Open IPTV – Release 1 Specification

Volume 5 - Declarative Application Environment

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Open IPTV Forum

Open IPTV Forum

Postal address

Open IPTV Forum support office address
650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 43 83
Fax: +33 4 92 38 52 90

Internet
http://www.oipf.tv

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This specification provides multiple options for some features. The Open IPTV Forum Profiling specification will complement the Release 1 specifications by defining the Open IPTV Forum implementation and deployment profiles. Any implementation based on Open IPTV Forum specifications that does not follow the Profiling specifications cannot claim Open IPTV Forum compliance.

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Contents

Figures

Tables

Foreword

This Technical Specification (TS) has been produced by Open IPTV Forum.

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Introduction

The Open IPTV Forum Release 1 Specification consists of seven Volumes:

- Volume 1 - Overview,
- Volume 2 - Media Formats,
- Volume 3 - Content Metadata,
- Volume 4 - Protocols,
- Volume 5 - Declarative Application Environment,
- Volume 6 - Procedural Application Environment, and
- Volume 7 - Content and Service Protection.

The present document, the Declarative Application Environment Specification (Volume 5), specifies the DAE functionality of the OIPTVF system Release 1.

1 Scope

The Open IPTV Forum has developed an end-to-end solution to allow any consumer end-device, compliant to the Open IPTV Forum specifications, to access enriched and personalized IPTV services either in a managed or a non-managed network.

Its functional architecture specification[ARCH] defines a block called OITF which resides inside the residential network. The OITF includes the functionality required to access IPTV services for both the unmanaged and the managed network.

Part of these functionalities is the **Declarative Application Environment (DAE)**: a declarative language based environment (browser) based on CEA-2014[CEA-2014-A] for presentation of user interfaces and including scripting support for interaction with network server-side applications and access to the APIs of the other OITF functions.

The DAE is the focus of this specification.

The requirements for specifying this functionality are derived from the following sources:

- Open IPTV Service and Platform Requirement for R1[REQS][REQS];
- Open IPTV Functional Architecture for R1[ARCH].

2 References

2.1 Standard References

[3GPP TS 24.229]	3GPP, TS 24.229, "IP Multimedia Call Control Protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP) Stage 3 (Release 8)"
[CEA-2014-A]	CEA, CEA-2014-A, (Including the August 2008 Errata) "Web-based Protocol Framework for Remote User Interface on UPnP Networks and the Internet (Web4CE)",
[MHP]	DVB Blue Book A107, "Digital Video Broadcasting (DVB); Multimedia Home Platform (MHP) Specification 1.2"
[DVB-IPTV]	ETSI TS 102 034.V1.3.1, "DVB-IPTV 1.3: Transport of MPEG-2 TS Based DVB Services over IP Based Networks (and associated XML)"
[EN 300 468]	ETSI EN 300 469, "Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB Systems"
[TISPAN]	ETSI TS 183 063, "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN);IMS-based IPTV stage 3 specification"
[IEC62455]	IEC, IEC 62455, "Internet protocol (IP) and transport stream (TS) based service access"
[RFC2119]	IETF, RFC 2119, "Key words for use in RFCs to Indicate Requirement Levels", March 1997.
[RFC2326]	IETF, RFC 2326, "Real Time Streaming Protocol (RTSP)", April 1998.
[RFC2616]	IETF, RFC 2616, "Hypertext Transfer Protocol -- HTTP/1.1", June 1999.
[RFC3550]	IETF, RFC 3550, "RTP: A Transport Protocol for Real-Time Applications", July 2003.
[RFC3840]	IETF, RFC 3840, "Indicating User Agent Capabilities in the Session Initiation Protocol (SIP)", August 2004.
[RFC3841]	IETF, RFC 3841, "Caller Preferences for the Session Initiation Protocol (SIP)", August 2004.
[MPEG-7]	ISO/IEC 15938-5, "Multimedia Content Description Interface - Part 5:Multimedia description schemes", , May 2003"
[JFIF]	JPEG File Interchange Format, Version 1.02, Eric Hamilton, C-Cube Microsystems, September 1, 1992
[PRES]	OMA, OMA-TS-Presence_SIMPLE_XDM-V1_1-20080627-A, "Presence XDM Specification"
[IM]	OMA, OMA-TS-SIMPLE_IM-V1_0-20080820-D, "Instant Messaging using SIMPLE".
[CSS3 UI]	W3C, "CSS3 Basic User Interface Module", May 2004.
[DOM 2 Core]	W3C, "Document Object Model (DOM) Level 2 Core Specification - Version 1.0", November 2000
[DOM 2 Events]	W3C, "Document Object Model (DOM) Level 2 Events Specification - Version 1.0", November 2000
[DOM 2 HTML]	W3C, "Document Object Model (DOM) Level 2 HTML Specification - Version 1.0", January 2003
[DOM 2 Views]	W3C, "Document Object Model (DOM) Level 2 Views Specification - Version 1.0", November 2000
[DOM 3 Events]	W3C, "Document Object Model (DOM) Level 3 Events Specification - Version 1.0", December 2007
[HTML Data Types]	W3C, "Basic HTML data types", December 1999
[SVG Tiny 1.2]	W3C, "Scalable Vector Graphics (SVG) Tiny 1.2 Specification", August 2006
[Window Object]	W3C, "Window Object 1.0", April 2006
[XHR]	W3C, "The XMLHttpRequest Object", April 2008

2.2 Open IPTV Forum References

[REQS]	Open IPTV Forum, “Open IPTV Forum Service and Platform Requirement”, September 2007.
[ARCH]	Open IPTV Forum, “Open IPTV Forum, Functional Architecture – V1.2”, January 2009.
[CSP]	Open IPTV Forum, “Release 1 Specification, Volume 7 - Content and Service Protection”, V1.0, January 2009
[MEDIA]	Open IPTV Forum, “Release 1 Specification, Volume 2 - Media Formats”, V1.0, January 2009
[META]	Open IPTV Forum, “Release 1 Specification, Volume 3 – Metadata”, V1.0, January 2009
[PROT]	Open IPTV Forum, “Release 1 Specification, Volume 4 – Protocols”, V1.0, January 2009
[PAE]	Open IPTV Forum, “Release 1 Specification, Volume 6 - Procedural Application Environment”, V1.0, January 2009

3 Terminology and Conventions

3.1 Conventions

All sections and annexes, except “Scope” and “Introduction”, are normative, unless they are explicitly indicated to be informative.

The key words “MUST”, “MUST NOT”, “REQUIRED”, “SHALL”, “SHALL NOT”, “SHOULD”, “SHOULD NOT”, “RECOMMENDED”, “MAY”, and “OPTIONAL” in this document are to be interpreted as described in [RFC2119].

In sections of the present document whose presence is indicated by one of the capabilities defined in section 9.3, use of the [RFC2119] terms “MUST”, “SHALL” or “REQUIRED” applies only when the capability is made available to DAE applications. They do not have the effect of making that section mandatory.

In this document, “application” means “declarative application” (browser based application) throughout the DAE platform specification, as opposed to the “procedural applications” (Java based applications) defined in the PAE platform specification.

In the documente APIs JavaScript attributes are read-write unless otherwise specified..

3.2 Definitions

Term	***Definition***
Audio from memory	Audible notifications and audio clips intended to be played from memory.
Embedded object	A software module that extends the capabilities of the OITF browser. Features provided by an embedded object are made available to DAE applications through the methods and properties of a specific javascript object.
Mandatory	The feature is an absolute requirement of the specification (a “MUST” as defined by RFC 2119).
Non-visual embedded object	A non-visual embedded object is an embedded object that has no visible representation and cannot get input focus
Optional	The feature is truly optional (a “MAY” as defined by RFC 2119)
Remote UI	The display of a UI from one device on a second (remote) device across a network.
Trick Mode	Facility to allow the User to control the playback of Content, such as pause, fast and slow playback, reverse playback, instant access, replay, forward and reverse skipping.

3.3 Abbreviations

In addition to the Abbreviations provided in Volume 1, the following abbreviations are used in this volume.

Abbreviation	***Definition***
AJAX	Asynchronous JavaScript and XML
CSS	Cascading style sheets
DOM	Document object model
GIF	Graphics Interchange Format
HE-AAC	High Efficiency AAC
JPEG	Joint Photographic Experts Group
PNG	Portable Network Graphics
SVG	Scalable Vector Graphics
WAVE	Waveform audio format

4 DAE Overview

This specification builds on the capability model defined in CEA-2014[CEA-2014-A] in order to expose to an IPTV service provider the capabilities of any particular OITF.

In addition to what is defined in CEA-2014, other terminal capabilities are defined in section 9.3 covering most of the features defined in this specification. This document does not define whether these capabilities are mandatory or not. Other documents or specifications need to address that. A small minimum set of capabilities are defined in section 9.2 "Default UI profiles".

Section 3.1 of this document defines how to interpret [RFC2119] terms like "SHALL" in sections of this document included in a capability. In sections of this document which are not covered by capabilities, terms like "SHALL" apply as used in each section.

4.1 Architecture of DAE

This section will introduce the basic concepts in the architecture of the DAE specification and their relationships. [CEA-2014-A] is the baseline technology for the DAE. In particular the following requirements hold:

- The OITF SHALL support the i-Box model as defined in [CEA-2014-A] with the changes described in Annex B, in particular all requirements for an i-Box remote UI client as defined in section 5.1.2 and sections 5.2 through 5.10 of CEA-2014-A (i.e. all Remote UI client requirements inside the subsections that are marked as either “Mandatory for every RUIC” or “Mandatory for i-Box” except where modified by Annex B of this document). This also includes (through reference) Annexes C, F, G, H, I. The OITF SHALL also support the following features which are not mandatory for the i-box model.
    - 5.6.1 Multicast notifications
    - 5.7.1 Streamed A/V Content
    - 5.7.3 Full-screen video
- The OITF MAY support the 2-box and/or 3-box models defined in [CEA-2014-A]. Note that by default the interface with the AG and IG deviates from CEA-2014’s 2-box model and 3-box model. An overview of these differences is given in Section 4.1.1.
- A mandatory requirement in CEA-2014-A remains mandatory for the OITF, and recommended and optional requirements in CEA-2014-A remain recommended and optional for the OITF, unless explicitly specified differently inside this DAE specification. A detailed description of these differences can be found in Annex B.

4.1.1 Remote UI and box models (Informative)

The architecture overview from CEA 2014 Section 4.1 defines various box models. Next to the i-Box model for accessing IPTV service providers or 3rd party internet services, it defines a 2-Box and 3-box model for in-home remote UI. Box Models are divided by not only where the server resides but also where the UI control point reside to perform discovery and setup of a remote UI connection. In case of the 2-Box and 3-box model the UI control point is a UPnP control point that discovers in-home servers. In case of the 2-box model, there is a UPnP Remote UI control point inside the OITF. If the UPnP remote UI control point resides in an external device (e.g. web pad, remote controller), whereby the external device lists the Remote UI servers and sets up a UI connection between the OITF and Remote UI Server this is called the 3-box model. An OITF that supports the 3-box model must be discoverable through UPnP itself, and expose the profile information of a Remote UI client to the home network.

For the OITF, only the CEA-2014-A i-Box model is mandatory. The 2-box and 3-box models are optional. The default interaction with the Application Gateway (AG), the IMS Gateway (IG) and the CSP gateway (CSPG) deviate in the following manner. However, it is not precluded for an AG, IG, CSPG or other devices in the home network to expose themselves as a regular UPnP Remote UI server that is compliant with CEA-2014, for example to serve a Remote UI of its configuration screen to the OITF.

- The AG is similar to a level 1 remote UI server as defined in Section 5.1.1.2 of CEA-2014-A, with the difference that [Req. 5.1.1.2.d] is replaced with a different device description. The device description of the AG is defined in Section 10.1.1.2 of [PROT]. The requirements [Req. 5.1.1.2.b] and [Req. 5.1.1.2.c] are now optional: a URL to the XML UI Listing is provided by element <agUIServerURL> of the AG Description XML

document. Note that the UPnP Device description of the AG MAY offer a CEA-2014-A compatible level 1 or level 2 remote UI server in its UPnP device hierarchy that point to the same XML UI listing.

- The IG enables the discovery of IPTV services through the HNI-IGI interface as defined in [PROT]. This is quite different from a level 1 or level 2 remote UI server. The details of the device discovery of the IG are defined in Section 10.1.1.1 of [PROT].

Irrespective of the box models, and the discovery mechanism used, the OITF performs the following general steps to set up a connection to any internet or in-home service:

1) Setup & Connect phase:
   A. The OITF connects to a URL of a DAE application offered by a server over an HTTP connection. The OITF's capability profile is conveyed to the server, using the "User-Agent" HTTP header, to enable the server to adjust the contents to the DAE capabilities of the OITF. An OITF that supports additional content formats (e.g. Flash) can also convey these extensions to the server.
   B. After setting up the connection, the XHTML and/or SVG contents that constitute the DAE application are downloaded to the OITF.
   C. This connection can also be set up by a separate UI Control Point in case of an OITF that supports a 3-box model.
2) Presenting web content:
   A. After downloading the XHTML and/or SVG contents, the DAE application may become active and display a user interface as defined by the XHTML and/or SVG contents.
3) Controlling the UI:
   A. Remote control, keyboard and mouse events can be handled within scripts.
   B. Native control for web forms and spatial navigation must be supported.
   C. Client-side scripting control for the playback of A/V content must be supported.
4) Dynamic UI Updates:
   A. User interfaces can be dynamically updated by the server using a persistent TCP connection (NotifSocket) or through XML updates over an HTTP connection (AJAX).
5) 3rd Party Notifications:

- Notification messages linked to UI content can arrive on the OITF outside of an active UI interaction between the OITF and the server.

4.1.1.1 i-Box Model

The i-Box Model supports the remote presentation and control of UIs that reside on a server on the Internet (WAN). The client (OITF) resides within the home domain, and is either non-discoverable and has a built-in "Connection setup and control" to perform connection management related operations, or is discoverable by an external so called UPnP Remote UI Client Control Point within the home domain that allow the connection management related operations to be controlled by another device. This configuration is depicted in the diagram below.

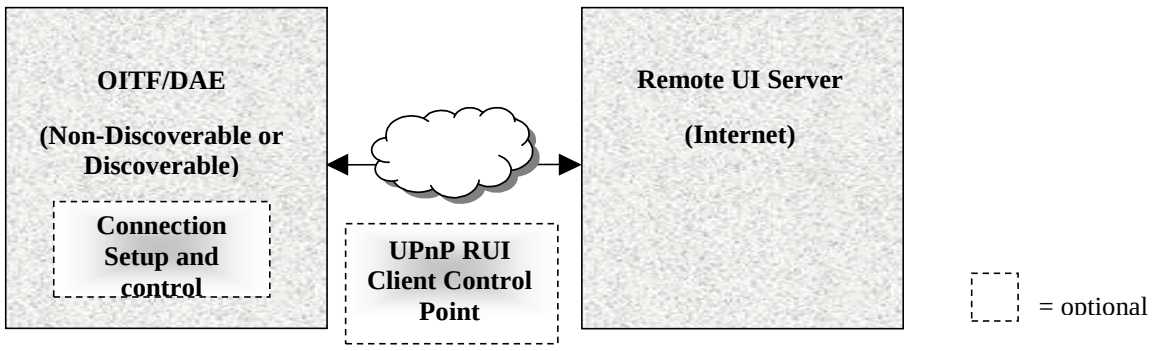


Figure 1: i-Box Model

4.1.1.2 2-Box Model

The 2-Box Model describes a configuration in which the server is discoverable in the home network. Since the client is not discoverable, it must have a UPnP Control Point in order to be functional in the network to be able to discover an AG device description (as defined in Section 10 of [PROT]), or a Remote UI server description as described in Section 5.1 of [CEA-2014-A].

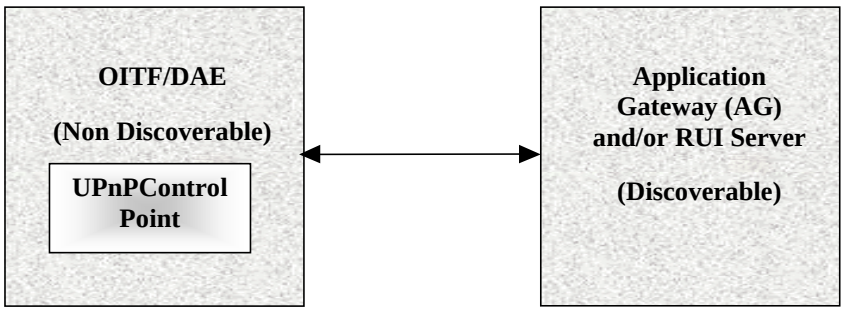


Figure 2: 2-Box Model

4.1.1.3 3-Box Model

When both the Remote UI Server and the Remote UI Client are discoverable, the configuration can be described by the 3-Box UI Model. This configuration has no restriction on the location of the UPnP Control Point for the discovery and connection management, as illustrated in the diagram below.

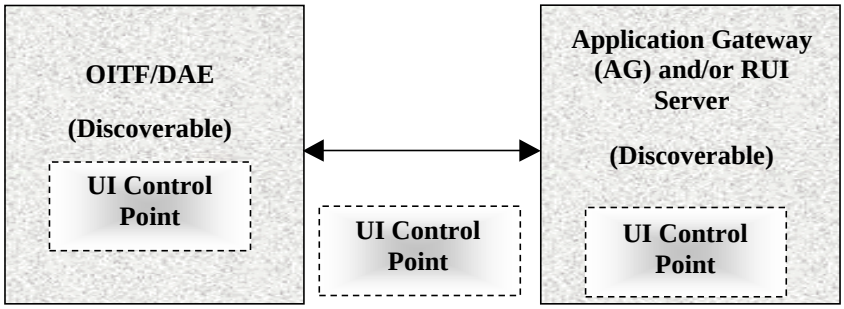


Figure 3: 3-box Model

4.2 Application Definition

This section defines what is meant by the concept of a 'DAE application'; which files and assets are considered to be part of a DAE application and how this relates to DAE application security and lifecycle.

A DAE application is an associated collection of documents (typically JavaScript, CSS and HTML or SVG documents) from the same fully-qualified domain, unless specified differently in Section 5.1.3.3. It is accessed over TLS and authenticated with an X509 certificate. Access to privileged capabilities can be requested through extensions to the X509 certificate (see section 10.1). Whilst the document is loaded within the browser, an additional browser object (the `ApplicationManager` object), defined in section 7.13.1 is present and accessible by the DAE application. The `ApplicationManager` object provides access to the `Application` class defined in section 7.13.2 which provides Javascript properties and methods that a DAE application possesses that exceed those of traditional "web pages".

The difference between a DAE application and a traditional web page is the context within which it is loaded and executes. For this reason, the definition and details of a DAE application focuses on the application execution environment and the additional capabilities provided to DAE applications. The next subsections describe some of the differences. Additional details about the DAE application lifecycle can be found in Section 5

4.2.1 Similarities between applications and traditional web pages

Both applications and traditional web pages have an initial document, almost always written in HTML, which can include the contents of other documents. These included documents can have a variety of types, including Cascading Style Sheets (CSS), JavaScript, SVG, JPEG, PNG and GIF.

A dynamic DOM, combined with XMLHttpRequest, permits AJAX-style changes to the current application or web page without necessarily replacing the entire document.

4.2.2 Differences between applications and traditional web pages

An application is created and terminated in a different manner to a web page. For the case of application creation, it is this difference that indicates to the browser that a new application is being started, rather than the loading of a (new) web page. For the case of application destruction, the difference indicates the termination of an application, as opposed to the loading of new contents within the context of the current application.

The application context includes information about the state of an application from the platform's perspective – permissions, priority (importance: which to terminate first in the event of insufficient resources, for example) and similar information that spans all documents within an application during the lifetime of that application.

An OITF SHALL support the execution of more than one application simultaneously. Applications MAY share the same screen estate in a defined and controlled fashion. This differs from multiple web pages, which are typically handled through different browser "windows" or "tabs" and may not share the same screen estate concurrently (although the details of this behaviour are often browser-dependent). This also differs from the use of frames, which, apart from iframes, do not support overlapping screen estate. Both foreground and background applications SHALL be supported simultaneously.

Applications SHALL be recorded within a hierarchy of applications. Each object representing an application possesses an interface that provides access to methods and attributes that are uniquely available to applications. For example, facilities to create and destroy applications can be accessed through such methods

4.2.3 The security model

Each application has a set of permissions to perform various privileged operations within the OITF. The permissions that are granted to an application are defined by the intersection of three permission sets:

1. The permissions requested by the application, using the mechanism defined in section 10.
2. The permissions supported by the OITF. Some permissions may not be supported due to capability restrictions (e.g. the *permission_pvr* permission will never be granted on a receiver that does not support PVR capability).
3. The permissions that may be granted, as determined by user settings or configuration settings specified by the operator (e.g. blacklists or whitelists; see section 10 for more information). This is a subset of (2), and may be different for different users.

4.3 Gateway Discovery and Control

This section describes how DAE applications discover the information of the gateway and subsequently interacts with the gateway. The discovery of the IG and AG by the OITF are defined in section 10.1 of [PROT][PROT]. The discovery takes place prior to the DAE application being initialized.The information about the discovered gateways is made available to DAE applications through the `application/oipfGatewayInfo` embedded object. DAE applications can use this gateway information to interact with the discovered gateways (e.g. IG, AG, CSP gateway and so on). The `application/oipfGatewayInfo` embedded object SHALL be made accessible through the DOM with the interface as defined in section 7.12.

Access to the functionality of the `application/oipfGatewayInfo` embedded object is privileged and SHALL adhere to the security requirements defined in section 10.1

4.4 Media Format

This section describes the main requirements for the format and usage of codecs in media referred to by DAE applications. This section also describes memory audio.

4.4.1 Media Format of A/V media except for audio from memory

This section describes the format and usage of the A/V media codec except for audio from memory.

- Format and usage of video codec SHALL adhere to Section 5 of [MEDIA].[MEDIA]
- Format and usage of subtitles format SHALL adhere to Section 6 of [MEDIA][MEDIA].
- Format and usage of teletext format SHALL adhere to Section 7 of [MEDIA][MEDIA].
- Format and usage of audio codec SHALL adhere to Section 8 of [MEDIA][MEDIA], except for Section 8.1.1.2, 8.1.5 and 8.2.1 which are covered in section 4.4.2.

4.4.2 Media Format of A/V media for audio from memory

This section describes the format and usage of the A/V media codec for audio from memory. Usage of corresponding A/V media object is described in Section 7.7.3 of this document.

For the audio from memory format, HE-AAC SHALL be supported by the OITF and WAVE MAY be supported by the OITF.

- Format and usage of HE-AAC audio from memory SHALL adhere to Section 8.1.1.2 and 8.2.1 of [MEDIA][MEDIA].
- Format and usage of WAVE audio from memory SHALL adhere to Section 8.1.5 and 8.2.1 of [MEDIA].

4.4.3 Media Transport

Format and usage of media transports referred to by DAE applications SHALL adhere to Section 4 of [MEDIA][MEDIA].

4.5 Resource Management

This section describes how resources (including non-granular resources such as memory and display area) are shared between multiple applications that may be running simultaneously. Applications SHOULD be able to tolerate the loss of scarce resources if they are needed by another application, and SHOULD follow current industry best practises in order to minimize the resources they consume.

This specification is silent about the mechanism for sharing resources between DAE applications, PAE applications and other applications running on the OITF. In the remainder of this section and this document, the term application refers solely to DAE applications

4.5.1 Application lifecycle issues

If an application attempts to start and not enough resources are available, the application with the lowest priority MAY be terminated until sufficient resources are available for the new application to execute or until no applications with a lower priority are running. Applications signalled using the method defined in section 5.2.1, which does not define priorities, SHALL be assumed to have a priority of 0x7F.

Applications may register a listener for `ApplicationUnloaded` events (see section 7.13.4) to receive notification of the termination of a child application.

Failure to load an asset or CSS file due to a lack of memory (e.g. image files) SHALL have no effect on the lifecycle of an application, but may result in visual artefacts (e.g. images not being displayed). Failure to load an HTML file due to a lack of memory MAY cause the application to be terminated.

4.5.2 Caching of application files

Application files MAY be cached on the receiver in order to improve performance; this specification is silent about the use of any particular caching strategy. For packaged applications, the entire package SHALL be retained (in either packaged or unpackaged form) until the application has terminated.

4.5.3 Memory usage

Applications SHOULD use current industry best practises to avoid memory leaks and to free memory when it is no longer required. In particular, applications SHALL unregister all event listeners before termination, and SHOULD unregister them as soon as they are no longer required.

Where available, applications SHALL use explicit destructor functions to indicate to the platform that resources may be re-used by other applications.

Applications MAY use the `gc()` method on the `application/oipfApplicationManager` embedded object to provide hints to the OITF that a garbage collection cycle should be carried out. The OITF is not required to act on these hints.

The `LowMemory` system event described in section 7.13.4 SHALL be generated when the receiver is running low on memory. The amount of free memory that causes this event to be generated is implementation dependent. Applications may register a listener for these events in order to handle low-memory situations as they choose best.

4.5.4 Media control

Where applications make conflicting requests for limited media decoding resources, the media decoding resources that are requested most recently are presumed to be the ones that are most wanted and the resources SHALL be granted to the application that most recently requested them. This applies to conflicts between different requests for streaming video or audio (whether over RF tuners or IP streams). This specification is intentionally silent about handling of resource use by embedded applications including scheduled recordings.

If audio from memory interrupts any other media presentation then the interrupted presentation SHALL be restored when the interrupting presentation ends.

When audio from memory is interrupted by a resource loss, the presentation is cancelled and SHALL NOT be restored..

4.5.5 Use of the display

A compliant OITF SHALL support one of two modes for managing the display of applications:

- Multiple applications may be visible simultaneously, with the OITF managing focus between applications.
- Only one application is visible at any time; switching to a different application hides the currently-visible application. The mechanism for switching between applications is implementation-dependent.

Applications SHALL be initially created with an associated DOM `Window` object that covers the entire area available to DAE applications (i.e. entire area that the browser has reserved for rendering the content, excluding the area used for the browser UI, such as status bar or browser buttons) and may choose to resize or display this DOM `Window` as appropriate. The default background of the DOM `Window`, and any areas of the browser area outside the DOM `Window` when it is resized SHALL be transparent – any video (if the hardware supports overlay as per the <overlay*>-elements defined in Section 9.2 for the capability profiles) or applications (if multiple applications can be visible simultaneously) with a lower Z-index will be visible except where the application has drawn UI elements.

Applications from the same service provider that are intended to run simultaneously SHOULD take care to co-ordinate their use of the display in order to ensure that important UI elements are not obscured.

The visibility of an application (e.g. by calling method `show()` or `hide()` on the `Application` object) SHALL NOT affect its use of resources.

4.5.6 Key Handling

The visibility of an application shall not affect the events that it receives – an active application SHALL receive user input events even when it is not visible.

Key events SHALL be dispatched to active applications using the process described in 7.13.4. In order to ensure that sensitive key input (e.g. PINs or credit card details) is limited only to the application it is intended for, applications SHOULD 'absorb' key events by calling the `stopPropagation()` method on the DOM2 `key` event. The `Application.isPrimaryReceiver` property enables applications to determine whether other applications will receive any key input prior ahead of the specified application.

4.6 Parental Access Control

The present document permits a number of different approaches to parental access control.

a) Enforcement in the network.

An IPTV service provider MAY manage parental access control completely in the network. Applications running on application servers back in the network MAY decide to block access to content or arrange a DAE application to ask for a PIN code as necessary. This approach can apply to any kind of content - streaming on-demand content, IP broadcast content and to downloaded content.

No specific support is needed for this approach in the specification.

b) Enforcement in the network for on-demand content and in the OITF/CG(Content Guide) for broadcast content

IPTV service providers MAY use the content protection mechanism for protected content to enforce access control to protected content. If used, this enforcement will happen in the OITF and in some cases in the CSP Gateway as well. In this approach, the content protection mechanism in the OITF would ask for PIN codes as needed.

The OITF/CG-based enforcement of this approach are defined in clause 4.1.6.1 of [CSP][CSP].

c) enforcement in the OITF

OITFs MAY enforce parental access controls themselves. Examples include embedded applications offering access to;

- IP delivered content based on information delivered to the metadata CG client.
- classical broadcast content in hybrid OITFs
- content delivered to the OITF (either streaming or downloaded)

In this approach, PIN dialogs would be generated by code forming part of the OITF implementation. The APIs in Section 7.14 provide some control over these dialogs. The PIN would typically be configured by an embedded application but MAY also be configured by a DAE application using the optional APIs defined in Section 7.10.2 "Configuration" of the present document.

This approach is reflected in a number of failure modes as defined in the following clauses of the specification;

- For broadcast channels (both IP and hybrid), in section 7.4.2 and 7.5.2 "Switching IP broadcast channels", see "`onChannelChangeError`" where errorState 3 is defined as "parental lock on channel"
- Parental rating errors and parental rating changes during playback of A/V content through the CEA-2014 A/V embedded object and the `video/broadcast` object are reported according to the mechanism described in 7.7.4 "Parental Ratings Error".

NOTE: Due to the variation in regulatory requirements and deployment scenarios, the present document is intentionally silent about which of these approaches or combination of approaches is used.

5 DAE Application Model

5.1 Application lifecycle

This section describes the lifecycle of a DAE application, including when an application is launched, when it is terminated and the behaviour when a DAE leaves the boundary of one application and enters another.

APIs related to DAE applications are described in 7.13 “DAE Applications APIs”.

5.1.1 The Application Tree

Applications are organised in to an implicit tree structure, where applications started by other applications may be child nodes of the parent. An OITF MAY keep separate application trees for different domains, possibly connected to a system root node maintained by the OITF that is not accessible by other applications. The root node of an application tree is created upon loading an initial application URI.

Applications created while the DAE environment is running (e.g. as a result of an external notification) that are not created through `createApplication()` SHALL be created as children of the system node.

5.1.2 The application display model

Multiple applications SHALL be displayed on the OITF in one of two modes:

- Multiple applications may be visible simultaneously. Full-screen video or other applications behind the current application shall be visible through any transparent areas in the application. Applications from the same service provider executing simultaneously are expected to co-ordinate their use of the screen and their management of user input events.

- Only one application is visible at any time. The mechanism for switching between applications is implementation-dependent. In this case, the `show()`, `hide()`, `activate()` and `deactivate()` methods provide hints to the execution environment about whether the user should be notified that an application requires attention. The mechanism for notifying the user is outside the scope of this specification.

The mode used SHALL be determined prior to initialisation of the DAE execution environment and shall persist until termination or re-initialization of the DAE execution environment. The means by which this mode is chosen is outside the scope of this specification.

In both modes, the background of the DOM `Window` object associated with an application SHALL be transparent by default as defined in Section 4.5.5. The DOM `Window` object associated with an application SHALL initially cover the entire area available to DAE applications (i.e. entire area inside the browser that the browser has reserved for rendering the content, excluding the area used for the browser UI, such as status bar or browser buttons); applications may resize this using the methods on the DOM `Window` object. Note that any resizing or positioning operations only affect the DOM `Window` object on which they are called.

5.1.2.1 Manipulating an application’s DOM Window object

Each application has an associated DOM `Window` object and a DOM `Document` object that represents the document that is currently loaded for that application. Even “windowless” applications that are never made visible have an associated DOM `Window` object.

Standard DOM `Window` methods are used to resize, scroll, position and access the application document (see section 0 for an example). Many browsers restrict the size or location of windows; these restrictions SHALL NOT be enforced for windows associated with applications within the browser area. Any area of the display available to DAE applications may be used by any application. Thus, ‘widget’-style applications can create a small window that contains only the application without needing to be concerned with any minimum size restrictions enforced by browsers.

5.1.3 Creating a new application

5.1.3.1 General

The present document defines a number of different application lifecycle models. These include;

- Web applications - pages loaded directly from a URL
- Using the `Application.createApplication` API call
- CE-HTML third party notifications
- Applications from SD&S signalling
- Applications started by the DRM agent
- Applications provided by the AG through the remote UI

5.1.3.2 Web applications

Web applications are started by fetching the first page of the application from a URL.

5.1.3.3 Using the Application.createApplication API call

Creating a new application is accomplished by creating a new `Application` object via the `Application.createApplication()` method. Calling this method will create a new application and add it to the application tree in the appropriate location.

```
// Assumes that the application/oipfApplicationManager object has the ID
// “applicationmanager”
Var appMgr = document.getElementById(“applicationmanager”);
var self = appMgr.getOwnerApplication(Window.document);

// create the application as a child o fthe current application
var child = self.createApplication( url_of_application, true );
```

Each application has an associated DOM `Window` object by default. This `Window` object is initially marked hidden to avoid screen flicker during application start-up. Once loaded (as might be indicated through an `onload` event handler), the application then typically calls the `show()` method of its parent `Application` object.

If the application does not ever need to be visible, then its DOM `Window` object will never be shown. In that case, the application should take steps to avoid being formatted to reduce computation and memory overheads. This is typically accomplished by setting the default CSS style of the document’s `BODY` element to `display: none`.

Because all applications have associated DOM `Window` objects, it is possible to make any application visible even if it is not normally intended to be visible. This is of particular benefit during debugging of hidden service type applications.

The DOM `Window` for an application cannot interact with other DOM `Window` objects of other applications in the system except through the application API. In other words, scripts that are part of the document being displayed inside a DOM `Window` object cannot discover other applications without going through the application API, which acts as a single point of security control.

All HTML, JavaScript and SVG files that comprise an application SHALL be retrieved from the same FQDN. If the application attempts to access files of these types from another domain, this access SHALL fail as if the content did not exist. Audio and video files with MIME types supported by OITF may be retrieved from other domains.

If the document of an application is modified (or even replaced entirely by other pages of the same FQDN), the `Application` object is retained. This means that the permission set granted when the application is created applies to all “edits” of the document or other pages in the application, until the application is destroyed.

5.1.3.4 CE-HTML third party notifications

The lifecycle of these is defined by [CEA-2014-A] and summarised in section 5.3.1 of the present document.

5.1.3.5 Starting applications from SD&S Signalling

These are described in section 5.2, “Application Announcement & Signalling”.

5.1.3.6 Applications started by the DRM agent

These SHALL be considered as web applications.

5.1.3.7 Applications provided by the AG through the remote UI

OITFs MAY include the capability to start these applications from an embedded application. OITFs SHALL include the ability for applications to discover these as defined by the "`application/oipfGatewayInfo`" embedded obiect in section 4.3.

5.1.4 Inheritance of permissions

Applications created by other applications (e.g. using the methods described in sections 5.1.3.2 or 5.1.3.3) SHALL NOT inherit the permissions issued to the parent application. The permissions granted to the new application will be defined by the mechanism specified in section 10.

When an application exports an API to other applications from the same provider, security checks SHALL be carried out in the context of the calling application, not the context of the exporting application. For instance, if an application exports an API that allows other applications to change channel, only applications that have been granted the permissions "*permission_tuner_control_lineup*" or "*permission_tuner_control*" will be allowed to change channel regardless of the permissions granted to the application exporting this API

5.1.5 Stopping an application

The `destroyApplication()` method (as specified in Section 7.13.2.2) SHALL terminate the application. Applications SHALL also be destroyed when following a link to a page loaded from a different domain. After the `destroyApplication()` method returns, further execution of the specified application SHALL NOT occur.

When an application is terminated, all associated resources SHALL be freed (or marked available for garbage collection). Any active network connections will be terminated. Any media content being presented by the application is stopped, although recordings or content downloads initiated by the application will not be affected.

Note that terminating an application does not imply any effect on the state of the DAE execution environment.

Additional requirements are defined for stopping selected service provider applications and applications part of scheduled content services in sections 5.2.2.3 and 5.2.2.4 respectively.

5.1.6 Privileged application APIs

The privilege model implemented with applications is based upon requiring access to the `Application` object representing an application in order to access the privileged functionality related to application lifecycle management and inter-application communication.

Only web pages running as DAE applications (e.g. from a known provider and loaded via TLS) have access to an `Application` object (via the `application/oipfApplicationManager` object).

5.1.6.1 Compromising the security

Since applications have access to `Application` objects, it is possible for applications to compromise the security of the framework by passing these objects to untrusted code. For example, an application could raise an event on an untrusted document and pass a reference to its `Application` object in the message. Any calls to methods on an `Application` object from pages not running as part of an application from the same provider SHALL throw an error as defined in section 10.1.1.

5.1.7 Active applications list

This is a list of application nodes ordered in a "most recently activated" order. It is used for dispatching system events and is not directly visible to applications.

An application is activated through calling the `activate()` method of the application node. This marks an application as active and inserts the application at the start of the active application list (removing it from the list first if it is already present).

An application is deactivated through the `deactivate()` method of the application node. This marks an application inactive and removes it from the active application list.

The currently active application is the application at the start of the active application list.

This specification does not define any behaviour if more than one copy of the browser is executing.

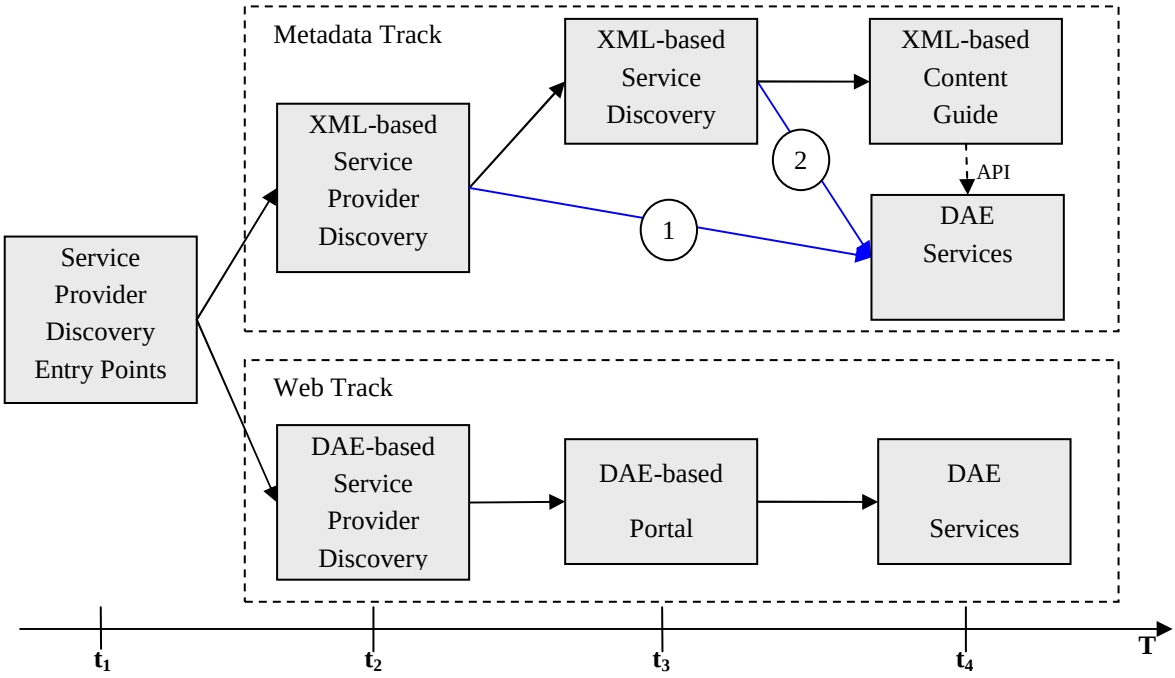
5.2 Application Announcement & Signalling

The present document defines two approaches for application announcement and signalling. Both include extensions to the DVB SD&S mechanism. Neither is mandatory for OITFs.

5.2.1 Approach A

5.2.1.1 General

A described in [ARCH][ARCH], Service Provider Discovery information can be delivered to OITF as a XML document or a Web page. Also, Service Discovery and Content Guide information can be either XML data for the metadata CG client or DAE application. The Figure 4 describes overall data flows of Service Provider Discovery Entry Point, obtaining the Content Guide and accessing DAE services accordingly.



t_1 – SP Discovery Entry Points Phase

t_2 – Service Provider Discovery Phase

t_3 – Service Discovery Phase

t_4 – Service Access Phase (Obtaining Content Guide)

Figure 4: Overall Data Flow from SD&S to Content Guide

- Service Provider Discovery Entry point – IP address information in order to start the Service Provider Discovery phase, defined in the section 6 of [ARCH]
- XML-based Service Provider Discovery – Service Provider Discovery information which described in the form of SD&S XML document defined in [META]
- DAE-based Service Provider Discovery – DAE application which contains Service Provider Discovery information

- XML-based Service Discovery – Service Discovery information including Broadcast Discovery Record, Content Guide Discovery Record, Package Discovery Record, Communication Discovery Record which described in the form of SD&S XML document defined in [META]
- DAE-based Service Discovery – DAE application which includes Service Discovery information
- DAE-based Content Guide – DAE application which includes Content Guide information such as EPG or CoD Guide
- XML-based Content Guide – Content Guide information which described in the form of BCG XML document defined in [META]

In Figure 4, there are two main tracks to signal DAE applications – the Metadata track and the Web track. The process for traversing these tracks is dependent on whether Service Provider Discovery information is delivered as a XML-based Service Provider Discovery or DAE-based Service Provider Discovery.

The OITF SHALL traverse the Web track when Service Provider Discovery is delivered as DAE-based Service Provider Discovery. The Service Provider Discovery Entry Point has an IP address to start DAE-based Service Provider Discovery In the Web track. The method of obtaining IP address of Service Provider Discovery Entry Point is described in the section 6.2 of [ARCH]. With the given Service Provider Discovery Entry Point, the OITF SHALL automatically start DAE-based Service Provider Discovery. After the OITF launches the DAE-based Service Provider Discovery, OITF can access DAE-based Portal and DAE services through the DAE-based Service Provider Discovery. All application announcement and signaling SHALL be described in the DAE-based Service Provider Discovery. In the Web track, how to jump into the Metadata track is out of scope.

On the other hand, when Service Provider Discovery information is transmitted to the OITF as a XML-based Service Provider Discovery, the OITF SHALL traverse the Metadata track. While traversing the Metadata track, the OITF can launch DAE application.

In the Metadata Track, SD&S Metadata SHALL be used to make an announcement and signal of applications. In Figure 4, there are two points signaling and making announcement DAE applications which are expressed as “numbered arrows.”

Since there is no Metadata API is defined in the current DAE specification for SD&S Metadata defined in [META], the OITF SHALL use a native UI to show the result of parsing SD&S XML document. Also, OITF SHALL give a chance to the end-users to start applications at a time of their choice.

- Arrow Number 1 – The First step is to signal a DAE-based Service Discovery application. In order to start the DAE-based Service Discovery application, the Service Provider Discovery Record of 3.2.1 of [META] SHALL be used. When Service Provider Discovery Record is delivered to the OITF as a SD&S XML document, OITF SHALL parse the XML-based Service Provider Discovery and show the result through a native UI. If the Service Provider Discovery Record signals more than one service provider, the OITF SHALL offer the end-user the opportunity to select a certain service provider among given service providers. Once a service provider is selected, if the selected service provider signals a DAE-based Service Discovery application, then the OITF SHALL start that application. However, if only one service provider is signaled and that service provider signals a DAE-based Service Discovery application then the OITF SHALL either automatically start the DAE-based Service Discovery application or offer the end-user the opportunity to select the service provider. The detail information of how to signal the DAE application for Service Discovery with the Service Provider Discovery Record is described in the 3.2.1 of [META]. After the OITF starts the DAE application for Service Discovery, the DAE application for Service Discovery MAY include information to access an IPTV Service such as obtaining a Content Guide or consuming a piece of on-demand contents.
- Arrow Number 2 – The second step is to signal a DAE-based Content Guide and service-bound applications. The second signaling step SHALL be used if only a Service Provider provides its IPTV services with XML-based Service Discovery and signals DAE application for obtaining Content Guide and service-bound applications, which means OITF SHALL parse at least the SD&S XML document defined in the [META] and show the parsing results of SD&S XML document through a native UI.
- In order to signal the DAE-based Content Guide, the ContentGuide Discovery Record, defined in 3.2.2.2.1 of [META], SHALL be used. When OITF receives this record, the OITF SHALL parse the ContentGuide Record and keep the URI information for the content guide. The content guide URI information SHALL be used for launching a DAE-based Content Guide application, which SHALL be occurred when an end user requests content guide application through the native UI. The detail information of how to signal the DAE application for

Content Guide is explained in the 3.2.2.2.1 of [META]. In order to signal the service-bound applications, the Broadcast Discovery or Package Discovery record SHALL be used. For the detail information of how to signal DAE application for the service bound applications is explained in the 3.2.2.1 of [META].

5.2.1.2 Communication service applications

As described in [ARCH], there are communication services such as Chatting, Instant Message, Presence, and Caller ID. When the OITF accesses a DAE-based Service Discovery via DAE-based Service Provider Discovery or XML-based Service Provider Discovery, DAE-based Service Discovery SHALL signal or make an announcement for DAE-based Communication application if a service provider wants to enable the communication services. Also, the DAE-based Communication application SHALL be implemented in accordance with the section 7.8 of the current DAE specification.

If the DAE-based Service Discovery is delivered to the OITF, it is a Service Provider decision whether or not the Communication applications are included in the DAE-based Service Discovery.

However, if a Service Provider delivers XML-based Service Discovery and wants to provide Communication services to the OITF, the Communication Discovery Record SHALL be used for signalling or making an announcement for downloading or accessing Communication service applications which is defined in 3.2.2.2.2 of [META]. When OITF receives the Communication Discovery record, the OITF SHALL parse the record and the keep the URI of the Communication service. This URI SHALL enable the OITF to access the main entry application of DAE-based Communication applications, which SHALL be implemented in accordance with the section 7.8 of the current DAE specification. For the detail information of how to signal Communication service applications with the Communication Discovery Record, please refer to 3.2.2.2.2 of [META].

The OITFs which support communication service applications SHALL include a native UI to permit the end-user the opportunity to start the application at a time of their choice when XML-based Service Discovery is delivered to the OITFs.

5.2.2 Approach B

5.2.2.1 General

As described in [ARCH][ARCH], Service Provider Discovery information can be delivered to OITF as a XML document or a Web page. Service Discovery can be either XML data for a metadata client or a DAE application. A content guide can be either a DAE application or an embedded application consuming XML information delivered to the metadata CG client. The Figure 5 describes overall control flow from the Service Provider discovery entry points.

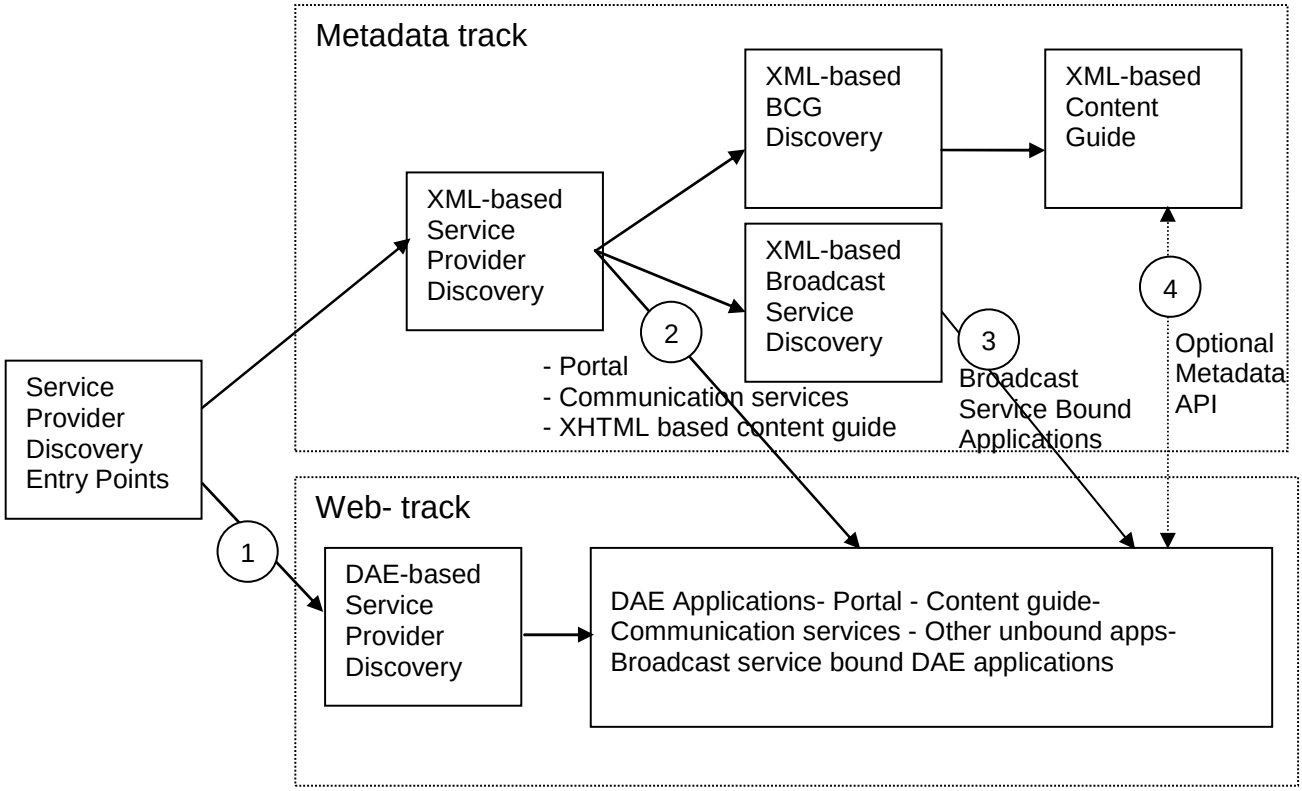


Figure 5: Overall control flow from service provider discovery entry points

Item 1 is web-based service provider discovery as defined by section 5.3.1.5 of [PROT][PROT].

Item 2 is applications from a service provider which should run (or be able to run) while that service provider is selected. These MAY include a service provider's portal, one or more communication service applications as well as a content guide in the form of DAE application. These are defined in section 5.2.2.3 below.

Item 3 is applications which are part of scheduled content services. These are defined in section 5.2.2.4 below.

Item 4 is the metadata API defined in section 7.9 of the present document.

5.2.2.2 Signalling format

This approach is based on the signalling defined in section 3.2.1.2 of [META][META]. The following table defines how that signalling SHALL be used to signal DAE applications.

Table 1: Application signalling

Descriptor or Element in [MHP]	Summary	Status in present document
AR.3.1 ApplicationList	List of applications	Required
AR.3.2 Application	Name, identifier, type specific descriptor, provider descriptors	Required. The following SHALL NOT be signalled for DAE applications. • providerExportDescriptor
AR.3.3 ApplicationIdentifier	2 numbers	Required
AR.3.4 ExternalApplicationIdentifier	Already running applications not signalled in this service	Ignored.

AR.3.5 ApplicationDescriptor	Numerous application attributes	Required
AR.3.6 VisibilityDescriptor	Attribute – indicate if application can be visible to users and/or other applications	Required
AR.3.7 IconDescriptor	Icon for application	The filename in the IconDescriptor SHALL be an HTTP URL.
AR.3.8 AspectRatio	Preferred aspect ratio for icons	Required.
AR.3.9 MhpVersion	Specification version	For applications compatible with the present document, “1”, “0” and “0” SHALL be signalled.
AR.3.10 StorageCapabilities	Can the application be stored or cached	Ignored.
AR.3.11 StorageType	Enumeration used in AR.3.10	As AR.3.10
AR.3.12 ApplicationType	Application type	The MIME type “application/ce-html+xml” SHALL be used for CEHTML applications. The MIME type “image/svg” SHALL be used for SVG applications.
AR.3.13 DvbApplicationType	Enumeration for AR.3.12	Ignored.
AR.3.14 ApplicationControlCode	Enumeration for AR.3.5	See below.
AR.3.15 ApplicationSpecificDescriptor	Container	Required. DAE applications SHALL be signalled using the WebApplicationDescriptor as defined by[META] [META]
AR.3.16 DVBJDescriptor	Application location	Ignored..
AR.3.17 ApplicationStructure	Classpath and initial class for use with AR.3.16	Ignored.
AR.3.18 AbstractIPService	Supports grouping of unbound applications	Ignored.
AR.3.19 UnboundApplicationDescriptor	Unbound application support	Ignored.
FLUTESessionDescriptor as defined by section B.13 of [META][META]	Support for distributing applications through multicast.	SHALL be supported if OITFs support FLUTE.

Elements and descriptors marked as ‘Ignored’ SHALL NOT be processed for DAE applications. Servers MAY include these in application signalling.

The application control code SHALL be interpreted as follows for DAE applications

AUTOSTART: Either the application SHALL be started or the OITF SHALL offer the end-user the opportunity to start the application. In the present document, the term "starting" when used in the context of an AUTOSTART application SHALL permit both of these options. NOTE: One example of the OITF offering the end-user the opportunity to start the application would be the UK convention of the OITF showing a red icon and starting the application if the end-user presses the red button on the remote control. Of course, other markets may have other established conventions for indicating this to end-users. NOTE: Applications wishing to start without being visible may achieve this by specifying a CSS style "display: none" for the body element.
PRESENT: The OITF SHALL take no action. There is no requirement for the OITF to provide a user interface allowing the end-user the opportunity to start applications with this control code. An IPTV service provider who signals applications with this control code SHALL provide an application able to start them.
KILL: The application SHALL be terminated.
PREFETCH: The OITF MAY start fetching files, data or other information needed to start the application but SHALL NOT start the application. Implementations MAY consider this control code to be the same as PRESENT.

Table 2: DAE application control codes

The other control codes from [MHP] are not defined for DAE applications. Control codes not defined for DAE applications SHALL be ignored.

NOTE: Some control codes only make sense when SD&S can be dynamically updated and updates pushed to the OITF, i.e. when push SD&S signalling (DVBSTP) is used.

5.2.2.3 Selected Service Provider Applications

Where the Service Provider Discovery Record is delivered as XML data (as defined in clause 6.2 of [ARCH][ARCH]) and an IPTV service provider is selected from that Service Provider Discovery Record, the OITF SHALL look in that XML data to identify the entry for the selected IPTV service provider. If the entry for the selected IPTV service provider signals the presence of interactive applications then all their applications signalled with a control code of AUTOSTART SHALL be started (if platform resources allow) in priority order.

Applications signalled with other control codes SHALL NOT be started at that moment. If the selected IPTV service provider changes, running applications from the former service provider started through this process SHALL be stopped and this process SHALL be re-run for the newly selected service provider.

