditional GET using HTTP with the value of the timestamp being used to construct an If-Modified-Since request header, and, if the request is successful and returns a newer resource, then use the resource returned by the HTTP response. If the request is not successful or no resource was returned, then use the resource referenced by the BIOPProfileBody. If the timestamp descriptor is present, but the value equates to “unknown”, the logic of the first case is applicable. The semantics are as if the descriptor is not present.
3. If no HTTPProfileBody is present, then use the BIOPProfileBody to obtain the resource.

A File Message's IOR shall contain no more than one instance of an HTTPProfileBody and no more than one instance of a BIOPProfileBody. If Interoperable Object Reference of the File Message contains a LiteOptionsProfileBody, then it shall not contain either a HTTPSPProfileBody or HTTPProfileBody or a BIOPProfileBody.

#### 10.2.1.2.2 HTTPS Profile

If the implementation supports the ACAP-X application environment, the implementation shall support the HTTPSPProfileBody described below. The profile is comparable to the profile for http, but signals that the protocol is to be https instead. The schema for the HTTPSPProfileBody is identical to that for HTTPProfileBody except for the ProfileIdTag code. See **Table 10-2** Semantics of the HTTPProfileBody.

**Table 10-2** Semantics of the HTTPProfileBody

HTTPSPProfileBody {	
ProfileIdTag	// 4 bytes. The value is <tbd>.
ProfileDataLength	// 4 bytes
ProfileDataByteOrder	// 1 byte
VersionMajor	// 1 byte
VersionMinor	// 1 byte
HostDataLength	// 1 byte
for (k=0;k<N1;k++) {	
HostData	// 1 byte
}	

```

Port           // 2 bytes
ObjectKeyLength // 2 bytes
for (k=0;k<N2;k++) {
    ObjectKeyData // 1 byte
}
}

```

Open Issue: We must request that a ProfileIdTag value be assigned.

The semantics of the fields are identical to that of the HTTPProfileBody. (The default port for https is 443.) The HTTPSPProfileBody may be used in conjunction with a BIOPProfileBody. The timestamp algorithm is identical to the algorithm for HTTPProfileBody.

#### 10.2.1.2.3 Network Service Access Point Address

The object carousel is a collection of resources organized as a graph. The root of the graph is the Service Gateway object, which aggregates the content for a specific service domain. To obtain access to the object carousel, the implementation must discover the Network Service Access Point Address. The Digital Storage Media Command and Control Specification defines the address as shown in **Table 10-3** Network Service Access Point Address.

**Table 10-3** Network Service Access Point Address

AFI	Type	Carousel Id	Specifier	Private Data
1-byte	1-byte	4-byte	4-byte	10-byte

The Digital Storage Media Command and Control Specification and MHP place certain restrictions on the fields of the structure (see **Table 10-4** Network Service Access Point Address Fields).

**Table 10-4** Network Service Access Point Address Fields

Construct	Structure	Field	Restriction	Source	Section
Carousel Address		Authorization Format Identifier	The field is zero so as to signal that the format is private.	MPEG 1998 DB 1.0	9.2.1
Carousel Address		Type	The field is zero so as to signal that the address is for another object carousel.	MPEG 1998 DB 1.0	9.2.1
Carousel Address		Carousel Id	The field designates a specific object carousel.	MPEG 1998 DB 1.0	9.2.1
Carousel Address		Specifier	The field is 0x01, which signals the presence of an Organization Unique Identifier (OUI) structure. The structure implies the schema of the private data.	MPEG 1998 DB 1.0	9.2.1
Carousel Address		Private Data	The field is specific to this specification. See below for details.	MPEG 1998 DB 1.0	9.2.1



The purpose of the Specifier field is to define the schema for the fields that follow. The Specifier itself is:

```
Specifier {
    SpecifierType    //1 byte
    SpecifierData    //3 byte
}
```

The Digital Storage Media Command and Control Specification assigns certain values, given in **Table 10-5** Specifier Type Assignments.

**Table 10-5** Specifier Type Assignments

Construct	Field	Value	Definition	Source	Section
Carousel Address	Specifier Type	0x00	ISO 13818-6 Reserved.	DB 1.0	9.2.1
Carousel Address	Specifier Type	0x01	IEEE Organization Unique Identifier.	DB 1.0	9.2.1
Carousel Address	Specifier Type	0x02- 0x07	ISO 13818-6 Reserved.	DB 1.0	9.2.1
Carousel Address	Specifier Type	0x08- 0xFF	The field is, for this specification, the value assigned to the Advanced Television Systems Committee. See below.	DB 1.0 ACAP 1.0	9.2.1

The Specifier Type field shall be 0x01, which implies that the data field is an Organization Unique Identifier (OUI) assignment. This is consistent with MHP, which adopts the same technique to signal the structure that follows. The Organization Unique Identifier is a unique code that the Institute of Electrical and Electronics Engineers assigns to organizations.

The value of the Organization Unique Identifier that the implementation shall recognize is the assignment for the Advanced Television Systems Committee. The value is 0x000979. **Table 10-6** Organization Unique Identifier Assignments, lists this and other assignments.

**Table 10-6** Organization Unique Identifier Assignments

Construct	Field	Value	Definition	Source	Section
Carousel Address	Specifier Data	0x000979	Advanced Television Systems Committee Organization	ATSC	
Carousel Address	Specifier Data	0x001000	Cable Labs Organization	OC 1.0	
Carousel Address	Specifier Data	0x00015A	Digital Video Broadcast Organization	DB 1.0	9.2.1

If the Organization Unique Identifier is not 0x000979, the implementation may elect to abort the carousel access. For ACAP-J applications, the implementation raises an exception to signal carousel access failure. See Section 7 (“ACAP-J Applications and Environment”) for details. There is no comparable exception for ACAP-X applications.

Given the Organization Unique Identifier, the implementation understands how to interpret the last fields of structure, that is the private data. The schema shall be (**Table 10-7** ACAP Carousel Location).

**Table 10-7** ACAP Carousel Location

Transport	First Tuple (two bytes)		Second Tuple (two bytes)		Third Tuple (two bytes)	
	Value	Semantics	Value	Semantics	Value	Semantics
Terrestrial	0x0000	Reserved	0xFFFF	Reserved for Future Use	0x0FFF	Reserved for Future Use
Terrestrial	0x0001-0xFFFF	Source Id	0xFFFF	Reserved for Future Use	0x0FFF	Reserved for Future Use
Cable	0x0000	Source Id for Out-of-Band	0xFFFF	Reserved for Future Use	0xFFFF	Reserved for Future Use
Cable	0x0001-0xFFFF	Source Id for In-Band	0xFFFF	Reserved for Future Use	0xFFFF	Reserved for Future Use

The implementation resolves the Source Id to the carousel address. For this specification, the Source Id resolves to a virtual channel. For values between [0x0001, 0x0FFF], the scope is a single transport stream (known through the Transport Stream Id). For values between [0x1000, 0xFFFF], the scope is region specific. There is, for the present, no single universal value space. The network shall manage the value space to avoid collisions.

If the network is broadcast, the value of zero for Source Id is reserved. If the implementation encounters the value zero for a broadcast network, the implementation can elect to abort the carousel access. The implementation raises an exception for ACAP-J applications. See the ACAP-J application section for details. There is no comparable exception for ACAP-X applications. If the network is cable, a value of zero is valid. This specification defines the value zero to mean that the carousel address is to be found in the out-of-band channel. See [<zzHyperLinkparatext\x11>](#) Sections 3.3, 4.2 and 4.3 for definitions of in-band versus out-of-band channels.

Editor: Replace the above missing reference with an appropriate reference citation.

### 10.2.2 Service Gateway Message

The Service Gateway represents the root of the object carousel. The implementation shall support the Service Gateway Message of section B.2.3.6 of MHP [2], subject to the clarifications and extensions of this section.

#### 10.2.2.1 Message Schema

The Message SubHeader structure of the message contains the Object Info structure. The descriptor sequence inside this structure a) may include a single Content Type Descriptor and b) may include a single Time Stamp Descriptor. These descriptors shall conform to the inheritance rules presented in Section 10.2.5("File Message").

The Binding structure of the message also contains the ObjectInfo structure. The descriptor sequence inside this structure a) may include a single Content Type Descriptor and b) may include a single Time Stamp Descriptor. These descriptors shall conform to the inheritance rules presented in the File Message portion of this chapter. If the Content Type Descriptor is present, it shall match a companion Content Type Descriptor of the object that the binding references.

*Note:* While the schema of the Content Type Descriptor is identical to that of MHP, this specification relaxes the semantic constraint that all leaf nodes of the object graph must include the descriptor. See Section 10.2.5 (“File Message”) for the inheritance rules. The inheritance rules are backwards compatible to the technique where all leaf nodes include the descriptor.

The other constraints of the object carousel design are applicable. See section B.2.3.5 and section B.2.3.6 of MHP [2] for details.

#### 10.2.2.2 Message Descriptors

The ObjectInfo structure may contain a single Content Type Descriptor and a single Time Stamp Descriptor as described under the File message.

##### 10.2.2.2.1 Label Descriptor

The ObjectInfo structure of the ServiceGateway message may contain a single Label Descriptor as described under the File message.

##### 10.2.2.2.2 Time Stamp Descriptor

The ObjectInfo structure of the ServiceGateway message may contain a single Time Stamp Descriptor as described under the File message.

### 10.2.3 Directory Message

The implementation shall support the Directory Message of Section B.2.3.5 of MHP [2], subject to the clarifications and extensions of this section.

#### 10.2.3.1 Message Schema

The Message SubHeader structure of the message contains the Object Info structure. The descriptor sequence inside this structure a) may include a single Content Type Descriptor and b) may include a single Time Stamp Descriptor. These descriptors shall conform to the inheritance rules given in Section 10.2.5 (“File Message”). If the binding of the object that references the node contain a Content Type Descriptor, the Object Info of the Message SubHeader of the node shall contain a single Content Type Descriptor. The two descriptor shall be the same.

The Binding structure of the message also contains the Object Info structure. The descriptor sequence inside this structure a) may include a single Content Type Descriptor and b) may include a single Time Stamp Descriptor. These descriptors shall conform to the inheritance rules presented in Section 10.2.5 (“File Message”). If the Content Type Descriptor is present, it shall match the companion Content Type Descriptor of the object that the binding references.

The other constraints of the object carousel design are applicable. See MHP [2], Section B.2.3.6 for details.

#### 10.2.4 Message Descriptors

The ObjectInfo structure may contain a single Content Type Descriptor and a single Time Stamp Descriptor as described under the File message.

##### 10.2.4.1.1 Label Descriptor

The ObjectInfo structure of the Directory message may contain a single Label Descriptor as described under the File message.

#### 10.2.4.1.2 Time Stamp Descriptor

The ObjectInfo structure of the Directory message may contain a single Time Stamp Descriptor as described under the File message.

### 10.2.5 File Message

The discussion of the File Message considers both the message schema and the schema and semantics of its descriptors.

#### 10.2.5.1 Message Schema

The implementation shall support the File Message of Section B.2.3.3 of MHP [2], subject to the clarifications and extensions of this section. The Message SubHeader structure of the message contains the Object Info structure. The descriptor sequence inside this structure a) may include a single Content Type Descriptor and b) may include a single Time Stamp Descriptor. These descriptors shall conform to the inheritance rules presented below. If the binding of the object that references the node contain a Content Type Descriptor, the Object Info of the Message SubHeader of the node shall contain a single Content Type Descriptor. The two descriptor shall be the same.

#### 10.2.5.2 Message Descriptors

This section describes the descriptors that can be present within the File Message.

##### 10.2.5.2.1 Content Type Descriptor

The Content Type Descriptor signals the format of the files that constitute the application. There shall be at most one such descriptor in the descriptor sequence inside the Object Info of the Message SubHeader. If multiple formats could describe the content, the format found in the descriptor should be the most descriptive.

If the descriptor is not present, or is present but the string is not known to the receiver, the receiver may attempt to recognize the content through its file extension, as described in MHP [2], Section 11.3.1.6.

##### 10.2.5.2.1.1 Descriptor Schema

MHP [2], Section B.2.3.4, defines the schema as:

```

ContentTypeDescriptor() {
    DescriptorTag           //8 bits. The value shall be 0x72.
    DescriptorLength       //8 bits. The length of the character sequence that follows.
    for (i=0; i<DescriptorLength; i++) {
        ContentTypeDataByte //8 bits. The character sequence that represents a MIME type.
    }
}

```

This specification adopts the same schema. The data within the descriptor forms a string the syntax of which is:

```

ContentTypeData = type "/"subtype *(";" parameter)

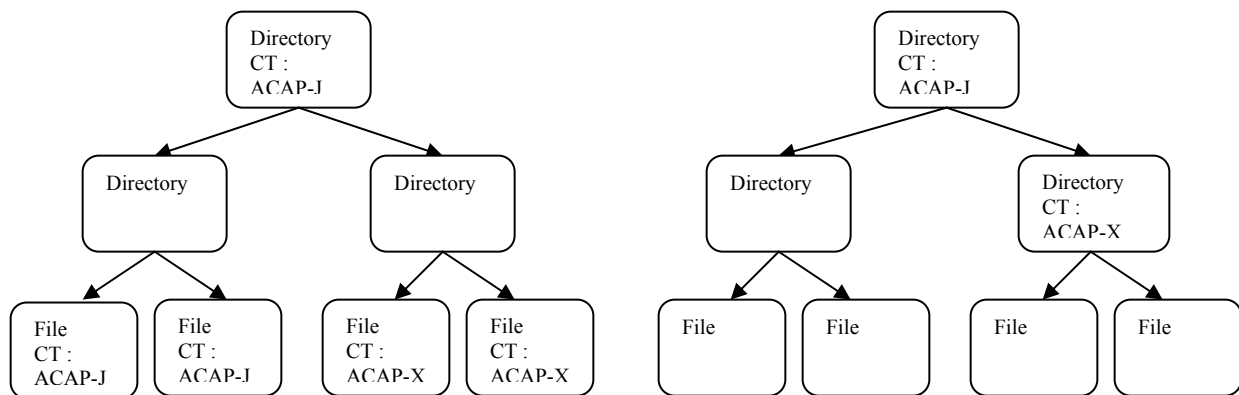
```

The type field, subtype field, and parameter field shall be consistent with section 5.0 of “MultiPurpose Internet Mail Extensions (MIME) Part One: Format of Internet Message Bodies” (rfc2045). The character encoding of the string shall be UTF-8.

#### 10.2.5.2.1.2 Descriptor semantics

This specification relaxes the constraint that Object Info inside the Message SubHeader of Files Messages must include the Content Type Descriptor. (To be careful, the reference specifications do allow defaults. The Content Type Descriptor must be present if the File Object does not match the defaults.) This specification allows content attributes to be defined at the root of the object carousel, or at intermediate nodes, rather than just at the leaf nodes. The nodes of the object graph inherit these attributes. The concept is applicable to both the Content Type Descriptor and the Time Stamp Descriptor. This section considers the inheritance rules for the Content Type Descriptor.

The inheritance rules of this specification are backward-compatible to the reference specifications: the message conventions of the reference specifications are still valid under the inheritance rules described here. The implementation, however, shall not expect the File Objects whose attributes differ from the defaults to contain the Content Type Descriptor. The implementation derives the attributes through inheritance rules.



**Figure 10-1** Content Type Inheritance.

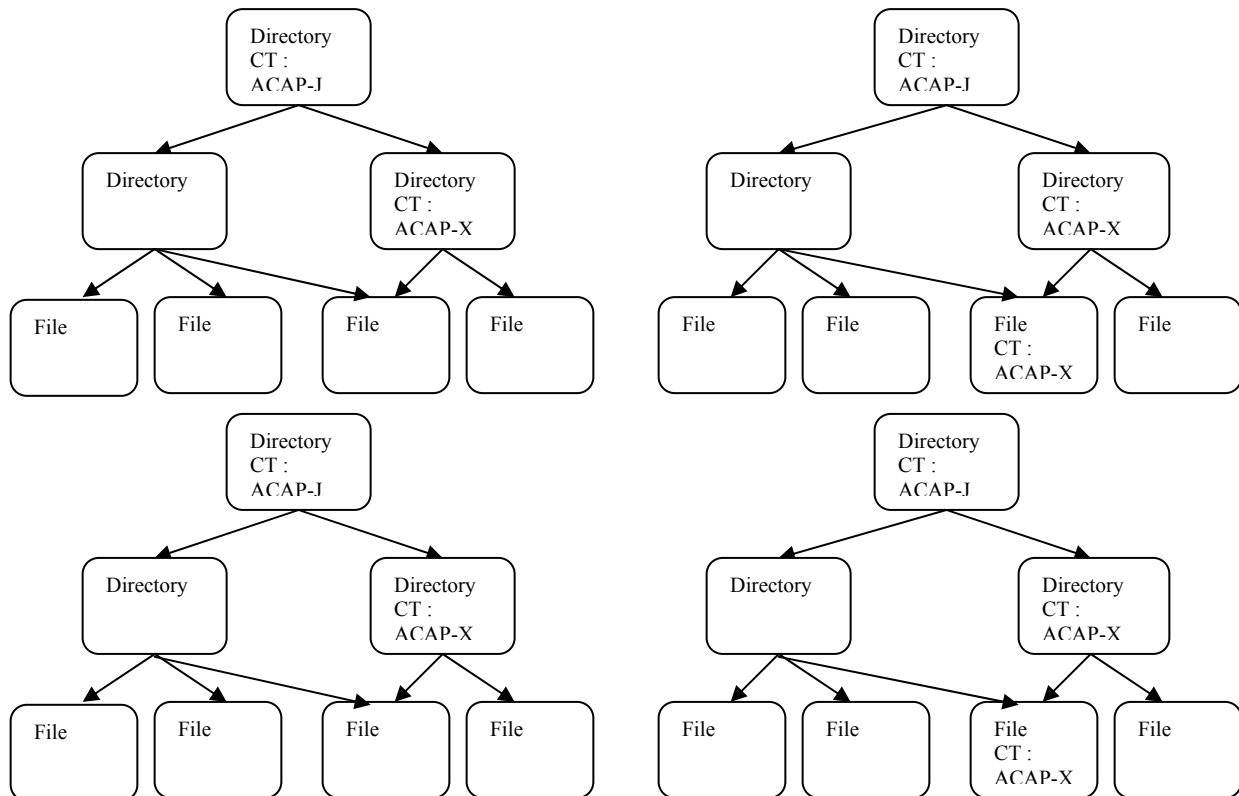
**Error! Reference source not found.**, illustrates the inheritance concept. For both object carousels shown, the leaf nodes are file objects. The premise is that for both object carousels, the files are, left to right, are a pair of ACAP-J applications and then a pair of ACAP-X applications.

