



**Connected TV**  
Requirements for Interoperability  
D-Book 7 Part B

**DTG**  
// Version 1 Digital TV Group

The industry association for digital television in the UK

# Preface

D-Book 7 Part B extends the interoperability guidelines in Part A into the Connected TV world. It offers architecture and protocols for interoperable IP delivered services.

This publication is built upon international standards including those published by OIPF, ETSI (incorporating HbbTV) and ISO/IEC (MPEG-DASH), with extensions to cater for UK-specific features. Where relevant, the DTG has submitted any enhancements and errata back to the relevant bodies.

This version of D-Book 7 Part B includes support for adaptive streaming with reference to, and profile extraction from the MPEG-DASH (ISO/IEC 23009-1) and Common Encryption (ISO/IEC 23001-7) specifications. At the time of publication, both 23009-1 and 23001-7 are only available as pre-publication drafts and as such these references may be subject to further clarifications and amendments as they are implemented by terminals and services in the UK and elsewhere. Any amendments and clarifications will be included in both a working draft D-Book and an errata document, available from the DTG D-Book webpage until such time as they can be published. Any devices designed to the MPEG-DASH and Common Encryption draft specifications would be expected to be updated to conform to the final published versions.

The DTG will seek to submit new extensions which link between MHEG and IP delivered services into the ETSI MHEG (ES 202 184) specification in due course.

Several platforms have indicated their intentions to reference sections of Part B, however at the time of publication Trade Mark Licence implementation requirements are still in development. The DTG has worked closely with its members to meet the requirements of the BBC's HTML applications, including the latest version of the BBC iPlayer, and other broadcaster's catch-up TV players.

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# Definitions and Abbreviations

## Definitions

<b>Adobe Flash</b>	Adobe Flash (formerly Macromedia Flash) is a multimedia platform. Flash has become a popular method for adding animation and interactivity to web pages. Flash is commonly used to create animation, advertisements, and various web page Flash components, to integrate video into web pages, and more recently, to develop rich Internet applications.
<b>Aerial</b>	See antenna.
<b>Antenna</b>	An antenna (or aerial) is a transducer designed to transmit or receive electromagnetic waves.
<b>Application</b>	An application is software designed to help the user to perform a particular task. Typical examples are EPG/user interface, content sharing, storage, media players and database applications.
<b>Application Programming Interface (API)</b>	An application programming interface (API) is an interface implemented by a software component to enable interaction with other software, much in the same way that a user interface facilitates interaction between humans and computers.
<b>Aspect Ratio</b>	Aspect ratio describes the relationship between the width of an image and its height.
<b>Attribute</b>	A data field attributing a value to an element.
<b>Audio Description</b>	A service which provides an audio commentary, describing the visual scene, in addition to the main audio track.
<b>Available Content</b>	Content which is available to start consumption, e.g. progressive part downloaded but ready to consume, completely downloaded, not embargoed [1], etc.
<b>Booked Content</b>	Content which has been identified for acquisition at some future time.
<b>Broadband</b>	A bi-directional, always on consumer service for delivering IP packets to the customer's premises.
<b>Broadband Transport Stream (BBTS)</b>	Marlin specified MPEG2-TS based container specification.
<b>Broadcaster</b>	Entity that transmits content to an audience. Typically a broadcaster using traditional methods is required to hold a licence to broadcast and must comply to guidelines relating to the type of content and geographical footprint as set out by a regulating body.
<b>Broadcast-independent application</b>	Interactive application not related to any broadcast channel or other broadcast data
<b>Broadcast-related application</b>	Interactive application associated with a broadcast television, radio or data channel, or content within such a channel
<b>CI Module</b>	A module that plugs into the Common Interface socket on a Terminal, typically to provide conditional access functionality.
<b>CI Plus</b>	An enhanced version of the Common Interface that adds security to the MPEG2-TS and the control path and defines an extended MMI based on MHEG-5.
<b>CI Plus Module</b>	A module that plugs into the CI Plus interface socket on a Terminal, typically to provide conditional access functionality.
<b>Cipher Block Chaining (CBC)</b>	A method involving the use of the previous encrypted block of data as an Initialisation Vector for the next block being encrypted.
<b>Clean Audio</b>	A component of a service which provides an audio track where the dialogue is boosted relative to the background noise.
<b>Client application</b>	Application running in the Terminal.
<b>Client Log</b>	Mechanism for storing user activity before reporting data for audience measurement.
<b>Codec</b>	A codec is a function capable of encoding and/or decoding a digital data stream or signal.
<b>Common Interface (CI)</b>	The Common Interface is an extensible digital interconnect found in digital TV devices. All Common Interface equipment must comply with [EN 50221-1997].

<b>Common Intermediate Format (CIF) / Quarter Common Intermediate Format (QCIF)</b>	Common Intermediate Format/Quarter Common Intermediate Format. An international standard size for low-resolution image and video display formats. CIF dimensions are 352 x 288 pixels and QCIF are 176 x 144 pixels.
<b>Condition Access Table (CAT)</b>	An MPEG2-TS table that gives the association between one or more CA systems, their EMM streams and any special parameters associated with them, see [ISO/IEC 13818-1].
<b>Conditional Access (CA)</b>	Conditional access (CA) is a technology used on the delivery network to restrict access to digital television (DTV) services by encrypting the transmitted programming.
<b>Connected TV</b>	A system where services are delivered either via IP, or via both Traditional Broadcast and IP. Both delivery channels may be used simultaneously to deliver a complete service – for example, a Traditional Broadcast service may link to further related content and applications that are delivered via IP.
<b>Content Delivery Network (CDN)</b>	Content Delivery Network, a set of managed servers that are placed as close to the end-user inside the IP network as is economically viable.
<b>Content discovery</b>	The process by which the user of the Terminal can locate content items which are available within the context of a service and subsequently select the item they want to view.
<b>Content Download</b>	Download delivery of content items to the local storage of the user's Terminal in non-real time. The consumption may happen at a different time to the delivery.
<b>Content Download Service (CDS)</b>	Service that provides download delivery of content items to the storage of the Terminal. The consumption is independent of the delivery. Note that when used for "Content Download Service" the abbreviation "CDS" must be pre-fixed with a pre-qualifier such as "DVB", i.e. "DVB-CDS" to differentiate it from the UPnP usage.
<b>Content item</b>	An editorially coherent grouping of one or more audiovisual components or generic data files which are intended to be consumed in conjunction with each other.
<b>Content on Demand (CoD)</b>	Content on demand: service that allows the user to receive and consume selected video content, radio programmes, Podcasts in real time at a time chosen by the user rather than as part of a scheduled service stream.
<b>Content Protection</b>	A set of technologies that ensure content is only used in accordance with the rights that have been granted. Note that content protection usually persists after authorised acquisition of the content by the user.
<b>Content provider</b>	Entity that owns or is licenced to sell content items.
<b>Content Service Provider (CSP)</b>	The entity which owns content items or licences content items from Content Providers and packages them into a service and has a direct relationship with the user or customer.
<b>CTV</b>	Connected TV
<b>CTV content item</b>	A single content item defined within a CTV service by the associated CTV metadata. This may be delivered as part of a schedule, as a CoD or VoD item or delivered using a content download method.
<b>CTV Service</b>	A set of CTV content items described by the associated CTV metadata.
<b>Customer</b>	The person who has the commercial relationship with the entity who provides the content or service.
<b>Customer Premises Equipment (CPE)</b>	Any equipment used for accessing CTV services in the customer's premises, including home gateways and terminals.
<b>Decoder</b>	A hardware device or software application which is used to translate a bit stream back into the original video or audio form.
<b>Delivery Network</b>	Network connecting the home gateway and content service providers.
<b>Descrambled</b>	Content that has been decrypted
<b>Device</b>	Device is not a CTV term and we should use the term 'Terminal'
<b>Digital Onscreen Graphic (DOG)</b>	A small stationary graphic most often used to add the channel logo to a programme.

<b>Digital Rights Management (DRM)</b>	Digital rights management (DRM) is a generic term for access control technologies that can be used to manage the usage of content items.
<b>Digital Video Recorder (DVR)</b>	A digital video recorder is a device that records video and audio in a digital format to a memory medium within or connected to the recorder. Same meaning as PVR.
<b>Downstream</b>	Data flows in the direction of the home.
<b>Drop out</b>	A fault where a signal is lost or impaired. On digital television transmission it can be caused by poor reception or the loss of MPEG frames. For an IP delivered piece of content impairment is normally caused by the network dropping packets. For both DTT and IP delivered content this may result in picture flashes, pixilation or freezes and/or sound disturbance or loss.
<b>DVB</b>	Digital Video Broadcasting, the European standard digital TV technology.
<b>DVB Component</b>	One of the entities which together make up a DVB event or CTV content item. For example, video, audio, subtitles
<b>DVB Event</b>	A single content item defined within a scheduled DVB service by the associated DVB metadata. MPEG refers to the equivalent of the DVB event as a "programme".
<b>DVB Service</b>	A sequence of DVB events on a scheduled delivery under the control of a broadcaster or service provider which can be broadcast as part of a schedule
<b>Editorial</b>	A policy or guidelines set by the owner of the content or CSP that presents their opinion of the way the content is presented, packaged, searched and aggregated together for the consumer to interact with.
<b>Electronic Programme Guide (EPG)</b>	Provides users with a continuously updated menu displaying scheduling information for current and up-coming programming for traditional broadcast content items. In the context of CTV this does not include CoD, VoD or MoD.
<b>Element</b>	A logical component of an XML document.
<b>Entitlement Control Message (ECM)</b>	Private conditional access information which specify the control words and possibly other, typically stream-specific, scrambling and/or control parameters, see [ISO/IEC 13818-1].
<b>Entitlement Management Message (EMM)</b>	Private conditional access information which specify the authorisation levels or the services of specific decoders, see [ISO/IEC 13818-1].
<b>Event</b>	Content item carried on a scheduled service.
<b>Firmware</b>	System software of the Terminal.
<b>Firmware update</b>	Update of firmware via any mechanism.
<b>fMP4</b>	Fragmented MP4
<b>Free to air (FTA)</b>	A service delivered without encryption and available free of charge at the point of consumption.
<b>Free to view</b>	A service delivered with encryption but available free of charge at the point of consumption.
<b>Fully Qualified Domain Name (FQDN)</b>	An unambiguous domain name containing all domain levels (e.g. www.dtg.org)
<b>High Definition (HD) TV</b>	Picture resolution greater than 520000 pixels per video frame
<b>Home Gateway</b>	Device that connects the delivery network to the home network.
<b>Home network</b>	The network connecting the home gateway and the Terminal. Other equipment may also be connected to this network.
<b>Hybrid Terminal</b>	A device capable of receiving and presenting broadcast signals and IPTV applications.
<b>InBand</b>	Stored inside the content container itself.
<b>Initialisation Vector (IV)</b>	Data used to initialise an encryption/decryption algorithm.
<b>Internet Protocol Television (IPTV)</b>	A service that distributes television content over an IP network that is managed.
<b>Internet Service Provider (ISP)</b>	An Internet service provider (ISP), is a company that offers its customers (end-users) access to the Internet and can offer subscription TV services. The ISP connects to its customers using a data transmission technology appropriate for delivering Internet Protocol datagrams, such as dial-up, DSL, cable modem, wireless or dedicated high-speed interconnects.

<b>Internet TV</b>	A service that distributes television content over the Internet. See also "Over the top service".
<b>IP</b>	IP is the primary protocol in the Internet Layer of the Internet Protocol Suite and has the task of delivering protocol datagrams (packets) from the source host to the destination host solely based on their addresses. For this purpose the Internet Protocol defines addressing methods and structures for datagram encapsulation.
<b>IP Broadcast</b>	One to many delivery over an IP-based network, including both multicast and stream replication.
<b>Key Rotation</b>	The periodic changing of key values used to protect content
<b>Marlin</b>	DRM and open digital content sharing platform.
<b>Measurement metadata (Behaviour)</b>	The schema (collection and structure) of the specific data describing the service and content consumption by the customer, and specific data for the Terminal to be used for remote management and firmware/software maintenance. This data may be used in an aggregated of customer specific way by various entities in the CTV depending on the requirements and regulatory restrictions.
<b>Media Presentation Description (MPD)</b>	An XML file containing metadata required for the delivery of adaptive bitrate content to a Terminal.
<b>Metadata</b>	A set of information created to describe a specific service or content item (audio or video asset) which allows a database to be created in the Terminal allowing the user to search for specific content items or types of content. The depth of information in the metadata and hence in the database may vary for different metadata provider.
<b>MHEG</b>	MHEG-5, or ISO/IEC 13522-5, is part of a set of international standards relating to the presentation of multimedia information, standardised by the Multimedia and Hypermedia Experts Group (MHEG). It is most commonly used as a language to describe interactive television services.
<b>MPEG</b>	Moving Pictures Experts Group. This group has produced a series of universal standards for compression of digital video for digital TV, DVDs and PVRs. MPEG-2 and MPEG-4 are used for digital TV. MPEG-4 offers better compression technology to deliver multimedia for fixed and mobile video.
<b>MPEG Programme</b>	Equivalent to DVB event
<b>MPEG-2</b>	MPEG-2 standards were published as parts of ISO/IEC 13818. Each part covers a certain aspect of the whole specification, including: - Part 1: Systems – describes synchronization and multiplexing of video and audio. Also known as ITU-T Rec. H.222.0. - Part 2: Video – compression codec for interlaced and non-interlaced video signals. Also known as ITU-T Rec. H.262. - Part 3: Audio – compression codec for perceptual coding of audio signals. A multichannel-enabled extension and extension of bit rates and sample rates for MPEG-1 Audio Layer I, II and III of MPEG-1 audio. -Part 6: Describes extensions for DSM-CC (Digital Storage Media Command and Control).
<b>MPEG-2 TS</b>	This is a specific reference to MPEG-2 (ISO/IEC 13818) Part 1 Systems. This describes synchronization and multiplexing of video and audio.
<b>MPEG-4</b>	MPEG-4 is a multi part standard but the term MPEG-4 without a part number following it refers to MPEG-4 part 10 which is a codec for video signals which is technically identical to the ITU-T H.264 standard.
<b>Multicast</b>	Multicast addressing is a network technology for the delivery of information to a group of destinations simultaneously. The word "multicast" is typically used to refer to IP multicast which is often employed for streaming media and Internet television applications.
<b>Multimedia on Demand (MoD)</b>	Multimedia on demand: service that allows the user to receive and watch selected video content, radio programmes, Podcasts at a time chosen by the user rather than as part of a scheduled service stream.
<b>Namespace</b>	A data container providing context for identifiers.
<b>OOB</b>	Not stored inside the content container itself

<b>OSI model</b>	See <a href="http://en.wikipedia.org/wiki/OSI_model">http://en.wikipedia.org/wiki/OSI_model</a>
<b>Over the top service (OTT)</b>	Over the Top, a term describing third-party home entertainment services that are delivered across (i.e., "on top" of) a broadband network without affiliation with the broadband service provider
<b>Packet Identifier (PID)</b>	A unique integer value used to identify elementary streams of a program in a single or multi-program Transport Stream, see [ISO/IEC 13818-1].
<b>Pay Per View (PPV)</b>	A service in which a customer pays to receive one or more specific content items.
<b>Personal Computer Memory Card International Association (PCMCIA)</b>	An interoperability standard for hosts and modules communicating over a 16-bit, 68-pin interface.
<b>Personal Video Recorder (PVR)</b>	A personal video recorder is a device that records video and audio in a digital format to a memory medium within or connected to the recorder. Same meaning as DVR.
<b>Play list</b>	A list of URLs, each of which refers to a content item.
<b>Primary distribution</b>	The connection between the content provider and the content service provider.
<b>Program Map Table (PMT)</b>	Provides a mapping between program numbers in an MPEG2-TS and the program elements that comprise it, see [ISO/IEC 13818-1].
<b>Programme</b>	An event in a schedule.
<b>Pull download service</b>	Content download initiated by the user
<b>Push download service</b>	Content download initiated by the service provider without explicit request by the user
<b>Push VOD</b>	A method by which broadcasters can signal content for acquisition by an appropriately enabled receiver without user intervention.
<b>Real Time Streaming Protocol (RTSP)</b>	The Real Time Streaming Protocol (RTSP) is a network control protocol for use in entertainment and communications systems to control streaming media servers. The protocol is used to establish and control media sessions between the player on the Terminal and the streaming media server.
<b>Red Button Application</b>	An application that indicates its availability by displaying a red icon overlaid on the video.
<b>Router</b>	OSI layer 3 connecting component which connects two or more link layer components to each other, not necessarily of the same type. Note: A router is able to select among multiple paths to route packets through the network based on a destination address available in the packet. The only OSI layer 3 type considered is IP.
<b>Schema</b>	A way to define the structure, content and, to some extent, the semantics of an XML document.
<b>Scrambled</b>	Content that has been encrypted.
<b>Secondary distribution</b>	The connection between the content service provider and home gateway.
<b>Service</b>	Editorially complete combination of content and data and associated metadata allowing the Terminal to reproduce the intended functionality.
<b>Service discovery</b>	The process by which the service is located. There may be several hierarchical levels involved in the metadata structure.
<b>Service Protection</b>	Ensures only authorised terminals can access a specific protected CTV service. It includes control of access to a service and authentication of the user and/or Terminal.
<b>Set Top Box (STB)</b>	This term is not used in CTV, use "Terminal" in CTV
<b>Short Solitary Block (SSB)</b>	Describes the data at the end of an encryption process that does not fit into a complete block of data for an encryption algorithm with a fixed block size.
<b>Side Loading</b>	Transfer of content to another device outside the Terminal. E.g. moving content to a portable media player.
<b>Simulcast</b>	Broadcasting a programme on multiple different CTV services at the same time.
<b>Smart card</b>	Also known as a 'viewing card': this plastic card is inserted into the slot in a Terminal (possibly via a CI module) that decrypts signals and allows the user to consume CTV services.

<b>Software</b>	The term software in the CTV project refers to application software which resides on the Terminal and is designed to help the user to perform a particular task.
<b>Sting</b>	A piece of content usually short in duration that either promotes other content or the brand of the content owner or content service provider. Also referred to as an interstitial and may be a trailer.
<b>Storage</b>	Method of holding content delivered to the home to be consumed later, the physical storage module, e.g. hard disk, may be integral to the Terminal or external but connected and should be considered as functionally part of the Terminal.
<b>Stored content</b>	local & remote on Terminal managed storage resources, downloaded or linear content which includes available and unavailable content.
<b>Subnet Mask</b>	A form of representation for defining IP addresses.
<b>Switch</b>	An infrastructure device in a network used to share or distribute IP traffic between network devices
<b>Technology-Neutral</b>	A term used to describe a network, hardware or software architecture which allows various alternative implementations to be done without compromising the resulting functionality.
<b>Terminal</b>	A device that conforms to one of the terminal profiles within this specification as specified by chapter <b>B.7</b> .
<b>Terrestrial</b>	DVB services broadcast and received via an aerial (antenna) in bands IV and V using the DVB-T/T2 standard.
<b>Traditional Broadcast</b>	One to many delivery over a terrestrial, cable or satellite network.
<b>Transport stream</b>	See <b>MPEG-2 TS</b>
<b>Unicast</b>	A transmission between a single sender and a single receiver over an IP network.
<b>Uniform Resource Identifier (URI)</b>	A sequence of characters identifying a resource that follows the syntax defined in RFC3986.
<b>Uniform Resource Locator (URL)</b>	A URI that in addition to identifying a resource provides a means of locating that resource by describing its primary access mechanism, (e.g. its network location).
<b>Uplink</b>	Signal sent to a communications satellite by a ground station.
<b>Upstream</b>	Delivery from home to content source
<b>User</b>	The person who interacts with the CTV service.
<b>VoD</b>	See <b>CoD</b> .
<b>Widescreen</b>	TV picture that gives a 'letterbox' shape when viewed on a screen.

## Abbreviations

<b>A/V</b>	Audio/visual
<b>AES</b>	Advanced Encryption Standard. A symmetric-key encryption standard based upon block-cipher techniques. The term is usually post-fixed with the cipher block length employed e.g. AES-128.
<b>AIT</b>	Application Information Table. A DVB Service Information table for signalling application parameters.
<b>BBFC</b>	British Board of Film Classification. The organisation that provides regulation of the presentation of moving images in the UK. In particular, the provider of the UK cinema film categorisation scheme.
<b>BRL</b>	Broadcast Record List
<b>CADD</b>	Content Access Download Descriptor. A data structure defined by OIPF to convey content metadata to terminals.
<b>CDS</b>	Content Download Service
<b>CSS3</b>	Cascading Style Sheets (3). A style sheet language used to describe the presentation semantics of a document written in a markup language
<b>DAE</b>	Declarative Application Environment. A declarative language-based environment (browser) based on CEA-2014 [CEA-2014-A] for presentation of user interfaces.

<b>DECE</b>	Digital Entertainment Content Ecosystem. A consortium of major Hollywood studios, consumer electronics manufacturers and retailers, network hardware vendors, systems integrators and Digital Rights Management (DRM) vendors.
<b>DHCP</b>	Dynamic Host Configuration Protocol. An auto-configuration protocol used on IP networks.
<b>DHCPv6</b>	Dynamic Host Configuration Protocol for IPv6
<b>DLNA</b>	Digital Living Network Alliance
<b>DNS</b>	Domain Name Server
<b>DSM-CC</b>	Digital Storage Media Command and Control. A set of tools for providing control channels associated with delivery of MPEG media.
<b>DVB</b>	Digital TV Broadcasting Project
<b>ETSI</b>	European Telecommunications Standards Institute. ETSI produces globally-applicable standards for Information and Communications Technologies (ICT), including fixed, mobile, radio, converged, broadcast and internet technologies.
<b>HbbTV</b>	Hybrid Broadcast Broadband TV. Consortium aimed at harmonising the broadcast and broadband delivery of entertainment through connected devices.
<b>HTML</b>	HyperText Markup Language. A language for defining web pages.
<b>HTTP</b>	HyperText Transfer Protocol. A networking protocol for distributed, collaborative, hypermedia information systems.
<b>IETF</b>	Internet Engineering task Force. An open international community of network designers, operators, vendors, and researchers concerned with the evolution of the Internet.
<b>IPv4, IPv6</b>	Different versions of the IP communication protocol.
<b>ISO-IEC</b>	ISO, the International Organisation for Standardization, and IEC, the International Electrotechnical Commission. European standards organisations.
<b>ITU</b>	International Telecommunications Union. An agency of the United Nations which regulates information and communication technology issues.
<b>MD</b>	Metadata.
<b>MIME</b>	Multipurpose Internet Mail Extensions. A system of identification for content types.
<b>MMI</b>	Man Machine Interface
<b>MP4</b>	MPEG-4
<b>MPEG-DASH</b>	Dynamic Adaptive Streaming over HTTP. A method for delivery of MPEG encoded content over IP.
<b>MPTS</b>	Multi-Program Transport Stream
<b>NDT</b>	Non-destructive tuning
<b>OIPF</b>	Open IPTV Forum. The Open IPTV Forum e.V. is a pan-industry initiative with the purpose of producing end to end specifications for IPTV.
<b>PMT</b>	Program Map Table. A PSI/SI table employed by MPEG and DVB standards to signal components that comprise a transport stream.
<b>PSI</b>	Program Specific Information. Data structures defined by MPEG to signal components within a transport stream.
<b>RC4</b>	A symmetric key stream cipher, developed by RSA Data Security Inc, and now widely available.
<b>RFC</b>	Request for Comment. A memorandum published by the Internet Engineering Task Force (IETF) describing methods, behaviours, research, or innovations applicable to the working of the Internet.
<b>RTP</b>	Real Time Protocol. One of the core set of communications protocols used on the Internet for conveying media content.
<b>SCP</b>	Service Content Protection
<b>SI</b>	Service Information. Data structures defined by DVB providing metadata relating to DVB services.
<b>TCP/IP</b>	Transmission Control Protocol/Internet Protocol. A set of communications protocols used widely on the Internet.
<b>TLS</b>	Transport Layer Security
<b>TTML</b>	Timed Text Markup Language. A language for defining a timed presentation of text, such as subtitles.

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<b>TVA</b>	TVAnytime Forum. The TV-Anytime Forum is an association of organisations which seeks to develop specifications to enable audio-visual and other services based on mass-market high volume digital storage in consumer platforms
<b>Type (XML)</b>	A defined structure for presenting 'well formed' data in an XML document.
<b>UDP</b>	User Datagram Protocol. One of the core set of communications protocols used on the Internet.
<b>UI</b>	User interface.
<b>UPnP</b>	Universal Plug and Play
<b>URN</b>	Uniform Resource Name. A form of URI for identifying a resource.
<b>WebGL</b>	Web-based Graphics Language. Extends the capability of the JavaScript programming language to allow it to generate interactive 3D graphics within a compatible web browser.

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# B.I Connected TV UK Landscape

## B.I.I Scope of the D-Book Part B

This part of the document describes a Television platform where TV channels, on-demand content and applications may be delivered over an Internet connection. It defines the signalling, transport, and presentation of enhanced and interactive applications designed for running on hybrid terminals that may include a DVB compliant broadcast connection as well as the broadband connection to the Internet.

The main uses of the broadcast connection are described in [I] Chapter 22.

The main uses of the broadband connection are the following:

- Download content (non-real time)
- VoD (Video on Demand): including progressive download and trick mode operations.
- IP linear delivery of content from sources managed by applications. (See also IC channel section, [I] Chapter 11 )
- Applications Data
- Audience measurement Data

NOTE: Content from IPTV services requiring service discovery and selection is out of scope of this specification.

NOTE: Software download and remote management of the Terminal is out of scope.

Applications are presented as described in [B.4 Connected TV Presentation](#).

This specification has the following characteristics which may additionally be profiled with a Trade Mark Licence agreement (TML):

- It is open and is not based on a single controlling authority or aggregator.
- Services and content from many different and independent providers may be accessed by the same Terminal.
- A trust model is defined such that Terminal functions can be made available to all applications or constrained to trusted applications.
- A co-existence model is defined to allow multiple applications to be deployed simultaneously ([B.4.2 Application Model, Lifecycle and Signalling](#)).
- Services and content may be protected.

Terminals that are not connected to broadband must still be able to render Traditional broadcast services. This includes both terminals which could be connected but have not yet been connected and terminals located where no broadband connectivity is available.

This specification does not preclude proprietary applications or services being run on the Terminal.

Both broadcast-related and broadcast-independent applications are supported.

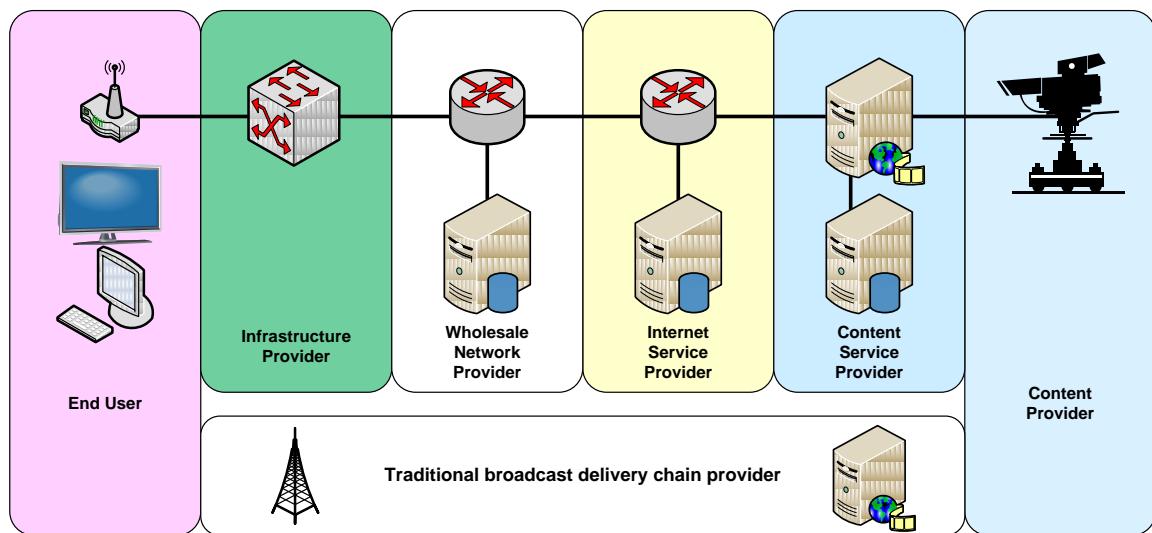
Broadband services are delivered according to a defined IP transport protocol, as described in [B.2 Connected TV IP Delivery](#).

This specification also defines the metadata required to ensure interoperability between a Terminal and content (as identified by its metadata) originating from different and unrelated sources through the defined delivery interfaces, as described in [B.3 Connected TV Metadata](#).

This is not a complete specification in its own right, and references other external specifications.

## B.I.2 Content TV Domains

**Figure B.I- I Content TV Domains**



### B.I.2.1 Content Provider

The Content Provider is the entity that owns or is licenced to sell the content or content assets; it may also be a Content Service Provider.

### B.I.2.2 Content Service Provider

The Content Service Provider is an aggregator of content and its associated licences which are used to create a service package that can either be wholesaled to an Internet Service Provider or delivered directly to the end-user in an Over The Top (OTT) service delivery.

### B.I.2.3 Internet Service Provider (ISP)

An ISP is an operator that provides telecommunication services to customers and other users either on a tariff or contract basis. An ISP can optionally operate a network. An ISP can also acquire or licence content from Content Providers and package this into a service to be consumed by the end-user or sold onto a Content Service Provider as a wholesale proposition.

### B.I.2.4 Wholesale Network Provider

The Wholesale Network Provider is the organisation that maintains and operates the network components required for CTV functionality. Although considered as two separate entities, the ISP and the Wholesale Network provider may be a single organisational entity.

### B.I.2.5 Infrastructure Provider

The Infrastructure Provider is the organisation that provides the physical assets and/or services that the ISP and Wholesale Network Provider use to deliver the CTV service to consumers. The Infrastructure Provider therefore has a business-to-business relationship with the Wholesale Network Provider and/or the ISP.

### B.I.2.6 Traditional Broadcast Delivery Chain Provider

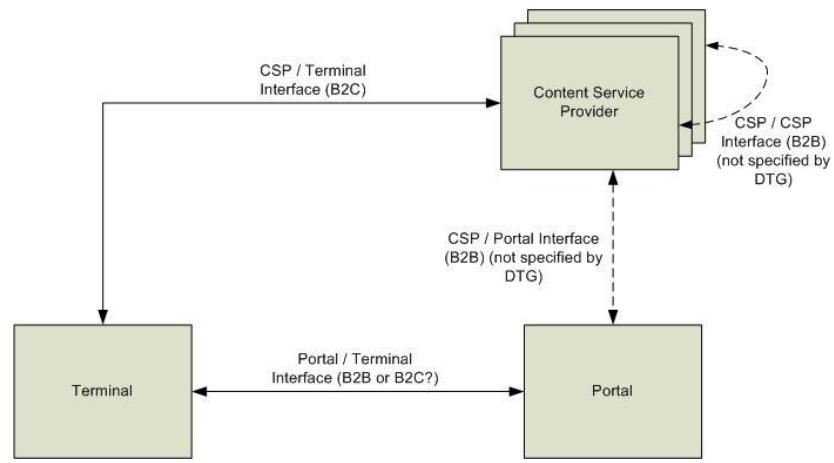
The Traditional Broadcast Delivery Chain Provider is an organisation that operates a terrestrial, satellite or cable network that broadcasts to all End-users with the correct receiving equipment.

### B.I.2.7 End-user

The End-user consumes the product or service. An End-user can optionally be a customer. The customer is responsible for concluding contracts for the services subscribed to and for paying for these services.

## B.I.3 System Overview

**Figure B.I- 2 System Overview**



The Portal represents the access to the End-user for one or more Content Service Providers.

The CSP/Terminal interface and the Portal/Terminal interface use the same technical interface specifications.

### B.I.3.1 Introduction

The primary intention of this section of the specification is to present an overview of all of the major functional components of the Terminal and how they are logically related; it provides a high level overview of the systems architecture and presents the major functional components.

The level of detail in this overview is general and abstract, details of the internal structures of the components and their low level implementations are defined later in this specification.

Not all systems and functional components may be necessary in a specific deployment or implementation, e.g. not all devices will have storage capabilities, several functional components may be combined into a single component in any practical deployment and the logical flow of information may then be different to that depicted in this overview.

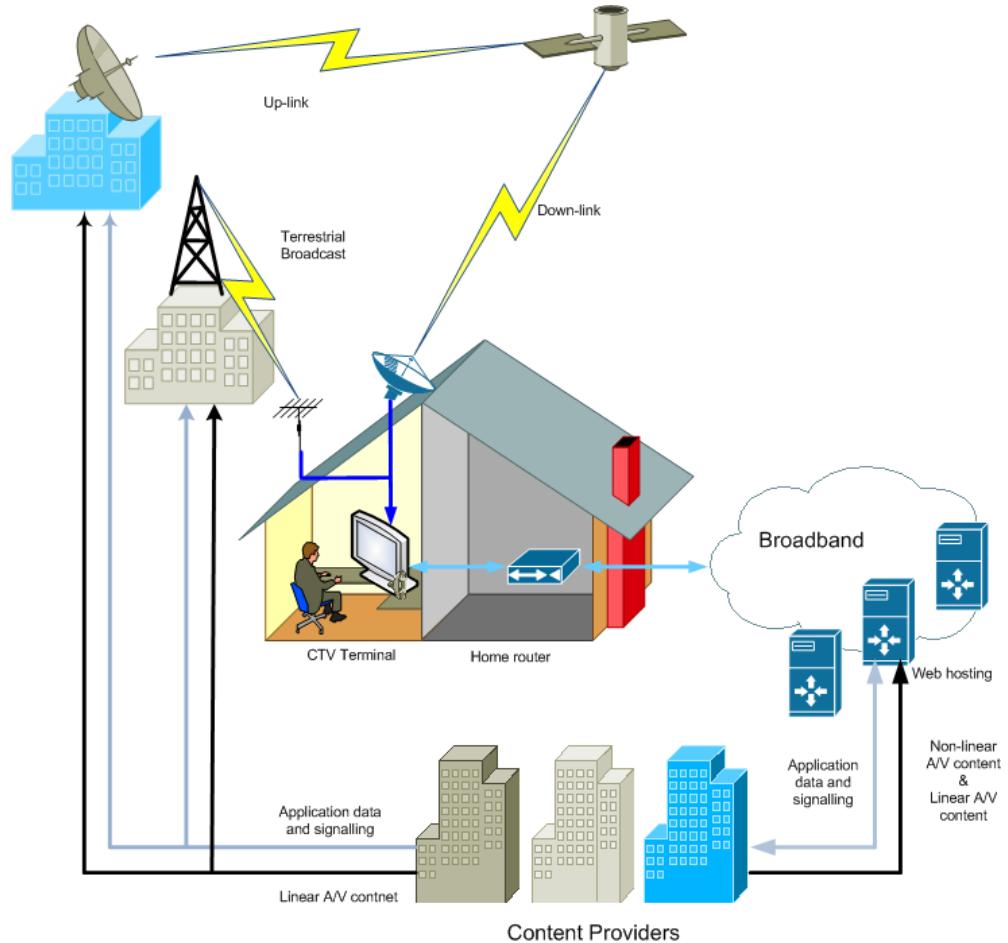
A Trade Mark Licence (TML) or a manufacturer's device specification will probably define the precise requirements and details for a given deployment.

### B.I.3.2 Functional Components of the CTV System

The Terminal has the capability to be connected to two networks in parallel. On the one side it may be connected to a traditional DVB broadcast network (DVB-C, DVB-S, DVB-T)

and on the other it can be connected to the Internet via a broadband interface, as shown in [Figure B.I- 3](#) below:

**Figure B.I- 3 Functional Components of a CTV system**

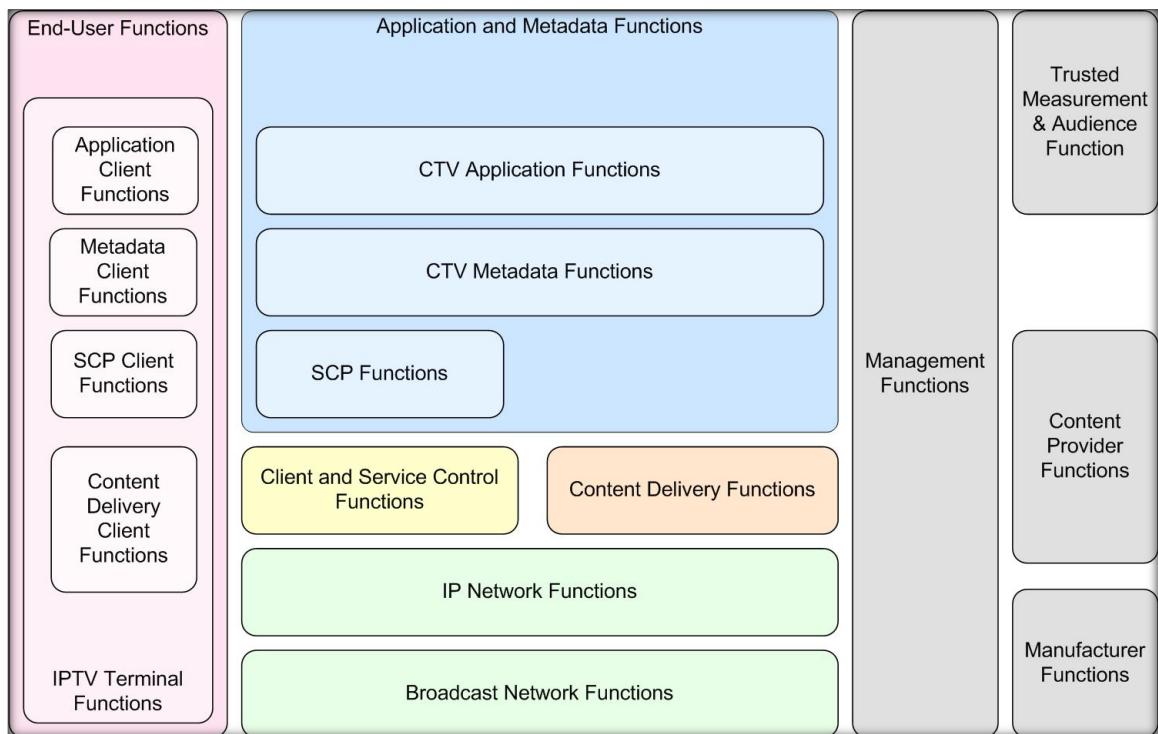


The traditional broadcast connection receives linear A/V content from DVB compliant sources, as well as interactive (e.g. MHEG) applications, EPG (DVB-SI / TVA) data, and other traditional broadcast services as defined in Part A of this specification.

The main uses of the broadband connection are the following:

- Download content (non-real time)
- VoD (Video on Demand): including progressive download and trick mode operations.
- IP linear delivery of content from sources managed by applications. (See also IC channel section, [\[1\]](#) Chapter 11)
- Applications Data
- Audience measurement Data

In order to realise these services the end-to-end hybrid CTV system requires the high level functional components as shown in [Figure B.I- 4](#) below. These functional components are based on the ITU model [\[2\]](#), which are fully expanded in [Connected TV Domains](#).

**Figure B.I- 4 CTV System Functional Components**

At the highest level these functional components correspond to the following chapters of this specification, as shown in [Table B.I- 1](#) below:

**Table B.I- 1 Mapping of System Components to D-Book Chapters**

Functional Component	D Book Chapter
Broadcast Network Functions	D-Book Part A [I]
IP Network Functions	<a href="#">B.2 Connected TV IP Delivery (inc Codecs)</a>
Content Delivery Client Functions	<a href="#">B.2 Connected TV IP Delivery (inc Codecs)</a>
Client & Service Control Functions	Not referenced from this specification
Content Delivery Functions	<a href="#">B.2 Connected TV IP Delivery (inc Codecs)</a>
CTV Metadata Functions	<a href="#">B.3 Connected TV Metadata</a>
Metadata Client Functions	<a href="#">B.3 Connected TV Metadata</a>
CTV Application Functions	<a href="#">B.4 Connected TV Presentation</a>
Application Client Functions	<a href="#">B.4 Connected TV Presentation</a>
SCP functions	<a href="#">B.5 Connected TV Security</a>
SCP Client Functions	<a href="#">B.5 Connected TV Security</a>
Trusted Measurement & Audience Function	<a href="#">B.6 Connected TV Audience Measurement</a>

### B.I.3.3 Related Specifications

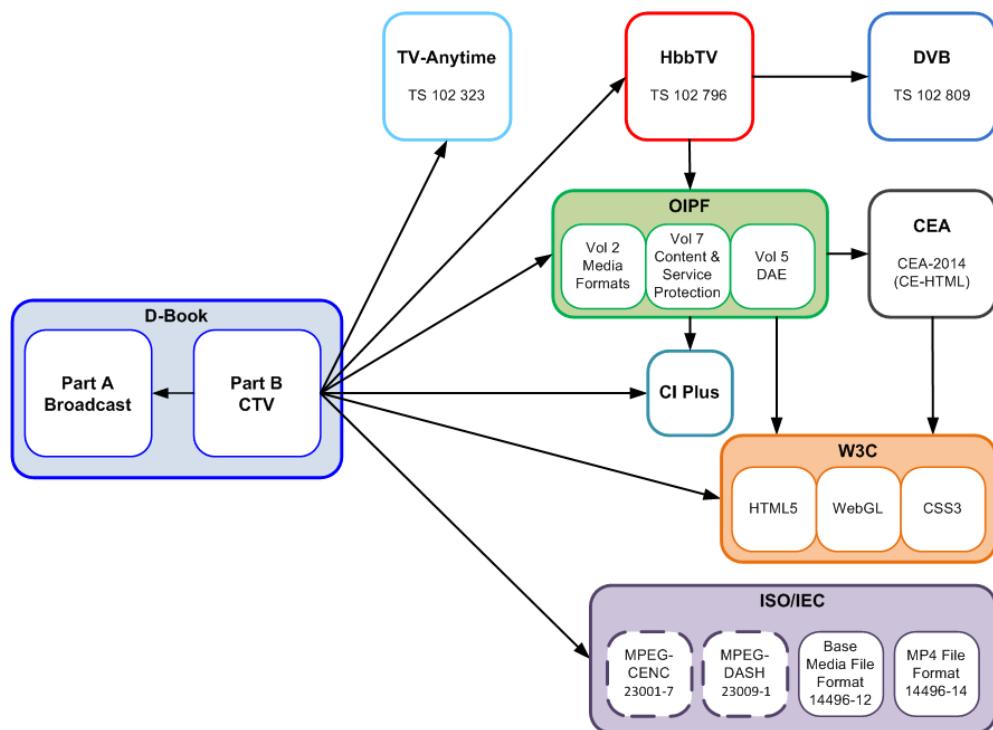
Wherever possible this specification references other, freely available and complete specifications that address the functional components depicted above. Four different categories of reference are made in this specification:

- This specification references an external specification in its entirety.
- This specification references specific parts of an external specification.
- This specification selects a profile from an external specification, where such an option exists.
- This specification extends an external specification in order to meet the requirements of the CTV platform.

In general, external specifications are only profiled and/or extended where absolutely necessary.

[Figure B.I - 5](#) below indicates the most significant specifications that are referenced by the CTV system. This diagram does not indicate the degree to which these specifications are referenced; this is covered in detail in the remaining chapters of this specification. The primary purpose of this figure is to assist an implementer of this specification in gathering together the most important external specifications; it is not an exhaustive representation. The meaning of the direction of the arrow is such that the 'start point' specification makes a significant reference to the 'end point' specification, but not necessarily to the whole specification. The specifications indicated by dotted lines are under consideration for the next version of the specification, for example, to take account of adaptive streaming ([B.2 Connected TV IP Delivery](#) ).

**Figure B.I - 5 External Specification Overview**



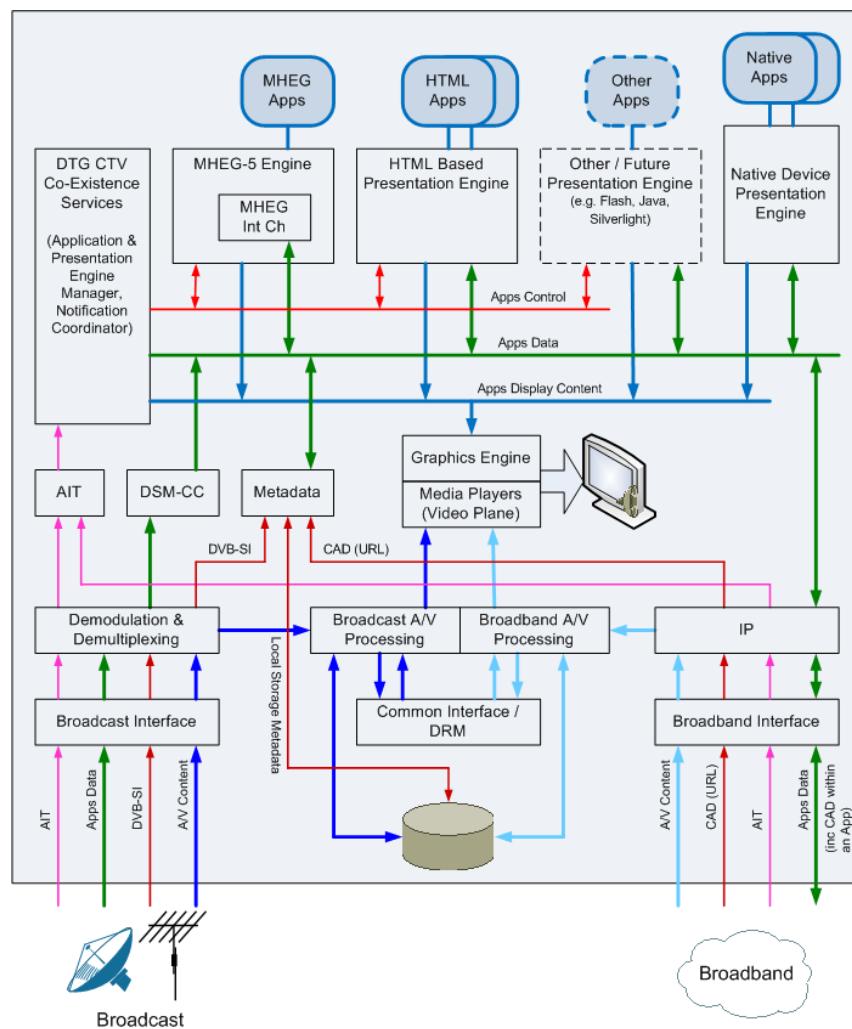
### B.I.3.4 Functional Components of the Terminal

Figure B.I- 6 below depicts an overview of the relevant functional components of the Terminal where individual components are described in more detail in the following chapters.

The traditional broadcast connection on the bottom, left-hand side of Figure B.I- 6 depicts the traditional DVB MPTS broadcast path described in detail in Part A of this specification. In the DTG context this includes DTT linear broadcast content both in standard and high definition, stereo audio, surround sound and possibly 3D in the near future. DSM-CC object carousels are used to transport MHEG-5 applications including both application data and stream events. DVB-SI metadata is provided to populate an EPG and an AIT can be used to signal and manage the lifecycle of interactive applications. Content can either be displayed or stored according to a device's capabilities.

The bottom, right-hand side of Figure B.I- 6 depicts the equivalent functionality in the broadband connection over an IP connection. This bi-directional channel allows specific content and applications to be requested and delivered in a non-linear manner. A/V content via broadband can be streamed or downloaded (including non real-time delivery), irrespective of whether such content is "live" or "on-demand". The abstract "Broadband Interface" and "IP" functions provide all the functionality necessary to provide the Terminal with the raw content or data coming from the Internet.

**Figure B.I- 6 Functional Components of a CTV Terminal**



The top portion of [Figure B.I- 6](#) depicts the CTV application runtime environment. This specification defines an interactive co-existence model such that multiple applications, possibly using different Presentation Engines, can co-exist within the Terminal simultaneously if required. Such applications can be “passive”, “active” or “inactive” as well as being either “hidden” or “displayed”. These terms, along with further capabilities of the co-existence model, are fully defined in [B.4 Connected TV Presentation](#) of this specification. This specification does not determine which, nor how many different Presentation Engines will be present in any specific implementation, it simply provides the framework in which co-operating and compliant engines can exist together.

It should be noted that Part A [\[I\]](#) of this specification defines an Interaction Channel capability associated with the MHEG-5 Presentation Engine. At an abstract level this can be deemed to be the functional equivalent of the return path capabilities of other Presentation Engines.

The central area of [Figure B.I- 6](#) depicts the rendering capabilities of the Terminal. At the highest abstract level, the display rendering capabilities are considered to comprise at least one video plane and one graphics plane, although in real deployments more will almost certainly exist, whereby application graphics are overlaid or displayed alongside the raw A/V content. Also shown are interfaces to a Common Interface function, which may or may not be enabled for both broadcast and broadband content. For devices that have storage the content can also be stored and replayed along with appropriate metadata. The metadata handling functions in the centre of [Figure B.I- 6](#) is capable of managing metadata from both broadcast (DVB-SI) and broadband (CAD) sources.

### B.I.3.5 Relationship between the D-Book Part B, platform specifications and trademark licences

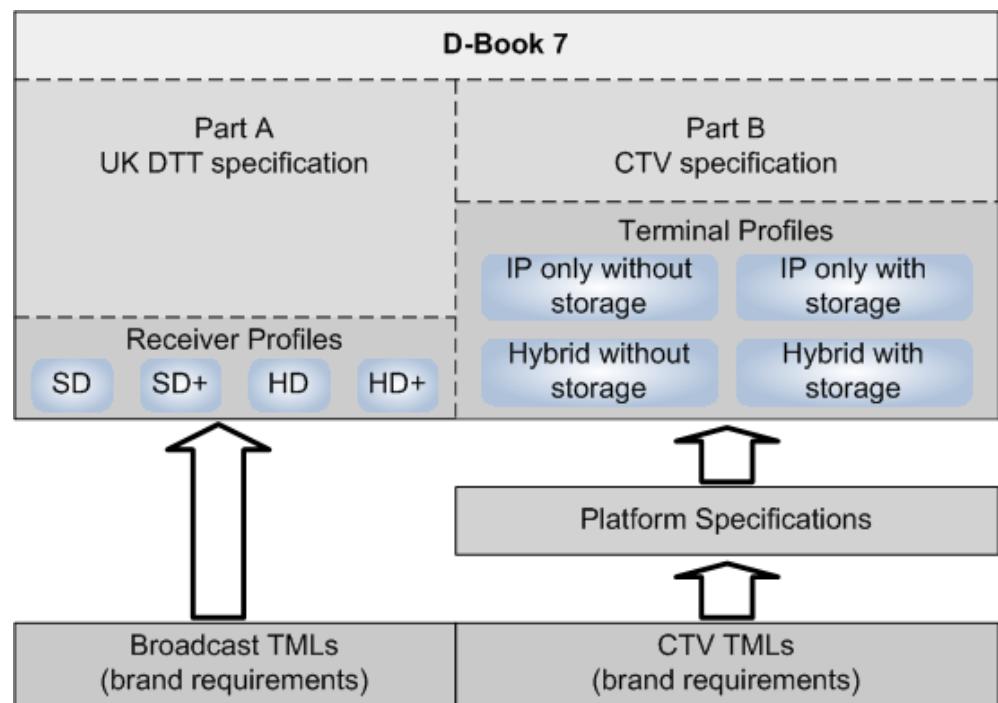
[Figure B.I- 7](#) below shows the how the D-Book is structured and proposed to be used in combination with Platform Specifications and Trademark Licences to build a complete system.

D-Book Part A specifies the interfaces that a broadcast receiver must implement and defines a number of receiver profiles. These profiles are directly referenced by broadcast trademark licences (TMLs) which typically include no, or very few additional technical requirements.

D-Book 7 Part B contains technical specifications covering the delivery of content and services via IP. The specification can be used as a common core of technical functions used by many platforms. It will be supplemented by the specifications of individual platforms, which will select the appropriate sections of the D-Book Part B, and will add additional functionality as required.

For example, a platform operator might select the HTML browser, audio and video codecs, encapsulation, and content delivery and metadata functions from the D-Book Part B. The operator’s platform specification specifies those items that are not included in or selected from the D-Book Part B.

Having a core of technical functions common to many platforms brings a number of advantages. Greater economies of scale can be achieved, in the supply of other receivers and services which will require less adaptation to individual platforms.

**Figure B.I- 7 Relationship between the D-Book, platform specifications and trademark licences**

## B.2 Connected TV IP Delivery

### B.2.1 Introduction

This chapter specifies the network elements required of a Terminal for compliant operation.

### B.2.2 Scope

This chapter defines the IP Networking components required for the Terminal to operate. In CTV the 'IP Network' is considered to be those elements from the point of service origin to the Terminal device. The 'IP Network' does not include further retransmission beyond the CTV device (e.g. within the home network).

### B.2.3 References

- [1] Digital Terrestrial Television – Requirements for Interoperability (D-Book 7 Part A) – Digital TV Group (2011-03)
- [3] IPv6 Node Requirements RFC 4294-bis - IETF December 2010
  - <http://tools.ietf.org/html/draft-ietf-6man-node-req-bis-07>
- [4] Privacy Extensions for Stateless Address Autoconfiguration in IPv6
  - IETF September 2007 - <http://tools.ietf.org/html/rfc4941>
- [5] Hypertext Transfer Protocol - HTTP/1.1 - IETF June 1999 –  
<http://www.ietf.org/rfc/rfc2616.txt>
- [6] ISO/IEC 14496-12 Coding of audio-visual objects Part 12: ISO base media file format – with:
  - Corrigendum 1:2008-12-01
  - Corrigendum 2:2009-05-01
  - Amendment 1:2009-11-15
  - Amendment 3:2011-01-28/DAM (Note 1)
- [7] ISO/IEC 14496-14:2003 Coding of audio-visual objects – Part 14: MP4 file format – 2003
- [11] [DASH] ISO-IEC 23009-1:2011 – Dynamic adaptive streaming over HTTP (DASH).

### B.2.4 IP Network

#### B.2.4.1 Physical Interface configuration

Terminals shall support at least one interface that is capable of meeting the requirements contained elsewhere in this specification.

#### B.2.4.2 IPv4 configuration

Terminals shall support both automatic configuration of network interfaces using DHCP and manual configuration. The default shall be to use DHCP. The following parameters shall be configurable:

- IP address
- Subnet mask
- Default gateway
- DNS server address(es)

### B.2.4.3 IPv6

IPv6-capable devices shall support the requirements of the IPv6 Node Requirements contained in the IETF draft update to RFC4294, known as RFC4294bis [3], with the exception of IPsec which is not required. Devices shall support Neighbour discovery, Path MTU Discovery, Stub-resolver and DHCPv6. DHCPv6 configuration shall be attempted to obtain DNS server addresses. If this is unsuccessful, IPv4 DNS server addresses shall be used (see Section [B.2.4.2 IPv4 configuration](#)).

Devices are strongly recommended to support the Privacy Extensions for Stateless Address Autoconfiguration defined in [4]. Any device not supporting these extensions would reveal a device-unique identifier in all IPv6 packets.

To operate effectively in a dual-stack IPv4/IPv6 environment, devices should implement a mechanism to try both IPv4 and IPv6 addresses when connecting to remote servers. It is recommended that the device maintains information about known successful paths to reduce connection delay and to reduce the number of attempted connections that are not subsequently used.

### B.2.4.4 Multicast

Multicast is the subject of future work and the necessary protocols may be added in a future revision of this specification. Although this specification is currently silent on the subject of multicast, the inclusion of multicast as an additional capability in any CTV device is not precluded.

### B.2.4.5 Performance

Terminals shall support realtime IP streaming A/V content bitrates of at least 10 Mbps. Additional capacity in the TCP stack will also be required for applications, data, metadata, graphics etc.

TLS implementations are required to support content at bitrates of at least 2.5 Mbps (for AES-128 encryption) or 4 Mbps (for RC4 encryption). It is expected that on many devices, software-only implementations will be able to meet this requirement.

### B.2.4.6 HTTP profile

#### B.2.4.6.1 Proxy Support

Terminals should support the use of an HTTP proxy for all HTTP requests. A Terminal which supports proxies shall use the same proxy for TLS traffic, using the HTTP CONNECT method.

#### B.2.4.6.2 Cookie Support

There is no requirement to share cookies or HTTP authentication credentials between different Presentation Engines or between Presentation Engines and other system components that use HTTP, for example media players and DRM engines.

#### B.2.4.6.3 Back-off mechanism for HTTP requests

This section specifies a standard back-off algorithm which shall be used when retrying HTTP requests that have failed. The algorithm shall be used in all cases where HTTP requests need to be retried unless otherwise stated.

If an HTTP 4xx, 501, 502 or 505 error response is received; devices shall not retry the request and shall deem it to have failed.

If an HTTP 500 or 504 error response is received, or the device is unable to establish a connection to the server, the device shall wait for a random period in milliseconds between 0 and the value given by  $4^{CurrentRetry} \times 100$  and then retry the request,

where currentRetry has the value 1 after the first failure and increments for each failed retry.

This algorithm waits up to 400 ms before the first retry, up to 1600 ms before the second, and so on.

If an HTTP 503 error response is received and a Retry-After header is present, the device shall wait for the specified period before retrying. If no Retry-After header is present, the device shall proceed as defined for a 500 response above.

The maximum number of retries or the maximum total time during which to attempt retries varies depending on the type of request. Unless otherwise stated, background requests shall be retried for up to one hour; foreground requests shall be retried for up to 30 seconds.

### B.2.4.7 Time

Terminals shall implement a mechanism of automatically obtaining UTC time.

By default terminals shall set their clock according to the time information present in the broadcast stream. This will give the best guarantee that the time information available to the Terminal is consistent with the broadcast schedule data. The Terminal shall obtain a new time value, from a source other than the broadcast stream, in the following circumstances:

- It has not been able to obtain any time information from the broadcast stream at all. This may be the case if the Terminal does not have a hardware real time clock and no broadcast signal is currently available.
- It has a time setting obtained from the broadcast stream which is more than 7 days old.
- It has a time setting obtained from the broadcast stream but the elapsed time and the accuracy of the Terminal's real time clock is such that the time error is expected to have exceeded 10 seconds.
- The complete system shall maintain the accuracy of time to within 10 seconds of UTC at all times. Content protection systems may have requirements for clocks with specific characteristics. Such clocks are out of scope of this document

## B.2.5 IP delivery of A/V media

### B.2.5.1 Common requirements for streaming (informative)

This section defines a set of notional APIs that show how the IP A/V capabilities are exposed to higher level presentation environments. Not all functions are applicable to all types of IP-delivered content. [Table B.2- 1](#) shows which are relevant to each type of IP content delivery described in this specification.

[Table B.2- 1](#) does not include presentation controls such as volume adjustment or video window positioning.