5.2.2.4 Applications part of scheduled content services

When a scheduled content service is selected, the following SHALL apply;

- The OITF shall determine if there are any applications signalled as part of the service as defined by sections 3.3.2.1 and 3.3.2.2 of [META][META].
- Applications which are part of that scheduled content service and which are signalled with a control code of AUTOSTART SHALL be started if not still running from any previously presented linear TV service.
- Applications which are part of that scheduled content service, which are signalled with a control code of AUTOSTART and which are already running from a previously presented scheduled content service SHALL
  a) continue to run uninterrupted if the `serviceBound` element of the `ApplicationDescriptor` in their signalling has value `false`
  b) be stopped and re-started if the `serviceBound` element of the `ApplicationDescriptor` in their signalling has value `true`
- Applications which are part of that scheduled content service and which are signalled with a control code of PRESENT SHALL continue to run if already running but SHALL NOT be started if not already running.

- Running applications from any previously presented scheduled content service which are not part of the new scheduled content service SHALL be stopped as part of the change of presented service.

While a scheduled content service is being presented, the following apply;

- Applications which are added to the service with a control code of AUTOSTART SHALL be automatically started when their addition is detected by the OITF. Applications added to the service with any other control code SHALL NOT be automatically started.

- Applications which are part of the service whose control code changes to AUTOSTART from some other value SHALL be automatically started unless already running.

  NOTE: The above requirements are only applicable with push SD&S (i.e. DVBSTP).

5.3 Event Notifications

This section describes 4 different notifications framework(In-session notification based on Home network domain, In-session notification based on Internet domain, 3rd Party notification based on Home network domain, 3rd Party notification based on internet domain) presented by CEA 2014. Moreover, it defines a new notification framework for IMS based notifications such as CallerID, Incoming Call Message, Chat Invite not only when a DAE application is active but also inactive.

Event notification mechanism allows OITFs to receive important UI or information from IPTV service provider or home network devices such as IG, AG or DLNA RUI compatible devices. CEA 2014 mandates 4 unique notification models which are dependent on whether the server exists on the internet domain or home network domain. Each of domain models have two unique scenarios depended on whether or not a DAE application is running. If a DAE application is active, the in-session notifications are used to support dynamic UI interaction between the server and the DAE application without the need to reload the XHTML page. Otherwise, 3rd party event notification should be used to receive and display a notification message outside of the current user session with a DAE application on the OITF, for example an event coming from another server, e.g. to receive emergency alerts, or events regarding news, weather, stock or other information. Generally, 3rd party event notification creates a new DAE application to display notification information.

IMS event notifications for Caller ID, Messaging and Chatting have different behavior from general event notification defined on CEA 2014 because IMS communication service should be accessed by authorized users and devices within the approval of IPTV service provider. Considering the issue of user's privacy, the DAE specification not only adopts the general Event Notification Frameworks from CEA 2014 as defined in section 5.3.1, but also defines a new IMS Event Notification Framework in Section 5.3.2.

5.3.1 Event Notification Framework based on CEA 2014

An OITF must be capable of displaying various event notifications from both Internet domain and home network domain. Event notification can be conveyed though active UI interaction's channel or out of session. As described in the diagram below, in-session notification is associated with a running DAE application, whereas a 3rd party event notification is delivered through an independent communication channel. If an OITF receives a 3rd party event after subscribing to a certain internet url or the OITF receives a multicasted event notification message, the OITF needs to perform 3rd party event notification and display its information inside a new DAE application.

The diagram below describes a general overview of Event Notification architecture.

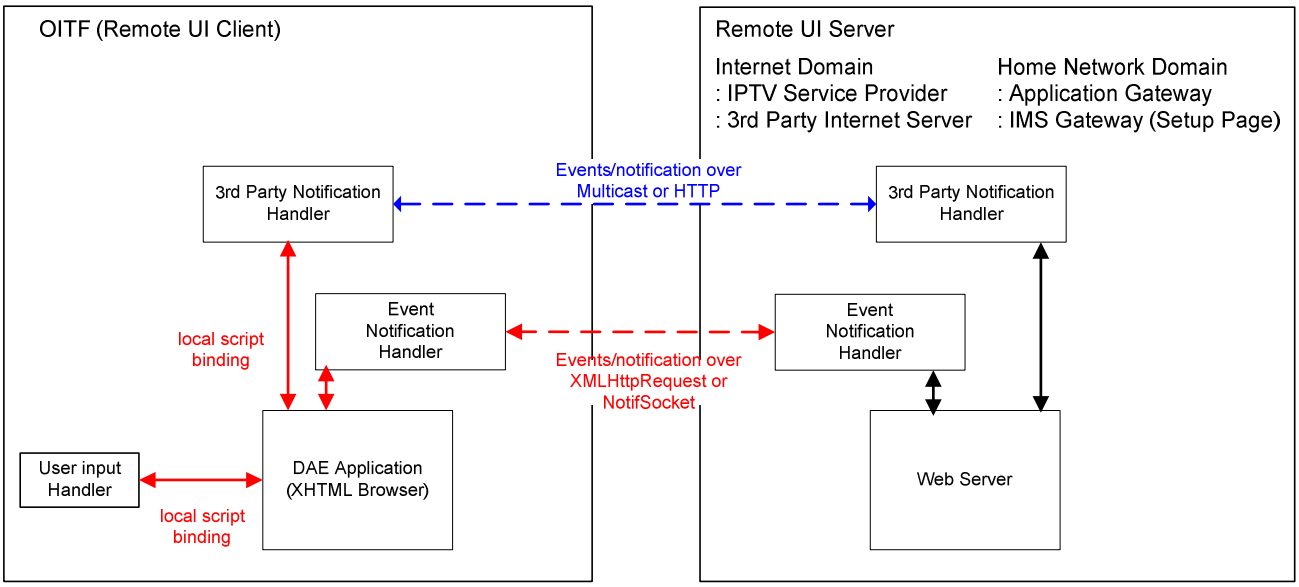


Figure 6: General Event Notification Architecture on OITF and Remote UI Server

In-Session notification are performed to update partial or whole DAE application UI through the `NotifSocket` object and/or the `XMLHttpRequest` object as defined by CEA 2014 A. `NotifSocket` object creates a persistent TCP connection between a DAE application and Remote UI server in order to support burst event notifications. In addition, DAE application can create an `XMLHttpRequest` object to make asynchronous HTTP requests to a web server on the internet domain. This establishes an independent HTTP connection channel to support XML updates between the DAE application and the Remote UI server.

On the other hand, if the OITF receives an incoming notification outside of an active interaction(i.e. session) with the server, a 3rd Party Event Notification must be executed to invoke a DAE application to fetch and render the UI content using the url contained within the notification message. This allows servers to "broadcast" important messages, such as Emergency alert messages, to an OITF at anytime, even when the DAE application would currently not be running. This should be done through a push-method with multicast message for the home network domain. and a pull-method for the internet case.

The next two subsections describe the requirements for the event mechanisms in more detail.

5.3.1.1 In-session Event Notification

In-Session notification can be defined as "Dynamic UI Update." With this mechanism, a server should be able to send a notification message during a UI interaction to update the UI dynamically without the need to reload the XHTML-page. The OITF SHALL support the two following scripting objects for In-session event notification:

- `XMLHttpRequest` Scripting Object (as defined in Section 5.5.2 of [CEA-2014-A])
  - The `XMLHttpRequest` is an embedded object on the browser and enables scripts to make HTTP request to a web server without the need to reload the page. It can be used by JavaScript to transfer and manipulate XML data to and from a web server using HTTP, establishing an independent connection channel between a web server and DAE applications. Whenever a DAE application needs to update the UI, it sends a request to the UI server, IPTV service provider or 3rd Party Internet Server, to monitor the change of status or event. In case an event, the UI server sends an HTTP response to the XMLHttpRequest.
- `NotifSocket` Scripting Object (as defined in Section 5.5.1 of [CEA-2014-A])
  - Even though `XMLHttpRequest` object has become more widespread on browsers and Internet Portal servers, it has a difficulty in supporting dynamic UI update on home domain's devices because it is requires to be invoked by the request of `XMLHttpRequest` on DAE application side. `NotifSocket` creates a persistent TCP connection between DAE application and UI server in order to support burst event notifications. Whenever the UI server needs to notify the DAE application running on the OITF of a UI update, it sends any types of update message, such as encoded binary or string, through the `NotifSocket` connection. The `NotifSocket` object allows an UI server to push any event information through the independent TCP/IP channel at any time.

5.3.1.2 Out of session Event Notification

Out of session event notification are defined as "3rd Party Notification" on the CEA 2014. Since these notifications are not part of an active remote UI interaction with a Remote UI Server, the OITF must launch a new DAE application to render the UI content using the url contained within the notification message.

The OITF SHALL support multicast notifications for 3rd party event notifications for the home network domain respectively the internet domain as defined below. Support for polling-based notifications as defined below is optional.

- Multicast Notifications (as defined in Section 5.6.1 of [CEA-2014-A])
  - The OITF SHALL support receiving of Multicast Notifications over multicast UDP, with a UPnP event message format defined by CEA 2014 if the incoming message comes from home network domain, whereby "X_" shall be prepended to the element names "`ruiEventURL`", "`friendlyName`" and "`profilelist`" of bullet 13 of [Req. 5.6.1.a] of [CEA-2014-A].. After interpreting the message, the OITF should create a new notification window with specified <`ruiEventURL`>. In order to ensure a reliable transmission of a multicast notification message, a Remote UI Server shall transmit the same notification message, with the same HTTP SEQ header value 2 or 3 times, where the time between transmissions should be a random time between 0 and 10 seconds.
- Polling-based Notification (as defined in Section 5.6.2 of [CEA-2014-A])
  - The OITF SHALL support polling-based 3rd Party notifications from an IPTV Service Provider or a 3rd Party Internet Server. To this end, the OITF subscribes to certain URIs to display web contents such as news, weather, stock or other information from Internet side on executing the **`subscribeToNotifications`**`(String url, String name, Number period, String type)`. An OITF should poll for notifications even when the CE-HTML browser is not active. If a new notification is received, this MAY be notified to the user in a vendor defined way, including direct rendering on the display and using a non-intrusive prompt. An OITF should restrict the total number of active notification subscriptions to about 10.

5.3.2 IMS Event Notification Framework

This section covers the DAE interactions needed to drive the message exchanges on the HNI-IGI interface in the case where the Service Provider offers an IMS application.

The HNI-IGI framework defines how an OITF interacts with an IMS Gateway (IG) via the HNI-IGI interface ([PROT][PROT] section 5.5.1).

Every message on the HNI-IGI interface SHALL be carried in a HTTP transaction where the OITF sends the HTTP request and the IG responds to the request. The HNI-IGI In-session framework, in the case of a DAE application, uses the XMLHttpRequest Script Object, as defined in section 5.5.2 of [CEA-2014-A] .

There are two message directions on the HNI-IGI interface, corresponding to outgoing and incoming messages from and to the OITF.

5.3.2.1 HNI-IGI transactions for out-going request messages

This message direction applies to outgoing messages from the OITF on the HNI-IGI interface. The OITF sends a request and the IG responds to the request. The following figure illustrates the sequences for in-session transactions for outgoing requests from DAE application to the IG.

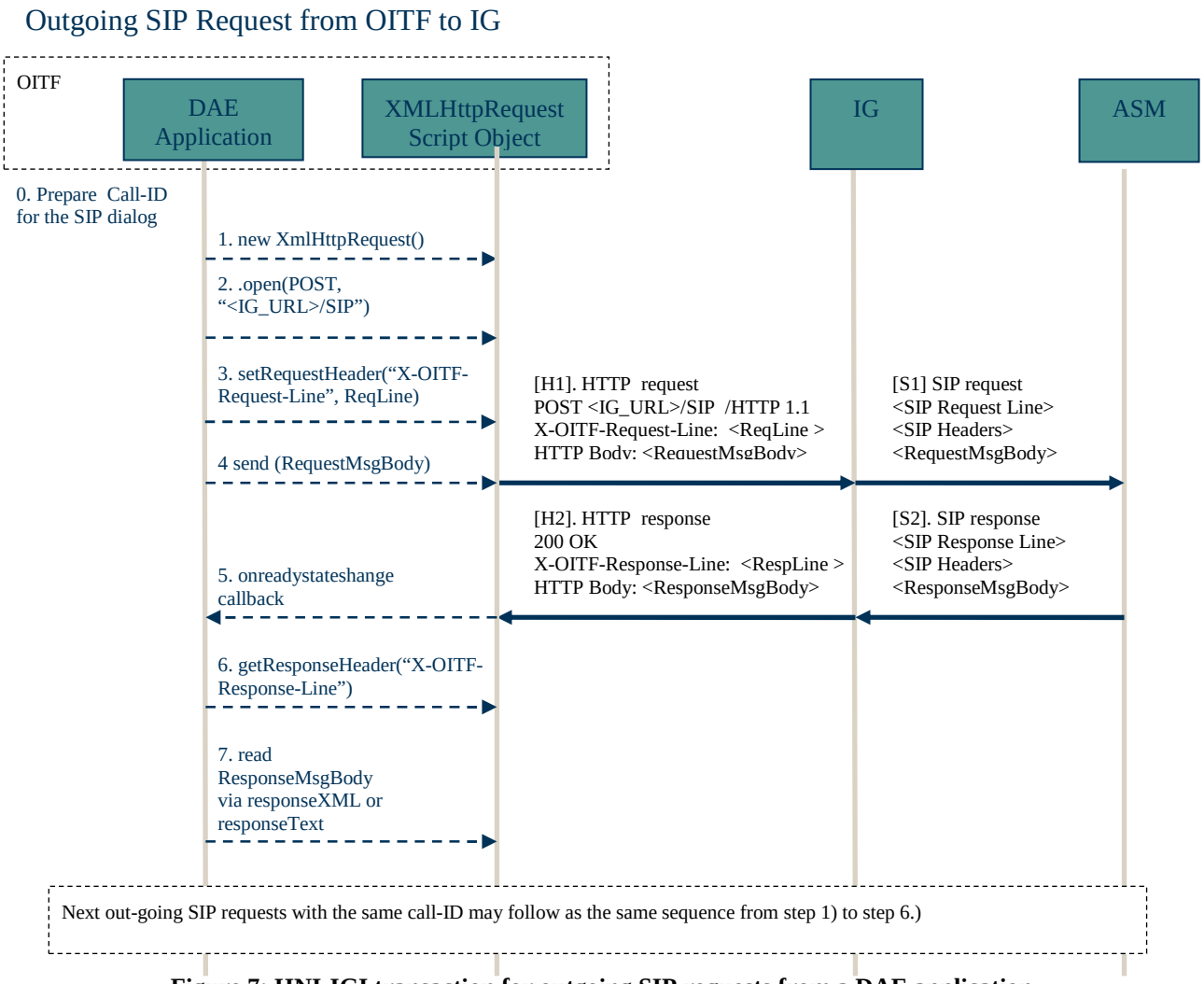


Figure 7: HNI-IGI transaction for outgoing SIP requests from a DAE application

0. Prepare the Call-ID for a SIP request.. The Call-ID SHALL be generated by the DAE application for an outgoing SIP request. This Call-ID SHALL be locally unique across all OITFs in a residential network. NOTE: How uniqueness is achieved is currently not defined

1. The DAE application SHALL create a new `XMLHttpRequest` object using the constructor "`new XMLHttpRequest()`".

2. The DAE application SHALL invoke the `open()` method to specify the HTTP method and Request-URI for the request. In this case, the HTTP POST method with the Request-URI of <IG URL>/SIP SHALL be used as specified in [PROT][PROT]

3. The DAE application SHALL invoke the `setRequestHeader()` method to specify the required HTTP headers as specified in [PROT][PROT]. This method SHALL be invoked for each required HTTP header. For example, the X-OITF-Request-Line HTTP header specifies the SIP request line for the SIP request. The Call-ID is specified in the X-OITF-Call-ID header.

4. The DAE application SHALL invoke the `send()` method to send the HTTP request. The SIP Message Request body is specified in a parameter of this method.

5. When the HTTP response is received, the `onreadystatechange` callback function SHALL be invoked.on the DAE application

6. The DAE application SHALL invoke the `getRequestHeader()` method to retrieve each HTTP header. The SIP Response Line is specified in the X-OITF-Response-Line header.

7. If the `readyState` property of the `XMLHttpRequest` object has value 4, the HTTP response body SHALL be retrieved via the `responseXML` or `responseText` properties of the `XMLHttpRequest` object. The SIP response body is specified in the HTTP response body.

5.3.2.2 HNI-IGI transaction for in-session incoming request messages

This message direction applies to incoming messages to the OITF on the HNI-IGI interface which are related to an existing IMS session. An example of this is a SIP NOTIFY message received from the network in response to a previous SIP SUBSCRIBE sent from the IG. The OITF sends a HTTP request and the IG responds to the request when it receives an incoming message from the network related to an existing session. The following figure illustrates the sequences for in-session transactions for incoming requests from the IG to the DAE application.

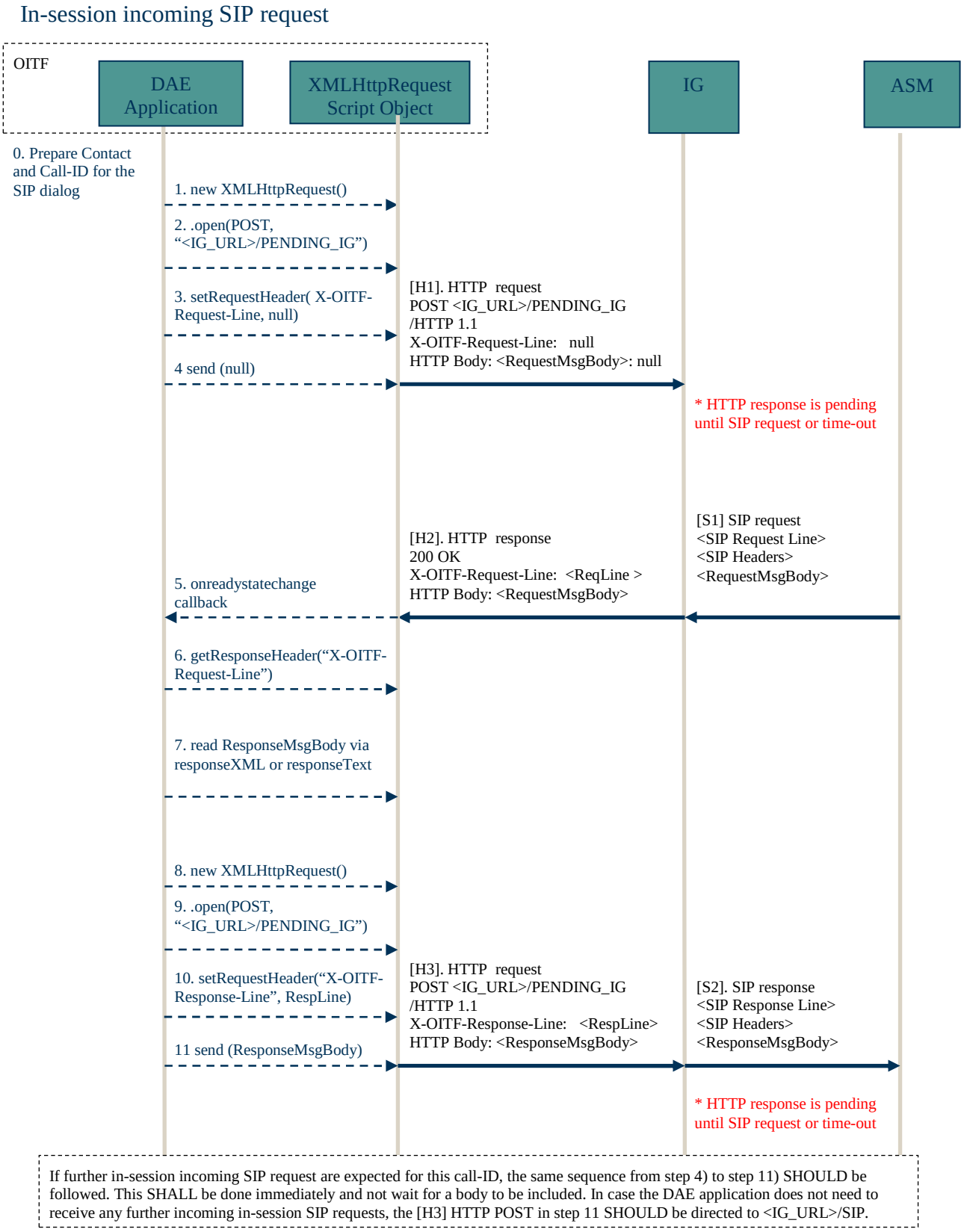


Figure 8: HNI-IGI transaction for in-session incoming SIP request

0. Prepare the Call-ID for this SIP session for which a message is expected. The Call ID SHALL be the same as the one created initially for this session.

1. The DAE application SHALL create a new XMLHttpRequest object using the the constructor "`new XMLHttpRequest()`".

2. The DAE application SHALL invoke the `open()` method to specify the HTTP method and the Request-URI for the request. In this case, the POST method with a Request-URI of <IG URL>/PENDING_IG SHALL be used as specified in [PROT][PROT]

3. The DAE application SHALL invoke the `setRequestHeader()` method to specify the required HTTP headers, as specified in [PROT][PROT]. This method is invoked for each HTTP header that is required. In this case, the X-OITF-Request-Line, which specifies the SIP request line for the SIP request, is set to the value "null". The SIP Call-ID is specified in the X-OITF-Call-ID header.

4. The DAE application SHALL invoke the `send()` method to send the HTTP request. For the HTTP request that sets up the initial long poll, no X-OITF headers are allowed for the HTTP request to the PENDING_IG Request-URI.

5. When the HTTP response is received, the specified `onreadystatechange()` callback function is invoked.

6. The DAE application SHALL invoke the `getResponseHeader()` method to retrieve each HTTP header. The SIP Request Line is specified in the X-OITF-Request-Line HTTP header.,

7. If the `readyState` property of the `XMLHttpRequest` object has value 4, the HTTP response body SHALL be retrieved via the `responseXML` or `responseText` properties of the `XMLHttpRequest` object. The SIP response body is specified in the HTTP response body.

8. The DAE application SHALL create a new `XMLHttpRequest` object using the the constructor "`new XMLHttpRequest()`".

9. The DAE application SHALL invoke the `open()` method to specify the HTTP method and the Request-URI for the request. In this case, the POST method with a Request-URI of <IG URL>/PENDING_IG SHALL be used as specified in [PROT][PROT]

10. The DAE application SHALL invoke the `setRequestHeader()` method to populate each HTTP header as specified in [PROT][PROT]. This method SHALL be invoked for each required HTTP header. For example, the X-OITF-Response-Line specifies the SIP response line for the SIP response. The Call-ID is specified in the X-OITF-Call-ID header.

11. The DAE application SHALL invoke the `send()` method to send the HTTP request. If there is a SIP response body, it is included as a parameter to the `send()` method. The SIP response body message is carried in the HTTP body for the HTTP request to the PENDING_IG Request-URI.

In the case where the OITF does not need to receive any further incoming in-session SIP requests, the [H3] HTTP POST in step 11 SHALL be directed to the <IG_URL>/SIP Request-URI.

5.3.2.3 HNI-IGI transaction for out of session incoming request messages

This message direction applies to incoming messages on the HNI-IGI interface which are not related to an existing session. An example of this is a SIP MESSAGE message received from the network, coming e.g. from an IPTV application or from another user. The following figure illustrates the sequences of out-of-session transactions for incoming requests from the IG to OITF.

The first figure describes what happens when the OITF is first turned on.

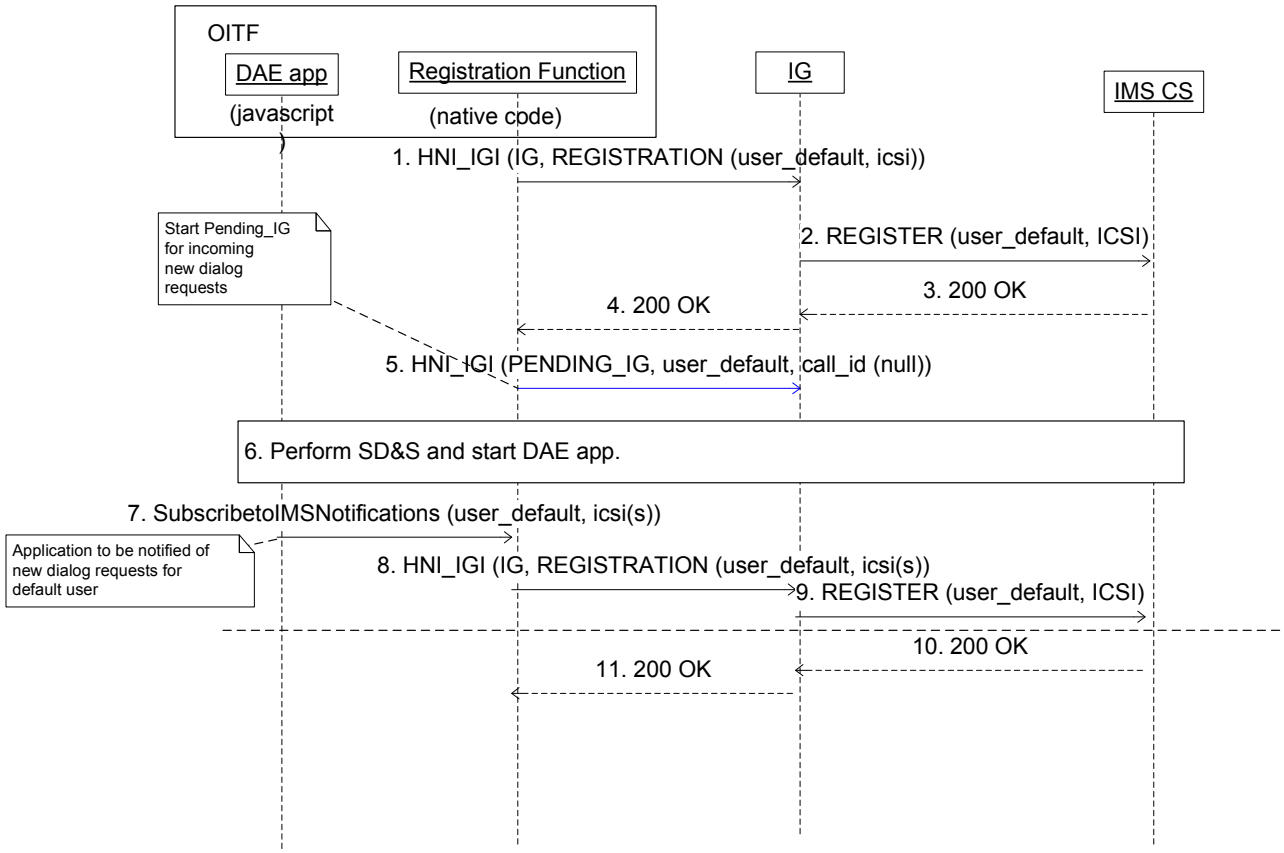


Figure 9: What happens when the OITF is first turned on

1. When the OITF is turned on the OITF SHALL send a HNI_IGI IG registration message to register the default user
2. The IG Registers the default user in the IMS network
3. The IMS network returns 200 OK
4. a 200 OK message SHALL be returned on the HNI_IGI
5. If there are native IMS applications that may receive unsolicited messages the OITF SHALL send a PENDING_IG message to the IG, for the default user and with the call_id set to null. The steps to send PENDING_IG are the same as steps 8-11 from section 5.3.2.2 “HNI-IGI transaction for in-session incoming request messages”.
6. The OITF performs service selection and discovery and loads the initial DAE page.
7. DAE IMS applications that desires to receive unsolicited notifications SHALL issue a `subscribetoImsNotifications()` method. (as defined in Section 7.8)
8. When applicable the OITF SHALL send a HNI_IGI IG registration message to re-register the default user, including new applications
9. The IG re-registers the default user in the IMS network
10. The IMS network returns 200 OK
11. a 200 OK message SHALL be returned on the HNI_IGI

The next figure describes what happens when a specific user logs in using the DAE interface.

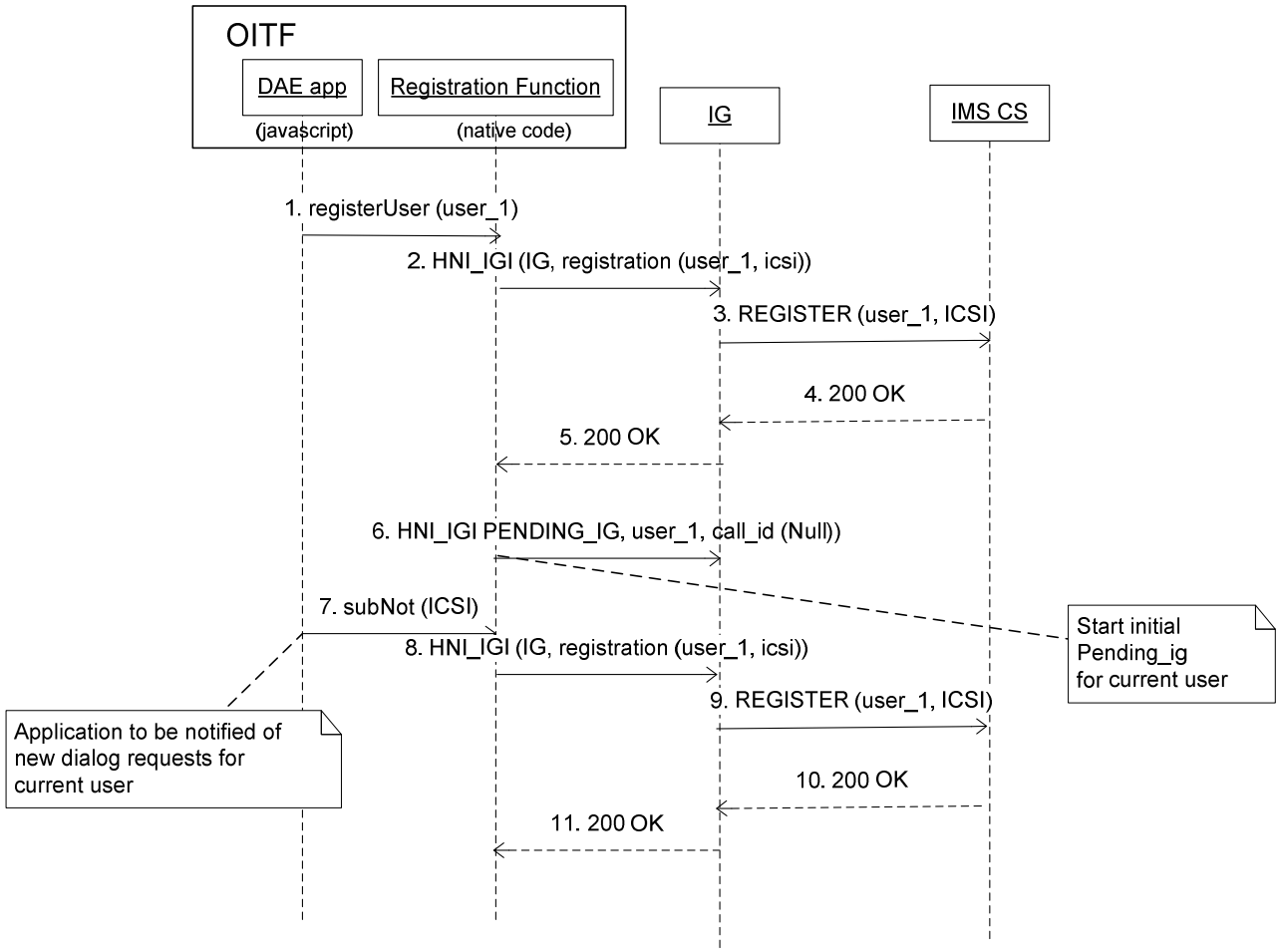


Figure 10: User logs in using the DAE interface

1. When the user desires to login the DAE SHALL call the registerUser() method to register the user
2. The OITF SHALL send a HNI_IGI IG registration message to register the user
3. The IG Registers the user in the IMS network
4. The IMS network returns 200 OK
5. a 200 OK message SHALL be returned on the HNI_IGI
6. If there are native IMS applications that may receive unsolicited messages the OITF SHALL send a PENDING_IG message to the IG, for the default user and with the call_id set to null. The steps to send PENDING_IG are the same as steps 8-11 from section 5.3.2.2 “HNI-IGI transaction for in-session incoming request messages”.
7. DAE IMS applications for the user that desires to receive unsolicited notifications SHALL issue a `subscribetoImsNotifications()` method (as defined in Section 7.8).

8. When applicable the OITF SHALL send a HNI_IGI IG registration message to re-register the user, including new applications
9. The IG re-registers the default user in the IMS network
10. The IMS network returns 200 OK
11. a 200 OK message SHALL be returned on the HNI_IGI

The next Figure describes what happens when an unsolicited message arrives from the network. The precondition is that a DAE application is already running and subscribed to the IMS notifications (refer to previous sequence when user logs in).

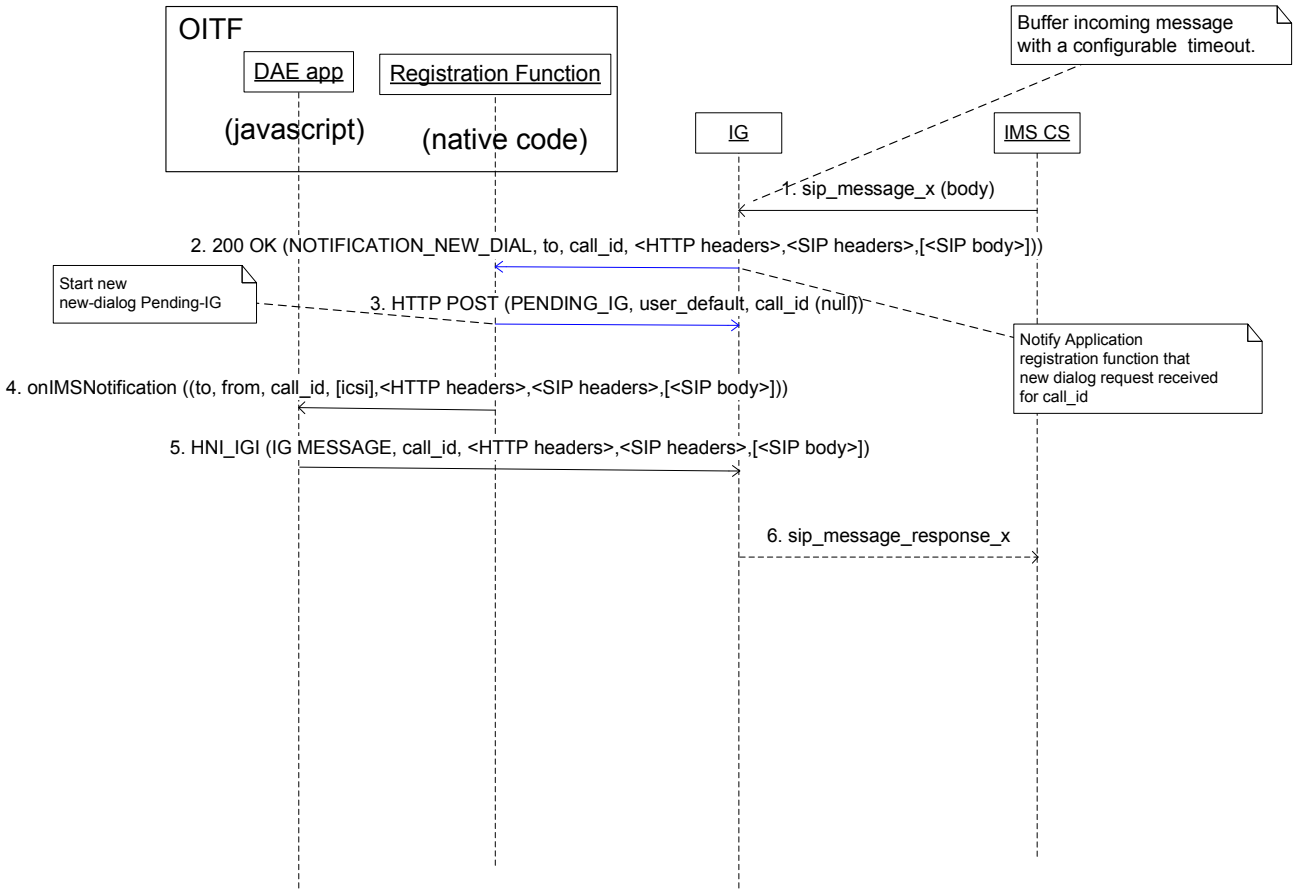


Figure 11: Unsolicited message from the network

1. A SIP message arrives from the network
2. The IG responds to the PENDING_IG request
3. The OITF SHALL immediately issue a new PENDING_IG request after receving a response on a PENDING_IG request. The steps to send PENDING_IG are the same as steps 8-11 from section 5.3.2.2 “HNI-IGI transaction for in-session incoming request messages”.

4. The OITF SHALL call the callback function `onImsNotification` for the corresponding application. This includes the IMS message.

5. The OITF MAY respond to the network with a new outgoing message. The steps to send PENDING_IG are the same as steps 8-11 from section 5.3.2.2 “HNI-IGI transaction for in-session incoming request messages”.

6. If the OITF sends a message the IG SHALL forward it to the network.

6 Formats

6.1 CE-HTML (Reference to the annex)

An OITF SHALL support the XHTML profile called CE-HTML as specified in Section 5.4 of CEA-2014-A[CEA-2014-A], with the exceptions as defined in Annex B.

NOTE: the list of default embedded objects and related Javascript APIs are defined in Section 7.

6.2 CE-HTML Referenced Formats

This section provides more details about formats used by CE-HTML

This section modifies the sections of the CEA-2014 specification which reference externally defined formats. In the absence of modifications below, those sections SHALL apply.

- **JPEG**: Support for lossless and hierarchical modes and arithmetic coding of DCT coefficients is OPTIONAL. The thumbnail feature of [JFIF] is OPTIONAL. OITFs not supporting thumbnails SHALL skip them if present and continue decoding the rest of the image.

6.3 SVG

This section contains extensions and modifications to W3C SVG 1.2 Tiny [SVG Tiny 1.2] and to the CEA-2014[CEA-2014-A].

6.3.1 Supporting SVG document

OITF SHALL support [SVG Tiny 1.2] document with the extensions to [CEA-2014-A] described in this subsection. These extensions SHALL be accomplished by means of the following text:

[Req 5.2.1.a] The following extensions apply:

- A Remote UI Client Capability Description SHALL include the following element in order to convey support for SVG:
  `<mime-extensions>image/svg+xml</mime-extensions>`

[Req 5.2.2.f] The following extensions apply:

- Referenced content SHALL adhere to the `image/svg+xml` MIME-type.

[Req. 5.3.a] The following extensions apply:

- If an `Accept` request header is used, then its value SHALL contain the string "`image/svg+xml`".
- If an `Accept-Encoding` and an `Accept` request header are used, then the value of the `Accept-Encoding` header SHALL contain the string "`gzip`" and "`deflate`".

[Req. 5.4.a] The following extensions apply:

- A Remote UI Client SHALL include a *Conforming Dynamic SVG Viewer* as defined by [SVG Tiny 1.2] .

The following applies to item 8):

- Compliant image content SHALL include the MIME-type `image/svg+xml` as defined by [SVG Tiny 1.2] .

[Req. 5.10.b] The following extensions apply:

- SVG viewer SHALL support SVG image content which uses logical coordinates greater than the resolution supported by the <width> and <height> parameters of the Remote UI Client capability.

[Annex G, Table 5] The following extensions apply:

- The `type` attribute of an `<a></a>` element tag SHALL specify the value `image/svg+xml` if a link to an SVG document is defined.
- The `<img/>` element tag SHALL allow image of content-type `image/svg+xml` to be used.
- The `<object/>` element tag SHALL allow content of content-type `image/svg+xml` to be used.

If an SVG document contains beyond SVG 1.2 Tiny elements, attributes or properties, these MAY be ignored. If the SVG document contains video or audio elements, these MAY be ignored.

6.3.2 Supporting DOM accessing between CE-HTML and SVG

6.3.2.1 Parent CE-HTML access to child SVG

In order to enable DOM accessing from parent CE-HTML[CEA-2014-A] document to child [SVG Tiny 1.2] document, the following extensions SHALL be applied to CE-HTML:

- [5.4.a] XHTML Profile (CE-HTML); The following applies to item 3) d):
    - The `HTMLObjectElement` interface, including the `contentDocument` attribute of this interface, SHALL be supported for SVG documents. If the `contentDocument` property of `HTMLObjectElement` refers to a [SVG Tiny 1.2] document, then the available methods and properties for the `contentDocument` are limited to the common subset of the [SVG Tiny 1.2] uDOM and the `Element` interface defined in.[DOM 2 Core].
    - Methods `blur()` and `focus()` SHALL be supported for SVG documents and SHALL have the same semantics as specified for interface `HTMLInputElement`.
- [Annex I, Table 9] The following extensions apply:

add `HTMLObjectElement` interface with the following properties and functions as defined by [DOM 2 HTML]:
`align, border, contentDocument, data, height, hspace, name, tabindex, type, vspace, width, blur(), focus();`

Scripting Interface (informative)	Properties and Methods (informative)	Additional Requirements and Recommendations (in addition to that defined above)

`HTMLObjectElement`	`#HTMLElement`
	`Align(*)`
	`border(*)`
	`contentDocument(**)`
	`data`
	`height`
	`hspace(*)`
	`name(*)`
	`tabindex`
	`type`
	`vspace(*)`
	`width`
	`blur()(**)`
	`focus()(**)`
		(*) use of this attribute is deprecated
		
		(**) at least supported for SVG content

Table 3: HTMLObjectElement interface

6.3.2.2 Child SVG access to parent CE-HTML

In order to enable DOM access from child [SVG Tiny 1.2] document to parent CE-HTML[CEA-2014-A] document, the following extensions SHALL be applied to CE-HTML:

- [5.4.2.a] The following extensions to be added to item 1) Properties - j) **readonly String name**:

- If a window object is associated with an embedded document, then the name property of the window SHALL match the name property of the element that generated the embedded document.

- [5.4.2.a] The following extensions to be added to item 1) Properties x):
  - x)**readonly Element frameElement -** Property frameElement SHALL resolve to the embedding element object or null if there is no such element.

- [Annex I, Table 9] The following extensions apply:
  - under window object entry, add read-only property frameElement;

Scripting Interface (informative)	Properties and Methods (informative)	Additional Requirements and Recommendations (in addition to that defined above)
Window	frameElement(available to DocumentViews of embedded SVG documents) cea2014_protocol_version cea2014_protocol_subversionNr document frames history innerHeight innerWidth location id name onblur onfocus onkeypress onkeydown onkeyup httptimeout(****) parent top maxHeight(****) maxWidth(****) topmost(****) height(****) width(****) focus() setTimeout() clearTimeout() setRenderMode() openURL()(****) reload()(****) replace()(****) requestFocus()(****) setHttpTimeout()(****) setTimer()(****) clearTimer()(****) getFrame()(****) escapeBeyondTopmost()(****) exitUnit()(****) download()(*) subscribeToNotifications()(**) XMLHttpRequest(***)	Additional implementation/authoring requirements: The methods and properties SHALL adhere to [Req.5.4.2.a]. (*) Method download() is only mandatory for Remote UI Clients for which <download> is true in their capability profile. (**) Method subscribeToNotifications is only mandatory for i-Box clients. (***) Property XMLHttpRequest is only mandatory for i-Box clients. (****) CEA-2027-A specific method that may not be supported as per Annex B of this DAE specification.

Table 4: Window interface

Add the DocumentView interface (defined in Table 5) to uDOM defined in [SVG Tiny 1.2]. It is a subset to DOM Level 2 Views[DOM 2 Views]. The DocumentView interface provides the access to innermost Window object so that child document can access to parent document. It has defaultView property described as follows:

interface **DocumentView**
{
readonly Window defaultView;
}
	defaultView resolves to the innermost Window object into which the Document is presented.
	
	If the window object is CE-HTML based, then the available methods and properties for the defaultView.frameElement are limited to the common subset of the [SVG Tiny 1.2] uDOM and DOM Core L2 Element interface.

Table 5: DocumentView interface to be added to uDOM

SVGDocument interface also changes to inherit the DocumentView interface.

6.3.2.3 Parent SVG access to child CE-HTML

In order to enable DOM accessing from parent [SVG Tiny 1.2] document to child CE-HTML document, the following extensions SHALL be applied to [SVG Tiny 1.2] :

- Add SVGForeignElement interface to uDOM defined in [SVG Tiny 1.2]. This interface represents the 'foreignObject' element in the SVG document.

interface **SVGForeignObjectElement**
{
Document contentDocument;
}
	The document this object contains, if there is any and it is available, or null otherwise.
	
	If this document is CE-HTML based, then the available methods and properties for the document are limited to the common subset of the [SVG Tiny 1.2] uDOM and DOM Core L2 Element interface.

Table 6: SVGForeignObjectElement interface to be added to uDOM

6.3.2.4 Child CE-HTML access to parent SVG

In order to enable DOM accessing from child CE-HTML[CEA-2014-A] document to parent [SVG Tiny 1.2] document, the following extensions SHALL be applied to [CEA-2014-A]:

- [5.4.a] XHTML Profile (CE-HTML); The following to be added to item 3) DOM2 - f)
  - **f) DOM level 2 Views** , with at least providing support property defaultView which SHALL resolve to the innermost Window scripting object into which the Document is presented. If Window object is [SVG Tiny 1.2] based, then the available methods and properties for the defaultView.frameElement are limited to the common subset of the [SVG Tiny 1.2] uDOM and [DOM 2 Core] Element interface.
- [Annex I, Table 9] The following extensions apply:
  - under Document interface entry, add read-only property defaultView;

Scripting Interface (informative)	Properties and Methods (informative)	Additional Requirements and Recommendations (in addition to that defined above)
Document	#Node defaultView doctype documentElement implementation createAttribute() createAttributeNS() createCDATASection() createComment() createDocumentFragment() createElement() createElementNS(), createEntityReference() createProcessingInstruction() createTextNode() getElementById() getElementsByTagName() getElementsByTagNameNS() importNode()	Additional implementation/authoring guideline: CE-HTML clients MAY not provide full support for XML namespaces and processing instructions, hence methods getElementByTagNameNS(), createAttributeNS(), createElementNS(),and createProcessingInstruction() MAY not be supported.

Table 7: Document interface

In order to support access from [SVG Tiny 1.2] document to the CE-HTML document, the following extensions SHALL be applied to [SVG Tiny 1.2]:

- Add Window interface to the uDOM defined in [SVG Tiny 1.2]. Window interface is subset to the Window object defined in W3C WebAPI activity[Window Object]. The Window interface provides the access to other documents in a compound document by reference.

interface **Window**
{
readonly String name;
readonly Element frameElement;
}
	If a Window object is associated with an embedded document, then the name property of the window SHALL match the name property of the element that generated the embedded document.
	
	frameElement property contains reference to embedded element or null if there is no such element.

Table 8: Window interface to be added to uDOM

6.3.2.5 Event propagation

When an event occurs on any element in child the embedded document, event propagation typically does not run beyond the embedded parent document's boundaries. However, events will still be dispatched to other applications as defined in section 7.13.4.

No event listener in parent catches any event in child document. If user pushes key button when an [SVG Tiny 1.2] element is focused, then KeyEvent occurs on the focused [SVG Tiny 1.2] element and it typically does not propagate to the CE-HTML document.

To accomplish setting and moving focus through [SVG Tiny 1.2] and CE-HTML document, following extension SHALL be applied.

- [Req. 5.4.1.m] The following extensions apply:

  - If a CE-HTML page includes <object> elements whose type attribute value is image/svg+xml, then the Remote UI Client SHALL (1) offer a means to set focus to any SVG element type for which an event listener SHALL be registered, and (2) generate appropriate DOM 2 focus events accordingly.

- [Req. 5.4.1.n] The following extensions apply:

  - If a CE-HTML page includes <object> elements whose type attribute value is image/svg+xml, then the Remote UI Client SHALL (1) offer a means to move focus away from any SVG element type for which an event listener SHALL be registered, and (2) generate appropriate DOM 2 focus events accordingly.

In order to pass an event that occurred in the CE-HTML document to a script in [SVG Tiny 1.2], the following extensions SHALL be applied to [SVG Tiny 1.2] :

- Add DocumentEvent interface to uDOM defined in [SVG Tiny 1.2]. It is same as DocumentEvent in DOM Level 2 Events. SVGDocument interface also changes to inherit the DocumentEvent interface.

- Add dispatchEvent method to EventTarget defined in [SVG Tiny 1.2]

6.3.2.5.1 DocumentEvent

The DocumentEvent interface provides a mechanism by which the user can create an Event of a type supported by the implementation.

6.3.2.5.1.1 Methods

Event **createEvent**(DOMString eventType)		
Description	Create a specified event. If specified *eventType* is supported, newly created Event object is returned. Otherwise, null is returned.	
Arguments	*eventType*	The type of Event interface to be created.

6.3.2.5.2 *EventTarget*

6.3.2.5.2.1 Methods

Boolean **dispatchEvent**(Event evt)		
Description	This method allows the dispatch of events into the implementations event model. The return value of dispatchEvent indicates whether any of the listeners which handled the event called preventDefault. If preventDefault was called the value is false, else the value is true.	
Arguments	*evt*	Specifies the event type, behavior, and contextual information to be used in processing the event.

NOTE: The following methods are described in the uDOM defined in [SVG Tiny 1.2]:

void **addEventListener**(String type, EventListener listener, Boolean useCapture)

```
void removeEventListener(String type, EventListener listener, Boolean useCapture)
```

```
void addEventListenerNS(String namespaceURI, String type, EventListener listener,
Boolean useCapture, DOMObject evtGroup)
```

```
void removeEventListenerNS(String namespaceURI, String type, EventListener listener,
Boolean useCapture, DOMObject evtGroup)
```

6.3.3 Attention to DAE application developers

6.3.3.1 Script APIs defined in DAE

The use of any script APIs defined in the DAE specification in script code inside an SVG document is not defined.The script code in [SVG Tiny 1.2] document SHALL be able to call functions on DOM nodes in [CEA-2014-A] document and vice versa. The present document does not define how to include CE-HTML embedded objects directly in [SVG Tiny 1.2] document.

6.3.3.2 Codec and connection supporting in SVG

DAE applications SHALL NOT rely upon codec support for the use of audio and video elements from [SVG Tiny 1.2].

DAE applications SHALL NOT rely upon support for use of Connection from [SVG Tiny 1.2].

7 APIs

7.1 Download CoD

This section defines the content-on-demand download interfaces for both DRM-protected and non-DRM protected content.

An OITF and a DAE application which have indicated support for downloading content by providing value "`true`" for element <download> in their capability profile as specified in Section 9.3.4 SHALL adhere to the following requirements.

NOTE: Annex D clarifies the purpose and the use of these interfaces in more detail.

7.1.1 Download manager

An OITF SHALL support a download manager to perform the actual download of the content, which allows the user to manage (e.g. suspend/resume, cancel) and monitor the download, in a consistent manner across different service providers. The download manager SHALL continue downloading as a background process even if the browser does not have an active session with the server that originated the download request anymore (e.g. has switched to another DAE application), even after a device power-down or network failure, until it succeeds or the user has given permission to terminate the download. (see 7.1.4 on HTTP Range support to resume HTTP downloads after a power/network failure).

7.1.2 Content Access Descriptor

An OITF SHALL support the Content Access Descriptor with the specified semantics, syntax and MIME-type as specified in Annex E.

If the OITF encounters an HTTP response message with the Content-Type of the content access descriptor ,(i.e. "`application/oipfContentAccess`") whilst following a link as specified by an anchor element (`<a>`), a third-party notification link, posting a form, or fetching the content for the "`data`"-attribute of an A/V object, the OITF SHALL use the data inside the content access description document to initiate the download, if the '`TransferType`' attribute of one or more <ContentURL>-elements has value "`full_download`" or "`playable_download`". If the content access descriptor contains multiple content items, then the order by which the items are downloaded, is defined by the OITF.

If the HTTP response is the result of an XMLHttpRequest, the content-access descriptor SHALL be passed onto the Javascript for further processing.

The OITF SHALL pass included DRM-information as part of the <DRMControlInformation>-elements of a content-access descriptor to the DRM agent, if it supports a DRM agent with a matching DRMSystemID as per Section 9.3.10.

NOTE 1: Typically fetching the content will be initiated immediately. However, in case the content-access descriptor refers to a download (i.e. the value for the '`TransferType`' attribute of the <ContentURL>-element has value "`full_download`" or "`playable_download`"), the download MAY be deferred to a later time.

NOTE 2: An OITF SHOULD offer an easy way to continue the UI interaction with the server from which a download has been initiated, e.g. allowing him/her to continue browsing on the page that triggered the download.

NOTE 3: An OITF SHOULD inform the user if the content-type of a content item being retrieved cannot be interpreted by the OITF

7.1.3 application/oipfDownloadTrigger

An OITF SHALL support a non-visual embedded object of type "`application/oipfDownloadTrigger`", with the following Javascript API to enable passing a content-access descriptor to an underlying download manager using Javascript

7.1.3.1 Methods

Boolean **registerDownload**(String contentAccessDescriptor)		
Description	Send contentAccessDescriptor to underlying download manager as a String formatted according to the Content Access Descriptor XML Schema as specified in Annex E. Returns `true` if the contentAccessDescriptor is valid and is accepted for triggering a download. Returns `false` otherwise	
Arguments	*contentAccessDescriptor*	String formatted according to the Content Access Descriptor XML Schema as specified in Annex E

7.1.4 Download protocol(s)

As specified in Section 5.2.3 of [PROT][PROT], if a server offers a content item for download using HTTP, the server SHALL make sure that HTTP Range requests as defined in [RFC2616] are supported for HTTP GET or POST requests to the URI of that downloadable content item, in order to be able to resume downloads (e.g. after power or network failure). If the content item is no longer available then the download server SHALL return an HTTP 404 “File Not Found” status code. Upon reception of an HTTP response with this status code the OITF SHALL stop his attempts to resume the download. If after downloading a content item the size of the downloaded content item does not match the indicated size parameter, the OITF SHOULD remove the downloaded content item.

If an OITF encounters a URI with a known URI scheme for one of the alternative download protocols indicated as being supported through the “protocolNames” attribute of the <download>-element of Section 9.3.4 other than “http”, it SHALL download of the content referenced by that URI. The same holds if the OITF encounters a known file-extension or file-type as supported by one of these alternative protocols (such as “.torrent” files).

7.1.5 application/oipfStatusView

The following embedded objects allow a visualization of the download status to be included as part of the UI coming from a (third party) server, without the need for any security model, and without compromising security and privacy.