For the object carousel on the left, the algorithm is that of MHP [2]. The algorithm requires that File Objects whose attributes differ from the defaults include descriptors to override the defaults. The default is that files contain ACAP-J applications. Thus for the object carousel on the left the File Objects that relate to ACAP-X applications include the Content Type Descriptor.

The object carousel on the right is the same object carousel, but the algorithm differs. The object carousel on the right adopts the inheritance rules described below. In the example, the root node declares that files are ACAP-J applications, and the intermediate node above the ACAP-X applications declares that subsequent files are ACAP-X applications. The observation is that the algorithm conserves bandwidth, since just the root of (homogeneous) sub-graphs contain the descriptor.

The inheritance rules are:

- The default Content Type Descriptor is “ACAP-J”. Since the default content type is “ACAP-J”, the Service Gateway Object need not contain a Content Type Descriptor. The inheritance rules presume the content type is “ACAP-J” and require the subgraph to include Content Type Descriptors only if the object carousel contains files that differ from the default.
- The Service Gateway Object or the Directory Objects may contain a Content Type Descriptors inside Object Info structure of the Message SubHeader. If the traverse to the leaf nodes encounters such a descriptor, the descriptor replaces the descriptor encountered at nodes above they subgraph. The attributes of the descriptor are applicable to all nodes of the subgraph unless the nodes of the subgraph include the descriptor, which then replaces the previous descriptor.
- The result of the inheritance evaluation shall be unambiguous. If the carousel structure includes multiple traverse paths to a node, the result of the inheritance evaluation for the node shall be the same for all traverse sequences. (The implication of the last rule is that certain carousel structures require that file objects that relate to ACAP-J applications must include Content Type Descriptors.)



**Figure 10-2** Content Type Inheritance Conflict.

**Figure 10-2** Content Type Inheritance Conflict., motivates the last rule. For both object carousels, the directory on the left contains both ACAP-J applications and ACAP-X applications. The implication is that, for the object carousel on the left, the traverse sequence though the directory on the left side of the figure evaluates the common file to be an ACAP-J application, since there is no descriptor to override the premise that the files are ACAP-J content. The traverse sequence through the directory on the right side of the figure evaluates the common file to be an ACAP-X application, since the traverse encounters a directory object that declares

subsequent files to be ACAP-X content. The distinct traverse sequences reach opposite conclusions.

The object carousel on the right resolves the conflict. (There are other realizations that also resolve the conflict.) The object carousel declares that the common file is an ACAP-X application. The conclusion of the inheritance rule is consistent independent of traverse sequence.

#### 10.2.5.2.2 Time Stamp Descriptor

The Time Stamp Descriptor describes the time at which the object was last modified. The schema is the same as that found in A/95 [57], but this specification relaxes certain semantic restrictions of that specification.

##### 10.2.5.2.2.1 Descriptor schema

The schema of the descriptor is:

```
TimeStampDescriptor() {
    DescriptorTag           // 8 bits The value shall be <tbid>.
    DescriptorLength       // 8 bits
    TimeStamp              //64 bits
}
```

The definition for each field is:

**Descriptor Tag** – The field identifies the descriptor. For the TimeStampDescriptor the value shall be <tbid>.

**Descriptor Length** – The field describes the byte count of the data that follows the Descriptor Length field it. The value of the field shall be set to 0x08.

**Time Stamp** – This 64 bit unsigned integer represents the UTC time when the object (or child objects) was last modified. The units are milliseconds since 00:00:00 of January 1, 1970 GMT. The value 0xFFFFFFFFFFFFFFFF shall indicate that the time is not available. For a Service Gateway Object or a Directory Object, the object is “modified” if a binding has been added or deleted, or if a binding name has been changed. For a File Object, the object is “modified” if the ContentTypeDescriptor, the ContentLength, or the ContentData have been changed. See discussion below for further clarifications.

The Transport Stream File System (the specification that defines the schema) requires that the Time Stamp Descriptor be present in File Objects. This specification relaxes this restriction. The File Objects may contain the descriptor. The alternative realization is for the parent nodes (that is a Service Gateway Message or Directory Message) to include the descriptor. The File Object in this case inherits the parent’s descriptor.

##### 10.2.5.2.2.2 Descriptor semantics

The inheritance algorithm for the Time Stamp Descriptor shall be as described below. The technique is comparable to the technique for the Content Type Descriptor. The inheritance algorithm is:

- The default Time Stamp Descriptor is the special value reserved to mean that the modification time is not available.

- The descriptor may be present in the Message SubHeader structure of a Service Gateway Message, Directory Message, or File Message, subject to the rules below. The Message SubHeader shall be at most a single descriptor.
- The descriptor may be present in the Binding structure of a Service Gateway Message or Directory Message, in which case the Message SubHeader of the object that the binding references shall also include the same descriptor. The Binding shall be at most a single descriptor.
- The Service Gateway Object and Directory Object should include the descriptor. In addition to the conditions of the Transport Stream File System specification (the addition of a binding, the deletion of a binding, or the change to a binding name), a modification to an object in the subgraphs below the Service Gateway Object or Directory Object should result in a change to parent descriptors. If the parent descriptor is present, the time value shall represent the most recent change to the child objects.
- The File Objects should contain the descriptor. If the descriptor is present, the time value shall represent the most recent time at which the ContentTypeDescriptor, ContentLength, or ContentBytes changed.
- The objects of the graph need not include the descriptor. If the descriptor is not present, inheritance rules shall determine the time stamp. If a child node does not include the descriptor, the node inherits the time stamp of its parent (or the default if the traverse to this point encounters no descriptor). If a child node does include a descriptor, the time stamp becomes the default for the children (if present) of this node as well as the node itself.
- The time stamp shall be unambiguous. If there are multiple traverse sequences to the same node, all traverse sequences shall result in the same time stamp value.

#### **10.2.6 Stream Message**

The specification supports two dialects of stream messages. The Stream Object message describes streams that do not also contain stream events. The Stream Event Object message (see below) describes streams that also contain stream events. This section describes the Stream Object.

The implementation shall support the Stream Message of Section B.2.3.8 of MHP [2], subject to the clarifications and extensions of this section. The realizable values for the Info\_T:Audio, Info\_T:Video, and Info\_T:Data fields are zero and one. The value zero means such a stream is not present. The value one means such a stream (or multiple streams) is present. If all three fields are zero, the nature of the stream was not known at the time the message was built. The semantics for other values is implementation dependent.

The implementation shall adopt the algorithm to isolate the elementary stream that contains the object carousel described in Section B.3.1 of MHP [2]. The implementation shall raise an exception for ACAP-J applications. There is no comparable exception for ACAP-X applications.

#### **10.2.7 Stream Event Message**

The stream event object is known in other designs as a trigger. The concept is that the platform, upon receipt, forwards the object inside the message to applications that register interest in these events. The application then performs some action.

The object carousel design provides multiple dialects of stream objects. The Stream Message (see above) applies if the stream does not also involve stream events. The Stream Event Message of this section applies if the stream does involve stream events.



Open Issue: The question of support for time aware stream events is still under discussion. The draft specification might not support the feature.

#### 10.2.7.1 Stream Event Concepts

The Stream Event feature of MHP [2] supports both stream events that are not time aware and stream events that are time aware. For stream events that are not time aware, the platform forwards the Stream Event Object to the application upon receipt. The application then performs (to be precise initiates) some action. The application initiates the action at once. For stream events that are time aware, the platform forwards the Stream Event Object at a specific time. These time aware events are also known as synchronous events. The implication of the time aware stream events is that the platform understands some concept of media time. For a more complete discussion of the concepts, see the companion appendix of this specification.

#### 10.2.7.2 Message Schema

The implementation shall support the Stream Event Message syntax as described in section B.2.3.9 of MHP [2], subject to the clarifications and extensions of this section. The realizable values for the Info\_T:Audio, Info\_T:Video, and Info\_T:Data shall be as described for the Stream Message. The interpretation of the values shall be as for the Stream Message. The contents of the EventList\_T: Event Names List can be just the null termination; in other words the event name can be the empty string. (This is consistent with MHP which is silent on the question, and thus does not preclude that the event name could be the empty string.)

#### 10.2.7.3 Message Semantics

The scope of this specification is the device that receives the transport stream, that is the edge node that terminates the network. The implementation shall support the semantics of Section B.2.4.1 of MHP [2]. The source nodes and intermediate nodes of the transport chain should, in addition, support the semantics of subsections of B.2.4.1 that relate to these nodes.

#### 10.2.7.4 Message Descriptors

In the case of time aware events, the message requires two descriptors. The first descriptor associates the stream event with a time line. The second descriptor contains time values that allow the device to calculate the time line. This section considers the descriptors.

Open Issue: The question of support for time aware stream events is still under discussion. The draft specification might not support the feature, or might require the device to support the feature but not require networks to emit time aware stream events or their descriptors.

##### 10.2.7.4.1 Stream Event Descriptor

The implementation shall support the Stream Event Descriptor as described in Section B.2.4.2 of MHP [2].

##### 10.2.7.4.2 NPT Reference Descriptor

Open Issue: The support for the descriptor, or an alternative descriptor, is still under discussion.

### 10.3 Data Carousel Protocol

#### 10.3.1 The Message Template

The data carousel design adopts certain conventions that are applicable to all messages. This section describes the conventions.

##### 10.3.1.1 Message Header

The implementation shall support the Generic Message Header of Sections 8.1 through 8.3 and Sections B.2.2.1 of MHP [2]. The implementation shall adopt the restrictions of Section B.2.6 and B.2.7 of MHP.

##### 10.3.1.2 Section Format

The implementation shall support the Section Format construct of Section B.2.1 of MHP [2], subject to the clarifications and extensions of this section. The Section Format schema anticipates two error detection techniques. MHP requires support for just one technique, which is the CRC32 algorithm. (The algorithm is described in Annex A of the Motion Pictures Experts Group Systems specification.) This specification requires support for both techniques. The second technique is the checksum algorithm defined in ISO 13818-6 (1998) Corrigenda 2-2001 (E) and described below:

Algorithm: The scope of the checksum is the entire section. The calculation treats the section as a sequence of 32-bit integers and performs one's complement addition on the entire integer sequence. The calculation begins at the most significant byte, then calculates the one's complement of the result. For the purpose of computing the checksum, the value of the checksum field itself is considered to be zero. If the message length is not a multiple of four bytes, the message shall be considered to be appended with bytes of 0x0 for the purpose of checksum calculation. If the result of the computation is zero, then the result shall be set to 0xFFFFFFFF (the alternative value for a one's complement representation of zero). Should a checksum not be desired, the value of checksum shall be set to '0x00000000' to indicate the checksum has not been calculated. This option is available for networks where the error protection occurs at a different strata of the protocol stack.

MHP [2] (Section B.2.1.1) requires the transport packets to contain at most two sections. This specification adopts the same constraint.

#### 10.3.2 Download Info Indication Message

The message specifies information to locate the modules of the carousel. The discussion considers three topics. The first describes the message structure, the second describes the Module Info structure found inside the message, and the third the descriptors that can appear inside the Module Info structure.

##### 10.3.2.1 Message Schema

The implementation shall support the Download Info Indication message as described in Section B.2.2.2 of MHP [2], subject to the clarifications and extensions of this section. The last structure of the message is private data. This specification requires that the first structure of the private data be the Registration Descriptor of the Motion Picture Experts Group. The purpose of the constraint is to eliminate name collisions. The Registration Descriptor provides the mechanism through which organizations reserve unique codes. The organization codes scope the private data found after the structure.

The Registration Descriptor shall adopt the restrictions of the <zzHyperLinkparatext\x11> and <zzHyperLinkparatext\x11> specifications. In addition to these conventions, the Format Identifier of the Registration Descriptor is to be registered with the Society of Motion Picture and Television Engineers. The web site for the organization (<http://www.smpte-ra.org>) provides further information on the registration process.

Editor: Replace the above two missing references with an appropriate reference citation.

#### 10.3.2.2 Method Structures

The implementation shall support the ModuleInfo structure as described in Section B.2.2.4 of MHP [2].

#### 10.3.2.3 Message Descriptors

The Module Info Structure can contain a descriptor loop. This section describes the descriptors that are to be supported.

##### 10.3.2.3.1 Type Descriptor

The implementation shall support the Type Descriptor as described in Section 8.2.2 of MHP [2], subject to the clarifications and restrictions of this section. The encoding of the character sequence that constitutes type field shall be UTF-8.

##### 10.3.2.3.2 Name Descriptor

The implementation shall support the Name Descriptor as described in Section 8.2.3 of MHP [2], subject to the clarifications and restrictions of this section. The encoding of the character sequence that constitutes the name field shall be UTF-8.

##### 10.3.2.3.3 Info Descriptor

The implementation shall support the Info Descriptor as described in Section 8.2.4 of MHP [2], subject to the clarifications and restrictions of this section. The encoding of the character sequence that constitutes the name field shall be UTF-8.

##### 10.3.2.3.4 Module Link Descriptor

The implementation shall support the Module Link Descriptor as described in Section 8.2.5 of MHP [2].

##### 10.3.2.3.5 CRC32 Descriptor

The implementation shall support the CRC32 Descriptor as described in Section 8.2.6 of MHP [2], subject to the clarifications and restrictions of this section. The algorithm shall be as described in Annex A of the Motion Pictures Experts Group Systems specification.

##### 10.3.2.3.6 Location Descriptor

The implementation shall support the Location Descriptor as described in Section 8.2.7 of MHP [2].

##### 10.3.2.3.7 Estimated Download Time Descriptor

The implementation shall support the Estimated Download Time Descriptor as described in Section 8.2.8 of MHP [2].

Open Issue: The text of Section 8.2.8 in the reference specification does not reserve a value to mean “unknown”. Should this specification do so?

#### 10.3.2.3.8 Compressed Module Descriptor

The implementation shall support the Compressed Module Descriptor as described in Sections 8.2.11, B.2.2.4, and B.2.9 of MHP [2], subject to the clarifications and extensions of this section.

Open Issue: Since the Compression Method field is one byte and the Original Size field is four bytes, the DescriptorLength field is, in practice, a constant.

The compression technique shall be the “zib” technique of rfc1950. If the Compressed Module Descriptor is present, then the data inside the module adopts the structure described in rfc1951. While this structure anticipates multiple compression techniques, this specification requires support for just the “deflate” technique. If the code indicates another compression technique, the implementation can elect to adopt the carousel assess. The implementation shall raise an exception for ACAP-J applications. There is no comparable exception for ACAP-X applications.

The Original Size field shall represent the size before compression, except where the Original Size is not known (or would require decompression on the source node to discover) in which case the value of the Original Size field shall be zero.

#### 10.3.2.3.9 Label Descriptor

The implementation shall support the Label Descriptor as described in Section B.2.2.4.1 of MHP [2], subject to the clarifications and restrictions of this section. The descriptor loop may contain multiple Label Descriptors. These descriptors designate modules that the implementation should prefetch. The information is a hint; the implementation need not prefetch the modules. (See the description of the prefetch descriptor for details.) The character encoding of the character sequence that represents the label shall be UTF-8. A label with zero characters is valid.

This specification further requires that the label be unique within the object carousel. The implication is that modules to which label refer must reside in the same Download Info Indication message. The label of a Label Descriptor shall match the companion label found in a Prefetch Descriptor.

#### 10.3.2.3.10 Caching Priority Descriptor

The implementation shall support the Caching Priority Descriptor as described in Section B.2.2.4.2 of MHP [2]. The value is a hint. The implementation can elect to ignore the value.

### 10.3.3 Download Server Initiate Message

The implementation shall support the Download Server Initiate Message as described in Section B.2.2.3 of MHP [2], subject to the clarifications and extensions of this section. The Download Server Initiate message bootstraps the traverse of the object carousel. The message provides the object reference to the Service Gateway object of the carousel. The Service Gateway object represents the root of the carousel structure.

#### 10.3.3.1 Message Schema

The last structure of the message, the ServerId, is the Network Service Access Point (NSAP) Address for the Service Gateway for the object carousel. The address shall adopt the restrictions described under the object carousel section of this specification.

### 10.3.3.2 Method Structures

The implementation shall support the Service Gateway Info Structure as described in Section B.2.2.5 of MHP [2].

### 10.3.3.3 Method Descriptors

The Module Info Structure can contain a descriptor loop. This section describes the descriptors that are to be supported.

#### 10.3.3.3.1 Type Descriptor

The implementation shall support the Type Descriptor as described in Section 8.2.2 of MHP [2], subject to the clarifications and restrictions of this section. The encoding of the character sequence that constitutes type field shall be UTF-8.