**Table B.2- I Common Requirements for streaming**

<b>Operation / event</b>	<b>Function</b>	<b>Function required for...</b>			
		<b>D-Book 7 Part A [1]</b>	<b>VOD HTTP progressive</b>	<b>VOD HTTP adaptive</b>	<b>Live streaming</b>
<b>setSource</b> (see CEA 2014 A/V Control object: 'data' attribute [12] [CEA-2014-A], 'setSource()' method [OIPF v1.1 vol5 7.14.7])	Specify media locator. Note: this may reference a 'manifest' rather than the media directly, especially where there is more than one media stream involved.	Y	Y	Y	Y
<b>getControlCapabilities</b> (see CEA 2014 A/V Control object: 'play()' method [12] [CEA-2014-A], 'stop()' method [12] [CEA-2014-A], 'seek()' method [12] [CEA-2014-A])	Find out which operations can be performed on the current stream (returns information about pause, ffwd, rewind, seek capability). This will vary between different terminals, different protocols and different streams.		Y	Y	Y
<b>startBuffering</b> (This API does not exist in OIPF - see state diagram [13] [OIPF 1.1 vol5 7.14.1.1].)	Initiate buffering of stream but do not commence presentation	Y	Y	Y	Y? (if delivery mechanism uses significant buffering)
<b>stopBuffering</b> (This API does not exist in OIPF)	Suspend buffering of content but do not affect playback.	Y	Y	Y	Y
<b>getStreamMetrics</b> (This API not in OIPF 1.1 [13], added in OIPF 2.0 [14] but not yet profiled in this specification.)	Return information including the period of time buffered, the incoming data rate (detail TBD), the current sub-stream (in an adaptive bit rate delivery system), buffer occupancy, error rate (where known)		Y	Y	Y
<b>setBufferMode</b> (A similar API exists in OIPF 1.1 but not included in HbbTV. Not profiled in this specification.)	Allow apps to influence buffering strategy		Y	Y	
<b>start</b> (see CEA 2014 A/V Control object: 'play()' method [12] [CEA-2014-A].)	Start playback	Y	Y	Y	Y
<b>stop</b> (see CEA 2014 A/V Control object: 'stop()' method [12] [CEA-2014-A].)	Stop playback	Y	Y	Y	Y
<b>getPosition</b>	Get the current time offset into the stream		Y	Y	Y

<b>Operation / event</b>	<b>Function</b>	<b>Function required for...</b>			
		<b>D-Book 7 Part A [1]</b>	<b>VOD HTTP progressive</b>	<b>VOD HTTP adaptive</b>	<b>Live streaming</b>
seekPosition (see CEA 2014 A/V Control object: 'seek()' method [12] [CEA-2014-A])	Seek to a specified time offset within the stream	No	Y	Y	Y <sup>1</sup>
addPositionCallback (This API does not exist in OIPF)	Request an event at a specified offset within the stream	No	Y	Y	N
getSpeed (see CEA 2014 A/V Control object: 'playSpeeds[]' property [13] OIPF v1.1 vol5 7.14.3)	Find out the current play speed		Y	Y	Y
setSpeed	Set the current play speed		Y	Y	Y <sup>2</sup>
setVideoTerminationMode	Freeze at last frame or go to black or loop.	Y	Y	Y	Y
getTracks (see [12] CEA 2014 A/V Control object: 'getComponents()' method [13] OIPF v1.1 vol5 7.14.4)	Return information about the constituent media components within the stream (or stream set)	Y	Y	Y	Y
setTrack (see CEA 2014 A/V Control object: 'selectComponent()' and 'unselectComponent()' methods [13] OIPF v1.1 vol5 7.14.4 )	Select components from within the stream (or stream set)	Y	Y	Y	Y
event: buffer status (See state diagram [13] OIPF 1.1 vol5 7.14.1.1)	Report significant buffering events (started, underrun, buffering complete, adaptive stream change, failure etc.)	Limited	Y	Y	
event: playback error	Report playback errors (network error, stream format error etc.)	Limited	Y	Y	Y
event: position	Event generated at requested position	No <sup>3</sup>	Y	Y	
event: content-driven in-stream event	Event generated by signalling included in the content stream		?	?	Y

The playback subsystem for IP-delivered video shall support the following features:

- The ability to queue the next item to be played so that it can be pre-buffered
- Clean transitions between playback of one media asset and the next with a minimum of hesitation at the boundary.

## B.2.5.2 HTTP streaming

Terminals shall support HTTP progressive streaming using the HTTP GET method.

## B.2.5.3 HTTP Adaptive Bitrate Streaming

### B.2.5.3.1 Overview

Terminals shall support adaptive bitrate streaming of A/V media according to [11] [DASH].

Note: At the time of writing, MPEG DASH is a Draft International Standard. Implementers of the adaptive bitrate streaming functions specified in the D-Book are advised to check for any corrigenda that may apply to this section.

Adaptive bitrate streaming involves the Terminal first downloading a ‘manifest’ file called the Media Presentation Description (MPD) and then using it to locate one or more segmented media streams, known as Representations.

HTTP adaptive bitrate streaming is invoked when a reference is made to media content that has the defined MIME type for an MPD.

Terminals shall support the DASH profiles defined in sections B.2.5.3.3 and B.2.5.3.4. Section B.2.5.3.5 defines additional requirements for terminals.

This specification does not cover:

- algorithms by which a Terminal may select between Representations
- means for applications to control adaptive Representation switching
- means of supporting ‘trick play’

### B.2.5.3.2 Media Presentation Description (MPD)

Terminals shall support the Media Presentation Description (MPD) format and corresponding XML schema specified in [11][DASH].

Terminals shall be able to parse *all* MPDs which are valid according to the specified schema but may ignore any parts of an MPD that are permitted to be ignored according to the profile in use.

A process for modifying an MPD into a profile-specific MPD, removing elements and attributes that do not fall within a particular profile is defined in section 8 of [11] [DASH].

If terminals are presented with an MPD that, after such modification, is found not to conform to a profile supported by the Terminal, behaviour is undefined.

Content providers should validate MPDs against the schema and verify that they signal the correct profiles and conform to those as defined in section 8 of [11] [DASH].

Terminals are not required to support XML encryption or XML signatures for MPDs.

Terminals shall support the retrieval of MPDs using both HTTP and HTTP over TLS.

Terminals shall support at least 8 Representations per AdaptationSet.

Note: A size limit for an MPD may be defined in a future revision of this specification.

#### B.2.5.3.2.1 MIME Type

As defined in [11] [DASH], the MIME type defined for an MPD is:

application/dash+xml

Content providers shall use this MIME type when providing MPDs to Terminals.

### B.2.5.3.3 MPEG-2 Transport Stream Profile

Terminals shall support the "MPEG-2 TS simple profile" defined in [11] [DASH].

Content providers making use of this profile shall ensure that content is provided as constrained by that profile, and also ensure that the MPD is marked with the profile identifier "urn:mpeg:dash:profile:mp2t-simple:2011".

Terminals shall support segments that, when assembled, form a transport stream conformant with the requirements of section B.2.6.2.

Terminals may ignore Index Segments.

Terminals shall ignore discontinuities in the value of the continuity\_counter field of the MPEG-2 TS packet header that occur at the start of a Segment.

#### B.2.5.3.3.1 Profile overview (informative)

This profile has the following properties:

- Initialisation Segments, Media Segments and Bitstream Switching Segments can be used and contain portions of an MPEG-2 transport stream.
- On-demand and live content are supported.
- All Representations are pre-multiplexed, i.e. they contain all media components and there is no support for 'late-binding'.

Note: this is enforced by the profile constraint that "Representations not in group 0 may be ignored".

- Where an AdaptationSet contains more than one Representation, @bitstreamSwitching must be true for that AdaptationSet and as a consequence:
- @segmentAlignment should be true ([11] [DASH] section 7.4.3.4).
- @startWithSAP is constrained to be 1, 2, or if certain conditions are met, 3 ([11] [DASH] section 7.4.3.4).
- PIDs for media components must be the same across all Representations in an AdaptationSet ([11][DASH] sections 8.7.3, 5.5.3.2 and 4.5.3).
- Media Segments may contain only complete PES packets and complete Access Units ([11] [DASH] section 7.4.3.2).
- The first PES packet in a Media Segment must contain a PTS value ([11] [DASH] section 7.4.3.2).

Note

There may be more than one AdaptationSet for this profile with @group=0. The choice between AdaptationSet is implementation dependent in this case.

### B.2.5.3.4 CTV Container File Format Profile

Terminals shall support the "ISO Base media file format live profile" defined in [11] [DASH].

Content providers making use of this profile shall ensure that content is provided as constrained by that profile, and also ensure that the MPD is marked with the profile identifier "urn:mpeg:dash:profile:isoff-live:2011".

#### B.2.5.3.4.1 Profile overview (informative)

This profile has the following properties:

- Representations must include an Initialisation Segment and one or more Media Segments.
- On-demand and live content are supported.

### B.2.5.3.5 Terminal requirements

#### B.2.5.3.5.1 Codecs

Terminals shall support media delivered using HTTP adaptive streaming for the codecs defined in section [B.2.7](#).

#### B.2.5.3.5.2 Representation switching

Terminals shall support seamless presentation of media in which the following characteristics change between segments:

- Video resolution, within the resolutions required in section [B.2.7](#).
- Sample aspect ratio, providing this change corresponds to a change in video resolution and results in the picture aspect ratio remaining the same.
- Frame rate, within the rates required in section [B.2.7](#).
- Video bitrate
- Interlaced or non-interlaced video.
- Audio bitrate
- Audio codec features (but not codec), for example use of SBR in HE-AAC.

Terminals are not required to support seamless presentation of media if any of the following characteristics change between segments:

- Video codec
- Audio codec
- Codec profile and level
- Number of audio channels

Terminals shall, however, tolerate changes to the above characteristics between Periods. In this case, the presentation is not required to be seamless.

Note: Further work is needed to precisely define 'seamless' as it applies to specific types of change. In addition, short term concessions may need to be considered for hardware that cannot meet all of these requirements. Video frame rate and scan format changes have been identified as particularly challenging in some cases.

Content providers are advised to include detailed format information in the attributes of Representations. Where such information is present, a Terminal should not make transitions between Representations that would cause noticeable disruption to the presentation of the media at the switch point unless the transition is necessary to prevent interruption to the media presentation due to lack of data.

#### B.2.5.3.5.3 Retrieval of Segments

Terminals shall support the use of the HTTP GET method for accessing Segments.

Range requests shall be supported as defined in [\[11\]](#) [DASH]. Where byte ranges are used to identify the location of a segment, and the baseURL being used by the client contains the byteRange attribute, the client may use the alternative method for retrieval specified in [\[11\]](#) [DASH] Annex E without first attempting to make an HTTP partial GET request and responding to the failure.

#### B.2.5.3.6 MPD Examples (Informative)

This section provides some example MPDs to illustrate how the system might be used.

**B.2.5.3.6.1 MPEG-2 TS on demand example**

Below is an MPD for a 7 representation stream using MPEG-2 TS as the container format.

All the streams share the Initialisation Segment at:

- <http://www.example.com/dash/test1media/init.ts>

Example Media Segment URLs are:

- <http://www.example.com/dash/test1media/A/0>
- <http://www.example.com/dash/test1media/A/1>
- <http://www.example.com/dash/test1media/G/2>

```
<?xml version="1.0" encoding="UTF-8"?>
<MPD xmlns="urn:mpeg:DASH:schema:MPD:2011" xmlns:xlink="http://www.w3.org/1999/xlink"
profiles="urn:mpeg:profile:dash:m2ts-simple:2011"
type="static"
minBufferTime="PT2S"
mediaPresentationDuration="PT58M20S">
<BaseURL>http://www.example.com/dash/test1media/</BaseURL>
<Period>
  <AdaptationSet
    mimeType="video/mp2t"
    codecs="avc1,mp4a"
    bitstreamSwitching="true"
    segmentAlignment="true"
    startWithSAP="1"
    group="0">
    <!-- Optional component information -->
    <ContentComponent contentType="video" id="50"/>
    <ContentComponent contentType="audio" lang="en" id="51"/>
    <!-- Video and English audio on PIDs 50 and 51 respectively -->

    <SegmentTemplate
      duration="4"
      timescale="1"
      media="$RepresentationID$/Number$"
      initialisation="init.ts"/>
    <Representation bandwidth="500000" id="A" frameRate="25" scanType="progressive"
      width="352" height="288" sar="16:11"/>
    <Representation bandwidth="1000000" id="B" frameRate="25" scanType="interlaced"
      width="544" height="576" sar="64:33"/>
    <Representation bandwidth="1500000" id="C" frameRate="25" scanType="interlaced"
      width="704" height="576" sar="16:11"/>
    <Representation bandwidth="2000000" id="D" frameRate="25" scanType="interlaced"
      width="704" height="576" sar="16:11"/>
    <Representation bandwidth="2500000" id="E" frameRate="50" scanType="progressive"
      width="1280" height="720" sar="1:1"/>
    <Representation bandwidth="4000000" id="F" frameRate="25" scanType="interlaced"
      width="1440" height="1080" sar="4:3"/>
    <Representation bandwidth="5000000" id="G" frameRate="25" scanType="interlaced"
      width="1920" height="1080" sar="1:1"/>
  </AdaptationSet>
</Period>
</MPD>
```

### B.2.5.3.6.2 MPEG-2 TS live examples

There are two examples here. The first one is the initial MPD, which is present on the server from the time when the programme is first advertised until at least 30 minutes after the start of the programme. Note that the SegmentTemplate element uses a format string in the media attribute, and there are two baseURL elements inside the MPD element offering redundant options to the client. Example Media Segment URLs are:

- <http://cdn1.example.com/dash/live/A/000000>
- <http://www.example.com/dash/live/A/000000>
- <http://cdn1.example.com/dash/live/A/000001>
- <http://www.example.com/dash/live/D/000001>
- <http://cdn1.example.com/dash/live/B/000002>

```
<?xml version="1.0" encoding="UTF-8"?>
<MPD xmlns="urn:mpeg:DASH:schema:MPD:2011" xmlns:xlink="http://www.w3.org/1999/xlink"
      profiles="urn:mpeg:profile:dash:m2ts-simple:2011"
      type="dynamic"
      minBufferTime="PT2S"
      mediaPresentationDuration="PT60M"
      minimumUpdatePeriod="PT10M"
      availabilityStartTime="2011-09-06T16:00:00Z"
      timeShiftBufferDepth="PT20M">
  <BaseURL>http://cdn1.example.com/dash/live/</BaseURL>
  <BaseURL>http://www.example.com/dash/live/</BaseURL>
  <Period>
    <AdaptationSet
      mimeType="video/mp2t"
      codecs="avc1,mp4a"
      bitstreamSwitching="true"
      segmentAlignment="true"
      startWithSAP="1"
      group="0">
      <SegmentTemplate
        duration="4"
        timescale="1"
        media="$RepresentationID$/$Number%06d$"
        initialisation="init.ts"
        startNumber="0"/>
      <!-- Note use of %06d formatting option to use leading zeros in segment numbers -->
      <Representation bandwidth="500000" id="A" frameRate="25" scanType="progressive"
                     width="352" height="288" sar="16:11"/>
      <Representation bandwidth="1000000" id="B" frameRate="25" scanType="interlaced"
                     width="544" height="576" sar="64:33"/>
      <Representation bandwidth="1500000" id="C" frameRate="25" scanType="interlaced"
                     width="704" height="576" sar="16:11"/>
      <Representation bandwidth="2000000" id="D" frameRate="25" scanType="interlaced"
                     width="704" height="576" sar="16:11"/>
      <Representation bandwidth="2500000" id="E" frameRate="50" scanType="progressive"
                     width="1280" height="720" sar="1:1"/>
      <Representation bandwidth="4000000" id="F" frameRate="25" scanType="interlaced"
                     width="1440" height="1080" sar="4:3"/>
      <Representation bandwidth="5000000" id="G" frameRate="25" scanType="interlaced"
                     width="1920" height="1080" sar="1:1"/>
    </AdaptationSet>
  </Period>
</MPD>
```

After 30 minutes a new MPD is made available, which only mentions segments which are still available. The first Media Segment listed here for representation B could be obtained from this URL:

- <http://cdn1.example.com/dash/live/B/000300>

```

<?xml version="1.0" encoding="UTF-8"?>
<MPD xmlns="urn:mpeg:DASH:schema:MPD:2011" xmlns:xlink="http://www.w3.org/1999/xlink"
profiles="urn:mpeg:profile:dash:m2ts-simple:2011"
type="dynamic"
minBufferTime="PT2S"
mediaPresentationDuration="PT60M"
minimumUpdatePeriod="PT10M"
availabilityStartTime="2011-09-06T16:20:00Z"
timeShiftBufferDepth="PT20M">
<BaseURL>http://cdn1.example.com/dash/live/</BaseURL>
<BaseURL>http://www.example.com/dash/live/</BaseURL>
<Period>
    <AdaptationSet
        mimeType="video/mp2t"
        codecs="avc1,mp4a"
        bitstreamSwitching="true"
        segmentAlignment="true"
        startWithSAP="1"
        group="0">
        <SegmentTemplate
            duration="4"
            timescale="1"
            media="$RepresentationID$/Number%06d$"
            initialisation="init.ts"
            startNumber="300"/>
        <!-- Note use of %06d formatting option to use leading zeros in segment numbers -->
        <Representation bandwidth="500000" id="A" frameRate="25" scanType="progressive"
            width="352" height="288" sar="16:11"/>
        <Representation bandwidth="1000000" id="B" frameRate="25" scanType="interlaced"
            width="544" height="576" sar="64:33"/>
        <Representation bandwidth="1500000" id="C" frameRate="25" scanType="interlaced"
            width="704" height="576" sar="16:11"/>
        <Representation bandwidth="2000000" id="D" frameRate="25" scanType="interlaced"
            width="704" height="576" sar="16:11"/>
        <Representation bandwidth="2500000" id="E" frameRate="50" scanType="progressive"
            width="1280" height="720" sar="1:1"/>
        <Representation bandwidth="4000000" id="F" frameRate="25" scanType="interlaced"
            width="1440" height="1080" sar="4:3"/>
        <Representation bandwidth="5000000" id="G" frameRate="25" scanType="interlaced"
            width="1920" height="1080" sar="1:1"/>
    </AdaptationSet>
</Period>
</MPD>

```

### B.2.5.3.6.3 MP4 multiplexed components on demand example

This is an example of an on demand programme using content containing pre-multiplexed components stored within a CTVFF container. The Initialisation Segment would be obtained from here:

- <http://www.example.com/dash/test2media/A.mp4>
- <http://www.example.com/dash/test2media/B.mp4>
- <http://www.example.com/dash/test2media/C.mp4>
- etc

Example Media Segment URLs would be:

- <http://www.example.com/dash/test3media/A/0>
- <http://www.example.com/dash/test3media/B/1>
- <http://www.example.com/dash/test3media/D/2>
- <http://www.example.com/dash/test3media/D/3>

```

<?xml version="1.0" encoding="UTF-8"?>
<MPD xmlns="urn:mpeg:DASH:schema:MPD:2011" xmlns:xlink="http://www.w3.org/1999/xlink"
profiles="urn:mpeg:profile:dash:isoff-live:2011"
type="static"
minBufferTime="PT2S"
mediaPresentationDuration="PT58M20S">
<BaseURL>http://www.example.com/dash/test3media/</BaseURL>
<Period>
    <AdaptationSet
        mimeType="video/mp4"
        codecs="avc1,mp4a"
        bitstreamSwitching="true"
        segmentAlignment="true"
        startWithSAP="2"
        group="0">
        <ContentComponent contentType="video" id="1"/>
        <ContentComponent contentType="audio" lang="en" id="2"/>
        <SegmentTemplate
            duration="4000"
            timescale="1000"
            media="$RepresentationID$/Number$"
            initialisation="$RepresentationID$.mp4"/>
        <Representation bandwidth="500000" id="A" frameRate="25" scanType="progressive"
            width="352" height="288" sar="16:11"/>
        <Representation bandwidth="1000000" id="B" frameRate="25" scanType="interlaced"
            width="544" height="576" sar="64:33"/>
        <Representation bandwidth="1500000" id="C" frameRate="25" scanType="interlaced"
            width="704" height="576" sar="16:11"/>
        <Representation bandwidth="2000000" id="D" frameRate="25" scanType="interlaced"
            width="704" height="576" sar="16:11"/>
        <Representation bandwidth="2500000" id="E" frameRate="50" scanType="progressive"
            width="1280" height="720" sar="1:1"/>
        <Representation bandwidth="4000000" id="F" frameRate="25" scanType="interlaced"
            width="1440" height="1080" sar="4:3"/>
        <Representation bandwidth="5000000" id="G" frameRate="25" scanType="interlaced"
            width="1920" height="1080" sar="1:1"/>
    </AdaptationSet>
</Period>
</MPD>

```

#### B.2.5.3.6.4 CTVFF separate components on demand example

This is an example for an on demand programme where each media component (in this case a video and an audio component) is delivered separately. The Initialisation Segments for the video components would be obtained from these URLs:

- <http://www.example.com/dash/test2media/video/A.mp4>
- <http://www.example.com/dash/test2media/video/B.mp4>
- <http://www.example.com/dash/test2media/video/C.mp4>
- etc

The audio Initialisation Segments would be obtained from these two URLs:

- <http://www.example.com/dash/test2media/audio/A-init.mp4>
- <http://www.example.com/dash/test2media/audio/B-init.mp4>

Example URLs for Media Segments would be:

- <http://www.example.com/dash/test2media/video/A/0>
- <http://www.example.com/dash/test2media/video/A/1>
- <http://www.example.com/dash/test2media/video/B/2>
- <http://www.example.com/dash/test2media/audio/A-0.mp4>
- <http://www.example.com/dash/test2media/audio/B-1.mp4>
- <http://www.example.com/dash/test2media/audio/B-2.mp4>

```
<?xml version="1.0" encoding="UTF-8"?>
<MPD xmlns="urn:mpeg:DASH:schema:MPD:2011" xmlns:xlink="http://www.w3.org/1999/xlink"
profiles="urn:mpeg:profile:dash:isoff-live:2011"
type="static"
minBufferTime="PT2S"
mediaPresentationDuration="PT58M20S">
<BaseURL>http://www.example.com/dash/test2media/</BaseURL>
<Period>
    <AdaptationSet
        mimeType="video/mp4"
        codecs="avc1"
        bitstreamSwitching="true"
        segmentAlignment="true"
        startWithSAP="2"
        group="1">
        <ContentComponent contentType="video" id="1"/>
        <BaseURL>video/</BaseURL>
        <SegmentTemplate
            duration="4000"
            timescale="1000"
            media="$RepresentationID$/Number$"
            initialisation="$RepresentationID$.mp4"/>
        <Representation bandwidth="500000" id="A" frameRate="25" scanType="progressive"
            width="352" height="288" sar="16:11"/>
        <Representation bandwidth="1000000" id="B" frameRate="25" scanType="interlaced"
            width="544" height="576" sar="64:33"/>
        <Representation bandwidth="1500000" id="C" frameRate="25" scanType="interlaced"
            width="704" height="576" sar="16:11"/>
        <Representation bandwidth="2000000" id="D" frameRate="25" scanType="interlaced"
            width="704" height="576" sar="16:11"/>
        <Representation bandwidth="2500000" id="E" frameRate="50" scanType="progressive"
            width="1280" height="720" sar="1:1"/>
        <Representation bandwidth="4000000" id="F" frameRate="25" scanType="interlaced"
            width="1440" height="1080" sar="4:3"/>
        <Representation bandwidth="5000000" id="G" frameRate="25" scanType="interlaced"
            width="1920" height="1080" sar="1:1"/>
    </AdaptationSet>
    <AdaptationSet
        mimeType="audio/mp4"
        codecs="mp4a"
        bitstreamSwitching="true"
        segmentAlignment="true"
        group="2">
        audioSamplingRate="48000">
        <ContentComponent contentType="audio" id="1"/>
        <BaseURL>audio/</BaseURL>
        <Representation bandwidth="96000" id="B">
            <SegmentTemplate initialisation="A-init.mp4" media="A-$Number$.mp4"
                duration="3000" timescale="1000"/>
        </Representation>
        <Representation bandwidth="128000" id="B">
            <SegmentTemplate initialisation="B-init.mp4" media="B-$Number$.mp4"
                duration="3000" timescale="1000"/>
        </Representation>
    </AdaptationSet>
</Period>
</MPD>
```

## B.2.5.4 UDP/RTP delivery

UDP/RTP may be added in a future version of the specification for use in conjunction with IP multicast

## B.2.5.5 HTTP content download

Content download over HTTP shall be performed as an HTTP GET.

The download manager shall support suspending and resuming downloads. If a download is suspended for more than 30 seconds, the Terminal shall close the connection to the server. When resuming a download for which the connection has been closed, the Terminal shall make a new HTTP GET request with a Range header to continue the download from the point it left off.

No more than four concurrent downloads shall be active at once.

In the event of a download failure, devices shall follow the standard back-off algorithm, specified in [Section B.2.4.6.3 Back-off mechanism for HTTP requests](#), using the timeout value for background requests.

## B.2.6 Container Types

### B.2.6.1 Overview

Three container types are specified for IP delivery of content to Terminals. Two of these are based on the ISO Base Media File Format and one is based on the MPEG-2 Transport Stream. The containers and their supported uses are summarised in the following table:

Use	Container type		
	MPEG-2 TS	CTVFF	Simple MP4
Download	Yes	No <sup>4</sup>	Yes
Progressive streaming	Yes	No	Yes <sup>5</sup>
HTTP adaptive bitrate streaming: on demand	Yes	Yes	No
HTTP adaptive bitrate streaming: live	Yes	Yes	No
Encrypted content	Yes	Yes	No

The following sections describe the containers in more detail, along with any additional restrictions that apply when the containers are used with specific delivery mechanisms.

### B.2.6.2 MPEG 2 Transport Stream

MPEG-2 transport stream content shall meet the mandatory requirements of section 4.1 of [[12](#)].

In addition, Terminals may assume that the Program Association Table (PAT) and Program Map Table (PMT) do not change for the duration of the stream.

---

<sup>4</sup> A standalone media file format is not yet defined for this container. It is expected that a later revision of this specification will add support for download.

<sup>5</sup> This format is not recommended for progressive streaming of longer assets due to the start up delay this incurs.

## B.2.6.2.1 HTTP Streaming

No additional constraints apply for HTTP Streaming.

Note: an unencrypted MPEG-2 TS prepared according to [1] section 13.5.4 (MHEG ICS) will be compliant with the requirements for HTTP Streaming of an MPEG-2 transport stream.

## B.2.6.2.2 Adaptive Bitrate Streaming

Where media is encapsulated in an MPEG-2 Transport Stream for delivery using HTTP Adaptive Bitrate Streaming, the additional requirements set out in section B.2.5.3.3 apply.

## B.2.6.2.3 Downloads

No additional constraints apply for downloading.

## B.2.6.2.4 MIME type

When serving content contained in an MPEG-2 TS file, the server SHALL indicate the MIME type to be:

video/MP2T

## B.2.6.3 Connected TV File Format (CTVFF)

The Connected TV File Format (CTVFF) is the name for the profiles of the ISO Base Media File Format specified by the present document. There are two profiles – one specifying the segment format used in HTTP Adaptive Bitrate Streaming and one specifying a standalone file for download.

Adaptive Bitrate Streaming      The profiles for segments for adaptive bitrate delivery are specified in section B.2.5.3.4.

Downloads      Note: A standalone media file format for the CTVFF has yet to be defined. It is expected that a file format for download will be defined in a later revision of this specification.

## B.2.6.4 Simple MP4

Terminals shall support content encapsulated in the ISO Base Media File Format ISO/IEC 14496-12 (2005) [6] and the MP4 file format ISO/IEC 14496 14 [7]. This container format allows numerous internal layouts, however the present document restricts this to ease the implementation of a conformant Terminal.

MP4 files conforming to this specification shall have the major brand 'avc1', indicating MPEG-4 part 10 (H.264) video content. MP4 files shall not be used to contain other video codecs.

Content encapsulated in MP4 files may be used both for download to play later (after the download has completed) and progressive download (where playback commences during the download).

MP4 files contain a number of 'boxes'. Terminals shall correctly play content contained in a file conformant to the mandatory requirements in the table below

**Table B.2- 2 MP4 file profile**

<b>Box type</b>	<b>Name</b>	<b>Usage</b>	<b>Terminal requirements</b>	<b>MP4 file profile</b>
'ftyp'	File Type Box	Indicates file format.		Shall mark MP4 files with 'avcl' as the major brand.
'pdin'	Progressive download information box	Indicates suggested buffering times		May be included
'moov'	Movie box	Contains header information for the media in the file.		SHALL NOT exceed 4MB. MP4 files shall be constructed with the 'moov' box before any media data is present.
'mvhd'	Movie header box			Only version 0 box SHALL be used.
'trak'	Track box	Identifies a track within the file.		
'tkhd'	Track header box			Only version 0 box SHALL be used.
'mdia'	Media box			
'mdhd'	Media header box			Only version 0 box SHALL be used.
'minf'	Media information box			
'hdlr'	Handler reference box			
'vmhd'	Video media header box			
'smhd'	Sound media header box			
'dinf'	Data information box	Specifies the location of the media samples.	MAY be ignored as restrictions in this specification prevent external location of media.	SHALL only contain the 'url' box as specified below.
'url'	Data entry url box	Specifies the location of the media samples using a URL or indicates they are within the current file.	MAY be ignored as restrictions in this specification prevent external location of media.	Flags on this box SHALL be set to 0x01 and the url string empty, indicating the track is within the current file.
'stbl'	Sample table box			
'stts'	Decoding time to sample box			
'ctts'	Composition time to sample box			

Box type	Name	Usage	Terminal requirements	MP4 file profile
'stsd'	Sample description table			
'stsz'	Sample size box			
'stz2'	Sample size box (compact version)			Where possible this box should be used in preference to 'stsz' to save space. This is likely to be the case for audio tracks.
'stsc'	Sample to chunk box			
'stco'	Chunk offset box	Indicates the location of chunks of samples within the file using a byte offset from the beginning of the file.		Note that the co64 box SHALL NOT be used.
'stss'	Sync sample box		Where present the Terminal SHALL use the information from this box to assist in seek operations. However if the box is empty or missing seek SHOULD still be performed, but decoding after the seek may take a number of frames to resume.	
'avcl'	AVC sample entry box			
'avcC'	AVC configuration entry box			
'btrt'	MPEG4 bitrate box			
'avcp'	AVC parameter sample entry box			
'sbgp'	Sample to group box			
'sgpd'	Sample group description box			

Box type	Name	Usage	Terminal requirements	MP4 file profile
'mvex'*	Movie extends box	Indicates that the file contains fragments.		
'mehd'*	Movie extends header box	Gives the total duration of a fragmented file.		This box SHALL be present and indicate the total duration if the mvex box is present in a file. Only version 0 box SHALL be used.
'moof'*	Movie fragment box	Contains header information for a fragment.		SHALL NOT exceed IMB
'traf'*	Track fragment box	Contains header information for the specified track within the fragment.		
'tfhd'*	Track fragment header box			
'trun'*	Track fragment run box	Contains sample duration and sizes for the track.		
'mfra'*	Movie fragment random access box	Contains a list of random access points in a fragmented file.		This box SHALL be the last box in all fragmented files.
'tfra'*	Track fragment random access box	Contains the random access points for the specified track.	Note version 1 boxes are allowed for the support of files over 4GB, which need 64 bit offsets.	Where fragments contain more than one randomly accessible sample, this box SHALL refer to at least the first randomly accessible sample in each fragment. The media SHOULD use a v0 box where the file size is less than 4GB.
'mfro'*	Movie fragment random access offset box	Helps a terminal obtain the 'mfra' box when this is placed at the end of the file.		This box SHALL be present and SHALL be the last box within the mfra box.

Boxes marked with an asterisk (\*) are only used in MP4 files containing fragments.

Media data for the tracks used by the MP4 file SHALL be contained within the file itself.  
References to tracks in external files SHALL NOT be used.

Edit lists SHALL NOT be used to alter playback. If an 'edts' box is present it SHALL be empty.

Note: some boxes have versions 0 and 1, and in many of these cases the v1 is to allow 64 bit timestamps to be used. The Timescale value set in the 'mvhd' SHALL be chosen appropriately by the content author to prevent the need to use 64 bit timestamps, and as such v1 boxes SHALL NOT be used where indicated in the table.

Any boxes not listed here MAY be ignored by the Terminal. MP4 files SHALL NOT contain boxes not listed here if a Terminal ignoring those boxes would materially affect the presentation of the media to the viewer. Note that 'mdat', 'free' and 'skip' boxes are not listed above as they are technically not parsed nor interpreted by the Terminal.

#### B.2.6.4.1 HTTP Streaming

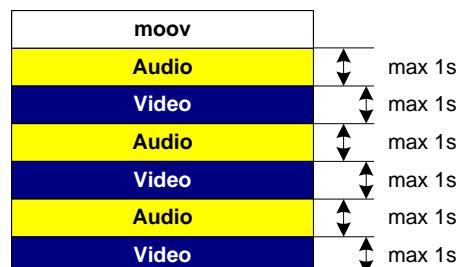
When content is intended for consumption through progressive download then there are additional requirements on the formatting of the media. These are to avoid lengthy delays at startup and to enable the Terminal to seek efficiently within the file.

MP4 files for HTTP streaming shall additionally meet the following restrictions (fragmentation may be required to meet these):

- 'moov' box total size SHOULD NOT exceed 1MB. This is to avoid excessive delays at startup while the 'moov' box loads.
- 'moof' boxes SHALL NOT individually exceed 1MB. This is to avoid the Terminal running out of media to play while downloading a 'moof'.
- Fragments (that is 'moof' plus 'mdat') SHALL NOT exceed 4GB. This avoids the need for 64 bit offsets to be used.

Media tracks shall be interleaved such that a track run or chunk (of audio or video samples) shall not represent a time of greater than 1 second, as illustrated for a file containing one audio and one video track in the following diagram:

**Figure B.2- 1 Media tracks interleaving**



Track runs and chunks shall be ordered by increasing value of decoding time of the first sample.

Adaptive Bitrate Streaming

Adaptive bitrate streaming is not supported for this container type.

Downloads

No additional constraints apply for downloading.

MIME type

When serving content contained in an MP4 file the server SHALL indicate the MIME type to be:

video/mp4  
or  
audio/mp4

The audio/mp4 type SHALL NOT be used for files containing video. The video/mp4 type MAY be used for files containing only audio.

## B.2.7 Codecs

### B.2.7.1 Video

All receivers shall include MPEG-4 AVC video ISO/IEC 14496-10 [15] decoding, as constrained by the ETSI TS 101 154 [16]. As a minimum, the following resolutions shall be supported: 720x576, 544x576, 480x576, 352x288, 1920x1080, 1440x1080, 1280x1080 interlaced at 25 frames/s; 1280x720, 960x720 at progressive 50 frames/s; 1280x720, 960x720, 1920x1080, 1440x1080, 1280x1080 progressive at 25 frames/s.

Receivers shall comply with the mandatory requirements set out in [1] sections 2.3.1, 2.3.2, 2.4.5.3, 2.4.5.5, 2.4.5.6, 2.4.6.1, 2.4.6.2, 3.2.1.4, 3.3.1.3, 3.3.4.1, 3.4.2.5.2.

### B.2.7.2 Audio

#### B.2.7.2.1 AAC and HE-AAC audio

Terminals shall decode AAC and HE-AAC audio as described in [1] Chapter 4.

#### B.2.7.2.2 MPEG-I Layer II audio

Terminals shall decode MPEG-I Layer II audio as described in [1] Chapter 4.

#### B.2.7.2.3 MPEG-I Layer III audio

Terminals shall decode MPEG-I Layer III audio as described in [17], Section 8.1.5.

### B.2.7.3 Subtitles

#### B.2.7.3.1 Timed Text (TTML) subtitles (for out of band delivery)

Subtitles for VOD content may be provided as a TTML Timed Text subtitle file as defined by <http://www.w3.org/TR/ttaf1-dfxp/>.

This format allows subtitles to be used with any media format and also allows the same subtitle file to be used for other platforms (for example, delivery to PC clients).

##### B.2.7.3.1.1 Profile

Terminals shall support at least the following features in [18] [Annex D TTML specification]:-

```
#backgroundColor
#cellResolution
#color
#content
#core6
#extent
#fontFamily
#fontSize
#fontStyle
#fontWeight
#layout
#length-cell
#length-em
```

<sup>6</sup> Only the xml:space attribute is applicable to presentation processors.

---

```
#length-integer
#length-percentage
#length-pixel
#length-positive
#length-real
#lineHeight
#nested-div
#nested-span
#origin
#padding
#presentation
#showBackground
#structure
#styling
#styling-chained
#styling-inheritance-content
#styling-inheritance-region
#styling-inline
#styling-nested
#styling-referential
#textAlign
#textDecoration-under
#timeBase-media7
#time-clock
#time-clock-with-frames
#time-offset
#time-offset-with-frames
#timing
#writingMode-horizontal-lr8
```

### B.2.7.3.2 Format

The Terminal shall support UTF-8 encoding for TTML files.

### B.2.7.3.3 Acquisition

The Terminal shall support HTTP and TLS for the acquisition of TTML files.

### B.2.7.3.4 Rendering

#### B.2.7.3.4.1 Resolution

The Terminal shall render subtitles to a graphics plane with a resolution of at least 1280x720, irrespective of the media resolution.

---

<sup>7</sup> This is the default.

<sup>8</sup> This is default.

**B.2.7.3.4.2 Anti-aliasing**

The Terminal shall render text using anti-aliasing with at least 8 levels, 7 of which to be mapped to colours between the relevant foreground and background colours.

**B.2.7.3.4.3 Number of colours**

The Terminal shall support rendering TTML files containing a maximum of 32 different combinations of foreground and background colours.

The Terminal shall support at least 8 distinct levels of opacity, with one of these levels being fully opaque and another being fully transparent (this allows for semi-transparent subtitles and anti-aliasing of text rendered upon transparent backgrounds).

**B.2.7.3.4.4 Timing**

Times within the subtitle file shall be interpreted relative to the start of the content item being presented.

Each subtitle shall be presented within 0.04 seconds of the specified time provided that the elapsed time since presentation of the preceding subtitle is greater than 0.2 seconds.

**B.2.7.3.4.5 Background colour fill**

When rendering a span with a tts: backgroundColor, the filled area shall cover the full line height as specified by the tts: lineHeight attribute.

Where there is text with tts: backgroundColor applied at the span level, the filled area shall extend the width of a space character, to the left of the first rendered character on each line, and to the right of the last rendered character on each line.

**B.2.7.3.5 Control of subtitle acquisition**

Terminals shall avoid downloading subtitles where not needed. In particular, for streaming media Terminals shall not download a TTML file for a content item where subtitles are not enabled. However, should the viewer enable subtitles during viewing, then the Terminal shall acquire the TTML file.

**B.2.7.3.6 Formatting defaults**

Terminals shall comply with the default formatting specified in the TTML standard [18], with the following exceptions.

**B.2.7.3.6.1 Cell resolution**

By default the cell resolution shall be set to 40 columns, and 16 rows. On a 1280x720 display, this provides cells of 32 pixels wide and 45 pixels high.

**B.2.7.3.6.2 Region**

If no region is specified, the Terminal shall adopt the following features:

- tts:backgroundColour: transparent
- tts:origin: 1c 1c
- tts:extent: 38c 14c
- tts:textAlign: centre
- tts:displayAlign: after

This defines a region that is 14 text lines (cells) high, and starts one cell into the screen. The displayAlign property ensures that all subtitles lines are vertically aligned to the bottom of the region by default.

**B.2.7.3.6.3 Font**

- tts:fontFamily: Tiresias

Where the platform does not support the font specified, it shall default to Tiresias as specified in [I] section 15.3.2.2. sansSerif and default shall always be mapped to Tiresias. Other font support is implementation dependent.

- **tts:fontSize:** The default font size shall be 0.9c. This corresponds to a height of 41px at a 1280x720 resolution.

#### **B.2.7.3.6.4 Paragraph**

- **tts:color:** white
- **tts:lineHeight:** 1c

#### **B.2.7.3.6.5 Span**

- **tts:backgroundColor:** black

### **B.2.7.3.7 In band delivery of subtitles**

#### **B.2.7.3.7.1 MPEG-2 TS**

A Terminal shall support subtitles as per [I] (Chapter 5).

#### **B.2.7.3.7.2 MP4**

Not yet supported

### **B.2.7.4 Audio description**

#### **B.2.7.4.1 Audio description in MPEG-2TS**

See [I] section 4.5 .

#### **B.2.7.4.2 Audio description in MP4 container**

Note: Audio description in MP4 container, with pan/fade signalling, will be added in a future release.

### **B.2.8 IP resource management (informative)**

#### **B.2.8.1 Introduction**

The receiver's IP connection is used for a variety of purposes, some of which are time critical and some of which are not. In addition, the user may have a broadband tariff in which traffic is charged at different rates at different times of day. This section describes a model for the management of the IP connection by the Terminal.

Three classes of traffic are defined:

- Time critical traffic
- High priority background downloads
- Low priority background downloads

#### **B.2.8.2 Time critical traffic**

Content that has been requested by the viewer for immediate consumption is time critical. This traffic includes:

- A/V media streaming using any streaming protocol
- Discrete content fetches by presentation engines

This traffic should always be permitted on the IP connection.

---

In the event that an active streaming session is unable to maintain sufficient buffered data for continued reliable operation, all background downloads should be suspended immediately and not resumed until the stream is paused or stopped or has been buffered in its entirety, or until the user requests resumption.

### **B.2.8.3 High priority background downloads**

Downloads requested by the user that have explicitly been requested for acquisition straightaway fall into this category.

This traffic should be permitted except when downloads have been suspended to maintain performance of a streaming media session. This traffic could be subject to an aggregate bandwidth limit that can be configured by the user (or by the ISP on their behalf).

### **B.2.8.4 Low priority background downloads**

Downloads requested by the user that have not explicitly been requested for acquisition straightaway fall into this category. This traffic should only be permitted during a configured background download window which would typically be overnight. This traffic could be subject to an aggregate bandwidth limit that can be configured by the user (or by the ISP on their behalf). The bandwidth limit for low priority downloads could be independent of the bandwidth limit for high priority downloads.

If the receiver has no configured background download window, this traffic should be permitted except when downloads have been suspended to maintain performance of a streaming media session.

If the receiver has no configured aggregate bandwidth limit for low priority background downloads, the aggregate bandwidth limit for high priority background downloads, if configured, should be applied.

# B.3 Connected TV Metadata

## B.3.1 Introduction

Metadata is information describing media content. It assists users in the process of discovering, selecting, managing (e.g. storing) and viewing content. Although the majority of the metadata defined in this chapter is directly related to content, and predominantly the storage aspects of such content, some metadata is associated with maintaining the continuity and robustness of the services to the End-user.

## B.3.2 Scope

This chapter of the CTV specification defines the metadata required to ensure interoperability between a Terminal and content (as identified by its metadata) originating from different and unrelated sources through the defined delivery interfaces. The chapter also describes the reference model in terms of functional architecture and interfaces over which metadata exchanges occur.

This chapter covers:

- Service and content metadata. A set of elements, attributes and properties that provide the descriptive editorial information about available content and services from broadcast and unmanaged IP networks and locally connected sources, identified in [B.3.2.1 Use Cases](#).
- Audience measurement metadata. The alignment between the measurement metadata fields and the content metadata elements and properties is specified in [B.6 Connected TV Audience Measurement](#).

It is assumed that the depth of metadata provided by the UK DTT services, specified in [\[I\]](#) of this document, has provided the general reference for the detail of content items which are needed to provide for all content covered by this specification. However, in some cases those data fields may not be applicable to all IP (linear and download) sourced content, and in other cases additional fields used to describe IP content will not be appropriate to or available for broadcast content.

This chapter does not:

- Provide specific metadata to enable the recording of content on-demand items although the metadata necessary for viewing them is supported.
- Define the specifications of metadata exchanged directly between the Service Provider and the Application. These are typically defined elsewhere, e.g. D Book Part A for DTT broadcast services (MD1 in the reference model in [Figure B.3-1](#) ), and private metadata formats between CTV applications and their private metadata sources (MD4 shown in [Figure B.3-1](#) ).
- Address any specific traditional IPTV metadata services, e.g. using DVB IPTV SD&S
- Support the requirements for conveying the schedule and description metadata for an IP linear streamed service from an Application to the Terminal to allow the terminal to expose that content onto a home network.

### B.3.2.1 Use Cases

The following (non exhaustive) list of use cases are covered by the reference model but not necessarily defined within this current version of the specification:

- Selecting, viewing and optionally storing content delivered from a traditional linear broadcast service (e.g. DTT). This may include broadcast record list content.

- Managing requests from End-users to download content from a download source over an unmanaged IP network.
- Selecting and storing content delivered from an IP linear streamed service over an unmanaged IP network managed by an Application.
- Selecting and viewing an IP linear streamed service managed by an Application.
- Selecting and viewing Content on Demand items, with or without trick mode capability, delivered over an unmanaged IP network managed by an Application.
- Selecting, viewing and managing content from local storage devices.
- Selecting, viewing, optionally storing and managing (if functionality is provided by the Terminal) content from other locally connected devices, e.g. home network sources and external storage.

### **B.3.2.2 Sources of Metadata**

The following categories of metadata are included in the scope of this specification.

The specification of the metadata attributes and properties is such that it shall be possible for a Terminal using an application based UI to create a consistent description of content items from all sources.

#### **B.3.2.2.1 Linear Broadcast metadata**

This is metadata that is associated with the content items provided by a Scheduled Content Service. In a Scheduled Content Service the content playout time is determined by the service provider. An example is DVB-SI / TV-Anytime metadata as broadcast over the DTT network.

#### **B.3.2.2.2 Linear IP Streaming metadata**

Beside those available on the broadcast networks additional services may be available as streamed linear services over the internet and managed by an application. As above the content playout time is still determined by the service provider. At the time of writing (2010) an example in the UK may be the simulcast services provided by BSkyB.

#### **B.3.2.2.3 Content on Demand (CoD) and Download metadata**

This is metadata describing content items available on an On-Demand basis delivered over IP and managed by the application. The On-Demand metadata is typically organised as a catalogue which may be presented in different perspectives such as alphabetical listing or grouped by genre. An example (current in 2011) would be “LoveFilm”.

Content on Demand is content delivered in real time (isochronously) for “viewing now”, and Download content items (including progressive download items) are delivered in non-real time to be stored for viewing from the storage location, possibly before the download is complete. The download method may be used to mitigate against poor IP delivery bitrates to provide better quality viewing than “view now” CoD.

#### **B.3.2.2.4 Local Stored Content metadata**

This is metadata describing content items that have been stored by the End-user and are available for playback from local storage. Since this metadata is managed entirely by the Terminal the format of the associated metadata is out of scope for this specification but sufficient depth of metadata should be available to the UI application to give a consistent level of description for stored content items. As a consequence content stored on removable storage devices, such as a USB memory, may not be playable on other Terminals.

#### **B.3.2.2.5 Content metadata for locally connected devices**

This is metadata describing content items that are available for playback from devices including network storage elsewhere in the home network. Since this metadata is managed entirely by the Terminal the format of the associated metadata is out of scope for this

specification but sufficient depth of metadata should be available to the UI application to give a consistent level of description for stored content items.

### B.3.3 References

- [1] DTG D-Book 7.0 Part A, , available from “<http://www.dtg.org.uk>”
- [13] OIPF DAE specification, volume 5, release 1.1, available from “<http://www.oipf.org>”
- [14] OIPF DAE specification, volume 5, release 2.0, available from “<http://www.oipf.org>”
- [IANA DTG-NS] IANA ref of DTG XML namespace, available from IETF (<http://www.ietf.org>)<sup>9</sup>
- [19] ETSI TS 102 034 DVB IPTV Specification, available from “<http://www.etsi.org>”
- [20] TVA. (2011-03-23 13:34:37) TV-Anytime Metadata Schema. [Online]. <http://tech.ebu.ch/tvanyime>
- [21][LANG CODING] International Standards Organisation, "ISO 639-1:2002 - Codes for the representation of names of languages -- Part 1: Alpha-2 code," 2002.
- [22][LANG RFC] RFC 3066, available from IETF (<http://www.ietf.org>)

### B.3.4 DTG Namespace Definition

All the schemas and classification schemes which have been created for this specification use the basic namespace “urn:dtg” which is registered with IANA [IANA DTG-NS]. Specific extensions may be used by separate functional areas within that registered namespace if it is considered appropriate to identify separation of interests, e.g. “urn:dtg:metadata”.

For the schemas and classification schemes related to content metadata used in this specification the document namespaces will be based on this namespace (“urn:dtg:metadata” and “urn:dtg:metadata:cs”).

### B.3.5 Service and Content discovery metadata reference model

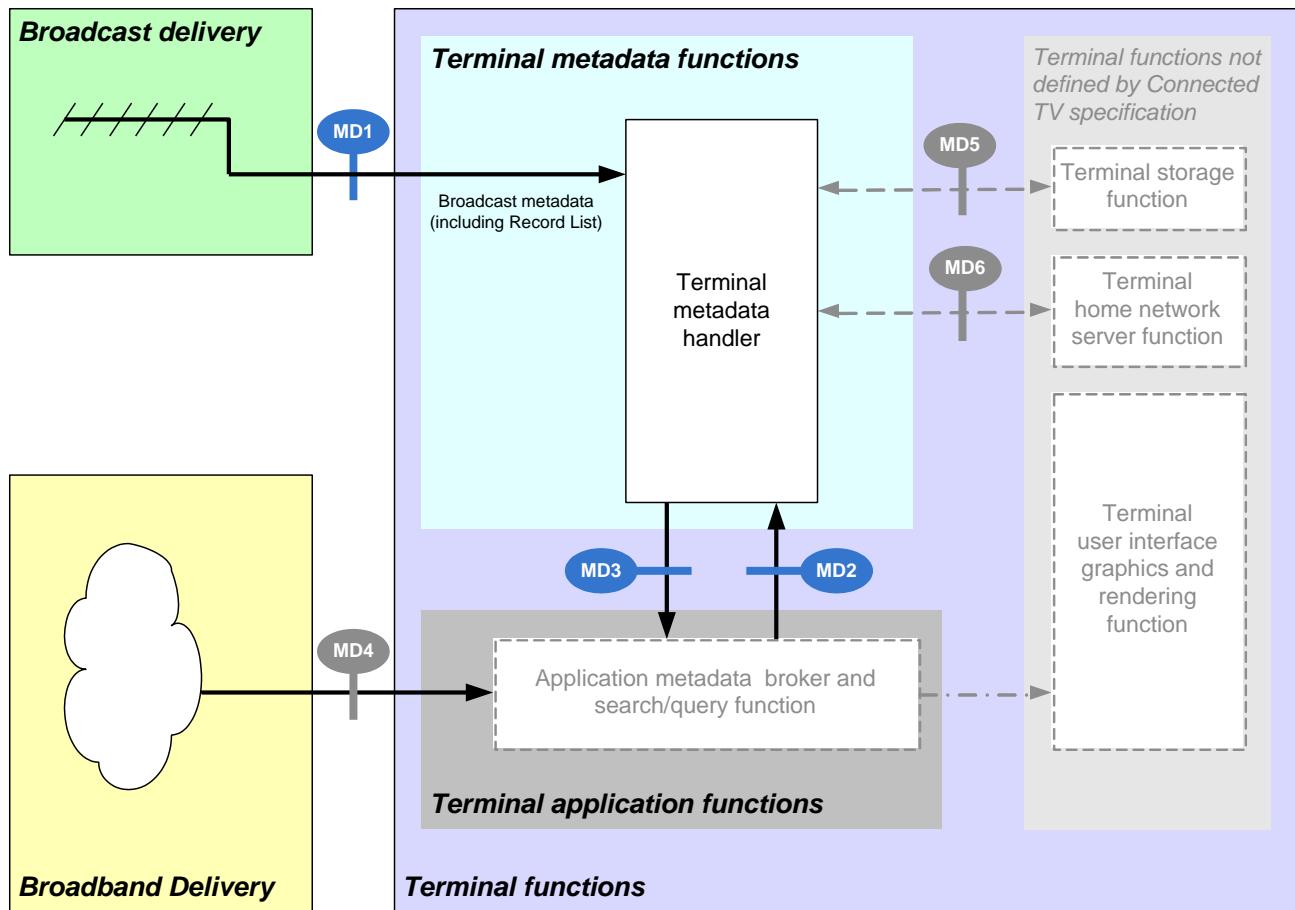
The model in [Figure B.3-1](#) shows the entities and interfaces for both the network part of the system and the Terminal within the home. Some of the interfaces defined to be part of the CTV network are specified in this document. Some of these interfaces are defined by either the delivery network architecture or the Terminal functionality and are not specified in this document, e.g. they are specified by the application, operator, [1] etc. or by the Terminal architecture. Those specifications will be referenced as required.

The profiling and scope of the interfaces is described in [Table B.3- 1](#) and the entities in the architecture diagram in [Figure B.3-1](#) are described in [Section B.3.5.1 Entities in Generic Metadata Architecture](#) below.

Only MD2 and MD3 are specified in this chapter and MD1 is specified in [\[1\]](#).

---

<sup>9</sup> Registration with IANA is in process

**Figure B.3-1 Service and Content Metadata model**

### B.3.5.1 Entities in Generic Metadata Architecture

The detailed description of the logical entities is considered to be out of scope for the metadata specification. Only those interfaces indicated in [Table B.3- 1](#) are in scope.

[Table B.3- 1](#) describes each of the interfaces. It indicates its status with regard to this specification. However, to aid understanding of the full architecture a short description of each entity follows. The interfaces identified as MD1 to MD6 are also mapped on the overall architecture shown in [Figure A1- 5 Connected TV Metadata Broker functions](#).

**Table B.3- I Profiling of metadata interfaces for Connected TV**

Ref.	Interface	Description	Comment
MD1	DVB-C/S/T 'air' interface	SI and TVA/DSM-CC for Record Lists conveyed to the Terminal in Transport Stream packets	Defined by [I]
MD2	Metadata interchange, Application to Terminal	Metadata from Application to Terminal metadata handler to support storage, home network and Terminal based search functions	Query and metadata schema/data model defined in section B.3.6.1 in conjunction with APIs specified in B.4
MD3	Metadata interchange, Terminal to Application	Metadata from Terminal to Application metadata handlers in response to queries and to enable presentation of a common Application UI	Query and metadata schema/data defined in section B.3.6.2 in conjunction with APIs specified in B.4
MD4	Internet TV metadata delivery (Application)	Delivery interface for metadata within Application	Implementation specific
MD5	Terminal storage metadata	Terminal storage metadata – terminal metadata handler	Implementation specific
MD6	Terminal HN metadata	Terminal HN function metadata – Terminal metadata handler	Implementation specific

### B.3.5.1.1 Broadcast Delivery

This represents the broadcast delivery network, e.g. the DTT transmitter network.

### B.3.5.1.2 Broadband Delivery

The broadband services are assumed to be delivered over an IP distribution network to the Terminal. Service and content discovery may be functionally separate from the delivery part of the service although a single organisation may act as a combination of some or all of the CSP, SP and ISP functions. It is assumed that inherently there may be no QoS or grade of service management across this part of the network although specific agreements may exist for some services.

### B.3.5.1.3 Terminal Functions

The functional entities within the Terminal are defined by the Terminal design.

#### B.3.5.1.3.1 Terminal Metadata Handler

This functional block receives, parses, translates and caches incoming metadata as required from any connection supported directly by the Terminal. It is also used to translate the available metadata to output to any other Terminal function which requires it, for instance the Terminal storage or home network (HN) functions. The scope for these interfaces in the context of the metadata specification is as described in Table B.3- I.

The interfaces between the Terminal metadata handler and the application environment (MD2 and MD3) are specified to allow metadata to be exchanged between those functions in a fully interoperable way.

### B.3.5.1.3.2 Application Metadata Handler and Search/Query Functions

This describes the functionality within the Terminal within which the applications manage the announcement and presentation of content. The method to encode and deliver the content metadata over interface MD4 to the application environment will be defined by the application writer within the boundaries of the specification in [B.4 Connected TV Presentation](#) Interfaces MD2 and MD3 are defined in this specification to enable consistent metadata exchanges with applications from different sources/providers.

### B.3.5.1.3.3 Related Terminal Functions not defined by CTV Specification

Although the methods used for implementing these functions are not specified in this document, some reference is made to them since some of the requirements and characteristics of the functions may have implications for the overall Connected TV metadata specification. The functions considered in the architecture are the local storage and home network functions although others may be implemented within the Terminal entities in Generic Metadata Architecture.

## B.3.5.2 Metadata interfaces between Terminal metadata handler and Application

This specification of the interfaces MD2 and MD3 between the application environment and the Terminal functionality is designed to ensure interoperability between Connected TV applications and the metadata functions within the Terminal.

The metadata describing content from download, IP linear and IP Content on Demand (CoD) services is represented as either an XML schema or as sets of JavaScript properties grouped within several classes, and exchanged as metadata objects using a family of methods and APIs.

Metadata is passed over MD3 from the Terminal to the Application for exposing content in an application UI describing locally available content from broadcast services, locally connected storage and connected devices such as home network devices.

## B.3.6 Metadata exchange formats across MD2 and MD3

### B.3.6.1 Interface MD2 - Application to Terminal

#### B.3.6.1.1 Download and Content on Demand Content over IP

The content metadata for a download content item shall be conveyed across MD2 from an Application to the Terminal to support storage of that content item. Also, content metadata for IP CoD content, with or without trick-modes, being viewed using the Application is conveyed through MD2 to pass some necessary metadata which is important at the point of playing the content, e.g. DRM and parental guidance.

Recording of CoD content is not in scope of this specification.

The structure used to pass the information from the application to the Terminal is the “AbstractContentAccessDescriptor”, represented in an XML form, defined in the OIPF DAE specification, volume 5, release 1.1 Annex C [\[13\]](#) and extended as defined in this document. The “ContentAccessDownloadDescriptor” form is used for downloaded content and the “ContentAccessStreamingDescriptor” form for Content on Demand (CoD) items to allow the terminal to enforce any Guidance restrictions for the content.

The schemas and classification schemes are defined in this chapter in section [B.3.8 Content Access Descriptors](#).

#### B.3.6.1.2 IP Linear Content

For IP linear content items, Programme and Channel objects created by the Application shall be conveyed across MD2 to the Terminal to enable recording of those items. Metadata carried in the Programme and Channel objects is represented as a set of

---

JavaScript properties exchanged using a family of APIs and methods defined in OIPF DAE [13].

Some of the properties are used as defined by OIPF and profiled in the OIPF DAE specification, volume 5, release 1.1 [13]. The remaining properties, which are either re-profiled or added by this specification, are defined in section B.4.5. The complete mapping of the properties is given in [Annex III.8: Mapping of properties across JavaScript Objects for metadata exchanges](#).

### B.3.6.2 Interface MD3

#### B.3.6.2.1 Metadata exchanged from Terminal to Application

MD3 shall be used to convert a set of properties which are used for the Terminal to return metadata to the application using the APIs and methods defined in B.4.5. For stored content the JavaScript objects used for this exchange are the Download object for downloaded content items and Recording object for those originating from linear content.