An OITF SHALL support the application/oipfStatusView embedded object. This embedded object SHALL provide an overall consistent graphical view of the status of the current downloads, the content that has been downloaded, and/or the content that has been recorded, as denoted by the states:

- “download_progress” (as defined below)

- “list_of_downloaded_content” (as defined below)

- “list_of_recorded_content” (as defined in Section 7.6.4).

The Content Download API described in Section 7.11.3 provides additional properties that MAY be used by a DAE application to visualize the download status.

The object SHALL support a <param>-element with the name “state”, which indicates the state that SHALL be visualized inside the object. An OITF that has indicated support for downloading content in its capability description (i.e. <download>true</download>) SHALL at least support the monitor states “download_progress” and “list_of_downloaded_content”. An OITF MAY support the visualization of additional states. An OITF SHALL silently ignore a request to visualize a state that it does not support; if this results in no state information being visualized at all (because the each <param>-element with name state referred to a non-supported state), the application/oipfStatusView object SHALL not be visualized and the object will have CSS `width` and `height` values of 0.

The object SHALL also support the inclusion of style hints through <param>-elements. At least the “background-color” and “font-size” style hints SHALL be supported using the syntax defined by CSS 2.1. An OITF MAY support additional style hints in addition to “background-color” and “font-size”. Additional style hints SHALL also follow the CSS 2.1 syntax. An OITF SHALL silently ignore any style hints that it does not support.

Example:

```
<object id="d1" type="application/oipfStatusView" width="200" height="100">
        <param name="state" value="download_progress"/>
        <param name="background-color" value="black"/>
        <param name="font-size" value="16px"/>
</object>
```

NOTE: this object is intended to allow services to link in to the privileged functionality of accessing privacy sensitive download information, without the need for certificates and privileged access requests. In certain managed network deployments this may not be sufficient. Therefore, in the managed network APIs in Section 7.11 more extensive APIs are given which provide Javascript control for a service platform provider over such highly privileged functionality.

7.2 Streaming CoD

This section defines the content-on-demand streaming interfaces for both DRM-protected and non-DRM protected content.

NOTE: Annex D clarifies the purpose and the use of these interfaces in the more detail.

7.2.1 Unicast streaming

If an OITF has indicated support for streaming CoD through the CEA-2014-A A/V object (see Section 9.3.11 for more information), then the OITF SHALL support the 'data'-attribute of the CEA-2014-A streaming object to refer to a content-access descriptor as defined in Annex E, e.g.:

```
<object id="d1" data="http://www.openiptv.org/fetch?contentID=25"
        type="application/oipfContentAccess" width="200" height="100"/>
```

The OITF SHALL support initiating playback of the A/V stream using the information provided by a content-access descriptor referred to by the 'data'-attribute, if the value for the 'TransferType' attribute of the <ContentURL>-element inside the content-access descriptor has value "streaming". To this end, the OITF SHALL fetch the content-access descriptor from the URL provided by the "data"-attribute, after which the descriptor SHALL be interpreted, resulting in an appropriate <ContentURL> to be selected to which a streaming CoD session will be initiated (as defined in Section 8)

The OITF SHALL pass included DRM-information as part of the <DRMControlInformation>-elements of a content-access descriptor to the DRM agent, if it supports a DRM agent with a matching DRMSystemID as per Section 9.3.10.

7.2.2 Multicast streaming

If an OITF has indicated support for IPTV channels through a <video/broadcast> element with type ID_IPTV_* (as defined in Section 7.5) the OITF SHALL support passing a content-access descriptor through the 'contentAccessDescriptorURL' argument of the 'setChannel'-method of the video/broadcast object (as defined in Section 7.5.2). If the content-access descriptor includes DRM information, the OITF SHALL pass this information to the DRM agent.

7.3 DRM Agent API

The following requirements SHALL apply to OITF and/or server devices which have indicated support for DRM protection by providing one or more <drm> elements as specified in Section 9.3.10:

7.3.1 application/oipfDrmAgent

An OITF SHALL support a non-visual embedded object of type "application/oipfDrmAgent", with the following Javascript API, to enable in-session message exchange from the web page with an underlying DRM agent.

Access to the functionality of the application/oipfDrmAgent embedded object SHALL adhere to the security requirements as defined in section 10.1

Note: Annex D provides a clarification to the browser interaction model when dealing with (services offering) protected content

7.3.1.1 Properties

`script` **`onDRMMessageResult`**

The script function (as defined in [HTML Data Types]) that is called when the underlying DRM agent has a result message to report to the current CE-HTML page as a consequence of a call to `sendDRMMessage`. The specified script function is called with three arguments `msgID`, `resultMsg` and `resultCode` which are defined as follows:

- `String msgID` – identifies the original message which has lead to this resulting message.
- `String resultMsg` – DRM system specific result message.
- `Integer resultCode` – result code. Valid values include:

Result message	Description	Semantics
0	Successful	The action(s) requested by `SendDRMMessage()` completed successfully
1	Unknown error	`SendDRMMessage()` failed because an unspecified error occurred.
2	Cannot process request	`SendDRMMessage()` failed because the DRM agent was unable to complete the necessary computations in the time allotted.
3	Unknown MIME type	`SendDRMMessage()` failed, because the specified Mime Type is unknown for the specified DRM system indicated in the MIME type
4	User Consent Needed	`SendDRMMessage()` failed because user consent is needed for that action

-

7.3.1.2 Methods

String **sendDRMMessage**(String msgType, String msg, String DRMSystemID)		
Description	Send message to DRM agent, using a message type as defined by the DRM system. Returns a unique ID to identify the message, to be passed as 'msgID' argument for the callback function registered through onDRMMessageResult. This is an asynchronous method. Applications will be notified of the results of the operation via events dispatched to onDRMMessageResult and corresponding DOM level 2 events.	
Arguments	*msgType*	A globally unique message type as defined by the DRM system, for example: application/vnd.marlin.drm.actiontoken+xml (i.e. MIME-type of Marlin Action Token) Valid values for the msgType parameter include the mime-types described in Annex C "DRM messages used in DAE" of[CSP] [CSP].
	msg	The message to be provided to the underlying DRM agent formatted according to the message type as indicated by attribute msgType Valid format for the msg parameter are message formats described in Annex C "DRM messages used in DAE" of [CSP][CSP]
	DRMSystemID	DRMSystemID as defined by element DRMSystemID in Table 9 of Section 3.3.2 of [META][META]. For example, for Marlin, the DRMSystemID value is "urn:dvb:casystemid:19188". In the case that attribute "msgType" indicates a CSPG-CI+ message as described in section 4.2.3.4.1.1.2 of [CSP][CSP], the "DRMSystemID" attribute SHALL be specified. Otherwise, the value may be null.

7.3.1.3 Events

For the intrinsic event "onDRMMessageResult", a corresponding DOM level 2 event SHALL be generated, in the following manner:

Intrinsic event	Corresponding DOM 2 event	DOM 2 Event properties
onDRMMessageResult	DRMMessageResult	▪ Bubbles: No ▪ Cancelable: No ▪ Context Info: msgID, resultMsg, resultCode

NOTE: the above DOM 2 event is directly dispatched to the event target, and will not bubble nor capture. Applications SHOULD NOT rely on receiving a DRMMessageResult event during the bubbling or the capturing phase. The addEventListener() method SHOULD be called on the application/oipfDrmAgent object itself. The third parameter of addEventListener, i.e. "useCapture", will be ignored.

7.4 Tuner control

This section SHALL apply to hybrid OITFs that have indicated support for tuner control (i.e. <video_broadcast>true</video_broadcast> as defined in Section 9.3.1) in their capability profile for one of the non-IPTV idTypes as specified in Section 7.4.1.1.3.1 for the Channel object (i.e. "ID_DVB_*", etc.). It describes the "video/broadcast" embedded object needed to support display and control by a DAE application of scheduled content received over local tuner functionality available to a hybrid OITF, including the conveyance of the channel list to the server. The term "tuner" is used here to identify a piece of functionality to enable switching between different types of scheduled content services that are identified through logical channels.

An OITF SHALL support the "video/broadcast" embedded object defined in section 7.4.2, including conveyance of the channel list as specified in 7.4.1. To protect against unauthorized access to the tuner functionality and people's personal favourite lists, the OITF SHALL adhere to the security model requirements as specified in Section 10.1, in particular the tuner related security requirements in Section 10.1.3.1

.NOTE: This section is focused on control and display of scheduled content received over local tuner functionality available to a hybrid device. This is very closely related to the control and display of scheduled content received over IP, as defined in Section 7.5.

NOTE 2: The APIs in this section allow for deployments whereby the channel line-up and favourite lists for broadcasted content are managed by the client, the server, or a mixture thereof.

7.4.1 Conveyance of channel list

To enable a service to control the tuner functionality on an OITF, the OITF needs to convey the channel list information that is managed by native code on the OITF device to the server. This information includes the list of uniquely identifiable channels that can be received by the physical tuner of a hybrid device, including information about how the channels are ordered and whether or not these channels are part of zero or more favourite lists.

The API supports two methods of conveying the channel list information to a service:

1) Method 1: through Javascript, by using the method "getChannelConfig()", as defined in Section 7.4.1.1.

2) Method 2: through an HTTP POST message that is sent upon the first connection to a service that requires tuner control, as defined in Section 7.4.1.2.

An OITF SHALL support method 1, and SHOULD support method 2. If an OITF conveys the channel list information using the HTTP POST message defined in method 2, then the server SHALL receive the conveyed channel list information and SHOULD rely on this information for the purpose of exerting tuner control. If a service that requires tuner control uses the posted channel list information to exert tuner control whenever the OITF connects to that service using method 2, the server SHALL indicate this compatibility with method 2 using the postList attribute specified in Section 9.3.1 (i.e., <video_broadcast postList="true">true</video_broadcast>). If an OITF does not support method 2, the HTTP message of the first connection to the service that requires tuner control SHALL be an HTTP GET message with an empty payload.

NOTE: conveyance of the channel list SHALL adhere to the security model requirements as specified in Sections 10.1.3.1 and 10.1.3.1.1.

7.4.1.1 Method 1: Javascript method "getChannelConfig()"

The OITF SHALL support method "getChannelConfig" as defined in Section 7.4.2.2 for the video/broadcast embedded object. This method returns a ChannelConfig object. The ChannelConfig datatype is defined as follows:

7.4.1.1.1 ChannelConfig

The ChannelConfig object provides the entry point for applications to get information about available channels.

7.4.1.1.1.1 Properties

readonly ChannelList **channelList**
The list of all available channels. The order of the channels in the list corresponds to the channel ordering as managed by the OITF. SHALL return the value "null" if the channel list is not (partially) managed by the Remote UI client (i.e., if the channel list information is managed entirely in the network).

readonly FavouriteListCollection **favouriteLists**
A list of favourite lists. SHALL return the value "null" if the favourite lists are not (partially) managed by the OITF (i.e., if the favourite lists information is managed entirely in the network).

readonly String **currentFavouriteList**
Currently active Favourite channel list given as the ID of one of the favourite list inside favouriteLists. If currentFavouriteList is the empty string, no favourite filter list is currently applied and all channels are 'selected'. SHALL return the value "null" if the favourite lists are not (partially) managed by the OITF (i.e., if the favourite lists information is managed entirely in the network).

7.4.1.1.1.2 Methods

<table>
<tr><td colspan="3"><code>ChannelList createFilteredList(Boolean blocked, Boolean favourite, Boolean hidden, String favouriteListID)</code></td></tr>
<tr><td>Description</td><td colspan="2">Create a filtered list of channels. Returns a subset of <code>ChannelConfig.channelList</code>.

The blocked, favourite and hidden flags indicate whether a channel is included in the returned list. These flags correspond to the properties on <code>Channel</code> with the same names. Each flag MAY be set to one of three values:

<table>
<tr><th>Value</th><th>Meaning</th></tr>
<tr><td><code>true</code></td><td>The channel is added if and only if the corresponding property has the value true.</td></tr>
<tr><td><code>false</code></td><td>The channel is added if and only if the corresponding property has the value false.</td></tr>
<tr><td><code>undefined</code></td><td>The channel is added regardless of the state of the corresponding property.</td></tr>
</table>

A channel will only be added to the list if the values of all three flags allow it to be added.

The <code>favouriteListID</code> attribute is used to select a particular <code>favouriteList</code> that the <code>createFilteredList</code> method uses as a basis of the filtering process. If <code>favouriteListID</code> is the empty string (i.e. “”), then the filtering is performed on all available channels as defined by <code>ChannelConfig.channelList</code>.</td></tr>
<tr><td rowspan="4">Arguments</td><td>Blocked</td><td>Flag indicating whether manually blocked channels SHALL be added to the list</td></tr>
<tr><td>Favourite</td><td>Flag indicating whether favourite channels SHALL be added to the list</td></tr>
<tr><td>Hidden</td><td>Flag indicating whether hidden channels SHALL be added to the list</td></tr>
<tr><td>favouriteListID</td><td>If the value of the favourite flag is <code>true</code>, indicates which favourites list SHALL be filtered upon.</td></tr>
</table>

7.4.1.1.2 ChannelList

The `ChannelList` object represents a list of channels. Items in the channel list can be accessed using array notation.

7.4.1.1.2.1 Properties

`readonly Integer` **`length`**
The number of items in the list.

7.4.1.1.2.2 Methods

`Channel item( Integer index )`		
Description	Return the channel at position index in the list, or undefined if no item is present at that position. The position can also be specified using array bracket notation instead of calling this method directly.	
Arguments	*Index*	The index of the item to be retrieved

`Channel getChannel( String channelID )`		
Description	Return the first channel in the list with the specified channel identifier. Returns null if no corresponding channel can be found.	
Arguments	*channelID*	The channel identifier of the channel to be retrieved, e.g., 'ccid:*{tuner.}*majorChannel*{.minorChannel}*'.

`Channel getChannelByTriplet( Integer onid, Integer tsid, Integer sid )`		
Description	Return the first (IPTV or non-IPTV) channel in the list that matches the specified DVB or ISDB triplet (original network ID, transport stream ID, service ID). Where no channels of type ID_ISDB_* or ID_DVB_* are available, or no channel identified by this triplet are found, this method SHALL return null.	
Arguments	*onid*	The original network ID of the channel to be retrieved.
	tsid	The transport stream ID of the channel to be retrieved. If set to "`null`" the client SHALL retrieve the channel defined by the combination of onid and sid. This makes it possible to retrieve the correct channel also in case a remultiplexing took place which led to a changed tsid.
	sid	The service ID of the channel to be retrieved.

`Channel getChannelBySourceID( Integer sourceID )`		
Description	Return the first (IPTV or non-IPTV) channel in the list with the specified ATSC source ID. Where no channels of type ID_ATSC_T are available, or no channel with the specified source ID is found in the channel list, this method SHALL return `null`.	
Arguments	*sourceID*	The ATSC terrestrial source_ID of the channel to be returned.

7.4.1.1.3 Channel

The Channel object represents a broadcast stream or service. It is defined as follows:

7.4.1.1.3.1 Constants

Name	Value	Use
TYPE_TV	0	Used in the `channelType` property to indicate a TV channel.
TYPE_RADIO	1	Used in the `channelType` property to indicate a radio channel.
TYPE_OTHER	2	Used in the `channelType` property to indicate that the type of the channel is unknown or known but not of type TV or radio.
ID_ANALOG	0	Used in the `idType` property to indicate an analogue channel identified by the property: '`freq`' and optionally '`cni`' or '`name`'.
ID_DVB_C	10	Used in the `idType` property to indicate a DVB-C channel identified by the three properties: '`onid`', '`tsid`', '`sid`'
ID_DVB_S	11	Used in the `idType` property to indicate a DVB-S channel uniquely identified by the three properties: '`onid`', '`tsid`', '`sid`'.
ID_DVB_T	12	Used in the `idType` property to indicate a DVB-T channel uniquely identified by the three properties: '`onid`', '`tsid`', '`sid`'.
ID_ISDB_C	20	Used in the `idType` property to indicate an ISDB-C channel identified by the three properties: '`onid`', '`tsid`', '`sid`'.
ID_ISDB_S	21	Used in the `idType` property to indicate an ISDB-S channel uniquely identified by the three properties: '`onid`', '`tsid`', '`sid`'.
ID_ISDB_T	22	Used in the `idType` property to indicate an ISDB-T channel uniquely identified by the three properties: '`onid`', '`tsid`', '`sid`'.
ID_ATSC_T	30	Used in the `idType` property to indicate a terrestrial ATSC channel uniquely identified by the property '`sourceID`'.

7.4.1.1.3.2 Properties

`readonly Integer` **`channelType`**
The type of channel, as indicated by one of the TYPE_* constants defined above

readonly Integer **idType**
The type of identification for the channel, as indicated by one of the ID_* constants defined above

readonly String **ccid**
Unique identifier of a channel within the scope of the OITF. The ccid is defined by the OITF and SHALL have prefix ‘ccid:’.

readonly Integer **onid**
DVB or ISDB original network ID (for channels of type ID_DVB_* and ID_ISDB_*)

readonly Integer **tsid**
DVB or ISDB transport stream ID (for channels of type ID_DVB_* and ID_ISDB_*)

readonly Integer **sid**
DVB or ISDB service ID (for channels of type ID_DVB_* and ID_ISDB_*)

readonly Integer **sourceID**
ATSC terrestrial source_ID

readonly Integer **freq**
For analogue channels, the frequency of the video carrier in KHz.

readonly Integer **cni**
For analogue channels, the VPS/PDC confirmed network identifier.

readonly String **name**
The name of the channel. Can be used for linking analog channels without CNI. Typically, it will contain the call sign of the station (e.g. 'HBO').

readonly Boolean **favourite**
Flag indicating whether the channel is marked as a favourite channel or not in one of the favourite lists as defined by property favouritelists

readonly StringCollection **favIDs**
The names of the favourite lists to which this channel belongs (see property favLists on object ChannelConfig)

readonly Boolean **locked**
Flag indicating whether the current state of the parental control system prevents the channel from being viewed (e.g. a correct parental control pin has not been entered). Note that this property supports the option of client-based management of parental control without excluding server-side implementation of parental control.

readonly Boolean **manualBlock**
Flag indicating whether the user has manually blocked viewing of this channel. Manual blocking of a channel will treat the channel as if its parental rating value always exceeded the system threshold. Note that this property supports the option of client-based management of manual blocking without excluding server-side management of blocked channels.

7.4.1.1.4 FavouriteListCollection

The FavouriteListCollection object represents a read-only collection of FavouriteList objects. Items in the collection can be accessed using array notation.

7.4.1.1.4.1 Properties

readonly Integer **length**
The number of items in the collection

7.4.1.1.4.2 Methods

FavouriteList **getFavouriteList**(String favID)		
Description	Return the first favourite list in the collection with the given favListID	
Arguments	*favID*	The ID of a favourite list.

FavouriteList **item**(Integer index)		
Description	Return the item at position index in the collection, or undefined if no item is present at that position. The position can also be specified using array bracket notation instead of calling this method directly.	
Arguments	*Index*	The index of the item that SHALL be returned

7.4.1.1.5 FavouriteList

The `FavouriteList` object represents a list of favourite channels. Items in the favourite list can be accessed using array notation.

7.4.1.1.5.1 Properties

readonly String **favID**
A unique identifier by which the favourite list can be identified

readonly String **name**
A descriptive name given to the favourite list

readonly Integer **length**
The number of items in the list.

7.4.1.1.5.2 Methods

Channel **item**(Integer index)		
Description	Return the channel at position index in the favourite list, or undefined if no item is present at that position. The position can also be specified using array bracket notation instead of calling this method directly.	
Arguments	*Index*	The index of the item to be retrieved

Channel **getChannel**(String channelID)		
Description	Return the first channel in the favourite list with the specified channel identifier. Returns null if no corresponding channel can be found.	
Arguments	*channelID*	The channel identifier of the channel to be retrieved, e.g., 'ccid:*{tuner.}* majorChannel*{.minorChannel}*'.

Channel **getChannelByTriplet**(Integer onid, Integer tsid, Integer sid)		
Description	Return the first (IPTV or non-IPTV) channel in the list that matches the specified DVB or ISDB triplet (original network ID, transport stream ID, service ID). Where no channels of type ID_ISDB_* or ID_DVB_* are available, or no channel identified by this triplet are found, this method SHALL return `null`.	
Arguments	*onid*	The original network ID of the channel to be retrieved.
	tsid	The transport stream ID of the channel to be retrieved. If set to "`null`" the client SHALL retrieve the channel defined by the combination of onid and sid. This makes it possible to retrieve the correct channel also in case a remultiplexing took place which led to a changed tsid.
	sid	The service ID of the channel to be retrieved.

Channel **getChannelBySourceID**(Integer sourceID)		
Description	Return the first (IPTV or non-IPTV) channel in the list with the specified ATSC source ID. Where no channels of type ID_ATSC_T are available, or no channel with the specified source ID is found in the channel list, this method SHALL return `null`.	
Arguments	*sourceID*	The ATSC terrestrial source_ID of the channel to be returned.

7.4.1.1.6 StringCollection

A `StringCollection` object represents a read-only collection of strings. Items in the collection can be accessed using array notation.

7.4.1.1.6.1 Properties

readonly Integer **length**
The number of items in the collection

7.4.1.1.6.2 Methods

String **item**(Integer index)		
Description	Return the item at position index in the collection, or `undefined` if no item is present at that position. The position can also be specified using array bracket notation instead of calling this method directly.	
Arguments	*index*	The index of the item that SHALL be returned

7.4.1.2 Method 2: HTTP POST message

If a server has indicated that it requires control of the tuner functionality of an OITF (i.e. <video_broadcast>true</video_broadcast> in the server capability description) for a particular service, then the OITF SHOULD issue an HTTP POST over TLS if it decides to connect to that service. The body of the HTTP POST over TLS request SHALL contain the Client Channel Listing, which SHALL adhere to the XML DTD defined below:

```
<?xml version="1.0" encoding="UTF-8"?>
<!ELEMENT ChannelConfig(ChannelList,(FavouriteLists,CurrentFavouriteList?)?)>
<!ELEMENT ChannelList(Channel*)>
<!-- List of channels that can be received by the tuner of the OITF; the order of channels in
the list corresponds to the channel order as managed by the OITF -->

<!ELEMENT Channel(((ONID, TSID, SID) | SourceID | (Freq, CNI?) | IPBroadcastID), Name,
Favourite?, Recordable?, Locked?, ManualBlock?)>
<!-- For a DVB digital channel use ONID+TSID+SID,
for an ISDB (ARIB) digital channel use ONID+TSID+SID,
for a ATSC terrestrial channel use SourceID,
for analog channel use Freq and CNI (if available). The IPBroadcastID element is only relevant
for IPTV broadcasts, as defined in Section 7.5  -->

<!ATTLIST Channel CCID ID #REQUIRED>
<!-- string: Unique identifier of a channel within the scope of the OITF. The format of CCID
SHALL have a prefix 'ccid:', e.g., 'ccid:{tuner.}majorChannel{.minorChannel}'. The CCID is
defined and managed by the OITF.-->

<!ATTLIST Channel channelType  CDATA  "TYPE_OTHER">
<!-- string: Indicates the type of media content carried over the channel. Valid values include
"TYPE_TV", "TYPE_RADIO" and "TYPE_OTHER". If not included, the default value is "TYPE_OTHER". -
->

<!ATTLIST Channel idType CDATA #REQUIRED>
<!-- string: Indicates the type of 'global' identification for the channel. Valid values are
"ID_ANALOG", "ID_DVB_C", "ID_DVC_S", "ID_DVB_T", "ID_ISDB_C", "ID_ISDB_S", "ID_ISDB_T",
"ID_ATSC_T", and "ID_IPTV_SDS", "ID_IPTV_URI". -->

<!ELEMENT ONID (#PCDATA)>
<!-- integer: DVB or ISDB original network ID (for channels of type ID_DVB_* and ID_ISDB_*) -->

<!ELEMENT TSID (#PCDATA)>
<!-- integer: DVB or ISDB transport stream ID (for channels of type ID_DVB_* and ID_ISDB_*) -->

<!ELEMENT SID (#PCDATA)>
<!-- integer: DVB or ISDB service ID (for channels of type ID_DVB_* and ID_ISDB_*) -->

<!ELEMENT SourceID (#PCDATA)>
<!-- integer: ATSC terrestrial source_ID -->

<!ELEMENT Freq (#PCDATA)>
<!-- integer: frequency of content carrier in KHz -->

<!ELEMENT CNI (#PCDATA)>
<!-- integer: VPS/PDC confirmed network identifier if valid -->

<!ELEMENT IPBroadcastID (#PCDATA)>
<!-- string: if the Channel has idType ID_IPTV_SDS, this element denotes the DVB Textual
Service Identifier of the IP broadcast service, specified in the format
"ServiceName.DomainName" with the ServiceName and DomainName as defined in TS 102 034 V1.3.1
If the Channel has idType ID_IPTV_URI, this element denotes a URI of the IP broadcast service.
This element is only relevant for IPTV broadcasts, as defined in Section 7.5
-->

<!ELEMENT Name (#PCDATA)>
<!-- string: Name of broadcaster, can be used for linking analog channels without CNI. May be
an empty string. -->

<!ELEMENT Favourite EMPTY>
<!-- empty: user has marked this TV channel as favourite -->

<!ATTLIST Favourite FavIDS IDREFS #REQUIRED>
<!-- indicates in which favourite lists this channel is selected, see FavouriteLists -->

<!ELEMENT FavouriteLists (FavouriteList+)>
<!-- collection of more than one favourite lists in OITF -->

<!ELEMENT FavouriteList (FavName)>
<!ATTLIST FavouriteList FavID ID #REQUIRED>
<!-- ID of favourite list, referred to by Channel.Favourite -->

<!ELEMENT FavName (#PCDATA)>
<!-- string: Name of favourite list -->
```

```
<!ELEMENT CurrentFavouriteList EMPTY>
<!ATTLIST CurrentFavouriteList FavID IDREF #REQUIRED>
<!-- currently active FavouriteChannelList, IDREF is one of ID in FavouriteLists, if
CurrentFavouriteList is not given, not favourite
   filter list is currently applied and all channels are 'selected' -->

<!ELEMENT Recordable (#PCDATA)>
<!-- Flag indicating whether the channel can be recorded; only applicable if the OITF indicated
support for control of its recording functionality. Valid values include “True” or “False”. If
this element is not included, the default value is “False”. -->

<!ELEMENT Locked (#PCDATA)>
<!-- Flag indicating whether the current state of the parental control system prevents the
channel from being viewed (e.g. a correct parental control pin has not been entered). Valid
values include “True” or “False”. If this element is not included, the default value is
“False”.-->

<!ELEMENT ManualBlock (#PCDATA)>
<!-- Flag indicating whether the user has manually blocked viewing of this channel.  Manual
blocking of a channel will treat the channel as if its parental rating value always exceeded
the system threshold. Valid values include “True” or “False”. If this element is not included,
the default value is “False”.-->
```

If the favourite lists are not (partially) managed by the OITF, the Client Channel Listing shall neither contain the “`FavouriteLists`” nor the “`CurrentFavouriteList`” element.

7.4.2 Video/broadcast

The OITF SHALL support the `video/broadcast` embedded object with the following properties and methods, which SHALL adhere to the tuner related security requirements in Section 10.1.3.1.

7.4.2.1 Properties

`Integer` **`width`**
The width of the area used for rendering the video object. This property is only writable if property `fullScreen` has value false. Changing the “`width`” property corresponds to changing the “`width`” property through the `HTMLObjectElement` interface, and must have the same effect as changing the width through the DOM Level 2 Style interfaces (i.e. CSS2Properties interface ‘style.width’), at least for values specified in pixels.

`Integer` **`height`**
The height of the area used for rendering the video object. This property is only writable if property `fullScreen` has value false. Changing the “`height`” property corresponds to changing the “`height`” property through the `HTMLObjectElement` interface, and must have the same effect as changing the height through the DOM Level 2 Style interfaces (i.e. CSS2Properties interface ‘style.height’), at least for values specified in pixels

`readonly Boolean` **`fullScreen`**
Returns “`true`” if this video object is in full-screen mode, “`false`” otherwise. The default value is `false`.

`script` **`onChannelChangeError`**
The script function (as defined in [HTML Data Types]) that is called when a request to switch a tuner to another channel resulted in an error preventing the broadcasted content from being rendered. The specified script function is called with the arguments `channelID` and `errorState`. These arguments are defined as follows:

`String channelID` – the identifier of the channel to which a channel switch was requested, but for which the error occurred. Specifies a ccid (as defined by the Channel Object in Section 7.4.1.1.3)

`Number errorState` – error code detailing the type of error:

Value	Decription
0	CCID not supported by tuner
1	cannot tune to given channel (no signal)
2	tuner locked by other object
3	parental lock on channel
4	encrypted channel, key/module missing
5	unknown CCID
6	channel switch interrupted (e.g. because another channel switch was activated before the previous one completed)
7	channel cannot be changed, because it is currently being recorded
100	unidentified error

`script` **`onChannelChangeSucceeded`**

The script function (as defined in [HTML Data Types]) that is called when a request to switch a tuner to another channel has successfully completed. The specified script function is called with argument `channelID`, which is defined as follows:

`String channelID` – the identifier of the channel to which the tuner switched. Specifies a ccid (as defined by the Channel Object in Section 7.4.1.1.3)

`script` **`onFullScreenChange`**

The script function (as defined in [HTML Data Types]) that is called when the value of `fullScreen` changes. The default value is `null`.

`script` **`onfocus`**

The script function (as defined in [HTML Data Types]) that is called when the video object gains focus

`script` **`onblur`**

The script function (as defined in [HTML Data Types]) that is called when the video object loses focus

7.4.2.2 Methods

ChannelConfig **getChannelConfig**()	
Description	Returns the channel line-up of the tuner in the form of a ChannelConfig object as defined in Section 7.4.1.1.1. The method SHALL return the value "null" if the channel list is not (partially) managed by the OITF (i.e., if the channel list information is managed entirely in the network).

void **setChannel**(String channelID, Boolean trickplay)		
Description	Requests the OITF to switch a (logical or physical) tuner to the channel specified by channelID and render the received broadcast content in the area of the browser allocated for the video/broadcast object. If the channelID specifies a ccid which is not supported by the OITF device, the OITF SHALL ignore the request to switch channel and trigger the script function specified by the onChannelChangeError property, specifying the value '0' ("CCID not supported by tuner") for the errorState, and dispatch the corresponding DOM 2 Event (see below). If the channelID specifies a ccid referring to a non-IP channel, the OITF SHALL relay the channel switch request to a local physical tuner that is currently not in use by another video/broadcast object and that can tune to the specified channel. If no tuner satisfying these requirements is available (i.e., all physical tuners that could receive the specified channel are in use), the OITF SHALL ignore the request and trigger the script function specified by the onChannelChangeError property, specifying the value '2' ("tuner locked by other object") for the errorState and dispatch the corresponding DOM 2 Event (see below). If multiple tuners satisfying these requirements are available, the OITF selects one. If, following this procedure, the OITF selects a tuner that was not already being used to display video inside the video/broadcast object, the OITF SHALL claim the selected tuner and the associated resources (e.g., decoding and rendering resources) on behalf of the video/broadcast object until the release() method is called on the video/broadcast object. The OITF SHALL visualize the video content received over the tuner in the area of the browser allocated for the video/broadcast object. If the OITF cannot visualize the video content following a successful tuner switch (e.g., because the channel is under parental lock), the OITF SHALL trigger the script function specified by the onChannelChangeError property with the appropriate channelID and errorState value, and dispatch a corresponding DOM 2 Event (see below). If successful, the OITF SHALL trigger the script function specified by the onChannelChangeSucceeded property with the appropriate channelID value, and also dispatch a corresponding DOM 2 event.	
Arguments	*channelID*	A unique identifier of a channel, e.g. 'ccid:*{tuner.}*majorChannel*{.minorChannel}*'.
	trickplay	Optional flag indicating whether resources SHOULD be allocated to support trick play. This argument provides a hint to the receiver in order that it may allocate appropriate resources. Failure to allocate appropriate resources, due to a resource conflict, a lack of trickplay support, or due to the OITF ignoring this hint, SHALL have no effect on the success or failure of this method. If trickplay is not supported, this SHALL be indicated through the failure of later calls to methods invoking trickplay functionality.

void **setChannelbySourceID**(Integer sourceID, Boolean trickplay)		
Description	Requests the OITF to switch a (logical or physical) tuner to the channel specified by the given ATSC terrestrial source_ID and render the received broadcast content in the area of the browser allocated for the broadcast video object. If the sourceID specifies a channel which is not supported by the OITF device, the OITF SHALL ignore the request to switch channel and trigger the script function specified by the onChannelChangeError property, specifying the value '0' ("CCID not supported by tuner") for the errorState, and dispatch the corresponding DOM 2 Event (see below). The OITF SHALL relay the channel switch request to a local physical tuner that is currently not in use by another broadcast video object and that can tune to the specified channel. If no tuner satisfying these requirements is available (i.e., all physical tuners that could receive the specified channel are in use), the OITF SHALL ignore the request and trigger the script function specified by the onChannelChangeError property, specifying the value '2' ("tuner locked by other object") for the errorState and dispatch the corresponding DOM 2 Event (see below). If multiple tuners satisfying these requirements are available, the OITF selects one. If, following this procedure, the OITF selects a tuner that was not already being used to display video inside the video/broadcast object, the OITF SHALL claim the selected tuner and the associated resources (e.g., decoding and rendering resources) on behalf of the video/broadcast object until the release() method is called on the video/broadcast object. The OITF SHALL visualize the video content received over the tuner in the area of the browser allocated for the video/broadcast object. If the OITF cannot visualize the video content following a successful tuner switch (e.g., because the channel is under parental lock), the OITF SHALL trigger the script function specified by the onChannelChangeError property with the appropriate channelID and errorState value, and dispatch a corresponding DOM 2 Event (see below). If successful, the OITF SHALL trigger the script function specified by the onChannelChangeSucceeded property with the appropriate channelID value, and also dispatch a corresponding DOM 2 event.	
Arguments	*sourceID*	The ATSC terrestrial source_ID of the channel to be set.
	trickplay	Optional flag indicating whether resources SHOULD be allocated to support trick play. This argument provides a hint to the receiver in order that it may allocate appropriate resources. Failure to allocate appropriate resources, due to a resource conflict, a lack of trickplay support, or due to the OITF ignoring this hint, SHALL have no effect on the success or failure of this method. If trickplay is not supported, this SHALL be indicated through the failure of later calls to methods invoking trickplay functionality.

void **setChannelByTriplet**(Integer onid, Integer tsid, Integer sid, Boolean trickplay)	
Description	Requests the OITF to switch a (logical or physical) tuner to the channel specified by the given DVB or ISDB triplet and render the received broadcast content in the area of the browser allocated for the video/broadcast object. If the arguments specify a triplet which is not supported by the OITF device, the OITF SHALL ignore the request to switch channel and trigger the script function specified by the onChannelChangeError property, specifying the value '0' ("CCID not supported by tuner") for the errorState, and dispatch the corresponding DOM 2 Event (see below). If the arguments specify a triplet referring to a non-IP channel, the OITF SHALL relay the channel switch request to a local physical tuner that is currently not in use by another

	video/broadcast object and that can tune to the specified channel. If no tuner satisfying these requirements is available (i.e., all physical tuners that could receive the specified channel are in use), the OITF SHALL ignore the request and trigger the script function specified by the onChannelChangeError property, specifying the value '2' ("tuner locked by other object") for the errorState and dispatch the corresponding DOM 2 Event (see below). If multiple tuners satisfying these requirements are available, the OITF selects one. If, following this procedure, the OITF selects a tuner that was not already being used to display video inside the video/broadcast object, the OITF SHALL claim the selected tuner and the associated resources (e.g., decoding and rendering resources) on behalf of the video/broadcast object until the release() method is called on the video/broadcast object. The OITF SHALL visualize the video content received over the tuner in the area of the browser allocated for the video/broadcast object. If the OITF cannot visualize the video content following a successful tuner switch (e.g., because the channel is under parental lock), the OITF SHALL trigger the script function specified by the onChannelChangeError property with the appropriate channelID and errorState value, and dispatch a corresponding DOM 2 Event (see below). If successful, the OITF SHALL trigger the script function specified by the onChannelChangeSucceeded property with the appropriate channelID value, and also dispatch a corresponding DOM 2 event.	
Arguments	*onid*	The original network ID of the channel to be set.
	tsid	The transport stream ID of the channel to be set. Setting this attribute is optional. If not set (value "null") the client SHALL tune to the channel defined by the combination of onid and sid. This makes it possible to tune to the correct channel also in case a remultiplexing took place which led to a changed tsid.
	sid	The service ID of the channel to be set.
	trickplay	Optional flag indicating whether resources SHOULD be allocated to support trickplay. This argument provides a hint to the receiver in order that it may allocate appropriate resources. Failure to allocate appropriate resources, due to a resource conflict, a lack of trickplay support, or due to the OITF ignoring this hint, SHALL have no effect on the success or failure of this method. If trickplay is not suppored, this SHALL be indicated through the failure of later calls to methods invoking trickplay functionality.

void **prevChannel**()	
Description	Requests the OITF to switch the tuner that is currently in use by the video/broadcast object to the channel that precedes the current channel in the active favourite list, or, if no favourite list is currently selected, to the previous channel in the channel list. If the previous favourite channel is a non-IP channel that cannot be received over the tuner currently used by the broadcast video object, the OITF SHALL relay the channel switch request to a local physical tuner that is not in use and that can tune to the specified channel. The behaviour is defined in more detail in the description of the setChannel method. If an error occurs during switching to the previous channel, the OITF SHALL trigger the script function specified by the onChannelChangeError property with the appropriate channelID and errorState value, and dispatch the corresponding DOM 2 Event (see below). If successful, the OITF SHALL trigger the script function specified by the onChannelChangeSucceeded property with the appropriate channelID value, and also

	dispatch the corresponding DOM 2 event. Note that the actual implementation of this method may differ depending on the deployment of client-side, server-side, or jointly managed channel lists and/or favourite lists.

`void` **`nextChannel`**`()`	
Description	Requests the OITF to switch the tuner that is currently in use by the `video/broadcast` object to the channel that succeeds the current channel in the active favourites list, or, if no favourite list is currently selected, to the next channel in the channel list. If the next favourite channel is a non-IP channel that cannot be received over the tuner currently used by the broadcast video object, the OITF SHALL relay the channel switch request to a local physical tuner that is not in use and that can tune to the specified channel. The behaviour is defined in more detail in the description of the `setChannel` method. If an error occurs during switching to the next channel, the OITF SHALL trigger the script function specified by the `onChannelChangeError` property with the appropriate `channelID` and `errorState` value, and dispatch the corresponding DOM 2 Event (see below). If successful, the OITF SHALL trigger the script function specified by the `onChannelChangeSucceeded` property with the appropriate `channelID` value, and also dispatch the corresponding DOM 2 event. Note that the actual implementation of this method may differ depending on the deployment of client-side, server-side, or jointly managed channels lists and/or favourite lists.

`void` **`setFullScreen`**`( Boolean fullscreen )`		
Description	Sets the rendering of the video content to full-screen (`fullscreen = true`) or windowed (`fullscreen = false`) mode (as per [Req. 5.7.4.f] of [CEA-2014-A]). If this indicates a change in mode, this SHALL result in a change of the value of property `fullScreen`. Changing the mode SHALL not affect the z-index of the video object.	
Arguments	*fullScreen*	Boolean to indicate whether video content SHOULD be rendered full-screen or not.

`Boolean` **`setVolume`**`( Integer volume )`	
Description	Adjusts the volume of the currently playing media to the volume as indicated by volume. Allowed values for the volume argument are all the integer values starting with 0 up to and including 100. A value of 0 means the sound will be muted. A value of 100 means that the volume will become equal to current “master” volume of the device, whereby the “master” volume of the device is the volume currently set for the main audio output mixer of the device. All values between 0 and 100 define a linear increase of the volume as a percentage of the current master volume, whereby the OITF SHALL map it to the closest volume level supported by the platform. The method returns “`true`” if the volume has changed. Returns “`false`” if the volume has not changed. Applications MAY use the `getVolume()` method to retrieve the

	actual volume set.	
Arguments	*volume*	Integer value between 0 up to and including 100 to indicate volume level.

`Integer` **`getVolume`**`()`	
Description	Returns the actual volume level set; for systems that do not support individual volume control of players, this method will have no effect and will always return 100.

`void` **`release`**`()`	
Description	Releases the decoder/tuner used for displaying the video broadcast inside the `video/broadcast` object, stopping any form of visualization of the video inside the `video/broadcast` object and releasing any other associated resources.

7.4.2.3 Events

For the intrinsic events "`onfocus`", "`onblur`", "`onChannelChangeError`", "`onChannelChangeSucceeded`", and "`onFullScreenChange`", corresponding DOM level 2 events SHALL be generated, in the following manner:

Intrinsic event	Corresponding DOM 2 event	DOM 2 Event properties
`onfocus`	`focus` (as specified in Section 1.6.5 of [DOM 2 Events])	Bubbles: No Cancelable: No Context Info: None
`onblur`	`blur` (as specified in Section 1.6.5 of [DOM 2 Events])	Bubbles: No Cancelable: No Context Info: None
`onFullScreenChange`	`fullScreenChange`	Bubbles: No Cancelable: No Context Info: None
`onChannelChangeError`	`channelChangeError`	Bubbles: No Cancelable: No Context Info: `ccid`, `errorState`
`onChannelChangeSucceeded`	`channelChangeSucceeded`	Bubbles: No Cancelable: No Context Info: `ccid`

Note: these DOM 2 events are directly dispatched to the event target, and will not bubble nor capture. Applications SHOULD not rely on receiving these events during the bubbling or the capturing phase. Applications that use DOM 2 event handlers SHALL call the `addEventListener()` method on the `video/broadcast` object itself. The third parameter of `addEventListener`, i.e. "`useCapture`", will be ignored.

7.4.2.4 Styling

The OITF SHALL support the CSS properties (which MAY be changed using the DOM Level 2 Style module) for embedded `video/broadcast` objects: ***width, height, position, float, top, left, right, bottom, vertical-align, padding*** and ***padding-**** properties, ***margin*** and ***margin-**** properties, ***border*** and ***border-**** properties, ***visibility***, and ***display***.

If the value of the <**overlaylocaltuner**>-element in the capability description of the OITF is not set to "none", then the OITF SHALL support overlays as defined by bullet p) of [Req. 5.2.1.a] of CEA-2014-A for broadcasts coming from the local tuner that are displayed using the video/broadcast embedded object. In this case, broadcast video objects SHALL support CSS-property ***z-index***, in both full-screen and windowed mode. Moreover, the OITF SHALL support the CSS ***opacity*** property and CSS3 **RGBA** color values, for any non-video XHTML element on top of a video object. If the value of the <**overlaylocaltuner**>-element in the capability description of the OITF is set to "none", no objects SHALL overlay the video, i.e. the value of z-index for video is ignored.

7.5 Scheduled content over IP

This section SHALL apply to OITFs that have indicated `<video_broadcast>true</video_broadcast>` in their capability profile (as defined in Section 9.3.2) for one of the IPTV-related idTypes as specified in Section 7.5.2.1 for the Channel object (i.e. "ID_IPTV_*", etc.):

7.5.1 Conveyance of channel list

To enable a service to make use of the channel line-up and the favourite lists that MAY be managed by an OITF for IP broadcast channels, the same 2 methods for conveying the channel list as defined in Section 7.4.1 SHALL be supported, whereby the list of constants for the `idType` property of the `Channel` object SHALL include the list of constants as defined below, and the property `ipBroadcastID` SHALL be introduced to uniquely identify an IP broadcast channel.

If an OITF does not manage the channel line-up and/or the favourite list information, the `getChannelList()` method described in section 7.4.1.1 SHALL return `null`, and the HTTP message described in section 7.4.1.2 SHALL be an HTTP GET message with an empty payload.

NOTE: conveyance of the channel list SHALL adhere to the security model requirements as specified in Section 10.1, in particular the tuner related security requirements in Section 10.1.3.1:

7.5.1.1 Channel

7.5.1.1.1 Constants

Name	Value	Use
`ID_IPTV_SDS`	`40`	Used in the idType property to indicate an IP broadcast channel uniquely identified through SD&S by a DVB textual service identifier specified in the format "ServiceName.DomainName" as value for property 'ipBroadcastID', with ServiceName and DomainName as defined in [DVB-IPTV]. This idType SHALL be used to indicate Scheduled content service defined by [PROT][PROT]
`ID_IPTV_URI`	`41`	Used in the idType property to indicate an IP broadcast channel uniquely identified by a URI (e.g. udp://), as value for property 'ipBroadcastID'.

7.5.1.1.2 Properties

readonly String **ipBroadcastID**
If the Channel has idType ID_IPTV_SDS, this element denotes the DVB textual service identifier of the IP broadcast service, specified in the format “ServiceName.DomainName” with the ServiceName and DomainName as defined in [DVB-IPTV]. If the Channel has idType ID_IPTV_URI, this element denotes a URI of the IP broadcast service.

7.5.2 Switching IP broadcast channels

To enable a client to switch to an IP broadcast channel, the following additions are defined on the `video/broadcast` object.

7.5.2.1 video/broadcast

7.5.2.1.1 Properties

The OITF SHALL support the properties for the `video/broadcast` object as defined in Section 7.4.2 whereby the `errorState` argument of an `onChannelChangeError` SHALL permit the additional values 8 and 9, defined as follows, and whereby the `channelID` argument of an `onChannelChangeError` and `onChannelChangeSucceeded` SHALL indicate an `ipBroadcastID`:

script on**ChannelChangeError**
The script function (as defined in [HTML Data Types]) that is called when a request to switch a tuner to another channel resulted in an error preventing the broadcasted content from being rendered. The specified script function is called with the arguments `channelID` and `errorState`. These arguments are defined as follows: `String channelID` – the identifier of the channel to which a channel switch was requested, but for which the error occurred. Specifies an ipBroadcastID (as defined in section 7.5.1.1.2) `Number errorState` – error code detailing the type of error:

Value	Description
0	CCID not supported by tuner
1	cannot tune to given channel (no signal)
2	tuner locked by other object
3	parental lock on channel
4	encrypted channel, key/module missing
5	unknown CCID
6	channel switch interrupted (e.g. because another channel switch was activated before the previous one completed).
7	channel cannot be changed, because it is currently being recorded

8	cannot resolve URI of referenced IP channel
9	insufficient bandwidth
100	unidentified error

`script` **onChannelChangeSucceeded**
The script function (as defined in [HTML Data Types]) that is called when a request to switch a tuner to another channel has successfully completed. The specified script function is called with argument `channelID`, which is defined as follows: `String channelID` – the identifier of the channel to which the tuner switched. Specifies an `ipBroadcastID` (as defined in section 7.5.1.1.2)

7.5.2.1.2 Methods

The OITF SHALL support the methods for the `video/broadcast` object as defined in Section 7.4.2, whereby the `setChannel` method SHALL support an additional optional attribute "`contentAccessDescriptorURL`".

`void` **setChannel**`( String channelID, String contentAccessDescriptorURL, Boolean trickplay )`	
Description	Requests the OITF to switch a (logical or physical) tuner to the channel specified by `channelID` and render the received broadcast content in the area of the browser allocated for the broadcast video object. The attribute `contentAccessDescriptorURL` allows for the optional inclusion of a content-access descriptor (the format of which is defined in Annex E) to provide additional information for dealing with IPTV broadcasts that are (partially) DRM-protected. The descriptor may for example include Marlin action tokens or a previewLicense.The attribute SHALL be given the value "`null`" if it is not applicable. If the `channelID` specifies a ccid which is not supported by the OITF device, the OITF SHALL ignore the request to switch channel and trigger the script function specified by the `onChannelChangeError` property, specifying the value '0' ("CCID not supported by tuner") for the `errorState`, and dispatch the corresponding DOM 2 Event (see below). If the `channelID` specifies a ccid referring to an IP broadcast channel or if the `channelID` specifies an `ipBroadcastID`, the OITF SHALL relay the channel switch request to a logical 'tuner' that can resolve the URI of the referenced IP broadcast channel. If no logical tuner cannot resolve the URI of the referenced IP broadcast channel, the OITF SHALL ignore the channel switch request and SHOULD trigger the script function specified by the `onChannelChangeError` property, specifying the value '8' ("cannot resolve URI of referenced IP channel") for the `errorState`, and dispatch the corresponding DOM 2 Event. If, following this procedure, the OITF selects a tuner that was not already being used to display video inside the `video/broadcast` object, the OITF SHALL claim the selected tuner and the associated resources (e.g., decoding and rendering resources) on behalf of the `video/broadcast` object until the `release()` method is called on the `video/broadcast` object. The OITF SHALL visualize the video content received over the tuner in the area of the browser allocated for the `video/broadcast` object, if necessary claiming the resources

	needed to decode and render the video until the `release()` method is called on the `video/broadcast` object. If the OITF cannot visualize the video content following a successful tuner switch (e.g., because the channel is under parental lock), the OITF SHALL trigger the script function specified by the `onChannelChangeError` property with the appropriate `channelID` and `errorState` value, and dispatch a corresponding DOM 2 Event (see below). If successful, the OITF SHALL trigger the script function specified by the `onChannelChangeSucceeded` property with the appropriate `channelID` value, and also dispatch a corresponding DOM 2 event.	
Arguments	*channelID*	ccid | ipBroadcastID A ccid is a unique identifier of a channel within the scope of the OITF. An *ipBroadcastID* is either the DVB service identifier of an IP broadcast service specified in the format 'ServiceName.DomainName' if the channel has idType ID_IPTV_SDS, or a URI if the channel has idType ID_IPTV_URI.
	contentAccessDescriptorURL	A content-access descriptor (the format of which is defined in Annex E) that can be optionally included to provide additional information for dealing with IPTV broadcasts that are (partially) DRM-protected. The value "`null`" SHALL be used if the attribute is not applicable.
	trickplay	Optional flag indicating whether resources SHOULD be allocated to support trick play. This argument provides a hint to the receiver in order that it may allocate appropriate resources. Failure to allocated appropriate resources, due to a resource conflict, a lack of trickplay support, or due to the OITF ignoring this hint, SHALL have no effect on the success or failure of this method. If trickplay is not suppored, this SHALL be indicated through the failure of later calls to methods invoking trickplay functionality.

`void` **`setChannelByTriplet`**`( Integer onid, Integer tsid, Integer sid, String contentAccessDescriptorURL, Boolean trickplay )`	
Description	Requests the OITF to switch a (logical or physical) tuner to the channel specified by the given DVB or ISDB triplet and render the received broadcast content in the area of the browser allocated for the broadcast video object. The attribute `contentAccessDescriptorURL` allows for the optional inclusion of a content-access descriptor (the format of which is defined in Section 7.1) to provide additional information for dealing with IPTV broadcasts that are (partially) DRM-protected. The descriptor may for example include Marlin action tokens or a previewLicense.The attribute SHALL be given the value "`null`" if it is not applicable. If the arguments specify a triplet which is not supported by the OITF device, the OITF SHALL ignore the request to switch channel and trigger the script function specified by the `onChannelChangeError` property, specifying the value '0' ("CCID not supported by tuner") for the `errorState`, and dispatch the corresponding DOM 2 Event (see below). If the arguments specify a triplet referring to an IP broadcast channel, the OITF SHALL relay the channel switch request to a logical 'tuner' that can resolve the URI of the referenced IP broadcast channel. If no logical tuner cannot resolve the URI of the referenced IP broadcast channel, the OITF SHALL ignore the channel switch request and

	SHOULD trigger the script function specified by the `onChannelChangeError` property, specifying the value '8' ("cannot resolve URI of referenced IP channel") for the `errorState`, and dispatch the corresponding DOM 2 Event. If, following this procedure, the OITF selects a tuner that was not already being used to display video inside the `video/broadcast` object, the OITF SHALL claim the selected tuner and the associated resources (e.g., decoding and rendering resources) on behalf of the `video/broadcast` object until the `release()` method is called on the `video/broadcast` object. The OITF SHALL visualize the video content received over the tuner in the area of the browser allocated for the `video/broadcast` object. If the OITF cannot visualize the video content following a successful tuner switch (e.g., because the channel is under parental lock), the OITF SHALL trigger the script function specified by the `onChannelChangeError` property with the appropriate `channelID` and `errorState` value, and dispatch a corresponding DOM 2 Event (see below). If successful, the OITF SHALL trigger the script function specified by the `onChannelChangeSucceeded` property with the appropriate `channelID` value, and also dispatch a corresponding DOM 2 event.	
Arguments	*onid*	The original network ID of the channel to be set.
	tsid	The transport stream ID of the channel to be set. Setting this attribute is optional. If not set (value "`null`") the client SHALL tune to the channel defined by the combination of `onid` and `sid`. This makes it possible to tune to the correct channel also in case a remultiplexing took place which led to a changed tsid.
	sid	The service ID of the channel to be set.
	contentAccessDescriptorURL	A content-access descriptor (the format of which is defined in Section 7.1) that can be optionally included to provide additional information for dealing with IPTV broadcasts that are (partially) DRM-protected. The value "`null`" SHALL be used if the attribute is not applicable.
	trickplay	Optional flag indicating whether resources should be allocated to support trick play.

7.5.2.1.3 Events

The OITF SHALL support the DOM 2 Events for the `video/broadcast` object as defined in Section 7.4.2.

7.5.2.1.4 Styling

The OITF SHALL support the CSS properties for the `video/broadcast` object as defined in Section 7.4.2.

If the value of the **<overlayIPbroadcast>**-element in the capability description of the OITF is not set to "none", then the OITF SHALL support overlays as defined by bullet p) of [Req. 5.2.1.a] of CEA-2014-A for IP broadcasts that are displayed using the video/broadcast embedded object. In this case, broadcast video objects SHALL support CSS-property ***z-index***, in both full-screen and windowed mode. Moreover, the OITF SHALL support the CSS ***opacity*** property and CSS3 ***RGBA*** color values, for any non-video XHTML element on top of a video object. If the value of the **<overlayIPbroadcast>**-element in the capability description of the OITF is set to "none", no objects SHALL overlay the video, i.e. the value of z-index for video is ignored.

7.6 PVR control

This section describes the APIs needed to support control by a DAE application of the recording (PVR) functionality available to an OITF, including time-shift support, scheduled recording and storage of basic metadata about recorded items.

7.6.1 Conveyance of channel list and list of scheduled recordings

This section and the following sections SHALL apply to OITFs that have indicated <record>true</record> as defined in Section 9.3.3 in their capability profile.