#### 10.3.3.3.2 Name Descriptor

The implementation shall support the Name Descriptor as described in Section 8.2.3 of MHP [2], subject to the clarifications and restrictions of this section. The encoding of the character sequence that constitutes the name field shall be UTF-8.

#### 10.3.3.3.3 Info Descriptor

The implementation shall support the Info Descriptor as described in Section 8.2.4 of MHP [2], subject to the clarifications and restrictions of this section. The encoding of the character sequence that constitutes the name field shall be UTF-8.

#### 10.3.3.3.4 Location Descriptor

The implementation shall support the Location Descriptor as described in Section 8.2.7 of MHP [2].

#### 10.3.3.3.5 Estimated Download Time Descriptor

The implementation shall support the Estimated Download Time Descriptor as described in Section 8.2.8 of MHP [2].

### 10.3.3.4 Group Link Descriptor

The implementation shall support the Compressed Module Descriptor as described in Section 8.2.9 of MHP [2].

#### 10.3.3.4.1 Subgroup Association Descriptor

The implementation shall support the Subgroup Association Descriptor as described in Section 8.2.1 of MHP [2].

### 10.3.3.5 Download Data Block Message

The implementation shall support the Download Data Block message. The Digital Storage Media Command and Control Specification defines the construction of the packets.

### 10.3.3.6 Download Cancel Message

The implementation shall support the Download Cancel Message as described in the Digital Storage Media Command and Control specification.

#### 10.3.3.6.1 Message schema

The implementation shall support the message schema as described in Section 7.3.5 of Digital Storage Media Command and Control specification, subject to the clarifications and extensions of this section. The last structure of the message is private data. This specification requires that the first structure of the private data be the Registration Descriptor of the Motion Picture Experts Group. The purpose of the constraint is to eliminate name collisions. The Registration Descriptor provides the mechanism through which organizations reserve unique codes. The organization codes scope the private data found after the structure.

The Registration Descriptor shall adopt the restrictions of the [<zzHyperLinkparatext\x11>](#) and [<zzHyperLinkparatext\x11>](#) specifications. In addition to these conventions, the Format Identifier of the of the Registration Descriptor is to be registered with the Society of Motion Picture and Television Engineers. The web site for the organization (<http://www.smpte-ra.org>) provides further information on the registration process.

Editor: Replace the above two missing references with an appropriate reference citation.

#### 10.3.3.6.2 Message Semantics

The Download Cancel Message contains the block count of the last valid block of the download session. While the implementation shall accept the message, the response is implementation dependent.

### 10.4 Transport Protocol

#### 10.4.1 Introduction

The object carousel design builds on the data carousel design. The data carousel design in turn builds on certain basic transport protocol tables. The discussion below considers the protocol tables that relate to applications. To be specific this portion of the specification considers the Program Map Table (PMT) and Application Information Table (AIT).

#### 10.4.2 Program Map Table

The Program Map Table (PMT) is the first of the sequence of protocol tables that announce applications. The Program Map Table provides information about the nature of the applications. It also contains the Application Signaling Descriptor, which publishes the Service Component that contains the Application Information Table (AIT). The Application Information Table, the subject of the next section, provides further details about the applications. The applications often require companion data streams. The Program Map Table, in this case, also includes a Data Broadcast Id Descriptor for each data stream.

The implementation shall support the descriptors listed in **Table 10-8** Program Map Table.

**Table 10-8** Program Map Table

Table	Construct	Field	Description	Source	Section
Program Map Table	Carousel Id Descriptor		The descriptor is present for object carousels.	MHP 1.0.3	10.2.2
Program Map Table	Deferred Association Tags Descriptor		The descriptor is present. See section 9.3.3 of the Data Broadcasting Specification for details.	DB 1.0	9.9.3
Program Map	Elementary	Elementary	The sequence includes at least one	MHP	10.1.1

Table	Stream Sequence: Generic Descriptors	Stream: Stream Type	reference to a Program Element that contains an Application Information Table. The Stream Type shall be 0x05 for such Program Elements.	1.0.3	10.2.1
Program Map Table	Elementary Stream Sequence: Generic Descriptors	Elementary Stream: Application Signaling Descriptor	The sequence includes at least one reference to a Program Element that contains an Application Information Table. The value of the Stream Type is 0x05 for such Program Elements.	MHP 1.0.3	10.1.1 10.2.1
Program Map Table	Elementary Stream Sequence: Generic Descriptors	Elementary Stream: Stream Type (Broadcast Data)	The sequence can contain references to Program Elements that transport data. The field is a transport specific value to signal such Program Elements.	MHP 1.0.3	10.2.2
Program Map Table	Elementary Stream Sequence: Generic Descriptors	Elementary Stream: Data Broadcast Id Descriptor	If the reference is to a Program Element that transports data, the descriptor can be present.	MHP 1.0.3	10.2.2

The discussion below considers these descriptors in further detail.

#### 10.4.2.1 Deferred Association Tags Descriptor

The implementation shall support the Deferred Association Tags Descriptor as described in Section 9.2.3 of the Data Broadcast specification. The Deferred Association Tag Descriptor resides in the outer descriptor sequence of the Program Map Table. The last field of the descriptor is the Original Network Id field. The semantics of the field is network specific. If the network is broadcast, the field is reserved for future specification. The value shall be zero. If the network is cable, the field is again reserved for future specification. The value shall be zero. If the network is satellite, the value of the field and its semantics are implementation dependent.

#### 10.4.2.2 Carousel Identifier Descriptor

The implementation shall support the Carousel Identifier Descriptor as described by MHP [2] Annex B.2.10.1. The descriptor shall reside in the descriptor loop of the elementary stream entry of the Program Map Table that designates the application's object carousel stream (stream type 0x0B).

*Note:* It is recommended that AUTOBOOT applications use a carousel identifier descriptor with formatId of 0x01, designating *enhanced boot* information.

#### 10.4.2.3 Application Signaling Descriptor

The implementation shall support the Application Signaling Descriptor as described in Section 10.7.1 of MHP [2], subject to the clarifications and extensions of this section. The descriptor identifies the Program Element that contains the Application Information Table. (There can be multiple such Program Elements.) The descriptor may also contain fields that encode the Application Type and the Version Number. If the Application Type field is present, it shall be the assignment for ACAP-J applications or ACAP-X applications.

If both the Application Type field of the Application Signaling Descriptor and the Content Type Descriptor of the Object Carousel messages is present, the values are to be consistent. **Table 10-9** Application Content Types, lists valid combinations for this specification.

**Table 10-9** Application Content Types

Application Type	Content Type
ACAP-J	application/acap-j
ACAP-X	application/acap-x

#### 10.4.2.4 Data Broadcast Id Descriptor

The implementation shall support the Data Broadcast Id Descriptor as described in Section 10.7.2.1 of MHP [2].

The presence of this descriptor is optional in application signaling. If the descriptor is present, it is associated with the elementary stream that contains the Object Carousel, not the stream that contains the Application Information Table. This restriction is consistent with MHP.

The specific form of the descriptor is comparable to the schema of section 10.7.2.2 of MHP [2], except the schema is to be considered to be specific to this specification, so as to allow independent extensions in the future. The schema shall be as follows:

```

ACAPDataBroadcastIdDescriptor {
    DescriptorTag           // 1 byte (0x66)
    DescriptorLength       // 1 byte
    DataBroadcastId        // 1 byte
    for i=1;i<N;i++ {
        ApplicationType     // 2 bytes
    }
}

```

The implementation shall support the Data Broadcast Id Descriptor as described in Section 10.7.2.1 of MHP [2]. The value of the DataBroadcastId field of this descriptor shall be *<td>*.

*Open Issue: A value to be assigned to the DataBroadcastId field has been requested from DVB for registration in ETR162.*

If the optional ApplicationType field is present, then it shall be one of the values defined by Section 10.4.3 for use with ACAP-J or ACAP-X application types. The behavior of an ACAP terminal device in the case that this field is some other value is implementation dependent, and may include aborting acquisition of the associated elementary stream and notifying the application through a run-time exception as appropriate.

#### 10.4.3 Application Information Table

The implementation shall support the Application Information Table as specified in Section 10.8 of MHP [2], subject to the clarifications and restrictions of this section.

*Open Issue: The Application Information Table publishes the available applications. The Application Information Table divides into a sequence of common descriptors, which are applicable to all representations of applications, plus a sequence of application specific descriptors, which are applicable to specific instances, plus a sequence of application representation specific descriptors, which are specific to the application representation. The material of this section considers these three dialects of application descriptors.*



The implementation shall support the schema for the Application Information Table as described in Section 10.1.1, 10.1.4, 10.4.6, 10.4.7, 10.5.1, 10.5.2, and 10.8.1 of MHP [2], subject to the clarifications and restrictions of this section. **Table 10-10** Application Information Table, provides a brief description of each construct and the section of the reference specification that contains the normative language.

**Table 10-10** Application Information Table

Construct	Structure	Field	Description	Source	Section
Application Information Table		Table Id	The value shall be 0x74 for application information sections.	MHP 1.0.3	10.4.6
Application Information Table		Section Syntax Indicator	The value shall be one.	MHP 1.0.3	10.4.6
Application Information Table		Reserved Future Use	The value shall be all ones.	MHP 1.0.3	10.4.6
Application Information Table		Reserved	The value shall be all ones.	MHP 1.0.3	10.4.6
Application Information Table		Section Length	The field represents the section length. The value is less than 1021 (0x3FD).	MHP 1.0.3	10.4.6
Application Information Table		Test Application Flag	The value can be one, which indicates a test application. The test application is not visible through application interfaces.	MHP 1.0.3	10.4.6
Application Information Table		Application Type	The value shall be 0x0006 for ACAP-J and 0x0007 for ACAP-X applications. The device can ignore other applications. See the table below.	ACAP 1.0	10.4.6
Application Information Table		Reserved	The value shall be all ones.	MHP 1.0.3	10.4.6
Application Information Table		Version Number	The value increments when the contents of the sub-table change.	MHP 1.0.3	10.4.6
Application Information Table		Current Next Indicator	The value shall be one.	MHP 1.0.3	10.4.6
Application Information Table		Section Number	The value of the first section of the sub-table is zero. The value increments for sections with the same Table Id and Application Type.	MHP 1.0.3	10.4.6
Application Information Table		Last Section Number	The value matches the last section of the sub-table.	MHP 1.0.3	10.4.6
Application Information Table		Common Descriptor Length	The value is the length of the common descriptor sequence. These descriptors are generic and thus applicable to all applications of the sub-table.	MHP 1.0.3 ACAP 1.0	10.4.6
Application Information	Generic Application	Transport Protocol	A single Transport Protocol Descriptor scopes all applications. The descriptor can	ACAP 1.0 MHP	10.1.1 10.1.4

Table	Descriptor Sequence	Descriptor	reside in either the Common Descriptor sequence or the Application Specific Descriptor sequence. The schema of the descriptor is specific to this specification. See subsequent discussion for details.	1.0.3	10.8.1
Application Information Table	Generic Application Descriptor Sequence	Common Descriptor	See the description of other Common Descriptors for details.	MHP 1.0.3 ACAP 1.0	10.4.6
Application Information Table	Generic Application Descriptor Sequence	Private Descriptor	The common descriptor sequence can contain private descriptors, subject to the rules of section 10.4.7 of MHP.	MHP 1.0.3	10.4.7
Application Information Table		Application Specific Descriptor Length	The value represents the length of the application specific descriptor sequence.	MHP 1.0.3	10.5.1
Application Information Table	Application Specific Descriptor	Application Identifier	The field identifies the application. The schema contains a unique organization code, which then scopes an application code. See the table below for details.	MHP 1.0.3	10.5.1
Application Information Table	Application Specific Descriptor	Application Control Code	The field encodes the execution state of the application. The values and semantics are application representation specific. The semantics for ACAP-J applications are described in section 10 of MHP. The semantics for ACAP-X applications are described in ACAP-X chapter of this specification.	ACAP 1.0 MHP 1.0.3	10.5.2 10.6.1
Application Information Table		Application Specific Descriptor Length	The length represents the sequence of application representation specific descriptors.	MHP 1.0.3	10.4.6
Application Information Table	Application Representation Specific Descriptor Sequence	Transport Protocol Descriptor	All applications are within the scope of a Transport Protocol Descriptor. The descriptor can reside in the Common Descriptor sequence or the Application Specific Descriptor Sequence. The schema of the descriptor is specific to this specification. See the transport chapter for details.	MHP 1.0.3 ACAP 1.0	10.1.1 10.1.4 10.8.1
Application Information Table	Application Representation Specific Descriptor Sequence	Application Descriptor	The field must be present. See the discussion below for details.	MHP 1.0.3	10.5.1
Application Information Table	Application Representation Specific Descriptor Sequence	Application Name Descriptor	The field must be present. See the discussion below for details.	MHP 1.0.3	10.5.1
Application Information Table	Application Representation Specific Descriptor Sequence	Application Icons Descriptor	The application specific descriptor sequence can contain one or more Application Icon Descriptors. See discussion below for details.	MHP 1.0.3	10.7.4.2

Application Information Table	Application Representation Specific Descriptor Sequence	Application Specific Descriptors	See discussion on Application Specific Descriptors below.	MHP 1.0.3 ACAP 1.0	10.1.1
Application Information Table	Application Specific Representation Descriptor Sequence	Private Descriptor	The Application Specific Descriptor sequence can contain private descriptors, subject to the rules of section 10.4.7 of MHP.	MHP 1.0.3	10.4.7
Application Information Table		CRC32	The source node calculates the value. The scope is the entire section. The target node then compares its calculation with this value so as to detect the presence of bit errors.	MHP 1.0.3	10.4.6

The Application Type field is described in Section 10.4.6 of MHP [2]. This specification adds two assignments. These and the other assignments are given in **Table 10-11** Application Type Assignments.

**Table 10-11** Application Type Assignments

Application Type	Description
0x0000	Reserved For Future Use
0x0001	Reserved (DVB-J Application)
0x0002	Reserved (DVB-HTML Application)
0x0006	ACAP-J Application
0x0007	ACAP-X Application
<td>-0x7FFF	Subject to Registration

**Open Issue:** Confirm that DVB consortia has registered 0x0006 and 0x0007 for use by ACAP application types.

The implementation shall recognize the assignments for the ACAP-J and ACAP-X application types. The response for other standard assignments above is implementation dependent. If the assignment is not standard (i.e. in the above list) the implementation can adopt pragmatics such as examination of file extensions, but the result is implementation dependent.

The Application Identification Structure of the Application Information Table shall conform to Section 10.5.1 of MHP [2]. The Organization Id field of the structure identifies the organization responsible for the application. The value shall be registered in TR 101 162. The Application Id field of the structure identifies the application instance. It is the obligation of the organization responsible for the application to manage the value space; the response to duplicate values is implementation dependent.

#### 10.4.3.1 Generic Application Descriptor Sequence

This section of the chapter considers the generic application descriptors.

##### 10.4.3.1.1 Transport Protocol Descriptor

This implementation shall support the Transport Protocol Descriptor as described in Section 10.8.1 of MHP [2], subject to the clarifications and restrictions of this section.

## 10.4.3.1.1.1 Descriptor schema

The implementation shall support the schema as described in Section 10.3.1 of MHP [2]. The assignments for certain fields within the descriptor are unique to this specification.

Open Issue: Transport Protocol Descriptor encodes the transport protocol to associate with a transport stream. The descriptor can reside in either the generic application descriptor sequence, in which case it is applicable to all applications of the sub-table, or reside in the application specific descriptor sequence, in which case it is applicable to just that application. In either case, all applications require the descriptor.

**Table 10-12** Protocol Id Assignments, presents the registered codes. The implementation shall support the “ACAP Object Carousel” protocol of this section. If the code is a different value, and the implementation does not recognize or does not support the protocol, the implementation can elect to abort the carousel access. The implementation raises an exception for ACAP-J applications. There is no companion exception for ACAP-X applications.

**Table 10-12** Protocol Id Assignments

Value	Description
0x0000	Reserved For Future Use
0x0001	Reserved (DVB Object Carousel)
0x0002	Reserved (DVB Protocol Encapsulation)
0x0003-0x0005	Reserved
0x0006	ACAP Object Carousel
0x0007	Reversed For Future Use
0x0100-0xFFFF	Subject to Registration in TR 101 162 [<td>]

Open Issue: Confirm that DVB consortia has registered 0x0006 for use by ACAP.

## 10.4.3.1.1.2 Object Carousel Selector structure

The selector field of the Transport Protocol Descriptor is specific to this specification. The selector field specifies the location of the transport stream for the situation where the connection is remote. The implementation shall support this schema:

```

ACAPTransportProtocolSelector {
    RemoteConnection          // 1 bit.
    ReservedFutureUse        // 7 bits. The value is to be all ones.
    If (RemoteConnection == "1") {
        SourceId             // 16 bits
        Reserved             // 32 bits
    }
    ComponentTag             // 8 bits
}

```

The semantics of each field are:

**RemoteConnection** – If the value is zero, the current service provides the transport connection. The subsequent fields are not present in this case. If the value is one, a service other than the

current service provides the transport connection. See Section 10.8.1.1 of MHP [2] for the details.

**SourceId** – The value shall be unique within the network. The expectation is that, in the future, there will be a registration process to preclude value collisions. For the present the organization that manages a specific network must assign unique values. The response to duplicate values is implementation dependent.

If the network is a broadcast network, the value zero is reserved. The value of zero is not valid for broadcast networks. If the implementation detects a value of zero, and if the network is broadcast, the implementation can elect to abort the carousel access. The implementation shall raise an exception for ACAP-J applications. There is no comparable exception for ACAP-X applications.