The level of metadata returned to the application shall be equivalent to that provided in the *AbstractContentAccessDescriptor* or Programme and Channel objects originally created by either the Terminal or the service provider application and made available to the Terminal when a download content or IP linear content item was stored or when the content/service listing is requested by an application.

The list of JavaScript properties used in this DTG specification is an extended and re-profiled version of that defined in the OIPF DAE specification, volume 5, release 1.1 [13] with some additions from OIPF DAE specification, volume 5, release 2.0 [14]. The API properties which are additional to those defined by OIPF are defined in B.4.5 and the complete mapping of the properties is given in [Annex III.8: Mapping of properties across JavaScript Objects for metadata exchanges](#).

MD3 is also the method by which the combination of Programme and Channel objects is passed to the Application to enable a unified UI for some or all of the content available for viewing to be created.

MD3 may be used either by a service provider application or a Terminal-specific application, e.g. to render a UI, although some access restrictions based on file permissions may apply.

### B.3.7 Use Cases and Processes for Metadata Exchanges

#### B.3.7.1 Use Cases and Processes for Metadata Exchanges across MD2

Metadata is conveyed from the Application to the Terminal to describe:

- IP download content to be stored from a service provider Application
- IP CoD content being consumed in real time using a service provider Application (recording is out of scope of this specification)
- IP linear content to be recorded through a service provider Application
- Content from an IP linear service being consumed in real time within an Application by conveying the Channel and Programme Objects from the application to the Terminal

The actual mechanisms for the recording is out of scope of this specification but the transfer mechanisms of the metadata from the application for IP content items are defined in the sections following.

The schemas and classification schemes are defined in this chapter in sections [B.3.8 Content Access Descriptors](#).

The Channel and Programme Objects are specified in OIPF DAE (Volume 5) [13] and [14] sections 7.13.12 and 7.16.2, with the extended properties defined in B.4.4.2.

### B.3.7.1.1 Storing of IP Download Content

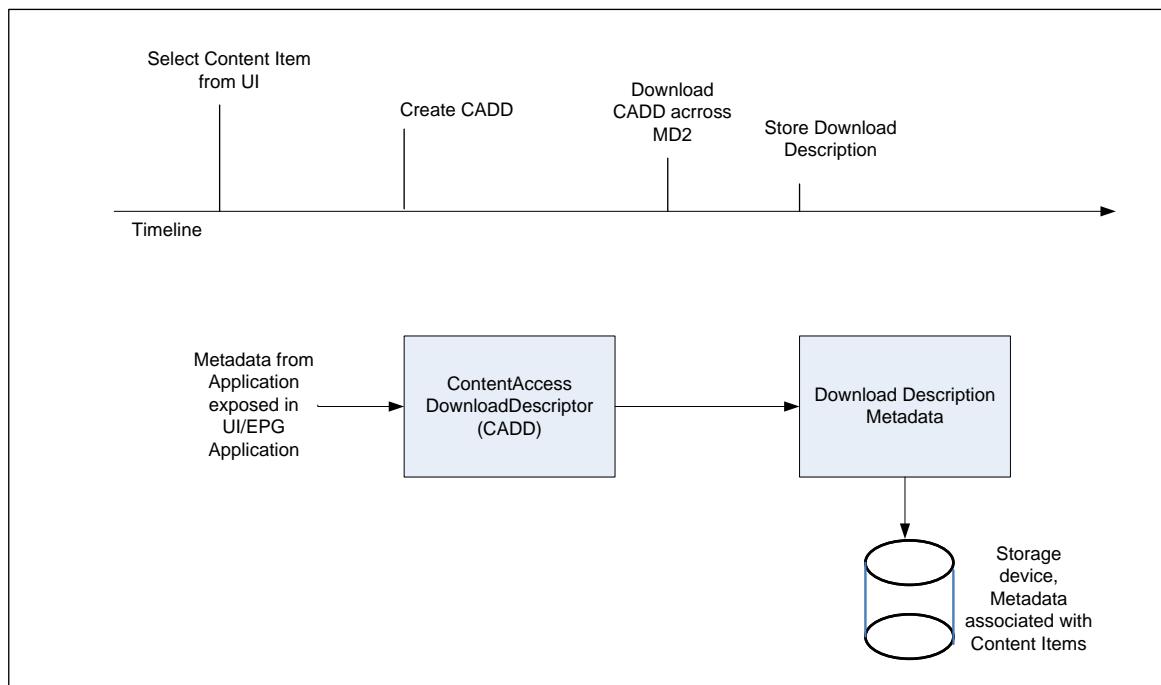
The selection of the content item to be downloaded shall be managed within an Application provided by a Service Provider.

The descriptive metadata originally provided by the metadata server over the Internet to the Application (MD4) shall be made available to the Terminal in the *ContentAccessDownloadDescriptor*, which is conveyed across MD2 to the terminal either directly using the *registerDownload()* method or indirectly using the *registerDownloadURL()* method.

The *ContentAccessDownloadDescriptor* is an instantiation of the *AbstractContentAccessDescriptor* specified in B.3.8 Content Access Descriptors.

The descriptive metadata may be used to create storage metadata for content items to allow the stored content to be exposed to and played later by the End-user

**Figure B.3-2 Metadata associated with recording of Download Content**

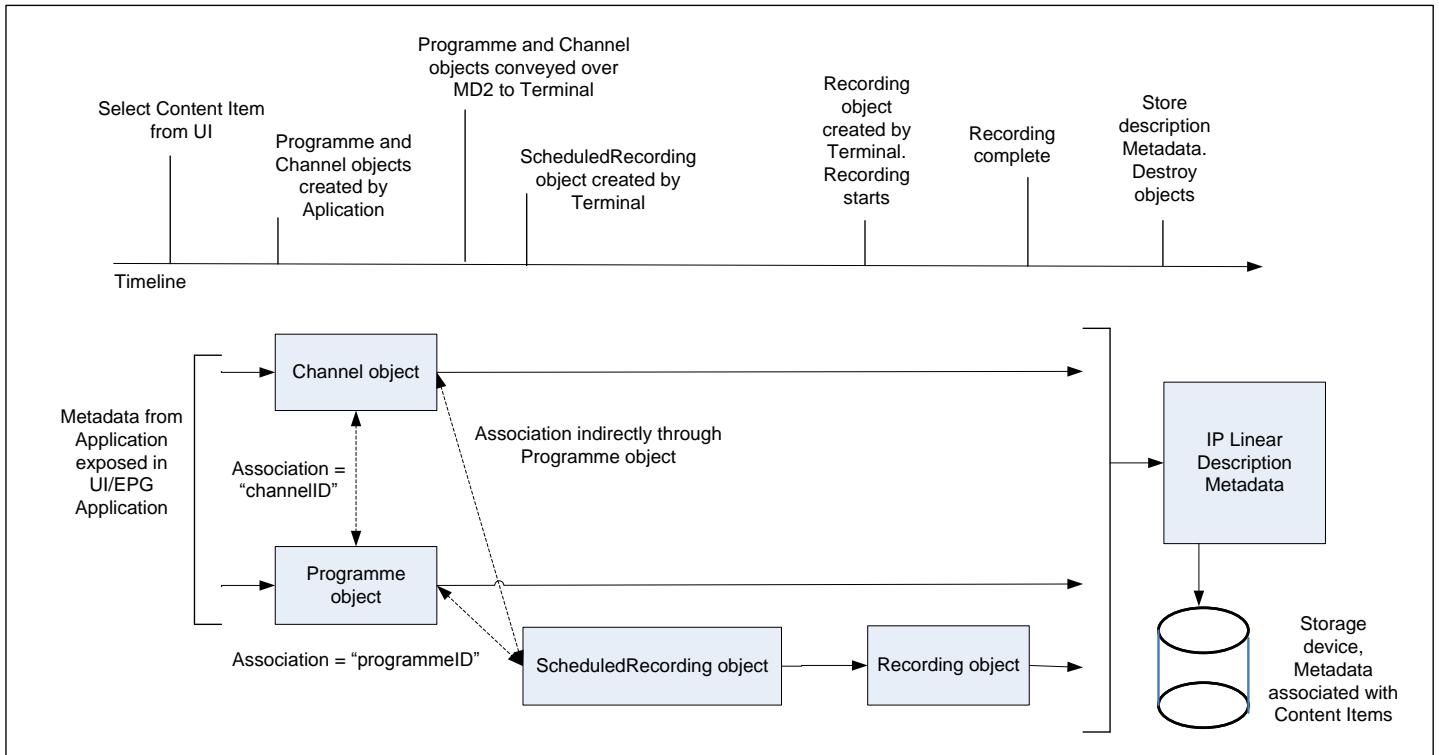


### B.3.7.1.2 Recording of IP linear Content

Among the content acquisition methods that the Terminal shall support and expose to the Application is the capture of a continuous portion of a linear channel delivered isochronously as a streaming service over IP.

Unlike the recording of a scheduled event distributed on one of the broadcast channels accessible to the Terminal for which the Terminal can acquire the content description and scheduling metadata from the broadcast service, information about the IP channel is not known by the Terminal and can only be accessed live by the End-user only through the Application.

The Application shall therefore not only request the recording of the content but also provide all the content description metadata. This allows the Terminal to manage subsequently this recording in a similar way to the case when the content is downloaded or captured from a broadcast channel.

**Figure B.3- 3 Metadata associations for recording of IP linear content**

The approach recommended to be followed by the Application to book such a capture and provide the content description metadata is described in this section. The API set is based on the OIPF DAE specification [13] using the extended list of properties defined in B.4.5, and shown in the property mapping table ([Annex III.8: Mapping of properties across JavaScript Objects for metadata exchanges](#)).

An Application that requests such a booking must sequentially:

1. Create a new channel object using the `createChannelObject` method of the Terminal video/broadcast object where:
  - `idType` is set to `ID_IPTV_URI`
  - `ipBroadcastID` references the URI locating the stream where the service is broadcast
2. Set the name properties of the created channel object to the actual name given by the Application to the channel. [Annex III.8: Mapping of properties across JavaScript Objects for metadata exchanges](#) shows how the properties are populated for content items from an IP linear source managed by an application.
3. Create a Programme object using the `createProgrammeObject` method of the application/oipfRecordingScheduler object
  - Set the `channelID` property of the Programme object to the `ccid` property of the newly created Channel object
  - Set the `startTime` property to the time when the content to record is scheduled to start.
  - Set the `duration` property to the duration in seconds of the content to record.
  - Set the Programme object properties to convey the content metadata as described in [Annex III.8: Mapping of properties across JavaScript Objects for metadata exchanges](#)

4. Request that the scheduler (i.e. application/oipfRecordingScheduler embedded object) schedules the recording of the programme using the record method associated with the newly created programme as the argument

**NOTE:** Optionally, the application may wish to apply a negative guard time offset to the scheduled start time to cater for the case where the event would start slightly earlier than initially scheduled and/or decide to extend the end of the recording beyond the scheduled end of the content to cope with possible shift or overrun. To achieve this, the application may respectively set in seconds the start/end padding of the scheduledRecording object generated from the call to the record (programme) method. By default, the Terminal sets these values to the value of the Configuration.pvrStartPadding and Configuration.pvrEndPadding properties anyway.

As a result, at (startTime – startPadding), the Terminal must tune to the location provided by ipBroadcastID, start to receive A/V data and store it on disk for the whole time window defined between (startTime – startPadding) and (startTime + duration + endPadding). However, the contention management function within the Terminal may be configured to apply Terminal or End-user specified rules where contentions at content item boundaries actually occur.

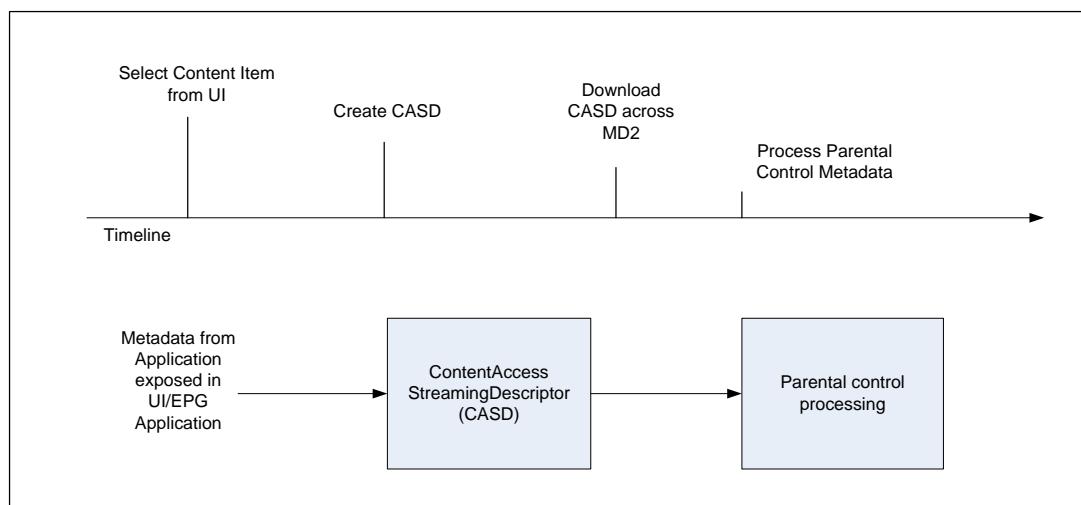
The Terminal shall complete this task even if the application that requested the recording has been terminated.

### B.3.7.1.3 Content from an IP Content on Demand (CoD) service being consumed in real time within an Application

Recording an item of content from an IP linear service is described in [B.3.7.1.2](#) but when a CoD item is selected for consumption only it is necessary for the Terminal to check the parental control information (ParentalRating and Guidance) before enabling viewing. Other information, e.g. DRM, may also be required by the Terminal which can be passed to the Terminal using the same mechanism.

This shall be supported by the Application passing the ContentAccessStreamingDescriptor to the terminal via MD2, the process is illustrated in [Figure B.3- 3](#). Additional description of the overall parental control mechanism is included in [B.5.14](#).

**Figure B.3- 4 Metadata associations for IP linear content on demand**



### B.3.7.1.4 Content from an IP linear service being consumed in real time within an Application

A *ContentAccessStreamingDescriptor* shall be sent from the Application to the Terminal when an End-user selects an IP linear stream for consumption, an Application shall trigger parental authorisation (see B.4.5.7) if required (see B.5.14 Parental controls).

When an IP linear service is being consumed parental control information may change at every programme or event boundary. If the Application becomes aware of a change of parental control status, then the Application shall trigger parental authorisation as described above.

The basic process for showing this information is shown in Figure B.3-4.

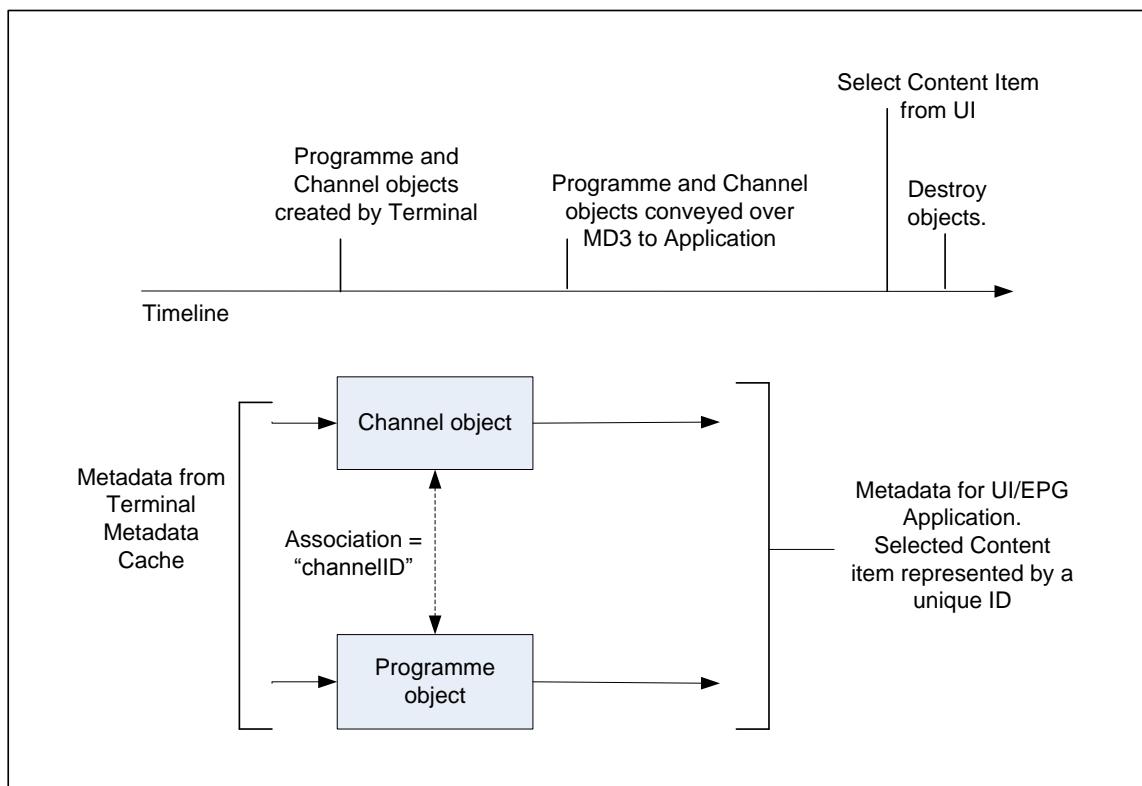
### B.3.7.2 Exposing of Content Sourced through Terminal in Application UI

In Terminals where a unified End-user interface (UI) is supported all content may be exposed through Service Provider specific or resident UI Applications. The methods differ for each Use Case dependent on its source, and the Application may be provided by a service provider or it may be Terminal specific. It is expected that some access restrictions will apply based on file permissions.

#### B.3.7.2.1 Exposing Content from Broadcast services and services from locally connected Devices

The Terminal shall use the available metadata (e.g. SI / BRL TVA or UPnP CDS) to create a Programme and Channel object which are used to populate the JavaScript properties of the associated set of APIs and methods to convey that metadata to the Application so that a UI can be produced.

**Figure B.3- 5 Exposing Content from Broadcast services and from Home Network services**



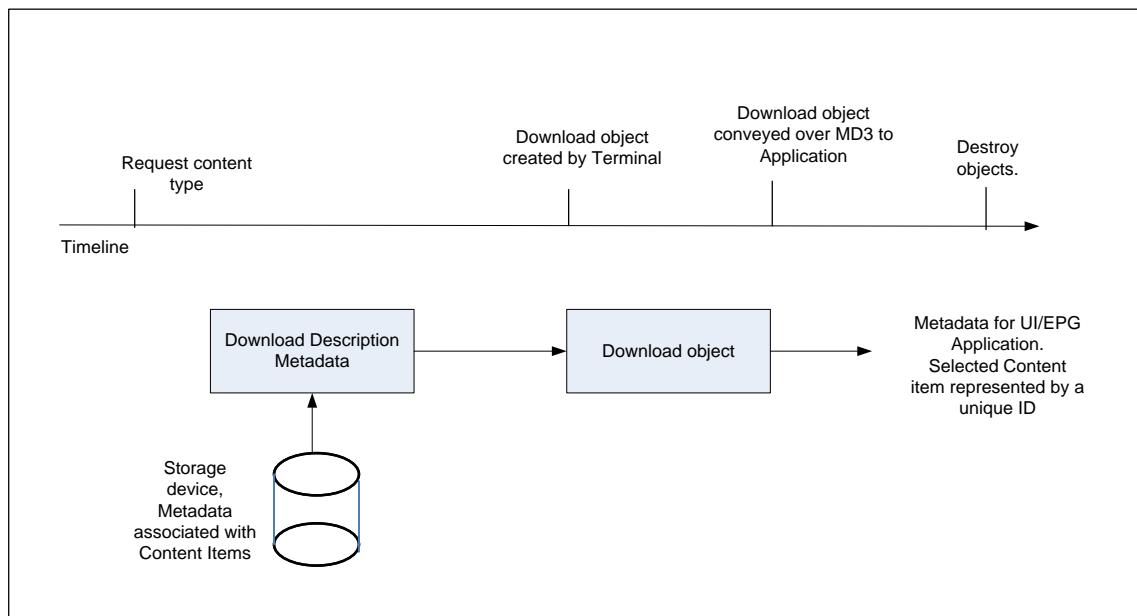
### B.3.7.2.2 Exposure and Playback of Locally Stored Content – Downloaded Content Item

The Terminal shall create a Download object to convey the stored metadata about a content item to the Application.

The Download object shall be returned to the Application using the API and methods as defined in [B.3.6 Metadata exchange formats across MD2 and MD3](#).

The Application shall initiate the playback of the selected content item.

**Figure B.3- 6 Metadata Associations for Exposing Content in Application UI**



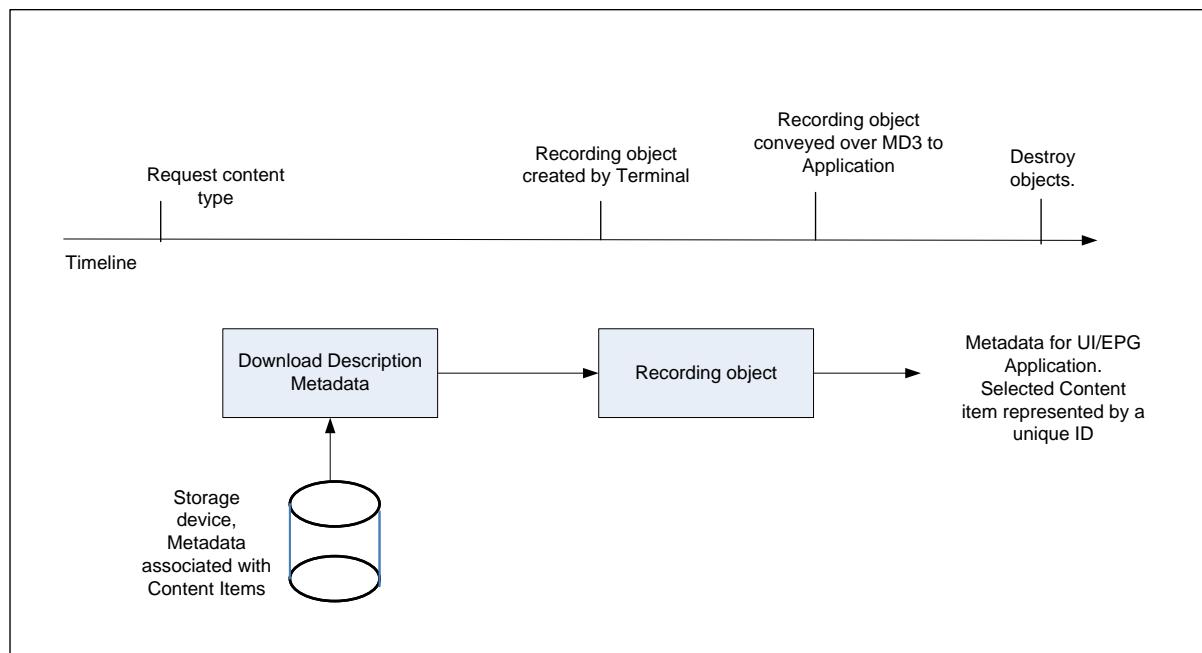
### B.3.7.2.3 Exposure and Playback of Locally Stored Content – Linear Content Item

For all content recorded from linear sources, as described in [B.3.7.1.2 Recording of IP linear Content](#) a common exposure and playback process applies as described here.

The Terminal shall create a Recording object to convey the stored metadata about a content item to the Application.

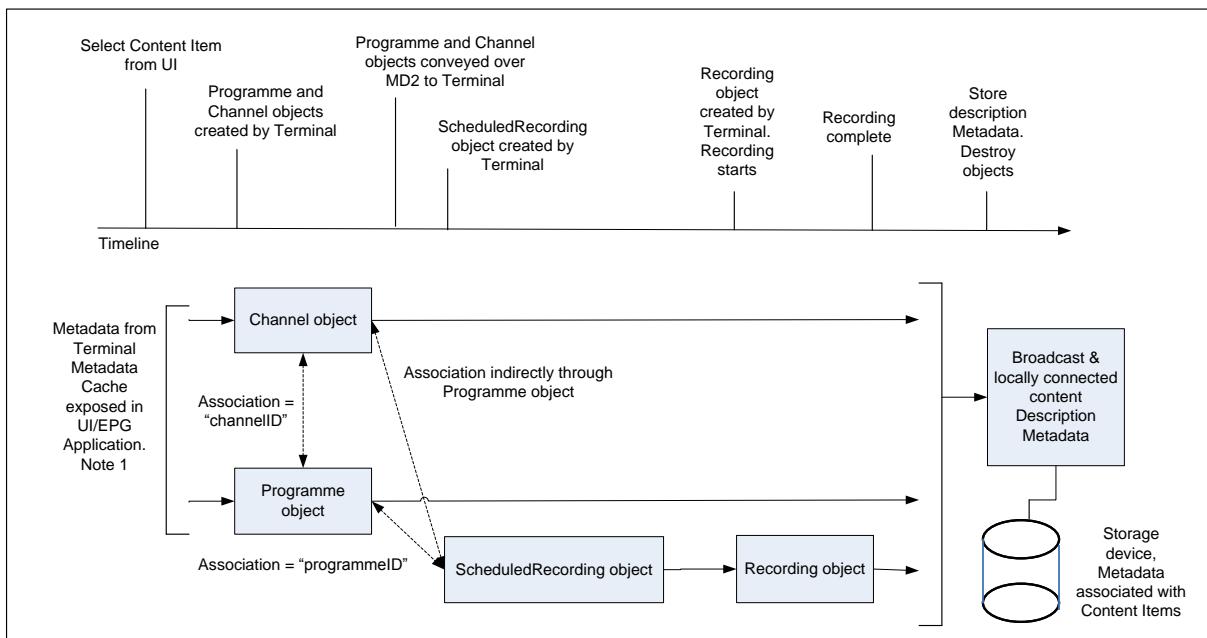
The Recording object shall be returned to the Application using the API and methods as defined in [B.3.6 Metadata exchange formats across MD2 and MD3](#).

The Application shall initiate the playback of the selected content item.

**Figure B.3- 7 Metadata Associations for Exposing Content in Application UI**

### B.3.7.3 Recording of content from broadcast services and other locally connected sources

The process for recording content from these sources is similar to that described in [B.3.7.1.2. Recording of IP linear Content](#) except that the program and channel objects are provided by the Terminal.

**Figure B.3- 8 Metadata associated with recording of Content from Broadcast and Locally Connected Sources**

## B.3.8 Content Access Descriptors

The *ContentAccessDownloadDescriptor* is used for download content and the *ContentAccessStreamingDescriptor* for content on demand (CoD) items. These schemas are defined in their original (OIPF) form in annexes E.1 and E.2 of [13] and are instances of a common *AbstractContentAccessDescriptor*.

As a result of the extensions and modifications the schema set defining the metadata for MD2, represented in an XML form, is as in [Table B.3-2](#).

**Table B.3-2 Equivalent schema files**

OIPF schema files (XSD)	DTG schema files (XSD)	Reference
<i>ContentAccessDownloadDescriptor</i>	<i>ContentAccessDownloadDescriptor</i>	<a href="#">Annex III.1: DTG ContentAccessDownloadDescriptor</a>
<i>ContentAccessStreamingDescriptor</i>	<i>ContentAccessStreamingDescriptor</i>	<a href="#">Annex III.2: DTG Content Access Streaming Descriptor</a>
<i>AbstractContentAccessDescriptor</i>	<i>dtg-AbstractContentAccessDescriptor</i>	<a href="#">Annex III.3: DTG extended AbstractContentAccessDescriptor</a>
	<i>dtg-MetadataDefinitionsSchema</i>	<a href="#">Annex III.4: DTG Metadata Definitions Schema</a>
<i>csp-DRMPriateDataType</i>		OIPF
<i>csp-HexBinaryPrivatedataType</i>		OIPF
<i>csp-MarlinPrivateDataType</i>		OIPF
<i>csp-MIPPVControlMessage</i>		OIPF

Where a DTG schema file is indicated it shall be used but if no equivalence is shown the single source of the schema (either OIPF or DTG) shall be used. All DTG defined schemas use the “urn: dtg: metadata” namespace defined in [B.3.4 DTG Namespace Definition](#).

Classification schemes for parental guidance and genre have been developed, these are additional to OIPF. These schemes are described in the relevant sections of [B.3.8](#) and are included as indicated [Table B.3-3](#).

**Table B.3-3 Equivalent schema files**

DTG Classification Scheme files (XML)	Reference
<i>BBFC</i> guidance scheme	<a href="#">Annex III.5: BBFC Classification Scheme</a>
Genre scheme	<a href="#">Annex III.6: DTG Genre Classification Scheme</a>
Warning Type scheme	<a href="#">Annex III.7 DTG Content Warning Classification Scheme</a>

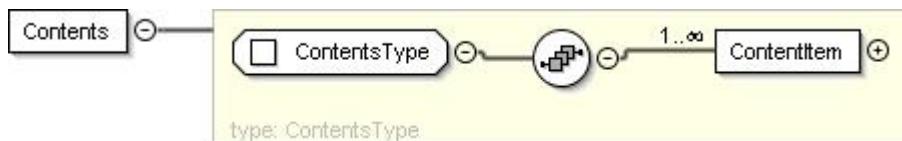
### B.3.8.1 Content access descriptor schema

The sections following describe the XML structures for the DTG modifications and extensions to the OIPF “AbstractContentAccessDescriptor” defined in Annex E.3 of [13].

#### B.3.8.1.1 ContentsType Schema

This represents a collection of ContentItems as defined by OIPF, no extensions are applied by DTG at this level.

```
<xss:complexType name="ContentsType">
  <xss:sequence>
    <xss:element name="ContentItem" type="ContItemType" minOccurs="1" maxOccurs="unbounded"/>
  </xss:sequence>
</xss:complexType>
```

**Figure B.3- 9 Abstract Content Access Descriptor**

### B.3.8.1.2 “ContItemType” Schema

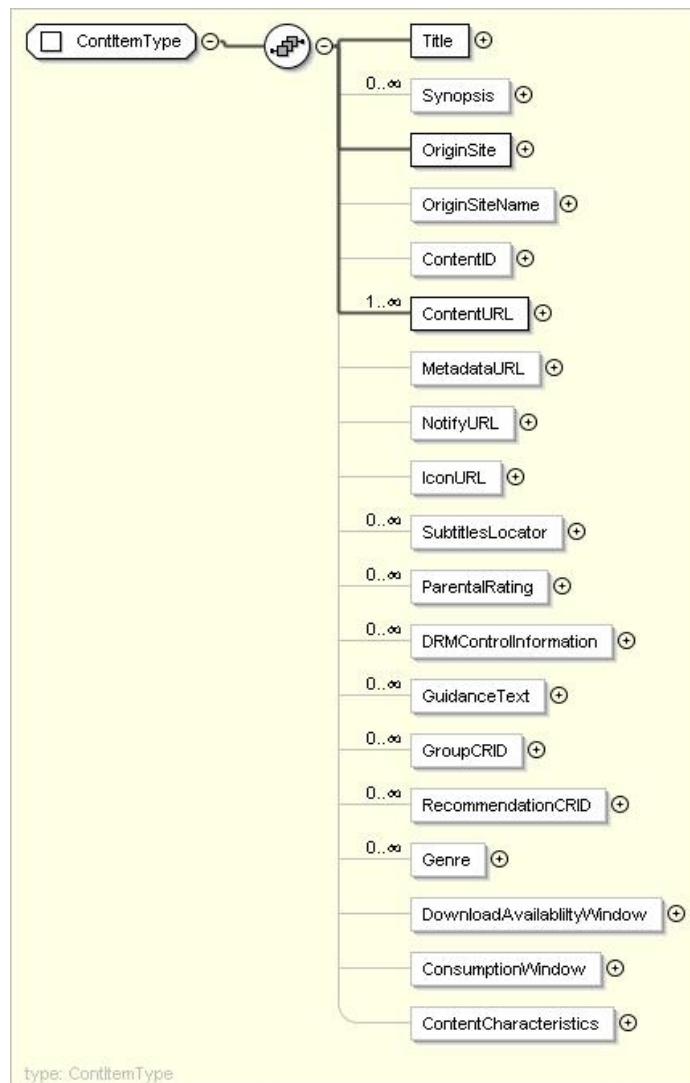
The ContentItem is a description of an item of content enabling storage and usage of that content item as defined by OIPF with extensions by DTG as defined below:

```
<xss:complexType name="ContItemType">
  <xss:sequence>
    <xss:element name="Title" type="TitleType"/>
    <xss:element name="Synopsis" type="SynopsisType" minOccurs="0" maxOccurs="unbounded"/>
    <xss:element name="OriginSite" type="xs:anyURI"/>
    <xss:element name="OriginSiteName" type="xs:string" minOccurs="0"/>
    <xss:element name="ContentID" type="xs:string" minOccurs="0">
      <xss:annotation>
        <xss:documentation> For CTV this is the content CRID and is mandatory
        </xss:documentation>
      </xss:annotation>
    </xss:element>
    <xss:element name="ContentURL" type="ContentURLType" maxOccurs="unbounded"/>
    <xss:element name="MetadataURL" type="xs:anyURI" minOccurs="0"/>
    <xss:element name="NotifyURI" type="xs:anyURI" minOccurs="0"/>
    <xss:element name="IconURL" type="xs:anyURI" minOccurs="0"/>
    <xss:element name="SubtitlesLocator" type="dtg:SubtitlesURLType" minOccurs="0"
      maxOccurs="unbounded">
      <xss:annotation>
        <xss:documentation>DTG extension element. Locator for subtitles coomponent of a
          service if carries as a seperately from main component set.</xss:documentation>
      </xss:annotation>
    </xss:element>
    <xss:element name="ParentalRating" type="ParentalRatingType" minOccurs="0"
      maxOccurs="unbounded"/>
    <xss:element name="DRMControlInformation" type="DRMControlInformationType" minOccurs="0"
      maxOccurs="unbounded"/>
    <!-- -->
    <!-- Additional elements defined by DTG -->
    <xss:element name="GuidanceText" type="dtg:GuidanceTextType" minOccurs="0"
      maxOccurs="unbounded">
      <xss:annotation>
        <xss:documentation>DTG extension element. Editorial guidance text to accompany the
          content item.</xss:documentation>
      </xss:annotation>
    </xss:element>
    <xss:element name="GroupCRID" type="dtg:CRIDType" minOccurs="0" maxOccurs="unbounded">
      <xss:annotation>
        <xss:documentation>DTG extension element. The CRID of a Group to which this content
          item belongs.</xss:documentation>
      </xss:annotation>
    </xss:element>
    <xss:element name="RecommendationCRID" type="dtg:CRIDType" minOccurs="0"
      maxOccurs="unbounded">
      <xss:annotation>
        <xss:documentation>DTG extension element. The CRID of a recommendation Group to which
          this content item belongs.</xss:documentation>
      </xss:annotation>
    </xss:element>
    <xss:element name="Genre" type="dtg:GenreType" minOccurs="0" maxOccurs="unbounded">
      <xss:annotation>
        <xss:documentation>DTG extension element. The genre of this content item, expressed
          as a controlled term from an MPEG-7 Classification Scheme.</xss:documentation>
      </xss:annotation>
    </xss:element>
    <xss:element name="DownloadAvailablilityWindow" type="dtg:AvailablilityWindowType"
      minOccurs="0">
      <xss:annotation>
        <xss:documentation>DTG extension element. The period of time for which this content
          item is available for acquisition by download.</xss:documentation>
      </xss:annotation>
    </xss:element>
    <xss:element name="ConsumptionWindow" type="dtg:ConsumptionWindowType" minOccurs="0">
      <xss:annotation>
        <xss:documentation>DTG extension element. The period of time for which this content
          item is available for consumption following sucessful download. (Provided for
          information only; a separate DRM system is responsible for policing the
          content item).</xss:documentation>
      </xss:annotation>
    </xss:element>
  </xss:sequence>
</xss:complexType>
```

```

        consumption of the downloaded content item.)</xs:documentation>
    </xs:annotation>
</xs:element>
<xs:element name="ContentCharacteristics" type="dtg:ContentCharacteristicsType"
    minOccurs="0">
    <xs:annotation>DTG extension element. Audio-visual and language characteristics
        of this content item. (Provided for information only.)</xs:documentation>
    </xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>

```

**Figure B.3- 10 Structure of DTG extended “ContentItem” schema****Table B.3- 4 Profiling of “ContentItem” schema**

<b>XML schema field</b>	<b>Status</b>	<b>Comments</b>
Content	Mandatory	Container for one or more content items
ContentItem	Mandatory	
Title	Mandatory	Specified by OIPF
Synopsis	Not required	Length restricted to 40 characters for DTG use Specified by OIPF

XML schema field	Status	Comments
OriginSite	Mandatory	Length restricted to 200 characters for DTG use Specified by OIPP This shall carry the URL (including the fully qualified domain name) of the provider site from which the content description can be downloaded.
OriginSiteName	Not required	See note 1 Specified by OIPP This is the name identifying the origin of the content to the End-user.
ContentID	Mandatory	Contains fully qualified CRID
ContentURL	Mandatory	As specified in B.4 of this document.
ContentURL[@DRMSystemID]	Not required	The schema and XML representation is shown in <a href="#">B.3.7.1.2</a> The schema and XML representation is shown in <a href="#">B.3.7.1.1</a> .
ContentURL[@TransferType ]	Mandatory	Value = “full_download”, “playable_download”
ContentURL[@Size]	Mandatory	
ContentURL[@MD5hash]	Not required	
ContentURL[@Duration]	Not required	
ContentURL[@MIMEType]	Mandatory	
ContentURL[@MediaFormat]	Not required	
ContentURL[@VideoCoding]	Not required	
ContentURL[@AudioCoding]	Not required	
MetadataURL	Mandatory	Identifies location of Specified by OIPP Only required if additional metadata is provided. See note 3 < do we need a max file size? >
NotifyURL	Not required	May be ignored by Terminal
IconURL	Not used	May be ignored by Terminal See note 2
SubtitlesURL	Optional	Specifically required if subtitles are provided as a separate service from the main contents service components. Uses SubtitlesURLType expanded in <a href="#">B.3.8.4.1</a>
ParentalRating	Not used	Terminals shall support DVB-SI and BBFC schemes, other content requiring guidance shall be identified using DTG

XML schema field	Status	Comments
		specific “DTGGuidance” field. Expanded in <a href="#">B.3.8.4.3</a>
DRMControlInformation	Not used	
GuidanceText	Optional	Used to carry DTG style text to indicate reason for content being unsuitable. Uses GuidanceTextType expanded in <a href="#">B.3.8.4.3</a>
GroupCRID	Optional	Contains fully qualified CRID Uses CRIDType, specified in <a href="#">B.3.8.5.1</a> , there may be multiple group CRIDs
RecommendationCRID	Optional	Contains fully qualified CRID Uses CRIDType, specified in <a href="#">B.3.8.5.1</a> , there may be multiple recommendation CRIDs
Genre	Optional	TermID/scheme structure, Terminals shall support mapping to DTG CTV scheme. Uses GenreType specified in <a href="#">B.3.8.4.6</a>
DownloadAvailabilityWindow	Optional	Start and end availability attributes for content item. Uses AvailabilityWindowType specified in <a href="#">B.3.8.4.7</a>
ConsumptionWindow	Optional	DTG extension to include “expiry”, “embargo” and ViewingPeriod fields. This uses AvailabilityWindowType expanded in <a href="#">B.3.8.4.7</a>
ContentCharacteristics	Optional	Complex element carrying multiple descriptive fields,. Uses ContentCharacteristicsType expanded in <a href="#">B.3.8.4.9</a>
<p>Note 1. The semantics of this field are not defined</p> <p>Note 2. Specification of size information for the icons is required</p> <p>Note 3. The metadata set provided by the metadataURL shall describe only the content item referenced by the contentURL.</p>		

All the mandatory (as specified by OIPF) contentAccessDescriptor schema fields shall be populated as specified in E.3 of [\[13\]](#). If equivalent metadata is provided in the additional metadata provided through the metadataURL that additional metadata should take precedence over the information provided in the contentAccessDescriptor.

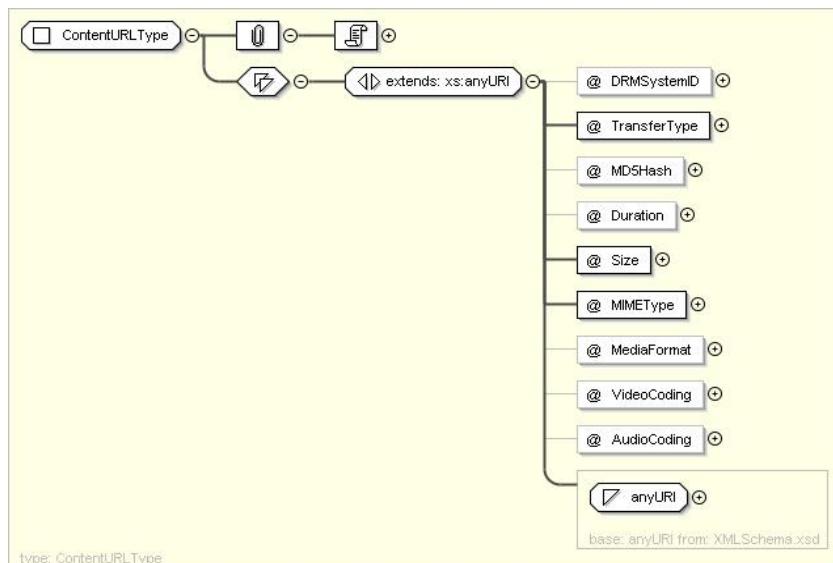
### B.3.8.2 ContentURLType

This carries the locator for the content item to be downloaded including several attributes to make that description more complete. It is profiled for use in this specification identically with OIPF DAE Release 1.1.and 2.0 [\[13\]](#) [\[14\]](#).

```

<xs:complexType name="ContentURLType">
  <xs:annotation>
    <xs:documentation>
      Multiple URLs may be provided but each must be for a different DRMSystemID
    </xs:documentation>
  </xs:annotation>
  <xs:simpleContent>
    <xs:extension base="xs:anyURI">
      <xs:attribute name="DRMSystemID" type="xs:string" use="optional"/>
      <xs:attribute name="TransferType" type="TransferTypeEnum" use="required"/>
      <xs:attribute name="MD5Hash" type="xs:string" use="optional"/>
      <xs:attribute name="Duration" type="xs:time" use="optional"/>
      <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>

```

**Figure B.3- 11 Expansion of “ContentURLType”**

The status and profiling of the ContentURLType is as defined by OIPF.

**Table B.3- 5 Profiling of “ContentURLType”**

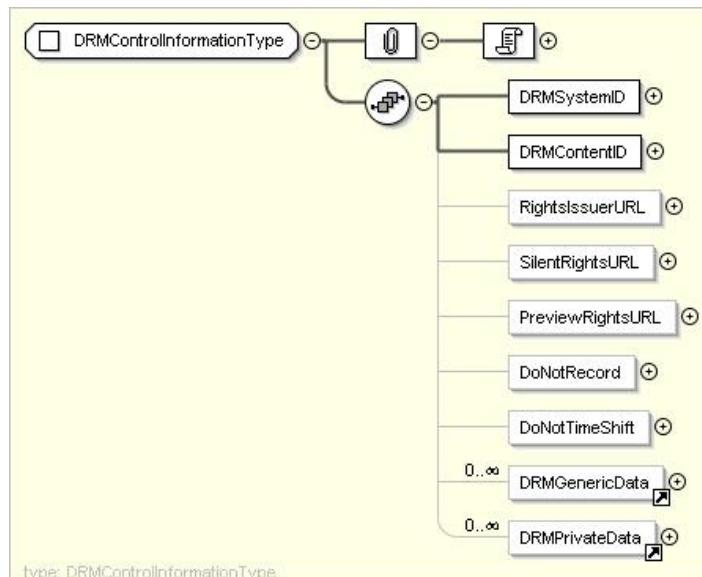
XML schema field	Status	Comments
ContentURL	Mandatory	As specified in B.2 of this document.
ContentURL[@DRMSystemID]	Not required	The schema and XML representation of the related DRM metadata (DRMControlInformation) is shown in B.3.8.3
ContentURL[@TransferType]	Mandatory	Value = “full_download”, “playable_download”
ContentURL[@Size]	Mandatory	May be set to “Undefined”
ContentURL[@MD5hash]	Not required	
ContentURL[@Duration]	Not required	
ContentURL[@MIMEType]	Mandatory	As specified by OIPF [24]
ContentURL[@MediaFormat]	Not required	
ContentURL[@VideoCoding]	Not required	
ContentURL[@AudioCoding]	Not required	

### B.3.8.3 DRMControlInformationType

The DRMControlInformation is provided to be used in an informative way in instances compliant with this specification. The profiling of the schema for all the fields is as specified in the OIPF DAE specification [13].

```
<xs:complexType name="DRMControlInformationType">
  <xss:sequence>
    <xss:element name="DRMSystemID" type="xs:string"/>
    <xss:element name="DRMContentID" type="xs:string"/>
    <xss:element name="RightsIssuerURL" type="xs:anyURI" minOccurs="0"/>
    <xss:element name="SilentRightsURL" type="xs:anyURI" minOccurs="0"/>
    <xss:element name="PreviewRightsURL" type="xs:anyURI" minOccurs="0"/>
    <xss:element name="DoNotRecord" type="xs:boolean" minOccurs="0"/>
    <xss:element name="DoNotTimeShift" type="xs:boolean" minOccurs="0"/>
    <xss:element ref="DRMGenericData" minOccurs="0" maxOccurs="unbounded"/>
    <xss:element ref="DRMPublicData" minOccurs="0" maxOccurs="unbounded"/>
  </xss:sequence>
</xs:complexType>
```

**Figure B.3- 12 Expansion of “DRMControlInformationType”**



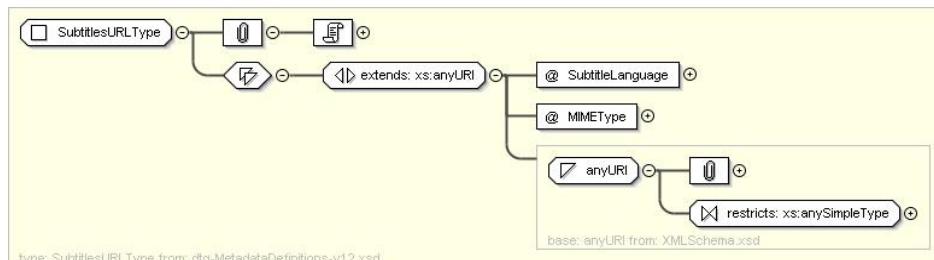
### B.3.8.4 DTG defined Complex Types

The following elements Types are defined by DTG for use in this specification directly at root level

#### B.3.8.4.1 SubtitlesURLType

This is used to provide the location of a subtitles component provided externally to the main service component group. Attributes conveying language and MIME type are also carried.

```
<xs:complexType name="SubtitlesURLType">
  <xss:annotation>
    <xss:documentation>
      Multiple subtitle URLs may be provided each with associated language and MIME type
    </xss:documentation>
  </xss:annotation>
  <xss:simpleContent>
    <xss:extension base="xs:anyURI">
      <xss:attribute name="SubtitleLanguage" type="xs:language" use="required"/>
      <xss:attribute name="MIMETYPE" type="mpeg7:mimeType" use="required"/>
    </xss:extension>
  </xss:simpleContent>
</xs:complexType>
```

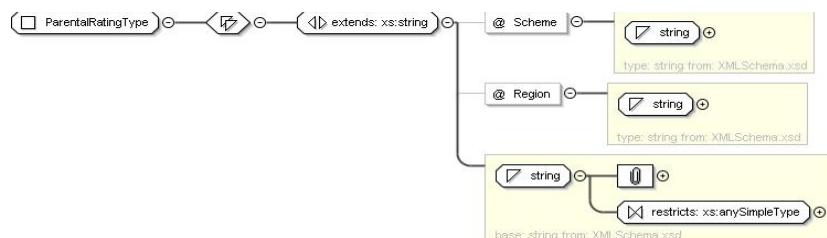
**Figure B.3- 13 Expansion of “SubtitlesURLType”****Table B.3- 6 Profiling of “SubtitlesURLType”**

XML schema field	Status	Comments
SubtitlesURLType	Mandatory if SubtitlesLocator is present as root element	Uses xs:AnyURI as base class
@SubtitleLanguage	Mandatory	ISO 639 2 or 3 character language code
@MIMEType	Mandatory	Use “application/ttml+xml” for Timed Text subtitles.

### B.3.8.4.2 ParentalRatingType

The OIPF method is used in this specification to carry the “watershed” flag; the profiling is as defined by OIPF.

```
<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>
```

**Figure B.3- 14 Expansion of “ParentalRatingType”****Table B.3- 7 Profiling of “ParentalRatingType”**

XML schema field	Status	Comments
ParentalRatingType		
@Scheme	Optional	String format
@Region	Optional	String format

**Field specific notes for Table B.3- 2:**

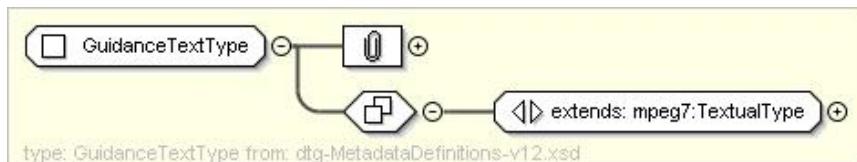
I. The semantics of this field are to be defined

### B.3.8.4.3 GuidanceTextType

The OIPF method is used in this specification to carry the “watershed” flag which is used in association with the GuidanceText to emulate the guidance method used currently for DTG broadcast services.

```
<xs:complexType name="GuidanceTextType">
    <xs:annotation>
        <xs:documentation>Provides editorial guidance text as a string with optional language attribute.</xs:documentation>
    </xs:annotation>
    <xs:complexContent>
        <xs:extension base="mpeg7:TextualType"/>
    </xs:complexContent>
</xs:complexType>
```

**Figure B.3- 15 Expansion of “GuidanceTextType”**



**Table B.3- 8 Profiling of “GuidanceTextType”**

XML schema field	Status	Comments
GuidanceTextType	Optional	Uses mpeg7:textualType

### B.3.8.4.4 GroupCRIDType

This element is optional and extends the use of the CRIDType defined by DTG and described in [B.3.8.5.1](#).

It contains the CRID of the group of which the content item is a member; there may be multiple instances of GroupCRID.

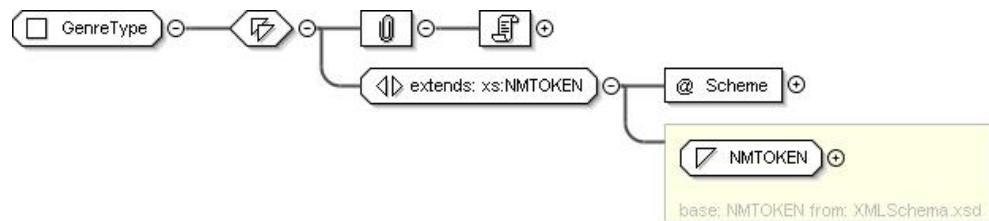
### B.3.8.4.5 RecommendationCRIDType

This element is optional and extends the use of the CRIDType defined by DTG and described in [B.3.8.5.1](#).

It contains the CRID of the other content items or groups which may be of interest to the user selecting this content item, there may be multiple instances of RecommendationCRID.

### B.3.8.4.6 GenreType

```
<xs:complexType name="GenreType">
    <xs:simpleContent>
        <xs:annotation>
            <xs:documentation>The content of this element is an unqualified term identifier defined within the scope of the MPEG-7 Classification Scheme specified in the Scheme attribute.</xs:documentation>
        </xs:annotation>
        <xs:extension base="xs:NMTOKEN">
            <xs:attribute name="Scheme" type="xs:anyURI" use="required">
                <xs:annotation>
                    <xs:documentation>The namespace URI of an MPEG-7 Classification Scheme. (The term identifier is specified in the element content.)</xs:documentation>
                </xs:annotation>
            </xs:attribute>
        </xs:extension>
    </xs:simpleContent>
</xs:complexType>
```

**Figure B.3- 16 Expansion of “GenreType”****Table B.3- 9 Profiling of “GenreType”**

<b>XML schema field</b>	<b>Status</b>	<b>Comments</b>
@Scheme	Mandatory	Name of scheme in use
Term ID	Mandatory	Based on xs:NMTOKEN

Table B.3-10 shows the overall mapping of the Connected TV genre coding to the [I] and DVB codes, and the meaning of the codes for those coding schemes. Terminals conformant to this specification shall support the [I] coding and the DTG CTV genre classification scheme for broadcast services, and the DTG CTV genre classification scheme for the linear IP services specified in [Annex III.6: DTG Genre Classification Scheme](#).

Table 8.7 of D-Book Part A [I] provides the definitive DTG mapping of the genre usage for the terrestrial services against the DVB values.

**Table B.3- 10 Programme Genre Coding**

<b>CTV CS termID</b>	<b>CTV description</b>	<b>Content_nibble_level_1</b>	<b>D-Book Description</b>	<b>DVB Description (for information only)</b>
0	Unclassified	0	Unclassified	Unclassified
1	Movie	0x1	Movie	Movie/Drama
2	News and Factual	0x2	News and Factual	News/Current affairs
2.1	News/Current affairs			
2.2	Arts/Culture (without music)			
2.3	Social/Political Issues/Economics			
3	Entertainment	0x3	Entertainment	Show/ Game show
3.1	Show/ Game show			
3.2	Music/Ballet/Dance			
4	Sport	0x4	Sport	Sports
5	Children's/ Youth programmes	0x5	Children's	Children's/ Youth programmes
3		0x6	Entertainment	Music/Ballet/Dance
2.2		0x7	News and Factual	Arts/Culture (without music)
2.3		0x8	News and Factual	Social/Political Issues/Economics
6	Education/Science/Factual Topics	0x9	Education	Education/Science/Factual Topics
7	Lifestyle/Leisure hobbies	0xA	Lifestyle	Leisure hobbies
		0xB	not supported	Special Characteristics
		0xC – 0xE	not supported	Reserved for future use
8	Drama	0xF	Drama	user defined

The CTV schema mapping uses a 2 layer Classification Scheme which enables mapping to the existing DTG DTT genre coding, in a backwardly compatible way and also enables extension to the DVB scheme where that information is available. A compliant Terminal shall be capable of parsing either 1 or 2 layer scheme termIDs where they are signalled in the ContentAccessDescriptor “DTGGenre” field. The “scheme” field shall be set to identify the corresponding scheme to which the termID applies.

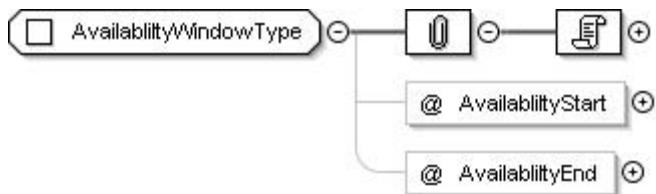
Note: 0xF is used by DTG DTT “Drama” genre and is equivalent to DTG CTV scheme value “8”, but DVB do not have a direct equivalent for this category.

### B.3.8.4.7 AvailabilityWindowType

This element is used to group information about the period when content items will be available for download.

```
<xs:complexType name="AvailabilityWindowType">
    <xs:annotation>
        <xs:documentation>The period of time for which this content item is available for acquisition by download.</xs:documentation>
    </xs:annotation>
    <xs:attribute name="AvailabilityStart" type="xs:dateTime" use="optional">
        <xs:annotation>
            <xs:documentation>Expressed as an XML schema dateTime.</xs:documentation>
        </xs:annotation>
    </xs:attribute>
    <xs:attribute name="AvailabilityEnd" type="xs:dateTime" use="optional">
        <xs:annotation>
            <xs:documentation>Expressed as an XML schema dateTime.</xs:documentation>
        </xs:annotation>
    </xs:attribute>
</xs:complexType>
```

**Figure B.3- 17 Expansion of “AvailabilityWindowType”**



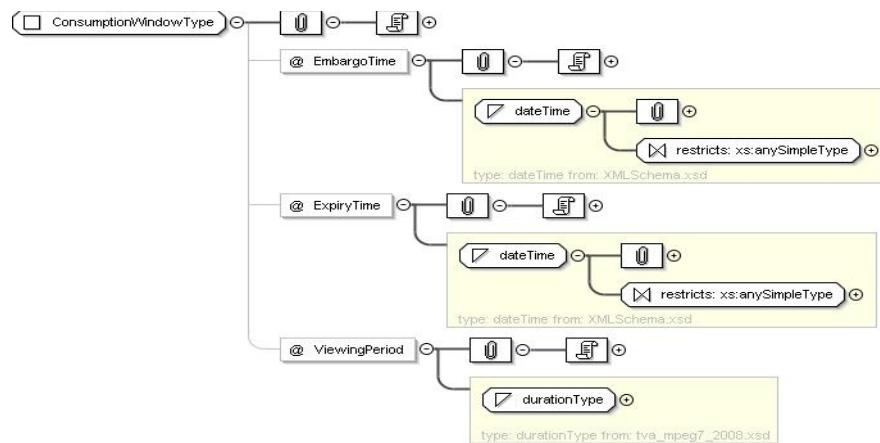
**Table B.3- 11 Profiling of “AvailabilityWindowType”**

XML schema field	Status	Comments
@AvailabilityStart	Optional	Uses dateTime format to carry information about start of availability for download content. Terminal should not try to download content before this time.
@AvailabilityEnd	Optional	Uses dateTime format to carry information about end of availability for download content. Terminal should not try to download content after this time.

### B.3.8.4.8 ConsumptionWindowType

The ConsumptionWindowType is used for the ConsumptionWindow element and carries information about the times when downloaded content can be viewed. Some download content will carry an embargo and expiry time set by the service provider, an attribute indicating how long the End-user has to complete viewing for a content item.

```
<xs:complexType name="ConsumptionWindowType">
    <xs:annotation>
        <xs:documentation>The period of time for which this content item is available for consumption following successful download. (Provided for information only; a separate DRM system is responsible for policing the consumption of the downloaded content item.)</xs:documentation>
    </xs:annotation>
    <xs:attribute name="EmbargoTime" type="xs:dateTime">
        <xs:annotation>
            <xs:documentation>Expressed as an XML schema dateTime.</xs:documentation>
        </xs:annotation>
    </xs:attribute>
    <xs:attribute name="ExpiryTime" type="xs:dateTime">
        <xs:annotation>
            <xs:documentation>Expressed as an XML schema dateTime.</xs:documentation>
        </xs:annotation>
    </xs:attribute>
    <xs:attribute name="ViewingPeriod" type="mpeg7:durationType">
        <xs:annotation>
            <xs:documentation>Expressed as an ISO 8601 period string.</xs:documentation>
        </xs:annotation>
    </xs:attribute>
</xs:complexType>
```

**Figure B.3- 18 Expansion of “ConsumptionWindowType”****Table B.3- 12 Profiling of “ConsumptionWindowType”**

XML schema field	Status	Comments
@EmbargoTime	Optional	Indicates the date after which the content can be viewed.
@ExpiryTime	Optional	Indicates the date after which the content cannot be viewed.
@ViewingPeriod	Optional	Indicates the length of time after the content is first viewed before it is expired.