To enable a service to schedule recordings of content that is to be broadcasted on specific channels, the OITF needs to convey the channel list information that is managed by the native code on the OITF. This information typically includes the channel line-up of the tuner of a hybrid device. The API supports two methods of conveying the channel list information to a service:

1) The OITF SHALL support method "`getChannelConfig`" as defined in Section 7.4.1.1 for the `application/oipfRecordingScheduler` object, as defined in Section 7.6.2.

2) If a server has indicated that it requires control of the recording functionality available to an OITF (i.e. `<recording>true</recording>` in the server capability description) for a particular service, then the OITF SHOULD issue an HTTP POST over TLS if it decides to connect to that service. The body of the HTTP POST over TLS SHALL contain the Client Channel Listing (as defined in Section 7.4.1.2).

   If a server has indicated that it requires control of both the tuner functionality and the recording functionality available to an OITF, the body of the HTTP POST SHALL contain a single instance of the Client Channel Listing whereby the `<Recordable>` element defined in Section 7.4.1.1 SHALL be used to indicate whether channels that can be received by the tuner of the OITF,can be recorded or not.

   If a server that requires control of the recording functionality uses the channel list information sent through an HTTP POST in its application(s), the server SHALL indicate the support of this service for posted channel list information using the postList attribute specified in Section 9.3.3 (i.e., `<recording postList="true">true</recording>`)

In addition, the OITF SHALL also support method '`getScheduledRecordings`' as defined in Section 7.6.2. This method returns a `ScheduledRecordingCollection` object, which is defined below.

Note that the conveyance of the channel listing and the scheduled recordings is subject to the security model requirements specified in Section 10.1, and in particular the recording related security requirements in Section 10.1.3.2.

7.6.1.1 ScheduledRecordingCollection

The `ScheduledRecordingCollection` object represents a read-only list of scheduled recordings in the system, i.e. recordings that are scheduled but which have not yet started. Items in the collection may be accessed using array notation. Note: Where a series is being recorded, every recorded episode will exist as an independent entry. Only the scheduled episode will carry the `isSeries` property.

7.6.1.1.1 Properties

`readonly Integer` **`length`**
The number of items in the collection

7.6.1.1.2 Methods

ScheduledRecording **item**(Integer index)		
Description	Return the item at position index in the list, or undefined if no item is present at that position. The position can also be specified using array bracket notation instead of calling this method directly.	
Arguments	*index*	The index of the item to be retrieved

7.6.1.2 ScheduledRecording

The `ScheduledRecording` object represents a scheduled programme in the system, i.e. a recording that is scheduled but which has not yet started.

7.6.1.2.1 Constants

Name	Value	Use
ID_TVA_CRID	0	Used in the programmeIDType property to indicate that the programme is identified by its TV-Anytime CRID (Content Reference Identifier).
ID_DVB_EVENT	1	Used in the `programmeIDType` property to indicate that the programme is identified by a DVB URL referencing a DVB-SI event as enabled by section 4.1.3 of [META]. OPTIONAL.

7.6.1.2.2 Properties

readonly Integer **startPadding**
The amount of padding to add at the start of a scheduled recording, in seconds. If the value of this property is undefined, the default start padding will be used.

readonly Integer **endPadding**
The amount of padding to add at the end of a scheduled recording, in seconds. If the value of this property is undefined, the default end padding will be used.

readonly Integer **repeatDays**
Bitfield indicating which days of the week the recording SHOULD be repeated. Values are as follows:

Day	Bitfield Value
Sunday	0x01 (i.e. 00000001)

Monday	0x02 (i.e. 00000010)
Tuesday	0x04 (i.e. 00000100)
Wednesday	0x08 (i.e. 00001000)
Thursday	0x10 (i.e. 00010000)
Friday	0x20 (i.e. 00100000)
Saturday	0x40 (i.e. 01000000)

These bitfield values can be ‘AND’-ed together to repeat a recording on more than one day of a week (e.g. weekdays)

A value of 0x00 indicates that the recording will not be repeated.

`readonly String` **name**

The short name of the scheduled recording, e.g. 'Star Trek: DS9'.

`readonly String` **longName**

The long name of the scheduled recording, e.g. 'Star Trek: Deep Space Nine'. If the long name is not available, this property will be undefined.

`readonly String` **description**

The description of the scheduled recording, e.g. an episode synopsis. If no description is available, this property will be undefined.

`readonly String` **longDescription**

The long description of the programme.

`readonly Integer` **startTime**

The start time of the scheduled recording, measured in seconds since midnight (GMT) on 1/1/1970.

`readonly Integer` **duration**

The duration of the scheduled recording (in seconds).

`readonly Channel` **channel**

Reference to the broadcast channel where the scheduled programme is available.

`readonly Boolean` **`isSeries`**

If true, then when a subsequent episode of a programme becomes available it SHOULD be added to the recording list automatically.

Note: Where several episodes of a season are available, then only the latest scheduled recording will carry the `isSeries` flag.

`readonly String` **`programmeID`**

The unique identifier of the scheduled programme or series, e.g., a TV-Anytime CRID (Content Reference Identifier).

`readonly Integer` **`programmeIDType`**

The type of identification used to reference the programme, as indicated by one of the ID_* constants defined above.

`readonly Integer` **`episode`**

The episode number for the programme if it is part of a series. This property is undefined when the programme is not part of a series or the information is not available.

`readonly Integer` **`totalEpisodes`**

If the programme is part of a series, the total number of episodes in the series. This property is undefined when the programme is not part of a series or the information is not available.

`readonly ParentalRatingCollection` **`parentalRating`**

A collection of parental rating values for the programme for zero or more parental rating schemes supported by the OITF. The initial value of this property (upon creation of the `Programme` object) is an instance of the `ParentalRatingCollection` object (as defined in Section 7.14.2) with length 0. Parental rating values can be added to this empty readonly parental rating collection by using the `add()` method of the `ParentalRatingCollection` object. The `ParentalRatingCollection` is defined in Section 7.14.2. The related `ParentalRating` and `ParentalRatingScheme` objects are defined in Section 7.14.1 and 7.14.3 respectively.

Note that if the service provider specifies a certain parental rating (e.g. PG-13) through this property and in the broadcast channel it has metadata that says that the content is rated PG-16, then the conflict resolution is implementation dependent.

7.6.2 Scheduling a recording

If an OITF has indicated support for the control of its recording (PVR) functionality by a server by stating <recording>true</recording> as defined in Section 9.3.3 in its capability description, the OITF SHALL support the scheduling of recordings of broadcasts through the use of the following non-visual embedded object:

```
<object type="application/oipfRecordingScheduler"/>
```

Note that an OITF which has indicated support for the control of its recording (PVR) functionality by a server (i.e., <recording>true</recording>) SHALL adhere to the security model as specified in Section 10.1

7.6.2.1 application/oipfRecordingScheduler

7.6.2.1.1 Methods

ScheduledRecording **record**(Programme programme)		
Description	Requests the scheduler to schedule the recording of the programme identified by the programmeID property of the programme. The other data contained in the programme object is used solely for annotation of the (scheduled) recording. If such programme metadata is provided, it is retained in the ScheduledRecording object that is returned if the recording of the programme was scheduled successfully, reflecting the possibility that not all relevant metadata might be available to the scheduler. If the recording could not be scheduled due to a scheduling conflict or lack of resources the value "null" is returned. Note that the actual implementation of this method should enable the scheduler to identify the domain of the service that issues the scheduling request in order to support future retrieval of the scheduled recording through the getScheduledRecordings() method.	
Arguments	*programme*	The programme to be recorded, identified by its programmeID.

ScheduledRecording **recordAt**(Integer startTime, Integer duration, Integer repeatDays, String channelID)		
Description	Requests the scheduler to schedule the recording of the broadcast to be received over the channel identified by channelID, starting at startTime and continuing for duration minutes. If the recording was scheduled successfully, the resulting ScheduledRecording object is returned. If the recording could not be scheduled due to a scheduling conflict or lack of resources the value "null" is returned. Note that the actual implementation of this method should enable the scheduler to identify the domain of the service that issues the scheduling request in order to support future retrieval of the scheduled recording through the getScheduledRecordings() method.	
Arguments	*startTime*	The start of the time period of the recording measured in seconds since midnight (GMT) on 1/1/1970.
	duration	The duration of the recording in seconds.
	repeatDays	Bitfield indicating which days of the week the recording SHOULD be repeated. Values are as follows:

Day	Bitfield Value
Sunday	0x01 (i.e. 00000001)
Monday	0x02 (i.e. 00000010)

		<table><tr><td>Tuesday</td><td>0x04 (i.e. 00000100)</td></tr><tr><td>Wednesday</td><td>0x08 (i.e. 00001000)</td></tr><tr><td>Thursday</td><td>0x10 (i.e. 00010000)</td></tr><tr><td>Friday</td><td>0x20 (i.e. 00100000)</td></tr><tr><td>Saturday</td><td>0x40 (i.e. 01000000)</td></tr></table> These bitfield values can be 'AND'-ed together to repeat a recording on more than one day of a week (e.g. weekdays) A value of 0x00 indicates that the recording will not be repeated.
	channelID	The identifier of the channel from which the broadcasted content is to be recorded. Specifies either a ccid or ipBroadcastID (as defined by the Channel Object in Section 7.4.1.1.3)

`ScheduledRecordingCollection` **`getScheduledRecordings`**`()`	
Description	Returns a subset of all the recordings that are scheduled but which have not yet started. The subset SHALL include only scheduled recordings that were scheduled using a service from the same FQDN as the domain of the service that calls the method.

`ChannelConfig` **`getChannelConfig()`**	
Description	Returns the channel line-up of the tuner in the form of a `ChannelConfig` object as defined in Section.7.4.1.1.1. Includes the favourite lists.

`void` **`remove`**`(ScheduledRecording recording )`		
Description	Removes a scheduled recording. As with the record method, only the programmeID property of the scheduled recording SHALL be used to identify the scheduled recording to remove. The other data contained in the scheduled recording SHALL NOT used when removing a scheduled recording.	
Arguments	*Recording*	The scheduled recording to be removed.

`Programme` **`createProgrammeObject`**`()`	
Description	Factory method to create an instance of `Programme`

7.6.2.2 Programme

The `Programme` data object used in the `record()` method of the `application/oipfRecordingScheduler` object represents an entry in a programme schedule, and is defined as follows:

Note: as described in the `record()` method of the `application/oipfRecordingScheduler` object, only the `programmeID` property of the programme object is used to determine the programme or series that will be recorded.

The other properties are solely used for annotation of the (scheduled) recording with programme metadata. The use of these metadata properties is optional. If such programme metadata is provided, it is retained in the `ScheduledRecording` object that is returned if the recording of the programme was scheduled successfully.

7.6.2.2.1 Constants

Name	Value	Use
ID_TVA_CRID	0	Used in the programmeIDType property to indicate that the programme is identified by its TV-Anytime CRID (Content Reference Identifier).
ID_DVB_EVENT	1	Used in the programmeIDType property to indicate that the programme is identified by a DVB URL referencing a DVB-SI event as enabled by section 4.1.3 of [META]. OPTIONAL.

7.6.2.2.2 Properties

`String` **name**
The short name of the programme, e.g. 'Star Trek: DS9'.

`String` **longName**
The long name of the programme, e.g. 'Star Trek: Deep Space Nine'. If the long name is not available, this property will be undefined.

`String` **description**
The description of the programme, e.g. an episode synopsis. If no description is available, this property will be undefined.

`String` **longDescription**
The long description of the programme

`Integer` **startTime**
The start time of the programme, measured in seconds since midnight (GMT) on 1/1/1970.

`Integer` **duration**
The duration of the programme (in seconds).

String **channelID**
The identifier of the channel from which the broadcasted content is to be recorded. Specifies either a ccid or ipBroadcastID (as defined by the Channel Object in Section 7.4.1.1.3)

Integer **episode**
The episode number for the programme if it is part of a series. This property is undefined when the programme is not part of a series or the information is not available.

Integer **totalEpisodes**
If the programme is part of a series, the total number of episodes in the series. This property is undefined when the programme is not part of a series or the information is not available.

String **programmeID**
The unique identifier of the programme or series, e.g., a TV-Anytime CRID (Content Reference Identifier).

Integer **programmeIDType**
The type of identification used to reference the programme, as indicated by one of the ID_* constants defined above.

readonly ParentalRatingCollection **parentalRating**
A collection of parental rating values for the programme for zero or more parental rating schemes supported by the OITF. The initial value of this property (upon creation of the Programme object) is an instance of the ParentalRatingCollection object (as defined in Section 7.14.2) with length 0. Parental rating values can be added to this empty readonly parental rating collection by using the addParentalRating()-method of the ParentalRatingCollection object. The ParentalRatingCollection is defined in Section 7.14.2. The related ParentalRating and ParentalRatingScheme objects are defined in Section 7.14.1 and 7.14.3 respectively. Note that if the service provider specifies a certain parental rating (e.g. PG-13) through this property and the actual parental rating extracted from the the stream says that the content is rated PG-16, then the conflict resolution is implementation dependent.

7.6.3 Recording and time-shifting the current broadcast

To start a recording of a current broadcast, an OITF SHALL support the following additional constants and methods on the video/broadcast object, if the OITF has indicated support for record functionality. Note that this functionality is subject to the security model as specified in Section 10.1:

7.6.3.1 Additional constants for video/broadcast object

Name	Value	Use
POSITION_START	0	Indicates a playback position relative to the start of the buffered content.
POSITION_CURRENT	1	Indicates a playback position relative to the current playback position.
POSITION_END	2	Indicates a playback position relative to the end of the buffered content.

7.6.3.2 Additional properties for video/broadcast object

readonly Integer **playbackOffset**
Returns the playback position, specified as the positive offset of the live broadcast in seconds, in the currently rendered (timeshifted) broadcast.

readonly Integer **maxOffset**
Returns the maximum playback offset, in seconds of the live broadcast, which is supported for the currently rendered (timeshifted) broadcast. If the maximum offset is unknown, the value of this property SHALL be undefined.

7.6.3.3 Additional methods for video/broadcast object:

Integer **recordNow**(Integer duration, String ccid)		
Description	Starts recording the broadcast currently rendered in the `video/broadcast` object. If the OITF has buffered the broadcasted content, the recording starts from the current playback position in the buffer. The specified duration is used by the OITF to determine the minimum duration of the recording in seconds from the current starting point. If `recordNow()` is called while the broadcast that is currently rendered in the `video/broadcast` object is already being recorded, the minimum duration of this ongoing recording is extended by duration seconds. Returns 0 if the recording started successfully, and a value > 0 if it fails (e.g. due to resource conflicts or lack of resources). If the OITF provides recording management functionality through the APIs defined in section 7.11.2, the resulting recording is made available to JavaScript via the `Recording` object defined in section 7.11.2.3. If the OITF supports metadata processing in the terminal, the fields of the resulting `Recording` object MAY be populated using metadata retrieved by the terminal. Otherwise, the values of these fields SHALL be implementation-dependent	
Arguments	*duration*	The minimum duration of the recording in seconds. A value of -1 indicates that the recording SHOULD continue until `stopRecording()` is called, storage space is exhausted, or an error occurs. In this case it is essential that

		`stopRecording()` is called later.
	ccid	The ccid of the channel to be recorded. A value of `null` indicates that the current channel should be recorded. This is an optional parameter. If the value specified does not refer to the current channel and the application does not have permission to record other channels (see section 10.1.3.4), this method SHALL fail.

`void` **`stopRecording`**`()`	
Description	Stops the current recording started by `recordNow`.

`Boolean` **`pause`**`()`	
Description	If recording has not yet been started, this method will start recording the broadcast that is currently being rendered live (i.e., not time-shifted) in the `video/broadcast` object. If the OITF has buffered the 'live' broadcasted content, the recording starts with the content that is currently being rendering in the `video/broadcast` object. If the recording started successfully, the rendering of the broadcasted content is paused, i.e. a still-image video frame is shown. If the `video/broadcast` object is currently rendering a time-shifted broadcast channel, playback of that time-shifted broadcast is paused. The value "`true`" is returned if the live or time-shifted broadcast was paused successfully, and "`false`" is returned if the request to pause the broadcast failed (e.g. due to a resource conflict or lack of resources).

`Boolean` **`resume`**`()`	
Description	Resumes playback of the time-shifted broadcast channel that is currently being rendered in the video/broadcast object at the speed specified by `setSpeed()`. If the desired speed was not set via `setSpeed`, playback is resumed at normal speed (i.e. speed 1.0). If the `video/broadcast` object is currently not rendering a time-shifted channel, the OITF shall ignore the request to start playback and shall return "`false`". If playback cannot be resumed the OITF shall also return "`false`", otherwise "`true`" is returned.

`Number` **`setSpeed`**`( Number speed )`	
Description	Sets the playback speed of the time-shifted broadcast to the value speed, without changing the paused/resumed state of the time-shifted broadcast. If the playback reaches the end of the time-shift buffer as a result of fastforwarding, the playback speed will be set to normal speed (i.e. speed 1.0) and playback will continue with live content. If during rewinding the playback has reaches the point that it cannot be rewound further, it will start playback of the content at normal speed. If the time-shifted broadcast cannot be played at the desired speed, specified as a value relative to the normal playback speed, the playback speed will be set to the best approximation of speed. Returns the actual playback speed specified as a float value relative to the normal playback. If the `video/broadcast` object is currently not rendering a time-shifted channel,

	the OITF shall ignore the request to resume playback and shall return the value '1.0'.	
Arguments	*speed*	The desired relative playback speed, specified as a float value relative to the normal playback speed of 1.0. A negative value indicates reverse playback. If the time-shifted broadcast cannot be played at the desired speed, the playback speed will be set to the best approximation.

`Boolean` **`seek`**`( Integer offset, Integer reference )`		
Description	Sets the playback position of the time-shifted broadcast that is being rendered in the `video/broadcast` object to the position specified by the offset and the reference point as specified by one of the constants defined at the beginning of Section 7.6.3. Playback of live content is resumed if the new position equals the end of the time-shift buffer. Returns "`true`" if the playback position was successfully set to the desired position, returns "`false`" in all other cases. If the `video/broadcast` object is currently not rendering a time-shifted channel or if the position falls outside the time-shift buffer, the OITF shall ignore the request to seek and shall return the value "`false`".	
Arguments	offset	The offset from the reference position, in seconds. This can be either a positive or negative value.
	reference	The reference point from which the offset SHALL be measured. The reference point can be either `POSITION_CURRENT`, `POSITION_START`, or `POSITION_END`.

`Boolean` **`stopTimeshift`**`()`	
Description	Stops recording the broadcast that is currently being rendered in time-shifted mode in the `video/broadcast` object and, if applicable, plays the current broadcast from the live point and stops time-shifting the broadcast. The OITF SHALL release all resources that were used to support time-shifted rendering of the broadcast Returns "`true`" if the time-shifted broadcast was successfully stopped and resources were released and "`false`" otherwise. If the `video/broadcast` object is currently not rendering a time-shifted channel, the OITF shall ignore the request to stop the time-shift and shall return the value "`false`".

In addition to these methods, the OITF SHALL support the `setChannel` method on the `video/broadcast` object defined in Section 7.5.2.1 with additional support for the optional attribute "`offSet`".

`void` **`setChannel`**`( String channelID, String contentAccessDescriptorURL, Boolean trickplay, Integer offSet )`	
Description	Requests the OITF to switch a (logical or physical) tuner to the channel specified by `channelID` and render the received broadcast content in the area of the browser allocated for the `video/brodcast` object, as specified by the `setChannel()` method in Section 7.5.2.1.2. The additional `offSet` attribute optionally specifies the desired offset w.r.t. the live broadcast in number of seconds from which the OITF SHOULD start playback immediately after the channel switch (whereby `offSet` is given as a positive value for seeking to a time in the past). If an OITF cannot start playback from the desired position, as indicated by the specified `offSet` (e.g. because the OITF did not, or could not, record the specified channel prior to the call to `setChannel`), if the specified `offSet` is '0', or if the `offSet` is not

	specified, the OITF SHALL start playback from the live position after the specified channel switch.	
Arguments	*channelID*	As defined in Section 7.5.2.1.2.
	contentAccessDescriptorURL	As defined in Section 7.5.2.1.2.
	trickplay	Optional flag indicating whether resources SHOULD be allocated to support trick play. This argument provides a hint to the receiver in order that it may allocate appropriate resources. Failure to allocate appropriate resources, due to a resource conflict, a lack of trickplay support, or due to the OITF ignoring this hint, SHALL have no effect on the success or failure of this method. If trickplay is not supported, this SHALL be indicated through the failure of later calls to methods invoking trickplay functionality.
	offSet	The optional offSet attribute MAY be used to specify the desired offset w.r.t. the live broadcast in number of seconds from which the OITF SHOULD start playback immediately after the channel switch (whereby offSet is given as a positive value for seeking to a time in the past).

7.6.4 Overview of recordings

A PVR typically has its own user interface to provide control over the PVR and provide a consistent aggregated overview of all finished and ongoing recordings. If a (third-party) service provider wants to offer the user such an overview as part of its UI, an embedded object needs to be defined. However, accessing the recording (status) overview through a Javascript API would be highly privacy and security sensitive. The `application/oipfStatusView` embedded object defined in Section 7.1.4 allows a visualization of the PVR status to be included as part of the UI coming from a (third party) server, without the need for any security model, and without compromising security and privacy.

An OITF that has indicated support for control of its recording functionality by a server (i.e., `<record>true</record>`) SHALL support the `application/oipfStatusView` embedded object defined in Section 7.1.2, for which it SHALL at least support the monitor state “list_of_recorded_content”.

NOTE: this object is is intented to allow services to link in to highly privileged functionality, without the need for certificates and privileged access requests. In certain managed network deployments this may not be sufficient. Therefore, in the managed network APIs in Section 7.11 more extensive APIs are given which provide Javascript control for a service platform provider over such highly privileged functionality.

7.7 Media playback API extensions

This section SHALL apply to OITFs that have indicated support for the AV Plugin object and/or the `video/broadcast` object in their capability profile, using the semantics described in [CEA-2014-A] and Section 9.3.

This section specifies several extensions to the audio object and the video object defined in Section 5.7.1 of [CEA-2014-A] and the `video/broadcast` object defined in Section 7.4.2, It also contains a subsection (i.e Section 7.7.3) that defines the audio playback from memory API.

7.7.1 Properties related to A/V playback

The following additional properties SHALL be supported on the audio object and video object defined in Section 5.7.1 of [CEA-2014-A] and the `video/broadcast` object defined in Section 7.4.2.

readonly Number **playPosition**
Returns the play position in number of milliseconds since the beginning of the referenced media as denoted by the server (i.e. in relation to NPT 0.0 as described in Section 3.6 of [RFC2326]) or undefined if the play position cannot be determined. Note: This does not replace the definition of the playPosition property defined in [Req. 5.7.1.f] of [CEA-2014-A], but because the media playback extensions in this section apply to both the CEA-2014 audio and video object as well as the `video/broadcast` object, it extends the `playPosition` property to the `video/broadcast` object.

readonly Number **playSpeeds**[ ]
Returns the ordered list of playback speeds, expressed as values relative to the normal playback speed (1.0), at which the currently specified A/V content can be played (either through an CEA-2014 audio or video object, respectively as a time-shifted broadcast in the `video/broadcast` object), or undefined if the supported playback speeds are not (yet) known. Note that the latter may happen at the start of playback of a video when the speeds supported by the server are not yet known.

7.7.2 Playback of selected A/V components

To support the selection of specific A/V components for playback (e.g. a specific subtitle language, audio language, different camera angle), the following methods SHALL be supported on the audio object and video object defined in Section 5.7.1 of [CEA-2014-A], and the `video/broadcast` object as defined in Section 7.4.2 of this document.

NOTE: The term component may correspond to MPEG_2 components, but is not restricted to that

7.7.2.1 Media playback extension to the audio, video and video/broadcast objects

7.7.2.1.1 Constants

Name	Value	Use
COMPONENT_TYPE_VIDEO	0	Represents a video component. This constant is used for all video components regardless of encoding.
COMPONENT_TYPE_AUDIO	1	Represents an audio component. This constant is used for all audio components regardless of encoding.
COMPONENT_TYPE_SUBTITLE	2	Represents a subtitle component. This constant is used for all subtitle components regardless of subtitle format. NOTE: A subtitle component may also be related to closed captioning as part of a video stream.

7.7.2.1.2 Methods

AVComponent[] **getComponents**(Integer componentType)	
Description	Returns a collection of AVComponent values representing the components of the specified type in the current stream.

	One or more of the components returned MAY be passed back to one of the other methods unchanged (e.g. `selectComponent()`).	
Argument	*componentType*	The type of component to be returned , as represented by one of the constant values listed in section 7.7.2.1.1

`AVComponent[] getCurrentActiveComponents( Integer componentType )`		
Description	Returns a collection of AVComponent values representing the currently active components of the specified type that are being rendered. One or more of the components returned MAY be passed back to one of the other methods unchanged (e.g. selectComponent()).	
Argument	*componentType*	The type of currently active component to be returned. represented by one of the constant values listed in section 7.7.2.1.1

`void selectComponent( AVComponent component )`		
Description	Select the component that will be subsequently rendered after calling the `play()` method on the CEA-2014-A A/V object or the `setChannel()` method on the `video/broadcast` object, or select the component for rendering if A/V playback has already started. If playback has started, this SHALL replace any other components of the same type that are currently playing.	
Argument	*component*	A component object available in the stream currently being played.

`void unselectComponent( AVComponent component )`		
Description	Stop rendering of the specified component of the stream.	
Argument	*component*	The component to be stopped

7.7.2.2 AVComponent

`AVComponent` represents a component within a complete media stream - a single stream of video, audio or data that can be played or manipulated. This is not necessary for basic playback, record or EPG services. However, it provides a mechanism to get at extended streams for enhanced services.

7.7.2.2.1 Properties

`readonly Integer type`
Type of the component stream. Valid values for this field are given by the constants listed in section 7.7.2.1.1

`readonly String encoding`

The encoding of the stream. The value of video format or audio format defined in section 3 of [MEDIA][MEDIA] SHALL be used.

readonly Boolean **encrypted**
Flag indicating whether the component is encrypted or not.

readonly Number **aspectRatio**
For components of type “video”, indicates the aspect ratio of the video or undefined if the aspect ratio is not known. Values SHALL be equal to width divided by height, rounded to a float value with two decimals, e.g. 1.78 to indicate 16:9 and 1.33 to indicate 4:3

readonly String **language**
For components of type “audio” or type “subtitle”, An ISO 639 language code representing the language of the stream.

readonly Boolean **audioDescription**
For components of type “audio”, has value true if the stream contains an audio description intended for people with a visual impairment, false otherwise.

readonly Integer **audioChannels**
For components of type “audio”, indicates the number of channels present in this stream (e.g. 2 for stereo, 5 for 5.1, 7 for 7.1).

readonly Boolean **hearingImpaired**
For components of type “subtitle”, has value true if the stream is intended for the hearing-impaired (e.g. contains a written description of the sound effects), false otherwise.

7.7.3 Playback of memory audio

This section describes specific usage of A/V media object corresponding to memory audio

7.7.3.1 Usage of CE-HTML tags

An <object> element which corresponds to a memory audio SHALL apply following restrictions:

1) The “type” attribute SHALL be included to define the MIME-type that matches the memory audio referred to by the value of the “data” attribute. The MIME-types for the memory audio SHALL adhere to Section 8.2.1 of [MEDIA][MEDIA].

2) The file extensions that SHALL be used for the memory audio are:

   - “.aac” for **HE-AAC** memory audio

- ".wav" for **WAVE** memory audio

3) Only in the case of HE-AAC memory audio, an <object>-element MAY contain a <param>-element to set the "loop" parameter. This parameter indicates the number of times the HE-AAC memory audio will play. The value SHALL be positive integers or "Infinite", which will play the memory audio continuously until stop() is called or the data-attribute is set to null. The default value of this parameter is "1".

To give DAE a hint to pre-fetch memory audio from the server when the CE-HTML document is loaded, <link>-element MAY be used whereby:

1) The "rel" attribute SHALL be set to a value "prefetch" and the "href" attribute SHALL be set to the URL of the memory audio which is expected to be pre-fetched.

7.7.3.2 Usage of DOM interface

The <object>-element as defined in Section 7.7.3.1 of this document SHALL be made accessible through the Javascript A/V media object specified in [CEA-2014-A], in the following manner:

1) Following attributes SHALL be supported: data, playState, error and onPlayStateChange, as defined in Req. 5.7.1.f of [CEA-2014-A].

2) Following methods SHALL be supported: play() and stop(), as defined in Req. 5.7.1.f of [CEA-2014-A]

The <param>-element as defined in Section 7.7.3.1 of this document SHALL be made accessible through the HTMLParamElement.

7.7.3.3 DAE requirements

If the "data" attribute of the <object>-element for memory audio is set to a valid value and "type" attribute of the <object>-element indicates the format being HE-AAC, DAE SHALL play the memory audio, as specified in below 1)-3).

If the "data" attribute of the <object>-element for memory audio is set to a valid value and "type" attribute of the <object>-element indicates the format being WAVE, DAE MAY play the memory audio, as specified in below 1)-3).

1) When the "play()" method is called by script, it SHALL start the playback of the memory audio designated by the "data" attribute.

2) When the "stop()" method is called or "data" attribute is set to null by script, OITF SHALL stop the playback of the memory audio which had previously played.

If the "rel" attribute of the <link>-element is set to a value "prefetch", the OITF MAY pre-fetch the memory audio referred by the "href" attribute of the <link>-element, when the CE-HTML page is loaded to the OITF.

An HE-AAC memory audio need not to be played simultaneously with other HE-AAC memory audio or Streamed A/V contents defined in Section 5.7.1 of [CEA-2014-A].

7.7.3.4 Example usage (Informative)

The following CE-HTML page shows an example of a script to start the playback of memory audio:

```
<head>
 :
<script type="text/javascript">
     function startBGM() {
         document.getElementById("aid1").play(1);
     }
     :
</script>
</head>
<body>
<object type="audio/mp4" id="aid1" data="http://www.avsource.com/audio/bgm.aac">
<param name="loop" value="infinite"/>
</object>
 :
<div id="btn1" onclick="JavaScript:startBGM()"><img src="start1.gif" /></div>
 :
</body>
```

The following CE-HTML page shows an example of a script to stop the playback of memory audio:

```
<head>
  :
<script type=”text/javascript”>
     function stopBGM() {
         document.getElementById(“aid1”).stop();
     }
  :
</script>
</head>
<body>
<object type="audio/mp4" id="aid1" data="http://www.avsource.com/audio/bgm.aac">
<param name=”loop” value=”infinite”/>
</object>
 :
<div id=”btn2” onclick=”JavaScript:stopBGM()”><img src=”stop1.gif” /></div>
  :
</body>
```

7.7.4 Parental Ratings Error

For parental rating errors during playback of A/V content through the CEA-2014 A/V embedded object (as defined in Section 5.7.1 of [CEA-2014-A]) or the “`video/broadcast`” object (as defined in Section 7.4.2 of this document), an OITF SHALL support the following intrinsic event properties and corresponding DOM 2 events, for the CEA-2014 A/V embedded object, respectively the “`video/broadcast`” object:

`script` **`onParentalRatingChange`**
The script function (as defined in [HTML Data Types]) that is called when a parental rating error occurs during playback of A/V content inside the embedded object, and is triggered whenever a parental rating is discovered for the A/V content that does not meet the parental rating criterium that is set for the parental control system in use (e.g. rating is at or above the current threshold), which has lead to blocking the consumption of the content.. The specified script function is called with three arguments `contentID`, `rating`, and `DRMSystemID` which are defined as follows: ▪ `String contentID` – the content ID to which the parental rating change applies. If the event is generated by the DRM system, it SHALL be the unique identifier for that content in the context of the DRM system (i.e. in the case of Marlin BB it is the Marlin contentID). Otherwise, it SHALL be the URI or DVB-IP serviceName.domainName identifier of the content being played if they are known. ▪ `ParentalRating rating` – the parental rating value of the currently playing content. The ParentalRating object is defined in Section 7.14 ▪ `String DRMSystemID` – optional argument that specifies the DRM System ID of the DRM system that generated the event as defined by element DRMSystemID in Table 8 of Section 3.3.2 of [META][META]. The value SHALL be `null` if the parental control is not enforced by a particular DRM system.

`script` **`onParentalRatingError`**
The script function (as defined in [HTML Data Types]) that is called when a parental rating error occurs during playback of A/V content inside the embedded object, and is triggered whenever a parental rating is discovered that is not supported by the OITF. The specified script function is called with three arguments `contentID`, `rating`, and `DRMSystemID` which are defined as follows: • `String contentID` – the content ID to which the parental rating change applies. If the event is

generated by the DRM system, it SHALL be the unique identifier for that content in the context of the DRM system (i.e. in the case of Marlin BB it is the Marlin contentID). Otherwise, it SHALL be the URI or DVB-IP serviceName.domainName identifier of the content being played, if they are known.

- `ParentalRating rating` – the parental rating value of the currently playing content. The ParentalRating object is defined in Section 7.14.

  `String DRMSystemID` – optional argument that specifies the DRM System ID of the DRM system that generated the event as defined by element DRMSystemID in Table 8 of Section 3.3.2 of [META][META]. The value SHALL be `null` if the parental control is not enforced by a particular DRM system.

7.7.4.1 Events

For the intrinsic events "`onParentalRatingChange`" and "`onParentalRatingError`", corresponding DOM level 2 events SHALL be generated, in the following manner:

Intrinsic event	Corresponding DOM 2 event	DOM 2 Event properties
`onParentalRatingChange`	`ParentalratingChange`	Bubbles: No Cancelable: No Context Info: `contentID`, `rating`, and `DRMSystemID`
`onParentalRatingError`	`ParentalRatingError`	Bubbles: No Cancelable: No Context Info: `contentID, rating`, and `DRMSystemID`.

Note: the above DOM 2 events are directly dispatched to the event target, and will not bubble nor capture. Applications SHOULD not rely on receiving a ParentalRatingError event during the bubbling or the capturing phase. The Applications that use DOM 2 event handlers SHALL call the `addEventListener()` method on the CEA-2014 A/V embedded object or the video/broadcast object itself. The third parameter of `addEventListener`, i.e. "`useCapture`", will be ignored.

7.7.5 DRM Rights Error

This section SHALL apply to OITF and/or server devices which have indicated support for DRM protection by providing one or more `<drm>` elements as specified in Section 9.3.10:

For notifying Javascript about DRM licensing errors during playback of DRM protected A/V content through the CEA-2014 A/V embedded object (as defined by as defined in Section 5.7.1 of CEA-2014-A) or the "`video/broadcast`" object (as defined in Section 7.5.2 of this document), an OITF SHALL support the following intrinsic event property and corresponding DOM 2 event, for the CEA-2014 A/V embedded object, respectively the "`video/broadcast`" object:

`script` **`onDRMRightsError`**

The script function (as defined in [HTML Data Types]) that is called when a DRM licensing error occurs during playback, recording or timeshifting of DRM protected AV content inside the embedded object.

The specified script function is called with four arguments `errorState`, `contentID`, `DRMSystemID` and `rightsIssuerURL` which are defined as follows:

- `Integer errorState` – error code detailing the type of error:

  0: no license
  1: invalid license

- `String contentID` – the unique identifier of the protected content in the scope of the DRM system that raises the error (i.e. in the case of Marlin BB it is the Marlin contentID).

- `String DRMSystemID` – DRMSystemID as defined by element DRMSystemID in Table 8 of Section 3.3.2 of [META][META]. For example, for Marlin, the DRMSystemID value is "`urn:dvb:casystemid:19188`".

- `String rightsIssuerURL` – optional element indicating the value of the rightsIssuerURL that can be used to non-silently obtain the rights for the content item currently being played for which this DRM error is generated, in cases whereby the `rightsIssuerURL` is known. Cases whereby the `rightsIssuerURL` is known include cases whereby the `rightsIssuerURL` has been extracted from the MPEG2_TS of the protected content, retrieved from the SD&S discovery record or from the associated BCG metadata. The corresponding `rightsIssuerURL` fields are defined in Section 4.1.3.4 of [CSP] and in section 3.3.2 of [META][META] respectively. If different URLs are retrieved from the stream and the metadata, then the conflict resolution is implementation-dependent.

For the intrinsic event "`onDRMRightsError`", a corresponding DOM level 2 event SHALL be generated, in the following manner:

Intrinsic event	Corresponding DOM 2 event	DOM 2 Event properties
`onDRMRightsError`	`DRMRightsError`	▪ Bubbles: No ▪ Cancelable: No ▪ Context Info: `errorState, contentID, DRMSystemID, rightsIssuerURL`

Note: the above DOM 2 event is directly dispatched to the event target, and will not bubble nor capture. Applications SHOULD NOT rely on receiving a DRMRightsError event during the bubbling or the capturing phase. Applications that use DOM 2 event handlers SHALL call the `addEventListener()` method on the CEA-2014 A/V embedded object or the video/broadcast object itself. The third parameter of `addEventListener`, i.e. "`useCapture`", will be ignored.

7.8 IMS APIs

If an OITF has indicated support for the control of its IMS functionality by a server by stating `<ims>true</ims>` as defined in Section 9.3.9 in its capability description, the OITF SHALL support IMS through the use of the following non-visual object:

```
<object type="application/oipfIms"/>
```

The IMS API provides the necessary javascript methods to register new users in the IMS network. It also provides methods to register users (`registerUser`), along with the supported feature tags, IMS Communication Service Identifier (ICSI) and IMS Application Reference Identifier (IARI), and de-register users (`deRegisterUser`). A method `getRegisteredUsers` is also defined to view all the registered users. A method `getAllUsers` retrieves all users provisioned in the IG. Once registered it is possible to switch users for using IMS services by using method `setUser`.

A property is defined to view the current user to be used for a service (`currentUser`).

In order to handle the out-of-session IMS notifications, namely, the new dialogues, there is a method for subscribing to these events (`subscribeImsNotification`). All new dialogues are communicated through a callback function (`onImsNotification`) to the application instance performing the subscription.

The IMS APIs apply only to privileged applications and SHALL adhere to the security model as defined in Section 10.

7.8.1 Registration

7.8.1.1 *Properties*

`script` **`onUserControlResult`**

This script function (as defined in [HTML Data Types]) is called with return result from the methods registerUser and deRegisterUser

The specified script function is called with 2 arguments – `user` and `resultMsg`.

- `String user` – The user id.

- `Integer resultMsg` – result message. Valid values include:

Result message	Description	Semantics
0	Successful	The action performed by the underlying functionality was successful.
1	Unknown error	The action performed by the underlying functionality failed because an unspecified error occurred.
2	Wrong user credentials	The user credentials was not accepted by the server. The DAE may request from the user a new PIN which can then be used to perform a new registerrUser with the provided PIN.
3	The user doesn't exist.	The user id doesn't exist in the local user table.

currentUser

The `currentUser` property indicates the current user to be used for a service.

readonly UserData **currentUser**
The current user property represents the public user identity which is being used or shall be used for HNI-IGI communication. If not set then the default user shall be used or indicated.

The UserData object contains the following properties:

readonly String **userId**
The user identifier represents the public user identity or IMPU.

readonly FeatureTagCollection **featureTags**
The FeatureTag data is optional (may have a value of null) and carries a collection of feature tag objects associated to an application. For example the feature tag may be an ICSI or IARI or a feature tag identifying the service for. an incoming instant messages. The object includes feature tags related to both DAE and native applications in OITF.

readonly String **friendlyName**
The friendly name for the user. Used as display name in outgoing messages.

The featureTag object contains the following properties.

readonly String **featureTag**
A string containing a featureTag value associated to an application. The featureTag value may have a value of null when used with subscribeImsNotification method. This indicates that all dialogues are reported. The feature tag SHALL populate the X-OITF- headers as specified in [TISPAN] Section 5.6.2, [IM], [3GPP TS 24.229], [RFC3840] and [RFC3841].

7.8.1.2 Methods

UserDataCollection **getRegisteredUsers**()	
Description	Return all the users that are currently registered with IG.

Void **registerUser**(string userId, string pin)

Description	This method performs user registration to the IMS network. Results from this method is sent to the callback method `onUserControlResult.`	
Arguments	*userId*	The user identifier represents the public user identity or IMPU.
	pin	The pin is optional and carries the password to be used towards the IG in case of HTTP Digest. If pin is not specified then the default user password shall be used.

`Void` **`deRegisterUser`**`( String userId )`		
Description	The indicated user is de-registered from IMS. Any sessions that may be open are closed. De-registration of default user has no effect nor de-registration of any users registered from a native application in the OITF. Results from this method is sent to the callback method `onUserControlResult.`	
Arguments	*userId*	The user identifier represents the public user identity or IMPU.

`UserDataCollection` **`getAllUsers`**`()`	
Description	Return all the users that are currently provisioned in the IG. The first entry in the collection is the default user. The users are retrieved according to the [PROT][PROT] section 5.3.6.3, User ID Retrieval for managed network service.

`Boolean` **`setUser`**`( String userId )`		
Description	Sets which user to use for IMS services. If this method isn't called prior to using the services, the default user will be used for the object. If called with ongoing sessions for the user shall be closed. If setUser is unsuccessful it is due to not registering the user. It is necessary to first register the user and wait for a successful response to the onUserControlResult callback function.	
Argument	*userId*	The user identifier represents the public user identity or IMPU.

7.8.2 IMS out-of-session notification

The IMS out-of-session notification methods provide a means to subscribe to IMS notifications for new dialogues which are received over the HNI-IGI interface from the IG.

7.8.2.1 Properties

`script` **`onImsNotification`**
This script function (as defined in [HTML Data Types]) is called on the application which called subscribeImsNotification when an unsolicited IMS notification arrives. The specified script function is called with 3 arguments.

`String responseHeaders` – The concatenated list of all HTTP headers, as a single string, with each header line separated by a U+000D (CR) U+000A (LF) pair excluding the status line

`String msgText` – the response entity body as a string, as defined in [XHR]

`Document msgXML` – the response entity body as a Document, as defined in [XHR].

`script` **`onNotificationResult`**

This script function (as defined in [HTML Data Types]) is called with return result from the registerApplication method.

The specified script function is called with 2 arguments – application and resultMsg.

Result message	Description	Semantics
0	Successful	The action performed by the underlying functionality was successful.
1	Unknown error	The action performed by the underlying functionality failed because an unspecified error occurred.
2	Wrong user credentials	The user credentials was not accepted by the server.
3	The user doesn't exist.	The user id doesn't exist in the local user table.

7.8.2.2 Methods

`Void` **`subscribeImsNotification`**`( FeatureTagCollection featureTagCollection, boolean performuserregistration)`

Description	This method subscribes for new IMS out-of-session dialogues for the indicated application for the currently active user. The notification shall be notified using `onImsNotification` callback method. If the application that made the subscription closes then there is an automatic un-subscription to new notifications. Otherwise it is possible to perform unSubscribeImsNotification. Any new dialogues shall be notified over the callback method `onImsNotification.`	
Arguments	*featureTagCollection*	The featureTagCollection object of the DAE application. The featureTag value may have a value of null. This indicates that all dialogues are reported.
	performuserregistration	If this is true a new user registration is required. SHOULD be set to false if it is know that other applications will be registered shortly

Void **unSubscribeImsNotification**(.)	
Description	The DAE application calling this method will be de-registered for IMS notifications. Associated feature tag(s) for the DAE application are removed from the featureTagCollection object for the user. A re-registration will be performed for the corresponding user. Results from this method is sent to the callback method onNotificationControlResult.

7.8.2.3 Events

For the intrinsic event "onNotificationResult" and "onImsNotification", corresponding DOM level 2 events SHALL be generated, in the following manner:

Intrinsic event	Corresponding DOM 2 event	DOM 2 Event properties
onNotificationResult	onNotificationResult	Bubbles: No Cancelable: No Context Info: resultMsg
onImsNotification	onImsNotification	Bubbles: No Cancelable: No Context Info: callId,contact,from,to

7.8.3 UserDataCollection

The UserDataCollection object represents a list of Users.

7.8.3.1 Properties

readonly Integer **length**
The number of items in the collection

7.8.3.2 Methods

UserData **item**(Integer index)	
Description	Return the item at position index in the list, or undefined if no item is present at that position. The position can also be specified using array bracket notation instead of calling this method directly.

Arguments	*index*	The index of the item to be retrieved

7.8.4 FeatureTagCollection

The `FeatureTagCollection` object represents a list of features associated to the user.

7.8.4.1 Properties

`readonly Integer` **`length`**
The number of items in the collection

7.8.4.2 Methods

`FeatureTag` **`item`**`( Integer index )`		
Description	Return the item at position index in the list, or undefined if no item is present at that position. The position can also be specified using array bracket notation instead of calling this method directly.	
Arguments	*index*	The index of the item to be retrieved

7.8.5 Communication services

If a client has indicated support for the control of its Communication Services functionality by a server by stating `<communication_services>true</communication_services>` as defined in Section 9.3.9 in its capability description, the client SHALL support IMS through the use of the following non-visual embedded object:

```
<object type="application/oipfIms"/>
```

The Communication Services API provides for instant messaging, presence and contact list services. The messages can either be in a chat session using MSRP (see [PROT][PROT]) or page mode messages sent without a session. The support of Communication Services SHALL follow the OMA specification [PRES], [IM].

The Communication Services API SHALL be supported in combined OITF and IG deployment cases. It MAY be supported in other deployment cases. The use of the HNI-IGI interface is OPTIONAL between the OITF and IG when these are co-deployed.

7.8.5.1 CommunicationServices

7.8.5.1.1 Properties

`script` **`onIncomingMessage`**
The script function (as defined in [HTML Data Types]) that is called when an incoming chat message is received for the active user. The specified script function is called with 3 arguments: - `String fromURI` – The sender address of the message.

- `String msg` – The text message sent by the remote peer.

- `Integer cid` – chat session identifier. Chat session identifier, either same as one received from openSession method or new if session is started by remote peer. Empty identifier if message is sent without a session.

`script` **`onContactStatusChange`**
This script function (as defined in [HTML Data Types]) is called when status has changed for a contact in the contact list or a user used with the method subscribeToStatus. The specified script function is called with 2 arguments: - `String remoteURI` – The user address which status has changed for - `Integer state` – Set to 1 if the user is present, and 0 if not. Other vaules may be defined in the future

`script` **`onNewWatcher`**
This script function (as defined in [HTML Data Types]) is called when a remote URI is requesting watcher authorization of the local user's presentity. The specified script function is called with 1 arguments: - `String remoteURI` – The remote user address which requested watcher authorization

7.8.5.1.2 Methods

`Integer` **`openChatSession`**`( String toURI )`		
Description	Opens a chat session with a remote user. Returns an integer identifier for the chat session to be used when a message is sent in the chat session or to match when incoming message is received.	
Arguments	*toURI*	The address of the remote chat user.

`void` **`sendMessageInSession`**`(Integer cid, String msg)`		
Description	Sends a new text message in a chat session. The chat can either be started by the user by calling the method openChatSession or can be a session received in the `onIncomingMessage callback function.`	
Arguments	*cid*	The chat session identifier.
	msg	Text message to send.

`void` **`closeChatSession`**`( Integer cid)`

Description	Closes a chat session.	
Arguments	*cid*	The chat session identifier.

`void` **`sendMessage`**`(String toURI, String msg)`		
Description	Sends a new text message to a remote peer without starting a session.	
Arguments	*toURI*	The address of the remote chat user.
	msg	Text message to send.

`void` **`setStatus`**`(Integer state)`		
Description	Sets the presence state of the local user.	
Arguments	*state*	Set to 1 if the user is present, and 0 if not. Other vaules may be defined in the future.

`void` **`subscribeToStatus`**`(String remoteURI)`		
Description	Subscribe to status for a remote user.	
Arguments	*remoteURI*	The address of the remote user.

`ContactCollection` **`getContacts`**`()`
Description	Get the users contact list

`void` **`allowContact`**`(String remoteURI)`
Description	Allows the watcher authorization to subscribe to the local user's presentity

`void` **`blockContact`**`(String remoteURI)`
Description	Blocks the watcher authorization to subscribe to the local user's presentity.

7.8.5.1.3 Events

For the intrinsic events "`onIncomingMessage`" and "`onContactStatusChange`" and "`onNewWatcher`", corresponding DOM level 2 events SHALL be generated, in the following manner:

Intrinsic event	Corresponding DOM 2 event	DOM 2 Event properties
onIncomingMessage	onIncomingMessage	Bubbles: No Cancelable: No Context Info: fromURI,msg,cid
onContactStatusChange	onContactStatusChange	Bubbles: No Cancelable: No Context Info: remoteURI,present
onNewWatcher	onNewWatcher	Bubbles: No Cancelable: No Context Info: remoteURI

7.8.5.2 ContactCollection

The ContactCollection object represents a read-only list of contacts in the users IMS contact list.

7.8.5.2.1 Properties

readonly Integer **length**
The number of items in the collection

7.8.5.2.2 Methods

Contact **item**(Integer index)		
Description	Return the item at position index in the list, or undefined if no item is present at that position. The position can also be specified using array bracket notation instead of calling this method directly.	
Arguments	*index*	The index of the item to be retrieved

boolean **remove**(String contactId)		
Description	Removes the contact represented by the contactId to the users IMS contact list. Returns true on success	
Arguments	*contactId*	Contact identifier of the user in the IMS contact list.

boolean **add**(Contact contact)		
Description	Adds the contact represented by the Contact object to the users IMS contact list. Returns true on success	
Arguments	*contact*	Contact object to be added from users IMS contact list.

7.8.5.3 Contact

7.8.5.3.1 Properties

String **contactId**
The contact identifier represents the public user identity or IMPU used in communication with the contact.

String **friendlyName**
The friendly name for the user. Used as display name in outgoing messages.

7.9 Metadata API

This section defines the Javascript APIs used by DAE applications for reading and searching metadata about programmes and channels. This API does not specify whether these query operations are carried out on the OITF or whether they require communication with a server.

The metadata API provides DAE applications with high-level access to metadata about programmes and channels. This section defines several extensions to the Programme and Channel classes (see sections 7.6.2.2 and 7.5.1.1) to deal with that.

This document describes the mapping between this API and BCG metadata. Mappings between this API and other metadata sources are not specified in this document.

Subsections 7.9.1 and 7.9.2 SHALL apply for OITFs that have indicated <clientMetadata> with value "true" and a "type" attribute with values "bcg", "sd-s" and"dvb-si" as defined in Section 9.3.7 in their capability profile. Subsections 7.9.2 through 7.9.13 SHALL apply for OITFs that have indicated <clientMetadata> with value "true" and a "type" attribute with value "bcg" and MAY apply for OITFs that have indicated <clientMetadata> with value "true" and a "type" attribute with value "dvb-si"

7.9.1 Channel

The OITF SHALL extend the Channel class defined in section 7.4.1.1.3 with the properties and methods described below.

The values of many of these properties are derived from elements in the BCG metadata. For optional elements that are not present in the metadata, the default value of any property that derives its value from one of those elements SHALL be undefined.

7.9.1.1 Properties

readonly String **longName**
The long name of the channel. If both short and long names are being transmitted, this property SHALL contain the long name of the station (e.g. 'Home Box Office'). If the long name is not available, this property SHALL be undefined. The value of this property is derived from the Name element that is a child of the BCG ServiceInformation element describing the channel, where the length attribute of the Name element has the value ‘long’.

readonly String **description**
The description of the channel. If no description is available, this property SHALL be undefined. The value of this field is taken from the ServiceDescription element that is a child of the BCG ServiceInformation element describing this channel.

readonly Boolean **authorised**
Flag indicating whether the receiver is currently authorised to view the channel. This describes the conditional access restrictions that may be imposed on the channel, rather than parental control restrictions.

readonly StringCollection **genre**
A collection of genres that describe the channel. This field contains the values of. any ServiceGenre elements that are children of the BCG ServiceInformation element describing the channel

Boolean **hidden**
Flag indicating whether the channel SHALL be included in the default channel list.

string **logoURL**
The URL for the default logo image for this channel. The value of this field is derived from the value of the first Logo element that is a child of the BCG ServiceInformation element describing the channel. If this element specifies anything other than the URL of an image, the value of this filed SHALL be undefined.

7.9.1.2 Methods

String **getField**(String fieldId)

Description	Get the value of the field referred to by fieldId that is contained in the BCG metadata for this channel. If the field does not exist, this method SHALL return `undefined`.	
Arguments	*fieldId*	The name of the field whose value SHALL be retrieved.

`String` **`getLogo`**`( Integer width, Integer height )`		
Description	Get the URI for the logo image for this channel. The width and height parameters specify the desired width and height of the image; if an image of that size is not available, the URI of the logo with the closest available size not exceeding the specified dimensions SHALL be returned. If no image matches these criteria, this method SHALL return `null`. The URI returned SHALL be suitable for use as the SRC attribute in an HTML `IMG` element or as a background image. The URIs returned by this method will be derived from the values of the `Logo` elements that are children of the BCG `ServiceInformation` element describing the channel	
Arguments	*width*	The desired width of the image
	height	The desired height of the image

7.9.2 Programme

The OITF SHALL extend the `Programme` class defined in section 7.6.2.2 with the properties and methods described below.

7.9.2.1 Properties

`readonly Channel` **`channel`**
Reference to the broadcast channel where the programme is available. The value of this field is derived from the `serviceIDref` attribute of the `Schedule` element that refers to this programme.

`readonly Boolean` **`blocked`**
Flag indicating whether the programme is blocked due to parental control settings or conditional access restrictions. The `blocked` and `locked` properties work together to provide a tri-state flag describing the status of a programme. This can best be described by the following table:

Description	blocked	locked
No parental control applies	`false`	`false`

Item is above the parental rating threshold (or manually blocked); no PIN has been entered to view it and so the item cannot currently be viewed.	`true`	`true`
Item is above the parental rating threshold (or manually blocked); the PIN has been entered and so the item can be viewed.	`true`	`false`

`readonly Integer` **`showType`**

Flag indicating the type of show (live, first run, rerun, etc,).

The value of this property is determined by the child elements of the programme's `BroadcastEvent` or `ScheduleEvent` element from the Program Location Table. Values are determined as follows:

Value	Decription
1	The programme is live; indicated by the presence of a Live element with a value attribute set to true.
2	The programme is a first-run show; indicated by the presence of a `FirstShowing` element with a value attribute set to true.
3	The programme is a rerun; indicated by the presence of a Repeat element with a value attribute set to true.

If none of the above conditions are met, the default value of this field SHALL be 2.

`readonly Boolean` **`subtitles`**

Flag indicating whether subtitles or closed-caption information is available.