If the network is a cable network, this specification assigns the value of zero to mean the channel is out-of-band. For definitions of in-band channels versus out-of-band channels, see Sections 3.3, 4.2 and 4.3 of the Digital Cable Network Interface Standard (SCTE 40) [30].

**ComponentTag** – The field identifies the component to which the application is bound. The component is the stream that carries the DSI of the object carousel.

#### 10.4.3.2 External Application Authorization Descriptor

The implementation shall support the External Application Authorization Descriptor as described in Section 10.7.5 of MHP [2].

#### 10.4.3.3 Download Info Indication Location Descriptor

The implementation shall support the Download Info Indication Descriptor as described in Section 10.8.3.3 of MHP [2], subject to the clarifications and extensions of this section.

The Transport Protocol Label field identifies the Transport Protocol Descriptor. The Protocol Id field of the Transport Protocol Descriptor to which the label refers shall be the assignment for the “ACAP Object Carousel” protocol.

### 10.4.4 Application Specific Descriptor Sequence

The second descriptor sequence that can be present is the application specific descriptor sequence. These application descriptors share a common schema, but the values and their semantics are specific to the application instance.

#### 10.4.4.1 Application Descriptor

The Application Specific Descriptor sequence of the Application Information Table contains at least one Application Descriptor instance. The schema of the descriptor shall be that of Section 10.7.3 of MHP [2], subject to the clarifications and extensions of this section. The Transport Protocol Label field within the descriptor identifies the Transport Protocol Descriptor. The Protocol Id field of the Transport Protocol Descriptor to which the label refers shall be the assignment for the “ACAP Object Carousel” protocol.

#### 10.4.4.2 Application Name Descriptor

The Application Specific Descriptor sequence of the Application Information Table contains one or more Application Descriptor Name instances. The implementation shall support the Application Name Descriptor as described in Section 10.7.4 of MHP [2].

#### 10.4.4.3 Application Icon Descriptor

The Application Specific Descriptor sequence of the Application Information Table can contain zero or one Application Icon Descriptor instance. The structure associates icons with the application. The implementation shall support the Application Icon Descriptor as described in Section 10.7.4 of MHP [2].

#### 10.4.4.4 Prefetch Descriptor

The Application Specific Descriptor sequence of the Application Information Table can include a single Prefetch Descriptor. The purpose of the descriptor is to alert the implementation about which application resources are time critical. The implementation shall support the Prefetch Descriptor as described in Section 10.3.3 of MHP [2].

### 10.4.5 Application Representation Specific Descriptor Sequences

In addition to descriptors that are specific to application instances, there are descriptors which are specific to the application representation. This section of the specification considers these descriptors.

#### 10.4.5.1 ACAP-J Application Descriptors

This section considers those descriptors that are specific to ACAP-J applications.

##### 10.4.5.1.1 ACAP-J Application Descriptor

The Application Representation Specific Descriptor sequence shall include a single ACAP-J Application Descriptor for each ACAP-J application. The descriptor contains a sequence of octets that the implementation forwards to the application at application launch. The implementation shall support the descriptor schema below (**Table 10-13** ACAP-J Application Descriptor).

**Table 10-13** ACAP-J Application Descriptor

Construct	Structure	Field	Restriction	Source	Section
ACAP-J Application Descriptor		Descriptor Tag	If the descriptor is present, the value is 0x<tbid>.	ACAP 1.0	This Section
ACAP-J Application Descriptor		Descriptor Sequence Length	The value represents the length of the entire descriptor data.	ACAP 1.0	This Section
ACAP-J Application Descriptor	Descriptor Sequence	Parameter Sequence Length	The value represents the length of the parameter data.	ACAP 1.0	This Section
ACAP-J Application Descriptor	Descriptor Sequence	Parameter Sequence	The sequence is initialization data that the receiver forwards at application launch.	ACAP 1.0	This Section

*Note:* The schema of the descriptor is identical to the schema of the MHP-J Application Descriptor found in MHP. This specification reserves a different descriptor code so as to anticipate future extensions.

##### 10.4.5.1.2 ACAP-J Application Location Descriptor

The ACAP-J Application Location Descriptor contains information through which the implementation resolves the location of the ACAP-J application. The Application Representation

Specific Descriptor sequence contains a single ACAP-J Application Location Descriptor for each ACAP-J application. The implementation shall support the descriptor schema below (**Table 10-14 ACAP-J Application Location Descriptor**).

**Table 10-14 ACAP-J Application Location Descriptor**

Construct	Structure	Field	Restriction	Source	Section
ACAP-J Application Location Descriptor		Descriptor Tag	If the descriptor is present, the value is 0x<td>.	ACAP 1.0	This Section
ACAP-J Application Location Descriptor		Descriptor Sequence Length	The value represents the length of the entire descriptor data.	ACAP 1.0	This Section
ACAP-J Application Location Descriptor		Base Directory Length	The value represents the length of the base directory character sequence. The base directory constitutes the first directory in the class path. See section 10.9.2 of MHP for details.	ACAP 1.0 MHP 1.0.3	10.9.2
ACAP-J Application Location Descriptor	Base Directory	Base Directory Character Sequence	The character sequence that represents the base directory.	MHP 1.0.3	10.9.2
ACAP-J Application Location Descriptor		Classpath Extension Character Sequence Length	The value represents the length of the classpath extension character sequence. The sequence specifies alternative locations for the classpath. See section 10.9.2 of MHP for details.	MHP 1.0.3	10.9.2
ACAP-J Application Location Descriptor	Classpath Extension Sequence	Classpath Extension	The string that specifies the alternative locations for the classpath.	MHP 1.0.3	10.9.2
ACAP-J Application Location Descriptor		Parameter Sequence Length	The value represents the length of the parameter sequence that the receiver appends to the initial path. See section 10.9.2 of MHP for details.	MHP 1.0.3	10.9.2
ACAP-J Application Location Descriptor	Parameter Sequence	Parameter List	The parameter sequence that the receiver appends to the initial path.	MHP 1.0.3	10.9.2

#### 10.4.5.2 ACAP-X Application Descriptors

This section considers those descriptors that are specific to ACAP-X applications.

##### 10.4.5.2.1 ACAP-X Application Descriptor

The Application Representation Specific Descriptor sequence may contain a single ACAP-X Application Descriptor for each ACAP-X application. The descriptor contains a sequence of octets that the implementation forwards to the application at application launch. The implementation shall support the descriptor as described below (**Table 10-15 ACAP-X Application Descriptor**).

**Table 10-15** ACAP-X Application Descriptor

Construct	Structure	Field	Restriction	Source	Section
ACAP-X Application Descriptor		Descriptor Tag	If the descriptor is present, the value shall be 0x<tbid>. The size of the field is none byte.	ACAP 1.0	This Section
ACAP-X Application Descriptor		Descriptor Sequence Length	The value represents the length of the entire descriptor data. The size of the field is one byte.	ACAP 1.0	This Section
ACAP-X Application Descriptor	Parameter Sequence	Parameter Sequence Length	The value represents the length of the parameter data.	ACAP 1.0	This Section
ACAP-X Application Descriptor	Parameter Sequence	Parameter Sequence	The character sequence is string that is appended to the application initial path as parameters. The encoding shall be UTF-8. It is valid for the string to be null.	ACAP 1.0	This Section

#### 10.4.5.2.2 ACAP-X Application Location Descriptor

The ACAP-X Application Location Descriptor contains information through which the implementation resolves the location of the ACAP-X application. The Application Representation Specific Descriptor sequence may contain a single ACAP-X Application Location Descriptor for each ACAP-X application. The implementation shall support the descriptor schema below (**Table 10-16** ACAP-X Application Location Descriptor).

**Table 10-16** ACAP-X Application Location Descriptor

Construct	Structure	Field	Restriction	Source	Section
ACAP-X Application Location Descriptor		Descriptor Tag	If the descriptor is present, the value shall be 0x<tbid>. The size of the field is one byte.	ACAP 1.0	Transport Chapter
ACAP-X Application Location Descriptor		Descriptor Length	The value represents the length of the entire descriptor data. The size of the field is one byte.	ACAP 1.0	Transport Chapter
ACAP-X Application Location Descriptor		Physical Root Length	The value represents the length of the physical root string. The size of the field is one byte.	ACAP 1.0	Transport Chapter
ACAP-X Application Location Descriptor	Physical Root Character Sequence	Physical Root Character	The variable length field is either empty or contains a UTF-8 encoded string that specifies the path to the root directory of the application. The semantics are transport protocol specific. See below for details	ACAP 1.0	Transport Chapter
ACAP-X Application Location Descriptor	Initial Path Character Sequence	Initial Path Character	The variable length field shall contain a UTF-8 encoded string that specifies the relative path to either 1) the ACAP-X application Metadata Resource (ARM) file or 2) the ACAP-X initial entity (i.e an XDML Family Document). The path is relative to the application root directory specified in the Physical Root field.	ACAP 1.0	Transport Chapter



The semantics of the physical root depends on the transport protocol. Table 10-12 Protocol Id Assignments above lists the feasible values for the ProtocolId field.

If the ProtocolId is the value for the ACAP Object Carousel, that is 0x0006, then the physical root field represents the relative path from the root directory of the object carousel. The implication is that if the physical root string is empty, the physical root for the application is the physical root of the object carousel.

#### 10.4.5.2.3 ACAP-X Application Boundary Descriptor

The descriptor may be present in the application representation specific descriptor sequence. The descriptor provides a regular expression that defines the data elements that form the application. If the descriptor is not present, the application boundary defaults to the complete set of all content that resides in the transport signalled in the Transport Protocol Descriptor associated with the application. There can be multiple ACAP-X Application Boundary Descriptor instances for the same ACAP-X application. In this case, the equivalent global regular expression is the OR combination (union) of the individual regular expressions. The syntax of the descriptor is given in **Table 10-17** ACAP-X Application Boundary Descriptor.

**Table 10-17** ACAP-X Application Boundary Descriptor

Construct	Structure	Field	Restriction	Source	Section
ACAP-X Application Boundary Descriptor		Descriptor Tag	If the descriptor is present, the value shall be 0x<td>. The size of the field is one byte.	ACAP 1.0	Transport Chapter
ACAP-X Application Boundary Descriptor		Descriptor Length	The value represents the length of the entire descriptor data. The size of the field is one byte.	ACAP 1.0	Transport Chapter
ACAP-X Application Boundary Descriptor		Label Length	The value represents the length of the label string. The size of the field is one byte.	ACAP 1.0	Transport Chapter
ACAP-X Application Boundary Descriptor	Label Character Sequence	Label Character	The variable length field is either empty or contains a UTF-8 encoded string that specifies the label that is associated with the set of data for the regular expression. The label can be used for prefetching in a transport specific manner.	ACAP 1.0	Transport Chapter
ACAP-X Application Boundary Descriptor	Regular Expression Byte Sequence	Regular Expression Byte	The variable length field shall contain a UTF-8 encoded string that specifies a regular expression. See below for details.	ACAP 1.0	Transport Chapter

The evaluation of the regular expression determines whether a resource is considered to be in the ACAP-X application's reference scope. The regular expression is subject to the schema and semantics described in the ACAP-X application chapter.

## 10.5 External Specification Errata

The review of the specifications on which this design builds found certain flaws. If the standards organizations that maintain the specification provides corrigenda process, requests to correct the flaws will be submitted in the hope that subsequent versions will correct the flaws. Because the

versions referenced in this design do not include these corrigenda, this section specifies the corrections.

### 10.5.1 Multimedia Home Platform

#### 10.5.1.1 Object Carousel Specification

**Table 10-18** Errata To External Specifications

Message	Construct	Structure	Field	Corrigenda	Source	Section
Download Info Indication	Module Info		Tap	The first loop shall be considered to be “for i=1;j<N1;i++” {“rather than “for j=1,j<N1;j++” {“.	ACAP 1.0	
Download Info Indication	Module Info		Label Descriptor	The contents of the loop within the descriptor shall be considered to be “Octet” rather than “LabelChar”.	ACAP 1.0	
Generic Message	BIOP Profile Body	Conn Binder	Tap	The text “BIOP_DELIVER_PARA_USE” shall be considered to be “BIOP_DELIVERY_PARA_USE”	ACAP 1.0	

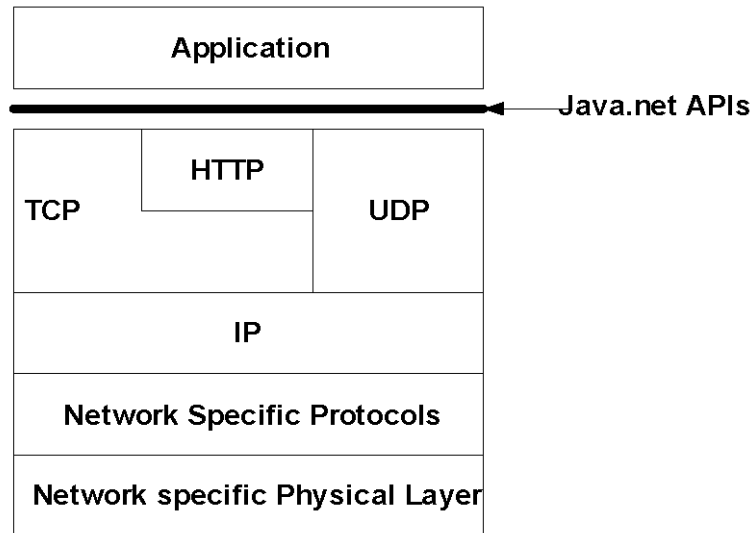
The broadcast stream is to repeat the table at least every 10 seconds, and the receiver that terminates the broadcast stream is to detect the table at least within one second. (See section 10.4.2 for details.) If the receiver concludes that the table contains errors, the receiver attempts to parse to the next available construct. (See section 10.4.1 for details.)

## 11. INTERACTION CHANNEL

### 11.1 Interaction Channel Protocols

This section describes the interaction channel protocols required in an ACAP device for use by an application.

**Figure 11-1** Interaction Channel network protocols., illustrates the network protocols used for the interaction channel.



**Figure 11-1** Interaction Channel network protocols.

#### 11.1.1 Network Specific Protocols

A wide range of network protocols defined by standards such as DOCSIS, DAVIC, CableCard Module, PSTN, Ethernet, and PPP or proprietary methods may be used to provide the interconnectivity between an ACAP device and a server. All the necessary protocols associated with each network specific protocols shall be supported by the ACAP device.

#### 11.1.2 Internet Protocol

An ACAP device shall support IP as described section 6.3.2 of GEM [1].

#### 11.1.3 User Datagram Protocol (UDP)

An ACAP device shall support UDP as described section 6.3.9 of GEM [1].

#### 11.1.4 Transmission Control Protocol (TCP)

An ACAP device shall support TCP as described section 6.3.3 of GEM [1].

#### 11.1.5 Hyper-Text Transfer Protocol (HTTP)

In an ACAP device where the ACAP-X environment is present, HTTP 1.1 protocol shall be supported as defined in the RFC 2616 [39] with constraints and modifications defined in the T3/S16 Draft Specification [40].

**11.1.6 Domain Name Service (DNS)**

An ACAP device shall support DNS as described section 6.3.10 of GEM [1].

## 12. SECURITY

Chapter 12 of GEM [1] shall apply with the clarifications and extensions detailed in the following sections.

### 12.1 Introduction

The ACAP security model is fully conformant to the GEM security model. It addresses the same areas of security; i.e. authentication of broadcast applications, security policies for applications, security over the interaction channel and certificate management.

The ACAP security model additionally specifies an alternate to the GEM security model in a way that takes into account particularities of the ACAP terrestrial environment, of the ACAP cable environment, and the policy access to functionalities not specified in GEM [1] which are exposed to ACAP applications. As such,

- Section 14.2, “ACAP Trust Model,” specifies extensions to the GEM trust model for ACAP terminals as allowed by GEM [1] Section 12.1.3.
- Section 14.4.1, “ACAP Signing Framework,” specifies a modified signing framework as allowed by GEM [1] Section 12.1.3.
- Section 14.4.2, “ACAP Extensions to Security Policies for Applications,” specifies the syntax and semantics of the additional ACAP permissions in a new permission request file as allowed by GEM [1] Section 12.6.

### 12.2 ACAP Trust Model

#### 12.2.1 General Rules

Applications that are eligible to be trusted shall be identified with an `application_id` from the signed applications range as defined by MHP [2], Table 12. Applications that are not eligible to be trusted shall be identified with an `application_id` from the unsigned applications range. An application with an `application_id` from the unsigned applications range is treated as not eligible to be trusted even if the files might be transmitted with signatures.

ACAP terminals shall not grant any access rights to resources outside the sandbox to ACAP applications that have not requested the appropriate permissions through a GEM or an ACAP permission request file and that are not eligible to be trusted. Other criteria for deciding whether or not to grant access to resources outside the sandbox and that are intentionally not specified in the present document may subsequently apply such as the user own policies.

*Note:* See the definition of “Trusted Application” in Section 3.

#### 12.2.2 Applications Received Over a Terrestrial Interface

Codesigning of applications received over a terrestrial interface is not required in order to establish that the application is eligible to be trusted, and therefore may be granted the right to access resources outside the sandbox. ACAP terminals that receive such an application are allowed to ignore any security files apart from the GEM or ACAP permission request files (see Section 12.4.2.1, “ACAP Permission Request File”) that could be present along the application before establishing that the application is eligible to be trusted. By default, an unsigned application received over a terrestrial interface will therefore be considered as eligible to be trusted.