#### B.3.8.4.9 ContentsCharacteristicsType

This complex element contains several extension elements describing the content item, the definition of the types used in this complex element are in [B.3.8.1](#).

```

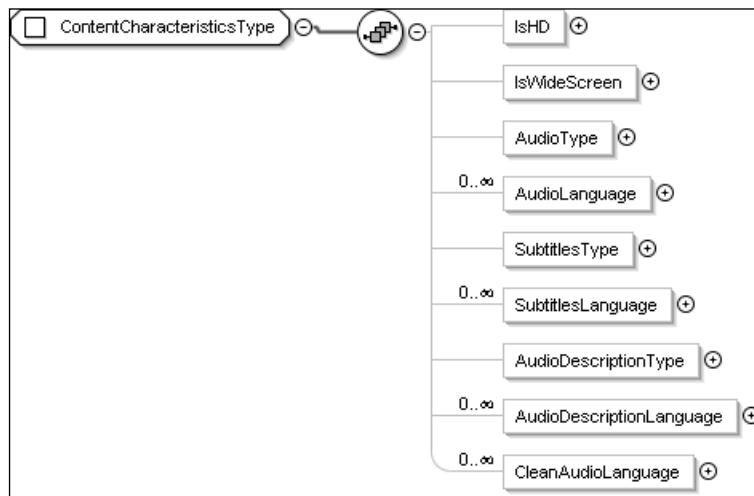
<xs:complexType name="ContentCharacteristicsType">
    <xs:sequence>
        <xs:element name="IsHD" type="xs:boolean" default="false" minOccurs="0">
            <xs:annotation>
                <xs:documentation>"true" indicates that video component is in High Definition format. Default is "false".</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="IsWideScreen" type="xs:boolean" default="true" minOccurs="0">
            <xs:annotation>
                <xs:documentation>"true" indicates that video component is intended to be presented in a 16:9 picture aspect ratio. Default is "true".</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="AudioType" type="AudioTypeType" minOccurs="0">
            <xs:annotation>
                <xs:documentation>Indicates the types of the audio components provided. No indication of correspondence of type to component is given.</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="AudioLanguage" type="xs:language" minOccurs="0" maxOccurs="unbounded">
            <xs:annotation>
                <xs:documentation>Indicates the languages for the audio components provided. No indication of correspondence of language to component type is given. Language coding is to RFC 3066 using a single ISO 639 "alpha-2" or "alpha-3" language code per element.</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="SubtitlesType" type="SubtitlesTypeType" minOccurs="0">
            <xs:annotation>
  
```

```

<xs:documentation>Indicates the type of the subtitle components provided. No indication of correspondence of type to component is given.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="SubtitlesLanguage" type="xs:language" minOccurs="0" maxOccurs="unbounded">
    <xs:annotation>
        <xs:documentation>Indicates the languages for the subtitle components provided. No indication of correspondence of language to component is given. Language coding is to RFC 3066 using a single ISO 639 "alpha-2" or "alpha-3" language code per element.</xs:documentation>
    </xs:annotation>
</xs:element>
<xs:element name="AudioDescriptionType" type="AudioDescriptionTypeType" minOccurs="0">
    <xs:annotation>
        <xs:documentation>Indicates the type of the audio description components provided. No indication of correspondence of type to component is given.</xs:documentation>
    </xs:annotation>
</xs:element>
<xs:element name="AudioDescriptionLanguage" type="xs:language" minOccurs="0" maxOccurs="unbounded">
    <xs:annotation>
        <xs:documentation>Indicates the languages for the audio description components provided, no indication of correspondence of language to component is given. Language coding is to RFC 3066 using a single ISO 639 "alpha-2" or "alpha-3" language code per element.</xs:documentation>
    </xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>

```

**Figure B.3- 19 Expansion of “ContentCharacteristicsType”**



**Table B.3- 13 Profiling of “ContentCharacteristicsType”**

<b>XML schema field</b>	<b>Status</b>	<b>Comments</b>
ContentCharacteristicsType		Grouping of extension elements describing the content item
IsHD	Optional	Boolean flag indicating whether the content item is in HD format. “True” indicates HD, default state = “False”, i.e. SD.
IsWideScreen	Optional	Boolean flag indicating whether the content item is in 16:9 format. “True” indicates widescreen, default state = “True”
AudioType	Optional	Attribute group of Boolean flags for mono, stereo and multi-channel. “True” indicates that an audio type is present and multiple bits can be set. Default = “False”. This is expanded in <a href="#">B.3.8.5.2</a> . There should only be a single instance of this.
AudioLanguage	Optional	Based on xs:language, and with language identifiers as defined in RFC1766 <a href="#">[25]</a> and RFC3066 <a href="#">[22]</a> using 2 or 3 character language codes. There may be multiple instances of this element if the content is multi-lingual.
SubtitlesType	Optional	Attribute group of Boolean flags for mono, stereo and multi-channel. “True” indicates that an audio type is present and multiple bits can be set. Default = “False”. This is expanded in <a href="#">B.3.8.5.3</a> There should only be a single instance of this.
SubtitlesLanguage	Optional	Based on xs:language, and with language identifiers as defined in RFC1766 <a href="#">[25]</a> and RFC3066 <a href="#">[22]</a> using 2 or 3 character language codes. There may be multiple instances of this element if the content is multi-lingual.
AudioDescriptionType	Optional	Attribute group of Boolean flags for mono, stereo and multi-channel. “True” indicates that an audio type is present and multiple bits can be set. Default = “False”. This is expanded in <a href="#">B.3.8.5.4</a> There should only be a single instance of this.
AudioDescriptionLanguage	Optional	Based on xs:language, and with language identifiers as defined in RFC1766 <a href="#">[25]</a> and

XML schema field	Status	Comments
		RFC3066 [22] using 2 or 3 character language codes. There may be multiple instances of this element if the content is multi-lingual.
CleanAudioLanguage	Optional	Based on xs:language, and with language identifiers as defined in RFC1766 [25] and RFC3066 [22] using 2 or 3 character language codes. There may be multiple instances of this element if the clean audio is provided in multiple languages.

### B.3.8.5 Other DTG defined Types

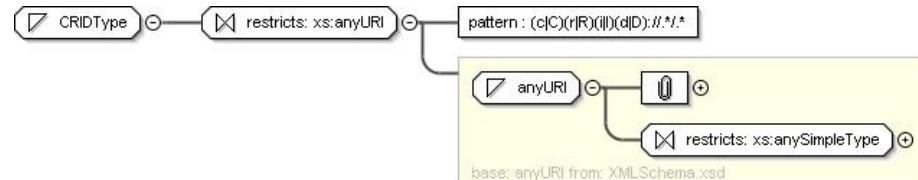
These types are used by the other higher level DTG defined Types specified in [B.3.8.4](#).

#### B.3.8.5.1 CRID Type

The CRIDType provides a generic definition based on a URI for identifiers for content items, groups and recommendations.

```
<xs:simpleType name="CRIDType">
    <xs:restriction base="xs:anyURI">
        <xs:pattern value="(c|C)(r|R)(i|I)(d|D)://.*/*"/>
    </xs:restriction>
</xs:simpleType>
```

**Figure B.3- 20 Expansion of “CRIDType”**



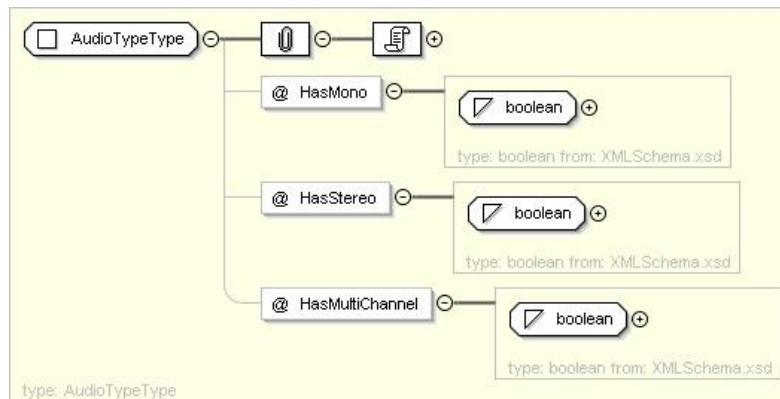
**Table B.3- 14 Profiling of “CRIDType”**

XML schema field	Status	Comments
CRIDType		Based on xs:anyURI with restrictions to the character set applied. ((c C)(r R)(i I)(d D)://.*/*)

#### B.3.8.5.2 AudioTypeType

This element contains a group of attributes defining the type of audio components present in the service.

```
<xs:complexType name="AudioTypeType">
    <xs:annotation>
        <xs:documentation>Indicates what type of audio components are included. Boolean attributes set to true if that type is carried. Multiple attributes may be set.</xs:documentation>
    </xs:annotation>
    <xs:attribute name="HasMono" type="xs:boolean" default="false"/>
    <xs:attribute name="HasStereo" type="xs:boolean" default="false"/>
    <xs:attribute name="HasMultiChannel" type="xs:boolean" default="false"/>
</xs:complexType>
```

**Figure B.3- 21 Expansion of “AudioTypeType”****Table B.3- 15 Profiling of “AudioTypeType”**

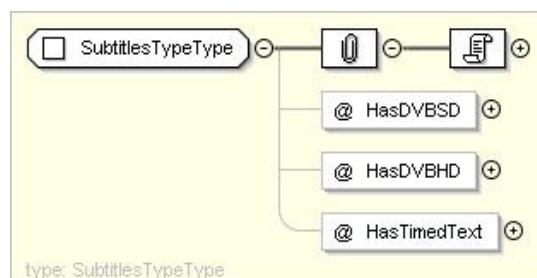
<b>XML schema field</b>	<b>Status</b>	<b>Comments</b>
AudioTypeType		Group of attributes indicating type of audio components present
HasMono	Optional	“True” indicates presence of one or more mono audio components. Default = “False”
HasStereo	Optional	“True” indicates presence of one or more stereo audio components. Default = “False”
HasMulti-Channel	Optional	“True” indicates presence of one or more multi-channel audio components. Default = “False”

### B.3.8.5.3 SubtitlesTypeType

This element contains a group of attributes defining the type of subtitles components present in the service.

```

<xs:complexType name="SubtitlesTypeType">
    <xs:annotation>
        <xs:documentation>Indicates what type of subtitle components are included. Boolean attributes set to true if that type is carried. Multiple attributes may be set.
        </xs:documentation>
    </xs:annotation>
    <xs:attribute name="HasDVBSD" type="xs:boolean" default="false"/>
    <xs:attribute name="HasDVBHD" type="xs:boolean" default="false"/>
    <xs:attribute name="HasTimedText" type="xs:boolean" default="false"/>
</xs:complexType>
  
```

**Figure B.3- 22 Expansion of “SubtitlesTypeType”**

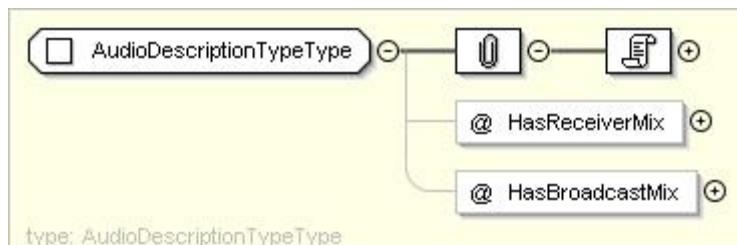
**Table B.3- 16 Profiling of “SubtitlesTypeType”**

<b>XML schema field</b>	<b>Status</b>	<b>Comments</b>
AudioTypeType		Group of attributes indicating type of subtitles present
HasDVBSD	Optional	“True” indicates presence of one or more subtitles components using DVB SD format. Default = “False”
HasDVBHD	Optional	“True” indicates presence of one or more subtitles components using DVB HD format. Default = “False”
HasTimedText	Optional	“True” indicates presence of one or more subtitles components using timed text method. Default = “False”

### B.3.8.5.4 AudioDescriptionTypeType

This element contains a group of attributes defining the type of audio description components present in the service.

```
<xs:complexType name="AudioDescriptionTypeType">
  <xs:annotation>
    <xs:documentation>Indicates what type of audio description components are included. Boolean attributes set to true if that type is carried. Multiple attributes may be set.</xs:documentation>
  </xs:annotation>
  <xs:attribute name="HasReceiverMix" type="xs:boolean" default="false"/>
  <xs:attribute name="HasBroadcastMix" type="xs:boolean" default="false"/>
</xs:complexType>
```

**Figure B.3- 23 Expansion of “AudioDescriptionTypeType”****Table B.3- 17 Profiling of “AudioDescriptionTypeType”**

<b>XML schema field</b>	<b>Status</b>	<b>Comments</b>
AudioDescriptionTypeType		Group of attributes indicating type of audio description present
HasReceiverMix	Optional	“True” indicates presence of one or more audio description components requiring

<b>XML schema field</b>	<b>Status</b>	<b>Comments</b>
		receiver mix capability in the Terminal. Default = "False"
HasBroadcastMix	Optional	"True" indicates presence of one or more audio description components using broadcast mix. Default = "False"

## B.4 Connected TV Presentation

### B.4.1 References

- [8] [OIPF2 HAS] Open IPTV Forum Release 2 specification, volume 2a (V2.0): "HTTP Adaptive Streaming".
- [14] [OIPF2] Open IPTV Forum Release 2 specification, volume 5 (V2.0): "Declarative Application Environment".
- [13] Open IPTV Forum Release 1 specification, volume 5 (VI.1.1): "Declarative Application Environment".
- [23] ETSI TS 102 796 (VI.1.1): "Hybrid Broadcast broadband TV".
- [26] W3C, HTML5 -A vocabulary and associated APIs for HTML and XHTML, Working Draft 24 June 2010  
W3C Working Draft 24 June 2010, <http://www.w3.org/TR/2010/WD-html5-20100624/>
- [27] HTML 5 Canvas 2D Context, W3C Working Draft 24 June 2010, <http://www.w3.org/TR/2010/WD-2dcontext-20100624/>,
- [28] WebGL Specification, Kronos Group Working draft June 10th 2010,  
<https://cvs.khronos.org/svn/repos/registry/trunk/public/webgl/doc/spec/WebGL-spec.html>
- [29] CSS3 Basic User Interface Module W3C Candidate Recommendation 11 May 2004,  
<http://www.w3.org/TR/2004/CR-css3-ui-20040511>
- [30] CSS Color Module Level 3, W3C Working Draft 21 July 2008, <http://www.w3.org/TR/2008/WD-css3-color-20080721>
- [31] CSS Backgrounds and Borders Module Level 3 W3C Working Draft 12 June 2010,  
<http://www.w3.org/TR/2010/WD-css3-background-20100612>
- [32] CSS Transitions Module Level 3 W3C Working Draft 01 December 2009,  
<http://www.w3.org/TR/2009/WD-css3-transitions-20091201>
- [33] CSS Animations Module Level 3 W3C Working Draft 20 March 2009, <http://www.w3.org/TR/2009/WD-css3-animations-20090320>
- [34] CSS 2D Transforms Module Level 3, W3C Working Draft 01 December 2009,  
<http://www.w3.org/TR/2009/WD-css3-2d-transforms-20091201>
- [35] CSS 3D Transforms Module Level 3, W3C Working Draft 20 March 2009,  
<http://www.w3.org/TR/2009/WD-css3-3d-transforms-20090320>
- [36] TS 102 809 "Digital Video Broadcasting (DVB); Signalling and carriage of interactive applications and services in Hybrid broadcast/broadband environments"
- [37] TS 102 851 "Digital Video Broadcasting (DVB);Uniform Resource Identifiers (URI) for DVB Systems"
- [38] Cascading Style Sheets Level 2 Revision 1 (CSS 2.1) Specification, W3C
- [39] Document Object Model (DOM) Level 2 Style Specification, W3C  
<http://www.w3.org/TR/2000/REC-DOM-Level-2-Style-20001113/>
- [40] CSSOM View module, W3C Working Draft 4 August 2011  
<http://www.w3.org/TR/cssom-view/>)

## B.4.2 Application Model, Lifecycle and Signalling

### B.4.2.1 Lifecycle

#### B.4.2.1.1 Introduction

The Application Lifecycle model is based around the key concepts of Application State and Application Display Mode.

- The Application State defines the extent to which users can interact with the Application.
- The Application Display Mode defines how the system should display the Application when there are one or more Applications in existence.

Applications shall have a valid combination of Application State and Application Display Mode at all times during their lifecycle. Presentation technologies need to define which combinations of states and Display Modes are applicable to Applications in that technology.

An Application's State can be set and modified by the system and by the Application itself throughout the lifecycle of the Application. An Application's Display Mode is static during its lifetime.

In most cases, an Application's State is independent of its Display Mode, but some combinations of States and Display Modes are invalid.

Native Applications (e.g. a native EPG) that are not governed by this lifecycle model are outside the scope of this document.

This specification does not include the concept of a parent-child relationship between Applications where the children are automatically terminated when the parent terminates.

#### B.4.2.1.2 Application Display Stack

Applications shall be displayed in an Application Display Stack that allows multiple Applications to be stacked on top of Full-screen Video.

Each Application shall own a single, logical Display that shall occupy a single position within the Display Stack.

An Application's Display shall be able to change position within the Display Stack during the lifecycle of the Application as a result of the Application changing State as described in the following sections.

The Application Display Stack shall be arranged as [Figure B.4- 1:](#)

**Figure B.4- 1 Application Display Stack**



Some presentation technologies may include video and subtitles as being part of their logical display, either in addition to, or instead of, Full-screen video; for example, a video object embedded in a page with the same z-order as the rest of the page. Presentation technologies shall define which of these are applicable to video in their individual technologies.

Subtitles (where rendered by the system software) and video shall always be considered as an inseparable pair in the logical display.

How the Application Display Stack is mapped to the physical display hardware is outside the scope of this document.

When an Application becomes Active, the system shall move it to the top of the Application Display Stack, such that it is visible to the End-user; unless it is overlaid by a Passive Application.

Subsequent behaviour is described in the framework presented below.

### B.4.2.1.3 Application States

Applications States define the extent to which users can interact with Applications when there are multiple Applications co-existing. During its lifecycle, an Application may transition between a number of defined States, thus allowing different levels of user interaction.

Applications shall always have a valid State defined, and can only exist in a single State at any time.

Presentation technologies may support Applications that are aware of their state and are able to adapt their behaviour accordingly. Such presentation technologies need to define a mechanism to allow Applications to be notified of changes in their state.

Application State transitions may either be requested by Applications or enforced by the system.

#### B.4.2.1.3.1 Active State

The Application in the Active State shall be the primary Application with which the End-user is interacting. At most only one Application shall be on the Active State at any time. It shall have the input focus and its graphics shall be displayed at the top of the Application Display Stack unless overlaid by a Passive Application.

The Application in the Active State shall receive all the User Input Events in the Application's current Key Set except for transient interruptions such as broadcast triggered native applications (see [B.4.2.3.5](#)), notifications (see section [B.4.2.6](#)) and other system functions.

Applications shall be launched into the Active State by default, unless any of the following are true:

- The Application is signalled to launch in a State other than Active, as defined by the Application State and Display Mode descriptor in [B.4.2.3.4](#).
- The newly launched Application is broadcast-related and the Active Application is either 1) broadcast-independent or 2) showing broadcast-delivered video scaled to other than full screen size or offset from the default position. In this case the Application starts in the Inactive State.
- The Application is launched by the Active Application but the Active Application requests it to be launched Inactive or Hidden.

It is optional for Presentation technologies to enable a launching Application to specify the initial State of any Applications that it launches.

Presentation technologies that are state-aware may include a mechanism to allow non-Active Applications to request that they are made Active. Where a presentation

technology does not include this functionality. Applications that are not Active shall only be able to become Active when no other Application is in front of them in the Display Stack or when the End-user accepts a notification.

If the Active Application exits or removes itself from the Display Stack (e.g. transitions to the Hidden State) then the next Application in the Application Display Stack shall become Active. This may result in there not being any Active Application.

The following table defines the valid Display Modes for Applications in the Active State.

**Table B.4- 1 Valid Display Modes for Applications in the Active State**

	Exclusive	Exclusive-Overlayable	Overlay
<b>Active</b>	Yes	Yes	Yes

#### B.4.2.1.3.2 Inactive State

Applications that are running and not Hidden, but are not the primary Application with which the End-user is interacting shall be in the Inactive State.

Inactive Applications do not have focus; however they shall be able to receive certain User Input Events as described in section .

The Display of Inactive Applications shall be below the display of the Active Application in the Application Display Stack.

When an Application is Activated, the previously Active Application shall either enter the Inactive State or be terminated if it is not permitted to run in the Inactive State as defined by the combinations of States and Display Modes defined for that presentation technology and by the application\_state\_and\_mode\_descriptor as defined in B.4.2.3.4.

This specification does not require any specific behaviour of Applications on becoming Inactive. For example, Applications may continue to connect to servers over the broadband network, render graphics or respond to events such as timers.

The following table defines the valid Display Modes for Applications in the Inactive State.

**Table B.4- 2 Valid Display Modes for Applications in the Inactive State**

	Exclusive	Exclusive-Overlayable	Overlay
<b>Inactive</b>	Yes	Yes	Yes

### B.4.2.1.3.3 Hidden State

Applications in the Hidden State are not included in the Display Stack. They shall not be visible and shall not become visible without leaving the Hidden State. They shall not receive User Input Events (except via Notifications as defined in section 0).

Presentation technologies that are state-aware may include a mechanism to allow Applications to request that they are made Hidden and may permit Applications to be launched directly into the Hidden state.

Transitioning to and from the Hidden State shall only happen following a request by an Application. This transition shall not be enforced by the Terminal.

On entering the Hidden State, the Application Display, including video, shall be removed from the Display Stack.

**NOTE:** This State is not suitable for Applications that wish to present audio or video without displaying any graphics for editorial reasons.

Applications that wish to run in the background without displaying any graphics should request a transition to the Hidden State. When they wish to display graphics, they must transition to the Active State in order to do so.

The following table defines the valid Display Modes for Applications in the Hidden state.

**Table B.4- 3 Valid Display Modes for Applications in the Hidden State**

	Exclusive	Exclusive-Overlayable	Overlay
<b>Hidden</b>	Yes	Yes	Yes

### B.4.2.1.3.4 Passive State

The Passive State shall allow Applications to be displayed on top of the Active Application. Applications in the Passive State cannot be focussed, and as such shall only receive User Input Events as defined in section B.4.2.2.1 Application Key Set.

Presentation technologies that are state-aware and support the Passive State shall include a mechanism to allow non-Passive Applications to request that they are made Passive.

Transitioning to the Passive State shall only be performed on request of the Application. There is no requirement for the system to be able to move an Active or Inactive Application to the Passive State.

The following table defines the valid Display Modes for Applications in the Passive State.

**Table B.4- 4 Valid Display Modes for Applications in the Passive State**

	Exclusive	Exclusive-Overlayable	Overlay
<b>Passive</b>	No	No	Yes

#### B.4.2.1.4 Application Display Modes

Application Display Modes define how the Terminal shall present Applications when there are multiple Applications co-existing.

An Application's Display Mode shall be static during its lifetime.

Presentation technologies shall define a default combination of State and Display Mode for newly-launched Applications. This may be overridden by the signalling defined in [B.4.2.3.4](#).

Some presentation technologies may include an API that permits an Application which launches a second Application to override the default State and Display Mode of the launched Application.

Some presentation technologies may only support a limited set of Display Modes. For example, MHEG only supports the Exclusive and Exclusive-Overlayable Display Modes.

##### B.4.2.1.4.1 Exclusive Display Mode

Applications in Exclusive Display Mode shall not visually co-exist with other Active or Inactive Applications.

Applications in Exclusive Display Mode shall not overlay other Applications, and can only be overlaid by Passive Applications.

An Application in Exclusive Display Mode shall fully obscure all Applications below it in the Display Stack. An Application in Exclusive Display Mode that includes transparency shall be transparent through to either Full-screen video, where present, or the background.

Exclusive Applications that are behind anything other than a Passive Application in the Display Stack shall be invisible even if not fully obscured by Applications in front of them.

This Display Mode is typically used where Applications are associated with video in the background that should not be obscured by other Applications below them.

The following table describes how Application States shall be interpreted for Applications in the Exclusive Display Mode.

**Table B.4- 5 Application States in the Exclusive Display Mode**

	Active	Inactive	Hidden	Passive
<b>Exclusive</b>	Applications behind this Application are not visible. Only Passive Applications can overlay this one.	Exclusive Applications that are behind anything other than a Passive Application in the Display Stack are not visible.	Graphics and A/V not presented. User Input Events not received.	A Passive Application cannot have exclusive screen access.

#### B.4.2.1.4.2 Exclusive-Overlayable Display Mode

Applications in Exclusive-Overlay Display Mode shall not visually co-exist with Applications below it in the Display Stack but may be overlaid by Applications above it.

Applications in Exclusive-Overlayable Display Mode can be overlaid by Applications in Overlay Display Mode which are above it in the Display Stack.

An Application in Exclusive-Overlayable Display Mode that includes transparency shall be transparent through to either Full-screen video, where present, or the background.

The following table describes how Application States shall be interpreted for Applications in the Exclusive-Overlayable Display Mode.

**Table B.4- 6 Application States in the Exclusive-Overlayable Display Mode**

	<b>Active</b>	<b>Inactive</b>	<b>Hidden</b>	<b>Passive</b>
<b>Exclusive-Overlayable</b>	This Application can be overlaid by other Applications. When Applications are activated in this mode, existing Applications shall not be visible except for Passive Applications.	Transitioning to the Inactive state has no effect on the Application.	Graphics and A/V not presented. User Input Events not received.	A Passive Application should not have exclusive screen access. Passive Applications should be small, unobtrusive overlays.

#### B.4.2.1.4.3 Overlay Display Mode

Applications in Overlay Display Mode may visually co-exist with Applications in Exclusive-Overlay or Overlay Display Modes.

Applications launched or Activated in Overlay Display Mode shall have no effect on the display of Passive Applications.

The following table describes how Application States shall be interpreted for Applications in the Overlay Display Mode.

**Table B.4- 7 Application States in the Overlay Display Mode**

	<b>Active</b>	<b>Inactive</b>	<b>Hidden</b>	<b>Passive</b>
<b>Overlay</b>	Applications in Overlay Display Mode can sit anywhere in the Application Display Stack. When Activated they should move in front of Active and Inactive Applications in the Display Stack and have no effect on Passive Applications.	Transitioning to the Inactive state has no effect on the Application.	Graphics and A/V not presented. User Input Events not received.	Applications in Passive State will typically be in the Overlay Display Mode. This supports tickers, volume control Applications and other overlays which require limited or no user input and don't affect the focus of other Applications.

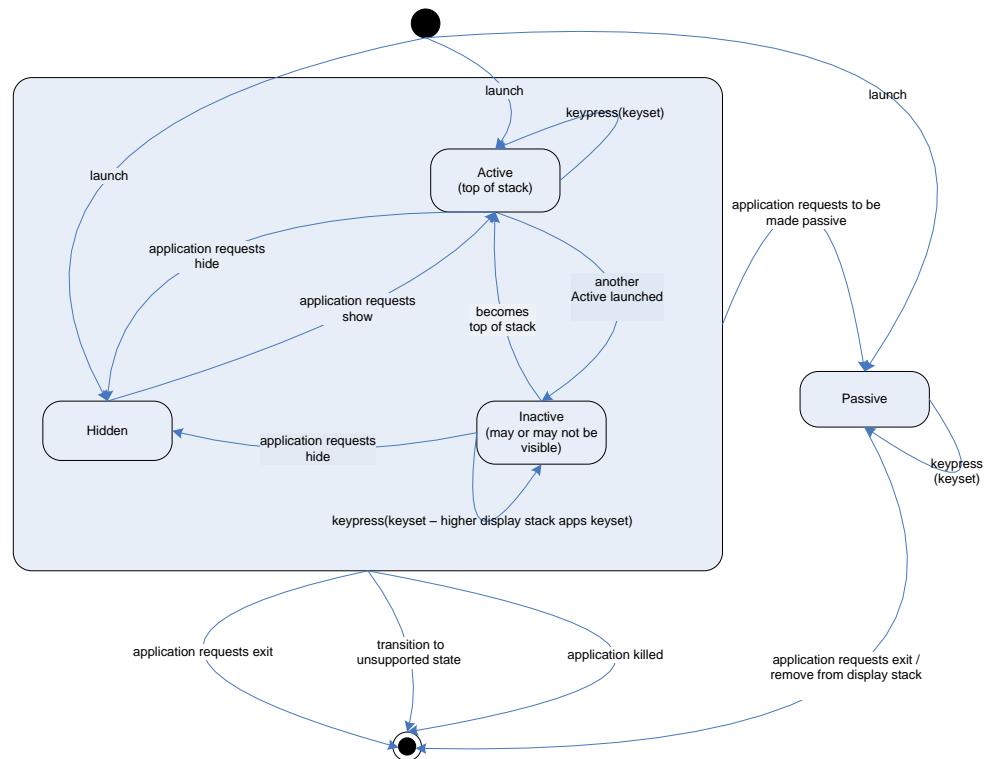
#### B.4.2.1.5 Application State / Display Modes

The following table defines which combinations of States and Display Modes are valid in this model. As defined in [B.4.2.1.1](#), presentation technologies may further restrict the set of valid combinations.

**Table B.4- 8 Valid Combinations of States and Display Modes**

	Display Mode		
	Exclusive	Exclusive-Overlayable	Overlay
Active	Yes	Yes	Yes
Inactive	Yes	Yes	Yes
Passive	No	No	Yes
Hidden	Yes	Yes	Yes

The following diagram depicts the allowable state transitions.

**Figure B.4- 2 State Transitions Diagram**

### B.4.2.1.6 Launching and terminating Applications

It shall be possible to launch Applications in the following ways:

- In response to signalling in a Broadcast Service (e.g. automatically starting a broadcast-related auto-start Application as defined in section [B.4.2.3.1](#)- Broadcast-delivered signalling).
- By an already running Application. Presentation technologies shall include a mechanism to allow one Application to start another Application. The details of this mechanism (e.g. API call) will be presentation technology specific.

It may also be possible to launch Applications by other means, including but not limited to:

- Directly by the End-user (e.g. by using dedicated user control functions or an equivalent menu provided by the Terminal).
- On device start-up (e.g. the initial Application of a Platform Operator).

The details of these are outside the scope of this specification.

The signalling described in sections [B.4.2.3.1](#)- and [B.4.2.3.2](#) shall enable the same Application (as identified by organisation\_id and application\_id) to be signalled in more than one presentation technology in which case, launching the Application shall be handled by Terminals as follows:

- If a Terminal supports only one of the presentation technologies in which the Application is signalled then that version of the Application shall be used.
- If a Terminal supports more than one of the presentation technologies in which the Application is signalled then except as defined below, the highest priority version of that Application shall be used. Priority shall be defined by the Priority field in the case of broadcast signalling and the Priority field in the Application Descriptor in the case of Broadband Signalling. If all of the following apply then a lower priority version of an application shall be started:
  - If the presentation engine required for the highest priority supported version of an Application is not running and starting it would require stopping the presentation engine used for a currently running Application.

NOTE: This specification does not define requirements for simultaneous support of presentation technologies.

- a lower priority version of the Application is available in a supported presentation technology which can be started without stopping a currently running Application
- If the terminal supports any of the presentation technologies in which an Application is signalled then MHEG-5 Applications signalled according to D-Book Part A [\[1\]](#) section 17.4 shall not be launched, as defined by [B.4.3.2.2](#) Coexistence of Classical and AIT Signalling.

It shall be possible to terminate an Application in the following ways:

- In response to signalling in a Broadcast Service as defined in section [B.4.2.3.1](#)- Broadcast-delivered signalling for Applications that are controlled by Broadcast Signalling.
- By an already running Application. Presentation technologies shall include a mechanism to allow an Application to stop itself and may include a mechanism to allow one Application to stop other Applications. The details of this mechanism (e.g. API call) will be presentation technology specific.
- By the Terminal, under error conditions e.g. lack of resources.

Applications may be stopped directly by the End-user; however this is not required to be supported by this specification.

When an Application in one Presentation Technology launches another Application in a different Presentation Technology, the launching process shall be considered to have succeeded when the first file of the launched Application has been fetched and has been validated as being well formed as defined by the Presentation Technology. Presentation Technologies shall define what “well formed” means for that technology and any more specific rules that may apply when launching applications within that technology.

### B.4.2.1.7 Relation of Applications to Broadcast

#### B.4.2.1.7.1 General

Applications shall be classified as either Broadcast-related or Broadcast-independent as follows:

- Broadcast-related Applications. These are signalled as part of a Broadcast Channel as defined in [section B.4.2.3.1](#)- Broadcast-delivered signalling.
- Broadcast-independent Applications. These are either not signalled at all or are signalled as in [section B.4.2.3.2](#)- Broadband-delivered signalling.

The lifecycle of both of these is described in more detail below.

Presentation technologies may support either one or both of these classifications and, where both are supported, may enable Applications to transition between them as described below.

#### B.4.2.1.7.2 Broadcast-Related Applications

Broadcast-related Applications shall be launched as follows:

- By other Applications using the presentation-technology specific mechanism referred to above that allows one Application to launch another. The Application to be launched shall be identified using the form of the 'dvb:' URL including the organisation\_id and application\_id as defined in section 6.3.1 of TS 102 851 [\[37\]](#).
- Specifically, where an Application is launched from an MHEG Application using the ApL ResidentProgram mechanism it inherits the broadcast-related trust level from the MHEG Application which was launched from a trusted source (i.e. the broadcast service) and so shall be broadcast-related unless it explicitly transitions to be broadcast-independent. See section [B.4.3.1.2.1](#).
- Under the control of broadcast-delivered signalling (see section [B.4.2.3.1 Broadcast-delivered signalling](#)). Presentation technologies supporting broadcast-related applications shall define a mapping from this signalling to the lifecycle of applications in their technology.

If more than one autostart Application is signalled at a time, only the highest priority one shall be started. Broadcasters should not signal more than one autostart Application of the same presentation technology at a time.

MHEG applications may be signalled for launch as defined by [\[1\]](#) D-Book Part A section 17.4 subject to conditions defined in [B.4.2.1.6](#).

#### B.4.2.1.7.3 Broadcast-independent Applications

Broadcast-independent Applications shall be launched as follows;

1. By other Applications using the presentation-technology specific mechanism, referred to above, that allows one Application to launch another.
2. By other mechanisms outside the scope of this specification, including but not limited to portals provided by a manufacturer or provisioned by a Platform Operator.

In the first of these, the Application to be launched shall be referenced either;

1. Directly by an HTTP or HTTPS URL that references the initial file or object for the Application; Presentation Technologies shall define what this initial file or object is in the context of their technology, or
2. Indirectly by an HTTP or HTTPS URL that references an XML AIT (see section [B.4.2.3.2- Broadband-delivered signalling](#)) that, in turn, references the initial file or object for the Application.

Where the URL refers directly to the entry point for an Application, the Broadcast-independent Application shall be created without an org\_id or app\_id. Presentation technologies may derive other behaviour from this URL, e.g. based on the fully qualified domain of the URL. The supported combinations of Application States and Display Modes shall be the defaults for the launched Application's Presentation Technology.

Where the URL refers to an XML AIT, the Broadcast-independent Application shall be created with the org\_id and app\_id that is specified in the XML AIT.

Presentation technologies that support both Broadcast-related and Broadcast-independent Applications may support Broadcast-independent Applications becoming Broadcast-related as defined in [\[23\] TS 102 796](#) section 6.2.2.6. Where a technology supports this feature, it shall be defined how the last of the conditions in that section is mapped into that technology.

#### B.4.2.1.7.4 Overlay of Broadcast Video

Broadcast-related Applications shall be able to overlay video from a broadcast channel that they are signalled as part of.

By default, broadcast-independent applications shall not be able to overlay broadcast video. Exceptions may be made, e.g. by a white-list mechanism. These exceptions are outside the scope of this specification.

## B.4.2.2 Resource management

### B.4.2.2.1 Application Key Set

An Application's Key Set defines the set of User Input Events that the Application shall be capable of receiving when the Application is in the Active or Passive states. Presentation technologies may also support Applications receiving User Input Events when in the Inactive State. This may be defined as part of the presentation technology or may be defined by an API call or signalling.

The system shall apply a default Key Set to each Application that is launched and allow the default Key Set to be configured by that Application. If an Application receives User Input Events when in the Inactive State then it may change the current Key Set on transition to or from that State.

Presentation technologies shall include a mechanism to allow an Application to request changes to its Key Set, allowing an Application to dynamically change its Key Set during its lifecycle.

Keys are delivered to the first Application that includes that key in its current Key Set, starting from the top of the Display Stack and working down, i.e. in the following order; 1) Passive Applications, 2) the Active Application and then 3) Inactive Applications (where supported by the Presentation Technology). Once delivered to an Application, User Input Events shall be consumed by that Application and shall not be delivered to any other Applications.

User Input Events beyond those defined by Group 6 in section 13.6 (e.g. GUIDE) may be restricted to only being available to Privileged Applications (see [B.5.9.2](#)) or Applications outside the scope of this model. These User Input Events shall be ignored if found in the Key Set of Unprivileged Applications. The set of User Input Events to which this applies is outside the scope of this specification.

If the Presentation Technology used by the Active Application requires certain User Input Events to be delivered to the Presentation Engine then these shall be delivered to the Presentation Engine even if they are included in an Inactive Application's Key Set.

Presentation Technologies shall define any User Input Events to which this applies and how they are handled by the Presentation Engine once delivered to it.

If an Application has enabled Broadcaster Interruptions, as defined in [B.4.2.3.5](#), then it may not receive all the User Input Events it expects – equivalent to that defined for MHEG in [\[I\]](#) D-Book Part A section 13.10.8.5. Note that at the present time only the use of the green button is defined, see [\[I\]](#) D-Book Part A sections 8.5.11 and 8.12.

#### B.4.2.2.2 Other resources

When an Active Application requests or requires one or more of the following resources that are being used by any other Application, they shall be assigned to the Active Application:

- Audio decoder
- Video decoder
- Tuner
- Demultiplexer
- CICAM
- AES decryption unit (for streaming content)

Passive applications are not excluded from requesting the above resources however they shall always have a lower priority than all Active and Inactive Applications in the event of any conflicts for resources.

The handling of any conflict between Active and Inactive Applications for CPU time, memory and other resources is outside the scope of this specification.

Audio volume and video scaling / position are not considered to be resources associated with the audio and video decoders.

#### B.4.2.3 Signalling

##### B.4.2.3.1 Broadcast-delivered signalling

This shall be as defined in section 7.2.3.1 of TS 102 796 [23] with the following notes, modifications and clarifications:

- In order for Applications in a presentation technology to be signalled in the broadcast channel, the following need to be defined:
  - An Application Type registered with the DVB Project.
  - Which Application control codes are applicable for that technology.
  - Whether and how the simple application boundary descriptor is applicable.
  - The values to be encoded in the application\_profile, version.major, version.minor and version.micro fields of the Application Descriptor (see section 5.2.5.2 of TS 102 809 [36]) for that presentation technology.
- An Application priority shall be supported and used as defined in section B.4.2.1.6.

Terminals shall monitor for broadcast signalling while either of the following apply:

5. Any broadcast-related applications are running
6. Any broadcast-delivered video is being presented to the End-user

### B.4.2.3.2 Broadband-delivered signalling

This shall be as defined in section 7.2.3.2 of TS 102 796 [23] with the following notes, modifications and clarifications:

- In order for Applications in a presentation technology to be signalled over broadband, the following shall be defined:
  - An Application Type to be used for the type field of the applicationDescriptor.
  - The values to be used in the profile, versionMajor, versionMinor and versionMicro fields of the MhpVersion type (see section 5.2.5.3 of TS 102 809 [36]).
  - NOTE: For presentation technologies which are to be used with both Broadcast-delivered signalling and Broadband-delivered signalling, the usage of the fields in the MhpVersion type shall be aligned with the uses of the application\_profile, version.major, version.minor and version.micro fields of the Application Descriptor in the broadcast-delivered signalling.
- The Priority Field in the applicationDescriptor shall be supported and used as defined in section 0.

### B.4.2.3.3 Signalling of Hybrid Application

Receivers shall support the behaviour mandated in TS 102 796 [23] section 6.2.2.5 except as follows:

In 6.2.2.5.3, the second bullet point shall read “Available only through broadband: the Terminal shall display an error message unless the application was either launched as autostart (e.g. following a channel selection or AIT update) or launched by another application”.

### B.4.2.3.4 Application State and Display Mode Descriptor

#### B.4.2.3.4.1 General

These extensions enable Applications to signal their capabilities with respect to combinations of States and Display Modes. Terminals shall not launch an Application in a State and Display Mode combination not signalled except as follows;

- Terminals not supporting the Overlay Display Mode shall instead put Applications in the Exclusive-Overlayable Mode (if supported) even if that is not signalled.
- Terminals not supporting both the Overlay and Exclusive-Overlayable modes shall instead launch Applications in the Exclusive Mode (if supported) even if that is not signalled.

Although these extensions permit signalling any of the valid combinations of Application State and Display Modes defined in this specification, not all of those may be available on all Terminals or with all presentation technologies. If the initial State and Display Mode combination is not available then an Application shall not be started (except as defined above) – even if some of the other States and Display Modes signalled are available.

Note that Platform Operators may impose requirements on Applications signalled as being prepared for particular States or Display Modes. For example;

- Applications signalled as being capable of running in the Inactive State should not offer the End-user choices with time-outs as the Application may be obscured, or it may take the end-user too long to switch it into the active State.
- Applications signalled as capable of running in the Hidden Application State should be careful about their use of processor time, memory, images and other resource consuming features.

#### B.4.2.3.4.2 MPEG-2 Encoding

This descriptor signals the initial State and Display Mode for an Application and those combinations of States and Display Modes that an Application supports.

**Table B.4- 9 Application State and Display Mode descriptor syntax**

	No. of bits	Identifier
application_state_and_mode_descriptor() {		
descriptor_tag	8	Uimsbf
descriptor_length	8	Uimsbf
display_mode	2	Uimsbf
initial_state	3	Uimsbf
supported_states	8	Uimsbf
reserved	3	Uimsbf
}		

**descriptor\_tag:** This 8 bit integer with value 0x71 shall identify this descriptor.

**descriptor\_length:** This 8 bit field shall indicate the number of bytes following the descriptor length field.

**display\_mode:** The display mode for the application. The value shall be encoded as defined in the below.

**Table B.4- 10 Encoding of Display Modes**

Display Mode	Encoding
Exclusive	0
Exclusive-Overlayable	1
Overlay	2
reserved	3

**initial\_state:** The initial state for the application. The value shall be encoded as defined in Encoding column in the table below.

**supported\_states:** The states which an application may run in. The value shall be encoded as defined in Bit-Mask column in the table below.

**Table B.4- 11 Encoding of Application States**

State	Bit-mask	Encoding
Active	0000 0001	0
Inactive	0000 0010	1
Hidden	0000 0100	2
Passive	0000 1000	3
reserved	???? 0000	4-7

Platform operators may define rules or guidelines that Applications must comply with before they can be signalled as able to run in the Inactive or Passive States. For example, use of processor time, memory, images and other resource consuming features.

**reserved:** This 4 bit field is reserved for future use.

#### B.4.2.3.4.3 XML Encoding

This shall signal the initial State and Display Mode for an Application and those combinations of States and Display Modes that an Application supports.

```
<complexType name="CTV_application">
  <complexContent>
    <extension base="mis:Application">
      <xsd:sequence>
        <xsd:element name="ApplicationStatesAndModes"
          type="ApplicationStateAndMode" minOccurs="0"/>
        <xsd:element name="InitialStateAndMode"
          type="ApplicationStateAndMode" maxOccurs="1"/>
      </xsd:sequence>
    </extension>
  </complexContent>
</complexType>

<xsd:simpleType name="ApplicationStateAndMode">
  <xsd:restriction base="xsd:string">
    <xsd:enumeration value="ACTIVE+EXCLUSIVE"/>
    <xsd:enumeration value="ACTIVE+EXCLUSIVE-OVERLAYABLE"/>
    <xsd:enumeration value="ACTIVE+OVERLAY"/>
    <xsd:enumeration value="INACTIVE+EXCLUSIVE"/>
    <xsd:enumeration value="INACTIVE+EXCLUSIVE-OVERLAYABLE"/>
    <xsd:enumeration value="INACTIVE+OVERLAY"/>
    <xsd:enumeration value="INACTIVE+HIDDEN"/>
    <xsd:enumeration value="PASSIVE+OVERLAY"/>
    <xsd:enumeration value="PASSIVE+HIDDEN"/>
  </xsd:restriction>
</xsd:simpleType>
```

#### B.4.2.3.5 Handling of Broadcast Triggered Native Applications

Presentation Technologies shall define a mechanism for Applications to indicate whether Broadcaster interruptions (as defined in D-Book Part A [I] section 8.5.1) are permitted or not and defaults for this. The value set for the Active Application shall be used by the system including when the Active Application changes.

## B.4.2.4 Presentation Technology Specific Details

Presentation technologies shall implement all of the Mandatory features and concepts and may implement the optional ones in the table below in order to be integrated into the Application framework provided by this specification. This table also defines the functions and concepts that shall be implemented by HTML and MHEG presentation technologies.

**Table B.4- 12 Features or Concepts to be specified for a presentation technology**

Feature or concept	Mandatory or optional	References	HTML	MHEG
The combinations of States and Display Modes that are applicable to the presentation technology.	Mandatory	<a href="#">B.4.2.1.1- Introduction</a>	All combinations of Active, Inactive, Hidden states with Overlay and Exclusive modes, i.e. not Passive or Exclusive-Overlayable	Active, Inactive, states, Exclusive, Exclusive-Overlayable modes
Whether video and subtitles are part of an Application's logical display or use the Full-screen video plane in the Display Stack or both.	Mandatory	<a href="#">B.4.2.1.2- Application Display Stack</a>	In general, video and subtitles are part of an Application's logical display. The exception to this is video controlled by the Terminal as defined in section 10.1.2 of TS 102 796 [23].	Video and subtitles are part of an Application's logical display.
Whether or not the presentation technology is state-aware.	Mandatory	<a href="#">B.4.2.1.3 Application states</a>	The HTML specification permits state-aware Applications but does not require Applications to be state-aware.	For the purposes of this specification MHEG is considered not state aware.

<b>Feature or concept</b>	<b>Mandatory or optional</b>	<b>References</b>	<b>HTML</b>	<b>MHEG</b>
A mechanism to allow an Application to be notified of a change in its State.	Mandatory if the presentation technology is state-aware	<a href="#">B.4.2.1.3- Application states</a>	The onApplicationTopmost, onApplicationNotTopmost, onApplicationShown and onApplicationHidden events on the Application object. See also section B.4.6.4.	Not supported
A mechanism to allow non-Active Applications to request that they are made Active.	Optional	<a href="#">B.4.2.1.3.1- Active State</a>	Application.show()	Not supported
A mechanism to allow a launching Application to specify the initial State of any Applications that it launches	Optional	<a href="#">B.4.2.1.3.1- Active State</a>	Not supported	Not supported
A mechanism to allow Active Applications to request that they are made Hidden	Optional	<a href="#">B.4.2.1.3.3- Hidden State</a>	Application.hide () causes a transition to Hidden State.	Not supported
A mechanism to allow non-Passive Applications to request that they are made Passive.	Mandatory if the presentation technology is state-aware and supports the Passive State.	<a href="#">B.4.2.1.3.4- Passive State</a>	Passive HTML Applications are not supported at present.	Not supported

<b>Feature or concept</b>	<b>Mandatory or optional</b>	<b>References</b>	<b>HTML</b>	<b>MHEG</b>
A default combination of State and Display Mode for newly-launched Applications.	Mandatory	<a href="#">B.4.2.1.4- Application Display Modes</a>	Active + Overlayable for all applications signalled with the AIT application type registered for CTV HTML applications as defined below, or where the initial document is served with a MIME type of "application/vnd.ctv.xhtml+xml". . Active + Exclusive for all other applications.	Active + Exclusive-Overlayable
An API which enables one Application to override the default State and Display Mode of a second Application that it is launching.	Optional	<a href="#">B.4.2.1.4- Application Display Modes</a>	Not supported	Not supported
A mechanism to allow one Application to start another Application	Mandatory	<a href="#">B.4.2.1.6 Launching</a> and terminating Applications	Application.createApplication()	ApplicationLaunch (ApL) resident program for non-MHEG apps. Launch/Spawn Elementary Actions for mheg only apps.
A mechanism to allow an Application to stop itself	Mandatory	<a href="#">B.4.2.1.6 Launching</a> and terminating Applications	Application.destroyApplication()	Quit action
A mechanism to allow one Application to stop other Applications	Optional	<a href="#">B.4.2.1.6 Launching</a> and terminating Applications	Application.destroyApplication()	Not supported

<b>Feature or concept</b>	<b>Mandatory or optional</b>	<b>References</b>	<b>HTML</b>	<b>MHEG</b>
Mapping from broadcast application signalling to application lifecycle	Mandatory if broadcast-related applications are supported.	<a href="#">B.4.2.1.7.2- Broadcast-Related Applications</a>	As defined by sections 6.2.2.2 and 6.2.2.3 of TS 102 796 [23].	As defined by section B.6.6.2 of this specification
The initial file or object for an Application that would be referenced by an HTTP or HTTPS URL when it is to be launched.	Mandatory if broadcast-independent Applications are supported.	<a href="#">B.4.2.1.7.3- Broadcast-independent Applications</a>	The first HTML document.	Not supported
Behaviour derived from the URL of the entry point of an Application (e.g. security requirements based on the fully qualified domain of the URL).	Optional	<a href="#">B.4.2.1.7.3- Broadcast-independent Applications</a>	The Application domain shall be set to the fully qualified domain of the initial page or as specified in the AIT.	Not supported
Support for Broadcast-independent Applications becoming Broadcast-related as defined in TS 102 796 [23] section 6.2.2.6. Where a technology supports this, it shall be defined how the last of the conditions is mapped into that technology.	Optional to support but mandatory to specify if supported.	<a href="#">B.4.2.1.7.3- Broadcast-independent Applications</a>	Shall be supported as specified in TS 102 796 [23].	Not supported
A mechanism to allow an Application to request changes to its Key Set, allowing an Application to dynamically change its Key Set during its lifecycle.	Mandatory	<a href="#">B.4.2.2.1- Application Key Set</a>	The KeySet class as defined in [13] 7.2.5.	The Application's InputEventRegister
Support for Applications receiving User Input Events when in the Inactive State.	Optional	<a href="#">B.4.2.2.1- Application Key Set</a>	Supported by section 4.4.7 of [13].	Not supported

<b>Feature or concept</b>	<b>Mandatory or optional</b>	<b>References</b>	<b>HTML</b>	<b>MHEG</b>
Whether the Presentation Technology requires certain key events as being delivered to the Presentation Engine, what these key events are and how the presentation engine handles them	Optional	<a href="#">B.4.2.2.1</a> - Application Key Set	The Text or Txt key event is not available to applications. It may be used to start and stop digital text applications as defined in section 6.2.2.3 of TS 102 796 <a href="#">[23]</a> .	No such requirements
An Application Type registered with the DVB Project.	Mandatory if the presentation technology is to be possible to signal in the broadcast.	<a href="#">B.4.2.3.1</a> - Broadcast-delivered	Application Type Code (0x0010) for applications that are conformant with the subset of XHTML defined by TS 102 796 <a href="#">[23]</a> .  Application Type Code (0x0012) for HTML applications compliant with this specification but which are not compatible with TS 102 796 <a href="#">[23]</a> .	Application Type Code (0x0008)
The Application control codes that are applicable for that technology.	Mandatory if the presentation technology is to be possible to signal in the broadcast.	<a href="#">B.4.2.3.1</a> - Broadcast-delivered signalling	As defined in Section 7.2.3.1 of TS 102 796 <a href="#">[23]</a> :  0x01 AUTOSTART  0x02 PRESENT  0x04 KILL  0x07 DISABLED	AUTOSTART, PRESENT and QUIT
Whether and how the simple Application boundary descriptor is applicable.	Mandatory to address if the presentation technology is to be possible to signal in the broadcast.	<a href="#">B.4.2.3.1</a> - Broadcast-delivered signalling	As defined in Section 7.2.3.1 of [S 102 796 <a href="#">[23]</a> ].	Not applicable

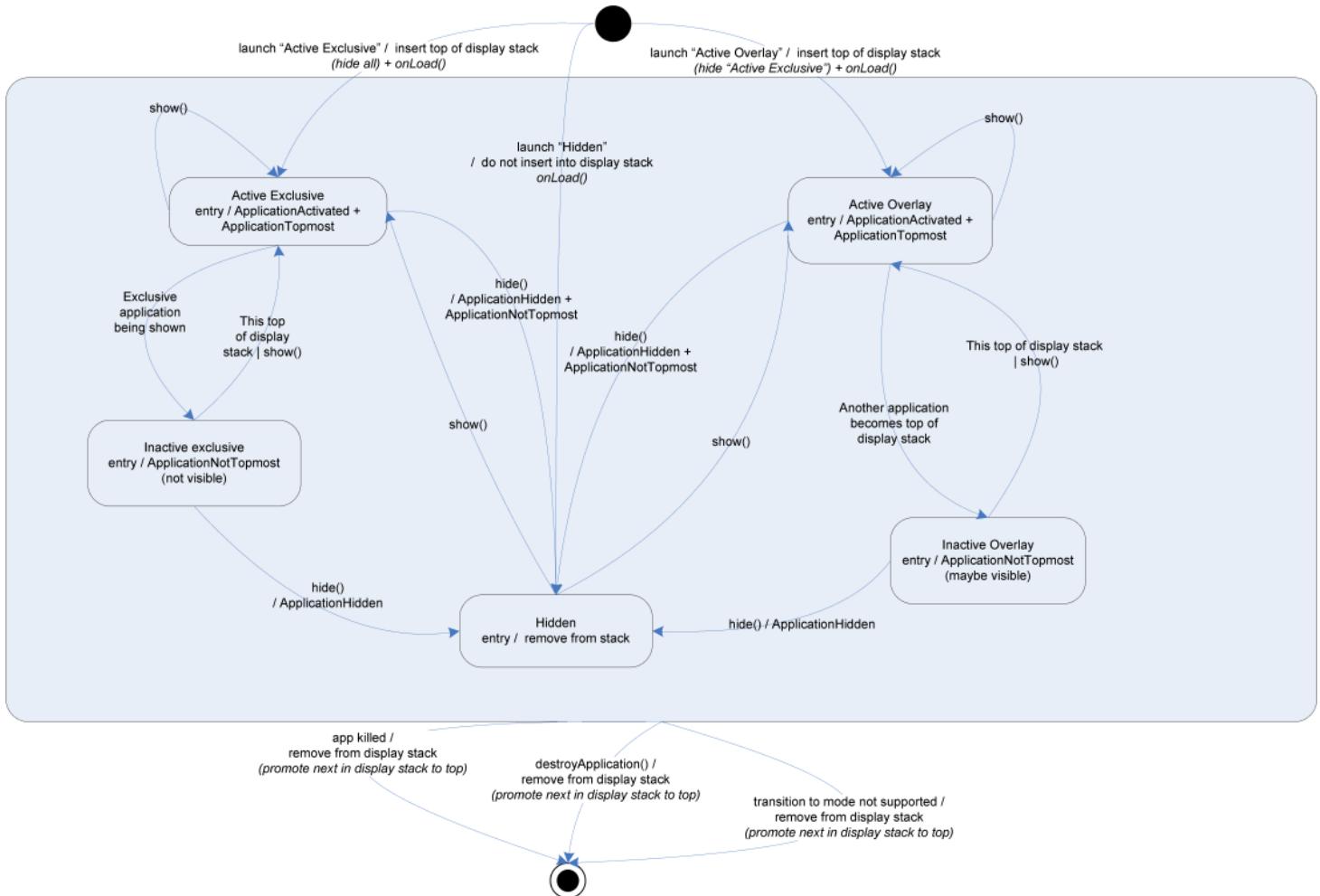
<b>Feature or concept</b>	<b>Mandatory or optional</b>	<b>References</b>	<b>HTML</b>	<b>MHEG</b>
The values to be encoded in the Profile and Version fields of the Application descriptor (see section 5.2.5.2 of TS 102 809 [36]) and the MhpVersion type (see section 5.2.5.3 of TS 102 809 [36]) for that presentation technology.	Mandatory if the presentation technology is to be possible to signal in the broadcast.	<a href="#">B.4.2.3.1</a> - Broadcast-delivered signalling	As defined in TS 102 7696 [23]. for applications that are conformant with the subset of XHTML defined by that specification.  Major.minor.micro = 1.1.1 for HTML applications compliant with this specification but which are not compatible with TS 102 796 [23].	application_profile is equivalent to the app_type_code in the data_broadcast_id descriptor Major.minor.micro = 1.1.1
The Application type to be used for the type field of the applicationDescriptor.	Mandatory if the presentation technology is to be possible to signal via broadband.	<a href="#">B.4.2.3.2</a> - Broadband-delivered signalling	"application/vnd.hbbtv.xhtml+xml" for applications that are conformant with the subset of XHTML defined by TS 102 796 [23].  "application/vnd.ctv.xhtml+xml" for HTML applications compliant with this specification but which are not compatible with TS 102 796 [23]	Not supported
Support for Notifications.	Optional	<a href="#">B.4.2.6</a> - Notifications	See section <a href="#">B.4.2.6</a> - Notifications	Not supported

<b>Feature or concept</b>	<b>Mandatory or optional</b>	<b>References</b>	<b>HTML</b>	<b>MHEG</b>
When an Application is launched from an Application in another Presentation Technology, define the meaning of a “well formed” Application to indicate that it can be considered launchable.	Mandatory	<a href="#">B.4.2.1.6</a> Launching and terminating Applications	<i>The initial document of the application is signalled with a MIME type of either "application/vnd.ctv.xhtml+xml" or "application/vnd.hbbtv.xhtml+xml".</i>	See section <a href="#">B.4.3.2.5</a> Definition of “well formed” for MHEG Applications
Support for Broadcast Triggered Native Applications	Optional	<a href="#">B.4.2.3.5</a> Handling of Broadcast Triggered Native Applications	See section <a href="#">B.4.5.6</a> Broadcaster Interruptions.	See section D-Book Part A [1] 13.10.8.5 SetBroadcasterInterruptions
Whether Broadcast Triggered Native Applications are enabled or disabled by default	Mandatory to specify if Broadcast Native Applications are supported	<a href="#">B.4.2.3.5</a> Handling of Broadcast Triggered Native Applications	See section <a href="#">B.4.5.6</a> Broadcaster Interruptions.	See section D-Book Part A [1] 13.10.8.5 SetBroadcasterInterruptions

### B.4.2.4.1 HTML State diagram

The diagram below shows the only combinations of Application states and Display Modes that shall be supported for HTML Applications, and the mechanisms that shall be used for transitioning between them.