This flag SHALL be `true` if one or more BCG `CaptionLanguage` elements are present in this programme's description, `false` otherwise.

`readonly Boolean` **`isHD`**

Flag indicating whether the programme has high-definition video.

This flag SHALL be `true` if a `VerticalSize` element is present in the programme's description and has a value greater than 576, false otherwise.

`readonly Integer` **`audioType`**

Bitfield indicating the type of audio that is available for the programme.

The value of this field is determined by the `NumOfChannels` elements in a programme's A/V attributes. Values are determined as follows:

Value	Description

1	A mono audio stream is available (at least one `AvAttributes.AudioAttributes` element is present which has a child `NumOfChannels` element whose value is 1).
2	A stereo audio stream is available (at least one `AvAttributes.AudioAttributes` element is present which has a child `NumOfChannels` element whose value is 2).
4	A multi-channel audio stream is available (at least one `AvAttributes.AudioAttributes` element is present which has a child `NumOfChannels` element whose value is greater than 2).

For programmes with multiple audio streams, these values may be ORed together.

`readonly Boolean` **`isMultilingual`**

Flag indicating whether more than one audio language is available for the programme.

This flag SHALL be true if more than one BCG Language element is present in the programme's description, false otherwise.

`readonly StringCollection` **`genre`**

A collection of genres that describe this programme.

The value of this field is the concatenation of the values of any `Name` elements that are children of `Genre` elements in the programme's description.

`readonly Boolean` **`hasRecording`**

Flag indicating whether the `Programme` has a recording associated with it (either scheduled, in progress, or completed).

`readonly StringCollection` **`audioLanguages`**

Supported audio languages, indicated by iso639 language codes.

`readonly StringCollection` **`subtitleLanguages`**

Supported subtitle languages, indicated by iso639 language codes.

`readonly Boolean` **`locked`**

Flag indicating whether the current state of the parental control system prevents the programme from being viewed (e.g. a correct parental control PIN has not been entered to allow the programme to be viewed).

7.9.2.2 Methods

String **getField**(String fieldId)		
Description	Get the value of the field referred to by `fieldId` that is contained in the metadata for this programme. If the field does not exist, this method SHALL return `undefined`.	
Arguments	*fieldId*	The name of the field whose value SHALL be retrieved.

StringCollection **getSIDescriptors**(Integer descriptorTag)		
Description	Get the contents of the descriptor specified by `descriptorTag`. If more than one descriptor with the specified tag is available for the given programme, the contents of all matching descriptors SHALL be returned in the order the descriptors are found in the stream. The descriptor content bytes SHALL be encoded in a string using a hexadecimal representation. If the descriptor specified by `descriptorTag` does not exist, or if the metadata for this programme was retrieved from a source other than DVB-SI, this method SHALL return `null`. If metadata for this programme has not yet been retrieved, this method SHALL return `undefined`. Applications SHALL be notified of the availability of additional metadata via `MetadataSearchEvents` targeted at the `application/oipfSearchManager` object used to retrieve the programme metadata.	
Arguments	*descriptorTag*	The descriptor tag as specified by [EN 300 468]

7.9.3 The SearchManager embedded object

OITFs SHALL implement the "`application/oipfSearchManager`" embedded object. This object provides a mechanism for applications to create and manage metadata searches.

7.9.3.1 Properties

readonly Integer **guideDaysAvailable**
The number of days for which guide data is available. A value of -1 means that the amount of guide data available is unknown. This information is derived from the `start` and `end` attributes of the `Schedule` entry in the Programme Location Table.

script **onMetadataUpdate**
This script function (as defined in [HTML Data Types]) is the DOM 0 event handler for events indicating changes in metadata.

script **onMetadataSearch**

This script function (as defined in [HTML Data Types]) is the DOM 0 event handler for events relating to metadata searches.

For the intrinsic events "onMetadataSearch" and "onMetadataUpdate", corresponding DOM level 2 events SHALL be generated, in the following manner:

Intrinsic event	Corresponding DOM 2 event	DOM 2 Event properties
onMetadataSearch	MetadataSearch	Bubbles: No Cancelable: No Context Info: see section 7.9.6
onMetadataUpdate	MetadataUpdate	Bubbles: No Cancelable: No Context Info: see section 7.9.7

These events are targeted at the application/oipfSearchManager object.

7.9.3.2 Methods

MetadataSearch **createSearch**(Integer searchTarget)		
Description	Create a MetadataSearch object that can be used to search the metadata.	
Arguments	*searchTarget*	The metadata that should be searched. Valid values of the searchTarget parameter are: **Value** / **Description** 1 – Metadata relating to scheduled content shall be searched. 2 – Metadata relating to on-demand content shall be searched. These values are treated as a bitfield, allowing searches to be carried out across multiple search targets.

ChannelConfig **getChannelConfig**()	
Description	Returns the channel line-up of the tuner in the form of a ChannelConfig object as defined in Section7.4.1.2. This includes the favourite lists.

7.9.4 MetadataSearch

A `MetadataSearch` object represents a query of the BCG and SD&S metadata about available programmes. Applications can create `MetadataSearch` objects using the `createSearch()` method on the `application/oipfSearchManager` object. When metadata queries are performed on a remote server, the protocol used is defined in section 4.1.2.2 of [META][META].

Due to the nature of metadata queries, searches are asynchronous and events are used to notify the application that results are available. `MetadataSearchEvents` SHALL be targeted at the `application/oipfSearchManager` object.

To minimise race conditions, results are updated on request rather than dynamically. Upon receipt of a `MetadataSearchEvent` indicating that more results are available, applications SHALL call `update()` on the corresponding `SearchResults` object to get the new results.

7.9.4.1 Properties

`readonly Integer` **`id`**

The ID of the search. This can be used by applications to match asynchronous events to the search that generated them. The value of this field is generated automatically and is implementation-dependent.

`readonly Integer` **`searchTarget`**

The target(s) of the search. Valid values of the `searchTarget` parameter are:

Value	Description
1	Metadata relating to scheduled content SHALL be searched.
2	Metadata relating to on-demand content SHALL be searched.

These values SHALL be treated as a bitfield, allowing searches to be carried out across multiple search targets.

`Query` **`query`**

The query that will be carried out by this search.

`readonly SearchResults` **`result`**

The results found so far, sorted by logical channel number and time.

This property MAY only be valid after a call to `update()`. The values within result MAY change after subsequent calls to `update()`.

7.9.4.2 Methods

void **addRatingConstraint**(ParentalRatingScheme scheme, Integer threshold)		
Description	Constrain the search to only include results whose parental rating value is below the specified threshold.	
Arguments	*scheme*	The parental rating scheme upon which the constraint SHALL be based. If the value of this argument is `null`, any existing parental rating constraints SHALL be cleared.
	threshold	The threshold above which results SHALL NOT be returned. If the value of this argument is `null`, any existing constraint for the specified parental rating scheme SHALL be cleared.

void **addCurrentRatingConstraint**()	
Description	Constrain the search to only include results whose parental rating value is below the threshold currently set by the user.

void **addChannelConstraint**(ChannelList channels)		
Description	Constrain the search to only include results from the specified channels. If a channel constraint has already been set, subsequent calls to `addChannelConstraint()`SHALL add the specified channels to the list of channels from which results should be returned,	
Arguments	*channels*	The channels from which results SHALL be returned. If the value of this argument is `null`, any existing channel constraint SHALL be removed.

void **addChannelConstraint**(Channel channel)		
Description	Constrain the search to only include results from the specified channel. If a channel constraint has already been set, subsequent calls to `addChannelConstraint()` SHALL add the specified channel to the list of channels from which results should be returned,	
Arguments	*channel*	The channel from which results SHALL be returned. If the value of this argument is `null`, any existing channel constraint SHALL be removed.

`void` **`orderBy`**`( String field, Boolean ascending )`		
Description	Set the order in which results SHOULD be returned. Repeated calls to `orderBy()` allow more complex orderings to be set.	
Arguments	*field*	The name of the field by which results SHOULD be sorted. A value of `null` indicates that any currently-set order SHALL be cleared and the default sort order should be used.
	ascending	Flag indicating whether the results SHOULD be returned in ascending or descending order.

`Query` **`createQuery`**`( String field, Integer comparison, String value )`		
Description	Create a metadata query for a specific value in a specific field within the metadata. Simple queries MAY be combined to create more complex queries. Applications SHALL follow the ECMAScript type conversion rules to convert non-string values into their string representation, if necessary	
Arguments	*field*	The name of the field to compare.
	comparison	The type of comparison.
	value	The value to check. Applications SHALL follow the ECMAScript type conversion rules to convert non-string values into their string representation, if necessary

`Boolean` **`findProgrammesFromStream`**`( Channel channel, Integer startTime, Integer count )`		
Description	Retrieve guide data for a specified number of programmes from a given channel from metadata contained in the stream as defined in section 4.1.3 of [META][META]. Searches made using this method will implicitly remove any existing constraints, ordering or queries created by prior calls to methods on this object. Results may be returned both synchronously and asynchronously, depending on whether data is available from the cache. If `findProgrammesFromStream()` returns `false`, results are not available until the notification events have been returned and `result.update()` has been called. If `findProgrammesFromStream()` returns `true`, results are available immediately, and the application need not wait for `COMPLETE` events or call `result.update()` to obtain the results.	
Arguments	*channel*	The channel for which programme information should be found.
	startTime	The start of the time period for which results should be returned measured in seconds since midnight (GMT) on 1/1/1970. The start time is inclusive; any programmes starting at the start time will be included in the search results. If `null`, the search will start from the current time
	count	The number of programmes for which information should be returned.

7.9.5 Query

The `Query` class represents a metadata query that the user wants to carry out. This may be a simple search, or a complex search involving Boolean logic. Queries are immutable; an operation on a query SHALL return a new `Query` object, allowing applications to continue referring to the original query.

The examples below show how more complex queries can be constructed:

```
Query qa = MetadataSearch.createQuery("Title", 6, "Terminator");
Query qb = MetadataSearch.createQuery ("SpokenLanguage", 0, "fr-CA");
Query qc = qb.and(qa.negate());
```

7.9.5.1 Properties

readonly String **field**	
	The name of the field to compare. Fields are identified by the fieldIDs defined in annex B.2 of TS 102-822-6-1, or using simplified XPath notiation. The '/' operator is the only permitted XPath operator.

readonly Integer **comparison**	
	The type of comparison. One of:

Value	Description
0	True if the specified value is equal to the value of the specified field.
1	True if the specified value is not equal to the value of the specified field.
2	True if the value of the specified field is greater than the specified value.
3	True if the value of the specified field is greater than or equal to the specified value.
4	True if the value of the specified field is less than the specified value.
5	True if the value of the specified field is less than or equal to the specified value.
6	True if the string value of the specified field contains the specified value. This operation is case insensitive, non whole word.
7	True if the specified field exists.

readonly String **value**	
	The value to check. Applications SHALL follow the ECMAScript type conversion rules to convert non-string values into their string representation, if necessary

7.9.5.2 Methods

`Query` **`and`**`( Query query )`		
Description	Create a query based on the logical AND of the predicates represented by the current query and the argument query	
Arguments	*query*	The second predicate for the AND operation.

`Query` **`or`**`( Query query )`		
Description	Create a query based on the logical OR of the predicates represented by the current query and the argument query	
Arguments	*query*	The second predicate for the OR operation.

`Query` **`not`**`()`	
Description	Create a new query that is the logical negation of the current query.

7.9.5.3 SearchResults

The `SearchResults` class represents the results of a metadata search. Since the result set may contain a large number of items, applications request a 'window' on to the result set, similar to the functionality provided by the OFFSET and LIMIT clauses in SQL.

Applications MAY request the contents of the result in groups of an arbitrary size, based on an offset from the beginning of the result set. The data SHALL be fetched from the appropriate source, and application SHALL be notified when the data is available.

7.9.5.4 Properties

`readonly Integer` **`length`**
The number of items in the currently available results.

`readonly Integer` **`offset`**
The current offset into the total result set.

`readonly Integer` **`totalSize`**
The total number of items in the result set. This MAY be `undefined` until `getResults()` has been called.

7.9.5.5 Methods

Object **item**(Integer index)		
Description	Return the item at position index in the collection of currently available results, or `undefined` if no item is present at that position. Applications SHALL be able to access items in the collection using array notation instead of calling this method directly.	
Arguments	*index*	The index into the result set

Boolean **getResults**(Integer offset, Integer count)		
Description	Retrieve a subset of the items that match the query. Results MAY be returned both synchronously and asynchronously, depending on whether data is available from the cache. If `getResults()` returns `false`, results are not available until the notification events have been returned and `update()` has been called. If `getResults()` returns `true`, results are available immediately, and the application need not wait for `COMPLETE` events or call `update()` to obtain the results.	
Arguments	*offset*	The number of items at the start of the result set to be skipped before data is retrieved.
	count	The number of results to retrieve.

void **abort**( )	
Description	Abort any outstanding request for results. Items currently in the collection SHALL be removed (i.e. the value of the `length` property SHALL be 0 and any calls to `item()`SHALL return `undefined`),

void **update**( )	
Description	Update the results available.

7.9.6 MetadataSearchEvent

A `MetadataSearchEvent` notifies the application about the status of a search through the guide data. These will be targeted at the `application/oipfSearchManager` object.

To receive these events, applications MAY add listeners for "`MetadataSearch`" events.

7.9.6.1 Properties

`readonly Integer` **state**

The type of event. This SHALL take one of the following values:

Value	Description
0	Search has stopped. This event SHALL be generated at the termination of every search.
1	More search results are available. Calling `update()` on the `SearchResult` object SHALL update the list of results to include the newly-retrieved data.
2	The data returned by the search is no longer valid, e.g. because of a change in the metadata. Applications that still require the data SHALL repeat the search.

`readonly Integer` **id**

The ID of the metadata search with which this event is associated. This MAY be used by applications to match events to the search that generated them.

7.9.7 MetadataUpdateEvent

The `MetadataUpdateEvent` object indicates a change in the state of a channel or programme that may require applications to re-build their displays. A `MetadataUpdateEvent` will be raised when the user changes the parental control settings (changing the lock status of an item) or when autonomous updates mean that the channel line up or programme database has changed.

`MetadataUpdateEvents` are intended to allow applications to update their user interfaces in response to a change in the state of a channel or programme without having to poll all channels or programmes to identify affected items.

7.9.7.1 Properties

`readonly Integer` **action**

The type of update that has taken place.

This field will take one of the following values:

Value	Description
1	The channel line-up has (or may have) changed and that the collection referred to by `ChannelConfig.all` has been updated. If an application has references to any `Channel` objects then it SHOULD dispose of them and rebuild its references. Where possible `Channel` objects are updated rather than removed - but their order in the `ChannelConfig.all` collection MAY have changed. Any lists created with `ChannelConfig.createFilteredList()` SHOULD be recreated in case channels have been removed.

2	A new version of metadata is available and applications SHOULD discard all references to `Programme` objects immediately and re-acquire them.
3	A change to the parental control flags for a content item has occurred (e.g. the user has unlocked the parental control features of the receiver, allowing a blocked item to be played).
4	A flag affecting the filtering criteria of a channel has changed. Applications MAY listen for events with this action code to update lists of favourite channels, for instance.

`readonly Integer` **`info`**

Extended information about the type of update that has taken place.

If the action field is set to the value 4, the value of this field SHALL be one or more of the following:

Value	Description
1	The list of blocked channels has changed.
2	A list of favourite channels has changed.
4	The list of hidden channels has changed.

If the action field is set to the value 3, the value of this field SHALL be one or more of:

Value	Description
1	The block status of a content item has changed.
2	The lock status of a content item has changed.

This field is treated as a bitfield, so values MAY be combined to allow multiple reasons to be passed.

`readonly Object` **`object`**

Object indicating the channel or programme that has been affected, or `null` if more than one item has been affected.

7.9.8 The CoD Manager embedded object

OITFs that have indicated `<clientMetadata>` with value "`true`" and a "`type`" attribute with value "`bcg`" SHALL implement an "`application/oipfCodManager`" embedded object with the following interface.

Content is organised into catalogues, where each catalogue contains a hierarchy of folders that are used to organise individual content items. The structure of the catalogue SHALL be determined by the server managing that catalogue and SHALL be reflected in the structure of the metadata passed to the OITF.

The three types of content in a CoD catalogue are assets (represented by the `CODAsset` class), folders (represented by the `CODFolder` class) and services (represented by the `CODService` class). A `CODAsset` is a user-level description of a piece of CoD content, and so it is more concerned with information such as the price, rental period, description and parental rating rather than detailed technical information about the asset such as encoding format. A CoD asset MAY represent a single movie, or a bundle of movies offered for a single price. `CODService` objects are a specific type of container representing subscription VoD (SVOD) services, where users purchase a group of assets which may change over time rather than a single movie or TV show.

The `CODAsset`, `CODFolder` and `CODService` classes define a type property that allows these classes to be distinguished by applications. For each class, this property SHALL take the value defined below:

Class	Value
`CODFolder`	0
`CODAsset`	1
`CODService`	2

This specification defines the mapping between the CoD API and BCG metadata. Mappings between the CoD API and other CoD metadata sources are not specified in this document.

7.9.8.1 Properties

`readonly ContentCatalogueCollection` **`catalogues`**
A collection of all available CoD catalogues, as listed in an SD&S BCG Discovery record.

`script` **`onContentCatalogueEvent`**
This script function (as defined in [HTML Data Types]) is the DOM 0 event handler for events relating to changes in a content catalogue collection.

`script` **`onContentAction`**
This script function (as defined in [HTML Data Types]) is the DOM 0 event handler for events relating to actions carried out on an item in a content catalogue.

7.9.9 CatalogueCollection

A `CatalogueCollection` object represents a set of content catalogues. Applications SHALL be able to access items in the collection using array notation.

7.9.9.1 Properties

readonly Integer **length**
The number of items in the collection.

7.9.9.2 Methods

contentCatalogue **item**(Integer index)		
Description	Return the item at position index in the list, or undefined if no item is present at that position. The position MAY be specified using array bracket notation instead of calling this method directly.	
Arguments	*index*	The index into the collection

7.9.10 ContentCatalogue

A `ContentCatalogue` represents a content catalogue for a content on demand service.

To receive events relating to operations on items in a catalogue, applications MAY add listeners for "`ContentAction`" events to the `application/oipfCodManager` object.

7.9.10.1 Properties

readonly String **name**
The name of the content catalogue that should be displayed to the user. The value of this property is given by the `Name` element in the catalogue's BCG discovery record.

readonly CODFolder **rootFolder**
The root folder of the content catalogue.

7.9.10.2 Methods

CODFolder **getPurchaseHistory**()	
Description	Get the list of items that have been purchased from the catalogue by the current user, including currently active rentals. Items in this list will be derived from children of the BCG `UserActionList` element which have an `ActionType` of `buy`. If the `ActionList` element is not present, this method SHALL return `null`.

7.9.11 ContentCatalogueEvent

The `ContentCatalogueEvent` class is a subclass of `Event` that provides information about changes to the available set of content catalogues. These events SHALL be targeted at the `application/oipfCodManager` embedded object. To receive these events, applications MAY add listeners for "`ContentCatalogue`" events to the `application/oipfCodManager` embedded object or attach an event handler to the embedded object's `onContentCatalogueEvent` property.

7.9.11.1 Properties

readonly Integer **action**
The type of event. For current versions of the specification, this property SHALL always have the value 0 to indicate a change in the list of available catalogues.

7.9.12 CODFolder

`CODFolder` represents a folder in a CoD catalogue. Folders may contain other folders, and an asset may be present in more than one folder.

Because a content list may contain a large number of items, the contents of the list are made available on demand using a paging model. Applications MAY request the contents of the list in 'pages' of an arbitrary size. The data SHALL be fetched from the appropriate source, and application SHALL be notified when the data is available.

Each folder is described by a `GroupInformation` element in the BCG Group Information Table.

7.9.12.1 Properties

readonly Integer **type**
The type of the item, used to distinguish between the types of objects that may be contained in a folder in a CoD catalogue. This SHALL always have the value 0 for folders.

readonly String **uid**
An ID for the folder. The value of this property is given by the BCG `GroupId` element that is a child of the `GroupInformation` element representing this folder.

readonly String **uri**
The `URI` used to refer to the folder. The value of this property is given by the `GroupId` attribute of the `GroupInformation` element representing this folder.

readonly String **name**
The name of the folder. The value of this property is given by the `Title` element that is a descendant of the `GroupInformation` element representing this folder.

readonly String **description**
A description of the folder, for display to an end user. The value of this property is given by the `Synopsis` element that is a descendant of the `GroupInformation` element representing this folder.

readonly String **thumbnailUri**
The URI of an image associated with this folder. For assets whose BCG description contains a `RelatedMaterial` element indicating a relationship of `Promotional Still Image`, the value of this property is given by the `MediaURI` element that is a descendant of that element. For assets without an appropriate `RelatedMaterial` element, the value of this property SHALL be `undefined`.

readonly Integer **length**
The number of items in the current page. If `getPage()` has not yet been called, the value of this property SHALL be `undefined`.

readonly Integer **currentPage**
The page number of the currently-available results, as specified in the last call to `getPage()`. If `getPage()` has not yet been called, the value of this property SHALL be `undefined`.

readonly Integer **pageSize**
The number of items that were requested from the content catalogue in a call to `getPage()`. This MAY be different form the number of items that are available (e.g. the last page in the collection). If `getPage()` has not yet been called, the value of this property SHALL be `undefined`.

readonly Integer **totalSize**
The total number of items in the folder. This MAY be `undefined` until `getPage()` has been called. The value of this property may be given by the `numOfItems` attribute of the `GroupInformation` element representing this folder.

7.9.12.2 Methods

Object **item**(Integer index)		
Description	Return the item at position index in the current page, or undefined if no item is present at that position. This function SHALL only return objects that are instances of `CODAsset`, `CODFolder`, or `CODService`. Applications SHALL be able to access items in the collection using array notation instead of calling this method directly	
Arguments	*index*	The index into the collection

void **getPage**(Integer page, Integer pageSize)		
Description	Retrieve one page of the folder's contents. The application SHALL be notified by an event targeted at the folder's parent content catalogue when the data is available. Calls to this method SHALL cancel any outstanding requests.	
Arguments	*page*	The number of the page for which data should be retrieved, indexed from zero.
	pageSize	The size of the page

void **abort**()	
Description	Abort the current request for a new page of folder contents. Any results for this folder SHALL be removed (i.e. the value of the length property will be 0 and any calls to the item() method SHALL return `undefined`),

7.9.13 CODAsset

The `CODAsset` represents a piece of CoD content that can be purchased and played. A `CODAsset` object MAY refer to a bundle of content items that are purchased together but which can only be played individually.

Some fields of a `CODAsset` object MAY not be populated until an application requests them; in this case the data MAY be fetched asynchronously from a server. Fields where the data has not been fetched from the server SHALL have a value of `undefined`. Fields for which data is not available on the server SHALL have a value of `null`.

7.9.13.1 Properties

`readonly Integer` **`type`**
The type of the item, used to distinguish between the types of objects that may be contained in a folder in a CoD catalogue. This property SHALL always have the value 1 for CoD assets.

`readonly String` **`uid`**
An ID for the asset. Folders, CoD services and CoD assets each have an ID which is unique within their parent catalogue. The value of this property is given by the `programId` attribute of the BCG `ProgramInformation` element that describes the asset.

`readonly String` **`uri`**
The CRID of the asset.

`readonly String` **`name`**
The title of the asset that will be displayed to the user. The value of this property is given by the BCG `Title` element that is a child of the asset's `BasicDescription` element.

`readonly String` **`description`**
A description of the asset, for display to an end user. The value of this property is given by the BCG `Synopsis` element that is a child of the asset's `BasicDescription` element.

`readonly StringCollection` **`genres`**
A collection of genres that describe this asset. The value of this property is the concatenation of the values of any `Name` elements that are children of `Genre` elements in the asset's description.

readonly ParentalRating **parentalRating**
The parental rating value of the asset. This information will be read from the ParentalGuidance element of an asset's description, if present.

readonly Boolean **blocked**
Flag indicating whether the asset is blocked due to parental control settings (i.e. whether its parental rating value exceeds the current system threshold).

readonly Boolean **locked**
Flag indicating whether the current state of the parental control system prevents the asset from being viewed (e.g. a correct parental control PIN has not been entered to allow the item to be viewed).

readonly String **thumbnailUri**
The URI of an image associated with this asset. For assets whose BCG description contains a RelatedMaterial element indicating a relationship of Promotional Still Image, the value of this property is given by the MediaURI element that is a descendant of that element. For assets without an appropriate RelatedMaterial element, the value of this property SHALL be undefined.

readonly String **price**
The price of the asset, in a form that can be displayed to the user. The value of this property is the concatenation of the value of the Price element that is a child of a PurchaseItem element in the asset's description and the value of the Price element's currency attribute. For example, a Price element of <Price currency="JPY">500</Price> would give the value 500 JPY for this field. Implementations MAY replace the currency code with the appropriate currency symbol (e.g. ¥).

readonly Integer **rentalPeriod**
The period for which the asset can be rented, in hours. For assets descriptions containing a Purchase element with a PurchaseType of urn:tva:metadata:cs:PurchaseTypeCS:2004:playForPeriod, the value of this property is derived from the QuantityUnit and QuantityRange elements that are children of that Purchase element. If a Purchase element with the appropriate PurchaseType is not present, the value of this field SHALL be undefined.

readonly Integer **playCount**
The number of plays allowed for this asset when it is purchased. For assets descriptions containing a Purchase element with a PurchaseType of urn:tva:metadata:cs:PurchaseTypeCS:2004:playCounts, the value of this property is derived from the QuantityUnit and QuantityRange elements that are children of that Purchase element. If a Purchase element with the appropriate PurchaseType is not present, the value of this field SHALL be undefined.

readonly Integer **duration**
The duration of the asset, in seconds. The value of this property is given by the BCG Duration element that is a child of the asset's BasicDescription element.

readonly String **previewUri**
The URI used to refer to a preview of the asset. For assets whose BCG description contains a RelatedMaterial element indicating a relationship of Trailer or Preview, the value of this property is given by the CRID of the asset referred to by that element. For assets without an appropriate RelatedMaterial element, the value of this property SHALL be undefined.

readonly BookmarkCollection **bookmarks**
A collection of the bookmarks set in a recording. If no bookmarks are set, the collection SHALL be empty.

7.9.13.2 Methods

Boolean **isReady**()	
Description	Check whether sufficient information is available to make a purchase or play the asset. Due to the asynchronous nature of CoD catalogues, not all of the information required to play or purchase a CoD asset may have been received by the OITF at any given time. If all of the required information is available, this method SHALL return true. Otherwise, this method SHALL request the missing information and return false. When the information is available, the application SHALL be notified via a ContentActionEvent with the reason code 1.

StringCollection **lookupMetadata**(String key)		
Description	Retrieve metadata for the asset. Metadata is stored as key/value pairs - retrieving the metadata for a specified key SHALL return all values that match that key.	
Arguments	*key*	The key for the metadata to be returned.

7.9.14 CODService

The `CODService` class is a subclass of `CODFolder` that represents a subscription CoD service. A subscription CoD service is similar to a folder, except that:

- The service SHALL be purchased in its entirety, rather than purchasing individual items from the service
- Business rules may prevent browsing of the content within a service unless the service has already been purchased

A `CODService` MAY contain a number of assets, folders and services.

7.9.14.1 Properties

readonly Integer **length**
The number of items in the current page of the service.

readonly Integer **currentPage**
The page number of the currently-available results, as specified in the last call to `getPage()`. If `getPage()` has not yet been called, the value of this property will be `undefined`.

readonly Integer **pageSize**
The number of items that were requested from the content catalogue in a call to `getPage()`. This MAY be different from the number of items that are available (e.g. the last page in the collection). If `getPage()` has not yet been called, the value of this property SHALL be `undefined`.

readonly Integer **totalSize**
The total number of items in the service. This MAY be `undefined` until `getPage()` has been called. The value of this property may be given by the `numOfItems` attribute of the `GroupInformation` element representing this folder.

readonly Integer **type**
The type of the item, used to distinguish between the types of objects that may be contained in a folder in a CoD catalogue. . This property SHALL always have the value 2 for a CoD service.

readonly String **uid**
An ID for the service. Folders, CoD services and CoD assets each have an ID which is unique within their parent catalogue. The value of this property is given by the `serviceId` attribute of the BCG `ServiceInformation` element that describes the service.

readonly String **uri**
The URI used to refer to the service. The value of this property is given by the BCG `serviceUrl` element that is a child of the `ServiceInformation` element that describes the service.

readonly String **name**
The name of the service that will be displayed to the user. The value of this property is given by the BCG `Name` element that is a child of the `ServiceInformation` element describing the service.

readonly String **description**

readonly String **thumbnailUri**
The URI of an image associated with this service. The value of this property is derived from the value of the first `Logo` element that is a child of the BCG `ServiceInformation` element describing the service. If this element specifies anything other than the URL of an image, the value of this property SHALL be `undefined`. Alternatively, for services whose BCG description contains a `RelatedMaterial` element indicating a relationship of `Trailer` or `Preview`, the value of this property is given by the CRID of the asset referred to by that element. For assets without an appropriate `RelatedMaterial` or `Logo` element, the value of this property shall be `undefined`.

readonly String **previewUri**
The URI used to refer to a preview of the content. For services whose BCG description contains a `RelatedMaterial` element indicating a relationship of `Trailer` or `Preview`, the value of this property is given by the CRID of the asset referred to by that element. For services without an appropriate `RelatedMaterial` element, the value of this property SHALL be `undefined`.

7.9.14.1.1 Methods

Boolean **isReady**()	
Description	Check whether sufficient information is available to make a purchase. Due to the asynchronous nature of CoD catalogues, not all of the information required to play or purchase a CoD service may have been received by the OITF at any given time. If all of the required information is available, this method SHALL return `true`. Otherwise, this method SHALL request the missing information and return `false`. When the information is available, the application SHALL be notified via a `ContentActionEvent` with the action code 1.

StringCollection **lookupMetadata**(String key)		
Description	Retrieve metadata for the service. Metadata is stored as key/value pairs - retrieving the metadata for a specified key SHALL return all values that match that key.	
Arguments	*key*	The key for the metadata to be returned.

7.9.15 ContentActionEvent

The `ContentActionEvent` class provides information about the success or failure of operations on the content catalogue, such as browsing a folder or purchasing a piece of content.

To receive these events, applications should add listeners for "`ContentAction`" events to the `application/oipfCodManager` embedded object or attach an event handler to the embedded object's `onContentAction` property.

7.9.15.1 Properties

readonly Integer **action**

The type of action that the event refers to. Valid values are:

Value	Description
0	An operation to browse a content collection (e.g. getting a page from the collection).
1	Indicates that more information is available about this item (e.g. that more information has been retrieved from the server)

readonly Integer **result**
The result of the action. Valid values are:

Value	Description
0	The operation succeeded
1	The item no longer exists in the catalogue
2	The server has not responded in the timeout period.
3	Communication with the server has been interrupted.

readonly Object **item**
The item in the catalogue that the event refers to.

readonly ContentCatalogue **catalogue**
The parent catalogue of the affected object.

7.10 Configuration and Setting APIs

This section defines the interface to configuration and user settings information. Hardware configuration of the OITF is managed via an instance of the `LocalSystem` object. This provides access to hardware information and provides an entry point to configure the outputs and network interfaces of the OIF. Settings relating to the user interface and behaviour of the platform software are managed via an instance of the `Configuration` object.

This section is subject to security control, (see 10.1.3.7) and only applies if `<configurationChanges>` has value `true`

7.10.1 The local configuration object

The OITF SHALL implement the "`application/oipfConfiguration`" object as defined below. This object provides an interface to the configuration and user settings facilities within the OITF.

7.10.1.1 Properties

readonly Configuration **configuration**
Accesses the configuration object that sets defaults and shows system settings.

readonly LocalSystem **localSystem**
Accesses the object representing the platform hardware.

7.10.2 Configuration

The `Configuration` object allows configuration items within the system to be read and modified. This includes settings such as audio and subtitle languages, display aspect ratios and other similar settings. Unlike the `LocalSystem` object, this is concerned with software- and application-related settings rather than hardware configuration and control.

APIs for PIN control and verification defined in this section are applicable to cases where parental control is enforced in the terminal (approach C defined in section 4.6).

7.10.2.1 Properties

`String` **`preferredAudioLanguage`**
A comma-separated set of languages to be used for audio playback, in order of preference. Each language SHALL be indicated by its ISO 639 language code.

`String` **`preferredSubtitleLanguage`**
A comma-separated set of languages to be used for subtitle playback, in order of preference. Each language SHALL be indicated by its ISO 639 language code.

`String` **`countryId`**
An ISO-3166 three character country code identifying the country in which the receiver is deployed.

`Integer` **`regionId`**
An integer indicating the time zone within a country in which the receiver is deployed. A value of 0 SHALL represent the eastern-most time zone in the country, a value of 1 SHALL represent the next time zone to the west, and so on. Valid values are in the range 0 – 60.

`readonly Boolean` **`isPINEntryLocked`**
The lockout status of the parental control PIN. If the incorrect PIN has been entered too many times in the configured timeout period, parental control PIN entry SHALL be locked out for a specified time.

`Integer` **`pvrPolicy`**
The policy dictates what mechanism the system should use when storage space is exceeded. Valid values are shown in the table below.

Value	Description
0	Indicates a recording management policy where no recordings are to be deleted.
1	Indicates a recording management policy where only watched recordings MAY be deleted.
2	Indicates a recording management policy where only recordings older than the specified threshold (given by the `pvrSaveDays` and `pvrSaveEpisodes` properties) MAY be deleted.

`Integer` **`pvrSaveEpisodes`**
When the `pvrPolicy` property is set to the value 2, this property indicates the minimum number of episodes that SHALL be saved for series-link recordings.

`Integer` **`pvrSaveDays`**
When the `pvrPolicy` property is set to the value 2, this property indicates the minimum save time (in days) for individual recordings. Only recordings older than the save time MAY be deleted.

`Integer` **`pvrStartPadding`**
The default padding (measured in seconds) to be added at the start of a recording.

`Integer` **`pvrEndPadding`**
The default padding (measured in seconds) to be added at the end of a recording.

7.10.2.2 Methods

`Integer` **`setParentalControlPIN`**`( String oldPcPIN, String newPcPIN )`	
Description	Set the parental control PIN. This operation SHALL be protected by the parental control PIN (if PIN entry is enabled). The return value indicates the success of the operation, and SHALL take one of the following values:

Value	Description
0	The PIN is correct.

	1	The PIN is incorrect
	2	PIN entry is locked because an invalid PIN has been entered too many times.
Arguments	*oldPcPIN*	The current parental control PIN.
	newPcPIN	The new value for the parental control PIN.

`Integer` **`setParentalControlPINEnable`**`( String pcPIN, Boolean enable )`		
Description	Enable or disable the parental control PIN. Disabling the parental control PIN SHALL set the blocked and locked properties of all programmes and channels to false. This operation is protected by the parental control PIN (if PIN entry is enabled). The return value indicates the success of the operation, and SHALL take one of the values listed for `setPIN()`.	
Arguments	*pcPIN*	The parental control PIN.
	enable	Flag indicating whether the parental control PIN SHALL be enabled or disabled.

`Boolean` **`getParentalControlPINEnable`**`()`	
Description	Returns the status of the parental control PIN. This method SHALL return `true` if the PIN is enabled, `false` otherwise.

`Integer` **`unlockWithParentalControlPIN`**`( String pcPIN, Object target, Integer duration )`		
Description	Unlock the object specified by target for viewing if `pcPIN` contains the correct parental control PIN. This operation SHALL be protected by the parental control PIN (if PIN entry is enabled). The return value indicates the success of the operation, and will take one of the values listed for `setPIN()`.	
Arguments	*pcPIN*	The parental control PIN.
	target	The channel or programme to be unlocked
	duration	The length of time (in seconds) for which the item SHALL be unlocked.

`Integer` **`verifyParentalControlPIN`**`( String pcPIN )`	
Description	Verify that the PIN specified by `pcPIN` is the correct parental control PIN. This method will return one of the following values:

	<table><tr><th>Value</th><th>Description</th></tr><tr><td>0</td><td>The PIN is correct.</td></tr><tr><td>1</td><td>The PIN is incorrect</td></tr><tr><td>2</td><td>PIN entry is locked because an invalid PIN has been entered too many times.</td></tr></table>	
Arguments	*pcPIN*	The parental control PIN to be verified.

`Integer` **`setBlockUnrated`**`( String pcPIN, Boolean block )`		
Description	Set whether programmes for which no parental rating has been retrieved from the metadata client nor defined by the service provider should be blocked automatically by the terminal. This operation SHALL be protected by the parental control PIN (if PIN entry is enabled). The return value indicates the success of the operation, and SHALL take one of the values listed for `setPIN()`.	
Arguments	*pcPIN*	The parental control PIN.
	block	Flag indicating whether programmes SHALL be blocked.

`Boolean` **`getBlockUnrated`**`()`	
	Returns a flag indicating whether programmes with no parental rating are currently blocked automatically. Set whether programmes for which no parental rating has been retrieved from the metadata client nor defined by the service provider should be blocked automatically by the terminal.

`String` **`getText`**`( string key )`		
Description	Get the system text string that has been set for the specified key.	
Arguments	*key*	A key identifying the system text string to be retrieved

`void` **`setText`**`( string key, string value )`		
Description	Set the system text string that has been set for the specified key. System text strings are used for automatically-generated messages in certain cases, e.g. parental control messages.	
Arguments	*key*	The key for the text string to be set. Valid keys are: <table><tr><th>Key</th><th>Description</th></tr></table>

<table>
<tr><td></td><td></td><td><table>
<tr><td>no_title</td><td>Text string used as the title for programmes and channels where no guide information is available.

Defaults to “No information”</td></tr>
<tr><td>no_synopsis</td><td>Text string used as the synopsis for programmes where no guide information is available.

Defaults to “No further information available”</td></tr>
<tr><td>blocked_title</td><td>Text string used as the title for programmes and channels blocked by parental control settings (if metadata hiding is enabled).

Defaults to “BLOCKED”</td></tr>
<tr><td>blocked_synopsis</td><td>Text string used as the synopsis for programmes blocked by parental control settings (if metadata hiding is enabled).

Defaults to “Program blocked by user”</td></tr>
<tr><td>manual_recording</td><td>Text string used to identify a manual recording.

Defaults to “Manual Recording”</td></tr>
</table></td></tr>
<tr><td></td><td>value</td><td>The new value for the system text string.</td></tr>
</table>

7.10.3 LocalSystem

The `LocalSystem` object allows hardware settings related to the local device to be read and modified.

7.10.3.1 Properties

`readonly String` **`deviceID`**
Private OITF Identifier. Unique identifier which SHALL be the same as X-HNI-IGI-OITF-DeviceID in [PROT][PROT].

`Boolean` **`systemReady`**
Indicates whether the system has finished initialising. A value of `true` indicates that the system is ready.

readonly String **softwareVersion**
String identifying the version number of the platform firmware.

readonly String **hardwareVersion**
String identifying the version number of the platform hardware.

readonly String **serialNumber**
String containing the serial number of the platform hardware.

readonly Boolean **pvrEnabled**
Flag indicating whether the platform has PVR capability (local PVR).

Boolean **standbyState**
Get or set the standby state of the receiver. A value of `true` indicates that the receiver is in standby mode.

Integer **volume**
Get or set the overall system volume. Valid values for this property are in the range 0 - 100.

Boolean **mute**
Get or set the mute status of the default audio output(s). A value of `true` indicates that the default output(s) are currently muted.

readonly AVOutputCollection **outputs**
A collection of `AVOutput` objects representing the audio and video outputs of the platform. Applications MAY use these objects to configure and control the available outputs.

readonly NetworkInterfaceCollection **networkInterfaces**
A collection of `NetworkInterface` objects representing the available network interfaces.

readonly Integer **tvStandard**
Get the TV standard(s) for which the system is configured. This enables the user interface to only display those options relevant to the available TV standard(s).

This property can take one or more of the following values:

Value	Description
1	Indicates platform support for the NTSC TV standard.
2	Indicates platform support for the PAL TV standard.
4	Indicates platform support for the SECAM TV standard.

Values are stored as a bitfield

`readonly Integer` **`pvrSupport`**

Flag indicating the type of PVR support used by the application. This property may take zero or more of the following values:

Value	Description
0	PVR functionality is not supported. This is the default value if <recording> as specified in Section 9.3.3 has value `false`.
1	PVR functionality is supported in the OITF. This is the default value if <recording> as specified in Section 9.3.3 has value `true`

Values are stored as a bitfield.

7.10.3.2 Methods

`Boolean` **`setScreenSize`**`(Integer width, Integer height)`		
Description	Set the resolution of the graphics plane. If the specified resolution is not supported by the OITF, this method SHALL return `false`. Otherwise, this method SHALL return `true`. The current size of the display area can be read using the `Window.innerHeight` and `Window.innerWidth` DOM properties.	
Arguments	*width*	The width of the display, in pixels
	height	The height of the display, in pixels

<table>
<tr><td colspan="3">Integer setPvrSupport(Integer state)</td></tr>
<tr><td>Description</td><td colspan="2">Set the type of PVR support used by the application. The types of PVR supported by the receiver MAY not be supported by the application; in this case, the return value indicates the pvr support that has been set.</td></tr>
<tr><td>Arguments</td><td>state</td><td>The type of PVR support desired by the application. More than one type of PVR functionality MAY be specified, allowing the receiver to automatically select the appropriate mechanism. Valid values are:
<table>
<tr><th>Value</th><th>Description</th></tr>
<tr><td>0</td><td>PVR functionality is not supported. This is the default value if <recording> as specified in Section 9.3.3 has value <code>false</code>.</td></tr>
<tr><td>1</td><td>PVR functionality is supported in the OITF. This is the default value if <recording> as specified in Section 9.3.3 has value <code>true</code>.</td></tr>
</table>
Values are stored as a bitfield.</td></tr>
</table>

7.10.4 NetworkInterface

The `NetworkInterface` class represents a physical or logical network interface in the receiver.

7.10.4.1 Properties

`readonly String` **ipAddress**
The IP address of the network interface, in dotted-quad notation for IPv4 or colon-hexadecimal notation for IPv6.

`readonly String` **macAddress**
The colon-separated MAC address of the network interface.

`readonly Boolean` **connected**
Flag indicating whether the network interface is currently connected.

`Boolean` **enabled**
Flag indicating whether the network interface is enabled. Setting this property SHALL enable or disable the network interface.

7.10.5 AVOutput

The `AVOutput` class represents an audio or video output on the local platform.

7.10.5.1 Properties

`readonly String` **name**
The name of the output. Each output SHALL have a name that is unique on the local system. At least one of the outputs SHALL have the name "all" and SHALL represent all available outputs on the platform.

`readonly String` **type**
The type of the output. Valid values are “`audio`”, “`video`”, or “`both`”

`Boolean` **enabled**
Flag indicating whether the output is enabled. Setting this property SHALL enable or disable the output.

`Boolean` **subtitleEnabled**
Flag indicating whether the subtitles are enabled. The language of the displayed subtitles is determined by a combination of the value of the `Configuration.preferredSubtitleLanguage` property (see section 7.10.2.1) and the subtitles available in the stream. For audio outputs, setting this property will have no effect.

`String` **videoMode**
Read or set the video format conversion mode, for which hardware support MAY be available on the device, used when displaying a 4:3 signal on a 16:9 display. Valid values are shown below.

Value	Behaviour
normal	Perform no format conversion
stretch	Stretch the 4:3 signal horizontally
zoom	Zoom the signal and clip the top and bottom of the picture.

For audio-only outputs, setting this property SHALL have no effect.

`String` **digitalAudioMode**

Set the output mode for digital audio outputs for which hardware support MAY be available on the device. Valid values are shown below.

Value	Behaviour
ac3	Output AC-3 audio
uncompressed	Output uncompressed PCM audio

For video-only outputs, setting this property SHALL have no effect.

`String` **audioRange**

Set the range for digital audio outputs for which hardware support MAY be available on the device. Valid values are shown below

Value	Behaviour
normal	Use the normal audio range
narrow	Use a narrow audio range
wide	Use a wide audio range

For video-only outputs, setting this property SHALL have no effect.

`String` **hdVideoFormat**

Set the video format for HD video outputs for which hardware support MAY be available on the device. Valid values are:

480i

480p

576i

576p

720p

1080i

1080p

For audio-only or standard-definition outputs, setting this property SHALL have no effect.

String **tvAspectRatio**
Indicates the display aspect ratio of the display device connected to this output for which hardware support MAY be available on the device. Valid values are: 4:3 16:9 14:9 4:3letterbox   For audio-only outputs, setting this property SHALL have no effect.

readonly StringCollection **supportedVideoModes**
Read the video format conversion modes that may be used when displaying a 4:3 signal on a 16:9 display. See the definition of the videoModes property for valid values. For audio outputs, this property will have the value null.

readonly StringCollection **supportedDigitalAudioModes**
Read the supported ouput modes for digital audio outputs. See the definition of the digitalAudioMode property for valid values. For video outputs, this property will have the value null.

readonly StringCollection **supportedAudioRanges**
Read the supported ranges for digital audio outputs. See the definition of the audioRange property for valid values. For video outputs, this property will have the value null.

readonly StringCollection **supportedHdVideoFormats**
Read the supported HD video formats. See the definition of the hdVideoFormat property for valid values. For audio outputs, this property will have the value null.

readonly StringCollection **supportedAspectRatios**
Read the supported TV aspect ratios. See the definition of the tvAspectRatio property for valid values. For audio outputs, this property will have the value null.

7.10.6 NetworkInterfaceCollection

A `NetworkInterfaceCollection` object represents a read-only collection of `NetworkInterface` objects. Applications SHALL be able to access items in the collection using array notation.

7.10.6.1 Properties

`readonly Integer` **`length`**
The number of items in the collection.

7.10.6.2 Methods

`NetworkInterface` **`item`**`( Integer index )`		
Description	Return the item at position index in the collection.	
Arguments	*index*	The index of the item that SHALL be returned

7.10.7 AVOutputCollection

A `AVOutputCollection` object represents a read-only collection of `AVOutput` objects. Applications SHALL be able to access items in the collection using array notation.

7.10.7.1 Properties

`readonly Integer` **`length`**
The number of items in the collection.

7.10.7.2 Methods

`AVOutput` **`item`**`( Integer index )`		
Description	Return the item at position index in the collection.	
Arguments	*index*	The index of the item that SHALL be returned

7.11 Basic OITF Configuration and Operation

This section describes APIs which enable service providers to deploy DAE applications which provide UIs for the basic configuration and operation of the OITF

This section describes new APIs and extensions to APIs defined elsewhere in this document that are available to DAE applications where the OITF is under the control of a service provider

Clients supporting the extended tuner control APIs defined in section 7.11.1 SHALL indicate this by adding the `<extendedAVControl>` element with value "`true`" to the client capability description as defined in section 9.3.6 .

Clients supporting the extended PVR management functionality defined in section 7.11.2 SHALL indicate this by adding the attribute '`manageRecordings = true`' to the `<recording>` element in the client capability description as defined in section 9.3.3.

Clients supporting the download management APIs defined in section 7.11.3 SHALL indicate this by adding the attribute "`manageDownloads`" to the `<download>` element with a value unequal to '`none`' in the client capability description as defined in section 9.3.4.

Clients supporting the remote management APIs defined in section 7.11.5 SHALL indicate this by adding the element `<remote_diagnostics>` with value "`true`" to the client capability description as defined in section 9.3.12

The functionality as described in this section is subject to the security model of Section 10.

7.11.1 Extensions to the tuner control API

7.11.1.1 Extensions to the broadcast video embedded object

OITFs SHALL support the following extensions to the `video/broadcast` embedded object:

7.11.1.1.1 Properties

`readonly Channel` **`currentChannel`**
The channel currently being presented by this embedded object if the user has given permission to share this information, possibly through a mechanism outside the scope of this specification. If no channel is being presented, the value of this property SHALL be `null`.

`script` **`onChannelScan`**
This script function (as defined in [HTML Data Types]) is the DOM 0 event handler for events relating to channel scanning. On IP-only receivers, setting this property SHALL have no effect.

7.11.1.1.2 Methods

`Integer` **`startScan`**`()`	
Description	Start a scan for new channels on all available sources. When each source finishes scanning, an `UpdateEvent` SHALL be raised with the type `CHANNELS_INVALIDATED` and any channel lists for that source SHALL have been updated. On IP-only receivers, this method SHALL have no effect.

void **stopScan**()	
Description	Stop a channel scan, if one is in progress. Any sources that have not finished scanning SHALL have their scans aborted and channel line-ups for SHALL NOT be changed. On IP-only receivers, this method SHALL have no effect.

7.11.1.2 ChannelScanEvent

A `ChannelScanEvent` informs the application of the status of a channel scan operation.

Applications MAY receive channel scan events by registering for "`ChannelScan`" events on the `video/broadcast` object or by setting its `onChannelScan` property.

7.11.1.2.1 Properties

`readonly Integer` **`type`**

The type of event. Valid values are:

Value	Description
0	A channel scan has started
1	Indicates the current progress of the scan.
2	A new channel has been found.
3	A new transponder has been found.
4	A channel scan has completed.
5	A channel scan has been aborted.

`readonly Integer` **`progress`**

The progress of the scan. Valid values are in the range 0 - 100, or -1 if the progress is unknown.

`readonly Integer` **`frequency`**

The frequency of the transponder (for scans on RF sources only).

readonly Integer **signalStrength**
The signal strength for the current channel. Valid values are in the range 0 - 100, or -1 if the signal strength is unknown.

readonly Integer **channelNumber**
The logical channel number of the channel that has been found.

readonly Integer **channelType**
The type of channel that has been found. Valid values are the same as for `Channel.channelType`.

readonly Integer **channelCount**
The total number of channels found so far during the scan.

readonly Integer **transponderCount**
The total number of transponders found so far during the scan (RF sources only).

7.11.1.3 FavouriteList

The `name` property of the `FavouriteList` object SHALL be read/write for OITFs which are controlled by a service provider. The following methods SHALL also be supported:

Boolean **insertBefore**(Integer index, String ccid)		
Description	Insert a new favourite into the favourites list at the specified index. This method SHALL return `true` of the operation succeeded, or `false` if an invalid index was specified (e.g. `index` > (`length` – 1)).	
Arguments	*index*	The index in the list before which the favourite should be inserted.
	ccid	The ccid of the channel to be added.

Boolean **remove**(Integer index)

Description	Remove the item at the specified index from the favourites list. Returns `true` of the operation succeeded, or `false` if an invalid index was specified.	
Arguments	*index*	The index of the item to be removed.

Boolean **commit**()	
Description	Commit any changes to the favourites list to persistent storage. This method SHALL return `true` of the operation succeeded, or `false` if it failed (e.g. due to insufficient space to store the list on the OITF). If a server has indicated that it requires control of the tuner functionality of an OITF in the server capability description for a particular service, then the OITF SHOULD send an updated Client Channel Listing to the server using HTTP POST over TLS as described in section 7.4.1.1.

7.11.1.4 FavouriteListCollection

The following extensions SHALL be supported by the `FavoriteListCollection` object:

Integer **createFavouriteList**()	
Description	Create a new favourite list and add it to the collection. The ID of the new favourite list SHALL be returned.

Boolean **remove**(Integer index)		
Description	Remove the list at the specified index from the collection. This method SHALL return `true` of the operation succeeded, or `false` if an invalid index was specified.	
Arguments	*index*	The index of the list to be removed.

Boolean **commit**()	
Description	Commit any changes to the collection to persistent storage. This method SHALL return `true` of the operation succeeded, or `false` if it failed (e.g. due to insufficient pace to store the collection). If a server has indicated that it requires control of the tuner functionality of an OITF in the server capability description for a particular service, then the OITF SHOULD send an updated Client Channel Listing to the server using HTTP POST over TLS as described in section 7.4.1.1.

7.11.2 Extensions to the PVR APIs

7.11.2.1 Extensions to the PVR scheduler object

The OITF SHALL support the following extensions to the `application/oipfRecordingScheduler` object defined in section 7.6.2.

7.11.2.1.1 Properties

readonly RecordingCollection **recordings**
Provides a list of scheduled and recorded programmes in the system. Note: Where a series is being recorded, every recorded episode SHALL exist as an independent entry. Only the scheduled recording SHALL carry the `isSeries` property.

readonly DiscInfo **discInfo**
Get information about the status of the local storage device.

script **onRecordingChange**
This script function (as defined in [HTML Data Types]) is the DOM 0 event handler for notification of changes in the state of recordings.

7.11.2.1.2 Methods

void **remove** (Recording recording)		
Description	Remove a recording (either scheduled, in-progress or completed). For non-privileged applications, recordings SHALL only be removed when they are scheduled but not yet started and the recording was scheduled by the current service.	
Arguments	*recording*	The recording to be removed.

void **stop**(Recording recording)		
Description	Stop an in-progress recording. The recording SHALL NOT be deleted.	
Arguments	*recording*	The recording to be stopped.

void **refresh**()
Description	Update the `recordings` property to show the current status of all recordings.

7.11.2.2 Programme

The OITF SHALL support the following extensions to the `Programme` class.

readonly Boolean **scheduledRecording**
The scheduled recording associated with this programme, or `false` if this programme has no scheduled recording. This flag SHALL be set to `false` when an in-progress or completed recording is associated with the programme.

readonly RecordingCollection **recordings**
The list of recordings associated with this programme.

7.11.2.3 Recording

`Recording` represents an in-progress or completed recording. Scheduled recordings SHALL be represented by the `ScheduledRecording` class defined in section 7.6.1. This class is a subclass of `ScheduledRecording` (see section 7.6.1.2).

Recordings MAY be "manual" in that they simply record a channel at a certain time, for a period - analogous to a traditional VCR - or alternatively recordings can be programme based.

Values of properties in the `Recording` object SHALL be obtained from metadata about the recorded programme. The mapping between these properties and the BCG metadata is described in section 7.9.2.

7.11.2.3.1 Properties

readonly Integer **state**

The state of the recording. One of:

Value	Description
1	The recording has started
2	The recording has stopped, having completed.
3	The recording sub -system is unable to record due to resource limitations.
4	There is insufficient storage space available. (Some of the recording may be available).
5	The recording has not taken place due to unknown (probably hardware) failure.

6	The recording has only partially completed due to a clash or hardware failure. There are three possible conditions for this: 1) The end of the recording is missed. 2) The start of the recording is missed 3) A piece from the centre of the recording is missed (e.g. due to the receiver rebooting or a transient failure of the network connection)

`readonly String id`

An identifier for this recording. This value SHALL be unique to this recording and so can be used to compare two recording objects to see if they refer to the same recording.

isManual *(Optional)*

`readonly Boolean isManual`

If `false`, then any fields whose name matches a field in the `Programme` object contains details from the programme guide on the programme that has been recorded.