### 12.2.3 Applications Received Over a Cable Interface

Codesigning of applications received over a cable interface is required in order to establish that the application is eligible to be trusted and therefore may be granted the right to access resources outside the sandbox. Either the GEM Signing Framework as defined in GEM [1] Section 12.6 or the ACAP Signing Framework as defined in Section 12.4.1, “ACAP Signing Framework” shall be used for content signing.

### 12.3 Security Policy for Applications

For clarification, GEM [1] Section 12.6 shall apply.

*Note:* Attention is drawn to the second paragraph of GEM [1] Section 12.6 where the interpretation of the terms “unsigned applications” and “signed applications” is clarified in the context of a GEM terminal specification where code signing is not required to establish trust, which is the case in an ACAP terrestrial environment. See Section 12.2, “ACAP Trust Model.”

Additionally, according to GEM [1] Section 12.6, an ACAP terminal is required to be able to operate in a mode where it grants permission to provide access to all of the functionality required by the profiles and options that it supports when appropriately requested (e.g. via the GEM or ACAP permission request files). The mechanism for causing the terminal to operate in this mode is implementation-dependent. The granting of permissions for accessing functionality outside of the claimed ACAP profile and options is not required.

*Note:* Broadcasters should be aware that if they chose not to sign applications requiring access to privileged operations, then there is no guarantee that those applications be signed at some point in the cable distribution chain and thus become eligible to be granted access to privileged operations when executed within a cable environment.

## 12.4 ACAP Extensions to GEM Security Model

### 12.4.1 ACAP Signing Framework

#### 12.4.1.1 General Principles

The ACAP Signing Framework for ACAP applications exists in addition to the existing GEM Signing Framework. It shall be based on the Signing Framework specified in GEM [1] Section 12 with the following modifications:

- The name of the hashfile shall be `acap.hashfile`
- The content (MIME media) type label of the hashfile shall be `application/acap-digest`.
- The name of the signature files shall be `acap.signaturefile.<x>`, where `<x>` is a string that distinguishes between several possible signature files. Apart from that deviation, the rules with respect to the format of `<x>` shall conform to the rules expressed in GEM [1] Section 12.4.
- The content (MIME media) type label of a signature file shall be `application/acap-signature`.
- The name of a certificate files shall be `acap.certificates.<x>`, where `<x>` is identical to the extension of the signature filename that is authenticated by the ACAP certificate chain in this file. Apart from that deviation, the rules with respect to the format of `<x>` shall conform to the rules expressed in GEM [1] Section 12.4.

- The content (MIME media) type label of a certificate file shall be application/acap-certificate.
- The profile of X.509 certificates for authentication of applications shall be conformant to OCAP 1.0 [4] Section 14.2.1.6.
- The permission request file to be used shall be the one specified in Section 12.4.2.1, “ACAP Permission Request File”.
- The description of the content of the signature file shall conform to GEM [1] Section 12.4 as modified by OCAP 1.0 [4] Section 14.2.1.24.
- ACAP terminals shall conform to OCAP 1.0 [4] Section 14.2.1.23.

and additions:

- The ACAP signing framework specifies the way ACAP-X applications are authenticated. See Section 12.4.1.2, “Authentication of ACAP-X applications.”

An ACAP terminal shall support both the GEM Signing Framework as specified in GEM [1] Section 12 and the ACAP Signing Framework as specified in this section.

ACAP applications should only include those security files defined in either GEM [1] or those security files defined in this specification and prefixed by «acap.». In the case that files from both models are included, the GEM security files shall not be used to authenticate the application but shall be listed in the appropriate ACAP hash file for the directory in which they occur.

#### 12.4.1.2 Authentication of ACAP-X applications

Authentication of ACAP-X applications shall be performed in the same way than for ACAP-J applications. If signed, an ACAP-X application shall follow either the GEM [1] signing framework or the ACAP signing framework as specified in the present document.

As such, non-authenticated ACAP-X applications will operate within a sandbox environment. Authenticated ACAP-X applications associated with a permission request file may be granted permissions outside the sandbox.

*Note:* The GEM [1] security model is independent of the type of the application. However, since GEM [1] only fully specifies the procedural environment, it is clarified here that ACAP-X applications must follow the same authentication process.

### 12.4.2 ACAP Extensions to Security Policies for Applications

#### 12.4.2.1 ACAP Permission Request File

##### 12.4.2.1.1 General principles

An ACAP terminal shall support both the GEM [1] Permission Request File (PRF) Document Type Definition (DTD) and an extended PRF DTD called the ACAP Permission Request File DTD defined in Annex B Section 2 (“ACAP Permission Request File Document Type”) as allowed by GEM [1] Section 12.6.

If both a GEM Permission Request File and an ACAP Permission Request File are in the same directory as the initial file of the ACAP application, then the GEM Permission Request File shall be ignored.

The returnchannel element and, in particular the phonenumbers element defined in GEM [1] may not have corresponding semantics in a cable environment. For clarification, an ACAP Cable-

only implementation is required to interpret the presence of the phonenummer element. It is however not required to process it.

The content (MIME media) type label of a permission request file shall be application/acap-permission.

The cookie, runtime code extension and Java bridge permissions defined in Sections 12.4.2.3.1, “Cookie Permission,” 12.4.2.3.2, “Runtime Code Extension Permission,” and 12.4.2.3.3 “Inter-Environment Bridge Permission” are only meaningful for terminals supporting the ACAP-X environment. An ACAP terminal not supporting an ACAP-X environment is required to interpret the presence of such permissions in an ACAP Permission Request File. It is however not required to process them.

#### 12.4.2.1.2 DTD definition

The ACAP Permission Request File (PRF) DTD extends the GEM [1] Permission Request File DTD since additional permissions have been added to meet ACAP requirements. However, in order to be conformant with GEM [1], the ACAP PRF DTD includes all elements and attributes of the GEM [1] PRF DTD.

The following Formal Public Identifier (FPI) shall be used to identify the ACAP PRF DTD:

"-//ATSC//DTD ACAP Permission Request File 1.0//EN"

and the following URL for the SystemLiteral may be used to reference this file:

<http://www.org.atsc/acap/dtd/acap-permission-1.dtd>

The Name used in the document type declaration shall be “permissionrequestfile”.

The ACAP PRF DTD is provided in Annex B.

#### 12.4.2.1.3 ACAP Permission Request file name and location

The format for the ACAP Permission Request File name shall be ‘acap.’<application name>.’perm’.

The prefix “acap” identifies this as a well known file defined by this specification. The portion “application name” carries the file name of the initial file of the application excluding any file name extension or suffix. The initial file depends on the application type as is shown in **Table 12-1** Application Name for Different Application Types for the types defined in this specification.

**Table 12-1** Application Name for Different Application Types

Application Type		Path from which File Name Shall be Extracted
Value	Meaning	
0x0006	ACAP-J	The name initial_class_byte, see Section 10.4.5.1.2, “ACAP-J Application Location Descriptor”
0x0007	ACAP-X	The name initial_path_bytes, see Section 10.4.5.2.2, “ACAP-X Application Location Descriptor”

The ACAP permission request file shall be located in the same directory as the initial file.



#### 12.4.2.2 Cable Specific Security Access Policy

In this section, the listed features are only accessible in a cable environment and therefore, can only be accessed by applications that have been signed using either the GEM or the ACAP Signing Framework.

##### 12.4.2.2.1 Monitor Application features access policy

A Monitor Application permission can provide a set of permissions typically required by an OCAP monitor application as specified in Section 9 (“Monitor Application Support”). Multiple instances of the `ocap:monitorapplication` element may appear, one for each type of permission that is requested. The following access policy is applied to Monitor Application Permissions:

###### 12.4.2.2.1.1 Applications not signed by the ACAP Signing Framework

An application not signed by the ACAP Signing Framework may not use any Monitor Application Features.

###### 12.4.2.2.1.2 Applications signed by the ACAP Signing Framework

By default, an application signed by the ACAP Signing Framework may not use any Monitor Application capabilities. However, the right to exercise specific Monitor Application capabilities can be requested with the Monitor Application Permission that can be put in the ACAP Permission Request File.

###### 12.4.2.2.1.3 Privileged Monitor Application API access

This section shall conform to Section 14.2.2.2 of OCAP 1.0 [4].

#### 12.4.2.3 ACAP Security Policy for Applications

##### 12.4.2.3.1 Cookie Permission

###### 12.4.2.3.1.1 Untrusted applications

Untrusted applications have no access to cookie information items.

###### 12.4.2.3.1.2 Trusted applications

A trusted application has by default no access to cookie information items, unless otherwise requested by the Permission Request File and granted by the ACAP terminal.

###### 12.4.2.3.1.3 Permission Request syntax

```
<ELEMENT %acap.cookie.qname; EMPTY>
<!ATTLIST %acap.cookie.qname;
    %acap.target.qname;          CDATA    #REQUIRED
    %acap.actions.qname;        CDATA    #REQUIRED
    %acap.xmlns.attrib;
>
```

The target attribute shall be specified as a URI to indicate the cookie's domain and path. A special target value of “\*” shall be used to specify **any** cookie.

The actions attribute shall consist of one or more of the following tokens: create, delete, read, and write. Multiple actions may be specified in a comma-separated list with optional intervening whitespace. If multiple actions are requested, then all requested actions shall be granted for any requested action to be granted; i.e., if some requested action is denied, then all requested actions shall be denied.

An `acap:cookie` element may appear as a child of the `permissionrequestfile` element of an ACAP application's permission request file.

#### 12.4.2.3.2 Runtime Code Extension Permission

The following ECMAScript and DOM related operations shall be construed as privileged runtime code extension operations:

- `Global.eval()`
- `Function.[[constructor]]`
- `Window.setTimeout()`
- Any function or property which permits the creation or mutation of an intrinsic event attribute
- Any function or property which permits the creation or mutation of a script element

#### Notes

- 1) The `Global.eval()` operation refers to the `eval()` method on the ECMAScript Global Object.
- 2) The `Function.[[constructor]]` operation refers to the internal `[[constructor]]` method on the ECMAScript Function Object.
- 3) A function or property that permits the creation or mutation of an intrinsic event attribute or a script element is considered to be a privileged operation only when it is attempting to create or mutate an intrinsic event attribute or script element; i.e., if the function or property is used to mutate or create other attributes or elements, then it is not considered a privileged operation.
- 4) The legacy (DOM-0) methods `HTMLDocument::write` and `HTMLDocument::writeln` are not included in the above list since they are not supported by this specification.

#### 12.4.2.3.2.1 Untrusted applications

Untrusted applications have no access to runtime code extensions.

#### 12.4.2.3.2.2 Trusted applications

A trusted application has by default no access to runtime code extensions, unless otherwise requested by the Permission Request File and granted by the ACAP terminal.

#### 12.4.2.3.2.3 Permission Request syntax

```
<IELEMENT %acap.rce.qname; EMPTY>
<!ATTLIST %acap.rce.qname;
    %acap.rce.value.qname;          (true|false) #REQUIRED
    %acap.xmlns.attrib;
>
```

An `acap:rcf` element may appear as a child of the `permissionrequestfile` element of an ACAP Application's permission request file.

#### 12.4.2.3.3 Inter-Environment Bridge Permission

In order to make use of the Inter-Environment Bridge as defined in Section 8.2.11.2.4, an ACAP application shall request an appropriate permission as defined in this section.

*Open Issue: This permission may be removed prior to publishing as a final standard if a suitable conformance regime is developed that ensures correct behavior of an implementation of the bridge.*

##### 12.4.2.3.3.1 Untrusted applications

Untrusted applications have no access to the Inter-Environment bridge.

##### 12.4.2.3.3.2 Trusted applications

A trusted application has by default no access to the Inter-Environment bridge, unless otherwise requested by the Permission Request File and granted by the ACAP terminal.

##### 12.4.2.3.3.3 Permission Request syntax

```
<ELEMENT %acap.bridge.qname; EMPTY>
<!ATTLIST %acap.bridge.qname;
    %acap.bridge.value.qname;          (true|false) #REQUIRED
    %acap.xmlns.attrib;
>
```

An `acap:bridge` element may appear as a child of the `permissionrequestfile` element of an ACAP Application's Permission Request File.

## 12.5 Security over the Interaction Channel

*Note:* In contrast to the OCAP 1.0 X.509 certificate profile as used for broadcast application authentication, GEM [1] Section 12.10 requires the use of the PKIX profile as mandated by TLS 1.0.

## 12.6 Platform Minima

GEM [1] Section 12.12 is extended with the following:

- An ACAP platform hardware is required to support at least 4 root certificates in order to support the ACAP security model
- The key lengths that an ACAP terminal is required to support is specified in the OpenCable Security Specification [12].

## 12.7 ACAP Security Operational Model

The ACAP Security Operational model which defines the operational procedures in order to implement in an end-to-end way the ACAP Security Framework is outside the scope of this document.

*Note:* This Security Operational model should include the creation, delivery and management of root certificates, the creation of application codesigning certificates and the procedures for issuing and managing them.

### **13. GRAPHICS REFERENCE MODEL**

Section 13 of GEM [1] shall apply.

*Note:* Due to regulatory requirements, close captions are required to not be obscured by application graphics.

Open Issue: The end user experience when closed captions, unbound applications, and service bound applications are visible at the same time needs more consideration.

## 14. SYSTEM INTEGRATION

### 14.1 Text Presentation

Open Issue: Need to provide a replacement for MHP Table D.3 "Pixel width for non-square pixel graphics devices". DASE-1 Part 1 Section 5.2 has some text on this subject.

### 14.2 Resource Reference and Locators

#### 14.2.1 ACAP URI Scheme

##### 14.2.1.1 Scheme Definition

This section defines the ACAP URI scheme. The format of this shown in an informal notation is as follows.

```

acap://<source_id>[.<stream_type>[,<ISO_639_language_code>]{&
<stream_type>[,<ISO_639_language_code>}] ] [;<event_id>]{/<path_segments>}

acap://<source_id>[.<stream_type>[,<index>]{&<stream_type>[,<index>}] ] [;<event_id>]{/
<path_segments>}

acap://<source_id>[.<PID>{&<PID>}] [;<event_id>]{/<path_segments>}

acap://<source_id>[.<component_name>{&<component_name>}] [;<event_id>]{/
<path_segments>}

acap://n=<service_name>[.<stream_type>[,<ISO_639_language_code>]{&
<stream_type>[,<ISO_639_language_code>}] ] [;<event_id>]{/<path_segments>}

acap://n=<service_name>[.<stream_type>[,<index>]{&<stream_type>[,<index>}] ] [;<event_id
>]{/ <path_segments>}

acap://n=<service_name>[.<PID>{&<PID>}] [;<event_id>]{/<path_segments>}

acap://n=<service_name>[.<component_name>{&<component_name>}] [;<event_id>]{/
<path_segments>}

acap://f=<frequency>.<program_number>[.<stream_type>[,<ISO_639_language_code>]{&
<stream_type>[,<ISO_639_language_code>}] ] [;<event_id>]{/<path_segments>}

acap://f=<frequency>.<program_number>[.<stream_type>[,<index>]{&<stream_type>[,<index>
]} ] [;<event_id>]{/ <path_segments>}

acap://f=<frequency>.<program_number>[.<PID>{&<PID>}] [;<event_id>]{/<path_segments>}

acap://f=<frequency>.<program_number>[.<component_name>{&<component_name>}] [;<event_i
d>]{/ <path_segments>}

acap://<path_segments>

```

A formal specification is expressed in BNF as used in IETF RFC 2396 [29]:

```

acap_uri = acap_scheme ":" acap_hier_part
acap_scheme = "acap" | "ocap"
acap_hier_part = acap_net_path | acap_abs_path
acap_net_path = "://" acap_entity [ acap_abs_path ]
acap_entity = acap_service | acap_service_component

```

```

acap_service = source_id | service_name | acap_program
acap_service_component = acap_service [ "." program_elements ] [ ";" event_id ]
program_elements = language_elements | index_elements | PID_elements |
component_elements
language_elements = stream_type [ "," ISO_639_language_code ] * ( "&" stream_type [
"," ISO_639_language_code ] )
index_elements = stream_type [ "," index ] * ( "&" stream_type [ "," index ] )
PID_elements = "+" PID * ( "&" PID )
component_elements = "$" component_name * ( "&" component_name )
acap_program = "f=" frequency "." program_number
service_name = "n=" 1* (unreserved_not_dot | escaped)
source_id= hex_string
component_name = 1* (unreserved | escaped)
frequency = hex_string
program_number = hex_string
stream_type = hex_string
ISO_639_language_code = alpha alpha alpha
index = hex_string
PID = hex_string
event_id = hex_string
hex_string = "0x" 1*hex
hex = digit | "A" | "B" | "C" | "D" | "E" | "F" | "a" | "b" | "c" | "d" | "e" | "f"
digit = "0" | "1" | "2" | "3" | "4" | "5" | "6" | "7" | "8" | "9"
acap_abs_path = "/" path_segments
(path_segments is defined in IETF RFC 2396 [42].)
path_segments = segment *( "/" segment )
segment = *pchar *( ";" param )
param = *pchar
pchar = unreserved | escaped | ":" | "@" | "&" | "=" | "+" | "$" | ","
unreserved = alphanum | mark
unreserved_not_dot = alphanum | mark_not_dot
alphanum = alpha | digit
alpha = lowalpha | upalpha
lowalpha = "a" | "b" | "c" | "d" | "e" | "f" | "g" | "h" | "i" | "j" | "k" | "l" | "m"
| "n" | "o" | "p" | "q" | "r" | "s" | "t" | "u" | "v" | "w" | "x" | "y" | "z"
upalpha = "A" | "B" | "C" | "D" | "E" | "F" | "G" | "H" | "I" | "J" | "K" | "L" | "M"
| "N" | "O" | "P" | "Q" | "R" | "S" | "T" | "U" | "V" | "W" | "X" | "Y" | "Z"

```

```
escaped = "%" hex hex
```

```
mark = "-" | "_" | "." | "!" | "~" | "*" | "'" | "(" | ")"
```

```
mark_not_dot = "-" | "_" | "!" | "~" | "*" | "'" | "(" | ")"
```

This syntax is fully compliant with the generic syntax of URIs as specified in RFC 2396 [29] and uses the registry-based naming authority version of that recommendation. Furthermore, all generic definitions specified in RFC 2396 [29] must be valid for the *acap* URI as well (e.g. escaping of special characters within file names, etc.) The *acap* URI extends the character set defined in RFC 2396 [29] for the *source\_name*, the *short\_name* and the *component\_name*.