**Figure B.4- 3 HTML state and display mode transitions diagram**



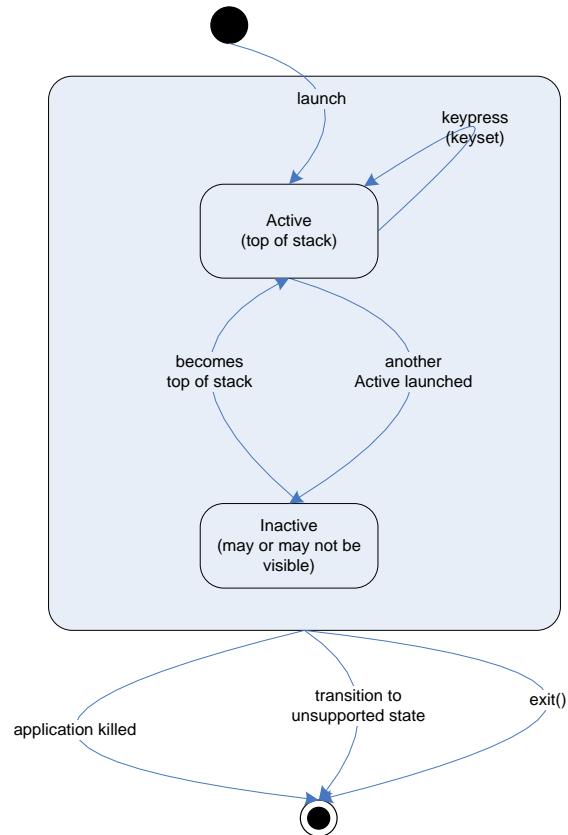
For the above state diagram, the following conventions are followed:

- States are labelled with the name of the state. Actions carried out when the state is entered are labelled with “entry /” followed by the behaviour when the state is entered, e.g. generation of an event.
- State transitions are labelled with the method call or action that triggers the transition. A vertical bar (“|”) indicates alternative ways of triggering the state transition. A forward slash (“/”) is used to indicate events generated or actions carried out as a result of the transition where this is not indicated in the target state.

### B.4.2.4.2 MHEG state diagram

The diagram below shows the only combinations of Application states and Display Modes that shall be supported for HTML Applications, and the mechanisms that shall be used for transitioning between them.

**Figure B.4- 4 MHEG state and display mode transitions diagram**



### B.4.2.5 DVB CI and Application MMI

See section 16.11 of D-Book Part A [1].

We need to consider if we need any text to describe the co-existence of High Level MMI and Application MMI. High Level MMI can be considered a system application which is out of scope, but Application MMI may need some wording.

It is possible that CI Plus may be incorporated into DBook specifications in the future. If that occurs, section 12.6.2.1 of the CI Plus spec will need to be enhanced here to accommodate the co-existence model.

## B.4.2.6 Notifications

Notifications are the mechanism by which Applications that aren't visible to the End-user can tell the End-user about something relevant. They may be used purely to provide information but may also offer the End-user the opportunity to make the notifying Application become the Active Application.

Conceptually, Notifications should be thought of as a mechanism by which an Application sends a message to a Resident Application (Passive State, Overlay Display Mode) which shows Notifications as they are requested. The properties of a notification shall include the following parameters:

- The reason for the notification shall be described with a short text description and may also include an icon and a longer text description. Presentation technologies that support Notifications need to define how Applications make this request.
- Whether the End-user accepting the notification shall result in the requesting Application becoming the Active Application.
- Notifications shall have a type as defined in the following table:

**Table B.4- 13 Notification Types**

Notification type	Description
Reminder	Time related notification for reminders. E.g. a pre-booked live event is about to start
TaskFinished	Time related notification that an asynchronous task initiated by the End-user has finished. E.g. a content download
NewContent	Media related notification that a new content item is available. E.g. a new episode in a series that the End-user is interested in
Expiration	Notification that time-limited content is about to expire
Other	Other notification, other than those listed above. E.g. Social networking event, email notification

Applications shall be able to request a notification be shown to the End-user as follows:

- Terminals shall support showing a notification to the end-user.
- When a Notification is presented to the end-user, it should be clearly visually different from any visible Applications.
- Applications requesting a Notification shall be able to be informed about their Notifications being:
  - Accepted – the End-user has made a positive action to accept the Notification,
  - Failed – the Notification was not shown,
  - Shown – the Notification has been shown to the end-user,
  - Closed – a Notification which has been shown to the end-user is no longer visible; for example, the Notification being actively dismissed by the end-user (where supported), the Notification being automatically closed after a timeout or the Notification being closed by the Application which initiated it.
- Terminals shall implement a timeout mechanism after which the Notification is closed.
- Applications shall be able to cancel a Notification that they have requested.

- If an Application exits then any Notifications it has requested shall be cancelled.
- Terminals may include a mechanism to permit the end-user to block Notifications. This mechanism may be based on the type of the Notification – e.g. users who only choose to receive alerts or reminders. Applications shall be able to test if a Notification would be blocked by the current settings, for example at the time an event is booked or a reminder is set so that the Application can inform the End-user that it cannot function correctly.

Except as specified above, other details of the user interface for presenting Notifications to the End-user are outside the scope of this specification.

## B.4.3 MHEG-5 UK Profile

Connected TV Terminals shall support the UK Profile as defined in D-Book Part A [1] sections 11 to 19 with additions described in this section.

### B.4.3.1 MHEG-5 Engine Profile

#### B.4.3.1.1 GetEngineSupport ‘feature’ strings

**Table B.4- 14 GetEngineSupport**

<b>String</b>		<b>Constraint</b>
<b>Standard</b>	<b>Short</b>	
ConnectedTVExtension(N)	CTV(N)	Shall return “true” for N=0 if the Terminal supports the features defined in section B.4.4
ApplicationLaunchExtension(N)	ApE(N)	Shall return “true” for N=0 if the receiver supports ApplicationLaunchExtension.  For other values of N, shall return “true” if the receiver supports launching applications whose MIME type=N. Receivers shall consider that MIME type strings are case insensitive when determining if a MIME type is supported.

#### B.4.3.1.2 Resident Programs

Table B.4-15 lists the ResidentPrograms that receivers implementing ApplicationLaunchExtension shall implement.

**Table B.4- 15 Mandatory Resident Programs for receivers that implement ApplicationLaunchExtension**

<b>Resident program</b>		<b>Invocation</b>			<b>Reference</b>
		<b>Typical Use</b>		<b>Never Fork</b>	
<b>Description</b>	<b>Name</b>	<b>Call</b>	<b>Fork</b>		
ApplicationLaunch	ApL	✓			B.4.3.1.2.1, “ApplicationLaunch”
GetLaunchArguments	GLA	✓			B.4.3.1.2.2, “GetLaunchArguments”

**B.4.3.1.2.1 ApplicationLaunch****Synopsis:** Hands control of execution to another application of an arbitrary type.**Arguments:** ApL (location, [name, value]..., success)

in/ out/ in-out	type	name	comment
input	GenericOctetString	location	Location of the application to run
input	GenericOctetString	name	
input	GenericBoolean or GenericInteger or GenericOctetString	value	List of name/value pairs to be passed to the application
output	GenericBoolean (Shall provide an IndirectReference to a BooleanVariable)	success	True if the application started successfully, false otherwise.

**Description:** Causes a new application to be started with the specified arguments. The application to run is specified by the location parameter.

The Application launched using this resident program is classified as broadcast-related, as described in B.4.2.1.7.

A side-effect of the resident program may be that the MHEG engine is stopped (killing the application). In all cases the state of the True Persistent Storage shall not be affected.

The resident program takes a variable number of arguments. Zero or more name/value pairs may be present. If any name/value pairs are present, the name/value pairs are used to construct a data set of content type *application/x-www-form-urlencoded* as specified by section 17.13.4 of HTML 4.01 [41] except that references to IETF RFC 1738 shall be taken as references to IETF RFC 3986, which updates it. This produces a data set of the form *name1=value1&name2=value2*, where each of the names and values has been percent-encoded after replacing any space characters with ‘+’.

The data set may contain characters that are not represented in the US-ASCII character set; consequently the percent-encoding shall be carried out as specified for characters from the Universal Character Set in section 2.5 of IETF RFC 3986. Characters are assumed to be encoded as UTF-8. For example, the character Latin Capital Letter A With Grave is represented in UTF-8 by the octets 0xC380. In the text representation of MHEG, this character would be written as ‘=C3=80’; after percent-encoding this would become “%C3%80”.

The data set is appended to the location, with a ‘?’ character as a separator; this forms a URI which references both the application to launch and the parameters to be passed to it.

GenericOctetString arguments are treated directly as strings. GenericInteger arguments are converted to strings as decimal integers with no leading zeros. GenericBoolean arguments are converted to the string “true” if true and to “false” if false.

In any case where an invalid set of arguments is supplied (such as a missing value argument) the resident program call shall fail in accordance with D-Book Part A [1], section 13.10.12. It shall not be possible to launch an MHEG Application using this resident program.

The location URI shall:

- 1- follow the rules for use of reserved characters in HTTP URIs as defined in D-Book Part A [1] section 18.3.2.5.
- 2- be either a dvb: URL identifying an application as defined in 4.2.1.7.2 or an HTTP or HTTPS URL as defined in 4.2.1.7.3.

#### B.4.3.1.2.2 GetLaunchArguments

**Synopsis:** Retrieves an argument set by another application of an arbitrary type.

**Arguments:** GLA( name, value )

in/ out/ in-out	type	name	comment
input	GenericOctetString	name	Name of argument to be retrieved
output	GenericOctetString (shall provide an IndirectReference to an OctetStringVariable)	value	Value of argument

**Description:** Retrieves the value of the named argument. Arguments can be set by applications of an arbitrary type, other than MHEG, when launching an MHEG application.

The value of the argument is provided to the application as an OctetStringVariable. It is the responsibility of the application to convert this value into another type (using the SetVariable elementary action or one of the type conversion resident programs) if required.

If the argument to be retrieved does not exist then the resident program succeeds and the value parameter is a zero length string.

### B.4.3.2 Signalling

#### B.4.3.2.1 MHEG AIT Signalling

Terminals shall support AIT and metadata signalling of MHEG applications as defined in TS102809 [36] and further profiled in [Table B.4- 16](#) Terminals shall support MPEG-2 encoding of the AIT but are not required to support XML encoding.

**Table B.4- 16 MHEG AIT Signalling**

<b>TS 102 809 [36]</b>	<b>M/O/ NI<sup>10</sup></b>	<b>Notes</b>								
5.2.2 Application types	M	The value of the application type field for the MHEG presentation technology is 0x0008.								
5.2.3 Application Identification	M	Application ids shall be in the range of unsigned applications as defined in TS102809 [36].								
5.2.4 Application Control Codes	M	The following control codes shall be supported: <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>MPEG-2 Encoding</td> <td>Identifier</td> </tr> <tr> <td>0x01</td> <td>AUTOSTART</td> </tr> <tr> <td>0x02</td> <td>PRESENT</td> </tr> <tr> <td>0x03</td> <td>KILL</td> </tr> </table>	MPEG-2 Encoding	Identifier	0x01	AUTOSTART	0x02	PRESENT	0x03	KILL
MPEG-2 Encoding	Identifier									
0x01	AUTOSTART									
0x02	PRESENT									
0x03	KILL									
5.2.5 Platform Profiles	M	The value of the application_profile shall be as defined for application_type_code in Part A annex C.  The value of the version fields shall be as follows: <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>Field</td> <td>Value</td> </tr> <tr> <td>version.major</td> <td>I</td> </tr> <tr> <td>version.minor</td> <td>I</td> </tr> <tr> <td>version.micro</td> <td>I</td> </tr> </table>	Field	Value	version.major	I	version.minor	I	version.micro	I
Field	Value									
version.major	I									
version.minor	I									
version.micro	I									
5.2.6 Application Visibility	M	As defined in TS102809 [36].  Shall be set to NOT_VISIBLE_ALL								
5.2.7 Application Priority	M	As defined in TS102809 [36].								
5.2.8 Application Icons	NI									
5.2.9 Graphics Constraints	NI									
5.2.10 Application Usage	NI									
5.2.11 Stored Applications	NI									
5.2.12 Application Description File	NI									
5.3.2 Program Specific Information	M	As defined in TS102809 [36].								
5.3.4 Application Information Table	M	A maximum of one sub-table shall be transmitted per service. The minimum repetition rate for the AIT sub table shall be 1 second.  Applications removed from the AIT sub-table which was previously signalled but where the AIT sub-table remains present in the network shall be stopped as if they had been signalled with a KILL control code.								

<sup>10</sup> Mandatory to provide, Optional to provide or Not Included (may be ignored by Terminals)

<b>TS 102 809 [36]</b>	<b>M/O/ NI<sup>10</sup></b>	<b>Notes</b>
5.3.4.7 Visibility of AIT	M	If an MHEG-5 application performs a destructive service tune away from the current service with or without selecting a new service, it will stop running even if the application is signalled in the AIT of the new selected service, see section D-Book Part A [1] section 13.10.6.4.  If an MHEG-5 application performs a non-destructive service tune away from the current service then the application behaviour will be as defined by D-Book Part A [1] section 16.2.9.  For destructive and non-destructive tunes, the receiver shall ignore the service_bound_flag in the Application descriptor.
5.3.4.9 Access to an MPEG-2 format AIT via a broadband connection	O	AIT via a broadband connection must reference an MHEG application delivered by a broadcast channel.
5.3.5.1 Application Signalling Descriptor	M	As defined in TS102809 [36].
5.3.5.2 Data Broadcast Id Descriptor	M	As defined in TS102809 [36].
5.3.5.3 Application Descriptor	M	When a receiver changes channel the value of the service_bound_flag shall not affect application lifecycle (see Visibility of AIT).
5.3.5.4 Application Recording Descriptor	NI	
5.3.5.5 Application Usage Descriptor	NI	
5.3.5.6 User Information Descriptors	NI	
5.3.5.7 External Authorization Descriptor	NI	
5.3.5.8 Graphics Constraints Descriptor	NI	
5.3.6 Transport Protocol Descriptors	M	Terminals shall support the Object Carousel transport protocol as defined in TS102809 [36]. Receivers need not support other transport protocols.
5.3.7 Simple Application Location Descriptor	M	As defined in TS102809 [36].
5.3.8 Simple Application Boundary Descriptor	NI	
5.3.9 Service Information Descriptor	NI	
5.3.10 Stored Applications Descriptor	NI	

### B.4.3.2.2 Coexistence of Classical and AIT signalling

Two types of application signalling are available in a CTV environment:

- Classical application signalling as described in section D-Book Part A [I] section 17.4 (Application identification and boot)
- AIT signalling as described in B.4.2.3.1.

Classical application signalling, AIT signalling, both signalling types or neither may be present for a service.

Receivers supporting CTV shall support the application signalling precedence rules defined in this section. Receivers not supporting CTV shall only consider the classical signalling and shall ignore the AIT signalling.

If an AIT subtable for a service is present, then a CTV receiver shall process the AIT signalling and shall ignore any classical application signalling. If an AIT subtable for a service is not present, then a CTV receiver shall process the any available classical application signalling for MHEG.

The ‘presence of an AIT subtable for a service’ is defined as either of the following:

- An application\_signalling\_descriptor without a sub-loop is present in any ES\_loop of the PMT for that service AND at least one AIT subtable referenced from these ES loop(s) has a supported application\_type.
- An application\_signalling\_descriptor with a sub-loop containing a supported application\_type is present in any ES\_loop of the PMT for that service.

A supported application\_type is defined such that the CTV receiver has the ability to launch an application of any of the signalled application\_types.

### B.4.3.2.3 Life-Cycle Signalling in AIT and PMT

Existing service-level and network-level signalling is specified in the D-Book Part A [I] using certain descriptors and sub-descriptors in the PMT. When an interactive application uses information from the AIT, any life-cycle related information from the PMT shall be ignored.

This restriction applies to the PMT that contains the carousel\_id\_descriptor for the current object carousel, including the object carousel that contains the auto-boot application and any object carousel that is mounted as a result of LiteOptionsProfieBody object references or a non-destructive service tune.

#### B.4.3.2.3.1 carousel\_id\_descriptor

The existence of the carousel\_id\_descriptor in the PMT is mandatory as long as the object carousel is mounted, regardless of AIT signalling.

This means that if the carousel\_id descriptor identifying the mounted carousel is removed from a service then all MHEG applications that originated from the mounted DSM-CC carousel shall be terminated or removed from the application stack, and the boot process shall be restarted.

### B.4.3.2.3.2 data\_broadcast\_id\_descriptor

When AIT signalling is used, the existence or content of the data\_broadcast\_id\_descriptor in the PMT shall be ignored for the purpose of life-cycle signalling.

More specifically, the following restrictions shall apply:

1. Removal of the data\_broadcast\_id\_descriptor from the object carouselPMT shall not cause any application to be terminated or removed from the application stack, or the boot process to be restarted.
2. The network boot info sub-descriptor shall be ignored:
  - a. The NetworkBootInfo EngineEvent shall not be generated
  - b. The GetBootInfo ResidentProgram shall always return infoResult = false and bootInfo = " " (empty string).
  - c. Any change to NB\_version or NB\_action values shall not cause any application to be terminated or removed from the application stack, or the boot process to be restarted.
3. The service boot info sub-descriptor shall be ignored. Furthermore, any DsmccDescriptorList section with table\_id\_extension of 0xffff shall be ignored.

### B.4.3.2.4 MHEG NDT support with AIT signalling

Application lifecycle signalling may be PMT and Service Gateway or AIT as defined in [B.4.3.2.2](#). When performing a non-destructive tune the target service shall use the same signalling method as the source service.

When AIT signalling mode is used the target service shall include:

- An application\_signalling\_descriptor in the elementary stream loop of the PMT identifying the component carrying the AIT with MHEG application type as defined by [B.4.2.4](#).
- An AIT containing:
  - An application\_identifier in the application loop with an organisation\_id and application\_id matching that of the running application.
  - A transport\_protocol\_descriptor in either the common or application loops with a protocol\_id of 0x0001 (Object Carousel) and with selector bytes referencing the component carrying the “appropriate carousel id” as specified by D-Book Part A [\[I\]](#) section 13.10.6.4.
- A carousel\_id\_descriptor in the elementary stream loop of the PMT identifying the component carrying the Object Carousel DSI and which contains the “appropriate carousel id”.

If the carousel id specified by the non-destructive tune is explicit or current, as defined by D-Book Part A [\[I\]](#) section 13.10.6.4, then the appropriate carousel id in the target service signalling shall match this value. If the carousel is specified as initial then the carousel id in the target service is derived from the AIT.

If the appropriate signalling is not present on the target service then the receiver shall terminate the running application and attempt to launch the auto-boot application on the new service as defined in [B.4.3.2](#).

### B.4.3.2.4.1 Network and service boot info

Following a non-destructive tune, the receiver shall re-evaluate service and network level lifecycle signalling. If application signalling is AIT based as defined by [B.4.3.2.1](#) then network boot info and service boot info are not supported and shall not be evaluated.

### B.4.3.2.5 Definition of “well formed” for MHEG Applications

For the purposes of launching from another Presentation Technology via AIT, an MHEG Application is considered well formed if the IOR of the Initial Object has been extracted from the relevant parent Directory (or ServiceGateway) object.

### B.4.3.3 MHEG-5 Authoring Rules and Guidelines

#### B.4.3.3.1 Signalling MHEG Applications for all types of Terminal

If an MHEG application is present for a service, and an AIT subtable is present on that service, then MHEG applications should be signalled using both the classical signalling and the AIT signalling. This will allow non-CTV receivers to continue to receive applications.

#### B.4.3.3.2 Avoid moving carousel components

When AIT signalling is used to control MHEG lifecycle there is an implied association between the object carousel's auto-boot component as identified by the transport\_protocol\_descriptor in the AIT and the carousel id identified by the carousel id descriptor in the PMT on the same component D-Book Part A [1] section 17.4.3.1. Classical application signalling allows the auto-boot components PID to change without causing the running application to be terminated D-Book Part A [1] section 16.2.4. When AIT signalling is employed, moving the auto-boot component in this way breaks the implied association between carousel id and auto-boot component unless an equivalent change occurs in the AIT. As the signalling exists in both PMT and AIT it is not possible to update both in the receiver simultaneously and receiver behaviour during this transient period is undefined.

## B.4.4 OIPF browser profile

Connected TV Terminals shall support the browser profile defined in sections 8.2.1, 8.2.2 and Annex A of TS 102 796 [23] with the additional APIs from [13] described in section B.4.4.2

[Additions to the HbbTV profile](#) of OIPF below.

The terminal may support other uses or forms of HTML than the CTV browser profile defined here. These uses may include open internet browsing with the ability to type in a URL. The same browser implementation may be used for the CTV browser profile and these other uses. TML holders who require some form of device authentication may exclude that authentication from being available when a Terminal is browsing open internet content.

### B.4.4.1 MIME type and DOCTYPE for Connected TV Applications

All XHTML documents of a Connected TV Application shall include either:

- The Strict XHTML doctype (for documents that are conformant with the subset of the XHTML 1.0 Strict DTD defined in the present document).
- The Transitional XHTML doctype (for documents that are conformant with the subset of the XHTML 1.0 Transitional DTD defined in the present document).
- The HbbTV doctype defined in section A.2.6.2 of TS 102 796 [23] (for documents that are conformant with the subset of the XHTML defined by TS 102 796 [23]).
- The following "doctype" declaration:

```
<!DOCTYPE html PUBLIC "-//UKDTG//CTV//EN"
"http://www.dtg.org.uk/dtd/CTV.dtd">
```

It shall be followed by an <html> tag declaration including the xmlns attribute as follows:

```
<html xmlns="http://www.w3.org/1999/xhtml">
```

Note: Where a browser supports both a "Standards Mode" and a "Quirks Mode" for rendering documents, any documents of a Connected TV Application with the doctypes specified above shall be rendered in "Standards Mode" regardless of the presence of an XML declaration before the doctype declaration.

All XHTML documents of a Connected TV Application shall be served with the MIME content type "application/vnd.ctv.xhtml+xml" or "application/vnd.hbbtv.xhtml+xml" (for documents that are conformant with the subset of the XHTML defined by TS 102 796 [23]). All pages loaded from a carousel shall be handled as if they had the MIME type "application/vnd.ctv.xhtml+xml". When loading a Connected TV document, a Terminal shall not use the suffix from the filename to determine the MIME type.

Terminals are not required to load or run documents that are served with a MIME type other than "application/vnd.ctv.xhtml+xml" or "application/vnd.hbbtv.xhtml+xml", or which do not include one of the doctype declarations defined above.

#### B.4.4.2 Additions to the HbbTV profile of OIPF

This section describes the additional APIs from [13] that shall be supported in addition to the profile described in section 8 and Section B.12 A of TS 102 796 [23].

NOTE: The trust level values used in the "Trust Level" column are defined in section B.5.9.2

**Table B.4- 17 Additions to the HBBTV Profile for OIPF**

Section	Title	Comments	Trust Level
<b>4.4 Resource Management</b>			
4.4.7	Cross-Application event handling		Untrusted
<b>7.2 Application Management APIs</b>			
7.2.2	The Application class	<p>The <i>show()</i> method shall cause the application to transition to the Active application state. This shall move the application to the top of the display stack (adding it to the display stack if it is not already present).</p> <p>The <i>hide()</i> method shall cause the application to transition to the Hidden application state. This shall remove the application from the display stack.</p>	Untrusted
7.2.6	New DOM events for application support	Only the following events are required: <i>ApplicationActivated</i> , <i>ApplicationDeactivated</i> , <i>ApplicationTopmost</i> , <i>ApplicationNotTopmost</i> , <i>ApplicationShown</i> and <i>ApplicationHidden</i> . Other events are not included.	Untrusted
<b>7.3 Configuration and setting APIs</b>			
7.3.3	The LocalSystem class	Only <i>vendorName</i> and <i>modelName</i> are required - other properties and methods are not included	Untrusted
<b>7.4 Content download APIs (See Note 1)</b>			

Section	Title	Comments	Trust Level
<b>7.4.4</b>	The Download class	<p>Read-only support for the following properties is mandatory:</p> <p><i>totalSize</i>  <i>state</i>  <i>amountDownloaded</i>  <i>name</i>  <i>id</i>  <i>description</i>  <i>parentalRatings</i>  <i>startTime</i>  <i>timeElapsed</i>  <i>timeRemaining</i>  <i>contentID</i>  <i>iconURL</i></p> <p>All other properties and methods are optional.</p>	Trusted
<b>7.6 Content Service Protection API</b>			
<b>7.6.1</b>	The application/oipfDrmAgent embedded object		Untrusted
<b>7.10 Scheduled Recording APIs (See Note 2)</b>			
<b>7.10.2</b>	The ScheduledRecording class	<p>If the Terminal supports series recording via TVA then series recording shall be supported in this API.</p> <p>Read-write support for the following properties is mandatory:</p> <p><i>startPadding</i> (see note 5)  <i>endPadding</i> (see note 5)</p> <p>Read-only support for the following properties is mandatory:</p> <p><i>name</i>  <i>description</i>  <i>startTime</i>  <i>duration</i>  <i>channel</i>  <i>isSeries</i>  <i>programmeID</i> (see note 3)  <i>programmeIDType</i>  <i>episode</i>  <i>totalEpisodes</i>  <i>blocked</i> (see note 4)</p>	Trusted
<b>7.10.4</b>	Extension to application/oipfRecordingScheduler for control of recordings	<i>DisInfo</i> , <i>onPVREvent</i> , <i>remove ()</i> and <i>stop ()</i> are not included.	Trusted
<b>7.10.5</b>	The Recording class	Read-only support for the following properties is mandatory:	Trusted
		<i>state</i> <i>id</i> <i>subtitles</i> <i>subtitleLanguages</i> <i>isHD</i>	

Section	Title	Comments	Trust Level
		<p><i>isWidescreen</i>  <i>audioType</i>  <i>audioLanguages</i>  <i>genres</i>  <i>recordingStartTime</i>  <i>recordingDuration</i>  <i>bookmarks</i>  <i>blocked</i>  <i>locked</i>  <i>startPadding</i></p> <p>Note: this class implements the ScheduledRecording interface, and so all properties required for that class are also available on the Recording class.</p>	
<b>7.10.8</b>	The Bookmark class		Trusted
<b>7.10.9</b>	The BookmarkCollection class	<p>Only access to bookmarks set through the native UI or by the Terminal is supported.</p> <p>The <i>addBookmark()</i> and <i>removeBookmark()</i> methods are not included.</p>	Trusted
<b>7.12 Metadata APIs</b>			
<b>7.12.1</b>	The application/oipfSearchManager embedded object	See section B.6.7.3.1.4	Untrusted,
<b>7.12.2</b>	The MetadataSearch class	The <i>findProgrammesFromStream()</i> method is not included	Untrusted
<b>7.12.3</b>	The Query class		Untrusted
<b>7.12.4</b>	The SearchResults class		Untrusted
<b>7.12.5</b>	The MetadataSearchEvent class		Untrusted
<b>7.12.6</b>	The MetadataUpdateEvent class		Untrusted
<b>7.13 Broadcast video</b>			
<b>7.13.11</b>	The Channel class	<p>Read-write support for the following properties is mandatory:</p> <p><i>name</i>  <i>genres</i>  <i>logoURL</i></p> <p>Read-only support for the following properties is mandatory:</p> <p><i>channelType</i>  <i>idType</i>  <i>ccid</i>  <i>onid</i>  <i>tsid</i>  <i>sid</i>  <i>majorChannel</i>  <i>locked</i>  <i>authorised</i>  <i>hidden</i>  <i>ipBroadcastID</i>  <i>blocked</i></p> <p>All other properties and methods are optional.</p>	Broadcast-related

Section	Title	Comments	Trust Level
		Setting the values of writable properties on a Channel object shall have no effect except for Channel objects created using the <code>createChannelObject()</code> method on the video/broadcast object. Applications should only modify the values of writable properties before the Channel object is referenced by any other objects or used as a parameter to an API call. The effects of writing to these properties while another object is referencing the Channel object, or after it has been used as a parameter in an API call is implementation-dependent.	
<b>7.14 Media playback APIs</b>			
<b>7.14.5</b>	Extensions to A/V object for parental rating errors	Mandatory when PVR, content download or DRM is supported, optional otherwise	Untrusted
<b>7.14.7</b>	Extensions to A/V object for playing media objects	Aspects will be mandatory when PVR or content download is supported.	Trusted
<b>7.15 Miscellaneous APIs</b>			
<b>7.15.3</b>	application/oipfCapabilities embedded object	The <code>hasCapability()</code> method shall be supported with the profile names being the option strings as defined in clause B.6.8.1.2	Untrusted
<b>7.16 Shared Utility classes and features</b>			
<b>7.16.1</b>	The StringCollection class		Untrusted
<b>7.16.2</b>	The Programme class	<p>Read-write support for the following properties is mandatory:</p> <p><i>name</i>  <i>description</i>  <i>startTime</i>  <i>duration</i>  <i>channelID</i>  <i>programmeIDType</i>  <i>programmeID</i> (see note 3)  <i>subtitles</i>  <i>isHD</i>  <i>audioType</i>  <i>genres</i>  <i>subtitleLanguages</i>  <i>audioLanguages</i>  <i>channel</i>  <i>isWidescreen</i>  <i>isMultilingual</i>  <i>parentalRatings</i>  <i>blocked</i></p> <p>Read-only support for the following properties is mandatory:</p> <p><i>blocked</i> (see note 4)  <i>locked</i>  <i>hasRecording</i></p> <p>All other properties are optional.</p>	Untrusted

Section	Title	Comments	Trust Level
Note 1: Only mandatory for products that include download functionality. If content download is supported, the manageDownload attribute of the download capability shall have the value "samedomain".			
Note 2: Only mandatory for products that include PVR functionality. If the PVR feature is supported, the manageRecordings attribute of the recording capability shall have the value "samedomain".			
Note 3: If the value if the programmeIDType property is ID_DVB_EVENT, the value of this property shall be the DVB URL of the event, and shall not include the transport stream ID or the time/duration.			
Note 4: The value of this property is derived from the guidance_type field in the guidance descriptor (if present) and the time of day (e.g. before or after the watershed). The value of this property may be overridden if parental control is enforced by the content protection system.			
Note 5: When a ScheduledRecording object is created, the Terminal shall set the initial values of these properties to the default start and end padding for recordings as specified through the Terminal UI.			

The mapping between ECMAScript properties listed above and DVB-SI is defined in  
[Annex III.8: Mapping of properties across JavaScript Objects for metadata exchanges](#).

#### B.4.4.3 Additions for metadata-independent recording

For products that include PVR functionality, the following properties from [13] shall be supported. This is to allow scheduling recordings without EPG metadata.

**Table B.4- 18 Additions for metadata-independent recording**

Section	Title	Comments	Trust Level
7.10.2	The ScheduledRecording class	Support for the following properties is mandatory: <i>repeatDays</i>	Trusted
7.10.5	The Recording class	Support for the following properties is mandatory: <i>isManual</i>	Trusted

#### B.4.4.4 Additions for DRM status notification & discovery

For products that include DRM capability, , the following properties, methods and classes from [14] shall be supported. This is to support notification of changes in the status of available DRM systems

**Table B.4- 19 Additions for DRM status notification and discovery**

Section	Title	Comments	Trust Level
7.6.1	The Application/oipfDrmAgent embedded object	Support for the following properties and methods is mandatory: DRMSystemStatus() onDRMSystemStatusChange and the equivalent DOM2 event.	Untrusted
7.7.1	The Application/oipfGatewayInfo embedded object	Support for the following properties is mandatory: isCSPGCIPlusSupported isCSPGCIPlusDiscovered CSPGCIPlusDRMType onDiscoverCSPGCIPlus and the equivalent DOM2 event	Untrusted

## B.4.4.5 Additions for linear IP services and adaptive streaming.

Devices that support linear services delivered via IP shall support the creation of Channel objects for these services using the `createChannelObject()` method on the video/broadcast embedded object, as described in section B.1 of [8].

Devices supporting adaptive streaming for on-demand media shall support the methods described in section B.1 of [8] for initiating playback.

## B.4.4.6 Additions from W3C Specifications

The set of features from CSS 2 [38] required by TS 102 796 [23] shall be extended with the background-attachment property and the "inline-block" value for the CSS display property.

The set of features from DOM Level 2 required by TS 102 796 [23] shall be extended with the style property of the HTMLElement which is defined by the ElementCSSInlineStyle interface which is defined in the DOM Level 2 Style Specification [39].

The scrollTop and scrollLeft properties on the Element class defined in the CSSOM View module [40] shall be supported.

The set of elements from HTML5 [26] required by TS 102 796 [23] should be extended with the "section" element.

## B.4.5 Extensions to the OIPF browser profile

### B.4.5.1 Graphics

#### B.4.5.1.1 Introduction

The CTV graphics specification delivers a rich user interface experience comparable with other consumer devices such as smart phones and tablet devices. The emphasis is on being able to offer a smooth, dynamic user interface, supporting a range of animations and transitional effects.

In order to support a rich UI experience, certain key operations shall be implemented:

- Transforms including: Scaling, Rotation and Translation
- Transparency & Blending
- Shadows, Gradient Fills, Reflections
- Rounded corners
- Animation/Transitions
  - For properties such as: Colour, Alpha per asset, Position, Size, Text Style, etc
  - Support for Control Functions such as: Start, stop, animation path, animation speed, bounce effects, momentum, etc
  - Rotation
- Perspective, although this is dependent on support for 3D

In order to meet the requirements outlined above the following technologies shall be supported:

- HTML5 Canvas Tag
- CSS3
- WebGL

### B.4.5.1.2 Graphics profiles

This specification considers two profiles of graphical capabilities, Basic, and Advanced. The Basic Profile enables applications to deliver an enhanced UI experience to the consumer on the Terminals. The Advanced Profile supports all of the core CTV features of the Basic Profile as well as additional, enhanced, features mainly related to 3D graphics capabilities.

A Terminal supporting the Basic Profile is considered representative of current mass-market HD TV and STB capabilities, typically being a 600 DMIPS class CPU with hardware 2D graphics acceleration support for blitting and PorterDuff operations.

A Terminal supporting the Advanced Profile is representative of emerging higher-end HD TV and STB capabilities, typically being a 1000DMIP+ class CPU with 3D graphics acceleration support for OpenGL ES2.0 operations.

### B.4.5.1.3 The HTML5 Canvas element

The HTML5 canvas element allows for dynamic, scriptable rendering of 2D shapes and bitmap images. It provides scripts with a resolution-dependent bitmap canvas, which can be used for rendering graphs, game graphics, or other visual images on the fly.

The HTML5 canvas element shall be supported as defined by the W3C HTML5 standard [26] section 4.8.10, with the exception of colour correction. Colour Correction shall be implemented as specified in the D-Book 7 Part A [1], section 14.3.2.

In order to utilise the HTML5 canvas element, the following profiles of the 2D Context API and 3D Context API are specified.

#### B.4.5.1.3.1 The HTML5 Canvas 2D Context

The HTML Canvas 2D Context API shall be supported for both Basic and Advanced Profiles, as defined by the W3C standard HTML5 Canvas 2D Context [27] with the modifications and clarifications detailed in the following table. The table also provides an indication as to whether an HTML 2D Context feature will benefit from the availability of hardware acceleration in the platform.

**Table B.4- 20 HTML5 2D Context API**

HTML5 2D Context API	Acceleration (NA/2D/ 3D/Vector)	Basic Profile	Advanced Profile	Comment
<b>Canvas State</b>				
context.Save	NA	X	X	
context.Restore	NA	X	X	
<b>Transformations</b>				
context.scale	2D	X	X	
context.rotate	2D	X*	X	* Note: Feature is not guaranteed to be hardware accelerated in Basic Profile, and performance will be limited
context.translate	2D	X	X	
context.transform	2D/3D		X	
context.setTransform	NA		X	
context.globalAlpha	2D	X	X	
<b>Global composite operations</b>				
source-over (default)	2D	X	X	
source-in	2D			
source-out	2D		X	
source-atop	2D		X	
destination-over	2D		X	

destination-in	2D		X	
destination-atop	2D		X	
destination-over	2D		X	
lighter	2D		X	
copy	2D		X	
XOR	2D		X	
VendorName-OperationName	2D		X	
<b>Colours and Styles</b>				createPattern() for video and canvas elements not included
context.strokeStyle	NA	X	X	
context.fillStyle	NA	X	X	
gradient.addColorStop	NA	X	X	
context.createLinearGradient	2D	X*	X	* Note: Feature is not guaranteed to be hardware accelerated in Basic Profile, and performance will be limited
context.createRadialGradient	3D	X*	X	* Note: Feature is not guaranteed to be hardware accelerated in Basic Profile, and performance will be limited
context.createPattern	2D	X	X	Note: Does not include support for HTML5 video elements
<b>Line Styles</b>				
context.lineWidth	NA	X	X	
context.lineCap	NA	X*	X	* Note: Feature is not guaranteed to be hardware accelerated in Basic Profile, and performance will be limited for styles other than "butt", and "square", i.e. rounded/curved styles.
context.lineJoin	NA	X	X	
context.miterLimit	NA	X	X	
<b>Shadows</b>				
context.shadowColor	NA	X	X	
context.shadowOffsetX	NA	X	X	
context.shadowOffsetY	NA	X	X	
context.shadowBlur	3D	X*	X	* Note: Feature is not guaranteed to be hardware accelerated in Basic Profile, and performance will be limited
<b>Rects</b>				
context.clearRect	2D	X	X	
context.fillRect	2D	X	X	
context.strokeRect	2D	X*	X	* Note: Feature is not guaranteed to be hardware accelerated in Basic Profile, and performance will be limited particularly for curved/rounded strokes
<b>Paths</b>				
context.beginPath	NA	X	x	
context.moveTo	2D	X	X	
context.closePath()	NA	X	X	
context.lineTo	2D	X	X	

context.quadraticCurveTo	Vector		X	
context.bezierCurveTo	Vector		X	
context.arcTo	Vector		X	
context.arc	Vector		X	
context.rect	2D	X	X	
context.fill	2D	X	X	
context.stroke	2D	X	X	
context.clip			X	
context.isPointInPath		X	X	
<b>Text</b>				
context.font	NA	X	X	
context.textAlign	NA	X	X	
context.textBaseline	NA	X	X	
context.fillText	NA	X	X	
context.strokeText	NA	X	X	
metrics = context.measureText	NA	X	X	
metrics.width	NA	X	X	
<b>Images</b>				
context.drawImage (image, dx, dy)	2D	X	X	*Note: drawImage() for video not included
context.drawImage image, dx, dy, dw, dh)	2D	X	X	
context.drawImage (image, sx, sy, sw, sh, dx, dy, dw, dh )	2D	X	X	
<b>Supporting interfaces</b>				
All classes used as parameters and return types, by the specified APIs. Refer to [Canvas 2D Context] for details.	NA	X	X	

#### B.4.5.1.3.2 The HTML5 Canvas 3D Context

The HTML 3D context provides support for 3D graphics via the WebGL API. See section [B.4.5.1.4 WebGL](#) for more information.

#### B.4.5.1.4 WebGL

WebGL is the means by which an HTML5 Canvas tag can make use of 3D graphics. 3D graphics is an optional feature. If Terminals indicate that the feature is supported, as per the capabilities API detailed in section [B.4.4](#), then the feature shall be supported according to the Khronos Group specification WebGL [\[28\]](#).

#### B.4.5.1.5 CSS3

CSS3 is not a single specification but consists of a series of modules, 7 of which are relevant to this specification:

- Basic UI
- Colour
- Backgrounds and Borders
- Transitions
- Animations
- 2D Transforms
- 3D transforms

---

Of these modules, some have been profiled by OIPF, and where suitable CTV adopts these profiles.

#### B.4.5.1.5.1 Basic UI Module

The CSS3 basic UI module shall be implemented according to the following table for Basic and Advanced Profile CTV devices. The table also provides an indication as to whether a particular CTV feature benefits from the availability of hardware acceleration in the platform.

**Table B.4- 21 CSS3 Basic UI module**

CSS3 Basic UI module	Acceleration (NA/2D/3D/Vector)	Basic Profile	Advanced Profile	Comment
nav-up	NA	X	X	included as per OIPF profile
nav-right	NA	X	X	included as per OIPF profile
nav-left	NA	X	X	included as per OIPF profile
nav-down	NA	X	X	included as per OIPF profile
outline properties	NA	X	X	included as per OIPF profile
box-sizing	NA	X	X	included as per OIPF profile

#### B.4.5.1.5.2 Colour Module

The CSS3 colour module shall be implemented as specified in the OIPF specification, for both Basic and Advanced profiles [13].

### B.4.5.1.5.3 Backgrounds and Borders Module

The CSS3 backgrounds and borders module shall be implemented according to the following table for Basic and Advanced Profile CTV devices. The table also provides an indication as to whether a particular CTV feature benefits from the availability of hardware acceleration in the platform.

**Table B.4- 22 CSS3 Backgrounds and Borders module**

CSS3 Backgrounds and Borders module	Acceleration (NA/2D/3D/Vector)	Basic Profile	Advanced Profile	Comment
multiple background images	NA	X	X	
background-color	NA	X	X	
background-image	NA	X	X	
background-repeat	NA	X	X	
background-attachment	NA	X	X	
background-position	NA	X	X	
background-clip	NA	X	X	
background-origin	NA	X	X	
background-size	NA	X	X	
background	NA	X	x	
backgrounds of special elements	NA	X	X	
border-color	NA	X	X	
border-style	NA	X	X	
border-width	NA	X	X	
border-radius	NA	X	X	Basic Profile is as specified by OIPF subset. Advanced Profile is as full CSS3 specification.
Corner Shaping	NA	X	X	
Corner Clipping	NA	X	X	
Color and Style Transitions	NA	X	X	
Overlapping Curves	NA	X	X	
Effect on Tables	NA	X	X	
border shorthand	NA	X	X	
border-image-* properties	2D	X	X	
box-shadow property	3D	X*	X	Basic Profile supports simple shadows only (not blurred)

**B.4.5.1.5.4 The CSS3 Transitions module**

The CSS3 transitions module shall be implemented according to the profile of the W3C CSS3 specification [32] detailed in the table below. The table below also provides an indication as to whether a particular CTV feature benefits from the availability of hardware acceleration in the platform.

**Table B.4- 23 CSS3 Transitions module**

CSS3 Transitions module	Acceleration (NA/2D/3D/Vector)	Basic Profile	Advanced Profile	Comment
transition-property	NA	X	X	
transition-duration	NA	X	X	
transition-timing-function	NA	X	X	
transition-delay	NA	X	X	
transition-shorthand	NA	X	X	
background-color	NA	X	X	
background-image	NA		X	
background-position	NA	X	X	
border-bottom-color	NA	X	X	
border-bottom-width	NA		X	
border-color	NA	X	X	
border-left-color	NA	X	X	
border-left-width	NA		X	
border-right-color	NA	X	X	
border-right-width	NA		X	
border-spacing	NA		X	
border-top-color	NA	X	X	
border-top-width	NA		X	
border-width	NA		X	
bottom	2D	X	X	
color	NA	X	X	
crop	NA		X	
font-size	NA		X	
font-weight	NA		X	
grid-*	NA		X	
height	NA		X	
left	2D	X	X	
letter-spacing	NA		X	
line-height	NA		X	
margin-bottom	NA		X	
margin-left	NA		X	
margin-right	NA		X	
margin-top	NA		X	
max-height	NA		X	

<b>CSS3 Transitions module</b>	<b>Acceleration (NA/2D/ 3D/Vector)</b>	<b>Basic Profile</b>	<b>Advanced Profile</b>	<b>Comment</b>
max-width	NA		X	
min-height	NA		X	
min-width	NA		X	
opacity	2D	X	X	
outline-color	NA	X	X	
outline-offset	NA		X	
outline-width	NA		X	
padding-bottom	NA		X	
padding-left	NA		X	
padding-right	NA		X	
padding-top	NA		X	
right	2D	X	X	
text-indent	NA		X	
text-shadow	NA		X	
top	2D	X	X	
vertical-align	NA		X	
visibility	NA		X	
width	NA		X	
word-spacing	NA		X	
z-index	NA		X	

**B.4.5.1.5.5 The CSS3 2D Transformations module**

The CSS3 2D transformations module shall be implemented according to the profile of the W3C CSS3 specification [34] detailed in the table below. The table below also provides an indication as to whether a particular CTV feature benefits from the availability of hardware acceleration in the platform.

**Table B.4- 24 CSS3 2D Transforms module**

CSS3 2D Transforms module	Acceleration (NA/2D/3D/Vector)	Basic Profile	Advanced Profile	Comment
matrix(<number>, <number>, <number>, <number>, <number>, <number>)	NA		X	
translate(<translation-value>[, <translation-value>])	2D	X	X	
translate(<translation-value>[, <translation-value>])	2D	X	X	
translateY(<translation-value>)	2D	X	X	
scale(<number>[, <number>])	2D	X	X	
scaleX(<number>)	2D	X	X	
scaleY(<number>)	2D	X	X	
	3D	X*	X	* Note: Feature is not guaranteed to be hardware accelerated in Basic Profile, and performance will be limited
rotate(<angle>)				
skewX(<angle>)	3D		X	
skewY(<angle>)	3D		X	
skew(<angle> [, <angle>])	3D		X	

**B.4.5.1.5.6 The CSS3 3D Transformations module**

3D graphics is an optional feature for Advanced Profile compliant Terminals. If Terminals indicate that the feature is supported, as per the capabilities API detailed in section [B.4.6.2.6 Support for CTV graphics extensions](#), then the CSS3 3D Transformations module shall be supported according to the W3C standard, [35] detailed in the table below. The table below also provides an indication as to whether a particular feature benefits from the availability of hardware acceleration in the platform.

**Table B.4- 25 CSS3 3D Transforms module**

CSS3 3D Transforms module	Acceleration (NA/2D/3D/Vector)	Basic Profile	Advanced Profile	Comment
matrix	3D		×	
matrix3d	3D		×	
translate(<translation-value>[, <translation-value>])	3D		×	
translate3d(<translation-value>, <translation-value>, <translation-value>)	3D		×	
translateX(<translation-value>)	3D		×	
translateY(<translation-value>)	3D		×	
translateZ(<translation-value>)	3D		×	
scale(<number>[, <number>])	3D		×	
scale3d(<number>, <number>, <number>)	3D		×	
scaleX(<number>)	3D		×	
scaleY(<number>)	3D		×	
scaleZ(<number>)	3D		×	
rotate(<angle>)	3D		×	
rotate3d(<number>, <number>, <number>, <angle>)	3D		×	
rotateX(<angle>)	3D		×	
rotateY(<angle>)	3D		×	
rotateZ(<angle>)	3D		×	
skewX(<angle>)	3D		×	
skewY(<angle>)	3D		×	
skew(<angle> [, <angle>])	3D		×	
perspective(<number>)	3D		×	

### B.4.5.1.6 Graphics Resolutions

Graphics resolutions shall be supported as specified in [1].

### B.4.5.1.7 Device performance & Benchmarking

Section **Error! Reference source not found.** provides an indication for the class of device required to give an acceptable End-user experience for Basic and Advanced Profile graphics. Absolute minimum performance levels will be defined once CTV implementations are available for benchmarking.

## B.4.5.2 Media control

### B.4.5.2.1 The HTML5 media elements

Sections 4.8.7, 4.8.8, 4.8.9 and 4.8.10 of HTML5 [26] SHALL be supported. Those sections cover the <source>, <audio> and <video> elements, as well as the associated interfaces and processes. Only the XHTML syntax of said markup SHALL be supported.

### B.4.5.3 Metadata access

#### B.4.5.3.1 Extensions to the OIPF metadata API's

This section describes the extensions to the APIs defined in [13] which are defined by this specification.

##### B.4.5.3.1.1 Extensions to the Download class

<code>readonly Integer duration</code>
The duration of the downloaded media (in seconds)

**readonly Date embargoTime**

The embargo time of the download. Before the embargo time, attempts to play the download shall fail.

**readonly Date expiryTime**

The expiry time of the download. After the expiry time, attempts to play the download shall fail.

**readonly Number viewingPeriod**

The viewing period of the download, measured in hours. After the viewing period has expired, attempts to play the download shall fail.

**readonly Boolean hasAD**

Flag indicating whether the download has an audio description

**readonly StringCollection ADLanguages**

Supported audio description languages, indicated by ISO 639 language codes.

**readonly Boolean viewed**

Flag indicating whether the download has been viewed.

**readonly Boolean subtitles**

Flag indicating whether subtitles are available for this download

**readonly Number subtitlesType**

The type of subtitles supported for this download.

**readonly Boolean isHD**

Flag indicating whether the download has high-definition video.

**readonly Boolean isWidescreen**

Flag indicating whether the download has widescreen video.

**readonly Integer audioType**

Bitfield indicating the type of audio that is available for the programme. Values are determined as follows:

Value	Description
1	A mono audio stream is available.
2	A stereo audio stream is available.
4	A multi-channel audio stream is available.

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.

**readonly StringCollection audioLanguages**

Supported audio languages, indicated by iso639 language codes.

**readonly StringCollection subtitleLanguages**

Supported subtitle languages, indicated by iso639 language codes.

**readonly Integer reason**

The reason property is only valid if the value of the state property is DOWNLOAD\_FAILED.

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.
3	The item is invalid due to bad checksum or length.
4	Other reason.

If no error has occurred, this argument SHALL take the value undefined.

**readonly BookmarkCollection bookmarks**

A collection of the bookmarks set in a download. If no bookmarks are set, the collection SHALL be empty.

**B.4.5.3.1.2 Extensions to the ScheduledRecording class****readonly String programmeCRID**

The programme CRID of the programme

**readonly StringCollection groupCRIDs**

The group CRIDs associated with the programme

**readonly StringCollection recommendationCRIDs**

The recommendation CRIDs associated with the programme.

**readonly String IMI**

The TV-Anytime Instance Metadata ID for this programme.

**readonly String guidanceText**

The guidance text for the recording, e.g. "Contains strong language and scenes which some may find upsetting".

**readonly StringCollection genres**

A collection of genres that describe the recording.

**readonly Date embargoTime**

The embargo time of the recording. Before the embargo time, attempts to play the recording shall fail. The value of this property shall be undefined for recordings which are not scheduled as the result of a broadcast record list.

**readonly Date expiryTime**

The expiry time of the recording. After the expiry time, attempts to play the recording shall fail. The value of this property shall be undefined for recordings which are not scheduled as the result of a broadcast record list.

**readonly Boolean isHD**

Flag indicating whether the programme to be recorded has high-definition video.

**readonly Boolean isWidescreen**

Flag indicating whether the programme to be recorded has widescreen video.

**readonly Integer audioType**

Bitfield indicating the type of audio that is available for the programme to be recorded. Values are determined as follows:

<b>Value</b>	<b>Description</b>
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 to be recorded.

**readonly StringCollection audioLanguages**

Supported audio languages, indicated by iso639 language codes.

**readonly StringCollection subtitleLanguages**

Supported subtitle languages, indicated by iso639 language codes.

**readonly Number subtitlesType**

The type of subtitles supported for the programme to be recorded.

**readonly Boolean hasAD**

Flag indicating whether the recording has an audio description

**readonly StringCollection ADLanguages**

Supported audio description languages, indicated by ISO 639 language codes.

**readonly Number viewingPeriod**

The viewing period of the scheduled recording, measured in hours. The value of this property shall be undefined for recordings which are not scheduled as the result of a broadcast record list.

readonly Boolean <b>isManual</b>
----------------------------------

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.

#### B.4.5.3.1.3 Extensions to the Recording class

Note that all the extensions to the ScheduledRecording class defined in section [B.4.5.3.1.2 Extensions to the ScheduledRecording class](#) are also supported on the Recording class. The definitions of the properties audioLanguages, subtitleLanguages, isHD, isWidescreen and audioType given in section [B.4.5.3.1.2](#) are identical to the definitions of the corresponding properties on the Recording class given in [\[13\]](#). These properties are already included as extensions to the Recording class in table B.4-17.

readonly Boolean <b>viewed</b>
--------------------------------

Flag indicating whether the recording has been viewed.

#### B.4.5.3.1.4 Extensions to the Application/oipfSearchManager embedded object

The createSearch () method SHALL support an additional value for the searchTarget parameter, as shown below:

**Table B.4- 26 Extensions to the Application/oipfSearchManager**

Value	Description
1	Metadata relating to scheduled content shall be searched.
2	Metadata relating to on-demand content shall be searched.
4	Metadata relating to content recorded through the CTV recording mechanism or downloaded through the CTV download mechanism shall be searched. Use of this value SHALL be restricted to Trusted Applications only; attempts by other Applications to use this SHALL return no results.

**B.4.5.3.1.5 Extensions to the Programme class****String guidanceText**

The guidance text for the programme, e.g. "Contains strong language and scenes which some may find upsetting".

**String programmeCRID**

The programme CRID of the programme

**StringCollection groupCRIDs**

The group CRIDs associated with the programme

**StringCollection recommendationCRIDs**

The recommendation CRIDs associated with the programme.

**String IMI**

The TV-Anytime Instance Metadata ID for this programme.

**Boolean hasAD**

Flag indicating whether the recording has an audio description

**StringCollection ADLanguages**

Supported audio description languages, indicated by ISO 639 language codes.

**Number subtitlesType**

The type of subtitles supported for this download.

## B.4.5.4 Security

Section B.5.9.2 of this specification defines four security levels for applications. For HTML applications, these security levels impose the following restrictions:

**Table B.4- 27 Application Security model**

Security level	Restrictions
Untrusted	As defined in Table B.4-2 and table A.1 of TS 102 796 [23].
Broadcast-related	As defined in Table B.4-2 and table A.1 of TS 102 796 [23].
Trusted	As defined in Table B.4-2 and table A.1 of TS 102 796 [23].
Privileged	Applications with this trust level shall have access to all recordings and downloads, i.e. access to the OIPF application/oipfRecordingScheduler, application/oipfDownloadTrigger or application/oipfDownloadManager objects shall be unrestricted.

Note that Table B.4-27 relaxes the security levels of some of the APIs defined in TS 102 796 [23].

## B.4.5.5 Notifications

This API is the HTML/JavaScript implementation of the Notification mechanism defined in section B.4.2.6Notifications

Note: This API is aligned with the W3C Web Notifications API (<http://dev.w3.org/2006/webapi/WebNotifications/publish/Notifications.html>). It is hoped to replace this definition with a normative reference to that API (with some extensions) when that specification is sufficiently stable. Of the types of notification included in that document, this API supports only ambient Notifications and a subset of interactive Notifications – where the End-user selecting a notification results in the originating Application becoming the Active Application. This is handled by the Terminal implementation and not by the Application receiving an event and then making a request to be shown.

### B.4.5.5.1 The NotificationCenter Interface

The NotificationCenter interface defines methods and constants used for scheduling Notifications and shall be implemented by the Application/oipfApplicationManager embedded object.

#### Constants

The following constants are defined as properties of the NotificationCenter class:

Constant name	Use
<b>reminder</b>	A reminder that something is about to start
<b>taskfinished</b>	A task which was started by the end-user has now finished
<b>newcontent</b>	A new content item is available (e.g. in a series of interest to the user).
<b>expiration</b>	Content is about to become unavailable.
<b>other</b>	Other notification, other than those listed above. E.g. Social networking event, email notification

#### Methods

<b>Notification createNotification( String icon, String title, String body, Number type )</b>		
Description	Creates a notification object using the parameters supplied. Note that the Terminal may truncate the notification title and body for display purposes.	
Arguments	<i>icon</i>	A URL for an icon for the notification. This URL shall be relative to the base URL of the current document.
	<i>title</i>	A short plain text description of the notification.
	<i>body</i>	A longer plain text description of the notification.

### B.4.5.5.2 The Notification class

#### Properties

<b>function onclose()</b>	
Description	This function is called when a notification is closed, either by the cancel() method being called or by the notification system.
<b>function ondisplay()</b>	
Description	This function is called after a call to the show() method when the notification becomes visible to the end-user.
<b>function onerror()</b>	
Description	This function called after a call to the show() method if the notification will not be shown to the end-user.
<b>function onclick()</b>	
Description	This function is called after a call to the show() method if the user accepts the notification.

Number <b>notificationType</b>	
Description	The type of the notification. This shall be one of the constants defined in the <code>NotificationCenter</code> class.

**Methods**

<b>void cancel()</b>	
Description	If the notification is currently shown to the end-user then remove it (and call any onclose function). If the Notification is queued waiting to be shown then remove it from the queue (and call any onerror function).

<b>void showNotification(Boolean requestActivation)</b>	
Description	Shows the notification to the end-user. This may be queued if the notification implementation has a limit on the number of Notifications shown at one time and that limit is already reached.
Arguments	<p><i>requestActivation</i></p> <p>If true, offer the user the choice of making this Application become the Active Application. This may be queued if the notification implementation has a limit on the number of Notifications shown simultaneously and that limit is already reached.</p> <p>This parameter is optional – if not specified, the default value of this parameter is false.</p>

<b>Boolean test()</b>	
Description	Tests if the notification would be presented to the end-user or if it would be blocked. The method shall return true if the notification would be offered to the end-user and false if the notification would be blocked. A return value of true from this method does not guarantee that a notification will be shown to the end user at some later time since the configuration of any blocking mechanism may have been changed in the mean time.

**Events**

For the intrinsic events listed in the table below a corresponding DOM level 2 event SHALL be generated in the following manner:

**Table B.4- 28 Notification Events**

Intrinsic event	Corresponding DOM 2 event	DOM 2 Event properties
onclose	close	Bubbles: No Cancelable: No Context Info: None
ondisplay	display	Bubbles: No Cancelable: No Context Info: None
onerror	error	Bubbles: No Cancelable: No Context Info: None
onclick	click	Bubbles: No Cancelable: No Context Info: None

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 the events listed above during the bubbling or the capturing phase. Applications that use DOM 2 event handlers SHALL call the `addEventListener()` method on the `Notification` class. The third parameter of `addEventListener`, i.e. “useCapture”, will be ignored.

### B.4.5.6 Broadcaster Interruptions

This section describes the extensions to the APIs defined in [13] to support broadcast-triggered native applications as defined in sections A.8.5.11 and B.4.2.3.5.

#### B.4.5.6.1 Extensions to the Configuration class

Boolean <b>broadcasterInterruptions</b>
Flag indicating whether applications can be interrupted by a broadcast-triggered native application.  The value of this flag enables or disables the receiver's ability to respond to other broadcaster signalling, e.g. promotional linking (see D-Book Part A [1] Section 8.5.11) which may interrupt or overlay the current application.  A value of true indicates that applications may be interrupted by a broadcast-triggered native application. A value of false indicates that they may not.  The default value for this property is true.

#### B.4.5.6.2 Broadcast Region

String <b>broadcastRegion</b>
The name of the preferred region that has been set for the receiver. The value of this string shall be the value carried in the <code>target_region_name_descriptor</code> corresponding to the <code>target_region_descriptor</code> with the highest <code>region_depth</code> value for the selected region.