If `true`, only the channel, start time and duration of the recording are valid.

doNotDelete *(Optional)*

`Boolean doNotDelete`

If `true`, then this recording should not be automatically deleted by the system.

saveDays *(Optional)*

`Integer saveDays`

The number of days for which an individual or manual recording SHOULD be saved. Recordings older than this value MAY be deleted. If the value of this property is `undefined`, the default save duration SHALL be used.

saveEpisodes *(Optional)*

`Integer saveEpisodes`

The number of episodes of a series-link that SHOULD be saved. Older episodes MAY be deleted. This is only valid when set on the latest scheduled recording in the series. If the value of this property is

undefined, the default value SHALL be used.

readonly Boolean **blocked**

Flag indicating whether the programme is blocked due to parental control settings or conditional access restrictions.

readonly ParentalRating **parentalRating**

The parental rating value for the programme.

readonly Integer **showType**

Flag indicating the type of show. This field SHALL take one of the following values:

Value	Description
0	The show is live.
1	The show is a first-run show.
2	The show is a rerun.

readonly Boolean **subtitles**

Flag indicating whether subtitles or closed-caption information is available.

readonly StringCollection **subtitleLanguages**

Supported subtitle languages, indicated by iso639 language codes.

readonly Boolean **isHD**

Flag indicating whether the programme has high-definition video.

readonly Boolean **isWidescreen**

Flag indicating whether the programme is broadcast in widescreen.

readonly Integer **audioType**

Bitfield indicating the type of audio that is available for the programme. Since more than one type of

audio may be available for a given programme, the value of this field SHALL consist of one or more of the following values ORed together:

Value	Description
1	Mono audio
2	Stereo audio
4	Multi-channel audio

`readonly Boolean` **`isMultilingual`**

Flag indicating whether more than one audio language is available for this recording.

`readonly StringCollection` **`audioLanguages`**

Supported audio languages, indicated by iso639 language codes.

`readonly StringCollection` **`genres`**

A collection of genres that describe this programme.

`readonly Integer` **`recordingStartTime`**

The actual start time of the recording, including any padding. This MAY not be the same as the scheduled start time of the recorded programme (e.g. due to a recording starting late, or due to start/end padding). For recordings that have not yet started, the value of this field SHALL be `undefined`.

`readonly Integer` **`recordingDuration`**

The actual duration of the recording, including any padding. This MAY not be the same as the scheduled duration of the recording (e.g. due to a recording finishing early, or due to start/end padding). For recordings that have not yet started, the value of this field SHALL be `undefined`.

Bookmarks *(Optional)*

`readonly BookmarkCollection` **`bookmarks`**

A collection of the bookmarks set in a recording. If no bookmarks are set, the collection SHALL be empty.

readonly Boolean **locked**
Flag indicating whether the current state of the parental control system prevents the recording from being viewed (e.g. a correct parental control PIN has not been entered to allow the recording to be viewed).

7.11.2.4 Bookmark (Optional)

The Bookmark class represents a bookmark or chapter mark in a recording or CoD asset. This is not a web bookmark – instead, it is a point from which the viewer may want to resume playback of a piece of content. These MAY be set implicitly without user intervention (e.g. at the point where a user stops watching a recording, in order to allow them to resume from that point later) or explicitly by the user (e.g. at the start of a favourite scene).

7.11.2.4.1 Properties

readonly Integer **time**
The time at which the bookmark is set, in seconds from the start of the content item.

readonly String **name**
The name of the bookmark.

7.11.2.5 BookmarkCollection (Optional)

A BookmarkCollection is a collection of bookmarks, ordered by time. Applications SHALL be able to access items in the collection using array notiation.

NOTE: In principle bookmarks MAY be stored on in the network however the protocol for communicating bookmarks between the OITF and the network is not defined in the present document.

7.11.2.5.1 Properties

readonly Integer **length**
The number of items in the collection.

7.11.2.5.2 Methods

Bookmark **item**(Integer index)		
Description	The item at position index in the collection.	
Arguments	*index*	The index into the collection.

Bookmark **addBookmark**(Integer time, String name)		
Description	Add a new bookmark to the collection. If the bookmark cannot be added (e.g. because the value given for time lies outside the length of the recording), this method SHALL return `null`.	
Arguments	*time*	The time at which the bookmark is set, in seconds since the start of the recording.
Arguments	*name*	The name of the bookmark

void **removeBookmark**(Bookmark bookmark)		
Description	Remove a bookmark from the collection.	
Arguments	*bookmark*	The bookmark to be removed

7.11.2.6 RecordingCollection

A `RecordingCollection` object represents a read-only collection of recordings. Applications SHALL be able to access items in the collection using array notation. A collection MAY contain `ScheduledRecording` objects, `Recording` objects, or a combination of the two.

7.11.2.6.1 Properties

readonly Integer **length**
The number of items in the collection.

7.11.2.6.2 Methods

Object **item**(Integer index)		
Description	Return the item at position `index` in the collection.	
Arguments	*index*	The index of the item to be returned

7.11.2.7 PVREvent

`PVREvent` objects SHALL be generated when recordings are active and SHALL indicate changes in the status of a recording. To receive these events, applications MAY add a listener for "`PVR`" events to the `application/oipfRecordingScheduler` object or set the value of the `onRecordingChange` property in the `application/oipfRecordingScheduler` object.

These events SHALL be targeted directly at the `application/oipfRecordingScheduler` object and do not bubble. These events are not cancellable.

7.11.2.7.1 Properties

`readonly Integer` **state**

The current state of the recording. One of:

Value	Description
1	The recording has started
2	The recording has stopped, having completed.
3	The recording sub -system is unable to record due to resource limitations.
4	There is insufficient storage space available. (Some of the recording may be available).
6	The recording has stopped before completion due to unknown (probably hardware) failure.
7	The recording has been newly scheduled.
8	The recording has been deleted (for complete or in-progress recordings) or removed from the schedule (for scheduled recordings)
9	The recording is due to start in a short time
10	The recording has been updated

`readonly Recording` **recording**

The recording to which this event refers

7.11.2.8 DiscInfo

The `DiscInfo` class provides details of the storage usage and capacity in the PVR.

7.11.2.8.1 Properties

`readonly Integer` **free**

The space (in megabytes) available on the storage device for recordings.

readonly Integer **total**
The total capacity (in megabytes) of the storage device. Depending upon the system, free MAY be less than total even with no recordings as some of the disc space MAY be used for management purposes.

readonly Integer **scheduled**
The space (in megabytes) reserved for scheduled recordings.

7.11.3 Content Download API

This section defines APIs required to support the download of content items from a remote server. These extensions do not specify the underlying transport mechanism, and may be used for both pull content download and push content download. OITFs that support content download in a managed network SHOULD support the classes defined in this section.

7.11.3.1 The download manager embedded object

In a managed network, privileged applications may need access to the download management functionality in a CoD system. This access may be required to implement a UI to the download manager, to queue a download or to display the progress of a specific download. OITFs SHOULD support an "`application/oipfDownloadManager`" object with the following interface.

7.11.3.1.1 Properties

readonly DownloadCollection **downloads**
The complete list of downloads that are being managed by the download manager. This includes scheduled, in-progress and complete downloads. Access to this field SHALL only be available to privileged applications.

script **onDownloadStatusChange**
The script function (as defined in [HTML Data Types]) that is called when the status of a download has changed. The specified script function is called with three arguments `item`, `status` and `reason`, which are defined as follows: - `Download item` – the Download object whose status has changed. - `Integer status` – the new status of the download. Valid values include:

Status	Semantics
0	The download has completed successfully
1	The download is in progress
2	The download has been paused (either by an application or automatically by the OITF)
3	The download has failed

4	The download has been queued but has not yet started

- `Integer reason`. Extended reason code. This is only valid if the value of the status argument is 3.

Reason	Semantics
0	The local storage device is full
1	The item cannot be downloaded (e.g. because it has not been purchased)
2	The item is no longer available for download

7.11.3.1.2 Methods

`Boolean` **`pause`**`( Download download )`		
Description	Pause an in-progress or queued download. For in-progress downloads, more data SHALL NOT be downloaded until the download is resumed. For completed downloads, this operation SHALL return `false`.	
Arguments	*Download*	The download to be paused

`Boolean` **`resume`**`( Download download )`		
Description	Resume a paused download. If the download is not paused, this operation SHALL return `false`.	
Arguments	*download*	The download to be resumed

`Boolean` **`cancel`**`( Download download )`		
Description	Cancel a scheduled or in-progress download. If the download is in progress, any downloaded data SHALL be deleted. If the download is completed, this operation SHALL return `false`.	
Arguments	*download*	The download to be cancelled.

`Boolean` **`delete`**`( Download download )`		
Description	Delete a completed download. If the download is scheduled or in-progress, this operation SHALL return `false`.	
Arguments	*download*	The download to be deleted.

DownloadCollection **getDownloads**()	
Description	Returns a collection of downloads initiated by the calling application

7.11.3.1.3 Events

For the intrinsic event "onDownloadStatusChange", a corresponding DOM level 2 event SHALL be generated, in the following manner:

Intrinsic event	Corresponding DOM 2 event	DOM 2 Event properties
onDownloadStatusChange	DownloadEvent	Bubbles: No Cancelable: No Context Info:

NOTE: the above DOM 2 event is directly dispatched to the event target, and will not bubble nor capture. Applications SHOULD not rely on receiving a DownloadEvent during the bubbling or the capturing phase. Applications that use DOM 2 event handlers SHALL call the addEventListener() method on the application/oipfDownloadManager object. The third parameter of addEventListener, i.e. "useCapture", will be ignored.

7.11.3.2 Download

A Download object represents a content item that has either been downloaded from a remote server or is in the process of being downloaded.

Applications MAY create Download objects and use them to initiate a download by calling createDownload() on the application/oipfDownloadTrigger object defined in section 7.1.3. If the ID of a download is a TV-Anytime CRID, then the values of the name, description and parentalRating properties SHALL be set by the DAE based on the metadata provided for the item matching that CRID. For downloads whose ID is a URI, these properties SHOULD be set by the application before initiating the download.

7.11.3.2.1 Properties

readonly Integer **totalSize**
The total size (in bytes) of the download

readonly Integer **status**
The current status of the download. When this changes, a download event SHALL be generated. Valid values are:

Value	Description
0	The download has completed.

1	The download is in progress.
2	The download has been paused (either by an application or automatically by the platform).
3	The download has failed.
4	The download is queued but has not yet started.

`readonly Integer` **amountDownloaded**

The amount of data that has been downloaded, as a percentage of the total size.

`String` **name**

The name of the download

`Integer` **downloadIDType**

The type of download ID stored in the `id` property. Valid values are:

Value	Description
0	The ID is a TV-Anytime CRID
1	The ID is a URI

`String` **id**

The ID of the download. This SHALL be a URI or a TV-Anytime CRID.

`String` **description**

A description of the download.

`ParentalRating` **parentalRating**

The parental rating value of the download

`DRMControlInfoCollection` **drmControl**

A collection of zero or more `DRMControlInformation` objects corresponding to the DRM Control information associated to that content. The `DRMControlInfoCollection` is defined in Section 7.11.3.6. The related `DRMControlInformation` object is defined in Section 7.11.3.5.

readonly Date **startTime**
The time that the download is scheduled to start (in the case of scheduled downloads) or `null` if no start time was set.

readonly Integer **timeElapsed**
The time (in seconds) that has elapsed since the download of the item was started. This SHALL NOT include any time the item spent queued for download.

readonly Integer **timeRemaining**
The estimated time remaining (in seconds) for the download to complete. If this is unknown the value of this property SHALL be `undefined`.

7.11.3.3 DownloadCollection

A `DownloadCollection` is a collection of `Download` objects. Applications SHALL be able to access items in the collection using array notation.

7.11.3.3.1 Properties

Readonly Integer **length**
The number of items in the collection.

7.11.3.3.2 Methods

Download **item**(Integer index)		
Description	The item at position `index` in the collection.	
Arguments	*index*	The index into the collection.

7.11.3.4 Extensions to the application/oipfDownloadTrigger object

The following method SHALL be supported by the `application/oipfDownloadTrigger` object defined in section 7.1.3

Download **createDownload**(String contentAccessDescription, Date downloadStart)	
Description	Send `contentAccessDescription` to underlying download manager as a String formatted according to the Content Access Descriptor XML Schema as specified in Section 7.1.1. Returns a `Download` object if `contentAccessDescription` is valid and is accepted

	for triggering a download. Returns NULL otherwise	
Arguments	*contentAccessDescription*	String formatted according to the Content Access Descriptor XML Schema as specified in Section 7.1.1
	downloadStart	The time at which the download should be started. A value of `null` indicates that the download should start as soon as possible.

`Download` **`createDownloadFromCRID`**`( String CRID, String IMI, Date downloadStart )`		
Description	Send `(CRID,IMI)` to underlying download manager. Returns a `Download` object if `the (CRID,IMI) tuple` is valid and is accepted for triggering a download. Returns NULL otherwise. The values of the `name`, `description`, `parentalRating` and `DRMControl` properties SHALL be based on the metadata provided for the item matching that CRID.	
Arguments	*CRID*	The TV-Anytime Content reference ID that points to the general information about the item to download that does not change regardless of how the content is published or broadcast
	IMI	The TV-Anytime Instance Metadata ID that points to the specific information related to the item to download, such as content location, usage rules (pay-per-view, etc.) and delivery parameters (e.g. video format).
	downloadStart	The time at which the download should be started. A value of `null` indicates that the download should start as soon as possible.

7.11.3.5 DRMControlInformation

A `DRMControlInformation` object represents the DRM Control information structure defined in §3.3.2 of [META].

7.11.3.5.1 Properties

`Readonly String` **`drmType`**
URN with the DVB CASystemID (16 bit number) in there. DRMType shall be signalled by prefixing the decimal number format of CA_System_ID with "`urn:dvb:casystemid:`". For example, hexadecimal 0x4AF4 is assigned as CA_System_ID for “Marlin” by DVB, “Marlin” `drmType` is encoded as “`urn:dvb:casystemid:19188`”.

`Readonly String` **`drmContentID`**
DRM Content ID for CoD or scheduled content item, e.g. the Marlin Content ID

`Readonly String` **`rightsIssuerURL`**
A URL used by OITF to obtain rights for this content item

`Readonly String` **`silentRightsURL`**

A URL used by OITF to obtain rights silently, e.g. a Marlin Action Token.

Readonly String **drmContentID**
DRM Content ID for CoD or scheduled content item, e.g. the Marlin Content ID

Readonly String **previewRightsURL**
A URL used by OITF to obtain rights silently for preview of this content item, e.g. a Marlin Action Token.

Readonly String **drmPrivateData**
Private data for the DRM scheme indicated in drmType to be applied for this content item. Private DRM Data is actually structured as an XML document whose schema is specific to the considered DRM system. One example is Marlin DRM private data schema defined in [CSP].

Readonly Boolean **doNotRecord**
A flag indicating whether this content item is recordable or not.

Readonly Boolean **doNotTimeShift**
A flag indicating if this content item is allowed for time shift play back.

7.11.3.6 DRMControlInfoCollection

A drmControlInfoCollection represents a collection of DRM Control information sets related to a specific content. Applications SHALL be able to access items in the collection using array notation.

7.11.3.6.1 Properties

readonly Integer **length**
The number of items in the list.

7.11.3.6.2 Methods

DRMControlInformation **item**(Integer index)		
Description	Return the item at position index in the list, or undefined if no item is present at that position.	
Arguments	*index*	The index of the DRM Control Information.

7.11.4 Extensions to the CEA-2014A media playback APIs

To support integration between sections 7.9, 7.11.2 and 7.11.3 of this specification and the A/V streaming object defined in [CEA-2014-A], OITFs SHOULD add the method defined below on the A/V streaming object if any of the APIs defined in those sections are supported.

`void` **`setSource`**`( Object item, String contentAccessDescriptorURL )`		
Description	Plays the content item represented by `item`. This has the same semantics as setting the `data` property of the A/V control object with the URI of the item.	
Arguments	*item*	The item to be played. Content items may be instances of the `Recording`, `CODAsset` or `Download` classes, depending on the level of support provided by the OITF for the APIs defined in sections 7.9, 7.11.2 and 7.11.3 of this document. Note: Implementations may choose to define one or more private fields on these classes in order to distinguish them.
	contentAccessDescriptorURL	A content-access descriptor (the format of which is defined in Annex E) that MAY be used to provide additional information for dealing with items that are (partially) DRM-protected. This parameter is optional.

7.11.5 Remote diagnostics and management APIs

This section defines interfaces to perform remote diagnostics and management of the device.

Browser based remote management SHALL be supported by OITFs that have indicated `<remote_diagnostics>true</remote_diagnostics>` in their capability profile (as defined in Section 9.3.12)

7.11.5.1 application/oipfRemoteManagement embedded object

The `application/oipfRemoteManagement` embedded object has the following properties and methods.

Access to the functionality of the `application/oipfRemoteManagement` embedded object SHALL adhere to the security requirements as defined in section 10.

7.11.5.1.1 Properties

`readonly String` **`vendorName`**
String identifying the vendor name of the device

`readonly String` **`modelName`**
String identifying the model name of the device

`readonly String` **`softwareVersion`**

String identifying the version number of the platform firmware.

`readonly String` **hardwareVersion**
String identifying the version number of the platform hardware.

7.11.5.1.2 Methods

`String` **getParameter**`( String parameterName )`		
Description	Returns the requested parameter.	
Arguments	*String parameterName*	"SAMPLE_PACKET_LOSS": This queries the RTP packet loss since the last call to this function, or the start of the current RTP content item, whichever is more recent. The returned string is of the format "<time in milliseconds since the last sample> <fraction lost> <number of packets lost>". These fields (i.e. <xxx>) are defined as described in [[RFC3550] section 6.4.2] and are decimal numbers (encoded as strings). If no content item is playing an empty string is returned. "SAMPLE_DECODER_ERRORS": This queries the decoder errors since the last call to this function, or the start of the current RTP content item, whichever is more recent. The returned string is of the format "<time in milliseconds since the sample> <total number of frames decoded> <total number of errors>". These fields are decimal numbers (encoded as strings). If no content item is playing an empty string is returned. "CUMULATIVE_PACKET_LOSS": This queries the RTP packet loss since the start of the current RTP content item. The returned string is of the format "<time in milliseconds of this sample within the content> <fraction lost> <number of packets lost>". These fields (i.e. <xxx>) are defined as described in [[RFC3550] section 6.4.2] and are decimal numbers (encoded as strings). If no content item is playing an empty string is returned. "CUMULATIVE_DECODER_ERRORS": This queries the decoder errors since the start of the current RTP content item, whichever is more recent. The returned string is of the format "<time in milliseconds of this sample within the content> <total number of frames decoded> <total number of errors>". These fields are decimal numbers (encoded as strings). If no content item is playing an empty string is returned. Optionally, further vendor specific parameters may be supported. In the case that a parameter is requested that a device does not support, it SHALL return an empty string.

`String` **setParameter**`( String parameterName, String value )`	
Description	Sets the requested parameter. Support for this API is optional.

Arguments	*parameterName*	The name of the parameter
	value	The value of the parameter.

Void **triggerSoftwareUpdate**()	
Description	Triggers an OITF to starts its software update process. The process itself and any user involvement (e.g. to confirm agreement for a software update) is not defined.

7.12 APIs for Gateway Discovery and Control

The application/oipfGatewayInfo object SHALL provide the information of the gateway and subsequently interact with the gateway (e.g. IMS Gateway, Application Gateway and Content Service Protection Gateway) as defined in section 4.3. The OITF SHALL support the gateway discovery and control though the use of the following non-visual embedded object:

```
<object id="gatewayinfo" type="application/oipfGatewayInfo">
```

Access to the functionality of the application/oipfGatewayInfo embedded object is privileged and SHALL adhere to the security requirements defined in Section 10.1.

7.12.1 application/oipfGatewayInfo

7.12.1.1 Properties

readonly Boolean **IGDiscovery**
readonly property that indicates whether an IMS Gateway is discovered or not

readonly Boolean **AGDiscovery**
readonly property that indicates whether an Application Gateway is discovered or not

readonly Boolean **cspGatewayDiscovery**
readonly property that indicates whether an CSP Gateway is discovered or not

readonly String **igURL**
readonly property that indicates the base Gateway's URL for interacting between an OITF and an IMS Gateway

readonly String **agURL**
readonly property that indicates the base Gateway's URL for interacting between an OITF and an

Application Gateway

`readonly String` **cspGatewayURL**
readonly property that indicates the base Gateway's URL for interacting between an OITF and an CSP Gateway

`Integer` **interval**
read-write property that specifies the periodic interval time(seconds) to discover the gateways

`script` **onDiscoverIG**
read-write property that specifies the script function that SHALL be called when an IMS Gateway is discovered by the OITF

`script` **onDiscoverAG**
read-write property that specifies the script function that SHALL be called when an Application Gateway is discovered by the OITF

`script` **onDiscoverCSPG**
read-write property that specifies the script function that SHALL be called when an CSP Gateway is discovered by the OITF

7.12.1.2 Methods

`Boolean` **isIGSupportedMethod**`( string MethodName )`	
Description	Shall return '`true`' when the IG supports the method named 'MethodName'. If the function returns `false`, it indicates that IG does not support the specified method.

7.13 DAE Applications APIs

An OITF providing DAE application capability SHALL implement the behaviour of the classes defined in this section.

7.13.1 The ApplicationManager object

An OITF SHALL support a non-visual embedded object of type "`application/oipfApplicationManager`", with the following Javascript API, to enable applications to access the privileged functionality related to application lifecycle and management that is provided by the application model defined in this section.

If one of the methods on the `application/oipfApplicationManager` is called, by a webpage that is not a privileged DAE application, the DAE SHALL throw an error as defined in section 10.1.1.

7.13.1.1 Methods

`Application` **`getOwnerApplication`**`( Document document )`		
Description	Get the application that the specified document is part of. If the document is not part of an application, or the calling application does not have permission to access that application, this method will return `null`.	
Arguments	*document*	The document for which the Application object should be obtained.

`ApplicationCollection` **`getChildApplications`**`( Application application )`		
Description	Get the applications that are children of the specified application.	
Arguments	*application*	The application whose children should be returned.

`void` **`gc`**`()`	
Description	Provide a hint to the execution environment that a garbage collection cycle should be initiated. The OITF is not required to act upon this hint.

7.13.2 The Application class

The `Application` class is used to implement the characteristics of a DAE application.

7.13.2.1 Properties

`readonly Boolean` **`visible`**
`true` if the application is visible, `false` otherwise. The value of this property is not affected by the application's Z-index or position relative to other applications. Only calls to the `show()` and `hide()` methods will affect its value.

`readonly Boolean` **`active`**
`true` if the application is in the list of currently active applications, `false` otherwise (as defined in Section 5.1.7).

`readonly StringCollection` **`permissions`**
`StringCollection` object containing the names of the permissions granted to this application.

`readonly Boolean` **`isPrimaryReceiver`**
`true` if the application receives system events before any other application, `false` otherwise.

This class also includes properties representing DOM 0 event handlers for the events listed in sections 7.13.4 and 7.13.5, such as `onApplicationActivated` for the event "`ApplicationActivated`". These properties are not listed here for clarity.

7.13.2.2 Methods

`void` **`show`**`()`	
Description	Make the application visible when multiple application can be visible simultaneously or request to make the application visible when only one application can be visible at any time (as defined by the application display model in Section 5.1.2). This method only affects the visibility of an application. In the case where more than one application is visible, calls to this method will not affect the z-index of the application with respect to any other visible applications

`void` **`hide`**`()`	
Description	Make the application invisible. This has no effect on the lifecycle of the application.

`void` **`activate`**`()`	
Description	Move the application to the front of the active applications list. This has the same semantics as calling `focus()` on the DOM `Window` object associated with the application. The application's `Window` object SHALL gain input focus and SHALL be moved to the top of the stack of visible applications, when multiple applications can be visible simultaneously, or request to make the application visible and give it input focus when only one application can be visible at any time (as defined by the application display model in Section 5.1.2).

`void` **`deactivate`**`()`	
Description	Remove the application from the active applications list. This has no effect on the lifecycle of the application and MAY have no effect on the resources it uses. Applications which are not active will receive no events except for system events targeted at nodes in the application's DOM tree (or at the Application object itself). Applications may still be manipulated via their `Application` object.

`Application` **`createApplication`**`( String uri, Boolean createChild)`		
Description	Create a new application and add it to the application tree. If the application cannot be created, this method SHALL return `null`	
Arguments	*uri*	The URI of the first page of the application to be created.
	createChild	Flag indicating whether the new application is a child of the current application. A value of `true` indicates that the new application should be a child of the current application; a value of `false` indicates that it should be a sibling.

`void` **`destroyApplication`**`()`

Description	Terminate the application, detach it from the application tree, and make any resources used available to other applications. When an application is terminated, any child applications shall also be terminated.

`void` **`dispatchSystemEvent`**`(Event event, EventTarget target)`		
Description	Dispatch a new system event (see Section 7.13.4)	
Arguments	*event*	The event to be dispatched.
	target	The target of the event.

7.13.3 The ApplicationCollection class

The `ApplicationCollection` class represents a collection of `Application` objects. Items in the collection may be accessed using array notation.

7.13.3.1 Properties

`readonly Integer` **`length`**
The number of items in the collection.

7.13.3.2 Methods

`Application` **`item`**`( Integer index )`		
Description	Return the item at position `index` in the collection, or `undefined` if no item is present at that position.	
Arguments	*index*	The index of the application to be returned

7.13.4 Events

As defined in [DOM 2 Events], standard DOM events are raised on a specific node within a single document. This specification extends the event capability of the OITF through system events, but does not change the DOM2 event model for dispatching events within documents.

System events have exactly the same API as the DOM 2 `Event` class. An OITF SHALL implement the system events and system event model described here.

System events may be dispatched to multiple applications. System events may be targeted at nodes in a web page (for example, the `KeyPress`, `KeyUp` and `KeyDown` events). System events may be raised by native code or by JavaScript. Event handlers may cancel further propagation of system events using the existing DOM model. No document receives a particular instance of a system event more than once. The active application list participates in (influences) the dispatch order of system events. Events may be handled with either capture phase or bubble phase event listeners.

The `dispatchSystemEvent()` method of an `Application` object is used to raise an event from JavaScript. The method takes two arguments; the `Event` object to be dispatched and the target of the event, which may be `null`. The use of the `target` argument is described in the system event dispatching algorithm below.

An application may create any type of (system) event using the existing event classes, with the exception of the `ApplicationLoaded`, `ApplicationUnloaded`, and `LowMemory` events which are reserved to signal specific events related to application lifecycle management. However, all events dispatched using the standard `dispatchEvent()` method are normal events, not system events. The `Application` class has the method `dispatchSystemEvent()` that permits the event to be dispatched. Thus, the only valid way to dispatch the event is to invoke it on an `Application` object.

The `KeyPress`, `KeyUp` and `KeyDown` events are all targeted system events. The events are all targeted at the node that has the input focus and SHALL not be automatically forwarded to other active applications, unless they come from the same FQDN as the currently active application at the start of the active application list. Method `dispatchSystemEvent()` enables key events to be passed to applications which are not the topmost application in the application stack and to applications from other FQDNs.

System event	Description
`KeyPress`	Generated when a key has been pressed by the user. May also be generated when a key is held down to indicate key-repeat.
`KeyUp`	Generated when a key pressed by the user has been released.
`KeyDown`	Generated when a key has been pressed by the user.
`ApplicationLoaded`	Generated immediately prior to a load event being generated in the affected application.
`ApplicationUnloaded`	Generated immediately prior to an unload event being generated in the affected application.
`LowMemory`	Generated when the DAE is running low on available memory.

Table 9: System events

Each of these events has a corresponding DOM 0 event handler property on the `Application` object. These are not shown in section 7.13.2 for clarity.

System event dispatching is performed in three ordered phases, following the standard DOM event dispatching mechanism. Cancelling the propagation of an event in any phase SHALL abort further raising of the event in subsequent phases.

1. Dispatch to the `Application` object of the currently active application, in the active application list. Default actions normally taken by the browser upon receipt of an event (e.g. moving input focus on receipt of a key event or inserting text into an input box) will not occur during any of these phases of event dispatching..

2. If this was a targeted system event, dispatch to the target node in the target application. Default actions SHALL be carried out at the end of this phase.

3. Iterate backwards through the list of active applications, starting at the currently active application, delivering the event to the Application object. Default actions normally taken by the browser upon receipt of an event (e.g. moving input focus on receipt of a key event or inserting text into an input box) will not occur during any of these phases of event dispatching.

Event listeners for system events are registered and unregistered using the same mechanism as for DOM2 events. Listeners for system events may be registered on the `Application` object as well as on nodes in the DOM tree.

If no applications are currently active, only targeted events will be dispatched; no events will be dispatched in phases 1 or 3 above.

7.13.5 New DOM Events for application support

New events have been created that are raised on the `Application` objects in the application tree. These are normal events, not system events, and are used to indicate changes in the state of an application.

Event	Description
`ApplicationActivated`	Issued when an application focus change occurs to inform the recipient of the event that the application is now focussed.
`ApplicationDeactivated`	Issued when an application focus change occurs to inform the recipient of the event that the application is now no longer focussed.
`ApplicationShown`	Issued when an application has become visible.
`ApplicationHidden`	Issued when an application has become hidden.
`ApplicationPrimaryReceiver`	This event is issued to indicate that the target is now at the front of the active application list.
`ApplicationNotPrimaryReceiver`	This event is issued to indicate that the target is no longer at the front of the active application list.
`ApplicationTopmost`	This event is issued to indicate that the target is now the topmost (i.e. it has the highest Z-index and is not obscured by any other visible applications, for OITFs where multiple applications are visible simultaneously.
`ApplicationNotTopmost`	This event is issued to indicate that the target is no longer at the topmost application. For OITFs where only one application is visible at a time, this event indicates that the application is no longer visible to the user.

Table 10: New DOM events for application support

These events do not bubble and cannot be cancelled. Each of these events has a corresponding DOM 0 event handler property on the `Application` object. These are not shown in section 7.13.2 for clarity.

7.13.6 Examples (informative)

The examples below illustrate some aspects of the application model.

7.13.6.1 Locating the Application object

The `ApplicationManager` class provides the `getOwnerApplication()` method, which returns the document's owning application node:

```
// Assumes that the application/oipfApplicationManager object has the ID
// “applicationmanager”
Var appMgr = document.getElementById(“applicationmanager”);
var self = appMgr.getOwnerApplication(Window.document);
```

All other application functionality is available from this object.

7.13.6.2 Creating a new application

Creating a new application is a simple matter of creating a new `Application` object.

```
// Assumes that the application/oipfApplicationManager object has the ID
```

```
// “applicationmanager”
Var appMgr = document.getElementById(“applicationmanager”);
var self = appMgr.getOwnerApplication(Window.document);
var child = self.createApplication( url_of_application, true );
```

A typical requirement on an application is to only become visible once it has fully loaded. To do this, it can take advantage of `load` events. Here is an example from a clock application, which wants to load an image to become the background of the clock, upon which it can write the text of the clock.

```
<script>
function loaded() {

    var screen = document.defaultView.screen;
    var clock = document.getElementById('clock');
    window.resizeTo( clock.width, clock.height );

    // position in bottom left
    window.moveTo( clock.width, screen.availHeight - clock.height );

    setup_clock( clock.width, clock.height );

    // Assumes that the application/oipfApplicationManager object has the ID
    // “applicationmanager”
    Var appMgr = document.getElementById(“applicationmanager”);
    var self = appMgr.getOwnerApplication(Window.document);
   self.show();
}
</script>

<style> * { margin: 0cm } </style>

<body onload="loaded()">
   <img id="clock" src="clockbackground.png" style="position: absolute; top: 0px;
left=0px">
</body>
```

7.13.6.3 Change the size of a visible application

The DOM `Window` object provides all the required APIs for changing the size of a window, so these should be used directly.

```
// Unnecessary, but valid, to go via the Application object

// Assumes that the application/oipfApplicationManager object has the ID
// “applicationmanager”
Var appMgr = document.getElementById(“applicationmanager”);
var self = appMgr.getOwnerApplication(Window.document);
self.window.resizeTo(720, 150);
self.window.moveTo(0, 426);
```

7.14 Parental Rating and Parental Control APIs

This section defines APIs related to parental ratings and parental control. Parental ratings are defined in terms of a parental rating scheme (e.g. MPAA) which defines the range of possible parental rating values and a parental rating value that references a particular value in the scheme.

Parental rating values may be modified by one or more labels that provide more indication about the reasons why the rating was assigned. A content item may have zero or more parental rating values associated with it.

Sections 7.14.1 through 7.14.4 define the `ParentalRating` and `ParentalRatingCollection` objects and the related `ParentalRatingScheme` and `ParentalRatingSchemeCollection` objects. These objects are used/referenced by various other objects, such as the `Programme` object as defined in Section 7.6.2 to indicate a particular parental rating.

Section 7.14.5 defines a new Javascript embedded object “`application/oipfParentalControlmanager`”, which allows applications to construct a new parental rating scheme (and a parental rating value using that scheme), and to temporarily enable or disable viewing of a content item,

7.14.1 ParentalRating

A `ParentalRating` object describes a parental rating value for a programme or channel. The `ParentalRating` object identifies both the rating scheme in use, and the parental rating value within that scheme.

In case of a BCG the values of the properties in this object will be read from the `ParentalGuidance` element that is the child of a programme's BCG description.

7.14.1.1 Properties

`readonly String` **name**
The case-insensitive string representation of the parental rating value. This value is a parental rating value, as defined in [MPEG-7] for the respective parental rating classification scheme (by the respective <Name>-element), or one of the following: ▪ string representation of one the values for the GermanyFSK rating scheme as defined in [META] ▪ string representation of the minimum recommended age in case the parental rating scheme refers to rating_type 0 in [IEC62455], which maps to the parental rating system in DVB Systems [EN 300 468] (i.e. in which case scheme.name=="" and scheme.length == 0). An example of a valid parental rating value is "PG-13".

`readonly ParentalRatingScheme` **scheme**
The parental rating scheme to which this parental rating value refers. This object is a representation of the [MPEG-7] parental guidance classification scheme used for the parental rating value, or the GermanyFSK rating scheme as defined in [META]. For rating_type 0 in [IEC62455], which maps to the parental rating system in DVB Systems [EN 300 468], the scheme object is an empty string collection (i.e. scheme.length == 0) and scheme.name has value empty string ("").

`readonly Integer` **value**
The parental rating value represented as an index into the set of values defined as part of the ParentalRatingScheme to which this rating applies, in case scheme.length > 0. In case scheme.length == 0 and scheme.name=="", the value indicates the minimum recommended age as per rating_type 0 in [IEC62455], which maps to the parental rating system in DVB Systems [EN 300 468]

`readonly Integer` **labels**
A set of content rating labels that may provide additional information about the rating. These form part of the rating, and are different from content advisory information that may be added by the network operator. In case of a BCG the value of this field is derived from `Genre` elements that refer to the `ContentAlertCS` classification scheme. Valid labels include:

Value	Description
1	Indicates that a content item features verbal sexual references.
2	Indicates that a content item features strong language.
4	Indicates that a content item features sexual situations.
8	Indicates that a content item features violence.
16	Indicates that a content item features fantasy violence.
32	Indicates that a content item features disturbing scenes.
64	Indicates that a content item features portrayals of discrimination.
128	Indicates that a content item features scenes of illegal drug use.
256	Indicates that a content item features strobing that could impact viewers suffering from Photosensitive epilepsy

The value of this field will consist of a binary mask corresponding to the sum of zero or more values listed above

7.14.2 ParentalRatingCollection

A `ParentalRatingCollection` represents a collection of parental rating values. Applications SHALL be able to access items in the collection using array notation.

7.14.2.1 Properties

`readonly Integer` **`length`**
The number of items in the list.

7.14.2.2 Methods

`ParentalRating` **`item`**`( Integer index )`		
Description	Return the item at position `index` in the list, or `undefined` if no item is present at that position.	
Arguments	*index*	The index of the parental rating.

`void` **`addParentalRating`**`( ParentalRatingScheme scheme, Integer value, Integer labels )`	
Description	Creates a `ParentalRating` object instance for a given parental rating scheme and

	parental rating value, and adds it to the `ParentalRatingCollection` for a programme or channel. The parental rating value SHALL be given as an index in a `StringCollection` of parental rating values that are defined for the `ParentalRatingScheme`, in case scheme.length > 0. In case scheme.length == 0 and scheme.name==””, the value indicates the minimum recommended age as per rating_type 0 in [IEC62455], which maps to the parental rating system in DVB Systems [EN 300 468].	
Arguments	*scheme*	The parental rating scheme to which this value refers
	value	The parental rating value as an index into the set of values defined as part of the `ParentalRatingScheme` to which this rating applies, , in case scheme.length > 0. In case scheme.length == 0 and scheme.name==””, the value indicates the minimum recommended age as per rating_type 0 in [IEC62455], which maps to the parental rating system in DVB Systems [EN 300 468]
	labels	An optional set of content rating labels that may provide additional information about the rating. Valid values are shown in the definition of the `ParentalRating.labels` property (see section 7.14.1).

7.14.3 ParentalRatingScheme

A `ParentalRatingScheme` describes a single parental rating scheme that may be in use for rating content, e.g. the MPAA or BBFC rating schemes. Ratings in the scheme may be accessed using array notation. The parental rating schemes supported by a receiver MAY vary between deployments.

Due to differences in the parental rating models that are in use, the meanings of ratings are dependent on the rating scheme. However, applications SHALL be able to compare values with consistent results - e.g. a parental rating value greater than the system's default setting indicates a programme that should not be viewable without PIN entry.

7.14.3.1 Properties

`readonly String` **`name`**
The URI of the [MPEG-7] classification scheme representing the parental rating scheme, or “`urn:oiptvf:GermanyFSKCS`” for the “GermanyFSK” parental rating classification scheme as specified in [META]. If the value of “name” is an empty string (“”), the `ParentalRatingScheme` remains empty (i.e. `ParentalRatingScheme.length == 0`). In that case the “value” attribute of the `ParentalRating` object element indicates the minimum recommended age for the given content-item, as per rating_type 0 in [IEC62455], which maps to the parental rating system in DVB Systems [EN 300 468].

`readonly Integer` **`length`**
The number of values in the rating scheme. For rating_type 0 in [IEC62455], which maps to the parental rating system in DVB Systems [EN 300 468], the length must be 0.

`readonly Integer` **threshold**
The current parental rating threshold for this rating scheme. Items with a parental rating value at or above the threshold SHALL be blocked by the parental control subsystem (if parental control is enabled). This is an index into the set of values represented as part of the `ParentalRatingScheme` in case attribute "length" is greater than 0. If the value of "name" is an empty string (""), and `ParentalRatingScheme.length == 0`, the threshold indicates a minimum recommended age at which or above which the content must be blocked by the parental control subsystem (if parental control is enabled).

`readonly String` **region**
The region to which the parental rating scheme applies as case-insensitive region code as defined in ISO 3166-1.

7.14.3.2 Methods

`String` **item**`( Integer index )`		
Description	Return the string representation of the rating at `index` in the rating scheme, or `undefined` if no item is present at that position.	
Arguments	*index*	The index of the parental rating.

`String` **iconUri**`( Integer index )`		
Description	Return the URI of the icon representing the rating at `index` in the rating scheme, or `undefined` if no item is present at that position. If no icon is available, this method SHALL return `null`.	
Arguments	*index*	The index of the parental rating scheme.

7.14.4 ParentalRatingSchemeCollection

A `ParentalRatingSchemeCollection` represents a collection of parental rating schemes. Applications SHALL be able to access items in the collection using array notation.

7.14.4.1 Properties

`readonly Integer` **length**
The number of items in the list.

7.14.4.2 Methods

ParentalRatingScheme **item**(Integer index)		
Description	Return the item at position index in the list, or undefined if no item is present at that position.	
Arguments	*index*	The index of the parental rating.

ParentalRatingScheme **addParentalRatingScheme**(String uri, String values)		
Description	Create a new ParentalRatingScheme object and adds it to the ParentalRatingSchemeCollection.. Applications MAY use this method to register new parental rating schemes with the platform. When registered, the new parental rating scheme SHALL be accessible through the ChannelConfig.parentalRatingSchemes property of the "application/oipfParentalControlmanager" object as defined in Section 7.14.5. This method returns a reference to the ParentalRatingScheme object representing the newly-defined scheme. If the value of the uri parameter corresponds to an already-registered rating scheme, this method returns a reference to the existing ParentalRatingScheme object. If associated with one or more recordings, the parental rating scheme SHALL be stored persistently until the associated recordings are erased. If not associated with a recording, the scheme MAY be stored persistently.	
Arguments	*uri*	The URI of the [MPEG-7] classification scheme representing the parental rating scheme or "urn:oiptvf:GermanyFSKCS" for the "GermanyFSK" parental rating classification scheme as specified in [META], or empty string ("") in case of rating_type 0 in [IEC62455], which maps to the parental rating system in DVB Systems [EN 300 468].
	values	A comma-separated list of the possible values in the rating scheme, in ascending order, as specified in IEC 62455. The values should be given in a format suitable for presentation to a user, whereby the string may differ from the string specified in IEC 62455 as long as the order specified in IEC62455 is unchanged. In case of rating_type 0 in [IEC62455], attribute values must be 'null'.

7.14.5 The parentalcontrolmanager object

This section defines a new Javascript embedded object "application/oipfParentalControlmanager", which allows applications to construct a new parental rating scheme (and a parental rating value using that scheme), and to temporarily enable or disable parental control in order to permit a content item to be viewed.

If an OITF supports parental controls as indicated by value "true" for element <parentalcontrol> (as defined by Section 9.3.5) in its capability profile, the OITF SHALL support the "application/oipfParentalControlmanager" object with the following interface

This interface allows an application to construct a new parental rating scheme (and a parental rating value using that scheme) as follows:

```
//get a reference to the parental control manager object
var pcManager = document.getElementById("pcmanager");

// add a new rating scheme – in this case, the MPAA rating scheme
var myScheme = pcManager.addParentalRatingScheme("urn:mpeg:mpeg7:cs:MPAAParentalRatingCS:2001",
                                                 "G,PG,PG-13,R,NC-17,NR");

// add a new parental rating value to myProgramme, e.g. ready for recording
// in this case, the programme is rated PG-13
myProgramme.parentalRatings.addParentalRating(myScheme, 2, null);
```

This functionality SHALL adhere to the security model in Section 10. The associated permission name is "*permission_parentalcontrolmanager*"

7.14.5.1 Properties

`readonly ParentalRatingSchemeCollection` **`parentalRatingSchemes`**
A reference to the collection of rating schemes known by the receiver.

7.14.5.2 Methods

`Integer` **`setParentalControlStatus`**`( String pcPIN, Boolean enable )`		
Description	As defined in [CSP], the OITF shall prevent the consumption of a programme when its parental rating doesn't meet the parental rating criterion currently defined in the OITF. Calling this method will temporarily allow the consumption of any blocked programme. Setting the parental control status using this method SHALL set the status until the consumption of any of all the blocked programmes terminates (e.g. until the content item being played is changed), or another call to `setParentalControlEnable` method is made. Note that this method affects parental control functionality related to all rating schemes, not only the rating scheme upon which the method is called. For the `Programme` and `Channel` objects as defined in Sections 7.6.2 and 7.4.1, the `blocked` property of a programme or channel SHALL be set to `true` for programmes whose parental rating does not meet the applicable parental rating criterion, but the `locked` property SHALL be set to `false`. This operation to temporarily disable parental rating control SHALL be protected by the parental control PIN (i.e. through attribute pcPIN). The return value indicates the success of the operation.	
Arguments	*pcPIN*	The parental control PIN.
	enable	Flag indicating whether parental control should be enabled.

`Boolean` **`getParentalControlStatus`**`()`	
Description	Returns a flag indicating the temporary parental control status set by `setParentalControlStatus()`. Note that the returned status covers parental control functionality related to all rating schemes, not only the rating scheme upon

	which the method is called.

8 System integration aspects

8.1 Mapping from APIs to Protocols

This section describes mapping of DAE APIs to the specific protocol entities as defined in the protocol specification [PROT][PROT].

Section 8.1.1 describes mappings on the UNI that apply to both the managed and unmanaged cases.

Section 8.1.2 describes mappings on the HNI-IGI interface, and only apply in the managed case.

Section 8.1.3 describes mappings on the UNI that only apply to the unmanaged case.

8.1.1 Network (Common to Managed and Unmanaged Services)

This section provides details of mapping of the DAE APIs to the descriptions provided in the Protocol specification for APIs between the OITF and the Network over reference points UNIT-17.

8.1.1.1 Download CoD

Methods	Procedures
`registerDownload (string contentAccessDescriptor)`	API to download content described in the contentAccessDescriptor. Data structure of the contentAccessDescriptor as described in Annex E “Content Access Descriptor Format” If the OITF includes the Content Download functional entity ,the information in the contentAccessDescriptor is passed to the Content Download functional entity to download content over UNIT-17 using HTTP as described in [PROT][PROT] Sec 5.2.3.1 ‘Protocol over UNIT-17’ and section 7.1.4 “Download protocol(s)”.

8.1.2 OITF-IG Interface (Managed Services Only)

This section provides details of mapping of the DAE APIs to the descriptions provided in the Protocol specification [PROT][PROT] for APIs between the OITF and the Network over reference points HNI-IGI. Some methods and properties are closely associated to HNI-IGI and are included in this section. These are the RTSP control, reference point UNIS-11, and IGMP control, reference point UNIS-13,

8.1.2.1 Streaming CoD

The following tables describe the mapping of several methods of the CEA-2014 AV embedded object to the HNI-IGI protocol interfaces defined in [PROT][PROT]

Method	Procedures
`play( Number speed )`	Selection of a content item results in session initation and access to content stream. Parameters needed to build the offer SDP may be pre defined locally in the OITF or the OITF SHALL request the IG to retrieve missing SDP parameters as described in [PROT][PROT] Sec 5.2.2.1 ’Protocol over HNI-IGI’.

If the OITF does not have all transport parameters (RTP or UDP transport for MPEG2TS encapsulation or direct RTP, FEC layers addresses and ports), code information or bandwidth information to populate the SDP the OITF SHALL prompt the IG to send OPTIONS request in order to retrieve the missing parameters,

The OITF SHALL provide the following information for the OPTIONS request. Not all required headers are listed. Refer to the Protocol specification [PROT][PROT] for a complete list.

X-OITF-Request-Line	Identify the HNI-IGI method with the content identifier as described by the **data** property.eg. `OPTION sip:PSI-Twister@IPTV_Service_Control.orange.com SIP/2.0`
X-OITF-From	Local defined OITF **CurrentUser** property. eg. `<sip:family@ims.live.ericsson.com>; tag=1211455936632545012`
X-OITF-To	Copied from the **data** property. eg. `sip: PSI-Twister@IPTV_Service_Control.orange.com`

The response to the OPTIONS message request contains the information to populate the SDP offer.

The OITF prepares an SDP offer and requests the IG to initate a session, in addition to the SDP the following parameters are forwarded from the OITF to the IG. Not all required headers are listed. Refer to the Protocol specification [PROT][PROT] for a complete list.

X-OITF-Request-Line	Identify the HNI-IGI method with the content identifier as described by the **data** property.eg. `INVITE sip:PSI-Twister@IPTV_Service_Control.orange.com SIP/2.0`
X-OITF-From	Local defined OITF **CurrentUser** property. eg. `<sip:family@ims.live.ericsson.com>; tag=1211455936632545012`
X-OITF-To	Copied from the **data** property. eg. `sip: PSI-Twister@IPTV_Service_Control.orange.com`

After a successful session setup the OITF SHALL use the media player to access the RTSP URI with the session ID negotiated and received as part of the SDP offer, described in [PROT][PROT] sec 7.1.1.2 ‘RTSP for managed model UNIS-11 and NPI 10’.

The OITF SHALL send an RTSP PLAY over UNIS-11 using attribute values received in the SDP from the session initiation procedure. The RTSP PLAY is as described in the [PROT][PROT] Sec 7.1.1.2 ‘RTSP for

<table>
<tr><td></td><td>
managed model UNIS-11 and NPI 10’.

The RTSP fields in the RTSP PLAY message SHALL be filled as follows:

o The RTSP URL SHALL be set from the SDP h-uri attribute in the case of an absolute URI. The “data” property SHALL be updated with the SDP h-uri attribute. If the value of h-uri is a relative URI that is in the form of a media path, then the RTSP absolute URL is constructed by the OITF using the SDP IPAddress (from c-line) and port (from m-line) as the base followed by h-uri value for the media path. <code>(eg. rtsp://10.5.1.72:22554/TV3/823527)</code>

o The RTSP Scale header SHALL be set to the value specified in argument speed in method play. The argument SHOULD equal one of the values in the playsSpeeds property. The Scale values [RTSP sec 12.34] are as follows:

▪ 1 indicates normal play,

▪ If not 1, the value corresponds to the rate with respect to normal viewing rate,

▪ A negative value indicates reverse direction

If the speed argument of method play does not equal a supported play speed indicated by the playSpeeds property, the player SHALL play the content at the closest available playback speed. The play() method SHOULD only return false if the best effort to play back the file at any speed has failed.

The actual playback speed SHALL be available through the “speed” property of the A/V object.
</td></tr>
<tr><td><code>stop()</code></td><td>
The method enables the OITF to terminate and ongoing CoD session. The OITF SHALL request the IG to terminate the session as described in [PROT][PROT] Sec 5.2.2.1 ’Protocol over HNI-IGI’.

The OITF SHALL include the following information from the request. Not all required headers are listed. Refer to the Protocol specification [PROT][PROT] for a complete list.
<table>
<tr><td><code>X-OITF-Request-Line</code></td><td>Identify the HNI-IGI method with the content identifier as described by the data property.eg.

<code>BYE sip:PSI-Twister@IPTV_Service_Control.orange.com SIP/2.0</code></td></tr>
<tr><td><code>X-OITF-From</code></td><td>Local defined OITF CurrentUser property. eg.

<code><sip:family@ims.live.ericsson.com>; tag=1211455936632545012</code></td></tr>
<tr><td><code>X-OITF-To</code></td><td>Copied from the data property. eg.

<code>sip: PSI-Twister@IPTV_Service_Control.orange.com</code></td></tr>
</table>
The OITF SHALL remove all context information relevant to the terminated COD session upon a successful response from the IG.
</td></tr>
</table>

seek(Number pos)	Sets current play postion to “pos”, by using the “Range” parameter in the RTSP PLAY as described in [PROT][PROT] sec 7.1.1.2 ‘RTSP for managed model UNIS-11 and NPI 10’.
pause()	This method causes the OITF to send an RTSP PAUSE message (refer to [PROT][PROT] sec 7.1.1.2 ‘RTSP for managed model UNIS-11 and NPI-10’). The RTSP PAUSE message SHALL include: ▪ The RTSP URL SHALL be set to the value retrieved from the fmtp:iptv_rtsp h-uri attribute of the SDP answer. ▪ Session header SHALL be set as specified in the SDP answer fmtp:iptv_rtsp h-session attribute
next()	Not Supported. Note: Track information is not supported in the protocol specification and therefore out of scope.
previous()	Not Supported. Note: Track information is not supported in the protocol specification and therefore out of scope.

Property	Procedures
read/write String data	This property holds the user part of the content identifier [PROT][PROT] Sec 6.2.2.1.1 ‘Protocol over UNIS-8’. It is used by the OITF compose the following headers for requests towards the IG X-OITF-Request-Line X-OITF-To If the “data” property of the AV object refers to a Content-Access Descriptor (i.e. the object has type “application/oipfContentAccess” as defined in Section 7.2), the OITF must perform the following steps prior to performing the procedures defined in [PROT] as described for method play(): ▪ An HTTP GET request SHALL be made with the Request-URI set to the URL of the Content-Access Descriptor as denoted by the “data” property of the AV object. ▪ After the server has returned a Content Access Descriptor (i.e. a document with type “application/oipfContentAccess”), the OITF SHALL interpret the contents of the Content-Access Descriptor and choose a URL defined by one of the <ContentURL>-elements. The criteria for choosing a URL can be the DRM system supported by the OITF. The URL SHALL then be used for setting up a Streaming CoD session. The “data” property of the AV object SHALL be changed to represent the chosen URL. ▪ Based on the information retrieved from the Content-Access Descriptor, the OITF SHALL passing the <DRMControlInformation> to the appropriate DRM agent, and SHOULD initialize the AV playback, i.e. by loading the correct codecs as identified by the Content-access

	Descriptor.
readonly Number playPosition	The property holds the current play positon in milliseconds of the media referenced by the data property. The property value SHALL be based on the value retrieved using the RTSP GET_PARAMETERS method and parameter “position” (refer to [PROT][PROT] Sec 7.1.1.2 ‘RTSP for managed model UNIS-11 and NPI-10’) adjusted for played duration and used scale. If information is not available the value SHALL be undefined. Note this may happen at the beginning of playing a video and GET_PARAMETER has not returned a value.
readonly Number playSpeeds[ ]	The property holds the available speeds, or referred in RTSP as Scale, to be used to change the playback speed. The property value SHALL be based on the value retrieved using RTSP GET_PARAMETERS method and parameter “scales” (refer to [PROT][PROT] Sec 7.1.1.2 ‘RTSP for managed model UNIS-11 and NPI-10’). If information is not available the value SHALL be undefined. Note this may happen at the beginning of playing a video and GET_PARAMETER has not returned a value.
readonly Number playTime	The property holds the total duration in milliseconds of the media referenced by the data property. The property value SHALL be based on the value retrieved using RTSP GET_PARAMETER method and parameter “duration” (refer to [PROT][PROT] Sec 7.1.1.2 ‘RTSP for managed model UNIS-11 and NPI10’). If information is not available the value SHALL be undefined. Note this may happen at the beginning of playing a video and GET_PARAMETER has not returned a value.
readonly Number playState	No procedures defined since it is not related to protocol specification.
readonly Number error	No procedures defined since it is not related to protocol specification.
readonly Number speed	Float value indicating the actual playback speed for the content referenced by the data property. The normal default playback speed is represented by value 1.

8.1.2.2 Scheduled Content

8.1.2.2.1 Conveyance of channel list

Service discovery description procedure as described in [PROT][PROT] sec 6.3.1.1 ‘Service Provider discovery’ and [PROT][PROT] Annex B 2.3 ‘IPTV Service discovery description’ enables the OITF to obtain the URL to access the broadcast channel information. The OITF SHALL utilise UNIS-7 using this URL to obtain the Broadcast Discovery Record.