#### 14.2.1.1.1 Additional restrictions

The following additional restrictions apply to the ACAP URI scheme:

1. When the *acap\_net\_path* part is missing and only the *acap\_abs\_path* is present, the URL refers to a file in a default object carousel within the current service.
2. If the *acap\_entity* is an *acap\_service* (i.e. not a *acap\_service\_component*) then there shall only be one Object Carousel in the ACAP service.
3. If the *stream\_type* is an audio stream type, then the *ISO\_639\_language\_code* may be used to select a specific language track (namely audio). If the *ISO\_639\_language\_code* is not present, then the default language track is selected.
4. The name may contain the characters other than “unreserved\_not\_dot” as defined above by encoding each such character using its ASCII representation. If the name needs to include other characters these MUST be represented using the escaped sequence defined in IETF RFC 2396 [29]. For example, the character sequence “B&B” can be expressed as “B%26B”. The name in the URL SHALL be translated to UTF-8 before URL byte escaping is applied.
5. *source\_id* shall conform to the ANSI/SCTE 65 2002 [45] specification.
6. The name may contain the characters other than “unreserved” as defined above by encoding each such character using its ASCII representation. If the *component\_name* needs to include other characters these must be represented using the escaped sequence defined in IETF RFC 2396 [29]. For example, the character sequence “B&B” can be expressed as “B%26B”. The name in the URL shall be translated to UTF-8 before URL byte escaping is applied.
7. *stream\_type* shall conform to the SCTE 08 (formerly DVS 011) [46] specification.
8. The encoding format of *ISO\_639\_Language\_code* is UTF-8.
9. The following restrictions apply to the *acap\_abs\_path* part of a name:
  - The total length of pathnames, separators and filename shall be less than or equal to 254 bytes long.
  - The following characters are not allowed in filenames and pathnames: character null (0xC080), byte zero.
  - The encoding of the filename is in UTF-8 (as defined in GEM [1] Section 7.1.5)
  - The directory separator character (i.e. Java's *path.separator* property) shall be a slash character (0x2F).
  - An absolute filename starts with a slash character (as indicated in the BNF above).

#### 14.2.1.2 Extended ACAP URI Scheme for ACAP-X

The following extensions to the ACAP URI scheme shall be valid when used by ACAP-X applications.

```

acap_x_uri = acap_uri | acap_scheme ":" acap_x_hierpart
acap_x_hierpart = acap_x_net_path

acap_x_net_path = "//" acap_x_entity

acap_x_entity = acap_service_contextual | acap_service_component_contextual |
ait_specifier

acap_service_contextual = "current" | "original"

acap_service_component_contextual = "current.audio" | "current.video" | "current.av"

ait_specifier = ait_filter "." "ait" ait_abs_path

ait_filter = "current"

ait_abs_path = "/" ait_entity

ait_entity = ait_root_directory | ait_application

ait_root_directory = "app_root"

ait_application = org_id_part "." app_id_part [ "?" ait_params ]

org_id_part = lowercase_hex_string

app_id_part = lowercase_hex_string

lowercase_hex_string = "0" | lowercase_hex_not_zero 0*lowercase_hex

lowercase_hex = digit | "a" | "b" | "c" | "d" | "e" | "f"

lowercase_hex_not_zero = digit_not_zero | "a" | "b" | "c" | "d" | "e" | "f"

digit_not_zero = "1" | "2" | "3" | "4" | "5" | "6" | "7" | "8" | "9"

ait_params = "arg_" 1*digit "=" *uric ["&" ait_params ]

```

### 14.2.1.3 Referencing Specific Entities

#### 14.2.1.3.1 Program Streams

Where `acap_entity` is an `acap_service`, the ACAP service that consists of entire program streams identified by the entity is referenced.

#### 14.2.1.3.2 Program Elements

Where `acap_entity` is an `acap_service_component`, a single program element is referenced.

#### 14.2.1.3.3 Files and Directories

When a path is present in a URL where the `acap_entity` part identifies an ACAP service, the path references an object in an object carousel within the service.

When a path is present in a URL where the `acap_entity` part identifies one component of an ACAP service and that component carries an object carousel stream, the path references an object in an object carousel whose “root” (i.e., DSI message) is sent within that component. In this case the component tag set shall only contain one element. The semantics when the path is present in URL where the `acap_entity` part identifies something else than the two cases described above are not specified in this specification.



## 14.2.1.3.4 Resolution of Locator Elements

In cable receivers, when the CableCard Module is present, locators shall be resolved using the SI present in the OOB signaling. In cable receivers when the CableCard Module is absent, the in-band SI shall be used for resolution. See SCTE 65 [45] for out-of-band and A/65B [47] for in-band.

## 14.2.1.3.4.1 Contextual

**Table 14-1** ACAP URI Contextual Constructs

Name	Cable	Terrestrial	Comment
current	The Virtual Channel to which the ACAP receiver is currently tuned to.		The ACAP receiver needs to keep a record for the Virtual Channel listing the application making use of this identifier. Otherwise, ambiguity may occur if the receiver has multiple tuners.
current.av	The default audio and video components of the 'current' service (see above) as specified in GEM [1] Section 11.6.2.		
current.audio	The default audio component of the 'current' service (see above) as specified in GEM [1] Section 11.6.2.		
current.video	The default video component of the 'current' service (see above) as specified in GEM [1] Section 11.6.2.		
original	The Virtual Channel to which the ACAP receiver was originally tuned to when launching the application.		

## 14.2.1.3.4.2 Universally resolvable

Constructs listed in **Table 14-2** ACAP URI Universally Resolvable Constructs, rely on signaling which is mandatorily present in terrestrial and all profiles of cable.

**Table 14-2** ACAP URI Universally Resolvable Constructs

Name	Cable	Terrestrial	Comment
source_id	The source_id field in the VCM_structure of the Short Form Virtual Channel Table (Profile 1 through 5) or the source_id field in Long Form Virtual Channel Table (Profile 5 and 6) as defined in ANSI/SCTE 65 [45]. If both are present, the Long Form version shall be used. If no CableCard Module is present, then the source_id field in the Cable Virtual Channel Table as defined in <ref to in-band PSIP>	The source_id field in the Terrestrial Virtual Channel Table as defined in ATSC A/65B [47].	
association_tag	An association_tag value in one of the Association Tag Descriptors located in the inner descriptor loop of the TS_program_map_section associated with the Virtual Channel.		Where association tag is used with an environment specific virtual channel identification (e.g. short_name) then the combination is also environment specific.
stream_type	The first program element matching that stream type. The stream types are	The first program element matching that stream type.	Where multiple streams of a given type are present, the

	defined in the stream type assignments table of ISO 13818-1 [22] and in the Stream Type Codes table of SCTE 54 [31].	The stream types are defined in the stream type assignments table of ISO 13818-1 [22] and in A/53B [7].	one selected may be implementation dependent..
org_id/app_id	The org_id and app_id identifier shall correspond to the organization_id and application_id field, respectively, in the Application Identifier of an Application Information Table (AIT). <xref to ACAP>.		
application_name	The application name in the Application Name Descriptor of the Application Information Table. <xref to ACAP>.		
app_root	The app_root name shall correspond to the root directory path of the application as found in the acap_x application location descriptor within the AIT <xref to ACAP-X specific descriptors>.		
ISO 639 language code	The first audio program element matching the specified ISO 639-2 3-character language code. The ISO 639 descriptor shall be checked first and if absent then the AC-3 descriptor.		

#### 14.2.1.3.4.3 Environment specific

Constructs listed in **Table 14-3** ACAP URI Environment Specific Constructs, are those where the underlying signaling is not required to be present in all of terrestrial and all cable profiles.

**Table 14-3** ACAP URI Environment Specific Constructs

Name	Cable	Terrestrial	Comment
service_name	If the service information contains a Long-form Virtual Channel Table, Terrestrial Virtual Channel Table or Cable Virtual Channel Table, the short_name from that table is translated to a UTF-8 string and compared with the UTF-8 representation of service_name. Otherwise, if the service information contains a Source Name Sub-table in the Network Text Table, each source_name component with mode less than 0x40 is translated to a UTF-8 string according to its mode and byte string and compared with the UTF-8 representation of service_name. Components of source_name using format-effector modes are ignored in the comparison. Otherwise the service_name is not resolvable.		Use of this in cable assumes the MSO ensures these names are uniquely correlated with source_ids in their network. These names are not interchangeable between cable networks.
component_tag	A component_tag value in one of the Stream Identifier Descriptors located in the inner descriptor loop of the TS_program_map_section associated with the Virtual Channel identified	Not defined.	Where component tag is used with an environment specific virtual channel identification (e.g. short_name) then it is also environment specific.
component_name	The component name string in the Component Name Descriptor located in the inner descriptor loop of the TS_program_map_section associated with the Virtual Channel (see below)..	Not defined.	This identifier can only be used with cable systems supporting Profiles 4, 5 and 6 of ANSI/SCTE 65 [45].
event_id	The event_id identifier shall correspond to the event_ID in the Aggregate Event Information Table (AEIT) as defined in ANSI/SCTE 65 [45].	The event_id shall correspond To an event_ID field in an Event Information Table as defined in ATSC A/65B [47].	Event identifiers shall be scoped by a Virtual Channel identifier. In cable, this identifier may only be resolved in systems supporting Profiles 4,5,6.

The `component_name` in the PMT is represented as a Multiple String Structure with each set of string components associated with a specific language. The set of string components corresponding to language code `eng` are selected, and decompressed for comparison. Each PMT `component_name` string component with mode less than 0x40 is translated to a UTF-8 string according to its mode and byte string and compared with the UTF-8 representation of the `component_name` extracted from the locator. Components of the PMT `component_name` using format-effector modes are ignored in the comparison.

#### 14.2.1.3.4.4 Physical constructs

Constructs listed in **Table 14-4** ACAP URI Physical Layer Constructs, below are specific to a particular environment or cable head-end.

*Note:* Applications should not include hard-coded values of these. Locators using them are intended to be dynamically constructed in the ACAP receiver based on locally accurate information; e.g. as would be returned by `org.ocap.si.PMTElementaryStreamInfo.getElementaryPID()`.

**Table 14-4** ACAP URI Physical Layer Constructs

Name	Cable	Terrestrial	Comment
<code>carrier_frequency</code>	No resolution mechanism required.		
<code>program_number</code>	A 16-bit value as specified in ISO 13818-1 [22]z.		
<code>PID</code>	In this case the program element is indicated by the PID.		
<code>Index in PMT</code>	In this case the program element is the indexed program element matching that stream type. The index specifies the ordinal number of the elementary streams that have same <code>stream_type</code> in the PMT. The first elementary stream of them is <code>index = 0</code> .		If multiple MPEG PES of the same stream type are present in the program, then the index can be used to select the first, second, third, and so forth.

### 14.3 Persistent Local Storage

As specified in Section 14.6 of GEM [1].

## 15. MINIMUM RECEIVER REQUIREMENTS

### 15.1 General

Annex G of GEM [1] shall apply.

Open Issue: In order to be fully compliant with GEM, we need to specify a functional equivalent for MHP Table G.2 found in Section G.4.1.

### 15.2 User Input

For terrestrial receivers, Section G.5 of GEM [1] shall apply.

For cable receivers, additionally Section 24.2.1.2 “Input Events” of OCAP 1.0 [4] shall apply.

This specification recommends support for keyboard input, either provided at time of manufacture or the option of adding a keyboard input at a later time.

### 15.3 Graphics

GEM [1] Section G.1.2, “Minimum Color Lookup Table,” does not apply to this specification. No functional equivalent is provided in this specification. All ACAP receivers shall support a graphics resolution of at least 16 bits per pixel.

Open Issue: consider if we need to be more explicit about how the 16 bits are divided between R, G., B, and A.

Open Issue: This divergence from GEM is expected to be resolved prior to publication of ACAP by amending GEM to remove the requirement to specify a default palette and amending ACAP to GEM compliance on this point. See 19.1.1 GEM errata”.

The minimal set of required device resolutions that ACAP terminals must support is as follows:

- HBackgroundDevice resolution of 640 x 480
- HVideoDevice resolution of 640 x 480
- HGraphicsDevice resolution of 640 x 480

These resolutions must be supported for display aspect ratios of 4:3 and 16:9.

Open Issue: There should be minimum requirements on pixel aspect ratios for the above HGraphicsConfiguration, HVideoConfiguration, and HBackgroundConfiguration. Requiring configurations to include support for square pixels on 4:3 displays may be part of this solution.

If ACAP receivers either display or output HD video without down-conversion to SD then they shall support at least the graphics resolution of 960x540 in addition to those listed above.

## 16. DETAILED PLATFORM PROFILE DEFINITIONS

This section defines the capabilities of platforms as presented to applications. Products that claim to conform to a profile shall provide at least the minimum capabilities identified for the profile. In some cases this implies that specific hardware resources are present in the platform. (See **Table 16-1** Detailed Platform Profile Definitions.)

**Table 16-1** Detailed Platform Profile Definitions

Area	Specification	ACAP-J only Profile	ACAP-J and ACAP-X Profile
<b>GEM Compliance</b>			
GEM	GEM [1], clause 15.0, "Interactive Broadcast Profile"	M	M
	Section 17.1, "Compliance with GEM"	M	M
<b>Broadcast Streaming Formats</b>			
Video	Section 6.3.1, "Video"	M	M
Audio	Section 6.3.2, "Audio"	M	M
<b>Broadcast Channel Protocols</b>			
Broadcast Channel Protocols	Section 10.1.1, "Notation," – Section 10.4.5.1.2, "ACAP-J Application Location Descriptor"	M	M
	Section 10.4.5.2.1, "ACAP-X Application Descriptor," to Section 10.4.5.2.3, "ACAP-X Application Boundary Descriptor"	--	M
<b>Interaction Channel Protocols</b>			
Interaction Channel Protocols	Section 11.1.2, "Internet Protocol," – Section 11.1.4, "Transmission Control Protocol (TCP)," and Section 11.1.6, "Domain Name Service (DNS)"	M	M
	Section 11.1.5, "Hyper-Text Transfer Protocol (HTTP)"	--	M
<b>ACAP-J environment</b>			
ACAP-J environment	Section 7, "ACAP-J Applications and Environment"	M	M
	Section 7.2.1.2, "Inter-Environment DOM Integration"	--	M
<b>ACAP-X environment</b>			
ACAP-X environment	, Section 8, "ACAP-X Applications and Environment"	--	M
<b>Resource Reference and Locators</b>			
Resource Reference and Locators	Section 14.2.1.1, "Scheme"	M	M
	Section 14.2.1.2, "Extended ACAP URI Scheme for ACAP-X"	--	M
<b>Minimum Receiver Requirements</b>			
GEM Platform Minima	GEM GEM, clauses 15.1 through 15.5	M	M
ACAP Platform Minima	Section 15, "Minimum Receiver Requirements"	M	M
Security	Section 12, "Security"	M	M

## 17. CONFORMANCE

### 17.1 Compliance with GEM

ACAP terminals shall comply in full with GEM [1]. This specification adopts the MHP definition of the following functional equivalents, as specified in GEM [1] clause 15.6:

- Arch
- Carousel
- Application Signalling
- Text Wrapping

For avoidance of doubt, in the event of a conflict between GEM [1] and this specification, the normative guarantees of GEM [1] shall take precedence except as detailed in Section 17.1.1, "GEM errata".

#### 17.1.1 GEM errata

Editor: Please include a table comparable to the one in the transport chapter for errata to GEM.

Open Issue: Some issues with GEM have been identified, but they are expected to be resolved with the MUG prior to publication of ACAP. They are:

Open Issue: GEM Issue M78. This could be implemented in GEM with language like this: MHP [1], clause 7.1.1.1 is included in the present document with the modification that the requirement to ignore "Any indications in the transmitted image with respect to" .."colour space or gamma" does not apply. GEM terminals may process these.

Open Issue: GEM Issues M76 and M77. These could be implemented in GEM with language like this: MHP [1], clause 7.1.1.2 is included in the present document with these modifications:

- An ACAP System which supports this facility shall implement the sequential DCT-based decoding processes with Huffman coding of DCT coefficients as defined by [JPEG], Sections F.2.1 and F.2.2. Support for arithmetic coding of these is not required.

- Support for the thumbnails defined in JFIF is not required.

Open Issue: GEM Issue M79: This could be implemented in GEM with language like this: For this reason, the CLUT as specified in MHP is not required, but either a functional equivalent shall be provided or the GEM terminal specification shall require a per-pixel colour resolution of at least 16 bits/pixel.

Editor: MHP [1], clause 7.1.1.3 is included with these modifications:

- the reference to PNG shall be changed from "V1 01-Oct-96 Portable Network Graphics." to "Portable Network Graphics (PNG): Functional specification. ISO/IEC 15948:2002 (E) W3C Proposed Recommendation 1 October 1996, revised 20 May 2003"

## **Annex A: Content Identification API**

### **1. PACKAGE ORG.ATSC.SI**

#### 1.1 Description

This package provides SI extensions for ACAP.