## B.4.5.7 Extensions to the application/oipfParentalControlManager embedded object

See [B.5.14](#) for parental control requirements.

### Properties

<code>Boolean parentalControlEnabled</code>	
Flag indicating whether parental control support is enabled in the Terminal. This property shall take one of the following values:	
Value	Semantics
true	Parental control is enabled in the Terminal
false	Parental control is disabled in the Terminal
undefined	The Terminal does not support parental control.

<code>function onParentalAuthorisationResult</code>											
The function to be called when the parental authorisation process initiated by a call to <code>promptForAuthorisation()</code> is complete. This function is called with one argument:											
<ul style="list-style-type: none"> <li>Integer result – the result of the authorisation process. The following result values are defined:</li> </ul> <table border="1"> <thead> <tr> <th>Value</th><th>Semantics</th></tr> </thead> <tbody> <tr> <td>0</td><td>Parental authorisation has not been granted</td></tr> <tr> <td>1</td><td>Parental authorisation has been granted</td></tr> <tr> <td>2</td><td>Parental control is not enabled in the Terminal</td></tr> <tr> <td>3</td><td>The Terminal does not support parental control</td></tr> </tbody> </table>		Value	Semantics	0	Parental authorisation has not been granted	1	Parental authorisation has been granted	2	Parental control is not enabled in the Terminal	3	The Terminal does not support parental control
Value	Semantics										
0	Parental authorisation has not been granted										
1	Parental authorisation has been granted										
2	Parental control is not enabled in the Terminal										
3	The Terminal does not support parental control										

### Methods

<code>void promptForAuthorisation( String promptText )</code>		
Description	Prompt the Terminal to perform parental authorisation of the current End-user as described in <a href="#">B.5.14</a> . The application will be notified of the result of the authorisation process via a “parentalAuthorisationResult” event targeted at the application/oipfParentalControlManager object.	
Arguments	<code>promptText</code>	Text to be displayed to the End-user as part of the authorisation prompt. See D-Book Part A <a href="#">[I]</a> section 13.10.9a.4 for restrictions on the length and format of this text.

### Events

For the intrinsic events listed in the table below a corresponding DOM level 2 event SHALL be generated in the following manner:

Intrinsic event	Corresponding DOM 2 event	DOM 2 Event properties
<code>onParentalAuthorisationResult</code>	<code>ParentalAuthorisationResult</code>	Bubbles: No Cancelable: No Context Info: result

## B.4.6 Capability exchange and the user-agent header

### B.4.6.1 User-Agent Header

All outgoing HTTP requests made by a Connected TV Presentation Engine shall include a User-Agent header using the syntax described in this clause. This User-Agent header may not be included in requests made by a media player or DRM system.

The User-Agent header shall include:

CTV/1.0 (<capabilities>; [<vendorName>]; [<modelName>]; [<softwareVersion>]; [<hardwareVersion>]; <reserved>) [42]

Where:

- The <capabilities> field consists of zero or more concatenated Connected TV option strings as defined in clause **Error! Reference source not found..**
- The <vendorName>, <modelName>, <softwareVersion> and <hardwareVersion> fields are the same as the one defined in the application/oipfRemoteManagement object in the OIPF DAE specification [13] and are optional.
- The <reserved> field is reserved for future extensions.

This User-Agent header may be extended with other implementation-specific information including other user agent information. In particular, it is recommended to include the browser user agent information.

Valid examples of this syntax are:

User-Agent: CTV/1.0 (+PVR+DL; Sonic; TV44; 1.32.455; 2.002) Bee/3.5

User-Agent: CTV/1.0 (;;;;)

### B.4.6.2 Capability exchange mechanism

The capability exchange mechanism defined in section 9.3 of [13] shall be supported, with the restrictions defined in section A.1 of TS 102 796 [23] and with the extensions defined below.

#### B.4.6.2.1 HTML5 media control

The device shall indicate support for HTML5 media control through the <html5\_media> element:

```
<xs:element name="html5_media" type="xs:boolean"/>
```

If included, the value of this element shall be: (true|false).

#### B.4.6.2.2 Metadata API support

The device shall indicate support for metadata searching (as defined in sections B.4.5.2 and B.4.5.3.1.4) through the capability exchange mechanism described in section 9.3.7 of [13]. Only support for the “dvb-si” metadata system is defined in this version of the specification. Support for indicating other metadata systems or indicating different profiles of the “dvb-si” metadata system may be added in a future version of the specification.

### B.4.6.2.3 Support for multiple simultaneously-running applications

The device shall indicate support for multiple simultaneously-running applications (as defined in B.4.2) through the <multipleApplications> element:

```
<xs:element name="multipleApplications"
  type="multipleApplicationsType"/>
<xs:complexType name=" multipleApplicationsType ">
  <xs:simpleContent>
    <xs:extension base="xs:boolean">
      <xs:attribute name="type" type="xs:string"/>
      <xs:attribute name="notifications" type="xs:boolean"/>
    </xs:extension>
  </xs:simpleContent>
</xs:complexType>
```

This element has the following semantics:

**<multipleApplications>** - indicates whether or not the Terminal supports multiple simultaneously-running applications. If included in the client capability description, the value of this element SHALL be: (true|false). The <multipleApplications> element has the following attributes:

- attribute “**type**” SHALL include a non-empty space separated list of names of supported application models, if the value of the <multipleApplications> element is true.
- Below is an extensible list of case insensitive application model names which MAY be used for this attribute:
  - “**none**”: indicates support for only one application and only one presentation engine at one time.
  - “**oneEngine**”: indicates support for multiple applications running within the same presentation engine, but only one presentation at one time.
  - “**oneApplication**”: indicates support for multiple presentation engines at one time, but only one application running in each presentation engine at one time.
  - “**full**”: indicates support for multiple applications running simultaneously in multiple presentation engines.
- attribute “**notifications**” SHALL include Boolean value indicating support for the notifications API defined in section B.4.5.5, if the value of the <multipleApplications> element is true.

### B.4.6.2.4 DRM support

The device shall indicate support for metadata searching through the capability exchange mechanism described in section 9.3.10 of [13].

### B.4.6.2.5 Support for linear services delivered via IP

The device shall indicate support for the delivery of linear services via IP (as defined in section B.4.4.5) through the <linear\_ip> element:

```
<xs:element name="linear_ip" type="xs:boolean"/>
```

If included, the value of this element shall be: (true|false).

### B.4.6.2.6 Support for CTV graphics extensions

The device shall indicate support for the CTV graphics extensions (as defined in [B.4.5.1](#)) through the <graphicsProfile> element:

```
<xs:element name="graphicsProfile" type="graphicsProfileType"/>
<xs:complexType name=" graphicsProfileType ">
<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:

**<graphicsProfile>** - indicates support for the CTV graphics extensions. If included in the client capability description, the value of this element SHALL be: (true|false). The <graphicsProfile> element has the following attributes:

- attribute “type” SHALL include a non-empty space separated list of graphics profiles, if the value of the <graphicsProfile> element is true.

Below is an extensible list of case insensitive application model names which MAY be used for this attribute:

- “**basic**”: indicates support for the basic graphics profile.
- “**advanced**”: indicates support for the advanced graphics profile.

### B.4.6.2.7 Support for series recording

The device shall indicate support for series recording using TV-Anytime CRIDS (as defined in [B.4.4.2](#)) through the <series\_recording> element:

```
<xs:element name="series_recording" type="xs:boolean"/>
```

If included, the value of this element shall be: (true|false).

### B.4.6.3 CTV Option strings

In addition to the option strings defined in TS 102 796 [\[23\]](#), the following option strings shall be supported.

**Table B.4- 29 CTV Option strings**

Option String	Description
+HTML5MEDIA	Indicates support for HTML 5 media control
+LINEARIP	Indicates support for linear services delivered via IP

### B.4.6.4 Application profile

In addition to the bit field define in table 5 in section 7.2.3.1 of TS 102 796 [\[23\]](#), add the following for 5.2.5 Platform profiles:

**Table B.4- 30 Application profile values**

Value	Description
0x0008	HTML5MEDIA feature
0x0010	LINEARIP feature
0x0020	DRM feature
0x0040	Advanced GFX feature

# B.5 Connected TV Security

## B.5.1 Introduction

The Internet has opened new opportunities for content providers but has also brought with it new problems. The availability of high speed internet connections and the ease with which data can be shared online has caused a lot of headaches in both the video and music industry.

Hundreds of millions of pounds is invested in creating high quality content every year and the potential loss of revenue if that content is not protected from copying can be enormous. Protecting the ownership of content has never been more important.

This specification aims to provide users with access to as much content as possible whilst respecting the requirements of the content owners who may wish to protect that content. It also aims to reduce the burden on platform operators and content owners wanting to make their content available to Terminals compliant with this specification.

## B.5.2 Scope

This specification defines the security related requirements for a Terminal, specifically:

- Composition of containers for protected content.
- Decryption of protected content and associated delivery of required Keys, IVs and other security related metadata.
- Integration of DRM(s) into Terminals and associated interactions.
- Security applied to Application APIs.
- Secure delivery of Applications and metadata.
- Guidelines for the protection of the Terminal in a network environment.
- Guidelines for the protection of End-user data.
- Information for supporting CI Plus as an optional DRM system.

## B.5.3 Security framework

### B.5.3.1 Content encryption

Protecting content can add additional overhead to content owners. They do not wish to be burdened with providing multiple copies of content for each combination of DRM, video/audio codec, device type, bitrate, streaming vs. downloading etc. The combinations quickly spiral out of control resulting in many versions of the same content to service each platform and Terminal. This in turn impacts the CDN, resulting in fewer cache hits and the need for larger cache capacity to support this multiplicity.

This specification significantly reduces this burden by providing a common container format; reducing the need for separate versions of the same content to support each DRM system.

This is achieved by specifying a single encryption scheme for each of MPEG2-TS and MP4 content, regardless of the DRM system that is used or the Terminal that it is being delivered to.

All DRM systems will need to employ the same decryption key (and initialisation vector) for the same piece of content. Where a DRM system may obtain the key from is out of the scope of this specification. For example, [Figure B.5-1](#) shows two different DRM systems obtaining the same key information from two different remote servers.

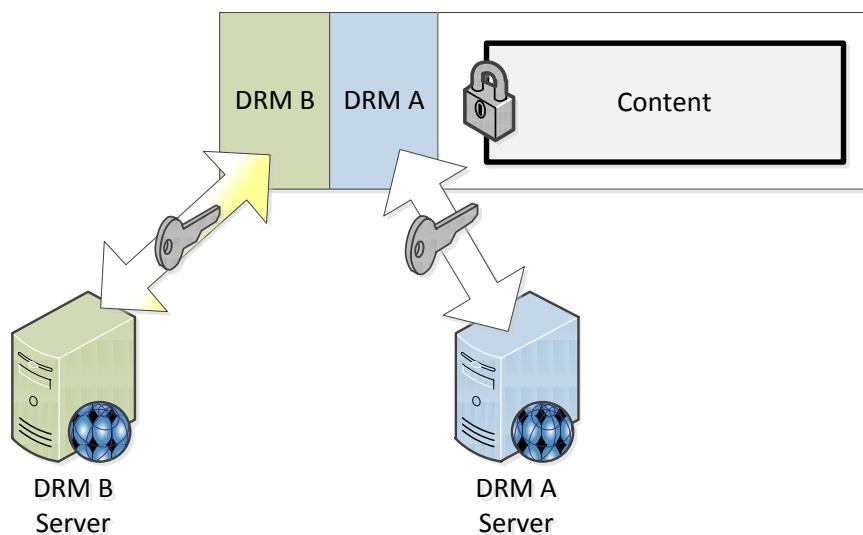
By separating and standardising the encryption of the content from the DRM it also becomes possible to add or remove (if no longer supported) a DRM system after encryption of the content without requiring re-encryption or multiple copies of the same content to be stored ([Figure B.5-2](#) and [Figure B.5-3](#)).

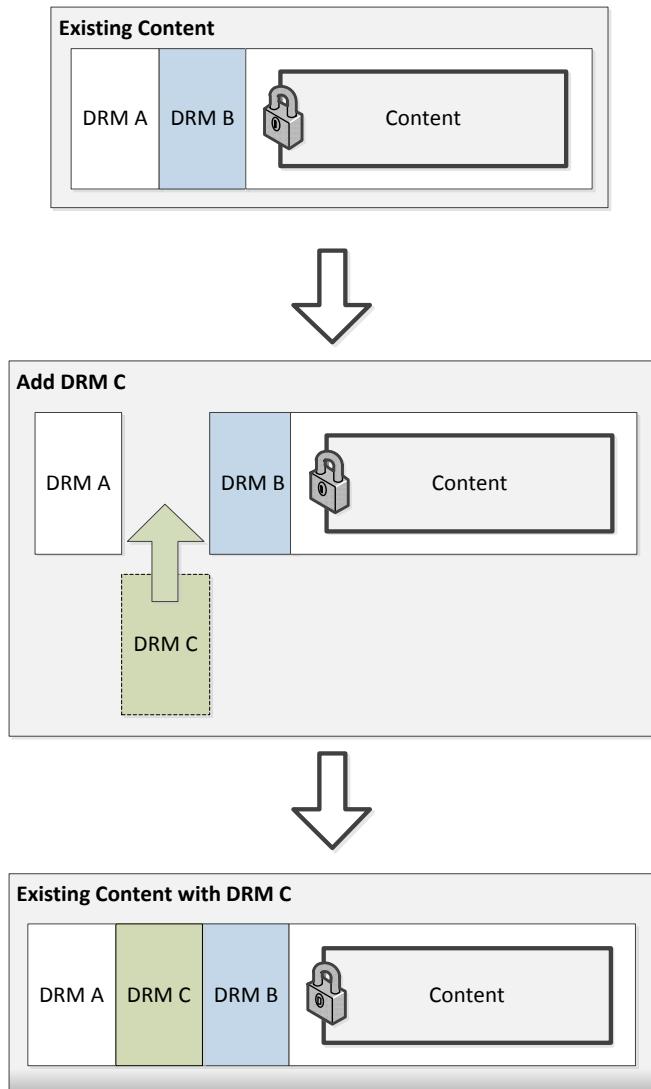
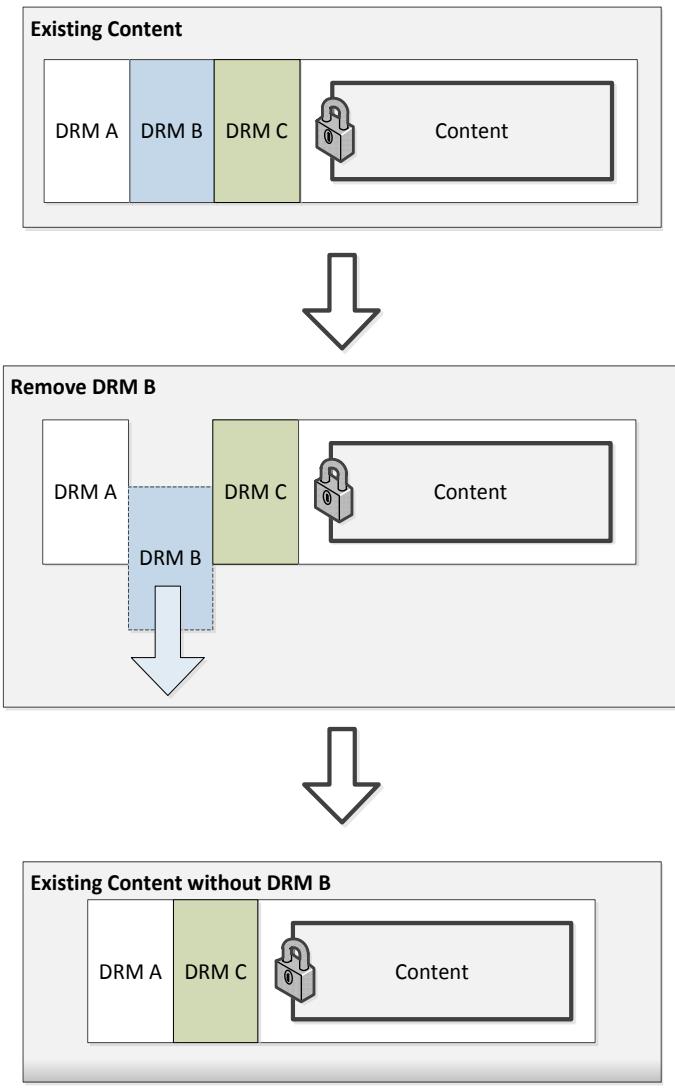
This specification allows each DRM system to store private data in the same container as the content (in-band) if required, this:

- Allows DRM systems to store private data embedded within the content that is outside the scope of this specification.
- De-couples the need for the server of the content to separately supply the DRM signalling (requiring a mapping between the two items).
- Facilitates secure side-loading of content onto other devices, which this specification aims not to prevent.

Signalling may also be provided out-of-band to a DRM system (i.e. in the `AbstractContentAccessDescriptor`) or as a combination of both in and out of band as required.

**Figure B.5-1 Content protected by multiple DRM systems using the same key/IV.**



**Figure B.5-2 Adding DRM support to existing content****Figure B.5-3 Removing DRM Support from existing content.**

### B.5.3.2 DRM selection

This specification is not mandating a single DRM for content protection but instead is providing a framework into which any DRM able to function within the framework can be used. It is therefore the choice of the manufacturer to decide which, if any, DRMs will be supported in a compliant Terminal.

The choice of DRM by a manufacturer is outside the scope of this specification but it is expected that business to business relationships and/or licence agreements with platform operators would likely inform the selection of a specific DRM solution.

The choice of DRM(s) has a direct impact on the content that is made available; this is especially true for premium content. It is strongly recommended that industry agreement is sought elsewhere to identify the DRM(s) that studios, service providers and manufacturers wish to support in order to enable access to the desired content.

### B.5.4 DRM signalling

DRM information may be signalled both in band (see B.5.5 and B.5.6) and out of band.

Out of band signalling may be provided in the DRMIInformationStructure of the AbstractContentAccessDescriptor ([Annex III.3: DTG extended AbstractContentAccessDescriptor](#)) and provided to the Terminal as a ContentAccessDownloadDescriptor or ContentAccessStreamingDescriptor ([Annex III.1: DTG ContentAccessDownloadDescriptor](#)). Out of band signalling may also be provided directly from an Application using the APIs specified in B.5.8. For rate-adaptive delivery, data may also be stored in the MPD (see section B.5.7.1).

### B.5.5 MPEG2-TS content protection

This section defines the protection of MPEG2 Transport Stream packets for content delivered under a DRM scheme.

#### B.5.5.1 Content encryption

The transport stream header shall be left in the clear. As defined in ISO/IEC 13818-1 [[43](#)], the header may include an adaptation field. Only the payload is ever encrypted.

When the payload of a Transport Stream packet is encrypted it shall be encrypted using the AES-128 encryption algorithm defined in FIPS PUB 197 [[44](#)]. This is used in the variant of Cipher-Block-Chaining (CBC) mode with Residual and Short Solitary Block handling technique defined in SCTE 52:2003 [[42](#)]. This is consistent with D-Book 7 Part A [[1](#)] section 13.5.4.1.

Where the key delivery mechanism does not carry an Initialisation Vector (“whitener” in SCTE 52:2003 [[42](#)]) then a value of zero will be assumed.

#### B.5.5.2 DRM signalling

In band signalling can be provided by private PIDs within the MPEG2-TS container, typically these would contain EMM and ECM data.

If the CAT contains a CA Descriptor then there is an implication that a component of the content in the MPEG2-TS is protected by a CA system. The CA descriptor will identify where the EMM stream can be found. Similarly CA descriptors in the PMT will define which elementary streams or if an entire service are/is protected and will identify where the relevant ECM stream(s) can be found. Multiple DRM systems can be supported by the use of multiple CA descriptors where required.

The data contained within the signalling is out of scope and private to the DRM system(s).

### B.5.5.3 Key delivery

Keys for descrambling the protected content shall be delivered by the appropriate DRM system(s), usually within an encrypted content licence.

The key delivery mechanism specified in D-Book Part A [1] Section 17.17 is not precluded by this specification for MHEG applications.

The format and protection of such DRM licences is the responsibility of the DRM vendor, and are out of scope for this specification. The licence may be obtained by the DRM client using the information that was included in the DRM-specific signalling.

## B.5.6 MP4 content protection

This section defines the protection of CTVFF content delivered under a DRM scheme.

### B.5.6.1 Content encryption

The Common Encryption protection scheme specified in [45][CENC] shall be used for all encrypted CTVFF files. The same [45] [CENC] encryption algorithm, AES128 Counter Mode [44] [FIPS PUB 197] [CTR] shall be used for all DRM systems for the protection of CTVFF files, to enable access to the same protected content file through any of the DRM systems supported by the service provider. [45]

Note: This aligns with the UltraViolet Common File Format [9] [CFF] and [11][DASH]

The above encryption algorithm shall be used whether the content is streamed, downloaded, or otherwise distributed to the Terminal. Different keys may be used (for example per video/audio track) within the same CTVFF container. The same key values shall be used by each DRM (as per [45] [CENC]).

Key Rotation is allowed (for example for live services), provided that the chosen DRM(s) support it. Consideration should be given to the latency in the delivery of keys to ensure uninterrupted service (for example key rotation at most once a day and new keys being provided at least 60 seconds before being needed for decryption). Information required in the decryption process, such as Initialisation Vectors, must be contained in the appropriate format, referenced using the Sample Auxiliary Information Offsets box ("saio") and Sample Auxiliary Information Sizes box ('saiz'). Both the formatting and use of these boxes must be as specified in [45] [CENC]. Although these boxes can point to the IVs, etc, anywhere in the fragment, the information should be gathered within a Sample Encryption box ("senc") as defined in [9] [CFF] section 2.2.6 excluding section 2.2.6.3 (which is not intended for live content, only downloaded).

### B.5.6.2 DRM signalling

DRM signalling comprises one or more valid sets of decryption information, or one or more pointers to where such information can be obtained, or some combination thereof.

DRM signalling for each supported DRM shall be included in the CTVFF container.

All in-band DRM-specific signalling information for each supported DRM shall be placed in a separate Protection Systems Specific Header ("pssh") box [CENC] within the CTVFF container<sup>11</sup>. In this way, the signalling can be easily added or replaced without requiring any other changes to the container. Note that it may also be possible to embed out-of-band delivered signalling in the CTVFF container's "pssh" boxes.

In accordance with [9] [CFF], any changes in the size of "pssh" boxes shall be compensated by the opposite change in the size of the "free" box thus ensuring file size and internal pointers remain unchanged. If there is insufficient space in the "free" box to compensate for the required data the behaviour is undefined. Note that upon creation of a CTVFF

<sup>11</sup> The IPMP signalling method defined in [MPEG4S] may be used in addition to the pssh boxes for providing DRM-specific information.

container sufficient space should be allocated to the “free” box for all expected changes in “pssh” boxes.

The DRM-specific data contained within the signalling is out of scope and private to the DRM system(s).

The ‘pssh’ boxes in the CTVFF container may be used and combined in various ways, the choice of which is out of scope. Some possible examples follow below:

Id	Name	Description
1	Licence Embedded by Service Provider	In this case, the service provider delivers a unique copy of the CTVFF container that already includes the relevant DRM licence(s) necessary for use by that individual user or household. This requires no further interaction with the service provider but would not be playable by another user.
2	Licence Provided on Playback	<p>In this case, the CTVFF container holds licence acquisition information (a —pointer<sup>12</sup>) for each supported DRM. When a device attempts to play the contents, the relevant DRM looks at the pointer and uses it to request a valid Licence for this device and user.</p> <p>This approach allows the same file to be reused for multiple customers (e.g. cached in a CDN), and could allow the consumer to share it with friends in a “super-distribution model”. However, playback requires an active network connection to obtain the licence.</p>
3	Licence Embedded by Device	In this case, a file is received with no licences, but with licence acquisition information (pointers) as per 2 above. When the device receives the file, it uses the pointer(s) to obtain a valid licence. This licence is then embedded in the file as in 1 above. This approach allows the same file to be distributed to many users, but also only requires the receiving device to have network access.
4	Combination of the above	<p>Examples:</p> <ul style="list-style-type: none"> <li>• The service provider may include DRM licences for DRM-A and DRM-B, but only a pointer for DRM-C.</li> <li>• A device as described in 3 above will only be able to obtain and embed licences for DRMs that it has implemented. Pointers for other DRMs will remain unchanged, thus usable by later devices attempting to play the file with other supported DRMs.</li> </ul>

<sup>12</sup> Super-distribution refers to the ability to share content with other users who may be required to purchase a licence in order to enable full playback of that content.

### B.5.6.3 Key delivery

Keys for descrambling the protected content shall be delivered by the appropriate DRM system, usually within an encrypted content licence. The format and protection of such DRM licences is the responsibility of the DRM vendor, and are out of scope for this specification. The keys/licence may be obtained by the DRM client using the information that was included in the DRM-specific signalling.

### B.5.6.4 Content Usage Rights

It is the responsibility of the service provider to generate suitable DRM Licences that grant appropriate rights to the user under their business model.

The rights granted to a user for protected content by the DRM are definitive. Any other information indicating rights (e.g. in metadata, Application text, EPG data etc.) is purely informative and does not change these rights.

## B.5.7 Rate adaptive

Where adaptive bitrate systems are used there is the ability to include signalling information within the MPD and there are requirements on the construction of media and initialisation segments.

### B.5.7.1 MPD

Content protection signalling is stored within the MPD inside ContentProtection elements ([11] [DASH] section 5.8.4.1). A ContentProtection element shall be present for each content protection system used.

MPD URI definitions for ContentProtection elements shall conform to [11] [DASH] section 5.8.5.2 “Content protection”, where ISO/IEC14496-12 includes CTVFF containers. The appropriate parts are repeated here for clarification:

- “For Representations based on ISO/IEC 13818-1 (MPEG-2 Transport Stream), the following URI are defined to indicate the Conditional Access System used:  
urn:mpeg:dash:13818:1:CA\_descriptor:2011”
- “For Representations based on ISO/IEC14496-12 [CTVFF] a content protection scheme using the Protection System Specific Header Box defined in ISO/IEC 23001-7 may be identified in the ContentProtection element. In this case a UUID URN as defined in RFC 4122 indicating the UUID specified in the SystemId field of the Protection System Specific Header Box shall be used.”

It is recommended that all <Representation> elements within an <AdaptationSet> will be protected by the same <ContentProtection> element(s). Therefore the <ContentProtection> elements will normally be contained within the <AdaptationSet> rather than individual <Representation> elements.

### B.5.7.2 MPEG2-TS Segments

Where an initialisation segment is used, this must contain a PMT indicating the PIDs on which ECM messages for any DRMs being supported can be found. It may also contain a CAT indicating DRM specific information.

Media must be formatted such that:

- Devices must be able to begin decryption of a media segment straightaway. This means that every media segment (preceded by the initialisation segment if one is being used) must contain enough information for the device to begin decryption

before any encrypted media is encountered. This may be achieved through the inclusion of one or more ECMs at the beginning of each media segment.

- When key rotation is used, the minimum time required between new keys being made available to a Terminal and them being needed for decryption must be met where a Terminal is playing a continuous stream (ie not seeking), regardless of whether any rate adaptation is occurring. This may be achieved through the synchronisation of keys and key changes across all representations. For example keys can be rotated at the start of each segment (providing the segment duration is greater than the minimum key change period) and the next keys advertised ready for the next segment.

### B.5.7.3 CTVFF Segments

The encoding shall ensure that the necessary keys are available before each fragment is played. This should be achieved by using a common key across switchable tracks, or by ensuring that whatever keys will be used are delivered before the rate switch occurs.

## B.5.8 Presentation engine to DRM communication

DRM systems may communicate with Applications running on the Terminal via the OIPF application/oipfDrmAgent embedded object, including the additions specified by [B.4.4.4 Additions for DRM status notification & discovery](#). This object can be used by Untrusted applications as specified by [B.4.4.2](#) See OIPF Re 1, Vol 5 [[13](#)], 7.6.1 and OIPF Re 2, Vol 5 [[14](#)], 7.6.1 for details of the application/oipfDrmAgent embedded object.

## B.5.9 Application security

### B.5.9.1 Introduction

This section describes how to protect the Terminal's, Content Provider's and End-user's data from unrestricted access. Users expect their data to be protected from malicious or otherwise damaging and undesirable effects to their Terminal. This should be handled automatically without prompting the End-user.

### B.5.9.2 Application trust model

This specification defines four trust levels ([Table B.5- 1](#)). Untrusted, Broadcast-related and Trusted are aligned with TS 102 796 [[23](#)] clause 11.1, Privileged is included for information purposes only. By default, broadcast signalled Applications from regulated<sup>13</sup> services shall be given Broadcast-related trust. All other Applications are Untrusted unless the manufacturer specifies otherwise<sup>14</sup>.

**Table B.5- 1 CTV Application Trust Levels**

Name	Description
<b>Untrusted</b>	Gives access to features which do not require any of the trust levels listed below, for example displaying content.  Applications with this trust level shall not have access to recordings or downloads, see <a href="#">B.4.5.4</a> .  Applications that are considered Untrusted will still be able to store cookies on the Terminal (see OIPF Re 1, Vol 5 [ <a href="#">13</a> ] 9.1).
<b>Broadcast-</b>	Gives access to features related to the presentation and control of

<sup>13</sup> Identification of which services are regulated is out of scope.

<sup>14</sup> How a manufacturer decides whether to trust an Application or not is out of scope.

<b>related</b>	<p>broadcast services and information about broadcast services.</p> <p>Applications with this trust level shall not have access to recordings or downloads, <a href="#">B.4.5.4</a>.</p> <p>Examples of features that require access to this trust level include access to the channel list, selection of a broadcast channel and access to the currently selected channel.</p> <p>“Broadcast” does not imply a tuner source (e.g. IP delivered content may be considered “Broadcast”). The specification is deliberately vague about defining Broadcast services. See <a href="#">B.4.2.1.7 Relation of Applications to Broadcast</a> for details on how broadcast related applications are signalled.</p>
<b>Trusted</b>	<p>Gives access to features which can make persistent changes to the media content stored on the receiver related to the domain that originated the application (and obtain information about that media content).</p> <p>Applications with this trust level shall have access to recordings and downloads made by Applications from the same FQDN, see <a href="#">B.4.5.4</a>.</p> <p>Examples of features that require access to this trust level include scheduling of recordings, listing downloaded content items and removal of a downloaded content item. It is out of scope to define which Applications and/or domains can be deemed trusted, a manufacturer may choose to ask the End-user or automatically determine trust as desired.</p>
<b>Privileged</b>	<p>Gives unrestricted access to all features of the Terminal, as defined by the manufacturer. This will be a superset of the union of the “broadcast-related” and “trusted” trust levels.</p> <p>Applications with this trust level shall have access to all recordings and downloads, see <a href="#">B.4.5.4</a>.</p> <p>An example of a feature that requires privileged access would be the ability to wipe the End-user’s hard drive. The precise details of this trust level are not defined in this specification.</p>

## B.5.10 Transport Layer Security

Note: This section of the specification is being reviewed to add a mandatory list root CA certificates and additional requirements regarding the safe use of certificates for TLS.

Terminals shall support the use of TLS v1.2 RFC 5246 [\[46\]](#). Terminals shall support TLS\_RSA\_WITH\_AES\_128\_CBC\_SHA for all uses of TLS. Terminals shall also support TLS\_RSA\_WITH\_RC4\_128\_SHA for IP delivery of A/V media ([B.2.5](#)). Terminals may also support other cipher suites.

Terminals may include one or more client certificates<sup>15</sup> for use with TLS to authenticate the receiver to service providers.

Note that when Terminals are requested to accept an anonymous key exchange the Terminal may wish to notify the user of the implications (e.g identity of remote server is not verified).

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<sup>15</sup> The provisioning of client certificates is out of scope of this specification.

## B.5.11 Terminal protection

### B.5.11.1 Introduction

Due to the connected nature of a Terminal and the fact that it is likely to be connected through a standard connection in the home to the public internet it may be vulnerable to attack either intentionally targeted or as part of a more generalised attack that targets vulnerabilities in common components of devices, such as the TCP/IP stack and common libraries.

Manufactures should be aware of the risks posed by possible attacks and the possibility that their Terminal could be exploited if not appropriately protected. Given the possible number of deployments of Terminals in the UK reaching into the millions, exploits pose a credible risk not only to the Terminal itself but other internet connected devices. In addition, the traditionally slow and expensive process of providing updates to Terminals results in vulnerabilities being present for longer periods of time, increasing the risk of exposure to an exploit.

This section provides references to documents which manufacturers may find useful in understanding the risks involved and possible strategies for reducing vulnerability to attack as well as guidelines for protecting data in a connected environment.

All information in this section is informative only.

### B.5.11.2 Sources

The information contained in this section is from three sources:

- **Centre for the Protection of National Infrastructure (CPNI):** Provides integrated security advice (combining information, personnel and physical) to the businesses and organisations which make up the national infrastructure. CPNI is an interdepartmental organisation, with resources from industry, academia and a number of government departments and agencies. These include the Security Service, CESG (the UK's national technical authority for information assurance) and other government departments responsible for national infrastructure sectors.
- **National Security Agency (NSA):** A US government defence organisation, the National Security Agency/Central Security Service (NSA/CSS) is home to America's codemakers and codebreakers. It leads the community in delivering responsive, reliable, effective, and expert Signals Intelligence and Information Assurance products and services.
- **The Information Security Forum (ISF):** An independent, not-for-profit association of leading organisations dedicated to clarifying and resolving key issues in information security and developing security solutions that meet the business needs of its Members.

It is recommended that these sources are consulted directly for the most up to date information on security related topics.

### B.5.11.3 Recommended reading

The following resources are recommended reading material for both manufacturers of Terminals and CTV service providers. Some sections are more relevant than others to the CTV ecosystem but in general they provide comprehensive and useful information related to the security of both physical equipment and data.

**Table B.5- 2 Recommended reading**

Title	Description	Reference
The 60 Minute Network Security Guide	<i>"This Security Guide was written with the less experienced System Administrator and Information Systems Manager in mind, to help them understand and deal with the risks they face."</i>	[47]
Securing Red Hat Linux	<i>"The purpose of this guide is to provide security configuration recommendations for the Red Hat Enterprise Linux (RHEL) 5 operating system. The guidance provided here should be applicable to all variants (Desktop, Server, Advanced Platform) of the product."</i>	[48]
Current Advice – Mitigating the risk of Malicious Software	<i>"This document is designed to inform organisations about the countermeasures that they can employ in order to help mitigate the threat posed to their information systems by malicious software (malware)."</i>	[49]
NISCC Technical note 07/03 – Internet Worms	<i>"This document Identifies some of the factors which should influence any assessment of threat posed by newly emerging worms and provide advice on prevention and remediation."</i>	[50]
NISCC Technical Note 06/02 - Response to Distributed Denial of Service (DDoS) Attacks	<i>"This NISCC technical note is intended to provide information to enable organisations in the UK's Critical National Infrastructure to respond to Distributed Denial of Service (DDoS) attacks"</i>	[51]
Sources of Guidance on Security in the Telecommunications Sector	<i>"The aim of this guidance is to act as a single source for the publicly available advice, guidance, standards, good practice, best practice, etc., relating to the security of "telecommunications systems"</i>	[52]
The Standard of Good Practice for Information Security	<i>"The Standard of Good Practice for Information Security (the Standard) is the foremost authority on information security. It addresses information security from a business perspective, providing a practical basis for assessing an organisation's information security arrangements"</i>	[53]

## B.5.11.4 Data protection

The section lists some best practices for handling End-user data. This is directly relevant to the storage and transfer of information such as audience measurement and payment details.

Section SM 4.2 of [53] is recommended reading, of note SM 4.2.5 states:

*“Individuals about whom personally identifiable information is held (e.g. the ‘data subject’ according to the EU Directive on Data Protection) should:*

- a) *have their approval sought before this information is collected, stored, processed or disclosed to third parties*
- b) *be informed of how this information will be used, allowed to check its accuracy and able to have their records corrected or removed.”*

It is recommended that all End-user data is transferred securely, CB2.6.1 of [54] states:

*“The transfer of sensitive information (eg involving other business applications or third parties) should involve the use of cryptography to:*

- a) *protect the confidentiality of sensitive information when transferred*
- b) *determine if critical information has been altered during transfer*
- c) *enable the identity of the originator of critical information to be proven (eg using digital signatures to provide non-repudiation).”*

Additionally SD4.6.8 of [54] when specifically discussing web-enabled development states:

*“Sensitive information in transit should be protected against disclosure by using encryption (eg using Secure Sockets Layer (SSL) or Transport Layer Security (TLS)) and by using HTTP PUT operations rather than GET operations.”*

UE6.1.3 of [54] states:

*“Where personally identifiable information is stored or processed, there should be methods in place to ensure that it is:*

- a) *adequate, relevant and not excessive for the purposes for which it was collected*
- b) *accurate (eg by ensuring information is recorded correctly and kept up-to-date)*
- c) *kept confidential*
- d) *processed fairly and legally*
- e) *used only for specified, explicit and legitimate purposes*
- f) *held in a format that permits identification of individuals for no longer than is necessary*
- g) *only provided to third parties that can demonstrate compliance with legal and regulatory requirements for handling personally identifiable information*
- h) *Retrievable in the event of a request for access.”*

Finally UE6.1.4 of [54] states:

*“Personally identifiable information should be handled in accordance with relevant legislation (eg the EU Directive on Data Protection, the US Health Insurance Portability and Accountability Act (HIPAA) and the Payment Card Industry (PCI) Data Security Standard).”*

## B.5.11.5 System design

Section SD4 of [54] provides guidance on the design and build of products covering the arrangements needed to address information security during design; acquisition and system build to ensure that systems are built correctly, able to withstand malicious attacks, and that no security weaknesses are introduced during the build process.

Sub-section SD4.1.2 of [54] states:

“Systems should be designed to:

- a) provide ‘defence in depth’ (ie multiple layers of protection) to avoid reliance on one type or method of security control
- b) assume input from external systems is insecure
- c) repeat any client validation at the server, to defend against ‘man in the middle’ attacks
- d) employ secure defaults
- e) ensure key components ‘fail securely’ (ie in the event of a system failure, information is not accessible to unauthorised individuals, and cannot be tampered with or modified)
- f) run with ‘least privilege’ (ie only the minimum possible privileges are granted to a user or a process when accessing the system, and not high-level privileges such as ‘root’ in UNIX systems or ‘Administrator’ in Windows systems). ”

Some SoC provide additional security features that manufacturers may wish to make use of in their product. Security surrounding software updates should be considered carefully to ensure that only legitimate updates are applied to Terminals as appropriate.

## B.5.11.6 Network resilience

There are many steps that can be taken to reduce the risk of exploitation which should be considered. A compact ‘60 minute’ overview of best practices in network security across a range of devices is provided by [47]. Whilst large parts of this document aren’t applicable to Terminals directly there are many sections that are.

It is expected that a proportion of Terminals will be running a UNIX variant of some kind and as such the best practices in the “UNIX Systems and Networks” section of [47] provide some useful guidelines. Some relevant extracts are provided below:

- “As much as possible, use the latest available and stable versions of the operating systems and the applications
- Run a port scanner, such as nmap (available at <http://www.insecure.org/nmap>) to list open ports and services. In addition, run netstat -a to view the status of all socket and routing table entries.
- All unnecessary services (e.g., rex, rquotad, talk, sadmind, kcmsgd, rstatd, fs, exec, daytime, walld, fingerd, systat, rusersd, sprayd, uucpd, chargen, time, echo, display, tftp, comsat and discard) should be disabled so they do not start at boot time.
- Ensure that network configuration files (such as /etc/hosts, /etc/defaultdomain, /etc/defaultrouter, and /etc/netmasks) are owned by root/root and have permissions of 644.
- Ensure that recommended and system security patches are installed and are up-to-date
- Delete unneeded default system accounts (like nobody4, uucp).
- Look for setuid or setgid files and programs.
- Disable unnecessary setuid/setgid programs by deleting the uid and/or sgid bits with the chmod command.
- Look for world-writable directories and files and eliminate world access if not needed. This prevents unauthorized access or the insertion of malicious code.

- World writable directories (like /tmp) should have the sticky-bit set. (e.g. chmod 1777 /tmp)"

In addition [48] provides a comprehensive guide to securing a Red Hat Linux distribution. Many of the concepts and issues raised in this document are relevant to other operating systems as well as the embedded variants of Linux that would typically be deployed in a Terminal.

## B.5.12 End-user authentication

End-user authentication will be handled by the Application environment e.g. standard login mechanisms (see OIPF Re 1, Vol 7 [54] section 5.6). This may be re-enforced by a DRM if needed, APIs defined for DRM communication can be used to achieve this functionality (see B.5.8).

## B.5.13 Copy protection

Copy protection will be handled by DRM output control. The signalling and enforcement of this protection is proprietary to the DRM system and outside the scope of this specification.

## B.5.14 Parental controls

Approaches "a)" and "b)" of OIPF Re 1, Vol 5 [13] Section 4.5 are not required by this specification, approach "c)" is required as follows.

Terminals shall support a parental control mechanism sufficient to restrict access to content to authorised users. This may be a numeric PIN but alternative mechanisms are also allowed. It shall be possible for a user to enable the parental control mechanism and it may be possible for a End-user to disable it. The parental control mechanism shall be capable of performing authorisation of a End-user for content and Applications that do not support a DRM.

A parental rating value may be signalled in the *ParentalRating* element of the *AbstractContentAccessDescriptor* ( [B.3.8 Content Access Descriptors](#) and [Annex III.3: DTG extended AbstractContentAccessDescriptor](#)) and provided to the Terminal as a *ContentAccessDownloadDescriptor* ([Annex III.1: DTG ContentAccessDownloadDescriptor](#)) or *ContentAccessStreamingDescriptor* ([Annex III.2](#)). For a Scheme attribute value of "urn:dtg:metadata:cs:DTGContentWarningCS:2011" ([Annex III.7 DTG Content Warning Classification Scheme](#)) the *ParentalRating* value "W" for Watershed indicates that parental authorisation is required. For a Scheme attribute value of "urn:dtg:cs:BBFCContentRatingCS:2002" ([Annex III.5: BBFC Classification Scheme](#)) the level at which parental authorisation is required is not defined here. If playback of content requiring parental authorisation is requested, then the Terminal shall check that parental authorisation has been obtained before any media is presented.

An Application may trigger parental authorisation (see [B.4.5.7](#)) in addition to or instead of the parental signalling specified in this section. When viewing a live linear IP channel, this API is the only parental control mechanism available (B.3.7.1.4). When recording a live linear IP channel, the parental rating is communicated via the program object (B.3.7.1.2).

A Terminal may cache the parental authorisation in order to reduce the number of times that the End-user is prompted (if the authorisation method used requires a prompt). For example, an Application may trigger the parental authorisation and then provide a *ContentAccessDownloadDescriptor* containing a *ParentalRating* requiring parental authorisation shortly afterwards, it may be desirable not to prompt the End-user twice in quick succession in such a scenario.

## B.5.15 CI Plus integration

Where Terminals use CI Plus [55][CIP] to support the protection of IP delivered content the following shall apply.

- OIPF Re 1, Vol 7 [50] section 4.2.3 (CI+ based Gateway) taking account of OIPF Re 1, Errata 2 [OIPF E2] section 9 (Errata for Volume 7).
- B.4.4.4 (Additions for DRM status notification & discovery), CI Plus related presentation APIs.

Manufacturers should note that in order for CI Plus to be used to protect IP delivered MPEG2-TS content it must be possible for that content to be routed via a PCMCIA CI Plus slot for processing.

## B.5.16 References

[1] D-Book 7 Part A Digital Terrestrial Television – Requirements for Interoperability (The D-Book) – 7 Part A – Digital TV Group (2011-03)

[6] [ISOFF] ISO/IEC 14496-12, Third Edition, "Information technology — Coding of audio-visual objects – Part 12: ISO Base Media File Format" with:

- Corrigendum 1:2008-12-01
- Corrigendum 2:2009-05-01
- Amendment 1:2009-11-15
- Amendment 3:2011-01-28/DAM (Note 1)

[7] [MP4] ISO/IEC 14496-14:2003, —Information technology — Coding of audio-visual objects — Part 14: MP4 file format

[8] OIPF Re 2 Vol 2a HAS] OIPF2 HAS Open IPTV Forum Release 2 specification, volume 2a (V2.0): "HTTP Adaptive Streaming".

[9] [CFF] DECE/UltraViolet Common File Format v1.0, <http://www.uvuu.com>

[11] [DASH] ISO/IEC 23001-6 Information technology — MPEG systems technologies — Part 6: Dynamic adaptive streaming over HTTP (DASH)

[13] [OIPF Re 1, Vol 5] Open IPTV Forum (OIPF) Release 1 specification, volume 5 (V1.1): "Declarative Application Environment".

[14] [OIPF Re 2, Vol 5] OIPF2 Open IPTV Forum Release 2 specification, volume 5 (V2.0): "Declarative Application Environment".

[23] [TS 102 796 V1.1.1] ETSI TS 102 796 (V1.1.1): "Hybrid Broadcast broadband TV".

[42] [SCTE 52:2003] – Data Encryption Standard Cipher Block Chaining Packet Encryption.

[43] [ISO/IEC 13818-1] Information technology – Generic coding of moving pictures and associated audio information: Systems

[44] [FIPS PUB 197] – Federal Information Processing Standards Publication 197 – Advanced Encryption Standard (AES) (FIPS PUB 197).

[45] [CENC] ISO/IEC 23001-7

[46] [RFC 5246] – The Transport Layer Security (TLS) Protocol Version 1.2

[47] [NSA1] The 60 Minute Network Security Guide ([http://www.nsa.gov/ia/\\_files/support/I33-011R-2006.pdf](http://www.nsa.gov/ia/_files/support/I33-011R-2006.pdf))

[48] [NSA2] Securing Red Hat Linux ([http://www.nsa.gov/ia/\\_files/os/redhat/rhel5-guide-i731.pdf](http://www.nsa.gov/ia/_files/os/redhat/rhel5-guide-i731.pdf))

---

[CPNII] Centre for the Protection of National Infrastructure Current Advice  
[www.cpni.gov.uk/Docs/currentAdvice.pdf](http://www.cpni.gov.uk/Docs/currentAdvice.pdf)

[50] [CPNI2] NISCC Technical note 07/03 – Internet Worms -  
<http://www.cpni.gov.uk/docs/re-20030805-00727.pdf>

[51][CPNI3] NISCC Technical Note 06/02 - Response to Distributed Denial of Service (DDoS) Attacks - <http://www.cpni.gov.uk/docs/re-20021025-00481.pdf>

[52][CPNI4] Sources of Guidance on Security in the Telecommunications Sector  
[http://www.cpni.gov.uk/Docs/Sources\\_of\\_Guidance\\_on\\_Security\\_in\\_the\\_Telecommunications\\_sector.pdf](http://www.cpni.gov.uk/Docs/Sources_of_Guidance_on_Security_in_the_Telecommunications_sector.pdf)

[53] [ISFI] Information Security Forums - The Standard of Good Practice for Information Security (<https://www.isfsecuritystandard.com> / [www.securityforum.org](http://www.securityforum.org))

[54][OIPF Re I, Vol 7] Open IPTV Forum (OIPF) Release I specification, volume 7 (VI.I): “Authentication, Content Protection and Service Protection”.

[55] PI [CIP] Clus Specification. Common Security Extensions to the Common Interface. VI.3 (2011-01)

[56][OIPF E2] OIPF Release I IPTV Solution VI.I Errata 2 [2011-03-10]

[57][CTR] —Recommendation of Block Cipher Modes of Operation||, NIST, NIST Special Publication 800-38A, <http://www.nist.gov/>

[58] [MPEG4S] ISO/IEC 14496-1:2010, —Information technology — Coding of audio-visual objects — Part 1: Systems||

# B.6 Connected TV Audience Measurement

## B.6.1 Introduction

As rights owners of AV content, Connected TV service providers (data recipient) utilise audience measurement metrics to add value to their content licences for broadband delivered content. The Connected TV Audience Measurement specification implements a consistent and comparable reporting standard produced by the BMWG (Broadband Measurement Working Group).

BARB (Broadcasters' Audience Research Board) (data recipient), underwritten by UK broadcasters provides totality of home viewing by panel membership across all channels and all platforms. Panel homes are uniquely representative of total viewing throughout the UK based on statistical, demographical, geographical and viewing environment representation. If a Terminal implements BARB reporting it shall do as defined in sections 8.5

## B.6.2 References

[59] Website Traffic Reporting Standards (version 2, July 2010), section B4, JICWEBS.

## B.6.3 Data Capture Method

Connected TV service providers derive audience measurement metrics for six content consumption methods, covering two classes (Linear and Non-Linear): Linear including Linear IP and Linear Broadcast. Non-Linear including Stored Linear IP, Stored Linear Broadcast, Content on Demand and Download. [Table B.6- 1](#) and [Table B.6- 2](#) define the events logged. The client log shall be updated at a maximum interval of 5 minutes when no new event has occurred.

Two levels of permissioning shall be implemented: stop all Terminal logging or log with End-user consent. Terminal configuration options shall be provided for both levels.

## B.6.4 Data Submission Method

Data submission will be no longer than a 24 hour interval and before the client log reaches full capacity and data is lost. If data submission is acknowledged by data recipient then the client log is cleared. If no acknowledgement is received a 'first in, first out' policy is implemented. Data filtering shall not be applied by the Terminal. The transmission of measurement data shall be protected as defined in section [B.5.11.4](#).

### B.6.4.1 Terminal Memory Cache

The client log capacity and the terminal memory cache will dictate the frequency of data transfer to the data recipient. There are no specific requirements whether the storage of the client log is volatile or non-volatile.

### B.6.4.2 Terminal Polling

Polling intervals will be greater than once every 24 hours or within 10K of terminal cache limit. Polling is intended to operate a 'first in, first out' policy. The client should generate a check sum, if no return, the client clears the old data with new data until the data recipient server receives.

## B.6.5 Data Fields

Data fields from End-user operation, content service provider metadata and content delivery network metadata are captured by the Terminal media player. Data fields exist that are out of scope for measurement (e.g. Genre, Cast List).

Stored Linear Broadcast includes scheduled, manual & recordList originated recordings. There is currently no mechanism for distinguishing the origination of the recording. The chosen model could support the future identification of different Stored Linear Broadcast methods, if needed. If a End-user 'live pauses' Linear Broadcast, then the Linear Broadcast record ends and a Stored Linear Broadcast record begins. Non-Linear records will have one or more playback events, each comprising field's n08 - n10. For Linear records, if a record extends beyond a single event, it is assumed that if present, the Content ID refers to the content consumed at the start of the record.

Annex IV - [Metadata mappings](#) shows data field mapping to specified OIPF metadata fields

Annex IV - [Measurement report example](#) contains an XML audience measurement report example

### B.6.5.1 Linear Data Fields

The Terminal media player shall provide Linear IP and Linear Broadcast audience measurement metrics by capturing the following data:

**Table B.6- 1 Linear measurement data fields**

Data field	Type	Status
I01 Content ID	CRID	Optional
I02 Content title	String	Optional
I03 Content locator	URL	Mandatory
I04 Identifier of browser / player playing the content	User-Agent	Mandatory
I05 Additional industry-standard unique user	Cookie, registration ID	Mandatory
I06 Viewing start date / time	YYYY-DD-MM / 00:00:00	Mandatory
I07 Viewing duration	Seconds	Mandatory

### B.6.5.2 Non-Linear Data Fields

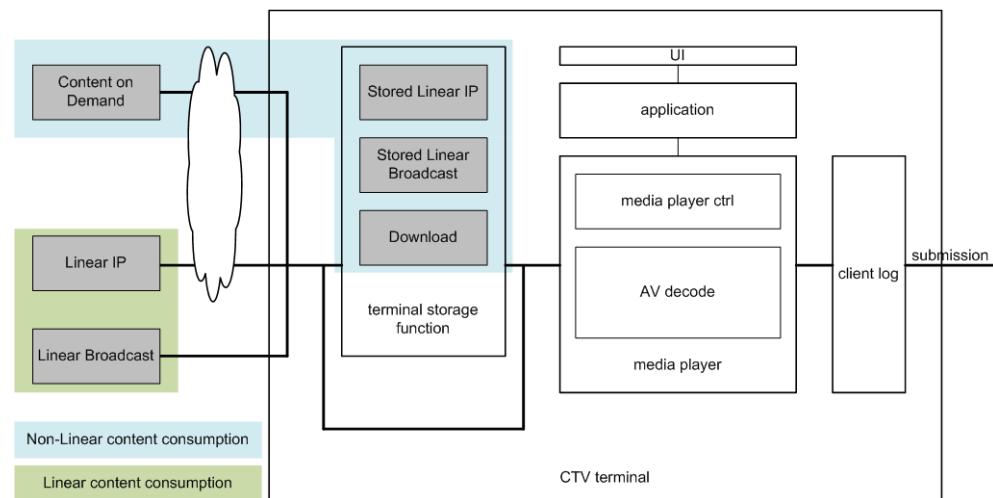
The Terminal media player shall provide Stored Linear IP, Stored Linear Broadcast, Content on Demand and Download audience measurement metrics by capturing the following data:

**Table B.6- 2 Non-Linear measurement data fields**

Data field	Type	Status
o01 Content ID	CRID	Optional
o02 Content title	String	Optional
o03 Content locator	URL	Mandatory
o04 Identifier of browser / player playing the content	User-Agent	Mandatory
o05 Additional industry-standard unique user	Cookie, registration ID	Mandatory
o06 Viewing start date / time	YYYY-DD-MM / 00:00:00	Mandatory
o07 Content Length	Seconds	Mandatory
o08 Start point play indicator	Seconds	Mandatory
o09 Play duration	Seconds	Mandatory
o10 Playback speed	1x / >1x / <1x / -1x / >-1x / <-1x 0x	Mandatory
o11 Acquisition date / time	YYYY-DD-MM / 00:00:00	Mandatory

## B.6.6 CTV Audience Measurement Data Flow

**Figure B.6- 1 Audience Measurement Data Flow**



## B.6.7 CTV Audience Measurement Data Schema

The schema represents the format of the data sent from the Terminal client log to the data recipient:

```
<?xml version="1.0" encoding="UTF-8"?>
<xsschema xmlns="urn:dtg:measurement:2011" xmlns:md="urn:dtg:metadata:2011" xmlns:xs="http://www.w3.org/2001/XMLSchema"
  xmlns:xml="http://www.w3.org/XML/1998/namespace" targetNamespace="urn:dtg:measurement:2011" elementFormDefault="qualified"
  attributeFormDefault="unqualified">
  <!-- schema filename is dtg-MeasurementSchema-v0_4.xsd -->
  <xss:annotation>
    <xss:documentation xml:lang="en">
      This schema is developed by Digital TV Group (DTG) and distributed in conjunction with the DTG Connected TV Specification (D-Book 7.0 Part B).
    </xss:documentation>
  </xss:annotation>
  <!-- Component defined by OIPF in metadata schema dtg-AbstractContentAccessDescriptor-v0_2.xsd -->
  <xss:import namespace="http://www.w3.org/XML/1998/namespace" schemaLocation="http://www.w3.org/2001/xml.xsd"/>
  <xss:import namespace="urn:dtg:metadata:2011" schemaLocation="dtg-MetadataDefinitionsSchema-v0_2.xsd"/>
  <!-- Component defined by OIPF in metadata schema dtg-AbstractContentAccessDescriptor-v0_2.xsd -->
```

```

<xs:complexType name="TitleType">
    <xs:simpleContent>
        <xs:extension base="xs:string">
            <xs:attribute ref="xml:lang"/>
        </xs:extension>
    </xs:simpleContent>
</xs:complexType>

<xs:simpleType name="CTVContentLocatorType">
    <xs:restriction base="xs:anyURI"/>
</xs:simpleType>
<xs:simpleType name="CTVUserAgentType">
    <xs:restriction base="xs:string"/>
</xs:simpleType>
<xs:simpleType name="CTVUserBrowserIDType">
    <xs:restriction base="xs:string"/>
</xs:simpleType>

<xs:simpleType name="LinearConsumptionTypeType">
    <xs:restriction base="xs:string">
        <xs:enumeration value="Linear Broadcast"/>
        <xs:enumeration value="Linear IP"/>
    </xs:restriction>
</xs:simpleType>

<xs:simpleType name="NonLinearConsumptionTypeType">
    <xs:restriction base="xs:string">
        <xs:enumeration value="Recorded Linear Broadcast"/>
        <xs:enumeration value="Recorded Linear IP"/>
        <xs:enumeration value="Content on Demand"/>
        <xs:enumeration value="Download"/>
    </xs:restriction>
</xs:simpleType>

<xs:complexType name="CTVConsumptionBaseType">
    <xs:sequence>
        <xs:element name="ContentLocator" type="CTVContentLocatorType"/>
        <xs:element name="ViewingStart" type="xs:dateTime"/>
        <xs:element name="UserAgent" type="CTVUserAgentType" minOccurs="0"/>
        <xs:element name="UserBrowserID" type="CTVUserBrowserIDType" minOccurs="0"/>
        <xs:element name="ContentID" type="md:CRIDType" minOccurs="0"/>
        <xs:element name="Title" type="TitleType" minOccurs="0"/>
    </xs:sequence>
</xs:complexType>

<xs:complexType name="CTVLinearConsumptionType">
    <xs:complexContent>
        <xs:extension base="CTVConsumptionBaseType">
            <xs:sequence>
                <xs:element name="ViewingDuration" type="xs:unsignedInt"/>
            </xs:sequence>
            <xs:attribute name="ConsumptionType" type="LinearConsumptionTypeType"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>

<xs:complexType name="CTVConsumptionEventType">

```

```
<xs:attribute name="StartPoint" type="xs:unsignedInt" />
<xs:attribute name="Duration" type="xs:unsignedInt" />
<xs:attribute name="Speed" type="xs:float" />
</xs:complexType>

<xs:complexType name="CTVNonLinearConsumptionType">
    <xs:complexContent>
        <xs:extension base="CTVConsumptionBaseType">
            <xs:sequence>

                <xs:element name="ContentAcquired" type="xs:dateTime"/>
                <xs:element name="ContentLength" type="xs:unsignedInt"/>
                <xs:sequence>
                    <xs:element name="ConsumptionEvent" type="CTVConsumptionEventType" minOccurs="1" maxOccurs="unbounded"/>
                </xs:sequence>
            </xs:sequence>
            <xs:attribute name="ConsumptionType" type="NonLinearConsumptionTypeType"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>

<xs:complexType name="CTVMeasurementRecordType">
    <xs:sequence minOccurs="1" maxOccurs="unbounded">
        <xs:choice minOccurs="1" maxOccurs="1">
            <xs:element name="LinearConsumptionRecord" type="CTVLinearConsumptionType" minOccurs="1" maxOccurs="1"/>
            <xs:element name="NonLinearConsumptionRecord" type="CTVNonLinearConsumptionType" minOccurs="1" maxOccurs="1"/>
        </xs:choice>
    </xs:sequence>
    <xs:attribute name="UserAgent" type="CTVUserAgentType"/>
    <xs:attribute name="RecordRangeStart" type="xs:dateTime" use="optional"/>
    <xs:attribute name="RecordRangeEnd" type="xs:dateTime" use="optional"/>
</xs:complexType>