8.1.2.2.2 Switching channels

<table>
<tr><th>Methods</th><th>Procedures</th></tr>
<tr><td>setChannel(String channelID, String contentAccessDescriptorURL)</td><td>
The setChannel method of the <video/broadcast> object SHALL be used to initiate a broadcast session or switch channels. The procedures that are performed over the HNI-IGI reference point depend on the current state of broadcast session, either it is active or not. Note that an inactive broadcast session means no service is being viewed.

<u>Session Initation</u>

The OITF SHALL generate a session initiation request over the HNI-IGI including and SDP offer as described in [PROT][PROT] sec 5.2.1 ‘Scheduled Content’. The bandwidth is set according to the explanation under heading “Selection of Bandwidth” further down.

If a “contentAccessDescriptorURL” has been specified for the setChannel method, the OITF must perform the following steps prior to performing the procedures defined in [PROT] for performing setChannel as described below:

▪ An HTTP GET request SHALL be made with the Request-URI set to the URL of the Content-Access Descriptor as denoted by the “contentAccessDescriptor” attribute.

▪ Based on the information retrieved from the Content-Access Descriptor, the OITF SHALL passing the <DRMControlInformation> to the appropriate DRM agent,.

The OITF SHALL provide the following information as part of the scheduled session initiation request as described in [PROT][PROT] Sec 6.2.1 ‘Scheduled Content’. Not all required headers are listed. Refer to the Protocol specification [PROT][PROT] for a complete list.
<table>
<tr><td>X-OITF-Request-Line</td><td>Identify the HNI-IGI method with the well known PSI (Public Service Identifier) of the scheduled content. eg.

INVITE sip:IPTV_SC_Service@iptv.ericsson.com SIP/2.0</td></tr>
<tr><td>X-OITF-From</td><td>Local defined OITF CurrentUser property. eg.

<sip:family@ims.live.ericsson.com>; tag=1211455936632545012</td></tr>
<tr><td>X-OITF-To</td><td>PSI of the scheduled content. eg.

sip:IPTV_SC_Service@iptv.ericsson.com</td></tr>
</table>
The Offer SDP included in the OITF be SHALL have attributes as described in [PROT][PROT] Annex E.2 ‘Service Package SDP attributes.

On positive response to the INVITE request the OITF SHALL send an IGMP Join request on the UNIS-13 as described in [PROT][PROT] Sec 8.1.1.1 ‘Procedure for Scheduled Content on UNIS-13’.
</td></tr>
</table>

Session Modification

If the bandwidth conditions change as described under heading "Selection of Bandwidth" further down then the OITF SHALL generates a session modification request over the HNI-IGI including the new SDP offer.

The OITF SHALL provide the following information as part of the scheduled session modification request as described in [PROT][PROT] Sec 6.2.1 'Scheduled Content'. Not all required headers are listed. Refer to the Protocol specification [PROT][PROT] for a complete list.

`X-OITF-Request-Line`	Identify the HNI-IGI method with the well known PSI (Public Service Identifier) of the scheduled content. eg. `INVITE sip:IptvBroadcast@iptv.ericsson.com SIP/2.0`
`X-OITF-From`	Local defined OITF **CurrentUser** property. eg. `<sip:family@ims.live.ericsson.com>; tag=1211455936632545012`
`X-OITF-To`	PSI of the scheduled content. eg. `sip:IptvBroadcast@iptv.ericsson.com`

The Offer SDP included by the OITF SHALL have attributes as relevant to the new channel as described in [PROT][PROT] Annex E.2 'Service Package SDP attributes'.

On receiving a successful response to the INVITE request the OITF SHALL send and IGMP Leave and and IGMP Join request on the UNIS-13 as described in [PROT][PROT] Sec 8.1.1.1 'Procedure for Scheduled Content on UNIS-13'.

No Session Modification

If the bandwidth conditions as described under heading "Selection of Bandwidth" further down have not changed then the OITF SHALL send a membership report to leave the previously viewed channel, if applicable, and with the same membership report join to the multicast group associated with the selected channel. The multicast group information is retrieved from the Broadcast Discovery Record.

Selection of Bandwidth

The bandwidth to be used for the broadcast session depends on the information provided in the Broadcast Discovery Record (refer to [META][META], sec 3.2.x 'Broadcast Discovery Record'). The Broadcast Discovery Record uses the term "service" to indicate a channel.

If the TimeToRenegotiate (TTR) element is not provided within the IPService of the Broadcast Discovery Record then the bandwidth SHALL be based on the maximum bandwidth for all the services in the Broadcast Discovery Record. In this case only one session initiation is performed at initial activation of broadcast service, and no session modification is required.

If the TTR element is provided then the MaxBitRate from the new

	service and current service are compared. If broadcast service is not active and there is no active current service, session initiation is performed with the new service MaxBitRate. For already active broadcast service there are three conditions. ▪ If the MaxBitrate of the new service is greater than that of the current service and the reserved bandwidth is exceeded, network bandwidth reservation using the MaxBitrate of the new service SHALL occur immediately with session modification to ensure sufficient bandwidth is made available for the new service. ▪ If the MaxBitrate of the new service is equal to that of the current service, network bandwidth reservation procedures SHALL NOT be performed as sufficient bandwidth is already available for the new service. ▪ If the MaxBitrate of the new service is less than that of the current service and there is no pending TTR timer, a timer using the TTR element of the new service is started which will renegotiate the bandwidth with session modification. Note that at every channel change if there is a pending timeout for session modification due to a previous service change then the timer is restarted. When the timer expires the bandwidth for the currently viewed service is used in a session modification. The session initiation, session modification and no session modification are further described above.

8.1.2.2.3 End broadcast service

<table>
<tr><th>Methods</th><th>Procedures</th></tr>
<tr><td>release()</td><td>The release method of the video/broadcast object causes the OITF to perform an IGMP Leave on the active broadcast session as described in [PROT][PROT] sec 8.1.1.1 “Procedure for leaving a Scheduled Content service”.

OITF SHALL then execute a session termination procedure by sending a BYE request over the HNI-IGI interface as described in section [PROT][PROT] Sec 5.2.1.1 ‘Protocol over HNI-IGI’. The request SHALL include the following information. Not all required headers are listed. Refer to the Protocol specification [PROT][PROT] for a complete list.
<table>
<tr><td>X-OITF-Request-Line</td><td>Identify the HNI-IGI method with the well known PSI (Public Service Identifier) of the scheduled content. eg.

INVITE sip:IPTV_SC_Service@iptv.ericsson.com SIP/2.0</td></tr>
<tr><td>X-OITF-From</td><td>Local defined OITF CurrentUser property. eg.

<sip:family@ims.live.ericsson.com>; tag=1211455936632545012</td></tr>
<tr><td>X-OITF-To</td><td>PSI of the scheduled content. eg:

sip:IPTV_SC_Service@iptv.ericsson.com</td></tr>
</table></td></tr>
</table>

8.1.2.3 IMS APIs

Methods	Procedures
`registerUser( String userId, String pin )`	Performs IMS registration with the specified user ID as described in [PROT][PROT] sec 5.3.6.1 'Procedure for User Registration and Authentication in Managed Model on HNI-IG Interface'.
`deRegisterUser( String userId )`	Performs IMS de-registration with the specified user ID as described in [PROT][PROT] sec 5.3.6.1 'Procedure for User Registration and Authentication in Managed Model on HNI-IG Interface'.
`subscribeImsNotification (FeatureTagCollection featureTagCollection, boolean performuserregistration)`	OITF maintains applications that have subscribed to notifications. If applicable it will send a re-registrationto the IG. When new messages arrive at the IG it shall notify the OITF. (as defined in [PROT][PROT] sec 5.5.1.2).
`unSubscribeImsNotification()`	This is a local call within OITF to notify that the DAE application shall not receive unsolicited notification. The OITF shall use native code to handle new dialogues. Any feature tag values that were added by the DAE application are removed for the indicated userId since no native code is setup to process the new dialogues for the feature tag values.

8.1.3 Network (Unmanaged Services only)

This section provides details of mapping of the DAE APIs to the descriptions provided in the Protocol specification [PROT] for APIs between the OITF and the Network. These are the RTSP control, reference point UNIS-11, reference point UNIS-13.

8.1.3.1 Streaming CoD

Method	Procedures
`play( Number speed )`	The "`speed`" parameter is a floating point value indicating the requested playback speed. A value of 1 represents normal playback speed, and other values are relative to this. **RTSP** The RTSP URL signalled by the "data" attribute SHALL be used to initiate the process defined in [PROT][PROT] Sec 7.1.1.1.1. The "data" attribute SHALL furthermore be updated with the new URI after redirection requests (moved). The RTSP PLAY request SHALL include a "`Scale`" header set to the value of the "`speed`" parameter passed to the API. The server will play the stream at the specified speed, if supported. **HTTP** The HTTP URL signalling by the "data" attribute SHALL be used to initiate the process defined in [PROT][PROT] Sec 5.2.2.2. The "data" attribute SHALL furthermore be updated with the new URI after redirection requests

	(moved). The "speed" parameter SHALL be passed to the OITF media player, which SHOULD attempt to play back the content at the requested speed.
stop()	**RTSP** The OITF SHALL initiate the process defined in [PROT][PROT] Sec 7.1.1.1.2. **HTTP** The OITF SHALL stop playback. The OITF MAY close the connection to the server and MAY clear any buffered content.
seek(Number pos)	**RTSP** Sets current play postion to "pos", by using the "Range" parameter in the RTSP PLAY as described in [PROT][PROT] sec 7.1.1.1 'RTSP for managed model UNIS-11 and NPI 10'. **HTTP** The OITF SHALL attempt to playback from the specified position "pos". It MAY use the RANGE header as described in [PROT][PROT] Sec 5.2.2.2 as necessary.
pause()	**RTSP** This method causes the OITF to send an RTSP PAUSE message (refer to [PROT][PROT] sec 7.1.1.2 'RTSP for managed model UNIS-11 and NPI-10'). The RTSP PAUSE message SHALL include: **HTTP** The OITF SHALL pause playback.
next()	Not Supported. Note: Track information is not supported in the protocol specification and therefore out of scope.
previous()	Not Supported. Note: Track information is not supported in the protocol specification and therefore out of scope.

Property	Procedures
read/write String data	**RTSP** This property holds the RTSP URI for the content item. **HTTP** The property holds the HTTP URI for the content item. If the "data" property of the AV object refers to a Content-Access Descriptor (i.e. the object has type "application/oipfContentAccess" as defined in Section 7.2), the OITF must perform the following steps prior to performing the procedures defined in [PROT] as described for method

	play(): ▪ An HTTP GET request SHALL be made with the Request-URI set to the URL of the Content-Access Descriptor as denoted by the “data” property of the AV object. ▪ After the server has returned a Content Access Descriptor (i.e. a document with type “application/oipfContentAccess”), the OITF SHALL interpret the contents of the Content-Access Descriptor and choose a URL defined by one of the <ContentURL>-elements. The criteria for choosing a URL can be the DRM system supported by the OITF. The URL SHALL then be used for setting up a Streaming CoD session. The “data” property of the AV object SHALL be changed to represent the chosen URL. ▪ Based on the information retrieved from the Content-Access Descriptor, the OITF SHALL passing the <DRMControlInformation> to the appropriate DRM agent, and SHOULD initialize the AV playback, i.e. by loading the correct codecs as identified by the Content-access Descriptor.
`readonly Number playPosition`	The property holds the current play positon in milliseconds of the media referenced by the data property. For RTP, The property value SHALL be based on the value retrieved using the RTSP GET PARAMETERS method and parameter “position” (refer to [PROT][PROT] Sec 7.1.1.2 ‘RTSP for managed model UNIS-11 and NPI-10’) adjusted for played duration and used scale. If information is not available the value SHALL be undefined. Note this may happen at the beginning of playing a video and GET_PARAMETER has not returned a value.
`readonly Number playSpeeds [ ]`	For RTSP, the property holds the available speeds, or referred in RTSP as Scale, to be used to change the playback speed. The property value SHALL be based on the value retrieved using RTSP GET PARAMETERS method and parameter “scales” (refer to [PROT][PROT] Sec 7.1.1.2 ‘RTSP for managed model UNIS-11 and NPI-10’). For HTTP, the possible playback speeds are determined by the OITF internal capabilities and buffering model, and the speed at which content is delivered. The OITF MAY make this information available via this property. If information is not available the value SHALL be undefined. Note this may happen at the beginning of playing a video and GET_PARAMETER has not returned a value.
`readonly Number playTime`	The property holds the total duration in milliseconds of the media referenced by the data property. For RTSP, the property value SHALL be based on the value retrieved using RTSP GET_PARAMETER method and

	parameter “duration” (refer to [PROT][PROT] Sec 7.1.1.2 ‘RTSP for managed model UNIS-11 and NPI10’). For HTTP, the property value MAY be determined using the “Content-Length” HTTP header, although it is noted that this method does not work for variable bit rate content. If information is not available the value SHALL be undefined. Note this may happen at the beginning of playing a video and GET_PARAMETER has not returned a value.
`readonly Number playState`	No procedures defined since it is not related to protocol specification.
`readonly Number error`	No procedures defined since it is not related to protocol specification.
`readonly Number speed`	Float value indicating the actual playback speed of the player for the content referenced by the data property. The normal default playback speed is represented by value 1.

8.2 URI Schemes and their usage

The following table lists possible URL schemas and their usages within DAE documents (XHTML, JavaScript, images, and references to A/V content). If a certain URL scheme is supported, the corresponding protocols to an URL scheme SHALL be supported as defined by the reference(s)

Table 11: URI schemes and usages

<table>
<tr><th>URI scheme</th><th>Usage</th><th>Reference</th><th>Comments</th></tr>
<tr><td>dvb</td><td>Application launching</td><td>Application locator as defined by section 14.1.7 of [MHP]</td><td></td></tr>
<tr><td rowspan="3">http and https</td><td>Transport of DAE documents</td><td>Section 5.3.3.1 of [PROT][PROT]

Section 5.3 of [CEA-2014-A]

Section 5 of [CSP][CSP]</td><td>An URL to refer documents supported by DAE</td></tr>
<tr><td>COD streaming(“http-get”)</td><td rowspan="3">Annex F of [PROT][PROT].</td><td rowspan="3">A Content URL specified in the data attribute of A/V object as defined in the section 5.7.1 “Streamed A/V content” of [[CEA-2014-A]</td></tr>
<tr><td>COD download(“http-get”)</td></tr>
<tr><td rowspan="2">crid</td><td>COD streaming (“sip-rtsp-rtp-udp”)</td></tr>
<tr><td>COD streaming(“sip-rtsp-udp”)</td></tr>
</table>

rtsp	COD streaming (“rtsp-rtp-udp”)		A Content URL specified in a Content Access Descriptor describned in the section 7.1.1
	COD Streaming(“rtsp-udp”)		

9 Capabilities

9.1 Minimum DAE capability requirements

This section defines minimum capabilities which OITF implementations are required to provide to the Declarative Application Environment and the applications running in that environment.

The following section defines minimum capabilities which SHALL apply to all OITFs.

OITFs SHALL support multiple simultaneous applications loaded and running in the browser.

OITFs SHALL support at least 2 DAE applications being visible at one time, one application showing a notification in the notification window (as defined in Section 5.6.3 of CEA-2014-A) and one in the main browser area. OITFs MAY support more than one DAE application being visible at one time in the main browser area. On OITFs where only one DAE application is visible at one time in the main browser area, it is OITF implementation specific how the visible application is changed.

OITFs with an HD output SHALL support 1280x720 graphics on that output when HD video is being decoded or when no video is being decoded. OITFs MAY support 1920x1080 graphics.

The present document does not define any requirements concerning support for SD graphics.

OITFs SHALL support unrestricted scaling of IP delivered video.

The present document does not define any requirements for scaling of video not delivered via IP, e.g. in hybrid OITFs.

The present document does not define requirements for supporting decoder format conversion.

The present document does not define requirements for pixel depth in the graphics system except that OITFs SHALL support at least one bit of per-pixel alpha.

The present document does not require the capability to mix audio from memory and audio from a currently decoded stream.

OITFs SHALL support decoding one stream containing video and audio. They MAY support decoding more than one stream.

OITFs SHALL support the Tiresias font or equivalent with the “Basic Euro Latin Character set”. They MAY support other fonts in addition.

OITFs SHALL provide some means for text input. The present document does not specify any particular solution.

The present document recommends support for pointer based input. Please note that Annex B contains some requirements regarding pointer based input.

In their SSL/TLS implementation, OITFs SHALL support

a) key lengths of up to 2048 bits for the asymmetric encryption part

b) for the symmetric part, at least 128-bit for AES and at least 168-bit for 3DES

The present document does not define requirements for minimum memory sizes for DAE applications or OITF behaviour when available memory is low. This specification is deliberately silent about the conditions under which the LowMemory event defined in section 7.13.4 is generated.

OITFs SHALL support at least 100 cookie's with a maximum of 20 per domain and a maximum size for any individual cookie of 4K.

The present document does not require control of audio volume to be exposed to the DAE.

OITFs SHALL make at least the following remote control key events available to DAE applications;

- 0-9
- up, down, left, right, enter / OK , back

If the OITF remote control has an applicable button for the following keys then corresponding key events SHALL be made available to DAE applications and this SHALL be signalled using the CEA-2014 capability exchange mechanism.

- The keys in the CEA-2014 “<playcontrolkeys>” group
- VK_FAST_FWD
- VK_REWIND

The present document is intentionally silent concerning whether making the following remote control key events available to DAE applications is mandatory or optional:

- The keys in the CEA-2014 "<colorkeys>" group,
- VK_HOME,
- VK_MENU,
- VK_GUIDE,
- VK_TELETEXT,
- VK_SUBTITLES,
- VK_CHANNEL_UP,
- VK_CHANNEL_DOWN,
- VK_VOLUME_UP,
- VK_VOLUME_DOWN,
- VK_MUTE.

Where OITFs make other remote control key events available to DAE applications, this SHALL be done as specified by CEA-2014. Whenever applicable, this SHOULD be done using the complementary UI profiles defined in the next paragraph.

9.2 Default UI profiles

The OITF SHALL support at least one of the CEA-2014 UI-related base profiles defined in Table 12, as indicated by the "**name**" attribute of the <ui_profile> element of the OITF capability description.

Table 12: Base UI Profile Names

Base UI Profile Name	Default values
"OITF_SDEU_UIPROF"	<width>720</width> <height>576</height> <colors>high</colors> <hscroll>false</hscroll> <vscroll>true</vscroll> Tiresias with support for the Unicode character range “Basic Euro Latin Character set” as defined in Annex E of [MHP]. <key>VK_BACK</key>

	<navigationkeys>true</navigationkeys> <numerickeys>true</numerickeys> <pointer>false</pointer> <security protocolNames="ssl tls">true</security> <overlay>per-pixel</overlay><!-- whereby at least one level of partial transparency between graphics and video must be supported as per the minimum requirements of Section 9.1 --> <overlaylocal>per-pixel</overlaylocal><!-- whereby at least one level of partial transparency between graphics and video must be supported as per the minimum requirements of Section 9.1 --> <overlaylocaltuner>per-pixel</overlaylocaltuner><!-- whereby at least one level of partial transparency between graphics and video must be supported as per the minimum requirements of Section 9.1 --> <overlayIPbroadcast>per-pixel</overlayIPBroadcast><!-- whereby at least one level of partial transparency between graphics and video must be supported as per the minimum requirements of Section 9.1 --> <notificationscripts>false</notificationscripts> <save-restore>false</save-restore>
"OITF_SD60_UIPROF"	Same as OITF_SDEU_UIPROF, with the following modifications: <width>720</width> <height>480</height>
"OITF_SDUS_UIPROF"	Same as OITF_SDEU_UIPROF, with the following modifications: <width>640</width> <height>480</height>
"OITF_HD_UIPROF"	Same as OITF_SDEU_UIPROF, with the following modifications: <width>1280</width> <height>720</height> <colors>high</colors> Tiresias with support for the Unicode character range “Basic Euro Latin Character set” as defined in Annex E of [MHP].
"OITF_FULL_HD_UIPROF"	Same as OITF_HD_UIPROF, with the following modifications: <width>1920</width> <height>1080</height>

In order to capture the heterogeneity of the features supported by OITF devices, this specification also defines a set of complementary UI Profile name fragments, each constituting a particular logical subset of capabilities, for which a OITF can indicate support by appending the UI Profile name fragment to the name of the supported base UI profile in the “name” attribute of the <ui_profile>-element. Both the OITF and server SHALL support the concatenation of a series of UI profile name fragments in any order.

Table 13: Complementary UI Profile Name Fragments

UI Profile Name Fragment	Default values
"+TRICKMODE"	<key>VK_PLAY</key> <key>VK_PAUSE</key> <key>VK_STOP</key> <key>VK_REWIND</key> <key>VK_FAST_FWD</key>
"+AVSTREAM"	<video_profile type="application/oipfContentAccess"/>
"+DL"	<download protocolNames="http">true</download> <mime-extensions>application/oipfContentAccess</mime-extensions>
"+IPBC"	<video_broadcast type=”ID_IPTV_SDS” scaling=”arbitrary”>true</video_broadcast>
"+ANA"	<video_broadcast type=”ID_ANALOG” scaling=”quarterscreen”>true</video_broadcast>
"+DVB_C"	<video_broadcast type=”ID_DVB_C” scaling=”quarterscreen”>true</video_broadcast>
"+DVB_T"	<video_broadcast type=”ID_DVB_T” scaling=”quarterscreen”>true</video_broadcast>
"+DVB_S"	<video_broadcast type=”ID_DVB_S” scaling=”quarterscreen”>true</video_broadcast>
"+META_BCG”	<clientMetadata type=”bcg”>true</clientMetadata >
“+META_SI”	<clientMetadata type=”dvb-si”>true</clientMetadata >
"+ITV_KEYS"	<key>VK_HOME</key> <key>VK_MENU</key> <key>VK_CANCEL</key> <key>VK_SUBTITLES</key> <colorkeys>true</colorkeys>
"+CONTROLLED"	<key>VK_CHANNEL_UP</key> <key>VK_CHANNEL_DOWN</key> <key>VK_VOLUME_UP</key> <key>VK_VOLUME_DOWN</key> <key>VK_MUTE</key> <configurationChanges>true</configurationChanges>

	<extendedAVControl>true</extendedAVControl> When relevant (ie when coupled with +DL, resp +PVR): <download manageDownloads="true">true</download> <pvr manageRecordings="true">true</pvr> <remote_diagnostic>true</remote_diagnostic>
"+PVR"	<key>VK_RECORD</key> <recording>true</recording>
"+DRM"	<drm DRMSystemID="urn:dvb:casystemid:19188">TS_BBTS TTS_BBTS MP4_PDCF</drm>

Whenever an OITF supports an extension to the capabilities that can be defined using a combination of a base UI Profiles and a (number of) UI Profile fragment(s), it SHALL advertise this extension using the CEA-2014 UI Profiles extension mechanism.

Examples of valid OITF capability profiles are:

A pure HD-capable IPTV OITF, which supports live DVB-IP TV via SD&S, streamed mpeg at SD and HD formats, trickplay, and access to an embedded BCG metadata client:

```
<profilelist>
    <ui_profile name=”OITF_HD_UIPROF+IPBC+AVSTREAM+META_BCG+TRICKMODE+ITV_KEYS+CONTROLLED+DRM”>
        <ext>
            <parentalcontrol schemes=”urn:mpeg:mpeg7:cs:MPAAParentalRatingCS:2001”> true
            </parentalcontrol>
        </ext>
    </ui_profile>
    <video_profile type="application/oipfCcontentAccess"/>
    <video_profile name=”TS_AVC_SD_25_HEAAC” type=”video/mpeg” transport=”http-get rtsp-rtp-udp”
    DRMSystemID="urn:dvb:casystemid:19188"/>
    <video_profile name=”TS_AVC_HD_25_HEAAC” type=”video/mpeg” transport=”http-get rtsp-rtp-udp”
    DRMSystemID="urn:dvb:casystemid:19188"/>
</profilelist>
```

A hybrid HD-capable box, supporting live DVB broadcasts over satellite, broadcast recording, and (Marlin-protected and unprotected) VoD in progressive download:

```
<profilelist>
    <ui_profile name=” OITF_HD_UI_PROF+AVSTREAM+TRICKMODE+ITV_KEYS+CONTROLLED+DRM+DVB_S+META_SI+PVR”>
        <ext>
            <parentalcontrol schemes=”urn:mpeg:mpeg7:cs:MPAAParentalRatingTVCS:2001”> true
            </parentalcontrol>
        </ext>
    </ui_profile>
    <video_profile name=”AVC_SD_25_HEAAC” type=”video/mpeg” transport=”http-get rtsp-rtp-udp”/>
    <video_profile name=”AVC_HD_25_HEAAC” type=”video/mpeg” transport=”http-get rtsp-rtp-udp”/>
</profilelist>
```

A hybrid device providing access to its ATSC terrestrial tuner, DVB-IPTV ‘tuner’, and PVR functionality to DAE applications, but not exposing ‘trickmode’ or ‘controlled’ key events to DAE applications running in the browser:

```
<profilelist>
    <ui_profile name="OIF_HD_UIPROF+PVR+IPBC">
        <ext>
            <video_broadcast type='ID_ATSC_T' scaling=”arbitrary”>true</video_broadcast>
            <parentalcontrol schemes=”urn:mpeg:mpeg7:cs:MPAAParentalRatingCS:2001
            urn:mpeg:mpeg7:cs:MPAAParentalRatingTVCS:2001”> true </parentalcontrol>
        </ext>
    </ui_profile>
</profilelist>
```

9.3 CEA-2014 Capability Negotiation and Extensions

This section contains extensions and modifications to the CEA-2014[CEA-2014-A] capability negotiation mechanism. If an OITF doesn’t return a given capability via the capability exchange mechanism as defined in Section 5.2 of CEA-2014-A, either as part of the profile or using an <ext>-element, that capability is not supported. The schema with the extensions and modifications to the capability description as defined in this section can be found in Annex F. The schema in Annex F SHALL be used instead of the existing capability description schema as defined in Annex C of CEA-2014 [CEA-2014-A].

9.3.1 Tuner/broadcast capability indication

If an OITF supports control over its local tuner functionality by a server, an OITF SHALL indicate this through the capability exchange mechanism as defined in Section 5.2 of CEA-2014-A. To this end the following new elements SHALL be supported for a capability description or capability profile (see Annex F for more information):

- **<video_broadcast>** - indicates whether or not the OITF supports the video/broadcast object to enable control of its local tuner functionality by a server (i.e. retrieving the tuner’s channel line up, switching channels of the tuner, and rendering the output of the broadcasted content inside the browser). The <video_broadcast>-element has six attributes:
    - Attribute *type* specifies the type(s) of tuner(s) for which the OITF allows tuner control, by using a space-separated list of idType values as specified in Section 7.4.2.1 for the Channel object (i.e. “ID_ANALOG”, “ID_DVB_C”, etc.).
    - Attribute *transport* specifies a space-separated list of supported (transport) protocols in case of IP Broadcasts (i.e. if the type attribute contains one of the ID_IPTV_* idType values as specified in Section 7.5). This is done by using one or more of the (transport) protocol names as defined in Annex F of the [Protocols specification].
    - Attribute *scaling* specifies the method of video scaling the OITF supports for the tuner output (i.e. “arbitrary”, “quartersize”, “0.33x0.33” or “none”), with default value “arbitrary” if omitted.
    - Attribute *minSize* specifies the minimal size, as a percentage of the full extent of the OITF’s display, to which the OITF supports scaling of video content received over the (logical or physical) tuner if attribute *scaling* has value “arbitrary”. The value “0” for the *minSize* attribute indicates support for arbitrary and unrestricted scaling of the video. The value of the attribute *minSize* SHALL be silently ignored if the value of the attribute *scaling* is not “arbitrary”.
    - Attribute *nrstreams* provides an indication of the number of video streams that can be rendered simultaneously by the indicated tuner functionality (typically limited by the number of tuners supported by the device), with a default value of “1” if omitted.
    - Attribute *postList* specifies whether or not the OITF supports the HTTP POST method defined in Section 7.4.1.1, respectively whether or not the server uses the posted channel list information, if conveyed by the OITF, to exercise tuner control. If an OITF does not post the channel list information, a server SHALL, irrespective of the value it specified for the *postList* attribute in its server capability description, rely on the getChannelConfig() method defined in Section 7.4.1.2 to access the channel list information.

The <video_broadcast>-element is defined using the following XML Schema fragment. Multiple <video_broadcast>-elements may be specified to distinguish between tuners with different behaviour or capabilities, for example with respect to scaling:

```
<xs:element name="video_broadcast" type="videoBroadcastType" minOccurs="0"
maxOccurs="unbounded"/>
<xs:complexType name="videoBroadcastType">
    <xs:attribute name="type" type="xs:string" use="required"/>
    <xs:attribute name="transport" type="xs:string"/>
    <xs:attribute name="nrstreams" type="xs:unsignedInt" default="1"/>
    <xs:attribute name="scaling" type="scalingType" default="arbitrary"/>
    <xs:attribute name="minSize" type="xs:unsignedInt" default="0"/>
    <xs:attribute name="postList" type="xs:boolean" default="false"/>
</xs:complexType>
```

- **<overlaylocaltuner>** - indicates whether or not the OITF supports overlays for video broadcasts received through the local tuner, i.e. allows XHTML content to be rendered on top of video content broadcasted over local tuner. If included, the value of this element SHALL be: (none|on-off|global|per-pixel), whereby the same requirements as defined for element <overlay> in [Req. 5.2.1.a] of CEA-2014-A SHALL apply.

NOTE: As defined by [Req. 5.2.1.e] of CEA-2014-A also a server MAY use these elements in the server capability description, if a server requires control of the tuner functionality of an OITF for the correct rendering of its service.

9.3.2 Broadcasted content over IP capability indication

If an OITF supports functionality for rendering the output of the broadcasted content received over IP inside the browser and optionally providing an IPTV related channel line-up and favourite list to the server, an OITF SHALL indicate this through the capability exchange mechanism as defined in Section 5.2 of CEA-2014-A. This SHALL be done using the same <video_broadcast> element as defined in Section 9.3.1, whereby the type attribute contains one of the ID_IPTV_* idType values as specified in Section 7.5:

- **<video_broadcast>** - indicates whether or not the OITF supports the video/broadcast object to enable control rendering the output of the broadcasted content received over IP inside the browser and optionally providing an IPTV related channel line-up and favourite list to the server.

To indicate support for overlays over IP broadcasts the following element SHALL be used (see Annex F for more information):

- **<overlayIPbroadcast>** - indicates whether or not the OITF supports overlays for IP video broadcasts, i.e. allows XHTML content to be rendered on top of video content broadcasted over IP. If included, the value of this element SHALL be: (none|on-off|global|per-pixel), whereby the same requirements as defined for element <overlay> in [Req. 5.2.1.a] of CEA-2014-A SHALL apply.

NOTE: As defined by [Req. 5.2.1.e] of CEA-2014-A also a server MAY use these elements in the server capability description, if a server requires control of the video/broadcast object to control broadcasts received over IP for the correct rendering of its service.

9.3.3 PVR capability indication

Support for the control of recording functionality that is available to the OITF by a server SHALL be indicated in the capability exchange mechanism as defined in Section 5.2 of CEA-2014-A. This specification defines the following element that can be added to a capability description:

- **<recording>:** indicates whether or not the OITF supports control of its local recording (i.e. PVR) functionality by a server. If included, the value of this element SHALL be (true|false). The boolean attribute *ipBroadcast* specifies whether or not the OITF also supports recording of A/V content broadcasted over IP, and the Boolean attribute *postList* specifies whether or not the OITF supports the HTTP POST method defined in Section 7.6.1, respectively whether or not the server uses the posted channel list information, if conveyed by the OITF, to control the recording functionality available to the OITF. If an OITF does not post the channel list information, a server SHALL,

irrespective of the value it specified for the *postList* attribute, rely on the `getChannelConfig()` method defined in Section 7.6.1 to access the channel list information. The Boolean attribute *manageRecordings* specifies whether or not the OITF supports managing recordings through the JavaScript APIs defined in section 7.11.2.

The <recording>-element is defined using the following XML Schema fragment (see Annex F for more information):

```
<xs:element name="recording" type="pvrType"/>
<xs:complexType name="pvrType">
   <xs:simpleContent>
      <xs:extension base="xs:boolean">
         <xs:attribute name="ipBroadcast" type="xs:boolean" default="false"/>
         <xs:attribute name="manageRecordings" type="xs:boolean" default="false"/>
         <xs:attribute name="postList" type="xs:boolean" default="false"/>
      </xs:extension>
   </xs:simpleContent>
</xs:complexType>
```

NOTE: As defined by [Req. 5.2.1.e] of CEA-2014-A a server MAY also use these element in the server capability description, if a server requires control of the recording (PVR) functionality that is available to an OITF for the correct rendering of its service.

9.3.4 Download CoD capability indication

If a client supports downloading content to a client (with or without DRM protection), the client SHALL indicate this by using the value “true” for the <download>-element inside the client capability description, as defined in Section 5.2.1 of CEA-2014-A. The <download>-element SHALL adhere to the definition of bullet o) of [Req. 5.2.1.a] of CEA-2014-A. Furthermore, the client SHALL include a <mime-extensions>-element (as defined by bullet t) of [Req. 5.2.1.a] of CEA-2014-A) in its capability description with value “application/oipfContentAccess” to indicate support for the content access description document format as defined in Section 7.1.

A client MAY include an informative list of MIME-types it supports for playback after download through the <mime-extensions> element. Note that since content download may be separated from content playback, a server SHOULD not rely on this information to be present.

If a client supports managing downloads through the JavaScript content download API specified in Section 7.11.3 then the client SHALL indicate this using the attribute *manageDownloads*. This attribute has the following definition (see Annex F for more information):

```
<xs:attribute name="manageDownloads" type="xs:string" default="none"/>
```

If present, this attribute SHALL take one of the following values:

- **“none”**: indicates that the client does not support managing downloads
- **“initiator”**: indicates that downloads initiated by the current application may be managed
- **“samedomain”**: indicates that downloads initiated by applications from the same fully-qualified domain may be managed.
- **“all”**: indicates that downloads initiated both by the current application and other applications may be managed

If not present, a value of “none” SHALL be assumed.

Example:

```
<download protocolNames=”http ftp” manageDownloads=”all > true </download>
<mime-extensions> application/oipfContentAccess </mime-extensions>
```

NOTE: As defined by Req. 5.2.1.e of [CEA-2014-A] a server MAY also use these element in the server capability description, if a server requires the download CoD mechanisms available on a client for the correct operation of its service.

9.3.5 Parental ratings

If an OITF supports a parental control system, the OITF SHALL indicate this by using the value “true” for element <parentalcontrol> in the OITF capability profile/description, and define a space separated list of names of parental rating schemes using the “schemes” attribute.

The schema of the <parentalcontrol>-element is defined as follows (see Annex F for more information):

```
<xs:element name="parentalcontrol" type="parentalControlType"/>
<xs:complexType name="parentalControlType">
     <xs:simpleContent>
         <xs:extension base="xs:boolean">
              <xs:attribute name=”schemes” type=”xs:string”/>

         </xs:extension>
     </xs:simpleContent>
</xs:complexType>
```

For which the following semantics SHALL apply:

<parentalcontrol> - indicates whether or not the OITF supports a client controlled parental control system. If included in the OITF capability description, the value of this element SHALL be: (true|false). The <parentalcontrol>-element has the following attributes:

- attribute **“schemes”**: SHALL be a non-empty space separated list of case-insensitive names of parental rating schemes registered with the platform (either by the manufacturer, or by applications where the rating scheme is associated with a recording), if the value of the <parentalcontrol>-element is true. Valid rating schemes names include the ParentalRating classification scheme names as defined in [MPEG-7], extended with the “GermanyFSK” system as specified in [META][META]).

  Example:

```
<parentalcontrol schemes=”urn:mpeg:mpeg7:cs:MPAAParentalRatingCS:2001”>
         true
</parentalcontrol>
```

9.3.6 Extended A/V API support

The OITF SHALL indicate support for the extended A/V control APIs defined in section 7.11.1 using the following element in the OITF’s capability description (see Annex F for more information):

```
<xs:element name="extendedAVControl" type="xs:boolean"/>
```

If included, the value of this element SHALL be: (true|false).

9.3.7 OITF Metadata API support

The OITF SHALL indicate support for client-side metadata processing and the APIs defined in section 7.9 using the following element in the OITF’s capability description (see Annex F for more information):

```
<xs:element name="clientMetadata" type="metadataType"/>
<xs:complexType name="metadataType">
         <xs:simpleContent>
             <xs:extension base="xs:boolean">
                <xs:attribute name="type" type="xs:string"/>
             </xs:extension>
         </xs:simpleContent>
</xs:complexType>
```

This element has the following semantics:

<clientMetadata> - indicates whether or not the OITF supports a client-side metadata processing. If included in the RUI Client capability description, the value of this element SHALL be: (true|false). The <clientMetadata> element has the following attributes:

- attribute **“type”** SHALL include a non-empty space separated list of names of supported metadata systems/protocols, if the value of the <clientmetadata> element is true.

Below is an extensible list of case insensitive metadata system/protocol names which MAY be used for this attribute:

- **“bcg”**: indicates support for the TV-Anytime Broadband Content Guide metadata format.
- **“sd-s”**: indicates support for the DVB SD&S metadata format.
- **“dvb-si”**: indicates support for the DVB-SI metadata format.

9.3.8 OITF Configuration API support

The OITF SHALL indicate support for modification of OITF configuration and settings by applications (via the APIs defined in section 7.10) using the following element in the OITF’s capability description (see Annex F for more information):

```
<xs:element name="configurationChanges" type="xs:boolean"/>
```

If included, the value of this element SHALL be: (true|false).

9.3.9 IMS API Support

The OITF SHALL indicate support for IMS API (via the APIs defined in section 7.8) using the following elements in the client’s capability description (see Annex F for more information):

```
<xs:element name="ims" type="xs:boolean"/>
<xs:element name="communication_services" type="xs:boolean"/>
```

If included, the value of these elements SHALL be: (true|false).

9.3.10 DRM capabilty indication

If an OITF supports content to a client under DRM protection, the client SHALL include one or more <drm>-elements inside the client capability description. The <drm>-element identifies support for a DRM system through attribute “DRMSystemID”. The <drm>-element is defined using the following XML Schema fragment (see Annex F for more information):

```
<xs:element name="drm" type="drmType" minOccurs="0" maxOccurs="unbounded"/>
<xs:complexType name="drmType">
        <xs:simpleContent>
            <xs:extension base="xs:string">
               <xs:attribute name="DRMSystemID" type="xs:string" use="required"/>
               <xs:attribute name="protectionGateways" type="xs:string" default=""/>
            </xs:extension>
        </xs:simpleContent>
</xs:complexType>
```

And with the following semantics:

<drm> - indicates whether or not the client supports a DRM content protection system for downloading and streaming content. If included in the RUI Client capability description, the value of this element SHALL be a space separated list of zero or more case-insensitive names of supported file and/or container formats for protected content by the DRM system indicated by the "DRMSystemID" attribute, such as the OMA DRM Content Format (DCF). Valid values include: the system_format name of the first column of Table 3 of [MEDIA], and a protection format of the second column of Table 3 of [MEDIA], concatenated with an underscore ‘_’. In case of the Gateway centric approach defined by [CSP], this attribute indicates the protectionFormats which are supported by the combination of OITF and CSP Gateway and may be omitted.

The <drm>-element has the following attributes:

- attribute **“DRMSystemID”** SHALL include a supported DRM system. Valid values for the "DRMSystemID" include the values as defined by element DRMSystemID in Table 8 of Section 3.3.2 of [META]. For example, for Marlin, the DRMSystemID value is “urn:dvb:casystemid:19188”. In case of the Gateway centric approach defined by [CSP], this DRMsystemID attribute indicates the DRM System(s) of UNIS-CSP-G which is supported by the combination of OITF and CSP Gateway.

- attribute **"protectionGateways"** SHALL include a space separated list of zero or more case-insensitive names of supported CSP Gateway types that are capable of supporting the DRM system indicated by attribute "DRMSystemID". This attribute is conditional mandatory and SHALL be specified in the case that the DRM System indicated by the "DRMSystemID" attribute is supported by the CSP Gateway. Valid values for the scheme for the Gateway centric approach defined by [CSP] are "dtcp-ip" and "ci+".

Examples:

```
<drm DRMSystemID="urn:dvb:casystemid:19188" >TS_BBTS TTS_BBTS MP4_PDCF</drm>
<drm DRMSystemID="urn:dvb:casystemid:12348" protectionGateways="ci+">TS_PF TTS_PF</drm>
<drm DRMSystemID="urn:dvb:casystemid:12348" protectionGateways="dtcp-ip">TS_PF</drm>
```

9.3.11 Media profile capability indication

If an OITF supports streaming A/V content to the client, the client SHALL indicate this by including a non-empty list of <audio_profile> and/or <video_profile> elements in the RUI client capability description. The <audio_profile> and <video_profile> elements SHALL adhere to the following requirements in addition to what has been defined by bullet v) and w) of [Req. 5.2.1.a] of CEA-2014-A:

- Valid values for the "type"-attribute of the <audio_profile> and <video_profile>-elements include the MIME-types given in Section 3 of [MEDIA].
- Valid values for the "name"-attribute include:
  - for <video_profile>-elements: the system format name, the video format name and the audio format name for A/V contents, concatenated with an underscore '_', as defined in Section 3 of [MEDIA].
  - for <audio_profile>-elements: the audio format name for pure audio contents in Table 4 of [MEDIA]
  - for both <video_profile>, and <audio_profile>-elements, it is allowed to include multiple profile names corresponding to the same MIME-type, by separating each profile name with a whitespace character.
- Valid values for the "transport"-attribute include (a space-separated list of) the protocol names as defined in the column "Name for <protocol>" in Annex F.1 of [PROT], whereby the value "http" as specified as default value for the "transport"-attribute in CEA-2014-A SHALL correspond to value "http-get".
- The <video_profile> and <audio_profile>-elements SHALL support a new attribute called "DRMSystemID", which SHALLinclude a space separated list of zero or more DRM system IDs supported for the media profile(s), whereby the DRMSystemID SHALL correspond to a <drm>-element (as defined in section 9.3.10. about DRM capability indication) with the same value for attribute "DRMSystemID". In the case the attribute "DRMsystemID" is specified, non-protected A/V contents of the media profile(s) SHALL be also supported. For non protected media profile(s), this attribute MAY be omitted (see Annex F for more information).
- Next to providing the list of supported audio and video profiles, the client SHALL include an <audio_profile> element and/or a <video_profile> element with the value "application/oipfContentAccess" for attribute "type", to indicate support for the content access description document format as defined in Section 7.1.1 as value for the "data" attribute of the A/V object as defined by [CEA-2014-A] to initiate the streaming of content.

Examples:

```
<video_profile type="application/oipfContentAccess"/>

<video_profile
          name="TS_MPEG2_SD_25_AC3 TS_AVC_HD_25_HEAAC"
          type="video/mpeg"
          DRMSystemID="urn:dvb:casystemid:19188"
          transport="rtsp-rtp-udp"
/>

<video_profile
          name="MP4_MPEG2_SD_25_AC3 MP4_AVC_HD_25_HEAAC"
          type="video/mp4"
          transport="http-get"
/>

<video_profile
          name="TS_AVC_HD_25_HEAAC"
          type="application/x-dtcp1"
          DRMSystemID="urn:dvb:casystemid:12348"
          transport="http-get"
/>

<audio_profile name="MPEG1_L3" type="audio/mpeg" transport="http-get"/>
```

9.3.12 Remote diagnostics support

The OITF SHALL indicate support for remote diagnostics (via the APIs defined in section 7.11.5) using the following element in the OITF's capability description (see Annex F for more information):

```
<xs:element name="remote_diagnostics" type="xs:boolean"/>
```

If included, the value of this element SHALL be: `(true|false)`.

9.3.13 SVG

The OITF SHALL indicate support for SVG as defined in section 6.3 using the Remote UI Client Capability Description defined for SVG in that section - `image/svg+xml`.

9.3.14 Other capability extensions

The following extensions to the capability profile elements as defined in [Req. 5.2.1.a] of CEA-2014-A SHALL be supported:

a) an additional value "0.33x0.33" for attribute "scaling" of the <video_profile>-element in bullet w) of [Req. 5.2.1.a], with the following related extension to the schema for type "scalingType" (see Annex F for more information):

```
<xs:enumeration value="0.33x0.33"/>
```

10 Security

10.1 Application / Service Security

This section defines the security model that applies to the privileged functionality exposed by an OITF to a server device. The main purpose of the security model is to protect local client side functionality exposed by an OITF to Javascript from unauthorized use. For example in the case of PVR control API, untrusted servers should be prevented from scheduling recordings.

The security model is quite generic, in a sense that it is not limited to particular privileged browser extensions, but can be applied to any local client side functionality exposed to any kind of networked application.

NOTE: The security model makes use of X509v3 certificates over TLS. Management of TLS root certificates, and which certificate authorities to trust is out of scope of this document.

10.1.1 OITF requirements

The following requirements SHALL apply to OITFs that expose security and/or privacy sensitive (i.e. privileged) functionality in one or more of the cases described in section 10.1.3

- An OITF SHALL prevent a CE-HTML page from a server from accessing the exposed security and/or privacy sensitive functionality, unless the server can be correctly authenticated (see below), and the server is granted the necessary privileges to access the security and/or privacy sensitive functionality.

- The OITF SHALL authenticate the server during a TLS handshake through a valid X.509v3 certificate, that is granted by a certificate authority that is trusted by the OITF. To this end, the OITF SHALL match the hostname or (sub)domainname of the CE-HTML page's URI with the hostname or (sub)domainname as specified in the X.509v3 certificate, in the manner as defined in Section 3.1 of IETF RFC 2818.

- The OITF SHALL support the Online Certificate Status Protocol (OCSP), at least the Lightweight Profile as defined in RFC 5019, to determine the current validity of the X.509v3 certificate before access to privileged functionality is granted

- The OITF SHALL support a private certificate extension for X.509v3 certificates called "permissions" that specifies a set of permissions requested by a server to access privileged functionality, through zero or more permission names associated with privileges. The OITF MAY grant an authenticated server the set of permissions, which are each associated with the right to access a specific set of privileged functionality. Allowed permissions names include the permission names as defined in Section 10.1.4.

  The set of permissions granted to an authenticated server by an OITF MAY depend on the occurrence of that server on a whitelist or blacklist available to the OITF.

  NOTE: Management of whitelists and blacklists available to an OITF is out of scope of this document.

- If the server does not have the necessary privileges to access a property, method or object, or the server cannot be properly authenticated, the OITF SHALL throw an error with the message property set to the value "SecurityError". The example below shows how this can be used by applications:

```
try {
  object.foo()
} catch(e)
{
  if (e.message == "SecurityError") {
    // I am not authorised to do this
  }
}
```

-

- The OITF MAY inform the user of the decision to deny a server requested access to privileged functionality and MAY offer the user the option to override this decision.

10.1.2 Server requirements

The following requirements SHALL apply to servers that wish to access security and/or privacy sensitive (i.e. privileged) functionality exposed by an OITF, in one or more of the cases defined in section 10.1.3:

- A server SHALL specify the use of TLS for each CE-HTML page that accesses privileged functionality (i.e. by using the “https://” URI scheme for the URL of the CE-HTML page).

- A server SHALL expose a valid X.509v3 certificate during the TLS certificate handshake.

- A server MAY request an OITF for certain permissions to access privileged functionality through a private certificate extension. If a server wants to do so, the server MAY include a private certificate extension called “permissions” as part of a valid X.509v3 certificate. If included, the “permissions” extension specifies a set of permissions through zero or more permission names. Allowed permissions names include the permission names as defined in Section 10.1.4.

10.1.3 Specific security requirements for privileged Javascript APIs

This section defines the specific security requirements for specific privileged Javascript APIs, such as the tuner/broadcast, recording, content download and DRM related APIs as defined in Sections 7.1, 7.3, 7.4 and 7.6 in addition to the security requirements defined in sections 10.1.1 and 10.1.2.

10.1.3.1 Security requirements for tuner control and lineup

Exposure of the channel line up and the video/broadcast APIs for controlling the (local) tuner as specified in Section 7.4 SHALL adhere to the security requirements in Sections 10.1.3.1.1 and 10.1.3.1.2.

10.1.3.1.1 Security requirements for exposure of the tuner channel lineup

Exposure of the channel line up of the (local) tuner as specified in Sections 7.4.1 and 7.5.1 SHALL adhere to the following security requirements:

- the OITF SHALL perform a security check (as defined in Section 10.1.1) to see if the server has the necessary privileges to obtain the channel lineup of the (local) tuner. If the server does not have the necessary privileges, or the server cannot be properly authenticated, the OITF SHALL:

    1. not convey the Client Channel Listing to the server through a HTTP POST.

    2. not expose the Client Channel Listing to the DAE application through the `getChannelConfig()` method of the video/broadcast object. Attempts to access this method SHALL throw an error as defined in section 10.1.1.

10.1.3.1.2 Security requirements for tuner control

Control of the (local) tuner as specified in Sections 7.4 and 7.5 SHALL adhere to the following security requirements:

- the OITF SHALL perform a security check (as defined in Section 10.1.1) to see if the server has the necessary privileges to control the (local) tuner. If the server does not have the necessary privileges or the server cannot be properly authenticated, the OITF SHALL deny requests to switch a local tuner to another channel by throwing an error as defined in section 10.1.1.

10.1.3.2 Security requirements for recording

The recording functionality as specified in Section 7.6 SHALL adhere to the following security requirements:

- *Recording of broadcasted content:* the OITF SHALL perform a security check (as defined by Section 10.1.1) to see if the server has the necessary privileges to schedule recordings of broadcasts. If the server does not have the necessary privileges or the server cannot be properly authenticated, the OITF SHALL deny a server’s request to access the functionality of the `application/oipfRecordingScheduler` object (as defined by Section 7.6.2.1), and SHALL also not expose the Client Channel Listing, neither through the HTTP POST, nor through the `getChannelConfig()` method. Furthermore, the OITF SHALL throw an error as defined in section 10.1.1 when an application loaded from the server attempts to access any properties or methods on the `application/oipfRecordingScheduler` object.

- *Recording of current A/V content broadcasted:* the OITF SHALL perform a security check (as defined by Section 10.1.1) to see if the server has the necessary privileges to record the current broadcast (as defined in Section 7.6.3). If the server does not have the necessary privileges or the server cannot be properly authenticated, the OITF SHALL deny a server’s request to start a recording of the broadcast currently rendered by the video/broadcast object by throwing an error as defined in section 10.1.1.

- *Control over and exposure of scheduled recordings:* the OITF SHALL restrict the visibility and control over scheduled recordings to those scheduled recordings that were initiated through a server from the same FQDN that scheduled the recordings.

10.1.3.3 Security requirements for content download functionality

The content download functionality as defined in Section 7.1 SHALL adhere to the following security requirements:

- *Initiating a download:* the OITF SHALL perform a security check (as defined in Section 10.1.1) to see if the server has the necessary privileges to initiate a download. If the server does not have the necessary privileges or the server cannot be properly authenticated, the OITF SHALL not start downloading the content after receiving a content-access description document as defined in Section 7.1.

NOTE 1: The server is the server that served the CE-HTML page or third-party notification that includes a link to a content-access description document. This is not necessarily the same server from which the content is downloaded.

NOTE 2: The URL from which a content item is downloaded (i.e. as specified by a <ContentURL> element in the content-access description document) does not have to be protected by TLS.

10.1.3.4 Security requirements for DRM related functionality

The DRM control functionality (i.e. the `application/oipfDrmAgent` embedded object) as defined in Section 7.3 SHALL adhere to the following security requirements:

- *Accessing the DRM agent:* the OITF SHALL perform a security check (as defined in Section 10.1.1) to see if the server has the necessary privileges to interact with the DRM agent, i.e. by accessing the DRM agent embedded object as specified in Section 7.3. If the server does not have the necessary privileges, or the server cannot be properly authenticated, the OITF SHALL throw an error as defined in section 10.1.1 when an application loaded from that server attempts to access any of its properties or methods on the DRM agent embedded object.

10.1.3.5 Security requirements for IMS functionality

The IMS functionality (i.e. the `application/oipfIms` embedded object) as defined in Section 7.8 SHALL adhere to the following security requirements:

- *Accessing the IMS embedded object:* the OITF SHALL perform a security check (as defined in Section 10.1.1) to see if the server has the necessary privileges to interact with the IMS functionality, i.e. by accessing the IMS embedded object as specified in Section 7.8. If the server does not have the necessary privileges, or the server cannot be properly authenticated, the OITF SHALL throw an error as defined in section 10.1.1 when an application loaded from that server attempts to access any of the classes, properties or methods defined in Section 7.8.

10.1.3.6 Security requirements for metadata processing functionality

The metadata processing functionality (i.e. the application/oipfSearchManager embedded object and other APIs) as defined in Section 7.9 SHALL adhere to the following security requirements:

- *Accessing the search manager:* the OITF SHALL perform a security check (as defined in Section 10.1.1) to see if the server has the necessary privileges to interact with the search manager, i.e. by accessing the `SearchManager` embedded object as specified in Section 7.9.3. If the server does not have the necessary privileges, or the server cannot be properly authenticated, the OITF SHALL throw an error as defined in section 10.1.1 when an application loaded from that server attempts to access any of the properties or methods on the `SearchManager` embedded object.

- *Accessing enhanced metadata:* the OITF SHALL perform a security check (as defined in Section 10.1.1) to see if the server has the necessary privileges to access the advanced metadata specified in section 7.9, i.e. by accessing the additional fields, methods and classes defined in that section. If the server does not have the necessary privileges, or the server cannot be properly authenticated, the OITF SHALL throw an error as defined in section 10.1.1 when an application loaded from that server attempts to access any of the classes, properties or methods specified in Section 7.9.

10.1.3.7 Security requirements for configuration and settings functionality

The configuration and settings functionality (i.e. the application/oipfConfiguration embedded object and other APIs) as defined in Section 7.9 SHALL adhere to the following security requirements:

- *Reading and modifying configuration and/or settings:* the OITF SHALL perform a security check (as defined in Section 10.1.1) to see if the server has the necessary privileges to interact with the configuration functionality, i.e. by accessing the configuration embedded object as specified in Section 7.10.1. If the server does not have the necessary privileges, or the server cannot be properly authenticated, the OITF SHALL throw an error as defined in section 10.1.1 when an application loaded from that server attempts to access any of the classes, properties or methods defined in section 7.10.