## org.atsc.si: ContentIdentification

- **Declaration:** public interface ContentIdentification
- **All Known Subinterfaces:** ISANIdentification, VISANIdentification
- **Description:** Superinterface for all content identification system specific retrieval interfaces.

Member Summary	
Methods	
int	<b>getIdentificationSystem()</b> Returns the value of the ID_system from the content identification descriptor as defined in ATSC A/57A, Content Identification and Labeling for ATSC Transport.
java.lang.String	<b>getIdentifier()</b> Returns a string representation of the underlying content identification value.
byte[]	<b>getIdentifierBytes()</b> Provides an array of n bytes that represent the underlying n byte value of the content identification.

### Methods

#### getIdentificationSystem()

public int **getIdentificationSystem()**

Returns the value of the ID\_system from the content identification descriptor as defined in ATSC A/57A, "Content Identification and Labeling for ATSC Transport."

**Returns:**

integer representation of the ID\_system value.

#### getIdentifier()

public java.lang.String **getIdentifier()**

Returns a string representation of the underlying content identification value.

**Returns:**

string representation of the content identification.

#### getIdentifierBytes()

public byte[] **getIdentifierBytes()**

Provides an array of n bytes that represent the underlying n byte value of the content identification.

**Returns:**

array of n bytes.



## org.atsc.si: ContentIdentifications

- **Declaration:** public interface ContentIdentifications
- **Description:** Provides an array of references to the various content identifiers associated with an instance of javax.tv.service.guide.ProgramEvent.

Member Summary
<b>Methods</b> ContentIdentification[] getIdentifiers() Returns an array of objects that implement the ContentIdentification interface.

### Methods

#### getIdentifiers()

public org.atsc.si.ContentIdentification[] **getIdentifiers()**

Returns an array of objects that implement the ContentIdentification interface. In the case where the underlying program event does not contain content identifiers, the getIdentifiers() method shall return an empty array.

#### See Also:

ContentIdentification

## org.atsc.si: ISANIdentification

- **Declaration:** public interface ISANIdentification extends ContentIdentification
- **All Superinterfaces:** ContentIdentification
- **All Known Superinterfaces:** VISANIdentification
- **Description:** Interface for retrieving ISO 15706 compliant content identification value for the underlying program event. This interface shall only be implemented when the underlying program event is identified by a ISAN.

Member Summary	
<b>Methods</b>	
int	getISANEpisodeIdentifier() Provides the episode segment of an ISAN content identification.
java.lang.String	getISANIdentifier() Provides a string representation of the ISAN Identifier.
byte[]	getISANIdentifierBytes() Provides an array of 8 bytes that represent the underlying 8 byte value of the ISAN content identification.
long	getISANRootIdentifier() Provides the root portion of an ISAN content identification.

Inherited Member Summary
<b>Methods inherited from interface ContentIdentification</b> getIdentificationSystem(), getIdentifier(), getIdentifierBytes()

### Methods

#### getISANEpisodeIdentifier()

```
public int getISANEpisodeIdentifier()
```

Provides the episode segment of an ISAN content identification.

#### Returns:

Integer value that is the episode segment of the ISAN content identification.

#### getISANIdentifier()

```
public java.lang.String getISANIdentifier()
```

Provides a string representation of the ISAN Identifier. The string representation shall be conformant with ISO 15706.

#### Returns:

String representation of the underlying ISAN content identification.

#### getISANIdentifierBytes()

```
public byte [] getISANIdentifierBytes()
```

Provides an array of 8 bytes that represent the underlying 8 byte value of the ISAN content identification.

**Returns:**

Array of 8 Bytes.

**getISANRootIdentifier()**

public long **getISANRootIdentifier()**

Provides the root portion of an ISAN content identification.

**Returns:**

Long value that is the root segment of the ISAN content identification.

## org.atsc.si: VISANIdentification

- **Declaration:** public interface VISANIdentification extends ISANIdentification
- **All Superinterfaces:** ContentIdentification, ISANIdentification
- **Description:** Interface for retrieving ISO 20925-1 compliant content identification values. This interface shall only be implemented when the underlying program event is identified by a V-ISAN.

Member Summary	
Methods	
java.lang.String	getVISANIdentifier() Provides a string representation of the V-ISAN content identification.
byte[]	getVISANIdentifierBytes() Provides an array of 12 bytes that represent the underlying 12 byte value of the VISAN content identification.
int	getVISANVersionIdentifier() Provides the version segment of a V-ISAN content identification.

Inherited Member Summary
<p><b>Methods inherited from interface ContentIdentification</b> getIdentificationSystem(), getIdentifier(), getIdentifierBytes()</p> <p><b>Methods inherited from interface ISANIdentification</b> getISANEpisodeIdentifier(), getISANIdentifier(), getISANIdentifierBytes(), getISANRootIdentifier()</p>

### Methods

#### getVISANIdentifier()

public java.lang.String **getVISANIdentifier()**

Provides a string representation of the V-ISAN content identification. The string representation shall be conformant with ISO 20925-1.

**Returns:**

String representation of the underlying V-ISAN content identification.

#### getVISANIdentifierBytes()

public byte[] **getVISANIdentifierBytes()**

Provides an array of 12 bytes that represent the underlying 12 byte value of the V-ISAN content identification.

**Returns:**

Array of 12 bytes.

#### getVISANVersionIdentifier()

public int **getVISANVersionIdentifier()**

Provides the version segment of a V-ISAN content identification.

**Returns:**

Integer value that is the version segment of a V-ISAN content identification

## Annex B: Document Type Definitions (Normative)

### 1. SCOPE

This annex specifies the following document types as used by ACAP XML based content types:

- ACAP Permission Request File Document Type
- ACAP-J Font Index File Document Type
- ACAP-X Application Metadata Document Type
- ACAP-X Markup Document Type

### 2. ACAP PERMISSION REQUEST FILE DOCUMENT TYPE

This document type defines the ACAP permission request file schema.

#### 2.1 acap-permission-1.dtd

```
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->
<!--          ACAP Permission Request File 1.0 DTD          -->
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->

<!-- This is the DTD for the ACAP 1.0 permission request file.

      The following formal public identifier shall be used to identify it:

      "-//ATSC//DTD ACAP Permission Request File 1.0//EN"

      The following URL for the SystemLiteral may be used to reference this file :

      http://www.atsc.org/acap/dtd/acap-permission-1.dtd
-->

<!-- Basic entities definition -->
<!ENTITY % URI.datatype "CDATA" >

<!-- ..... -->
<!-- The section below declares the OCAP extensions to the GEM PRF -->
<!-- ..... -->
<!--          Declare the OCAP namespace -->
<!ENTITY % ocap.xmlns "http://www.cablelabs.com/ocap" >
<!--          Declare the OCAP prefix associated with this namespace -->
<!ENTITY % ocap.prefix "ocap" >

<!-- Declare the xml namespace attribute for OCAP -->
<!ENTITY % ocap.xmlns.attrib
      "xmlns:%ocap.prefix; %URI.datatype; #FIXED '%ocap.xmlns;' "
>

<!-- Declare the additional OCAP-defined elements and attributes -->
<!ENTITY % ocap.monitorapplication.qname "%ocap.prefix;:monitorapplication" >
<!ENTITY % ocap.monitorapplication.name.qname "name" >
<!ENTITY % ocap.monitorapplication.value.qname "value" >
```

```

<!-- ..... -->
<!-- The section below declares the ACAP extensions to the GEM PRF -->
<!-- ..... -->
<!--      Declare the ACAP namespace -->
<!ENTITY % acap.xmlns "http://www.atsc.org/acap#permission" >
<!--      Declare the ACAP prefix associated with this namespace -->
<!ENTITY % acap.prefix "acap" >

<!-- Declare the xml namespace attribute for ATSC -->
<!ENTITY % acap.xmlns.attrib
      "xmlns:%acap.prefix; %URI.datatype; #FIXED '%acap.xmlns;' "
>

!--      Declare the additional ACAP-defined elements and attributes -->
<!ENTITY % acap.cookie.qname "%acap.prefix;:cookie" >
<!ENTITY % acap.cookie.target.qname "target" >
<!ENTITY % acap.cookie.actions.qname "actions" >

<!ENTITY % acap.rce.qname "%acap.prefix;:rce" >
<!ENTITY % acap.rce.value.qname "value" >

<!ENTITY % acap.bridge.qname "%acap.prefix;:bridge" >
<!ENTITY % acap.bridge.value.qname "value" >

<!-- All elements and attributes defined in GEM 1.0.x shall be supported and -->
<!-- inserted at this level with appropriate extensions necessary for -->
<!-- ACAP (prefixed by "acap:") and CableLabs (prefixed by "ocap:") -->

<!ELEMENT permissionrequestfile
      (file?, capermission?, applifecyclecontrol?, returnchannel?, tuning?,
      servicesel?, userpreferences?, network?, dripfeed?, persistentfilecredential*,
      %acap.cookie.qname;, %acap.rce.qname;, %acap.bridge.qname;,
      %ocap.monitorapplication.qname;*)>

<!ATTLIST permissionrequestfile
      orgid CDATA #REQUIRED
      appid CDATA #REQUIRED
>

<!ELEMENT file EMPTY>
<!ATTLIST file
      value (true|false) "true"
>

<!ELEMENT capermission (casystemid)+>
<!ELEMENT casystemid EMPTY>
<!ATTLIST casystemid
      entitlementquery (true|false) "false"
      id CDATA #REQUIRED
      mmi (true|false) "false"
      messagepassing (true|false) "false"
      buy (true|false) "false"
>

```

```
<!ELEMENT applifecyclecontrol EMPTY>
<!ATTLIST applifecyclecontrol
  value (true|false) "true"
>

<!ELEMENT returnchannel (defaultisp?,phonenumber*)>
<!ELEMENT defaultisp EMPTY>
<!ELEMENT phonenumber (#PCDATA)>

<!ELEMENT tuning EMPTY>
<!ATTLIST tuning
  value (true|false) "true"
>

<!ELEMENT servicesel EMPTY>
<!ATTLIST servicesel
  value (true|false) "true"
>

<!ELEMENT userpreferences EMPTY>
<!ATTLIST userpreferences
  write (true|false) "false"
  read (true|false) "true"
>

<!ELEMENT network (host)+>
<!ELEMENT host (#PCDATA)>
<!ATTLIST host
  action CDATA #REQUIRED
>

<!ELEMENT dripfeed EMPTY>
<!ATTLIST dripfeed
  value (true|false) "true"
>

<!ELEMENT persistentfilecredential (grantoridentifier, expirationdate, filename+,
  signature, certchainfileid)>
<!ELEMENT grantoridentifier EMPTY>
<!ATTLIST grantoridentifier
  id CDATA #REQUIRED
>
<!ELEMENT expirationdate EMPTY>
<!ATTLIST expirationdate
  date CDATA #REQUIRED
>
<!ELEMENT filename (#PCDATA)>
<!ATTLIST filename
  write (true|false) "true"
  read (true|false) "true"
>
<!ELEMENT signature (#PCDATA)>
<!ELEMENT certchainfileid (#PCDATA)>
```



```

<!-- In addition, the following elements and attributes are defined in order
to support OCAP specific behaviour. -->

<!ELEMENT %ocap.monitorapplication.qname; EMPTY>

<!ENTITY % OCAPMonitorAppPermType.class
  "(registrar | service | servicemanager | security | reboot | handler.reboot |
  handler.appFilter | handler.resource | handler.closeACAPtioning |
  filterUserEvents | handler.podResource | handler.eas | setCCIBits |
  setDownRes | setVideoPort | podApplication | signal.configured)"
>
<!ATTLIST %ocap.monitorapplication.qname;
  %ocap.monitorapplication.name.qname; %OCAPMonitorAppPermType.class; #REQUIRED
  %ocap.monitorapplication.value.qname; (true | false) #REQUIRED
  %ocap.xmlns.attrib;
>

<!-- In addition, the following elements and attributes are defined in order
to support ACAP-X application specific behaviour. -->

<!-- cookie permission request -->
<!ELEMENT %acap.cookie.qname; EMPTY>
<!ATTLIST %acap.cookie.qname;
  %acap.target.qname; CDATA #REQUIRED
  %acap.actions.qname; CDATA #REQUIRED
  %acap.xmlns.attrib;
>

<!-- runtime code extension permission request -->
<!ELEMENT %acap.rce.qname; EMPTY>
<!ATTLIST %acap.rce.qname;
  %acap.rce.value.qname; (true|false) #REQUIRED
  %acap.xmlns.attrib;
>

<!-- Java bridge permission request -->
<!ELEMENT %acap.bridge.qname; EMPTY>
<!ATTLIST %acap.bridge.qname;
  %acap.bridge.value.qname; (true|false) #REQUIRED
  %acap.xmlns.attrib;
>

```

### 3. ACAP-J FONT INDEX FILE DOCUMENT TYPE

This document type defines the ACAP-J application font index file schema.

#### 3.1 acap-j-font-index-1.dtd

```

<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->
<!--          ACAP-J Font Index File 1.0 DTD          -->
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->

<!-- This is the DTD for the ACAP-J 1.0 font index file.

```

The following formal public identifier shall be used to identify it:

"-//DVB//DTD Font Directory 1.0//EN"

The following URL for the SystemLiteral may be used to reference this file :

<http://www.atsc.org/acap/dtd/acap-j-font-index-1.dtd>

-->

```

<!ELEMENT fontdirectory (font)+>
<!ELEMENT font (name,fontformat,filename,style*,size?)>
<!ELEMENT name (#PCDATA)>
<!ELEMENT fontformat (#PCDATA)>
<!ELEMENT filename (#PCDATA)>
<!ELEMENT style (#PCDATA)>
<!ELEMENT size EMPTY>
<!ATTLIST size
  min CDATA "0"
  max CDATA "maxint"
>
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->
<!--                               END END END                               -->
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->

```

#### 4. ACAP-X APPLICATION METADATA DOCUMENT TYPE

This document type defines the ACAP-X application metadata schema.

##### 4.1 acap-x-metadata-1.dtd

```

<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->
<!--                               ACAP-X Application Metadata 1.0 DTD                               -->
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->

<!--
  This is ACAP-X Application Metadata 1.0, an XML Document Type specified
  for use with ACAP-X Applications.

  This module shall be identified by the following formal public identifier:

  "-//ATSC//DTD ACAP-X Application Metadata 1.0//EN"

  The following URL for the SystemLiteral may be used to reference
  this file :

  http://www.atsc.org/acap/dtd/acap-x-metadata-1.dtd
-->

<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->
<!--                               Parameters                               -->
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->

<!ENTITY % XMLNS "http://www.atsc.org/acap#metadata" >

```

```

<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->
<!--          Data Type Entity Declarations          -->
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->

<!-- media type, as per [RFC2045] -->
<!ENTITY % ContentType.datatype "CDATA" >

<!-- a language code, as per [LANG-TAGS] -->
<!ENTITY % LanguageCode.datatype "NMOKEN" >

<!-- a Uniform Resource Identifier, see [URI] -->
<!ENTITY % URI.datatype "CDATA" >

<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->
<!--          Attribute Entity Declarations          -->
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->

<!ENTITY % id.attrib
      "id          ID          #IMPLIED"
>

<!ENTITY % lang.attrib
      "xml:lang    %LanguageCode.datatype; #IMPLIED"
>

<!ENTITY % xmlns.attrib
      "xmlns      %URI.datatype;      #FIXED '%XMLNS;'"
>

<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->
<!--          Qualified Element Name Entity Declarations          -->
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->

<!ENTITY % application.qname          "application" >
<!ENTITY % identifier.qname          "identifier" >
<!ENTITY % entityset.qname          "entityset" >
<!ENTITY % entity.qname          "entity" >
<!ENTITY % descset.qname          "descset" >
<!ENTITY % name.qname          "name" >
<!ENTITY % desc.qname          "desc" >
<!ENTITY % condset.qname          "condset" >
<!ENTITY % cond.qname          "cond" >
<!ENTITY % cacheset.qname          "cacheset" >
<!ENTITY % cache.qname          "cache" >
<!ENTITY % paramset.qname          "paramset" >
<!ENTITY % param.qname          "param" >

<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->
<!--          Element Classes          -->
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->

<!ENTITY % optsets.class          "%condset.qname; |
                                %cacheset.qname; |

```

```

                                %paramset.qname;" >

<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->
<!--                               Element Declarations                               -->
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->

<!ENTITY % application.content      "(%identifier.qname;,
                                %entityset.qname;,
                                %descset.qname;+,
                                (%optsets.class;*)" >
<!ELEMENT %application.qname;      %application.content; >
<!ATTLIST %application.qname;
    %xmlns.attrib;
    %lang.attrib;
    %id.attrib;
>

<!ENTITY % identifier.content      "(%param.qname;)*">
<!ELEMENT %identifier.qname;      %identifier.content; >
<!ATTLIST %identifier.qname;
    %xmlns.attrib;
    %lang.attrib;
    %id.attrib;
    uuid          CDATA          #REQUIRED
>

<!ENTITY % entityset.content      "(%entity.qname;)+ " >
<!ELEMENT %entityset.qname;      %entityset.content; >
<!ATTLIST %entityset.qname;
    %xmlns.attrib;
    %lang.attrib;
    %id.attrib;
>

<!ENTITY % entity.content          "EMPTY">
<!ELEMENT %entity.qname;          %entity.content; >
<!ATTLIST %entity.qname;
    %xmlns.attrib;
    %lang.attrib;
    %id.attrib;
    entitytype    CDATA          #REQUIRED
    uri           %URI.datatype;  #REQUIRED
>

<!ENTITY % descset.content        "(%name.qname;, %desc.qname;)" >
<!ELEMENT %descset.qname;        %descset.content; >
<!ATTLIST %descset.qname;
    %xmlns.attrib;
    %lang.attrib;
    %id.attrib;
>

<!ENTITY % name.content           "(#PCDATA)">
<!ELEMENT %name.qname;           %name.content; >

```

```

<!ATTLIST %name.qname;
    %xmlns.attrib;
    %lang.attrib;
    %id.attrib;
>

<!ENTITY % desc.content          "(#PCDATA)">
<!ELEMENT %desc.qname;          %desc.content; >
<!ATTLIST %desc.qname;
    %xmlns.attrib;
    %lang.attrib;
    %id.attrib;
>

<!ENTITY % condset.content       "(%cond.qname;)+>
<!ELEMENT %condset.qname;       %condset.content; >
<!ATTLIST %condset.qname;
    %xmlns.attrib;
    %lang.attrib;
    %id.attrib;
>

<!ENTITY % cond.content          "(%param.qname;)*">
<!ELEMENT %cond.qname;          %cond.content; >
<!ATTLIST %cond.qname;
    %xmlns.attrib;
    %lang.attrib;
    %id.attrib;
    capability    CDATA          #REQUIRED
    qualifier     CDATA          #IMPLIED
>

<!ENTITY % cacheset.content      "(%cache.qname;)+>
<!ELEMENT %cacheset.qname;      %cacheset.content; >
<!ATTLIST %cacheset.qname;
    %xmlns.attrib;
    %lang.attrib;
    %id.attrib;
>

<!ENTITY % cache.content         "EMPTY">
<!ELEMENT %cache.qname;         %cache.content; >
<!ATTLIST %cache.qname;
    %xmlns.attrib;
    %lang.attrib;
    %id.attrib;
    target        %URI.datatype; #REQUIRED
    directives    CDATA          #REQUIRED
>

<!ENTITY % paramset.content      "(%param.qname;)+>
<!ELEMENT %paramset.qname;      %paramset.content; >
<!ATTLIST %paramset.qname;
    %xmlns.attrib;

```

```

    %lang.attrib;
    %id.attrib;
>
<!ENTITY % param.content          "EMPTY">
<!ELEMENT %param.qname;          %param.content; >
<!ATTLIST %param.qname;
    %xmlns.attrib;
    %lang.attrib;
    %id.attrib;
    name          CDATA          #REQUIRED
    value         CDATA          #IMPLIED
>
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->
<!--                      END END END                      -->
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->

```

## 5. ACAP-X MARKUP DOCUMENT TYPE

This document type defines the ACAP-X application markup schema, also known as XDML.