<xs:annotation>
    <xs:documentation xml:lang="en">CTV Measurement Report Document</xs:documentation>
</xs:annotation>
<xs:element name="CTVMeasurementRecord" type="CTVMeasurementRecordType"/>
</xs:schema>
```

# B.7 Connected TV Terminal Requirements

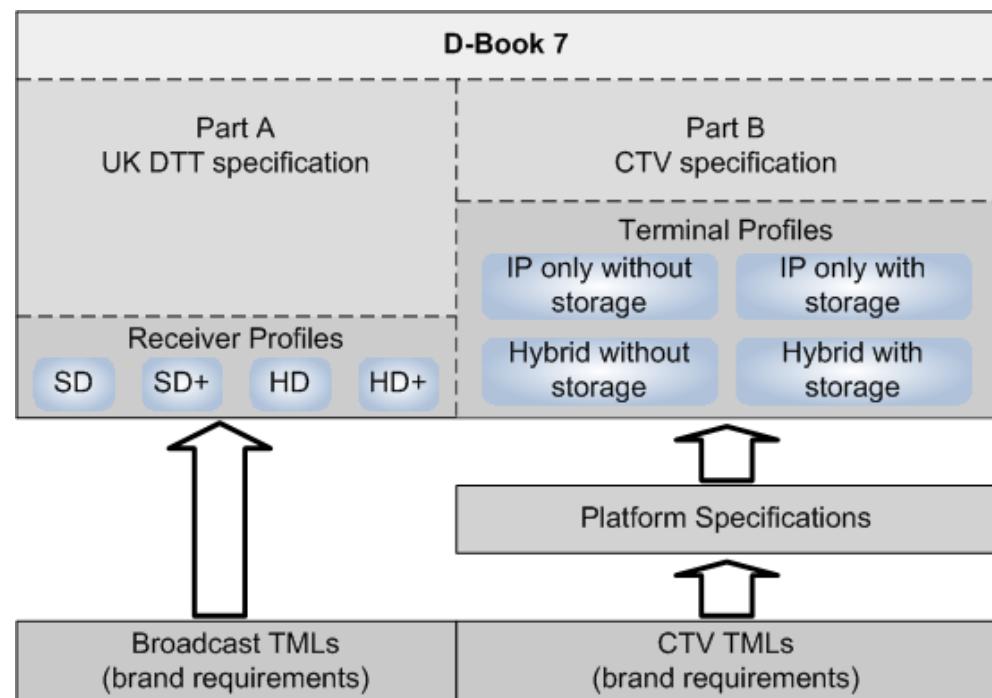
## B.7.1 Introduction

This chapter is intended to provide common sets of terminal and service features to enable both manufacturers and service providers to determine target markets for their products. It is intended that this chapter provides a guide to enable service providers to understand and, where relevant, reference and/or build upon the feature sets specified in this chapter for their TML technical requirements.

It is envisaged that a service provider may reference the features from this specification directly without building on a terminal profile defined here.

In addition this chapter is provided as a guide for Manufacturers who wish to achieve a minimum level of functionality and, where specified, performance in their products.

**Figure B.7- 1 D-Book 7 and TML Brand requirements**



In addition to terminals which are branded by a platform operator, there may also be so-called “non-branded” terminals which are placed in the horizontal market by a manufacturer. This specification provides a terminal profile for these “non-branded” terminals.

---

There are many types of IP-delivered services that are typically accessed by computer-based terminals. For ease of defining terminal requirements, this section only considers the following Connected TV service classes:

- Catch-up / VoD of unencrypted content
  - Real time delivery
  - Download delivery
- Catch-up / VoD of encrypted content
  - Real time delivery
  - Download delivery
- Live service of unencrypted content
- Live service of encrypted content
- Portals, EPG's, content guides, etc.
- Interactive services independent of TV content

Based upon the above service classes the following terminal profiles have been defined:

- IP Only without storage
- IP Only with storage
- DTT Hybrid without storage
- DTT Hybrid with storage
- Premium Platform terminal

Note: for clarification a hybrid terminal defined within this specification is one that provides access to both IP-based services and specifically DTT services, the latter in a manner compliant with the relevant sections of D-Book Part A Chapter 22 [1]. However, this section of the D-Book can be utilised with other tuner based broadcast services.

## B.7.2 IP-Only Terminal without storage

### B.7.2.1 Introduction

This section sets out the requirements for Connected TV terminals that are defined as IP-only. This is where the service is provided entirely over an IP connection.

### B.7.2.2 Set-up and connections

Terminals shall provide at least one network interface supporting TCP/IP as defined in [B.2.4](#).

It shall be possible for the user to display the terminal's MAC address.

Terminals without an integrated display shall provide an HDMI output as defined in D-Book 7 Part A section 22.3.4.4.1 [[I](#)].

### B.7.2.3 IP Connectivity

The terminal shall support the network stack requirements in section [B.2.4](#). It is optional for the terminal to support network stack requirements in section [B.2.4.3](#) (IPv6), [B.2.4.4](#) (multicast), and [B.2.4.6.1](#) (back-off mechanism for HTTP requests).

### B.7.2.4 Service discovery

The definition of service discovery is out of scope of this specification.

### B.7.2.5 Codecs

The terminal shall support the video and audio codecs specified in [B.2.6](#).

### B.7.2.6 Unprotected Encapsulation formats

The terminal shall support the following unprotected content encapsulation formats:-

- MPEG2-TS as defined in [B.2.6.2](#)
- MP4 file format as defined in [B.2.6.4](#)

### B.7.2.7 Content Delivery

The terminal shall support the following delivery mechanisms:-

- HTTP streaming as defined in [B.2.5.2](#)
- HTTP adaptive streaming with MPEG2-TS as defined in [B.2.6.2.2](#)

### B.7.2.8 Presentation

The terminal shall support the following presentation mechanisms

- The OIPF browser profile defined in [B.4.4](#) without ;
  1. Any requirement for the terminal to maintain a channel list by itself
  2. NOTE: various methods and properties in the video/broadcast object have failure modes explicitly defined when this is the case.
  3. The ChannelConfig object, the ChannelList class, the createChannelObject( Integer idType, String dsd, Integer sid ) method on the video/broadcast object.
  4. The features listed as "M-D" or M-P" in table A.1 of TS 102 796 [[23](#)] and extensions to those features defined in [B.4.4.2](#) and [B.4.5.3](#).
- The basic profile of graphics defined in [B.4.5.1](#).

The terminal shall support the following combinations of application states and display modes (as defined in [B.4.2.1.3](#) and [B.4.2.1.4](#)):

- Active + Exclusive

Note: there is no requirement to support more than one HTML application running at any one time.

The terminal shall support broadcast-independent applications as defined in [B.4.2.1.7.3](#).

The terminal shall support broadband-delivered signalling as defined in [B.4.2.3.2](#).

The terminal shall support ‘untrusted’ and ‘partially trusted’ applications as defined in [B.5.9.2](#).

### **B.7.2.9 Metadata and Metadata-Related Capabilities**

The terminal shall support use of the mandatory parts of the metadata to expose (in an application based UI) and render the selected items from the content available within the scope of an IP-only terminal with no locally connected storage.

The terminal shall support the metadata exchange mechanisms specified in [B.3.6](#) for the Use Cases described in [B.3.7.1.3](#), [B.3.7.1.4](#) and [B.3.7.2.1](#) (excluding broadcast services).

The function of exposing IP content for consumption shall be carried out by the application although the terminal shall monitor the ContentAccessStreamingDescriptor to manage changes in guidance for content items delivered over IP.

The status (mandatory, optional, etc.) of the elements of the XML structured ContentAccessStreamingDescriptor is provided in the detailed description of the Content Access Descriptors in [B.3.8](#). The mandatory elements shall be provided in the content metadata for a content item and the terminals shall support use of that metadata. The optional elements may be provided in the content description metadata, and if present shall be supported by the terminal.

The metadata properties for the exchanges using the JavaScript objects (Channel Object and Programme Object) are defined in OIPF Volume 5 DAE [14] extended by the properties listed in [B.4.4.2](#) (sections 7.13.11 and 7.16.2, note that these numbers refer to the locations of the original references in the OIPF Volume 5 DAE [14] and [B.4.5.2](#)). The status is indicated in those sections of [B.4.4.2](#), the optional elements may be provided in the content description metadata, and if present shall be supported by the terminal.

### **B.7.2.10 Accessibility**

The terminal may support TTML subtitles as defined in [B.2.7.3](#) and exposed using the methods described in [B.7.2.8](#).

The ability to carry metadata describing all the accessibility services associated with a content item is included in the XML structured Content Access descriptors defined in [B.3.8](#) and in the JavaScript Objects exchanged across the APIs defined in [B.4.4.2](#). This shall be supported by terminals.

This includes:

- Subtitle types and languages (the location (a URL) of the TTML form)
- Audio description type and languages
- Languages available in CleanAudio form

The inclusion of all of these attributes in the content description metadata is optional.

### **B.7.2.11 Content Security**

It is not mandatory for a terminal to implement a DRM system or any protected file formats. A terminal that implements the DRM framework as specified in chapter B.5 shall implement the following in addition to the requirements above:

### B.7.2.11.1 Protected encapsulation formats

A terminal shall support at least one of:

- MPEG2-TS as defined in [B.5.5](#)
- MP4 file format as defined in [B.5.6](#)

### B.7.2.11.2 Presentation Layer DRM interface

The terminal shall support the interface from the DRM system to the Presentation Layer as defined in [B.5.8](#). Note that the details of how this is supported are specific to the DRM system used.

### B.7.2.12 Maintenance & upgrade

The manufacturer shall declare support for a mechanism of firmware upgrade.

## B.7.3 IP-only Terminal with storage

All of the requirements given in [B.7.2](#) of the IP-only terminal without storage shall be supported, with the addition of the following.

### B.7.3.1 Content Delivery

HTTP content download shall be supported as defined in [B.2.5.5](#).

### B.7.3.2 Metadata and Metadata Related Capabilities

The terminal shall support use of the mandatory parts of the metadata for the selected items from the content available within the scope of an IP-only terminal with locally connected storage. The terminal shall support:

- Exposing available content in an application based UI), including content recorded on the terminal
- Recording selected content items (delivered by IP linear and download)
- Playback and rendering of recorded content
- Managing content storage
- Rendering of live content

In addition to the Use Cases and metadata exchange mechanisms supported for compliance with [B.7.2.9](#) the terminal shall support the Use Cases described in [B.3.7.1.1](#), [B.3.7.1.2](#), [B.3.7.2.2](#), [B.3.7.2.3](#), and [B.3.7.3](#).

The support for the XML structured Content Access Descriptors, as specified in [B.3.8](#), is as included in [B.7.2.9](#).

Additional support is required for the metadata properties for the exchanges using the JavaScript objects, and the scheduledRecording Object, recording Object and download Object shall additionally be supported. These are defined in OIPF Volume 5 DAE [14] extended by the properties listed in [B.4.4.2](#) (referenced to sections 7.4.4, 7.10.2 and 7.10.5 of OIPF Volume 5 DAE [14]) and [B.4.5.2](#). The status is indicated in those sections of [B.4.4.2](#), the optional elements may be provided in the content description metadata, and if present shall be supported by the terminal.

### B.7.3.3 Accessibility

Support for accessibility services associated with content delivered over IP is as defined in [B.7.2.10](#).

### B.7.3.4 Presentation

The terminal shall support elements of the browser profile defined in [B.4.4](#) and [B.4.5.3](#) specified as mandatory when content download is supported – specifically the features

listed as “M-D” and “M-P” in table A.1 of TS 102 796 [23] and extensions to those features defined in [B.4.4.2](#) and [B.4.5.3](#). PVR support shall include time-shift and recordNow with channels created using the Channel createChannelObject( Integer idType, Integer onid, Integer tsid, Integer sid, Integer sourceID, String ipBroadcastID ) method. Support for scheduled recording of channels created using this method is not required.

## B.7.4 DTT Hybrid Terminal without storage

The terminal shall support the requirements set out in section [B.7.2](#) of this chapter.

In addition the terminal shall support one of the four DTT receiver classes set out in D-Book Part A [1] Chapter 22. It is **strongly recommended** that the terminal supports the requirements set out in Section 22.3 HD AVC DVB-T2 Receiver.

### B.7.4.1 Metadata and Metadata Related Capabilities

The terminal shall support use of the mandatory parts of the metadata to expose (in an application based UI) and render the selected items from the content available within the scope of a terminal with IP and broadcast reception capability but with no locally connected storage.

In addition to the requirements described in [B.7.2.9](#) the terminal shall support the metadata requirements of D-Book 7 Part A for the broadcast content. Also, in addition to the Use Cases identified in [B.7.2.9 Use Case B.3.7.2.1](#) shall also support the function of exposing broadcast sourced content.

The function of exposing all content for consumption shall be carried out an application, provided by either the service provider or as part of the terminal design.

The support for the XML structured Content Access Descriptors, as specified in [B.3.8](#), shall be as described in [B.7.2.9](#).

The support for the exchanges using the JavaScript objects (Channel Object and Programme Object) shall be as described in [B.7.2.9](#).

### B.7.4.2 Accessibility

Support for accessibility services associated with content delivered over IP is as defined in [B.7.2.10](#).

For services delivered over a broadcast network the metadata provided will be compliant with B-Book 7 Part A [1], chapter 8, and shall be mapped to the terminal metadata exchange mechanisms as appropriate.

### B.7.4.3 Presentation

In addition to the requirements in section [B.7.2](#), the terminal shall support;

- The OIPF browser profile defined in [B.4.4](#) including the features removed by [B.7.2.8](#) relating to the terminal to maintain a channel list by itself, the ChannelConfig object, the ChannelList class.
- Broadcast-related applications and related requirements as defined in [B.4.2.1.7.2](#), [B.4.2.1.7.4](#), [B.4.2.3.1](#), [B.4.2.3.3](#), [B.4.2.3.4.2](#)and [B.4.2.3.5](#).
- The connected TV extension to MHEG-5 defined in section [B.4.3](#).

Note: there is no requirement to support MHEG-5 and HTML applications running simultaneously.

## B.7.5 DTT Hybrid Terminal with storage

The terminal shall support the requirements set out in section [B.7.2](#) and [B.7.3](#) of this chapter.

In addition the terminal shall support one of the 4 DTT receiver classes set out in D-Book Part A [\[1\]](#) Chapter 22. It is **strongly recommended** that the terminal supports the requirements set out in Section 22.4 HD AVC DVB-T2 Recorder.

### B.7.5.1 Metadata

In addition to the use Cases supported in [B.7.4.1](#) the terminal shall support Use Case [B.3.7.3](#) in terms of the objects required for exchanging the broadcast metadata between the terminal functionality and the application.

### B.7.5.2 Accessibility

Support for accessibility services associated with content delivered is as defined in [B.7.4.2](#).

### B.7.5.3 Presentation

In addition to the requirements in [B.7.3](#) and [B.7.4](#), it is **strongly recommended** that the device supports the features listed as “M-P” in table A.1 of TS 102 796 [\[23\]](#) and extensions to those features defined in [B.4.4.2](#) and [B.4.5.3](#).

## B.7.6 Premium Platform Terminal

This terminal profile is intended to collate all the common requirements from a premium based platforms to ensure standards commonality wherever possible. However, implementing this profile alone will not gain access to the platform and additional requirements will be included in appropriate Trade Mark Licences.

The intention is that this profile will build on top of the appropriate profiles defined above.

### B.7.6.1 Audience Measurement

The terminal shall support audience measurement as defined in section [B.6.4.1](#). Memory cache shall be provided.

Note: the size of the cache may be defined by a service provider's TML.

### B.7.6.2 Presentation

It is likely that premium services require support of other presentation technologies which will be defined in the TML and supporting documents. Where other presentation technologies are implemented, they shall comply with the co-existence rules defined in section [B.4.2](#).

### B.7.6.3 Interfaces

Premium service providers shall require adequate protection of delivered content on the output interfaces of the terminal. Analogue HD outputs are not permitted in line with requirements for content owners.

Control and rules regarding output interfaces are likely to be covered by the rules associated with a particular DRM.

Where content is unprotected by DRM and the output is implemented, the following protection shall be included:

- Analogue AV (SD): Copy Generation Management System –Analogue (CG MS-A)
- Digital AV: HDCP
- Recordable Media: Blu-Ray (AACS)

- 
- Portable Media: USB, HDD ...etc (encryption and binding to the terminal using AES128, Triple DES or similar)
  - Home Network Output: DTCP – IP (DLNA)

#### B.7.6.4 End-user authentication

Terminals shall implement section [B.5.12](#) including encrypted cookies.

#### B.7.6.5 IP Delivery

The terminal should support IPv6 (as in [B.2.4.3](#)) and multicast to ensure that the lifetime of the product is appropriate to support services.

#### B.7.6.6 TML Specific requirements

- Robust video pipeline within the terminal
- Protection of content on terminal outputs
- It is likely that premium services require support a once only secure key into the system for Terminal Identification. Details should be covered by the TML.

# References

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- [1] Digital TV Group, *D-Book 7 Part A*. London: DTG, March 2011.
- [2] International Telecommunication Union, "IPTV Functional Architecture," 2008-09.
- [3] IETF. (December 2010) draft-ietf-6man-node-req-bis-07 - IPv6 Node Requirements RFC 4294-bis. [Online]. <http://tools.ietf.org/html/draft-ietf-6man-node-req-bis-07>
- [4] IETF. (September 2007) RFC 4941 - Privacy Extensions for Stateless Address Autoconfiguration in IPv6. [Online]. <http://tools.ietf.org/html/rfc4941>
- [5] IETF. (June 1999) RFC 2616 Hypertext Transfer Protocol -- HTTP/1.1. [Online]. <http://www.ietf.org/rfc/rfc2616.txt>
- [6] International Standards Organisation, "ISO/IEC 14496-12 - Information technology -- Coding of audio-visual objects -- Part 12: ISO base media file format," Corrigendum 1:2008-12-01, Corrigendum 2:2009-05-01, Amendment 1:2009-11-15, Amendment 3:2011-01-28/DAM (Note 1).
- [7] International Standards Organisation, "ISO/IEC 14496-14:2003 - Information technology -- Coding of audio-visual objects -- Part 14: MP4 file format," 2003.
- [8] Open IPTV Forum, "Release 2 Specification, Volume 2a – HTTP Adaptive Streaming, V2.0," OIPF, September 2010.
- [9] DECE, "Common File Format v1.0," DECE/Ultraviolet, 2011.
- [10] "Protected Interopable File Format version 1.3,".
- [11] International Standards Organisation, "ISO 23009-1 Information technology — Dynamic adaptive streaming over HTTP (DASH) — Part 1: Media presentation description and segment formats," ISO/IEC, 2011.
- [12] CEA. (January 2011) CEA-2014-B (ANSI) Web-based Protocol and Framework for Remote User Interface on UPnP Networks and the Internet (Web4CE). [Online]. [http://www.ce.org/Standards/browseByCommittee\\_2757.asp](http://www.ce.org/Standards/browseByCommittee_2757.asp)
- [13] Open IPTV Forum, "Release 1 Specification, Volume 5 Declarative Application Environment VI.1," October 2009.
- [14] Open IPTV Forum, "Release 2 Specification, Volume 5 - Declarative Application Environment V2.0," OIPF, September 2010.
- [15] International Standards Organisation, "ISO/IEC 14496-10:2010 - Information technology -- Coding of audio-visual objects -- Part 10: Advanced Video Coding," 2010.
- [16] ETSI, "TS 101 154 VI.9.1 Digital Video Broadcasting (DVB); Specification for the use of Video and Audio Coding in Broadcasting Applications based on the MPEG-2 Transport Stream," 2009-09.
- [17] Open IPTV Forum, "Release 2 Specification, Volume 2 - Media Formats V2.0," OIPF, september 2010.
- [18] W3C. (18 November 2010) Timed Text Markup Language (TTML) 1.0. [Online]. <http://www.w3.org/TR/ttaf1-dfxp/>
- [19] ETSI, "TS 102 034 VI.4.1 Digital Video Broadcasting (DVB);Transport of MPEG-2 TS Based DVB Services over IP Based Networks,".
- [20] TVA. (2011-03-23 13:34:37) TV-Anytime Metadata Schema. [Online]. <http://tech.ebu.ch/tvanyime>
- [21] International Standards Organisation, "ISO 639-1:2002 - Codes for the representation of names of languages -- Part 1: Alpha-2 code," 2002.
- [22] IETF. (January 2001) RFC 3066 Tags for the Identification of Languages. [Online]. <http://www.ietf.org/rfc/rfc3066.txt>
- [23] ETSI, "TS 102 796 VI.1.1 Hybrid Broadcast Broadband TV," June 2010.
- [24] Open IPTV Forum. OIPF. [Online]. <http://www.openiptvforum.org/specifications.html>
- [25] IETF. (March 1995) Tags for the Identification of Languages. [Online]. <http://www.apps.ietf.org/rfc/rfc1766.html>
- [26] W3C. (24 June 2010) HTML5 A vocabulary and associated APIs for HTML and XHTML. [Online]. <http://www.w3.org/TR/2010/WD-html5-20100624/>

- 
- [27] W3C. (24 June 2010) HTML Canvas 2D Context. [Online]. <http://www.w3.org/TR/2010/WD-2dcontext-20100624/>
  - [28] Khronos Group. (18 February 2011) WebGL Specification. [Online]. <http://www.khronos.org/registry/webgl/specs/latest/>
  - [29] W3C. (11 May 2004) CSS3 Basic User Interface Module. [Online]. <http://www.w3.org/TR/2004/CR-css3-ui-20040511/>
  - [30] W3C. (21 July 2008, <http://www.w3.org/TR/2008/WD-css3-color-20080721/>) CSS Color Module Level 3.
  - [31] W3C. (12 June 2010) CSS Backgrounds and Borders Module Level 3. [Online]. <http://www.w3.org/TR/2010/WD-css3-background-20100612/>
  - [32] W3C. (December 2009) CSS Transitions Module Level 3. [Online]. <http://www.w3.org/TR/2009/WD-css3-transitions-20091201/>
  - [33] W3C. (20 March 2009) CSS Animations Module Level 3. [Online]. <http://www.w3.org/TR/2009/WD-css3-animations-20090320/>
  - [34] W3C. (01 December 2009) CSS 2D Transforms Module Level 3. [Online]. <http://www.w3.org/TR/2009/WD-css3-2d-transforms-20091201/>
  - [35] W3C. (20 March 2009) CSS 3D Transforms Module Level 3. [Online]. <http://www.w3.org/TR/2009/WD-css3-3d-transforms-20090320/>
  - [36] ETSI, "TS 102 809 V1.1.1 Digital Video Broadcasting (DVB); Signalling and carriage of interactive applications and services in Hybrid broadcast/broadband environments," 2010-01.
  - [37] ETSI, "TS 102 851 V1.2.1 Digital Video Broadcasting (DVB); Uniform Resource Identifiers (URI) for DVB Systems," ETSI, 2011-04.
  - [38] W3C. (07 June 2011) Cascading Style Sheets Level 2 Revision 1 (CSS 2.1) Specification. <http://www.w3.org/TR/2011/REC-CSS2-20110607/>
  - [39] W3C. (13 November, 2000) Document Object Model (DOM) Level 2 Style Specification. <http://www.w3.org/TR/2000/REC-DOM-Level-2-Style-20001113/>
  - [40] W3C. (4 August 2011) CSSOM View Module. <http://www.w3.org/TR/2011/WD-cssom-view-20110804/>.
  - [41] W3C. (24 December 1999) HTML 4.01 Specification. [Online]. <http://www.w3.org/TR/html401/>
  - [42] ANSI/SCTE. (2003) SCTE 52 2003 - Data Encryption Standard Cipher Block Chaining Packet Encryption, (Formerly DVS 042). [Online]. [http://www.techstreet.com/cgi-bin/detail?doc\\_no=SCTE%7C52\\_2003&product\\_id=1237149](http://www.techstreet.com/cgi-bin/detail?doc_no=SCTE%7C52_2003&product_id=1237149)
  - [43] International Standards Organisation, "ISO/IEC 13818-1:2007 - Information technology -- Generic coding of moving pictures and associated audio information: Systems," 2007.
  - [44] The National Institute of Standards and Technology, "FIPS PUB 197 ADVANCED ENCRYPTION STANDARD (AES)," NIST, November 26, 2001.
  - [45] International Standard Organisation, "ISO 23001-7," ISO/IEC, 23001-7,.
  - [46] IETF. (August 2008) RFC 5246 - The Transport Layer Security (TLS) Protocol Version 1.2. [Online]. <http://tools.ietf.org/html/rfc5246>
  - [47] National Security Agency, "The 60 Minute Network Security Guide," May 15, 2006.
  - [48] National Security Agency, "Guide to the Secure Configuration of Red Hat Enterprise Linux 5," September 14, 2010.
  - [49] NISCC , "Current Advice Mitigating the risk of Malicious Software," National Infrastructure Security Co-Ordination Centre, Version 1.4, October 2004.
  - [50] NISCC, "Technical note 07/03 – Internet Worms,".
  - [51] NISCC. (Access: 23-03-2011) NISCC Technical Note 06/02: Response to Distributed Denial of Service (DDoS) Attacks. [Online]. <https://www.niscc.gov.uk/Docs/re-20021025-00481.pdf>
  - [52] [CPNI4]. Sources of Guidance on Security in the Telecommunications Sector -. [Online]. [http://www.cpni.gov.uk/Docs/Sources\\_of\\_Guidance\\_on\\_Security\\_in\\_the\\_Telecommunications\\_sector.pdf](http://www.cpni.gov.uk/Docs/Sources_of_Guidance_on_Security_in_the_Telecommunications_sector.pdf)
  - [53] Information Security Forums. The Standard of Good Practice for Information Security, [www.securityforum.org](http://www.securityforum.org). [Online]. <https://www.isfsecuritystandard.com>
  - [54] Open IPTV Forum, "Release 2 Specification, Volume 7 - Authentication, Content Protection and Service Protection, V2.0," OIPF, September 2010.

- 
- [55] CI Plus, "CI Plus Specification, Common Security Extensions to the Common Interface V1.3," CI Plus, 2011-01.
  - [56] Open IPTV Forum, "OIPF Release 1 IPTV Solution V1.1 Errata 2," OIPF, 2011-03-10.
  - [57] NIST, "Recommendation of Block Cipher Modes of Operation," NIST - <http://www.nist.gov>, NIST Special Publication 800-38A,.
  - [58] International Standard Organisation, "ISO 14496-1:2010 - Information technology - Coding of audio-visual objects - Part 1: Systems," ISO/IEC, 2010.
  - [59] (February 2010) JICWEBS Website Traffic: Reporting Standards. [Online].  
<http://www.abc.org.uk/PageFiles/38/JICWEBSWebTraffic.pdf>
  - [60] ETSI, "TS 102 542-1 V1.3.1 Digital Video Broadcasting (DVB); Guidelines for the implementation of DVB-IPTV Phase 1 specifications; Part 1: Core IPTV Function – ETSI , " 2010-01.
  - [61] DLNA. The DLNA Networked Device Interoperability Guidelines - DLNA. [Online].  
<http://www.dlna.org/industry/certification/guidelines/>
  - [62] DVB, "ETSI TS 102 905 V1.1.1 Digital Video Broadcasting (DVB); Technical Specification for DVB Services in the Home Network Phase 1," 2010-05.
  - [63] Open IPTV Forum, "Services and Functions for Release 2, V1.0," October 2008.
  - [64] Open IPTV Forum, "Service and Platform Requirements V2.0," December 2008.
  - [65] Open IPTV Forum, "Functional Architecture – V2.0," 08 September 2009.
  - [66] Open IPTV Forum, "Release 2 Specification, Volume 3 - Content Metadata, V2.0," OIPF, September 2010.
  - [67] Open IPTV Forum, "Release 2 Specification, Volume 4 – Protocols, V2.0," OIPF, September 2010.
  - [68] Open IPTV Forum, "Release 2 Specification, Volume 4a – Examples of IPTV protocols sequences, V2.0," OIPF, September 2010.
  - [69] W3C. (2 March 2011) HTML5 - A vocabulary and associated APIs for HTML and XHTML. [Online].  
<http://dev.w3.org/html5/spec/Overview.html>
  - [70] NISCC, "Current Advice Mitigating the risk of Malicious Software," National Infrastructure Security Co-Ordination Centre, Version 1.4, October 2004.
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# Annex I: Architecture Overview and Functional Blocks

## I. Introduction

This chapter describes the architecture and its fundamental elements that are required to develop a connected TV (CTV) service in the UK. The CTV architecture is constructed from traditional broadcast service components of linear audio and video plus signalling which can be augmented by further service applications delivered over bidirectional broadband connections for example VoD, interaction, WEB based services and other applications running on the device. This architecture fully supports the traditional broadcast only model, a bidirectional network is not required for the receiving and viewing of traditional broadcast services. The traditional broadcast services are defined in Part A of this document. The architecture uses the concepts that were developed in the ITU and defined in [2] [ITU Y1910] as its starting point but [2] is not complete for the CTV model as it does not include a one to many traditional broadcast delivery chain.

## 2. References

[1] Digital TV Group, “D-Book 7 Part A,” DTG, Mar-2011.

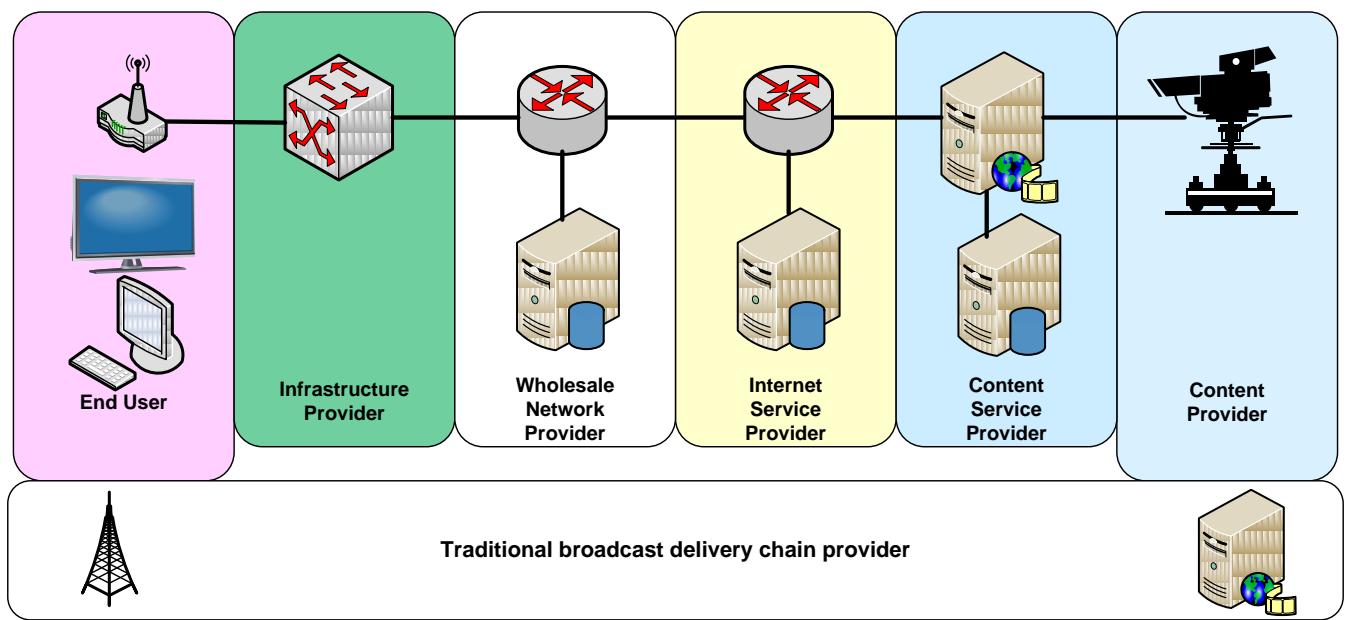
[2] [ITU Y1910] IPTV functional architecture - ITU (09/2008)

[19][ETSI TS 102 034 VI.4.1] Digital Video Broadcasting (DVB); Transport of MPEG-2 TS Based DVB Services over IP Based Networks - ETSI (2009-08).

[60] [ETSI TS 102 542-I VI.3.1] Digital Video Broadcasting (DVB); Guidelines for the implementation of DVB-IPTV Phase I specifications; Part I: Core IPTV Function – ETSI (2010-01)

## 3. Connected TV Domains

Although the functional split between the different network entities is shown below in Figure A1-1, in many cases a single entity might carry out the functionality required for multiple parts of the network, e.g. a single entity might operate as an ISP and CSP for their customers.

**Figure A1- 1 Connected TV Domains**

### 3.1. Content provider

The entity that owns or is licensed to sell content or content assets. Can also be a content service provider.

#### 3.1.1. Content service provider

An aggregator of content and its associated licences which is used to create a service package which can either be wholesaled to an internet service provider or delivered directly to the end user in an over the top service delivery.

#### 3.1.2. Internet service provider

A general reference to an operator that provides telecommunication services to customers and other users either on a tariff or contract basis. An internet service provider can optionally operate a network. The internet service provider can also acquire or licence content from content providers and package this into a service to be consumed by the end-user or sold onto (wholesale) a content service provider.

#### 3.1.3. Wholesale network provider

The organisation that maintains and operates the network components required for CTV functionality. Although considered as two separate entities, the internet service provider and the network provider can optionally be one organisational entity.

#### 3.1.4. Infrastructure provider

The organisation that provides the physical assets and or services which the internet service provider and wholesale network provider uses to deliver the CTV service to consumers. The infrastructure provider therefore has a business to business relationship with the wholesale network provider and or the internet service provider.

### **3.1.5. Traditional broadcast delivery chain provider**

The content provider packages the content and metadata into an agreed format and either plays the content out themselves or through a third party. The live stream of content is passed to an organisation called a traditional broadcast delivery chain provider who transmits the stream of content by means of either a terrestrial broadcast network or via a satellite or cable to all end users with the correct receiving equipment.

### **3.1.6. End-user**

The actual user of the products or services. The end-user consumes the product or service. An end-user can optionally be a customer. The customer is responsible for concluding contracts for the services subscribed to and for paying for these services.

## **4. Functional Blocks**

The domains of content provider and end-user remain the same. The domains of content service provider (CSP), internet service provider (ISP) and wholesale network provider are not used in the architecture as commercial and operational boundaries are not appropriate to an architectural decomposition.

The functional groups in the architecture are derived by grouping related functions. How these functional groups are allocated across operational and organisational boundaries is dependent on commercial relationships and will differ on an end user by end user basis and their commercial relationships with ISPs and CSPs. The provider of each function may differ as the end user interacts with different content.

## **5. Functional architecture framework**

The rectangular blocks represent functional blocks in the CTV architecture. The rounded rectangular areas represent the particular grouping of functions. The solid lines represent direct relationships between either functions or functional blocks. The dotted lines represent logical associations between end-user functions and either functions or functional blocks located outside the end-user functions. Crossed lines do not imply connections, unless explicitly stated.

### **5.1. End user functions**

The end-user functions perform mediation between the end user and the CTV infrastructure.

### **5.2. Application functions**

The application functions enable the end-user functions to select and purchase or rent a content item.

### **5.3. Service control functions**

The service control functions (SCF) provide the functions to request and release network and service resources required to support the CTV services. The service control functions can request the content delivery functions to allocate resources and request the network functions to reserve required network bandwidth for the content stream.

### **5.4. Network functions**

The Network functions are the pipes over which content and data are delivered to the end user and in the specific case of a telecommunications network , data also returns from the end user

### **5.5. Management functions**

The management functions handle overall system status monitoring and configuration. This set of functions can optionally be deployed in a centralized or a distributed manner.

## 5.6. Content provider functions

Content provider functions provide the content and associated metadata to content preparation functions,

## 5.7. Functional block definitions

### 5.8. The Terminal functions

The Terminal functions (CTF) are responsible for collecting control commands from the end user and interacting with the application functions to obtain service information e.g. EPG, content licences and keys for decryption. They interact with the service control and content delivery functions to receive the CTV services and also provide the capability for content reception, decryption and decoding.

The Terminal functions are split into two groups. Those defined by CTV and those not defined by CTV or are already defined as part of [1][D-Book 7 Part A].

#### 5.8.1. End user functions

##### 5.8.1.1.1. Application client functions

The application client functions exchange information with the CTV application functions to support CTV services and other interactive applications.

##### 5.8.1.1.2. Measurement & Audience Monitoring Client Functions

This client function interacts with the server application to carry data from the client to the server containing either device specific operational information or viewing (service/content specific) information. The data may be sent to the server either autonomously or on request of the server.

##### 5.8.1.1.3. Remote Management & Firmware Update Client Functions

This provides the functionality to locate appropriate firmware updates for the client device. The interaction with the server application should also allow the client to report success failure if a suitable management mechanism is in use. The query may be sent to the server at boot time or during normal operation, and may be initiated either autonomously by the client or as the result of a message from the server.

##### 5.8.1.1.4. Service and application discovery & selection client functional block

The SADS client functional block provides for the end user's discovery and selection of CTV services and applications.

##### 5.8.1.1.5. Linear TV client functional block

The linear TV client functional block interacts with the linear TV application functional block to perform session management, service authorization, presentation of the content metadata and execution of the service logic for the linear TV applications.

##### 5.8.1.1.6. On-demand client functional block

The on-demand client functional block interacts with the on-demand application functional block to perform session management, service authorization, presentation of the content metadata, and execution of the service logic for the on-demand applications.

##### 5.8.1.1.7. Push VoD application functional block

The PushVoD client functional block interacts with the on-demand application functional block to perform session management, service authorization, presentation of the content metadata, and execution of the service logic for the PushVoD and Content Download applications.

### 5.8.1.1.8. Other client functional blocks

These functional blocks interact with the other application functional blocks for the delivery and presentation of additional CTV services.

### 5.8.1.2. Metadata client functions

The metadata client functions must be able to receive delivered downstream or originate the metadata to be sent back to monitoring function in the headend.

Downstream metadata must be uncompressed and reconstructed so that the original data can be cached and used in suitable form to be useful in the client to present to the user in the client based UI application.

Upstream data must be processed and encapsulated in a form suitable for sending to the headend application.

The data model for the descriptive metadata for the services and content items should include the DRM type identification and the usage state information where applicable.

#### 5.8.1.2.1. Measurement metadata client functional block

This client function encodes, fragments and encapsulates either device specific operational information or viewing (service/content specific) information and manages its delivery to the headend monitoring service. The data may be sent to the server either autonomously or on request of the server. The metadata may define how to prepend and postpend targeted advertising or other material from either a local cached or remote source.

#### 5.8.1.2.2. Service & content discovery & selection client functional block

The SADS function receives the incoming metadata and reconstructs (possibly with caching) the service and content description information contained in a way which is useful to the presentation functions following. This function may need to receive and parse metadata using multiple different encoding.

#### 5.8.1.2.3. Linear TV metadata client functional block

Descriptive metadata for streamed linear TV services must be presented through the device specific UI. A suitable query and selection process used to locate and select the desired content item must be specified for CTV. The query may operate at a local level if the incoming metadata is cached in the device or it may query a network resource, e.g. an aggregator.

#### 5.8.1.2.4. On-Demand metadata client functional block

Descriptive metadata for on-demand TV services must be presented through the device specific UI. A suitable query and selection process used to locate and select the desired content item must be specified for CTV. The query may operate at a local level if the incoming metadata is cached in the device or it may query a network resource, e.g. an aggregator.

#### 5.8.1.2.5. PushVoD metadata client functional block

Descriptive metadata for on-demand TV services must be presented through the device specific UI. A suitable query and selection process used to locate and select the desired content item must be specified for CTV. The query may operate at a local level if the incoming metadata is cached in the device or it may query a network resource, e.g. an aggregator.

#### 5.8.1.2.6. Other client metadata functional block

TBD

### 5.8.1.3. Service and content protection (SCP) client functions

The service and content protection (SCP) client functions interact with SCP functions to provide service protection and content protection. The SCP client functions verify the usage rights and decrypt the content.

### **5.8.1.3.1. Content protection client functional block**

The content protection client functional block performs integrity checking, usage rights verification, content decryption and content tracing.

### **5.8.1.3.2. Service protection client functional block**

The service protection client functional block performs the authentication and authorisation of access to services and, optionally, protection of the services using methods such as encryption.

For free-to-air services the DRM metadata will be carried as part of the descriptive metadata for the service or content item.

For encrypted services the DRM metadata necessary for the services or content items which needs to be carried in a secure way should be protected as part of the CA system information.

### **5.8.1.3.3. Device protection client functional block**

Used to authenticate the device with the server when firmware updates are to be provided. This may only apply when device registration with a manufacturer, ISP or management service is in place.

### **5.8.1.3.4. Client protection client functional block**

Used to authenticate the user with the server where any personal profile information is to be transferred

## **5.8.1.4. Content delivery client functions**

The content delivery client functions receive and control the delivery of the content from the content delivery functions (CDF). After receiving the content, the content delivery client functions can optionally use the SCP client functions to decrypt and decode the content, and can also optionally support playback control for VoD services e.g. fast forward.

The ‘Device Management and Upgrade Client Function’ provides the functionality as follows:

The file transfers, service authorization, etc. for the delivery and installation of the firmware updates located by the process described in the ‘Remote Management & Firmware Update Client Functions’ section above. The updates may be complete or partial in nature, e.g. ‘plug-ins’ and the final payload protection and authentication will be not be standardised.

The file transfers associated with any Remote Management requirements, such as delivery of configuration files for the client device.

### **5.8.1.4.1. Error recovery client functional block**

The content delivery client functions can optionally include an error recovery client functional block. This functional block performs error recovery on the content streams in conjunction with the error recovery functional block within the content delivery functions.

### **5.8.1.4.2. Unicast content delivery client functional block**

The unicast content delivery client functional block receives the content from the unicast delivery functional block within the content delivery & storage functions. This functional block communicates with the content delivery control functional block within the content delivery & storage functions for the control of the unicast stream.

### **5.8.1.4.3. Multicast content delivery client functional block**

The multicast client functional block receives the content from the multicast delivery functional block within the content delivery & storage functions. This functional block communicates with the multicast control point functional block for the selection of the multicast stream.

#### **5.8.1.4.4. DTT content delivery client functional block**

The DTT delivery requirements are defined in the current version of [\[1\] \[D-Book 7 Part A\]](#), although any additional requirements and associations may be specified in this CTV document.

#### **5.8.1.5. Device management & upgrade client function**

The ‘Device Management and Upgrade Client Function’ provides the functionality as follows:

The file transfers, service authorization, etc. for the delivery and installation of the firmware updates located by the process described in the ‘Remote Management & Firmware Update Client Functions’ section above. The updates may be complete or partial in nature, e.g. ‘plug-ins’ and the final payload protection and authentication will not be standardised.

The file transfers associated with any Remote Management requirements, such as delivery of configuration files for the client device.

#### **5.8.1.6. End user function out of scope**

##### **5.8.1.6.1. Home network functional block**

The home network function enables the services provided through the Terminal to be shared with other devices in the home connected to the same home network. This functionality requires that the Terminal includes a content server able to serve the received content (subject to DRM restrictions, etc.) and a method of exposing the content items available in a home network compatible way.

A home network server function must also manage the DRM interoperability needed to make content available in the home network based on the metadata provided for the content items.

##### **5.8.1.6.2. Delivery network gateway functional block**

The delivery network gateway functional block provides IP connectivity between the external network (i.e., external to the home network) and the IP connection to the Terminal device. The delivery network gateway functional block manages IP connectivity, obtains IP addresses and configurations for the home network functions and Terminal devices.

Proposed text:

There must be resident functionality in the Terminal device to perform the initial IP connection to the ISP and download provisioning information which may include IP address for the Terminal device and any other relevant addresses which will be required, e.g. server addresses for audience measurement and remote management or update servers.

Some authentication client-server may be needed for this process to take place. During normal operation this functionality will continue to provide connectivity to the broadband access network.

The actual access network termination device (the DVB Delivery Network Gateway (DNG)) may be a second device because it must connect directly to the physical incoming network port, e.g. the telephone ADSL line connector which may not be located conveniently for the Terminal device.

The subsequent connection from the access network termination device (the DVB DNG) to the Terminal device will probably be IP, carried through the home over some suitable physical network method, e.g. Ethernet, Powerline, IEEE 802.11. This device may have more than one port, with different ports offering different services types, for example:

There may be a managed port which is designed to carry specific services such as IPTV and VoIP, and offer features such as QoS on those services. If the Terminal device connects to the managed port the IP address may be set by the SP/ISP headend rather than locally.

Alternatively the IP address for the Terminal device may be provided by either the access network termination device or within the Terminal device itself, particularly if the Terminal is home network capable.

The functionality offers differs depending on the network configuration, [\[2\]\[ETSI TS 102 034 V1.4.1\]](#) clause ... covering boot sequence, and [\[3\] \[ETSI TS 102 542-1 V1.3.1\]](#).

### 5.8.1.6.3. DTT Content Delivery Function

The requirements for the delivery of the DTT services for the UK is specified are [1] D book 7 Part A, with the extended features and restrictions as follows:

## 5.9. Connected TV application and metadata functions

The CTV application and metadata functions enable the Terminal functions to select content, including purchase if necessary,. When receiving requests from Terminal functions, the CTV application functions perform application authorization and execution of CTV service logic based on user profile, content metadata and other information retrieved from relevant entities. The CTV application functions also communicate with content delivery functions to prepare the delivery of media content to Terminal functions through content delivery functions.

### 5.9.1. Connected TV application functions

#### 5.9.1.1. Measurement & audience monitoring functional block

Generates return data from the Terminal to CSP, interfaces with Management Functions and Application Client Functions. This functional block captures, caches and reports content and platform data as initiated by user activity.

#### 5.9.1.2. Service and application discovery & selection functional block

The service and application discovery & selection (SADS) functional block provides for the discovery and selection of CTV services and applications. This can include the discovery and selection of services from multiple service providers. The SADS functional block generates and provides the service discovery information to the SADS client functional block. The service discovery information consists of one or more entry points to service selection. The entry points can optionally be in the form of a URL. Service discovery can optionally be performed using the CTV service control functions. The SADS functional block generates and provides the description information about the available applications, for example linear TV and video on demand, to the SADS client functional block. The SADS client functional block presents this information to the end user for browsing and selection.

#### 5.9.1.3. Linear TV application functional block

The linear TV application functional block performs session management, service authorization and execution of the service logic for linear TV applications.

#### 5.9.1.4. On-Demand application functional block

The on-demand application functional block performs session management, service authorization and execution of the service logic for on-demand applications.

#### 5.9.1.5. Push VoD application functional block

The push VoD application function block performs session management, service authorisation and execution of the service logic for push VoD applications.

#### 5.9.1.6. Other Application function(s)

These functional blocks provide for the delivery and presentation of additional CTV services and their content, e.g. games, distant learning. All the CTV application functions can optionally communicate with the application profile functional block to support the customization of CTV services.

#### 5.9.1.7. Application provisioning functional block

The application provisioning functional block manages the life-cycle of CTV applications, e.g. adding or withdrawing them from service.

### **5.9.1.8. Application profile functional block**

The CTV application profile can optionally include:

- End-user settings which include information related to the capabilities of the end-user's Terminal devices. A CTV end-user may be associated with one or more the Terminals with different capabilities.
- Global settings (e.g. language preference).
- Linear TV settings.
- List of subscribed linear TV service packages.
- VoD settings (e.g. parental control level).
- PVR (personal video recorder) settings (PVR preferences network/local, PVR user restrictions, PVR storage limit).
- CTV service actions data which encompasses information related to the actions the user can optionally have taken while accessing services, e.g.
- list of linear TV services (or programmes) that the user has paused and is hence likely to resume later, including the bookmark value associated with the paused;
- list of VoDs that the user has ordered and associated status;
- list of PVR contents that the user has asked to be recorded.

## **5.9.2. Connected TV metadata functions**

### **5.9.2.1. Measurement metadata functional block**

Utilises CTV Metadata to identify required measurement data fields, interfaces with Management Functions and Metadata Client Functions. The functional block parses content and platform metadata.

### **5.9.2.2. Service & content discovery & selection functional block**

Where metadata is provided for TV services in a specified (possibly at TML level) streamed way, e.g. as specified by DVB IPTV (TS 102 034) this function represents the ability to aggregate, encode and make available the metadata for the Terminals.

### **5.9.2.3. Linear TV metadata functional block**

Where metadata is provided for linear TV services in a specified (possibly at TML level) streamed way, e.g. as specified by DVB IPTV (TS 102 034) this function aggregates, encodes and makes it available to the terminal in an appropriate method, e.g. multicast or on-demand.

### **5.9.2.4. On-Demand metadata functional block**

Where metadata is provided for on-demand TV services in a specified (possibly at TML level) streamed way, e.g. as specified by DVB IPTV (TS 102 034) this function aggregates, encodes and makes it available to the Terminal in an appropriate method, e.g. multicast or on-demand.

### **5.9.2.5. Push VoD metadata functional block**

Where metadata is provided for VoD TV services in a specified (possibly at TML level) streamed way, e.g. as specified by DVB IPTV (TS 102 034) this function aggregates, encodes and makes it available to the Terminal in an appropriate method, e.g. multicast or on-demand.

This doesn't exist in the MD diagram

### **5.9.2.6. Other metadata function(s)**

This function represents the ability of the server to provide metadata for purposes other than those specifically defined here (service and content description and measurement). The aggregation, coding and delivery will be appropriate to the specific requirements.

### **5.9.2.7. Metadata provisioning functional block**

It may be necessary to provide a combination of information to configure a Terminal for effective connection to TV service delivery system. An example of such provisioning is provided in the DVB IPTV Handbook (TS 102 034).

### **5.9.2.8. Metadata profile functional block**

This represents the functionality in the server to provide the streamed metadata using a method appropriate for the Terminal for which it is to be provided.

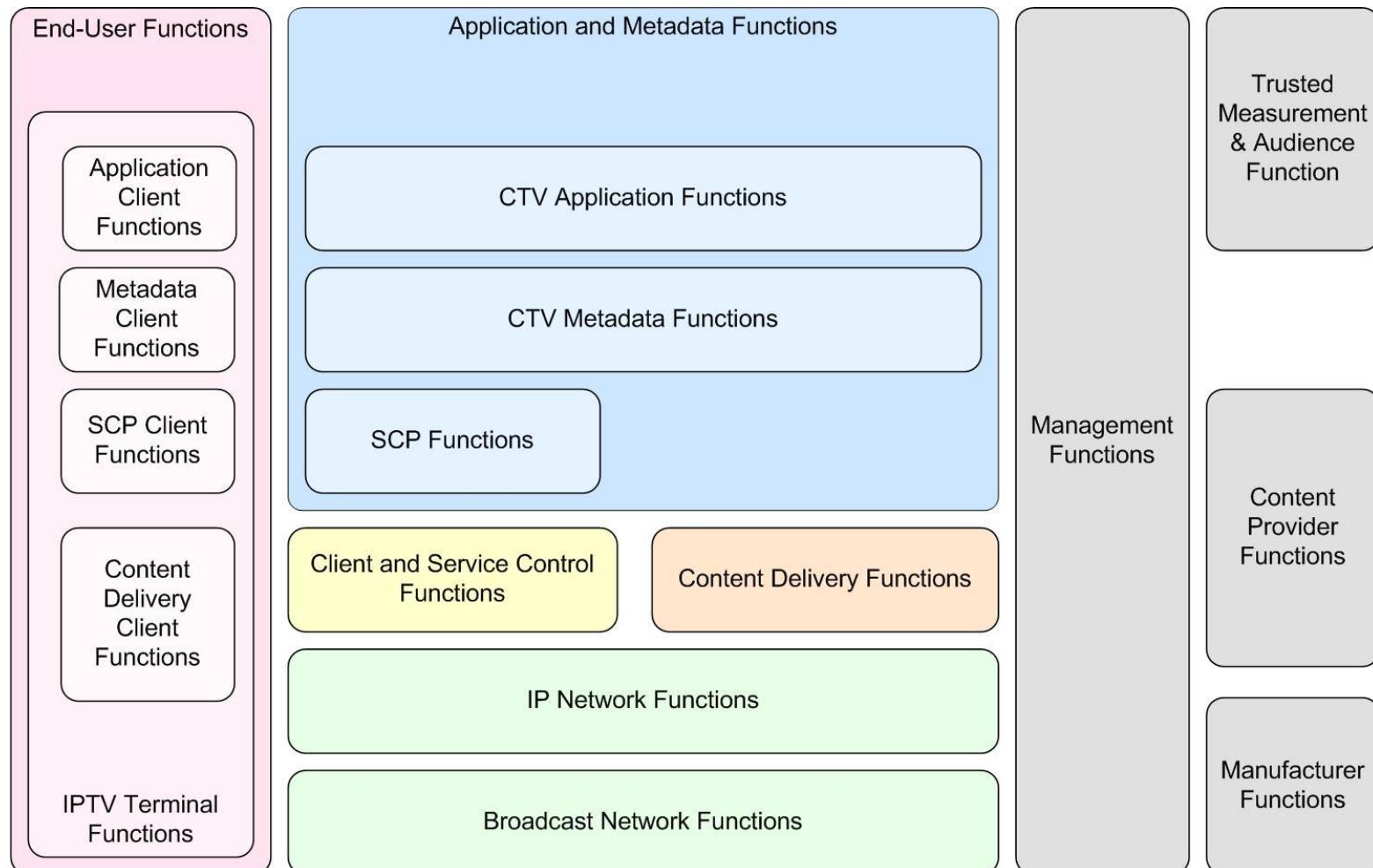
## **5.9.3. Content preparation functions**

The content preparation functions control the preparation and aggregation of the contents such as VoD programme, TV channel streams, and metadata and EPG data, as received from the content provider functions. The content preparation functions can optionally pre-process (e.g., transcode or edit) the content in advance of passing it to the content delivery, CTV application and SCP (Service and Content Protection) functions.

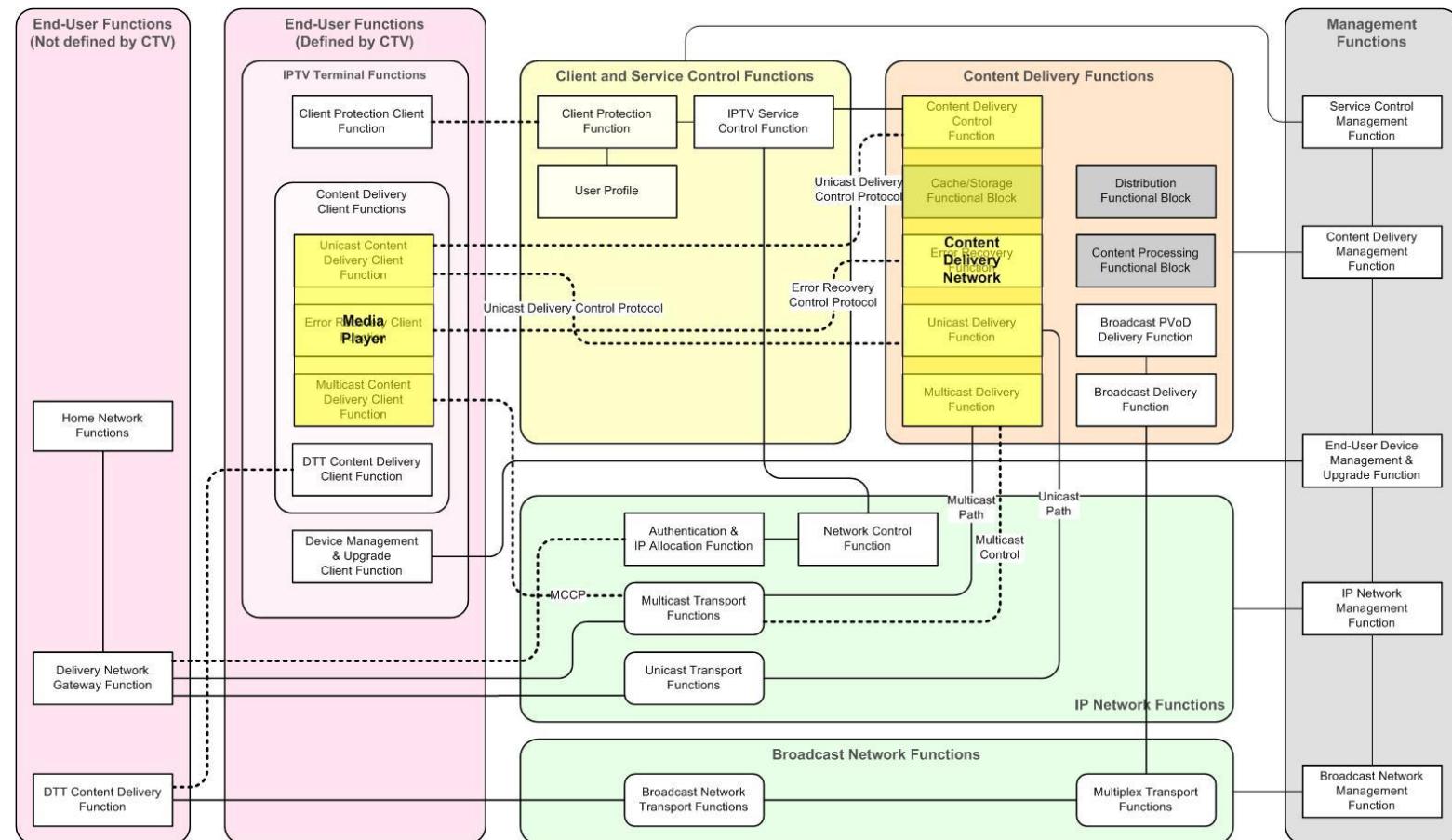
### **5.9.3.1. Service and content protection (SCP) functions**

The service and content protection (SCP) functions control the protection of the services and content. Content protection includes control of accessing the content and the protection of content using methods such as encryption. Service protection includes authentication and authorization to access the services and optionally protection of the services using methods such as encryption.

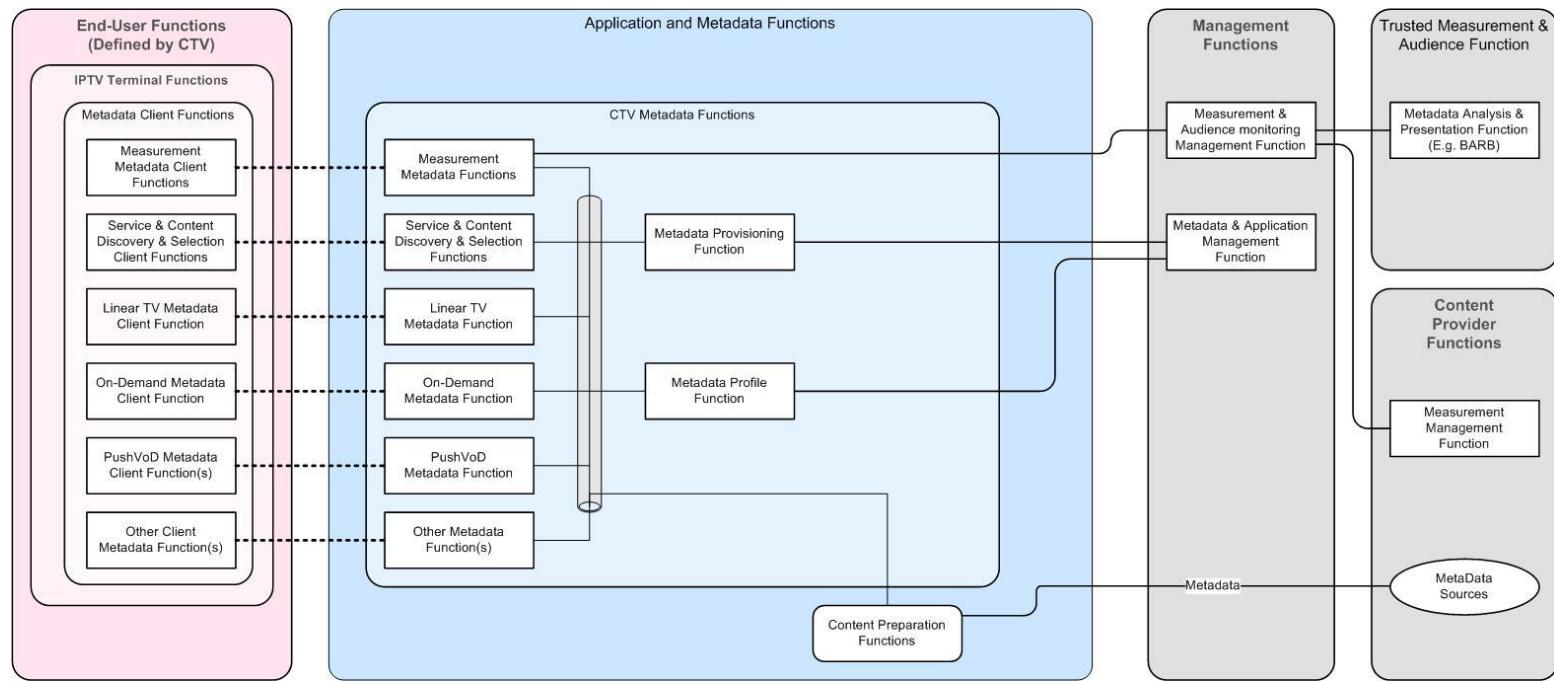
**Figure A1-2 Connected TV Architecture functions – level 2**



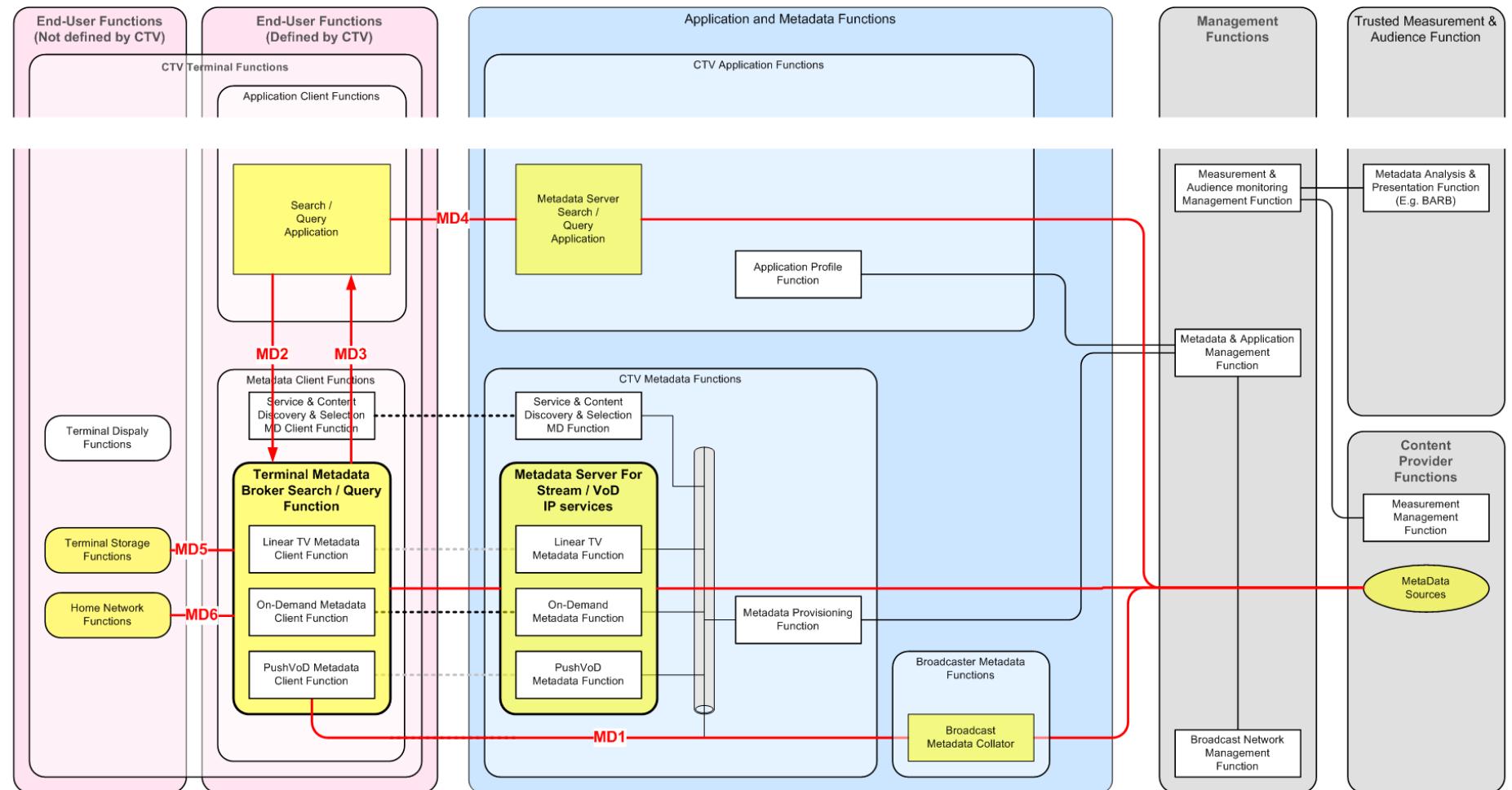
**Figure A1-3 Connected TV IP Delivery functions**



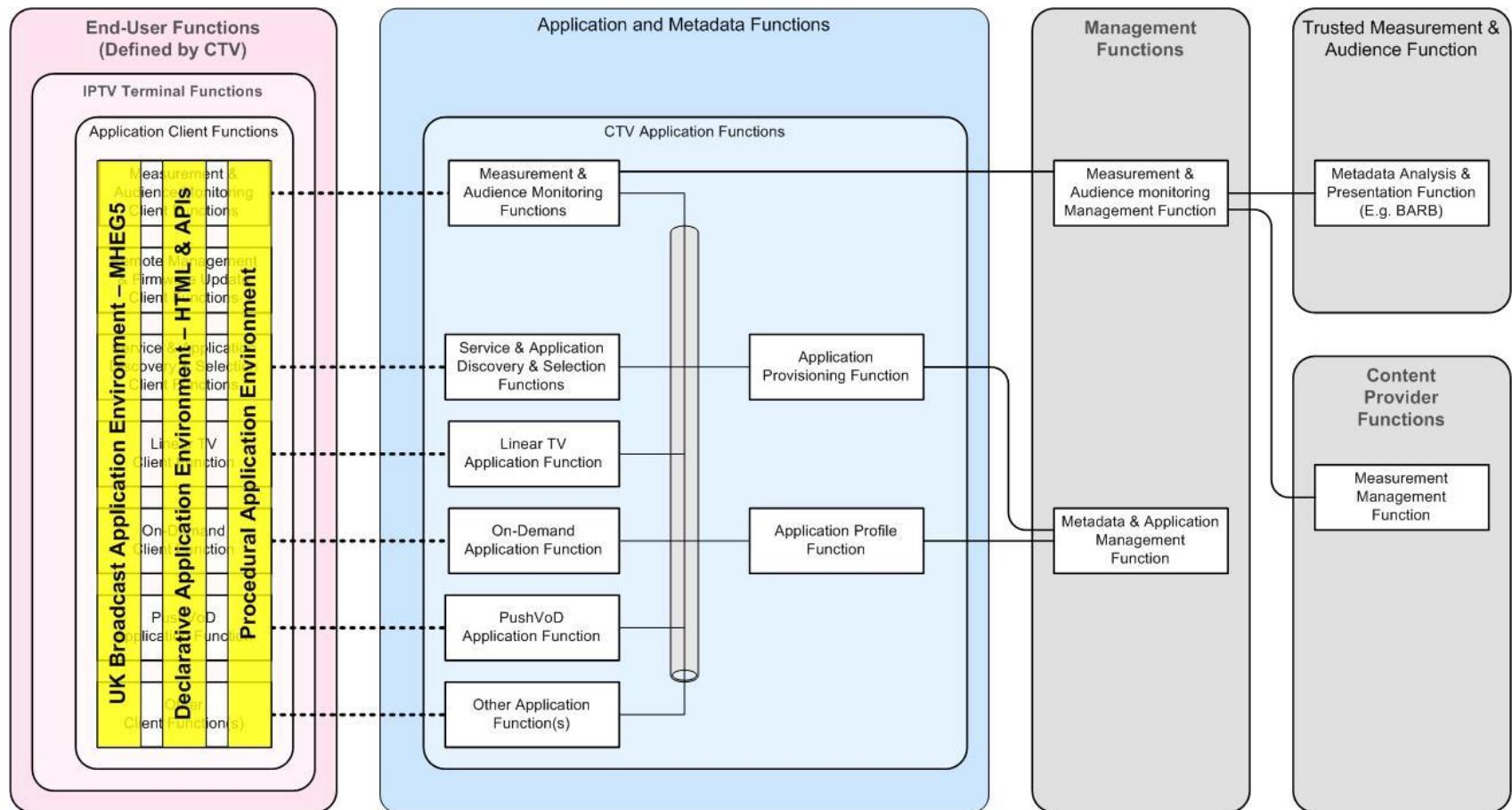
**Figure A1- 4 Connected TV Metadata functions**



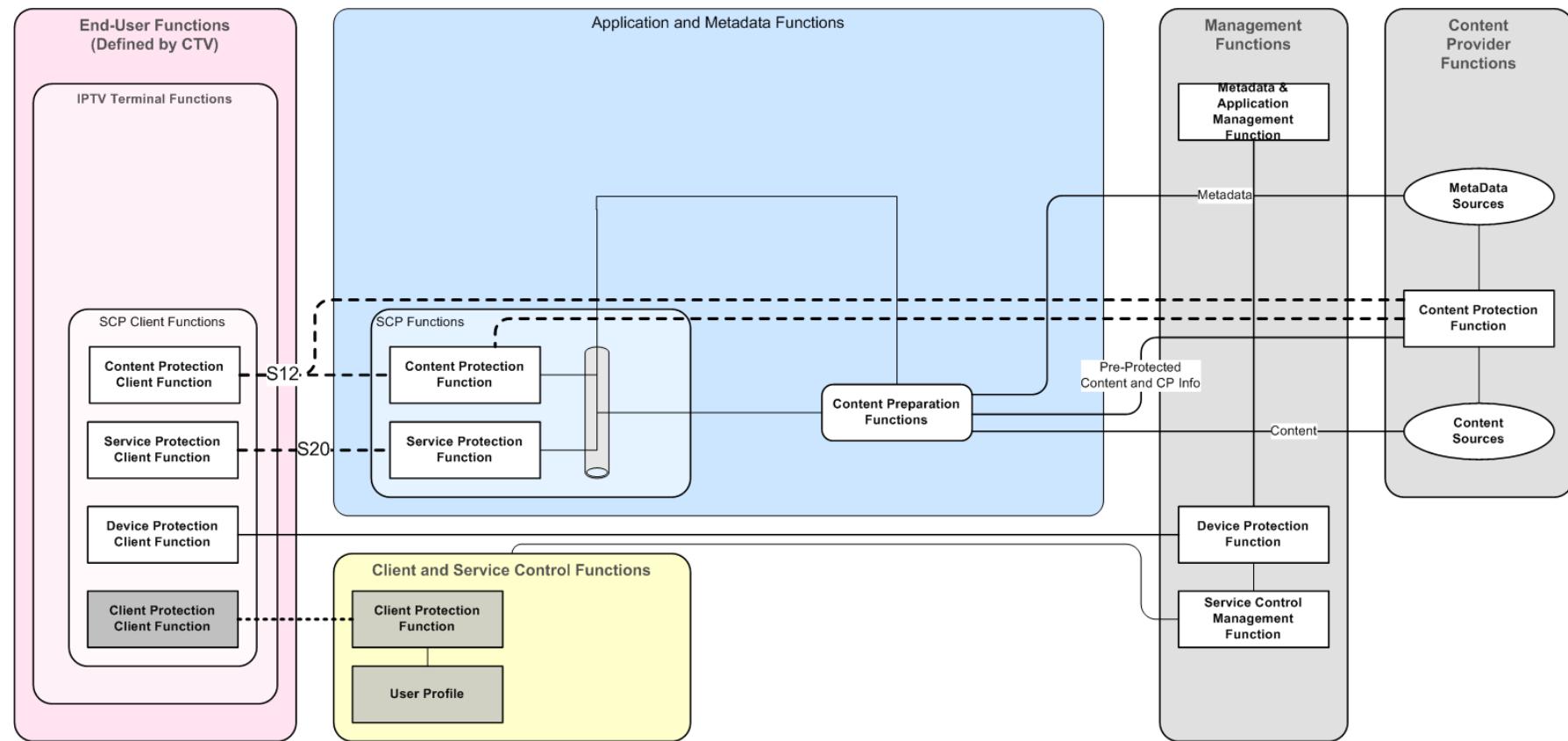
**Figure A1- 5 Connected TV Metadata Broker functions**



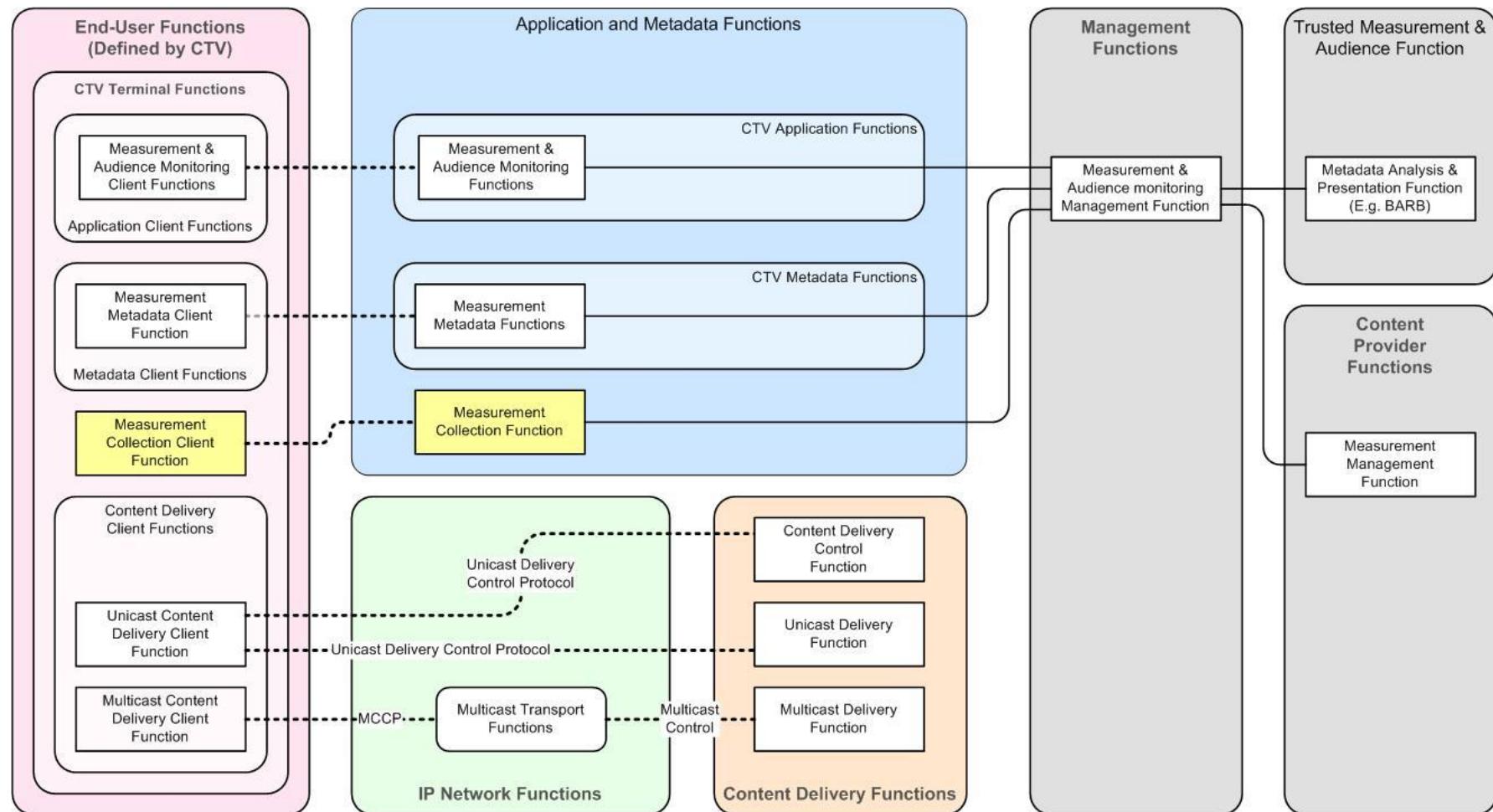
**Figure A1- 6 Connected TV Applications functions**



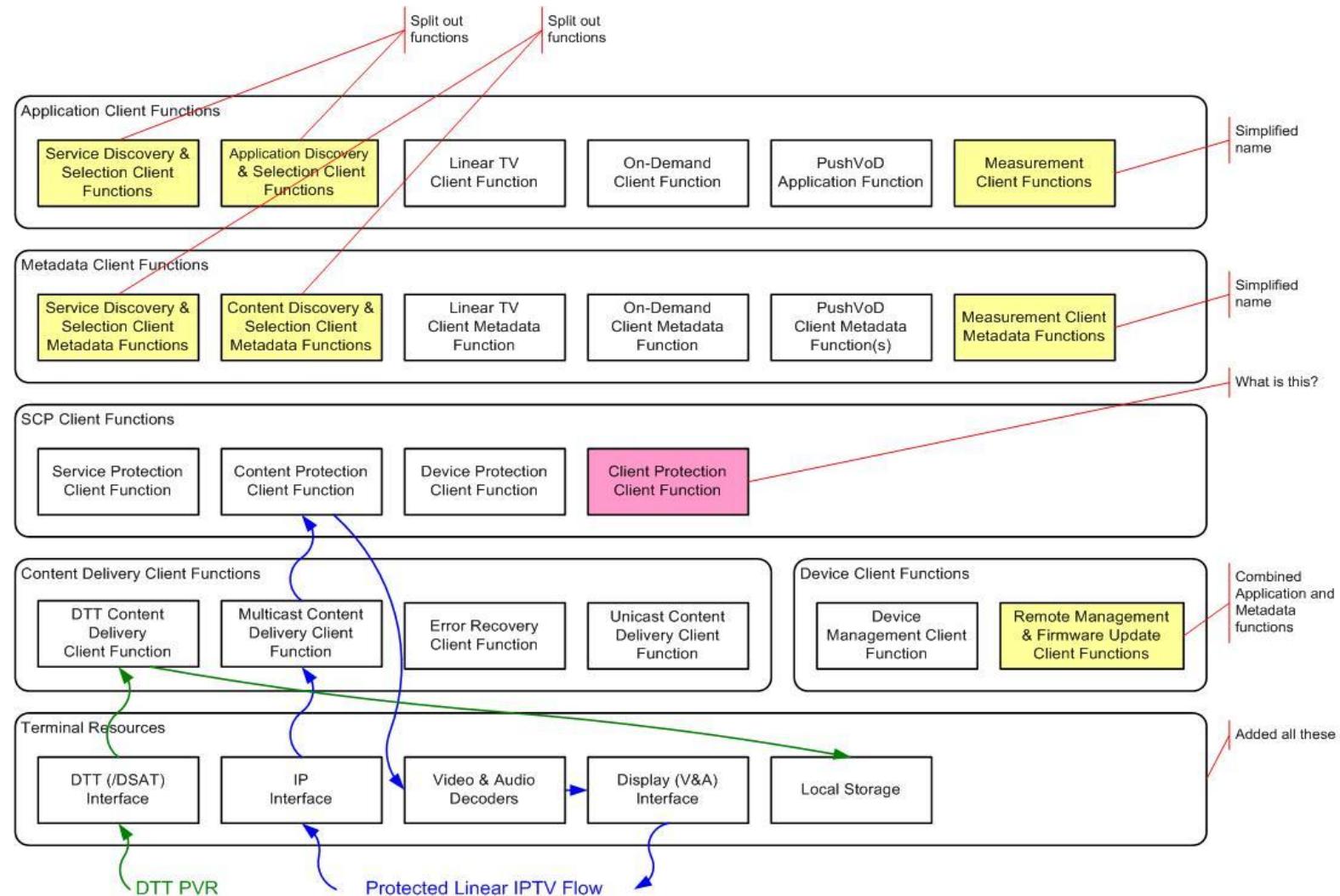
**Figure A1- 7 Connected TV Security functions**



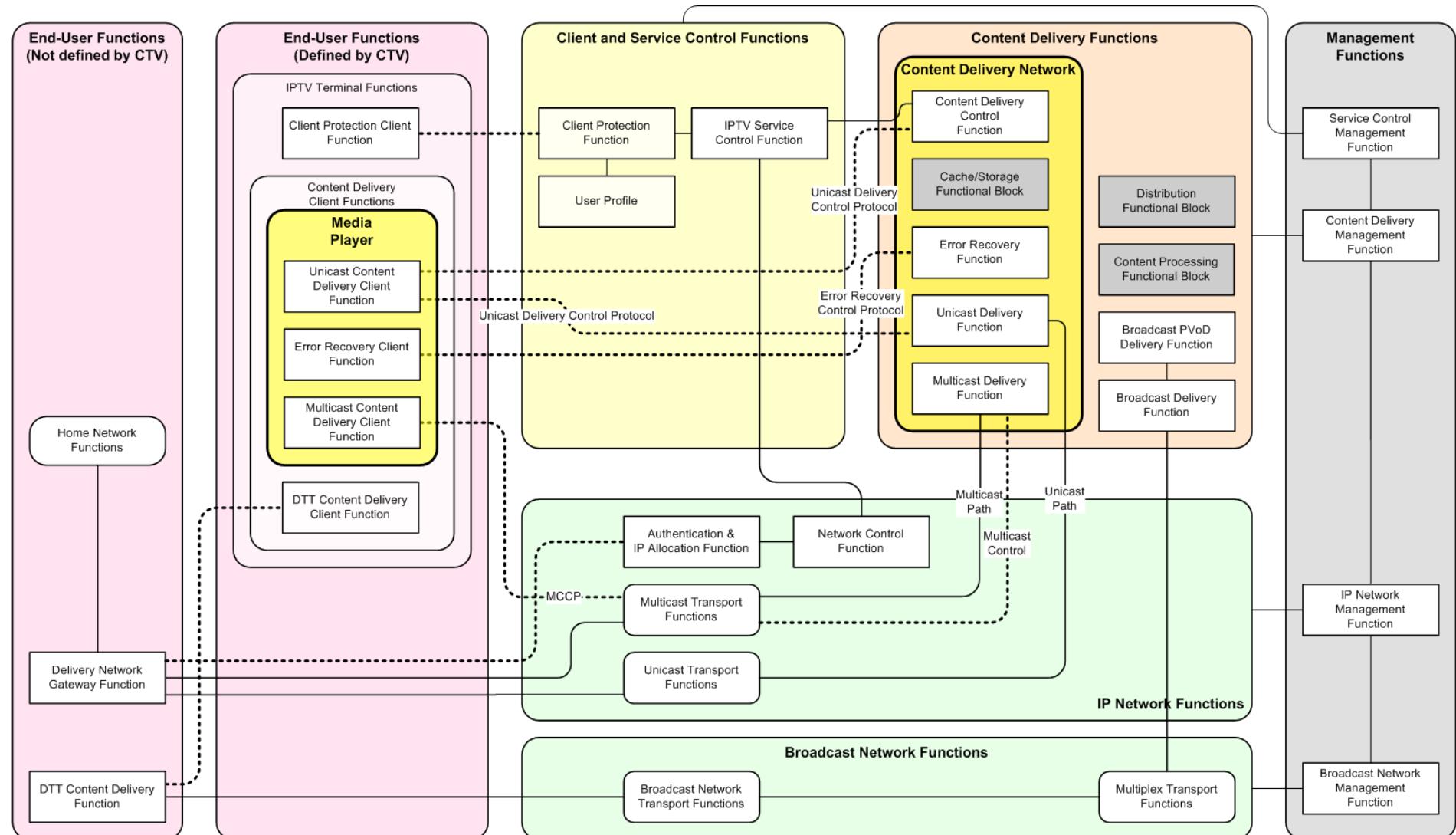
**Figure A1- 8 Connected TV Measurement functions**



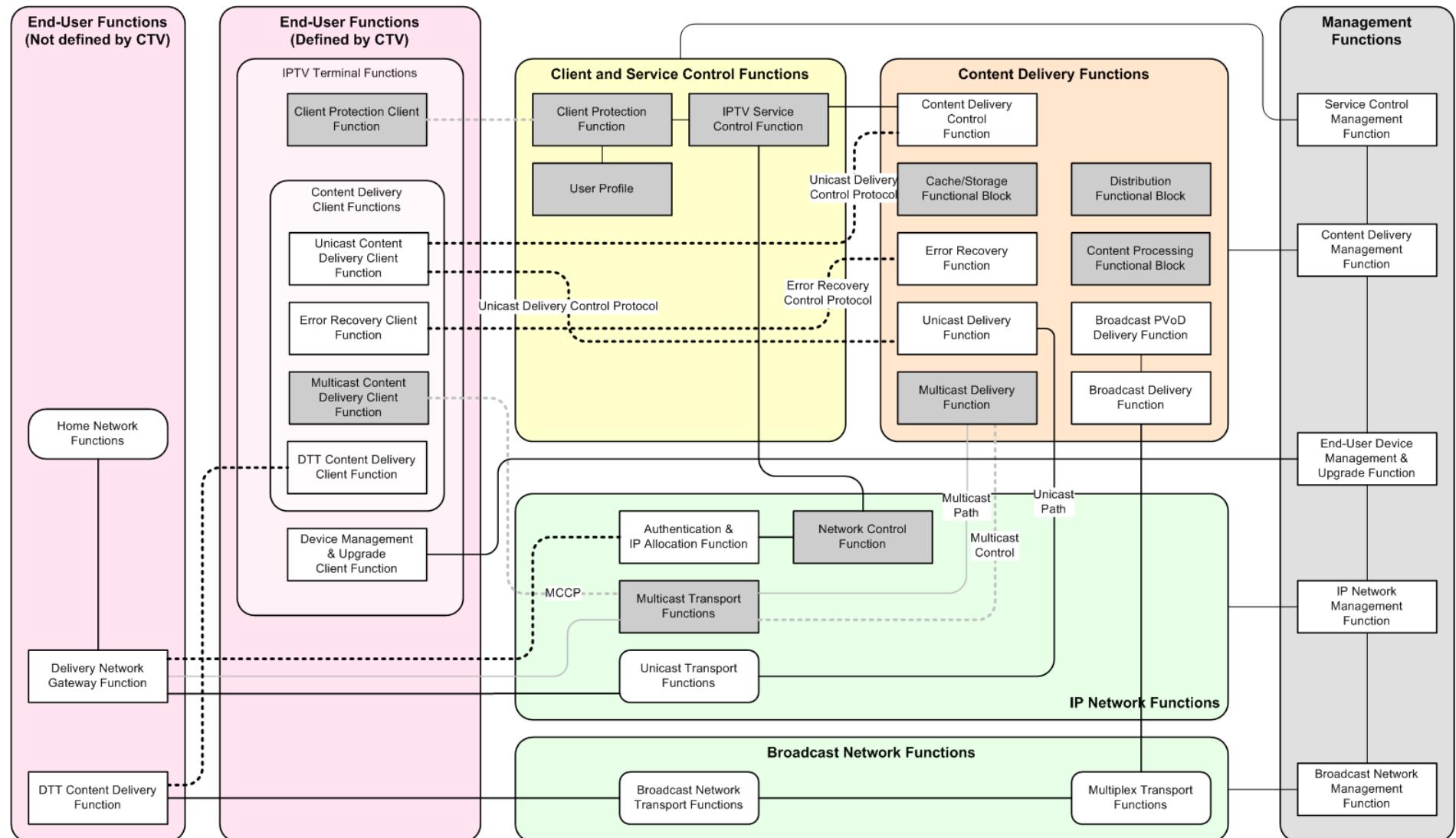
**Figure A1- 9 Connected TV Termical/User functions**



**Figure A1- 10 Media Player**



**Figure A1- II OTT**



### **5.9.3.2. Content protection functional block**

The content protection functional block controls the protection of the content and is responsible for the management of the content rights and the keys used to encrypt and decrypt the content. It acquires the content rights (or content licence, originated from the content provider) indication from the content preparation functions, generates and distributes this security information (rights object or keys) to the SCP client functions. It can optionally provide keys for content encryption. For example, when it receives a request for security information from Terminal functions, it interacts with the application profile functional block for user related security subscription information (e.g. time limited, whether fast forward/fast rewind are allowed) generates the rights object and delivers it to the Terminal functions. It also provides keys for service and content protection to CTV application functions, which then deliver the keys to relevant functions, e.g. The Terminal functions and the content encryption function.

### **5.9.3.3. Service protection functional block**

The service protection functional block controls the protection of services. Service protection includes authentication and authorization of access to services and the protection of the services using methods such as encryption.

## **5.10. Client and service control functions**

### **5.10.1. Connected TV service control functional block**

The CTV service control functional block provides the functions to handle service initiation, modification and termination requests, perform service access control, establish and maintain the network and system resources required to support the CTV services requested by the Terminal functions. The CTV service control functional block can optionally: provide registration, authentication and authorization functions for the end-user functions process requests from CTV application functions and forward them to the content delivery functions in order that the content delivery functions select the most appropriate content delivery & storage functions, for delivering content to the end-user functions request the content delivery functions or application functions to collect charging information.

### **5.10.2. User profile functional block**

The service user profile functional block:

- stores end-user service profile (i.e. CTV services subscribed to)
- stores customer related data (e.g. who pays the incurred charges)
- stores end-user location data
- stores end-user presence status (e.g. online/offline)
- performs basic data management and maintenance functions
- updating and storage of "user subscription data" or "network data" (e.g. the current network access point and network location)

Responses to queries for user profiles for:

- authentication;
- authorization;
- service subscription information;
- customer mobility;
- location;
- presence

### **5.10.3. Client protection functional block**

## **5.11. Content delivery functions**

The content delivery functions (CDF) perform cache and storage functionalities and deliver the content according to the request from the end-user functions. The content delivery functions can optionally process the content. Multiple instances of storage and delivery functionalities can optionally exist. The content delivery

functions select the suitable one(s). To maintain the same content at the multiple instances, the content delivery functions control the distribution of content to multiple instances of storage and delivery functionalities. Content is distributed to the content delivery functions before or during the service offering process. Content delivery functions interact with end-user functions (e.g., trick mode play functionality). Content delivery functions support unicast, multicast or both mechanisms.

### **5.11.1. Content delivery control functional block**

The content delivery control functional block handles control functions related to the content delivery & storage functions, such as control of the media resources, and handling of recoding commands such as for PVRs.

#### **5.11.1.1. Cache & storage functional block**

The cache & storage functional block is responsible for caching the content, e.g. in order to support time-shifted linear TV. It is also responsible for storing the content, e.g. in order to support VoD or other CTV services.

#### **5.11.1.2. Distribution functional block**

The distribution functional block receives the content from the content preparation functions. It distributes the content, which include live streams or files, residing among the separate instances of content delivery & storage functions.

#### **5.11.1.3. Error recovery functional block**

The content delivery functions can optionally include an error recovery functional block. This functional block serves to improve reliability in case that the CTV network functions cannot provide sufficient QoS. The error recovery functional block generates additional information for a content stream, either proactively or on request, such that the error recovery client functional block in the content delivery client functions can recover the content. The error recovery functional block relies on other content delivery functions to deliver the additionally generated information. The error recovery functional block relies on the availability of an error recovery client functional block in the content delivery client functions. The error recovery functional block can optionally be realized by forward error correction (FEC) or by retransmission.

#### **5.11.1.4. Content processing functional block**

The content processing functional block processes the content under the control of the content processing control functional block. The main functionalities are:

- Transcoding;
- Other functions such as watermarking, ad-insertion into streams, format conversion, resolution conversion, editing, etc;
- Encryption.

#### **5.11.1.5. Unicast delivery functional block**

The unicast delivery functional block is responsible for streaming and delivering (e.g. via RTP over UDP) content streams to the content delivery client functions via the Network Functions based on the use of the unicast protocols and mechanisms. It reports status information to content distribution & location control functions (e.g. reporting on established CTV media session) It can optionally provide other functions, such as file downloading and uploading to and from the content delivery client functions and embedding of a content tracing information.

#### **5.11.1.6. Broadcast push VoD delivery functional block**

Note: this is not currently true but it is expected to be so before the CTV document is delivered.

The delivery of PushVoD services over DTT is specified in the current version of [I] [D-Book 7 Part A]. The functionality will be covered within that version of the D-Book but future extensions to that such as delivery of metadata may be included in the CTV specification.

### **5.11.1.7. Multicast delivery functional block**

The multicast delivery functional block is responsible for streaming and delivering (e.g. via RTP over UDP) content streams to the content delivery client functions via the network functions based on the use of the multicast protocols and mechanisms.

### **5.11.1.8. Broadcast delivery functional block**

The delivery of broadcast services is specified in the current version of the D-Book for the UK DTT platform, although enhancements to those services may be carried over the IP network and may be covered in the CTV specification.

The delivery requirements for other broadcast platforms, such as those using cable and satellite transmission methods, will be specified in the appropriate documents.

## **5.12. Network functions**

The Network functions are the pipes over which content and data are delivered to the end user and data returns from the end user.

### **5.12.1. IP network functions**

The IP network functions are shared across all services delivered by IP to end-user functions. The IP network functions provide the IP layer connectivity to support CTV services.

#### **5.12.1.1. Authentication and IP allocation functional block**

The authentication and IP allocation functional block provides the functionality to authenticate the delivery network gateway functional block which connects to the network functions, as well as allocation of IP addresses to the delivery network gateway functional block and optionally to the Terminal functions.

#### **5.12.1.2. Multicast transport functional block**

##### **Multicast control point functional block**

The multicast control point functional block is responsible for the selection of the individual multicast streams to be delivered, over the access network, to the CTV end-user functions. The request for a multicast stream can optionally be authorized before it is accepted.

### **Multicast replication functional block**

The multicast replication functional block is responsible for replicating multicast streams from a multicast delivery functional block to all the instances of the multicast control point functional blocks.

#### **5.12.1.3. Unicast transport functional block**

The unicast transport functions are responsible for the transport of unicast content streams from the unicast delivery functional block to the end-user functions.

### **5.12.2. Broadcast network functions**

The Broadcast network functions can be delivered in multiple instances to the end user function depending on the number of DTT Content Delivery functions in the End-User Function.

#### **5.12.2.1. Multiplex Transport Functional block**

Refer to [\[I\]\[D-Book 7 Part A\]](#) Chapter 6 for details.

#### **5.12.2.2. Broadcast Network Transport functional block**

Refer to [\[I\] \[D-Book 7 Part A\]](#) Chapter 9.6.1 for details.

### **5.13. Content provider functions**

Content provider functions provide the content and associated metadata to content preparation functions, which contain the following sources.

#### **5.13.1. Metadata sources**

The content and metadata sources include content protection rights sources, content sources and metadata sources for the CTV services.

#### **5.13.2. Content protection functional block**

TBD

#### **5.13.3. Measurement management functional block**

Responsible for level 2 configuration of things like frequency of data collection, cache size and data flushing. Interfaces with Monitoring, Metadata and Collection Functions and Trusted (e.g. BARB) and CSP Management Functions.

### **5.14. Trusted measurement and audience function**

Third party industry standard data collection and reporting. In reality, likely to be same data set as CSP reporting. Data flow from the Terminal to trusted measurement and audience function, not the other way. Measurement data used for cross-CSP reporting.

#### **5.14.1. Metadata analysis & presentation functional block**

The functionality in the headend to separate and filter the measurement data returned by the population of Terminals to present the appropriate mix and level of user viewing information in either user specific or aggregated forms to the reporting authorities, e.g. BARB.

### **5.15. Manufacturer function**

This function allows the manufacturer to update elements of functionality on their devices over IP or DTT networks

### **5.15.1. Firmware update functional block**

Firmware update Functions allow manufacturers to update the firmware on their deployed devices.

# Annex II: Application

**Figure AII- 1 Interactions between MHEG and Core UI Applications**

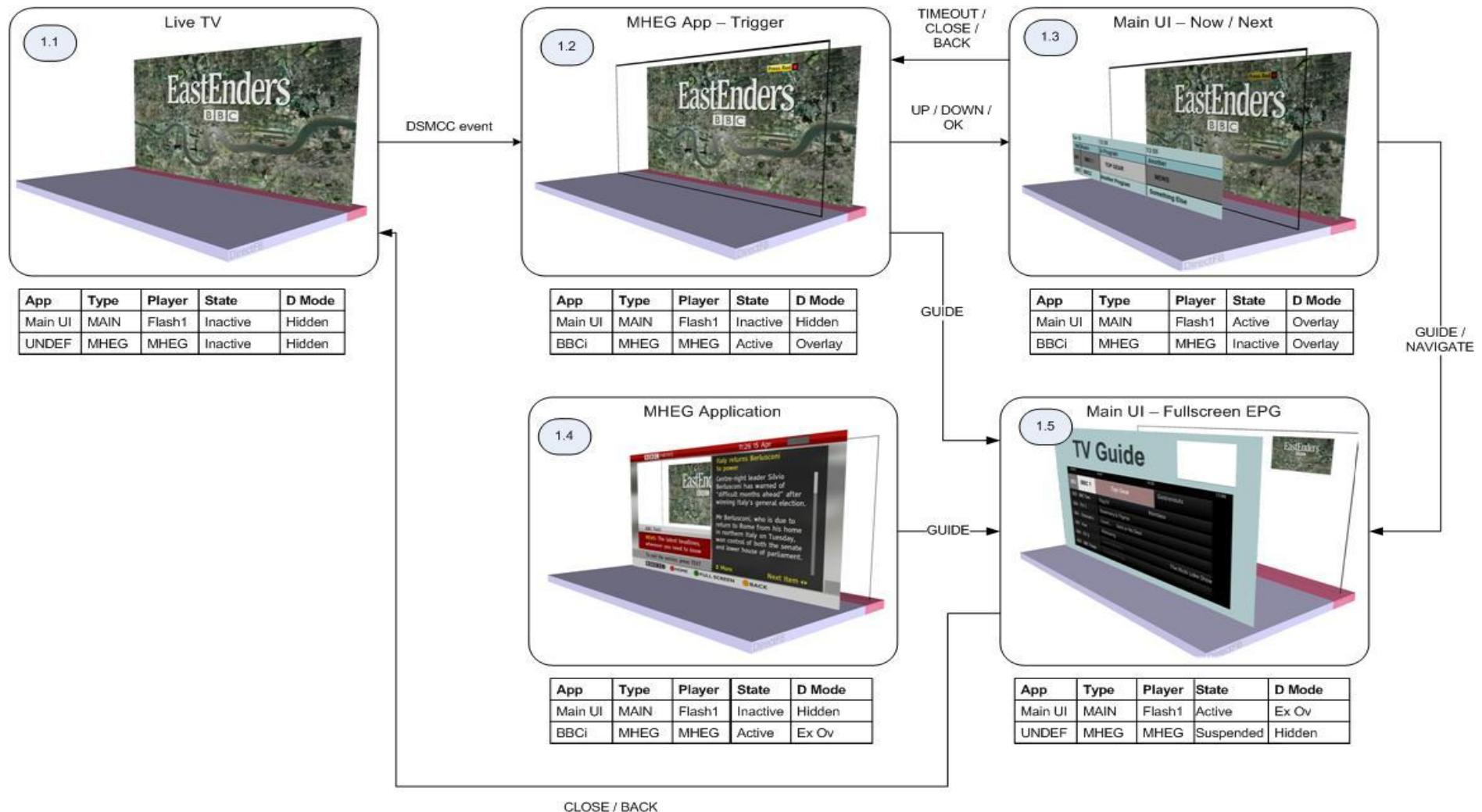
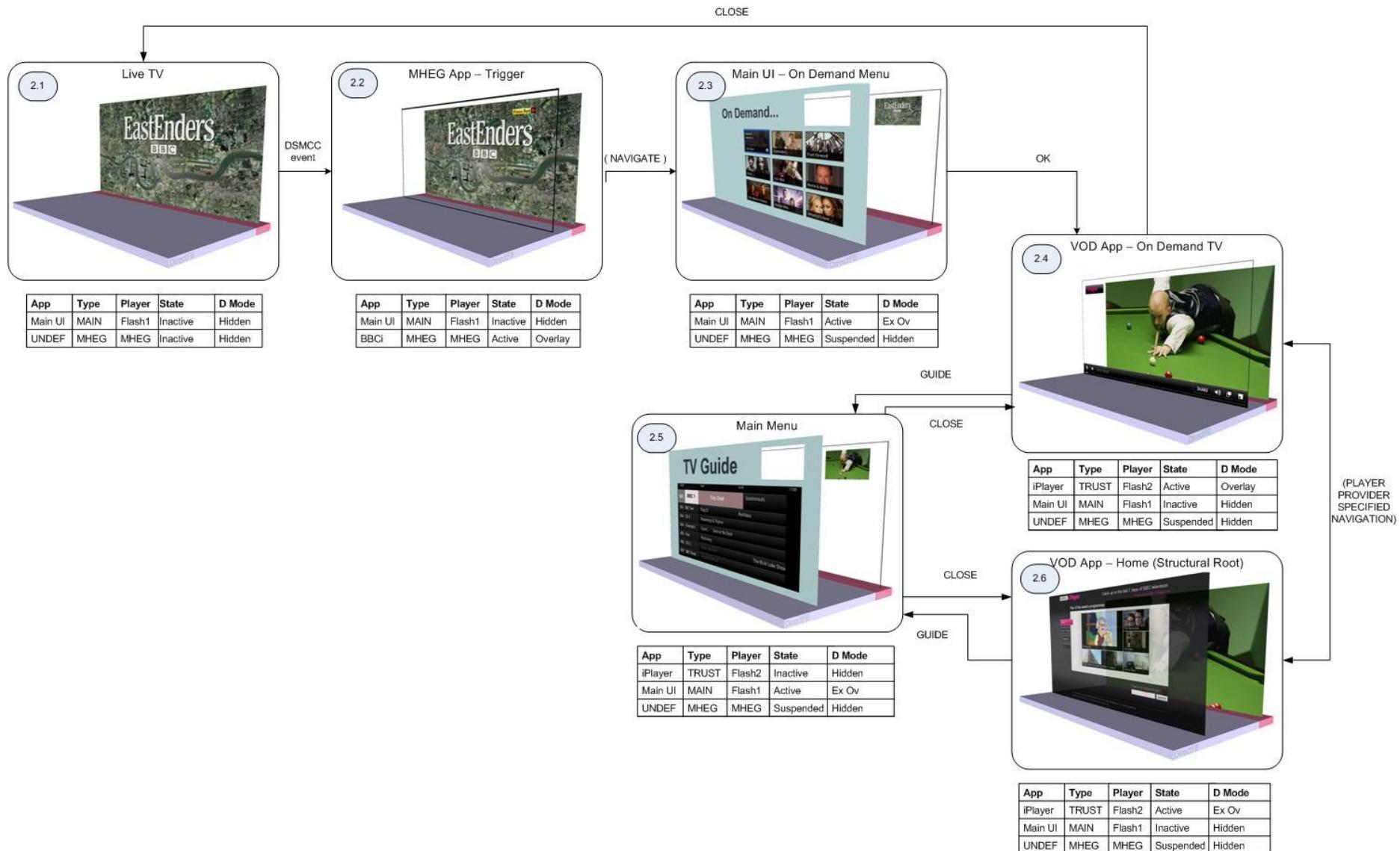
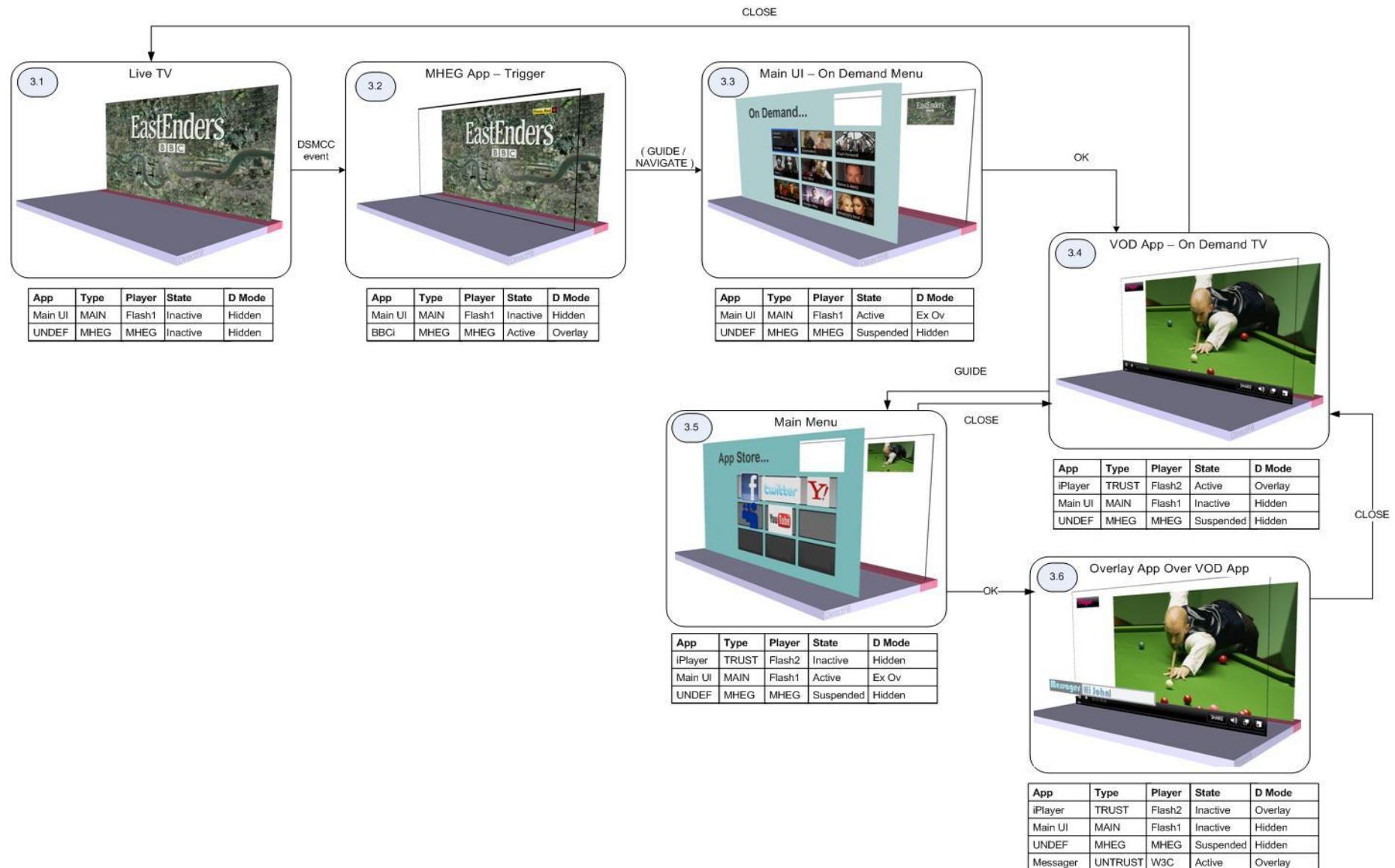


Figure AII-2 Interactions between the Core UI and other Video Playing Applications



**Figure AII- 3 Interactions between Core UI, Video Playing and Other Applications**



# Annex III: Metadata

## Annex III.I: DTG ContentAccessDownloadDescriptor