10.1.3.8 Security requirements for APIs for OITFs under the control of a service provider

APIs for OITFs under the control of a service provider as defined in Section 7.11 SHALL adhere to the following security requirements:

- *Accessing the extended tuner control APIs:* the OITF SHALL perform a security check (as defined in Section 10.1.1) to see if the server has the necessary privileges to interact with the extended tuner control APIs as specified in Section 7.10.1. If the server does not have the necessary privileges or the server cannot be properly authenticated, the OITF SHALL throw an error as defined in section 10.1.1 when an application loaded from that server attempts to access any of the classes, properties or methods defined in section 7.11.1.

- *Accessing the extended PVR APIs:* the OITF SHALL perform a security check (as defined in Section 10.1.1) to see if the server has the necessary privileges to interact with the extended PVR APIs as specified in Section 7.11.2. If the server does not have the necessary privileges or the server cannot be properly authenticated, the OITF SHALL throw an error as defined in section 10.1.1 when an application loaded from that server attempts to access any of the classes, properties or methods defined in section 7.11.1.

- *Accessing the download manager:* the OITF SHALL perform a security check (as defined in Section 10.1.1) to see if the server has the necessary privileges to interact with the download manager, i.e. by accessing the downloadmanager embedded object as specified in Section 7.11.3. If the server does not have the necessary privileges, or the server cannot be properly authenticated, the OITF SHALL throw an error as defined in section 10.1.1 when an application loaded from that server attempts to access any of the classes, properties or methods specified in Section 7.11.3.

- *Accessing all downloads:* the OITF SHALL perform a security check (as defined in Section 10.1.1) to see if the server has the necessary privileges to manage downloads not initiated by the current application, i.e. by accessing the downloads property of the downloadmanager embedded object as specified in Section 7.11.3. If the server does not have the necessary privileges, or the server cannot be properly authenticated, the OITF SHALL throw an error as defined in section 10.1.1 when an application loaded from that server attempts to access this property.

10.1.3.9 Security requirements for remote diagnostics and management API

The remote diagnostics and management API (i.e. application/oipfRemoteManagement) as defined in Section 7.11.5) SHALL adhere to the following security requirements:

- *Accessing remote diagnostics and management parameters and/or settings:* the OITF SHALL perform a security check (as defined in Section 10.1.1) to see if the server has the necessary privileges to interact with the remote diagnostics and management functionality, i.e. by accessing the application/oipfRemoteManagement embedded object as specified in Section 7.11.5. If the server does not have the necessary privileges, or the server cannot be properly authenticated, the OITF SHALL throw an error as defined in section 10.1.1 when an application loaded from that server attempts to access any of the classes, properties or methods defined in section 7.11.5.

10.1.3.10 Security requirements for parental control manager

The parental control manager API (i.e. `application/oipfParentalControlManager`) as defined in Section 7.14.5) SHALL adhere to the following security requirements:

- *Accessing parental control manager functionality:* the OITF SHALL perform a security check (as defined in Section 10.1.1) to see if the server has the necessary privileges to interact with the parental control manager functionality, i.e. by accessing the application/oipfParentalControlmanager embedded object as specified in Section 7.14.5. If the server does not have the necessary privileges, or the server cannot be properly authenticated, the OITF SHALL throw an error as defined in section 10.1.1 when an application loaded from that server attempts to access any of the classes, properties or methods defined in section 7.14.5.

10.1.4 Permission names

This section describes a non-limited set of permission names that MAY be included as part of the "permissions" extension of a X.509v3 certificate as defined in Sections 10.1.1 and 10.1.2:

- *"permission_tuner control_lineup*": this permission name allows a server to receive/fetch the tuner's channel line-up and to switch an OITF's local tuner to another channel and to functionality as specified in Section 7.4.

- *"permission_tuner_lineup*" : this permission name allows a server to receive/fetch the tuner's channel line-up as specified in Section 7.4.

- *"permission_tuner_control*" : this permission name allows a server to switch an OITF's local tuner to another channel as specified in Section 7.4.

- *"permission_recording"* : this permission name allows a server to receive/fetch the tuner's channel line-up, and to instantiate the scheduler object (as defined by Section 7.6.2) and access its functionality, and to access the additional functionality as specified in Section 7.6.3 for the `video/broadcast` object to record and timeshift the current broadcast.

- *"permission_download"* : this permission name allows a server to initiate downloads.

- *"permission_drmagent"* : this permission name allows a server to interact with the DRM agent, i.e. by accessing the DRM agent embedded object as specified in Section 7.3

- *"permission_metadata"* : this permission name allows a server to access client-side metadata processing functionality (as defined in section 7.9).

- *"permission_metadata_search"* : this permission name allows a server to access the search functionality provided client-side metadata search functionality (as defined in section 7.9.11).

- *"permission_extendedAV"* : this permission name allows a server to interact with the extended A/V control functionality provided by the OITF, as defined in section 7.11.1.

- *"permission_recordingsmanager"* : this permission name allows a server to manage recordings stored on the OITF using the APIs defined in section 7.11.2.

- *"permission_clientCOD"* : this permission name allows a server to interact with the CoD catalogue browsing functionality provided by the OITF, as defined in section 7.9.

- *"permission_settings"* : this permission name allows a server to modify user settings and configuration using the APIs defined in section 7.10.

- *"permission_downloadmanager"* : this permission name allows a server to interact with the download manager on the OITF using the APIs defined in section 7.11.3 to control downloads initiated by the current application.

- *"permission_downloadmanager_all"* : this permission name allows a server to interact with the download manager on the OITF using the APIs defined in section 7.11.3 and manage all downloads, including those initiated by other applications.

- *"permission_downloadmanager_samedomain"* : this permission name allows a server to interact with the download manager on the OITF using the APIs defined in section 7.11.3 and manage downloads initiated by applications from the same FQDN.

- *"permission ims"*: this permission name allows a server to interact with an IMS Gateway using the APIs defined in section 7.8.

- *"permission_remotemanagement":* this permission name allows a server to interact with an remote diagnostics and management API defined in section 7.11.5.

- *"permission_gatewayinfo"* : this permission name allows a server to interact with with the gateway discovery functionality provided by the client, as defined in sections 4.3 and 7.12

- *"permission_parentalcontrolmanager"* : this permission name allows a server to interact with the parental control manager on the OITF using the APIs defined in section 7.14.5 to override the parental control settings of an OITF.

10.2 User Authentication

The OITF SHALL adhere to the user authentication requirements as specified in Section 5 of [CSP][CSP]

Annex A. Change History (Informative)

Document Version	Date	Sections	Description
V0.01	2008-05-05	all	Initial Version Created by Ho Jin and Ottone Maurizio Grasso
V0.02	2008-06-12	all	Modification of skeleton based on Madrid meeting's agreement
V0.1	2008-06-17	7	Add OIPTVF-MD-DAE-020-R01-A/V_control_APIs_for_Tuner,_Recording,_CoD,_and_Scheduled_Content_(incl__Security_and_CSP_interfaces).doc
V0.0.01-2008-08-06	2008-08-06	all	Baseline of DAE specification. CRs approved in Stuttgart meeting were integrated
V0.0.01-2008-08-12	2008-08-12	all	Integration of CR-032, CR-068, CR-075, CR-078, CR-086, CR-089, CR-097, CR-098, CR-099(errata)
V0.0.01-2008-08-13	2008-08-13	all	Integration of CR-076, CR-084, CR-095
V0.0.01-2008-08-14	2008-08-14	all	New Editor's notes summary. Checked integration of CR-032+CR-087. Integration of CR-066, CR-081, CR-094, CR-116, CR-117, CR-118, CR-120, CR-121, CR-122, CR-123.
V0.0.01-2008-08-19	2008-08-19	all	Categorization of editor's notes
V0.0.01-2008-10-02	2008-10-02	all	Applied changes detailed as "Done" in "OIPTVF-MD-DAE-Technical-Review-TOTAL-r17.xls"
V0.0.01-2008-10-06	2008-10-06	all	Applied changes detailed as "Done" in "OIPTVF-MD-DAE-Technical-Review-TOTAL-r20.xls"
V0.0.01-2008-10-07	2008-10-07	all	Applied changes detailed as "Done" in "OIPTVF-MD-DAE-Technical-Review-TOTAL-r22.xls"
V0.0.01-2008-10-10	2008-10-10	all	Applied changes detailed as "Done" in "OIPTVF-MD-DAE-Technical-Review-TOTAL-r24.xls"
V0.0.01-2008-10-15	2008-10-15	all	Applied changes detailed as "Done" and CRs marked as "Implemented" in "OIPTVF-MD-DAE-Technical-Review-TOTAL-r27.xls"
V0.0.01-2008-10-20	2008-10-20	all	Applied changes detailed as "Done" and CRs marked as "Implemented" in "OIPTVF-MD-DAE-Technical-Review-TOTAL-r30.xls"
V0.0.01-2008-10-21	2008-10-21	all	Applied changes detailed as "Done" and CRs marked as "Implemented" in "OIPTVF-MD-DAE-Technical-Review-TOTAL-r31.xls". Applied all required edits.
V0.0.01-2008-10-23	2008-10-23	all	Applied editorial changes submitted from ANT, FT, Philips, TI.
V0.0.02-2008-10-23	2008-10-23	6.3.2.5	Aligned with CR-211-R01
V0.0.03-2008-10-23	2008-10-23	5.2.2	Checked Figure 5, Table 1 and Table 2
V0.0.04-2008-10-23	2008-10-23	7.11.3.4	Renamed method createDownload. Accepted all changes.
V0.0.01-2008-12-18	2008-12-18	all	Editorial changes: applied CR-252, CR-253, CR-254, CR-255, CR-256, CR-257.
V0.0.02-2008-12-18	2008-12-18	all	Corrected omissions related to CR-253.
V0.0.01-2008-12-19	2008-12-19	all	Editorial changes: applied CR-258, CR-259, CR-260, CR-264.
V0.0.01-2008-12-22	2008-12-22	all	Editorial changes (checked cross-references and typeface usage, changed Appendixes to Annexes). Applied all revisions.

Annex B. CE-HTML Profiling

This section defines a detailed set of deviations from the CEA-2014-A i-Box and 2-Box model [CEA-2014-A], in particular for those changes that are directly related to requirements in sections 5.1 through 5.10 and Annexes A through I of [CEA-2014-A]. Changes to requirements of CEA-2014-A are indicated by underlined text for text that must be added, and by strikethrough text for text that must be removed.

- Changes to Section 5.2: several new elements and new attribute/values have been added for the capability descriptions. Most of these are related to new functionality, and are defined in Section 11.2 and hence are not listed here. With respect to existing elements and attributes, the following changes apply:

    - an additional value “0.33x0.33” for attribute “scaling” of the <video_profile>-element in bullet w) of [Req. 5.2.1.a], with the following related extension to the schema for type “scalingType

        ```
        <xs:enumeration value="0.33x0.33"/>
        ```

    - the “name”-attribute of the <audio_profile> and <video_profile> elements in CEA-2014-A are restricted to DLNA media format profiles. The forum has specified its own audio and video format profile names that can be used by the “name” attribute as well.

    - new UI profiles have been defined for [Req. 5.2.1.b] that a client may choose to implement. Details are not included in this annex.

    - for both <video_profile>, and <audio_profile>-elements, it is allowed to include multiple profile names corresponding to the same MIME-type, by separating each profile name with a whitespace character.

    - element <pointer> requires some clarifications:

        m) <pointer> - indicates whether or not the Remote UI Client supports pointer-based input, such as mouse or touch. If included, the value of this element SHALL be: (true|false). A value of ‘true’ means that all mouse event types as defined in DOM level 2 Events SHALL be supported, and that server-side image maps SHALL be fully supported as defined in Section 13.6.2 of [HTML401] . Note that a value of ‘false’ still implies that ‘click’ events SHALL be supported, as per Req 5.4.1.s below.

- Changes to Section 5.3:

    - Req. 5.3.a (5) states that if the Content-Encoding header is used, it SHALL always have case-insensitive value “identity”, unless a client/server has explicitly indicated support for other content encodings by using an Accept-Encoding header. RFC 2616 (section 3.5) states that this content-coding is used only in the Accept-Encoding header, and SHOULD NOT be used in the Content-Encoding header. We follow RFC 2616 and use the following alternative definition for Req. 5.3.a: “if this header is used, it SHALL always have a value that matches one of the content encodings as sent by an Accept-Encoding header, and SHALL adhere to Section 3.5 of RFC 2616 regarding the use of “identity” encoding”

- Changes to Section 5.4:

    - Since the CSS3 “image-orientation” property was defined in CSS Print/Paged Media, browsers may have difficulty implementing it for normal web pages. It is therefore made OPTIONAL. Services needing image rotation SHOULD do this at the server before sending it to the client.

    - The W3C CSS working group made an official statement that the following DOM2 Style features are considered to be problematic and have therefore been classified as obsolete.

        - The UnknownRule interface (unknown rules should be dropped by the parser and thus never reach the DOM)

        - The getPropertyCSSValue method, CSSValue interface, all interfaces inheriting from CSSValue, and the RGBColor, Rect, and Counter interfaces (the CSSValue interface is thought to be too awkward for frequent use)

        These features are OPTIONAL.

    - Compatibility with CEA-2027-A is not a requirement for the present document. Therefore, a client MAY omit the list of methods as listed by bullet 3) and the alias as defined by bullet 5) of requirement [Req. 5.4.2.a] of CEA-2014-A.

Note: future revisions of CEA-2014-A or the DAE specification should consider the ability to specify a particular (maximum/minimum) size of textual or graphical labels to be inserted.

Requirement 5.4.a.3.a SHALL be changed as follows;

a) DOM level 2 Core [11], including the extended XML interfaces (except for Notation, Entity, EntityReference and Processing Instruction), i.e. method hasFeature(DOMString feature, DOMString version) of the DOMImplementation interface returns true for features “Core” and “XML”, and version “2.0”.

Requirement 5.4.a.3.c SHALL be extended with the following;

Focus events (i.e. events of type “focus”) SHALL be generated not only for <label>, <input>, <select>, <textarea>, and <button> as specified in Section 1.6.5 of [DOM 2 Events], but also at least for <a>-elements, in accordance with [DOM 3 Events].

For all elements which can receive focus events, a focus event SHALL be generated and the CSS “:focus” selector must be activated, irrespective if the focus is received through keyboard interaction, pointer interaction, calling an DOM focus() method through Javascript, or any other mechanism by which the focus can be changed.

Requirement 5.4.a.3.d SHALL be changed as follows;

d) DOM level 2 HTML [14] subset, which includes the following interfaces:

- HTMLDocument (excl. “applets”-attribute),
- HTMLElement,
- HTMLCollection,
- HTMLLinkElement,
- HTMLBodyElement,
- HTMLImageElement,
- HTMLAnchorElement,
- HTMLFormElement,
- HTMLInputElement (the select method is OPTIONAL),
- HTMLTextAreaElement (the select method is OPTIONAL),
- HTMLButtonElement,
- HTMLSelectElement,

Requirement 5.4.a.6.b SHALL be replaced as follows;

~~b) If both attributes are defined and not the same, then the value defined by attribute “id” SHALL take preference.~~

b) Content or service providers or authors SHOULD NOT define both “id” and “name” on a single element in their content.

Requirement 5.4.a.7 shall be extended with the following;

- **nav-up, nav-down, nav-left, nav-right** as defined in Section 10.2.2 of [CSS3 UI].
- **outline** and **outline-*** as defined in [Req. 5.4.1.q].

Requirement 5.4.1.f SHALL be changed as follows:

If the input-focus is on any forms element except a button, a Remote UI Client SHALL not generate any VK_UP, VK_DOWN, VK_LEFT, and VK_RIGHT key-events, except at those points in time that the focus is about to move away from the form element (e.g. if VK_LEFT is pressed while the cursor is placed at the beginning of a text-entry), to allow an author of a CE-HTML page to override the default focus navigation.

- The client SHOULD use the same physical keys for generating the VK_UP, VK_DOWN, VK_LEFT and VK_RIGHT key events that are used for a spatial navigation mechanism provided by the client. The same keys SHOULD also be used for spatial navigation specified through the CSS properties 'nav-up', 'nav-down', 'nav-left' and 'nav-right'.
- In accordance with this requirement, the focus navigation as defined through CSS properties 'nav-up', 'nav-down', 'nav-left' and 'nav-right' SHOULD only be active at those points in time when focus can be moved away from the form-element, to not interfere with the implementation specific handling of keys inside a form-element.

Requirement 5.4.1.m SHALL be changed as follows:

A Remote UI Client SHALL offer a means to set focus to the following elements in a CE-HTML page by using key-based input: <a>, <area>, all form elements, <iframe>, and <object>-elements of type "video" as defined in Section 5.7.

- Upon receiving focus, the Remote UI Client SHALL generate both a DOM 2 "focus" and a "DOMFocusIn" event for <a>, <area>, and ~~both a DOM 2 "focus" and "DOMFocusIn" event~~ for all form elements~~, for any registered event listeners~~.
- The Remote UI Client MAY not generate DOM 2 focus and DOMFocusIn events in the following two cases. For <iframe>-elements, ~~and <object> elements of type "video"~~ the Remote UI Client SHALL call the event listener that has been specified through the onfocus attribute of the "window" object (see Section 5.4.2) that is associated with the iframe. For <object>-elements of type "video", it SHALL call the event listener specified through the onfocus attribute of the A/V scripting object (Section 5.7). ~~The Remote UI Client MAY not generate a DOM 2 focus events in those cases.~~

Add a requirement 5.4.1.p that reads as follows:

[Req. 5.4.1.p] A Remote UI Server SHOULD use the CSS properties 'nav-up', 'nav-down', 'nav-left' and 'nav-right' to override the default spatial navigation as provided by the Remote UI client, instead of defining a spatial navigation mechanism in Javascript.

Add a requirement 5.4.1.q that reads as follows:

[Req. 5.4.1.q] If a Remote UI Server has specified the "outline-style" attribute to be unequal to "auto" (as defined in Section 8.3 of the CSS3 Basic User Interface Module), for an element that has input focus, the Remote UI Client SHALL not draw its own focus highlight around this item, but use the focus highlight style, color and width as defined by the values given to the "outline" and/or "outline-*" attributes.

Add a requirement 5.4.1.r that reads as follows:

[Req. 5.4.1.r] A Remote UI Client SHALL generate the focus events as specified by [Req. 5.4.1.m] and SHALL activate the CSS ":focus" selector, for any element which can receive focus events, irrespective if the focus is received through keyboard interaction, pointer interaction, calling an DOM focus() method through Javascript, or any other mechanism by which the focus can be changed.

Add a requirement 5.4.1.s as an extension to 5.4.1.m and 5.4.1.n

[Req. 5.4.1.s] A Remote UI Client SHALL offer a means to activate the following elements in a CE-HTML page by using key-based input: <a>, <area> <button>, <input type="submit">, <input type="reset"> and <input type="button">, <input type="radio">, and <select>.

The Remote UI Client SHOULD allow the same physical key that is used to generate a VK_ENTER key event to be used to activate these elements if these elements have input focus. If an access key has been defined the Remote UI Client SHALL allow the access key to be used to activate these element.

Upon activation, the Remote UI Client SHALL generate both a DOM 2 "DOMActivate" and a "click" event for above listed elements

- Changes to Section 5.6.2:

  Support for this section SHALL be optional for an OITF.

- Changes to Section 5.7:

  Requirement 5.7.1.f SHALL be modified as follows;

  [Req. 5.7.1.f] [Req. 5.7.1.f] The following properties and methods SHALL be supported for audio objects and for video objects. Support for playlists and support for the "persist" attribute is OPTIONAL

  Requirement 5.7.1.f point 1 SHALL be modified as follows;

  - 1) String data [RW] – media URL. If the value of data is changed while media is playing playback is stopped (resulting in a play state change). The default value is the empty string. If the value of this attribute is changed, the related data-attribute inside the DOM tree SHOULD be changed accordingly. If the value of this attribute is set to an empty string or is changed, the resources (files, server connections, etc…) currently owned by the object SHALL be released. If the media object is deleted, e.g. because another URL is loaded into the containing window (except in cases described for the optional persist property of media objects), the resources SHALL be released

- Changes to the Annexes:

  - In Annex C, the default value for the transport attribute of the audioProfileType and videoProfileType and for the "protocolNames" attribute of the downloadType is defined as "http". In Annex F.1 of [PROT][PROT] the equivalent protocol name is called "http-get". A DAE application/oipfDevice SHALL consider the default to be "http-get".

  - In Annex G, add the following bullet to the **General Authoring Requirements and Recommendations:**

    6) Even though the onmouse* attributes are defined for most XHTML elements, support for these mouse events is only guaranteed if a Remote UI client has identified support for pointer based input by specifying <pointer>true</pointer> in its capability description. For onclick events, Requirement Req 5.4.1.s holds.

  - In Annex H, as per the change to Section 5.4: the "image-orientation" attribute is not supported.

  - In Annex I change the additional implementation requirement for "MouseEvent as follows:

    The MouseEvent interface SHALL be implemented if <pointer> has value true in the Remote UI Client's capability profile, for all event types listed in Section 1.6.2 of [DOM 2 Events], and MAY not be implemented if <pointer> has value false. If <pointer> has value false, the MouseEvent interface SHALL be implemented to at least support click events, whereby the clientX, clientY, screenX, and screenY attributes MAY remain 0.

Annex C. Design Rationale (Informative)

The application model

As specified in section 4.2.2, applications are recorded within a hierarchy of applications. This hierarchy has a number of benefits for an environment where multiple applications may be executing simultaneously, including:

- Clear separation of applications so that permissions granted to one application cannot be exploited by another.
- Simpler event dispatch, whether for key events or externally triggered events such as parental control changes, caller ID integration, IM chat messaging, etc.
- The ability to deploy new applications without affecting other applications (either UI or structure)
- The ability for service providers to manage groups of applications, including invisible applications.

Each object representing an application possesses an interface that provides access to methods and attributes that are uniquely available to applications. For example, the facilities to create and destroy applications are accessed through such methods.

Development and maintenance efficiencies are gained through distinct application boundaries. Code reuse is offered through the application tree, permitting applications to export facilities as desired (for example, channel change logic may be embedded in the “zapper” application and exported to an EPG application). The paired advantages of compartmentalisation and code re-use are of increasing value as the number of authoring entities and applications grows – what is of marginal additional value for one authoring entity and three applications is of significant value for 10 authoring entities and 50 applications.

Annex D. Clarification of Download CoD, streaming CoD and CSP interfaces (Informative)

Introduction

There are many different usage models and scenarios that one can think of when dealing with protected content and the interactions the user or the device may have with a service provider. This includes usage models regarding user registration, domain management, license acquisition, downloading content, etc. This informative Annex aims to clarify the usage of the interfaces as specified in Sections 7.1, 7.2 and 7.3. in the context of these interactions. However, this Annex will only show some of the generic mechanisms as offered by these interfaces, not only the browser interfaces, but also including some of the local interfaces on the device (that actually do not need to be standardized) In the figure below these are indicated by dotted lines.

The main scenario that we envision is the following:

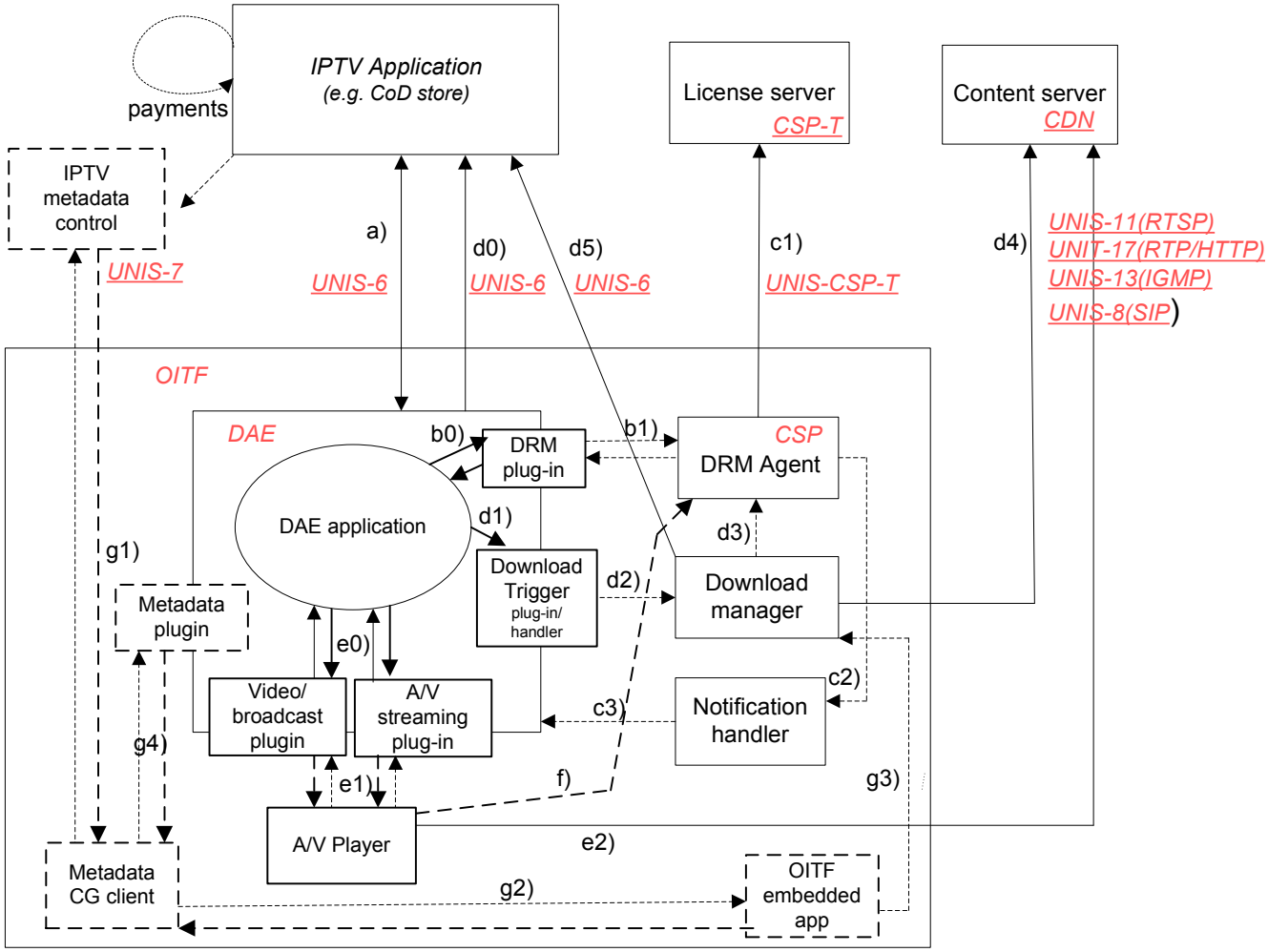


Figure 12: Main scenario

1. The OITF shows the UI of the CoD store. With this UI the user is able to interact with the CoD store to do things, such as user registration, browsing the content offered by the CoD store, and purchase a license.

   This can be done inside the browser using a standard CE-HTML interface. In the figure above, this is identified by a).

   In those deployments where the OITF supports the metadata CG client, an embedded application or a DAE application can make use of metadata provided through a metadata CG client. This is identified by g*).

2. After purchasing/selection of the content the selected content needs to be fetched. To this end, the download manager or the A/V embedded object needs to be triggered with information on how to fetch the content. This is done by using a special descriptor, with an easily identifiable MIME-type “application/oipfContentAccess”. This is indicated by interfaces d0, d1, d2, e0, e1), and e2).

   For certain steps in these interactions, the CoD store may need to interact with the DRM agent. This can be done by talking directly to the DRM agent during a browser session using interfaces b0) and b1). Alternatively, the <DRMControlInformation> element of the content access descriptor can be used to convey DRM specific messages to the DRM agent. This is indicated by interface d3).

   Note that both the DRM agent and Download manager are autonomous components that will be actively performing their duties, irrespective whether there is an active browser session or not. They will have their own interaction with e.g. the license server and download server, and possibly with the user. These interactions are identified by interfaces c1, c2, d4, d5.

3. The download manager or A/V player fetch the content, as indicated by interfaces d4 and e3.

4. Once the content is fetched, playback can be started in the A/V player. When the stream is protected, the A/V player will have to get a license from the DRM agent using interface f).

[CSP]***List of interfaces:***

- ***Interface a: browse, select and purchase content from CoD store***

  This interface is used to interact with the CoD store for operations such as user registration, browsing the content offered by the CoD store, and purchase a license. This is a standard CE-HTML/HTTP interface.

- ***Interface b*: In-session interaction from web page with underlying DRM agent***

  Interface b1 (and the related interface b2) is the application/oipfDrmAgent Javascript embedded object interface as defined in Section 7.3. This interface will allow messages to be exchanged between pages from the CoD store and the underlying DRM agent, whilst the user is having a user interface session with the CoD store. Examples of these messages are Marlin Action tokens. This is useful to enable scenarios, such as subscription license acquisition, registration, domain management, etc.

  The interface basically consists of one method: `sendDRMMessage(String msgType, String msg)`, which is very generic in the sense that any kind of message can be exchanged. The exact payload and types of messages that could be exchanged is defined in the [CSP][CSP]. An example of such message could be:

```
pluginElement = document.getElementById(“drmplugin”);
pluginElement.sendDRMMessage(“application/vnd.marlin.drm.actiontoken+xml”,
                             “<marlin>…</marlin>”);
…
<object id=”drmplugin” type=”application/oipfDrmAgent”/>
```

  Note that this API is designed to be asynchronous in nature, because certain interactions may take a undeterminate amount of time. Therefore, it is not wise to make the method synchronous, since that could block the Javascript engine. To this end we have defined an event handler: `onDRMMessageResult`, to register a callback function that will be called when the DRM agent completed handling of the message. For example:

```
function callbackF(String msgID, String resultMsg) {
        …
}
document.getElementByID(“drmplugin”).onDRMMessageResult = callbackF;
```

  An equivalent DOM2 event is also generated.

Content authors SHOULD be aware of the asynchronous nature of the API. Only after having received the callback message, the web page can assume that the DRM agent has handled the DRM message. The service author may need to define some visual cues to the user if he would like the user to wait for certain actions to finish.

- ***Interface c*: Autonomous out-of-session interaction between DRM agent and CoD store***

Interface c1) is the collection of interfaces between the DRM agent, the CoD store, the license server, etc. as defined in the [CSP][CSP]. The interaction is typically done outside the scope of the browser, and also without the user being involved. In the few cases where the user would be involved, the device will typically have its own "local" user interface to handle the interaction with the user. In some of these the DRM agent would need to open a web page to the originating CoD store, so that the user could resolve the issue directly with the store (e.g. using the rightsURL extracted from the MPEG2_TS). Since the user could be doing other things at that moment, it may not be appropriate to popup/replace the current browser session without the user consent. Therefore, the DRM agent could issue a notification event that will get listed along similar lines to a third-party nofication event. The user would be notified that his attention is required with respect to the DRM agent, and can then decide to take action and launch the browser.

In the figure above, these UI interactions are identified by interface c2) and c3). These interfaces however are typically local inside the OITF, and are not specified in more detail.

- ***Interface d*: Downloading content***

These interfaces are used for downloading content. In order to trigger the download, a special content-access descriptor with an easily identifiable MIME-type is used. This descriptor contains all the relevant data related to fetch the content. This content-access descriptor is typically provided by the CoD store. A browser application can fetch this descriptor in various different ways, e.g. by following a link or through an XMLHttpRequest. This is identified by interface d0. The content-access descriptor and MIME-type are defined in Section 7.1.1. It contains elements, such as <Content_URL> which indicates where the content item can be fetched, and <Metadata_URL> to indicate where additional metadata, such as genre, subtitles, artwork, etc. can be retrieved from.

Interface d1) (and related interface d2) are used to trigger/register the download with the download manager. This is done by handing over the content-access descriptor to the download manager, either automatically once a link (e.g. `<a href="www.openiptvforum.org/someContentAccessDescriptor">`) is followed to a content-access descriptor and the browser encounters the MIME-type "`application/oipfContentAccess`", or by calling method `registerDownload()` on the `application/oipfDownloadTrigger` embedded object after retrieving the content-access descriptor e.g. through XMLHttpRequest. Once the download is registered, the download manager will take care that the content is downloaded. Since this may be a lengthy task, the download manager is an independent process from the browser, that will perform its duty in the background even if the browser is closed. By making the download manager an independent process of the browser, the user can in the meantime do other things.

Interface d3) is a local interface that is used to pass optional DRM messages carried in the content-access descriptor from the Download manager to the DRM agent. These messages are included as part of one or more <DRMControlInformation>-element inside the content access descriptor (as defined by Annex E). These may include messages (such as a Marlin preview license) in cases where license information and the content to be downloaded can be packaged together.

Interface d4) is the actual interface for downloading the content. The protocols that can be used for downloading content are defined in the Open ITPV Forum Protocols specification document. The default protocol is HTTP, with support for HTTP Range requests. The HTTP Range requests are used in order for downloads to be able to resume after e.g. network failure or device power-down, because as mentioned above, the download manager is an autonomous component that must continue downloading the requested content items as a background process, even after a device power-down or network failure, until it succeeds or the user has given permission to terminate the download.

Interface d5) defines an interface to enable error recovery for the download mechanism. It is meant to recover from errors or other situations that lead to the corruption or deletion of the content/licenses or a current download to fail. To this end, a download manager must be able to refetch the content, and its licenses from the CoD store. Therefore interface d5) is defined, which allows the OITF to synchronize with the CoD store by issuing a secure HTTP GET request to the URL of element <OriginSite> concatenated with "/synchronize" as defined by the content-access

descriptor, after which the IPTV application offering the content-download replies with an XML document describing the list of zero or more content IDs that the IPTV application had previously offered for download to the given user (i.e. it is assumed that the IPTV application offering the content download still remembers which content a user has bought and downloaded before), using the following format:

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified"
           attributeFormDefault="unqualified">
  <xs:element name="synchronizelist" type="SynchronizeType"/>
  <xs:complexType name="SynchronizeType">
    <xs:sequence>
       <xs:element name="content" type="ContentType" minOccurs="1" maxOccurs="1"/>
    </xs:sequence>
  </xs:complexType>
  <xs:complexType name="ContentType">
     <xs:sequence>
       <xs:element name="content_ID" type="xs:string" minOccurs="0" maxOccurs="unbounded"/>
     </xs:sequence>
  </xs:complexType>
</xs:schema>
```

Example:

```
   <synchronizelist>
      <content>
         <content_ID>item 1</content_ID>
         <content_ID>item 2</content_ID>
         ...
      </content>
    </synchronizelist>
```

Note: To authenticate the user, cookies or single sign on may be used.

The OITF MAY use this information to decide which content and which licenses to refetch. Refetching the content is done by issuing a secure HTTP GET request to the following URL:

```
   <OriginSite> + "/synchronize" + "?" + a <content_ID> value ,
```

after which the application offering the content download replies with the appropriate information to retrigger the download by providing the appropriate content-access descriptor in order to trigger the download manager and DRM agent to redownload the content and related licenses.

Interface d6): Although the download manager is an autonomous process, the user may sometimes want to view or control the state of the download manager. To this end, the download manager will typically offer its own user interface, which allows the user to manage the ongoing downloads (e.g. suspend/resume, cancel) and monitor the progress of the items that are being downloaded. This is interface d6) in the figure above. In non-managed network deployments this is typically a local user interface, for which no protocol needs to be defined. However, since it may be useful for the user to have a quick overview of the current downloads, in Section 7.1.2 of this document a visualization embedded object called application/oipfStatusView has been defined by which a (third-party) server provider could include an overview of the status of the download manager as part of its UI. NOTE: for managed network deployments Javascript interfaces may be needed to have more control over the UI of the download manager. This is covered by the download manager APIs in the managed network section of the DAE specification.

- ***Interface e*: Streaming content and linear TV broadcasts over IP***

Playback of streamed content and linear TV broadcast over IP are triggered by using either the CEA-2014-A A/V streaming embedded object respectively the video/broadcast embedded object as defined in Section 7.4.2. Within the page of a service provider, the CEA-2014-A A/V streaming embedded object or the video/broadcast embedded object is called from JavaScript passing the appropriate parameters. For unprotected content, a content URL is sufficient. For protected content, additionally a license or action token is necessary.

Therefore, we also allow the content-access descriptor to be used on the "data" element for the CEA-2014-A A/V embedded object. For linear TV the content-access descriptor can be send as a parameter on the setChannel method of the video/broadcast embedded object. This is indicated by interface e0). The A/V embedded object and video/broadcast embedded object are responsible for passing the necessary information for the A/V player for fetching the content using interface e1), and for passing included <DRMControlInformation>-messages to the DRM agent for DRM protection of the streamed content using interface e2.

The content-access descriptor contains an attribute “TransferType” that indicates whether the content should be streamed, if it has been given value “streaming”. The A/V player must be able to start playback of items once sufficient data has been received to enable playback

- ***Interface f: Request license***

  The A/V Player will render the content. When the content is protected, the A/V embedded object will have to get the necessary keys from the DRM agent using interface f) in order to decrypt the content.

  If the content is played inside the browser, interface e1) also defines a callback event “`onDRMRightsError`” to allow the page to handle DRM-related errors (in addition to c1)

- ***Interface g*: Local metadata based applications***

  These interfaces are for use with local OITF embedded and DAE applications that may wish to use a metadata CG client for browsing and selecting the content.

Additional notes about Content-on-Demand:

For a detailed specification of how devices and users are authenticated, we refer to [CSP][CSP]. For the security model related to accessing the DRM agent and Download manager from an external source, such as a web page (i.e. to open up the browser’s sandbox), we refer to Section 10.1.

Annex E. Content Access Descriptor Format

An OITF that supports download CoD (as specified in Section 7.1) or streaming CoD (as specified in Section 7.2) SHALL support a content access descriptor with MIME-type "application/oipfContentAccess". The syntax and semantics of this content access descriptor is defined as follows

Note: optional means optional for server, but mandatory to be supported on OITFs that have indicated support for MIME-type "application/oipfContentAccess". Mandatory means mandatory for the server to include this element in the content access descriptor.

1) <***Contents***> - mandatory element which is a container for one or more <ContentItem> elements as child element.
2) <***ContentItem***> - mandatory element which indicates a content-item. All other elements listed below are child-elements of a <ContentItem> element.
3) <***Title***> - mandatory element which indicates a user interpretable name to describe the content item. In case of content download, it may serve as a basis/suggestion for the actual filename used for storing the downloaded content item. It is recommended for an OITF to not require the user to enter a filename and select the storage device for storing a downloaded content item.
4) <***Synopsis***> - optional element which indicates a user interpretable description of the content item.
5) <***OriginSite***> - optional element which indicates the URL of the site from which this content access description document can be downloaded. Typically this is the site from which the content is/can be purchased.
6) <***ContentURL***> - mandatory element which indicates the URL from which the content can be fetched. The element has the following attributes:
   a) Optional attribute "`DRMSystemID`", which indicates the DRM system for which this URL applies, using a value as defined by element DRMSystemID in Table 8 of Section 3.3.2 of [META][META]. For example, for Marlin, the DRMSystemID value is "urn:dvb:casystemid:19188". This attribute is used for linking a <ContentURL> to a corresponding <DRMControlInformation> element with the same DRMSystemID value. If the "DRMSystemID" attribute is not specified or has value empty string, then this indicates that the content is not DRM protected.
   b) Attribute "`TransferType`", which indicates the type of transfer used for the content, using one of the following values:
      i) "full_download", which indicates that the content-item must be fully downloaded and stored before playback..
      ii)"playable_download", which indicates that the content-item is available for playback whilst it is being downloaded and stored.
      iii) "streaming", which indicates that the content-item is streamed and should not be stored.

      The default value of the "TransferType" attribute is "playable_download".
   c) Mandatory attribute "`Size`", which indicates the size of the content item in bytes. If the size is unknown (e.g. in case of streaming), the value of this element is -1. If the value is greater or equal to 0, the value given here SHALL correspond to the value given to the Content-Size HTTP header if the content is fetched through an HTTP ContentURL. In case of a download: if after downloading the content item the size of the downloaded content item does not match the indicated size parameter, it is recommended for the OITF to remove the downloaded content item
   d) Mandatory attribute "`MIMEType`", which indicates the MIME-type of the content item. It is recommended for an OITF to inform the user if the content-type of a content item being retrieved cannot be interpreted by the OITF.
   e) Optional attribute "`MediaFormat`", which describes the media format of the content item. The value of this element should be one of the terms defined by the AVMediaFormatCS classification scheme specified in [META][META].
   f) Optional attribute "`VideoCoding`", which describes the coding format of the video. The value of this element should be one of the terms defined by the VisualCodingFormatCS classification scheme defined in [META][META].
   g) Optional attribute "`AudioCoding`", which describes the coding format of the audio. The value of this element should be one of the terms defined by the AudioCodingFormatCS classification scheme defined in [META][META].

   Multiple <ContentURL> elements may be included for a single <ContentItem>, as long as each <ContentURL>-element has a different value for the "DRMSystemID" attribute.
7) <***MetadataURL***> - optional element which indicates the URL from which additional metadata can be fetched for the content item, such as artwork, subtitle files. By default the metadata must be formatted according to TV anytime, as defined in [META].

8) <***NotifyURL***> - optional element which indicates the URL to which an HTTP GET request SHALL be made by the OITF, after the content-item has been fully and successfully fetched, in order to inform the server of the succesful completion of the transfer. If any content is returned from the <NotifyURL>, it MAY be shown in the browser.
9) <***ParentalRating***> - optional element which indicates the parental rating value (e.g. “PG-13”) for this content item. The element has the following attributes:
   a. Attribute “Scheme”, which indicates the name of the parental rating scheme that is used for indicating the value. Valid rating scheme names include the ParentalRating classification scheme names as defined in [MPEG-7], extended with the “GermanyFSK” system as specified in [META]). If no “Scheme” attribute is specified or the value of Scheme is an empty string (“”), the value of the <ParentalRating> element SHALL indicate the minimum recommended age for the given content-item.
   b. Attribute “Region”, which indicates the region to which the parental rating applies. Valid region names include the case-insensitive region codes as defined in ISO 3166-1.

   Multiple <ParentalRating> elements may exist, as long as each <ParentalRating>-element has a different value for the “Scheme” or the “Region” attribute.
10) <***DRMControlInformation***> - optional element which allows the inclusion of DRM related information that SHALL be passed to the DRM agent. This element SHALL adhere to the DRMControlInformation Type Semantics as defined in table 8 of Section 3.3.2 of [META]. For Marlin, additional semantics are defined in Section 4.1.5 of [CSP].
    Multiple <DRMControlInformation> elements may be included for a single <ContentItem>, as long as each <DRMControlInformation>-element has a different value for its “DRMSystemID” child-element.

A valid content-access descriptor SHALL adhere to the following XML Schema:

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
           xmlns:tns="urn:oipf:iptv:ContentAccessDescriptor:2008"
           targetNamespace="urn:oipf:iptv:ContentAccessDescriptor:2008"
           elementFormDefault="qualified" attributeFormDefault="unqualified">
<xs:import namespace="http://www.w3.org/XML/1998/namespace"
           schemaLocation="http://www.w3.org/2001/xml.xsd"/>
<!-- includes the definition for abstract type "DRMPrivateDataType" (as defined in [META])
     and its specific instance type "MarlinPrivateDataType" (as defined in [CSP]) -->
<xs:include schemaLocation="csp-MarlinPrivateDataType.xsd"/>
<xs:include schemaLocation="csp-DRMPrivateDataType.xsd"/>
<xs:include schemaLocation="csp-HexBinaryPrivateDataType.xsd"/>

<xs:element name="Contents" type="tns:ContentsType"/>
  <xs:complexType name="ContentsType">
    <xs:sequence>
      <xs:element name="ContentItem" type="tns:ContItemType" minOccurs="1"
                  maxOccurs="unbounded"/>
      </xs:sequence>
  </xs:complexType>
  <xs:complexType name="ContItemType">
    <xs:sequence>
      <xs:element name="Title" type="tns:TitleType"/>
      <xs:element name="Synopsis" type="tns:SynopsisType" minOccurs="0"/>
      <xs:element name="OriginSite" type="xs:anyURI" minOccurs="0"/>
      <xs:element name="ContentURL" type="tns:ContentURLType" minOccurs="1"
                  maxOccurs="unbounded"/>
      <xs:element name="MetadataURL" type="xs:anyURI" minOccurs="0"/>
      <xs:element name="NotifyURL" type="xs:anyURI" minOccurs="0"/>
      <xs:element name="ParentalRating" type="tns:ParentalRatingType" minOccurs="0"
                  maxOccurs="unbounded"/>
      <xs:element name="DRMControlInformation" type="tns:DRMControlInformationType"
                  minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
  </xs:complexType>
  <xs:complexType name="TitleType">
      <xs:simpleContent>
         <xs:extension base="xs:string">
            <xs:attribute ref="xml:lang"/>
         </xs:extension>
      </xs:simpleContent>
   </xs:complexType>
   <xs:complexType name="SynopsisType">
      <xs:simpleContent>
         <xs:extension base="xs:string">
            <xs:attribute ref="xml:lang"/>
         </xs:extension>
      </xs:simpleContent>
  </xs:complexType>
  <xs:complexType name="ContentURLType">
    <xs:simpleContent>
      <xs:extension base="xs:anyURI">
```

```
        <xs:attribute name="DRMSystemID" type="xs:string" use="optional"/>
        <xs:attribute name="TransferType" type="tns:TransferTypeEnum"
                      default="playable_download"/>
        <xs:attribute name="Size" type="xs:integer" use="required"/>
        <xs:attribute name="MIMEType" type="xs:string" use="required"/>
        <xs:attribute name="MediaFormat" type="xs:string" use="optional"/>
        <xs:attribute name="VideoCoding" type="xs:string" use="optional"/>
        <xs:attribute name="AudioCoding" type="xs:string" use="optional"/>
      </xs:extension>
    </xs:simpleContent>
  </xs:complexType>
  <xs:simpleType name="TransferTypeEnum">
    <xs:restriction base="xs:string">
         <xs:enumeration value="full_download"/>
         <xs:enumeration value="playable_download"/>
         <xs:enumeration value="streaming"/>
      </xs:restriction>
  </xs:simpleType>
  <xs:complexType name="ParentalRatingType">
      <xs:simpleContent>
        <xs:extension base="xs:string">
          <xs:attribute name="Scheme" type="xs:string" use="optional"/>
          <xs:attribute name="Region" type="xs:string" use="optional"/>
        </xs:extension>
      </xs:simpleContent>
  </xs:complexType>

  <xs:complexType name="DRMControlInformationType">
    <xs:sequence>
       <xs:element name="DRMSystemID" type="xs:string"/>
       <xs:element name="DRMContentID" type="xs:string"/>
       <xs:element name="RightsIssuerURL" type="xs:anyURI" minOccurs="0"/>
       <xs:element name="SilentRightsURL" type="xs:anyURI" minOccurs="0"/>
       <xs:element name="PreviewRightsURL" type="xs:anyURI" minOccurs="0"/>
       <xs:element name="DoNotRecord" type="xs:boolean" minOccurs="0"/>
       <xs:element name="DoNotTimeShift" type="xs:boolean" minOccurs="0"/>
       <xs:element ref="tns:DRMGenericData" minOccurs="0" maxOccurs="unbounded"/>
       <xs:element ref="tns:DRMPrivateData" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
  </xs:complexType>

   <xs:element name="DRMGenericData" type="tns:DRMGenericDataType"/>
   <xs:element name="DRMPrivateData" type="tns:DRMPrivateDataType"/>

   <xs:complexType name="DRMGenericDataType">
      <xs:sequence>
        <xs:any namespace="##any" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
      </xs:sequence>
   </xs:complexType>

   <xs:element name="MarlinPrivateData" type="tns:MarlinPrivateDataType"
               substitutionGroup="tns:DRMPrivateData"/>
   <xs:element name="HexBinaryPrivateData" type="tns:HexBinaryPrivateDataType"
               substitutionGroup="tns:DRMPrivateData"/>

</xs:schema>
```

An OITF SHALL silently ignore unknown elements and attributes that are part of a content-access descriptor.

Annex F. Capability Extensions Schema

This Annex contains the schema that includes the extensions and modifications to the capability negotiation mechanism as defined in Section 9.3. This schema redefines and adds the necessary extensions to the existing capability description schema as defined in Annex C of CEA-2014[CEA-2014-A]. The schema in this Annex SHALL be used instead of the existing capability description as defined in Annex C of CEA-2014[CEA-2014-A]. Note that for the additional "0.33x0.33" value for "scalingType" as defined in Section 9.3.14, a special construction has been defined. See the last two paragraphs of this Annex for more information.

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<xs:schema xmlns="urn:oipf:config:oitf:oitfCapabilities:2008"
           xmlns:xs="http://www.w3.org/2001/XMLSchema"
           targetNamespace="urn:oipf:config:oitf:oitfCapabilities:2008"
           elementFormDefault="qualified" attributeFormDefault="unqualified">
  <!-- schema filename is  config-oitf-oitfCapabilities.xsd -->
  <!-- Redefined uiExtensionsType of the original schema as defined in Annex C of CEA-2014
       (i.e. imports/ce-html-profiles-1-0.xsd) to add the new elements defined in Section 9.2
       of Open IPTV forum Volume 5 Declarative Application Environment Release 1 specification.
   -->
   <xs:redefine schemaLocation="imports/ce-html-profiles-1-0.xsd">
   <xs:complexType name="uiExtensionType">
      <xs:complexContent>
         <xs:extension base="uiExtensionType">
            <xs:choice minOccurs="0" maxOccurs="unbounded">
               <xs:element name="video_broadcast" type="videoBroadcastType" minOccurs="0"
                           maxOccurs="unbounded"/>
               <xs:element name="overlaylocaltuner" type="overlayType"/>
               <xs:element name="overlayIPbroadcast" type="overlayType"/>
               <xs:element name="recording" type="pvrType"/>
               <xs:element name="parentalcontrol" type="parentalControlType"/>
               <xs:element name="extendedAVControl" type="xs:boolean"/>
               <xs:element name="clientMetadata" type="metadataType"/>
               <xs:element name="configurationChanges" type="xs:boolean"/>
               <xs:element name="ims" type="xs:boolean"/>
               <xs:element name="communication_services" type="xs:boolean"/>
               <xs:element name="drm" type="drmType" minOccurs="0" maxOccurs="unbounded"/>
               <xs:element name="remote_diagnostics" type="xs:boolean"/>
            </xs:choice>
         </xs:extension>
      </xs:complexContent>
   </xs:complexType>
   <!-- Redefined downloadType to add attribute manageDownloads -->
   <xs:complexType name="downloadType">
      <xs:simpleContent>
          <xs:extension base="downloadType">
             <xs:attribute name="manageDownloads" type="manageDownloadsType" default="none"/>
          </xs:extension>
      </xs:simpleContent>
   </xs:complexType>
   <!-- Redefined audioProfileType to add attribute DRMSystemID -->
   <xs:complexType name="audioProfileType">
      <xs:complexContent>
         <xs:extension base="audioProfileType">
            <xs:attribute name="DRMSystemID" type="xs:string"/>
         </xs:extension>
      </xs:complexContent>
   </xs:complexType>
   <!-- Redefined videoProfileType to add attribute DRMSystemID -->
   <xs:complexType name="videoProfileType">
      <xs:complexContent>
         <xs:extension base="videoProfileType">
            <xs:attribute name="DRMSystemID" type="xs:string"/>
         </xs:extension>
      </xs:complexContent>
   </xs:complexType>
   </xs:redefine>
   <!-- ADDED: type definitions for the new elements defined in Section 9.2 of the
        Open IPTV forum Volume 5 Declarative Application Environment Release 1 specification
    -->
   <xs:simpleType name="manageDownloadsType">
      <xs:restriction base="xs:string">
         <xs:enumeration value="none"/>
         <xs:enumeration value="initiator"/>
         <xs:enumeration value="samedomain"/>
         <xs:enumeration value="all"/>
      </xs:restriction>
   </xs:simpleType>
   <xs:complexType name="videoBroadcastType">
```

```
      <xs:attribute name="type" type="xs:string" use="required"/>
      <xs:attribute name="transport" type="xs:string"/>
      <xs:attribute name="nrstreams" type="xs:unsignedInt" default="1"/>
      <xs:attribute name="scaling" type="scalingType" default="arbitrary"/>
      <xs:attribute name="minSize" type="xs:unsignedInt" default="0"/>
      <xs:attribute name="postList" type="xs:boolean" default="false"/>
   </xs:complexType>
   <xs:complexType name="pvrType">
      <xs:simpleContent>
         <xs:extension base="xs:boolean">
            <xs:attribute name="ipBroadcast" type="xs:boolean" default="false"/>
            <xs:attribute name="manageRecordings" type="xs:boolean" default="false"/>
            <xs:attribute name="postList" type="xs:boolean" default="false"/>
         </xs:extension>
      </xs:simpleContent>
   </xs:complexType>
   <xs:complexType name="parentalControlType">
      <xs:simpleContent>
         <xs:extension base="xs:boolean">
            <xs:attribute name="schemes" type="xs:string"/>
         </xs:extension>
      </xs:simpleContent>
   </xs:complexType>
   <xs:complexType name="metadataType">
      <xs:simpleContent>
         <xs:extension base="xs:boolean">
            <xs:attribute name="type" type="xs:string"/>
         </xs:extension>
      </xs:simpleContent>
   </xs:complexType>
   <xs:complexType name="drmType">
      <xs:simpleContent>
         <xs:extension base="xs:string">
            <xs:attribute name="DRMSystemID" type="xs:string" use="required"/>
            <xs:attribute name="protectionGateways" type="xs:string"/>
         </xs:extension>
      </xs:simpleContent>
    </xs:complexType>
</xs:schema>
```

Due to limitations of XML Schema it is not possible to redefine/extend the enumeration of type “scalingType” to add the additional value “0.33x0.33” as defined in Section 9.3.14. Therefore, this value must be directly added to the original schema as defined in Annex C of CEA-2014[CEA-2014-A] (i.e. imports/ce-html-profiles-1-0.xsd), as follows:

```
    [...]

   <xs:simpleType name="scalingType">
      <xs:restriction base="xs:string">
         <xs:enumeration value="arbitrary"/>
         <xs:enumeration value="quartersize"/>
         <xs:enumeration value="none"/>
         <xs:enumeration value="0.33x0.33"/>
      </xs:restriction>
   </xs:simpleType>

   [...]
```