### 5.1 acap-x-xdml-1.dtd

```

<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->
<!--                      XDML 1.0 DTD Driver                      -->
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->

<!--
    This is XDML 1.0, an XHTML Host Language Document Type specified for
    use with ACAP-X applications.

    This module shall be identified by the following formal public identifier:

    "-//ATSC//DTD XHTML ACAP XDML 1.0//EN"
-->

<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->
<!--                      XHTML Driver Parameters                      -->
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->

<!ENTITY % XHTML.version "-//ATSC//DTD XHTML ACAP-X XDML 1.0//EN">
<!ENTITY % XHTML.profile "">

<!ENTITY % XHTML.dtd.sysid.base
    "http://www.w3.org/TR/xhtml-modularization/DTD/">

<!ENTITY % ACAP.xmlns "http://www.atsc.org/acap#markup">

<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->
<!--                      Framework                      -->
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->

<!-- Framework Parameter: Include BIDI support -->

```

```

<!ENTITY % XHTML.bidi "INCLUDE">

<!-- Framework Parameter: Ignore intrinsic event attributes -->
<!ENTITY % xhtml-events.module "IGNORE">

<!-- Framework Parameter: Define Content Model -->
<!ENTITY % xhtml-model.mod
    PUBLIC "-//ATSC//ENTITIES ACAP-X XAML Content Model 1.0//EN"
        "acap-x-xaml-model-1.ent">

<!-- Framework Parameter: %Core.attrib; extensions -->
<!ENTITY % base.attrib "xml:base CDATA #IMPLIED">
<!ENTITY % style.attrib "style CDATA #IMPLIED">
<!ENTITY % Core.extra.attrib "%base.attrib; %style.attrib;">

<!-- Framework Parameter: missing qnames -->
<!ENTITY % frameset.qname "frameset">

<!-- Modular Framework Module -->
<!ENTITY % xhtml-framework.mod
    PUBLIC "-//W3C//ENTITIES XHTML Modular Framework 1.0//EN"
        "%XHTML.dtd.sysid.base;xhtml-framework-1.mod">
%xhtml-framework.mod;

<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->
<!--                               Element Modules                               -->
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->

<!-- Basic Text Module -->
<!ENTITY % xhtml-text.mod
    PUBLIC "-//W3C//ELEMENTS XHTML Text 1.0//EN"
        "%XHTML.dtd.sysid.base;xhtml-text-1.mod">
%xhtml-text.mod;

<!-- Hypertext Module -->
<!ENTITY % xhtml-hypertext.mod
    PUBLIC "-//W3C//ELEMENTS XHTML Hypertext 1.0//EN"
        "%XHTML.dtd.sysid.base;xhtml-hypertext-1.mod">
%xhtml-hypertext.mod;

<!-- Lists Module -->
<!ENTITY % xhtml-list.mod
    PUBLIC "-//W3C//ELEMENTS XHTML Lists 1.0//EN"
        "%XHTML.dtd.sysid.base;xhtml-list-1.mod">
%xhtml-list.mod;

<!-- Presentation Module -->
<!ENTITY % xhtml-pres.mod
    PUBLIC "-//W3C//ELEMENTS XHTML Presentation 1.0//EN"
        "%XHTML.dtd.sysid.base;xhtml-pres-1.mod">
%xhtml-pres.mod;

<!-- BIDI Override Element Module -->
<!ENTITY % xhtml-bdo.mod

```

```
    PUBLIC "-//W3C//ELEMENTS XHTML BIDI Override Element 1.0//EN"
        "%XHTML.dtd.sysid.base;xhtml-bdo-1.mod">
%xhtml-bdo.mod;

<!-- Forms Module -->
<!ENTITY % xhtml-form.mod
    PUBLIC "-//W3C//ELEMENTS XHTML Forms 1.0//EN"
        "%XHTML.dtd.sysid.base;xhtml-form-1.mod">
%xhtml-form.mod;

<!-- Tables Module -->
<!ENTITY % xhtml-table.mod
    PUBLIC "-//W3C//ELEMENTS XHTML Tables 1.0//EN"
        "%XHTML.dtd.sysid.base;xhtml-table-1.mod">
%xhtml-table.mod;

<!-- Param Element Module -->
<!ENTITY % xhtml-param.mod
    PUBLIC "-//W3C//ELEMENTS XHTML Param Element 1.0//EN"
        "%XHTML.dtd.sysid.base;xhtml-param-1.mod">
%xhtml-param.mod;

<!-- Object Element Module -->
<!ENTITY % xhtml-object.mod
    PUBLIC "-//W3C//ELEMENTS XHTML Embedded Object 1.0//EN"
        "%XHTML.dtd.sysid.base;xhtml-object-1.mod">
%xhtml-object.mod;

<!-- Image Element Module -->
<!ENTITY % xhtml-image.mod
    PUBLIC "-//W3C//ELEMENTS XHTML Images 1.0//EN"
        "%XHTML.dtd.sysid.base;xhtml-image-1.mod">
%xhtml-image.mod;

<!-- Client-side Image Map Module -->
<!ENTITY % xhtml-csismap.mod
    PUBLIC "-//W3C//ELEMENTS XHTML Client-side Image Maps 1.0//EN"
        "%XHTML.dtd.sysid.base;xhtml-csismap-1.mod">
%xhtml-csismap.mod;

<!-- Link Element Module -->
<!ENTITY % xhtml-link.mod
    PUBLIC "-//W3C//ELEMENTS XHTML Link Element 1.0//EN"
        "%XHTML.dtd.sysid.base;xhtml-link-1.mod">
%xhtml-link.mod;

<!-- Base Element Module -->
<!ENTITY % xhtml-base.mod
    PUBLIC "-//W3C//ELEMENTS XHTML Base Element 1.0//EN"
        "%XHTML.dtd.sysid.base;xhtml-base-1.mod">
%xhtml-base.mod;

<!-- Document Metainformation Module -->
<!ENTITY % xhtml-meta.mod
```



```

PUBLIC "-//W3C//ELEMENTS XHTML Metainformation 1.0//EN"
    "%XHTML.dtd.sysid.base;xhtml-meta-1.mod">
%xhtml-meta.mod;

<!-- Scripting Module -->
<!ENTITY % xhtml-script.mod
    PUBLIC "-//W3C//ELEMENTS XHTML Scripting 1.0//EN"
        "%XHTML.dtd.sysid.base;xhtml-script-1.mod">
%xhtml-script.mod;

<!-- Stylesheets Module -->
<!ENTITY % xhtml-style.mod
    PUBLIC "-//W3C//ELEMENTS XHTML Style Sheets 1.0//EN"
        "%XHTML.dtd.sysid.base;xhtml-style-1.mod">
%xhtml-style.mod;

<!-- Target Attribute Module -->
<!ENTITY % xhtml-target.mod
    PUBLIC "-//W3C//ELEMENTS XHTML Target 1.0//EN"
        "%XHTML.dtd.sysid.base;xhtml-target-1.mod">
%xhtml-target.mod;

<!-- Frames Module -->
<!ENTITY % xhtml-frames.mod
    PUBLIC "-//W3C//ELEMENTS XHTML Frames 1.0//EN"
        "%XHTML.dtd.sysid.base;xhtml-frames-1.mod">
%xhtml-frames.mod;

<!-- Document Structure Module -->
<!ENTITY % xhtml-struct.mod
    PUBLIC "-//W3C//ELEMENTS XHTML Document Structure 1.0//EN"
        "%XHTML.dtd.sysid.base;xhtml-struct-1.mod">
%xhtml-struct.mod;

<!-- Name Identifier Module -->
<!ENTITY % xhtml-nameident.mod
    PUBLIC "-//W3C//ELEMENTS XHTML Name Identifier 1.0//EN"
        "%XHTML.dtd.sysid.base;xhtml-nameident-1.mod">
%xhtml-nameident.mod;

<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->
<!-- Non-Parameterized Extensions -->
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->

<![%legend.attlist;[
<!ATTLIST %legend.qname;
    align ( top | bottom | left | right ) #IMPLIED
>
]]>

<![%param.attlist;[
<!ATTLIST %param.qname;
    %base.attrib;
>

```

```
]]>

<![%frameset.attlist;[
<!ATTLIST %frameset.qname;
    acap:onload %Script.datatype; #IMPLIED
    acap:onunload %Script.datatype; #IMPLIED
    acap:ondomstable %Script.datatype; #IMPLIED
    xmlns:acap %URI.datatype; #FIXED '%ACAP.xmlns;'
>
]]>

<![%body.attlist;[
<!ATTLIST %body.qname;
    acap:onload %Script.datatype; #IMPLIED
    acap:onunload %Script.datatype; #IMPLIED
    acap:ondomstable %Script.datatype; #IMPLIED
    xmlns:acap %URI.datatype; #FIXED '%ACAP.xmlns;'
>
]]>

<![%meta.attlist;[
<!ATTLIST %meta.qname;
    %base.attrib;
>
]]>

<![%script.attlist;[
<!ATTLIST %script.qname;
    %base.attrib;
>
]]>

<![%style.attlist;[
<!ATTLIST %style.qname;
    %base.attrib;
>
]]>

<![%title.attlist;[
<!ATTLIST %title.qname;
    %base.attrib;
>
]]>

<![%head.attlist;[
<!ATTLIST %head.qname;
    %base.attrib;
>
]]>

<![%html.attlist;[
<!ATTLIST %html.qname;
    %base.attrib;
>
```

```
]]>
```

```
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->
<!--                               END END END                               -->
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->
```

## 5.2 acap-x-xml-model-1.ent

```
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->
<!--                               XDML 1.0 Document (Content) Model                               -->
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->
```

```
<!--
```

```
This is the XDML 1.0 Document (Content) Model Module for use with the
XDML 1.0 Document Type specified for ACAP Declarative Applications.
```

```
This module declares certain parameter entities that define groupings
of elements employed in the definition of XDML 1.0 content models.
```

```
This module shall be identified by the following formal public identifier:
```

```
"-//ATSC//ENTITIES ACAP XDML Content Model 1.0//EN"
```

```
-->
```

```
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->
<!--                               Non-Empty Content Group Classes                               -->
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->
```

```
<!ENTITY % BlkStruct.class      "%p.qname;
                                |%div.qname;">
```

```
<!ENTITY % InlStruct.class      "%br.qname;
                                |%span.qname;">
```

```
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->
<!--                               Optionally Empty Content Group Classes                               -->
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->
```

```
<!ENTITY % Anchor.class        "|%a.qname;">
```

```
<!ENTITY % BlkPhras.class      "|%pre.qname;
                                |%blockquote.qname;
                                |%address.qname;">
```

```
<!ENTITY % BlkPres.class       "|%hr.qname;">
```

```
<!ENTITY % Heading.class       "|%h1.qname;
                                |%h2.qname;
                                |%h3.qname;
                                |%h4.qname;
                                |%h5.qname;
                                |%h6.qname;">
```

```

<!ENTITY % I18n.class          "|%bdo.qname;">

<!ENTITY % InlPhras.class      "|%abbr.qname;
                                |%acronym.qname;
                                |%cite.qname;
                                |%code.qname;
                                |%dfn.qname;
                                |%em.qname;
                                |%kbd.qname;
                                |%q.qname;
                                |%samp.qname;
                                |%strong.qname;
                                |%var.qname;">

<!ENTITY % InlPres.class       "|%b.qname;
                                |%big.qname;
                                |%i.qname;
                                |%small.qname;
                                |%sub.qname;
                                |%sup.qname;
                                |%tt.qname;">

<!ENTITY % InlForm.class       "|%input.qname;
                                |%select.qname;
                                |%textarea.qname;
                                |%label.qname;
                                |%button.qname;">

<!ENTITY % InlSpecial.class    "|%map.qname;
                                |%img.qname;
                                |%object.qname;">

<!ENTITY % List.class          "|%ul.qname;
                                |%ol.qname;
                                |%dl.qname;">

<!ENTITY % Table.class         "|%table.qname;">

<!ENTITY % Misc.class          "|%script.qname;
                                |%noscript.qname;">

<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->
<!--           Optionally Empty Content Group Class Extras           -->
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->

<!ENTITY % Block.extra         "%Table.class;
                                |%form.qname;
                                |%fieldset.qname;">

<!ENTITY % BlkNoForm.extra     "%Table.class;">

<!ENTITY % BlkNoTable.extra    "|%form.qname;
                                |%fieldset.qname;">

```

```

<!ENTITY % Inline.extra          ">

<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->
<!--          Aggregate Content Group Classes          -->
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->

<!ENTITY % Block.class           "%BlkStruct.class;
                                %BlkPhras.class;
                                %BlkPres.class;
                                %Block.extra;">

<!ENTITY % BlkNoForm.class       "%BlkStruct.class;
                                %BlkPhras.class;
                                %BlkPres.class;
                                %BlkNoForm.extra;">

<!ENTITY % BlkNoTable.class      "%BlkStruct.class;
                                %BlkPhras.class;
                                %BlkPres.class;
                                %BlkNoTable.extra;">

<!ENTITY % Inline.class          "%InlStruct.class;
                                %I18n.class;
                                %InlPhras.class;
                                %InlPres.class;
                                %InlSpecial.class;
                                %InlForm.class;
                                %Inline.extra;
                                %Anchor.class;">

<!ENTITY % InlNoAnchor.class     "%InlStruct.class;
                                %I18n.class;
                                %InlPhras.class;
                                %InlPres.class;
                                %InlSpecial.class;
                                %InlForm.class;
                                %Inline.extra;">

<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->
<!--          Content Group Mixes          -->
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->

<!ENTITY % Block.mix            "%Block.class;
                                %List.class;
                                %Heading.class;
                                %Misc.class;">

<!ENTITY % BlkNoForm.mix         "%BlkNoForm.class;
                                %List.class;
                                %Heading.class;
                                %Misc.class;">

<!ENTITY % BlkNoTable.mix        "%BlkNoTable.class;
                                %List.class;

```

```

                                %Heading.class;
                                %Misc.class;">

<!ENTITY % HeadOpts.mix        "(%script.qname;
                                |%style.qname;
                                |%meta.qname;
                                |%link.qname;
                                |%object.qname;)*">

<!ENTITY % Flow.mix            "%Block.class;
                                %List.class;
                                %Heading.class;
                                |%Inline.class;
                                %Misc.class;">

<!ENTITY % FlowNoTable.mix     "%BlkNoTable.class;
                                %List.class;
                                %Heading.class;
                                |%Inline.class;
                                %Misc.class;">

<!ENTITY % Inline.mix          "%Inline.class;
                                %Misc.class;">

<!ENTITY % InlNoAnchor.mix     "%InlNoAnchor.class;
                                %Misc.class;">

<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->
<!--           Element Content Model Predeclarations                       -->
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->

<!ENTITY % html.content        "( %head.qname;,
                                ( %body.qname; | %frameset.qname; ) )">

<!ENTITY % noscript.content    "( #PCDATA | %Flow.mix; )*>

<!ENTITY % blockquote.content  "( #PCDATA | %Flow.mix; )*>

<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->
<!--           END END END                                               -->
<!-- :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::: -->

```