```

<xs:schema xmlns:tns="urn:dtg:metadata:ContentAccessDownloadDescriptor:2011" xmlns:xs="http://www.w3.org/2001/XMLSchema"
  xmlns:xml="http://www.w3.org/XML/1998/namespace" targetNamespace="urn:dtg:metadata:ContentAccessDownloadDescriptor:2011"
  elementFormDefault="qualified" attributeFormDefault="unqualified">
  <!-- schema filename is dtg-ContentAccessDownloadDescriptor-v0_2.xsd -->
  <xs:annotation>
    <xs:documentation xml:lang="en">
      This schema is copyrighted by the Digital TV Group ("DTG") and distributed in conjunction
      with the Connected TV Specification (D-Book Part B). It is based on the Open IPTV Forum
      ("OIPF") schema "AbstractContentAccessDescriptor.xsd" distributed with the OIPF
      Release 1 specification. All the DTG and associated schemas should be co-located.
    </xs:documentation>
    <xs:annotation>
      Disclaimer
      The Digital TV Group members accept no liability whatsoever for any use of this document.
      This specification provides multiple options for some features. Any implementation based
      on D-Book Part B specifications that does not follow the profiling described in that specification
      cannot claim DTG compliance.
    </xs:annotation>
    <xs:documentation>
      Copyright Notification
      No part may be reproduced except as authorized by written permission.
      Any form of reproduction and/or distribution of these works is prohibited.
      Copyright 2011 © Members of the Digital TV Group
      All rights reserved.
    </xs:documentation>
    </xs:annotation>
    <!-- this schema redefines the generic Content Access Descriptor Schema iptv-
        AbstractContentAccessDescriptor.xsd as defined in Annex E.3 by limiting the allowable
        values for attribute "TransferType" to "playable_download" and "full_download" -->
    <xs:redefine schemaLocation="dtg-AbstractContentAccessDescriptor-v0_2.xsd">
      <xs:simpleType name="TransferTypeEnum">
        <xs:restriction base="tns:TransferTypeEnum">
          <xs:enumeration value="full_download"/>
          <xs:enumeration value="playable_download"/>
        </xs:restriction>
      </xs:simpleType>
    </xs:redefine>
  </xs:schema>

```

## Annex III.2: DTG Content Access Streaming Descriptor

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema targetNamespace="urn:dtg:metadata:ContentAccessStreamingDescriptor:2011"
  xmlns:tns="urn:dtg:metadata:ContentAccessStreamingDescriptor:2011" xmlns:xs="http://www.w3.org/2001/XMLSchema"
  xmlns:xml="http://www.w3.org/XML/1998/namespace" elementFormDefault="qualified" attributeFormDefault="unqualified">
  <!-- schema filename is dtg-ContentAccessStreamingDescriptor-v0_9.xsd -->
  <xs:annotation>
    <xs:documentation xml:lang="en">
      This schema is copyrighted by the Open IPTV Forum ("OIPF") and distributed in conjunction
      with Release 1 of the IPTV Solution Specification.
    </xs:documentation>
    <xs:annotation>
      Disclaimer
      This schema is copyrighted by the Digital TV Group ("DTG") and distributed in conjunction
      with the Connected TV Specification (D-Book Part B). It is based on the Open IPTV Forum
      ("OIPF") schema "AbstractContentAccessDescriptor.xsd" distributed with the OIPF
      Release 1 specification. All the DTG and associated schemas should be co-located.
    </xs:annotation>
    <xs:documentation>
      Disclaimer
      The Digital TV Group members accept no liability whatsoever for any use of this document.
      This specification provides multiple options for some features. Any implementation based
      on D-Book Part B specifications that does not follow the profiling described in that specification
      cannot claim DTG compliance.
    </xs:documentation>
    <xs:annotation>
      Copyright Notification
      No part may be reproduced except as authorized by written permission.
      Any form of reproduction and/or distribution of these works is prohibited.
      Copyright 2011 © Members of the Digital TV Group
      All rights reserved.
    </xs:annotation>
    </xs:annotation>
    <!-- this schema redefines the generic Content Access Descriptor Schema iptv-
        AbstractContentAccessDescriptor.xsd as defined in Annex E.3 by limiting the allowable
        values for attribute "TransferType" to "streaming" -->
    <xs:redefine schemaLocation="dtg-AbstractContentAccessDescriptor-v0_9.xsd">
      <xs:simpleType name="TransferTypeEnum">
        <xs:restriction base="tns:TransferTypeEnum">
          <xs:enumeration value="streaming"/>
        </xs:restriction>
      </xs:simpleType>
    </xs:redefine>
  </xs:schema>

```

## Annex III.3: DTG extended AbstractContentAccessDescriptor

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns:xml="http://www.w3.org/XML/1998/namespace" xmlns:dtg="urn:dtg:metadata:2011"
  elementFormDefault="qualified" attributeFormDefault="unqualified">

```

```

<!-- schema filename is dtg-AbstractContentAccessDescriptor-v0_2.xsd -->
<xss:annotation>
  <xss:documentation xml:lang="en">
    This schema is developed by Digital TV Group (DTG) based on the Open IPTV Forum ("OIPF")
    "AbstractContentAccessDescriptor" schema and distributed in conjunction with the DTG
    Connected TV Specification (D-Book 7.0 Part B).

    Other associated schemas such as those developed by Open Internet TV Forum and Digital TV Group
    are required with this schema and should be co-located.

    Disclaimer
    The DTG members accept no liability whatsoever for any use of this document.
    This specification provides multiple options for some features. Any implementation based on
    DTG Conencted TV specification that does not follow the profiling described in the specification
    cannot claim DTG Conencted TV compliance.

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    Any form of reproduction and/or distribution of these works is prohibited.
    Copyright 2011 © Members of the Digital TV Group
    All rights reserved.

  </xss:documentation>
</xss:annotation>
<!-- This is the generic (i.e. "abstract") content access descriptor XML Schema that forms the basis for the XML Schemas of document
types:
  application/vnd.oipf.ContentAccessDownload+xml and application/vnd.oipf.ContentAccessStreaming+xml. This schema includes the
definition
  for abstract type "DRMPriateDataTpe" (as defined in Open IPTV Forum Solution Specification Volume 3 Metadata Release 1) and its
  specific instance type "MarlinPrivateDataTpe" or "HexBinaryPrivateDataTpe" (as defined in Open IPTV Forum Solution Specification
  Volume 7 Authentication, Content Protection and Service Protection Release 1) -->
<xss:import namespace="http://www.w3.org/XML/1998/namespace" schemaLocation="http://www.w3.org/2001/xml.xsd"/>
<xss:include schemaLocation="csp-MarlinPrivateDataTpe.xsd"/>
<xss:include schemaLocation="csp-DRMPriateDataTpe.xsd"/>
<xss:include schemaLocation="csp-HexBinaryPrivateDataTpe.xsd"/>
<xss:import namespace="urn:dtg:metadata:2011" schemaLocation="dtg-MetadataDefinitionsSchema-v0_2.xsd"/>
<xss:element name="Contents" type="ContentsType"/>
<xss:complexType name="ContentsType">
  <xss:sequence>
    <xss:element name="ContentItem" type="ContItemTpe" maxOccurs="unbounded"/>
  </xss:sequence>
</xss:complexType>
<xss:complexType name="ContItemTpe">
  <xss:sequence>
    <xss:element name="Title" type="TitleType"/>
    <xss:element name="Synopsis" type="SynopsisType" minOccurs="0" maxOccurs="unbounded"/>
    <xss:element name="OriginSite" type="xs:anyURI"/>
    <xss:element name="OriginSiteName" type="xs:string" minOccurs="0"/>
    <xss:element name="ContentID" type="xs:string" minOccurs="0">
      <xss:annotation>
        <xss:documentation>For CTV this is the content CRID and is mandatory</xss:documentation>
      </xss:annotation>
    </xss:element>
    <xss:element name="ContentURL" type="ContentURLType" maxOccurs="unbounded"/>
    <xss:element name="MetadataURL" type="xs:anyURI" minOccurs="0"/>
    <xss:element name="NotifyURL" type="xs:anyURI" minOccurs="0"/>
    <xss:element name="IconURL" type="xs:anyURI" minOccurs="0"/>
    <xss:element name="SubtitlesURL" type="dtg:SubtitlesLocatorType" minOccurs="0" maxOccurs="unbounded">
      <xss:annotation>
        <xss:documentation>DTG extension element. Locator for subtitles coomponent of a service if carried as a seperately from main
component set.</xss:documentation>
      </xss:annotation>
    </xss:element>
    <xss:element name="ParentalRating" type="ParentalRatingType" minOccurs="0" maxOccurs="unbounded"/>
    <xss:element name="DRMControlInformation" type="DRMControlInformationType" minOccurs="0" maxOccurs="unbounded"/>
  <!-- -->
  <!-- Additional elements defined by DTG -->
  <xss:element name="GuidanceText" type="dtg:GuidanceTextType" minOccurs="0" maxOccurs="unbounded">
    <xss:annotation>
      <xss:documentation>DTG extension element. Editorial guidance text to accompany the content item.</xss:documentation>
    </xss:annotation>
  </xss:element>
  <xss:element name="GroupCRID" type="dtg:CRIDType" minOccurs="0" maxOccurs="unbounded">
    <xss:annotation>
      <xss:documentation>DTG extension element. The CRID of a Group to which this content item belongs.</xss:documentation>
    </xss:annotation>
  </xss:element>
  <xss:element name="RecommendationCRID" type="dtg:CRIDType" minOccurs="0" maxOccurs="unbounded">
    <xss:annotation>
      <xss:documentation>DTG extension element. The CRID of a recommendation Group to which this content item
belongs.</xss:documentation>
    </xss:annotation>
  </xss:element>
  <xss:element name="Genre" type="dtg:GenreType" minOccurs="0" maxOccurs="unbounded">
    <xss:annotation>
      <xss:documentation>DTG extension element. The genre of this content item, expressed as a controlled term from an MPEG-7
Classification Scheme.</xss:documentation>
    </xss:annotation>
  </xss:element>
  <xss:element name="DownloadAvailabiltyWindow" type="dtg:AvailabiltyWindowType" minOccurs="0">
    <xss:annotation>
      <xss:documentation>DTG extension element. The period of time for which this content item is available for acquisition by
download.</xss:documentation>
    </xss:annotation>
  </xss:element>
  <xss:element name="ConsumptionWindow" type="dtg:ConsumptionWindowType" minOccurs="0">
    <xss:annotation>
      <xss:documentation>DTG extension element. The period of time for which this content item is available for consumption following
successful download. (Provided for information only; a separate DRM system is responsible for policing the consumption of the downloaded
content item.)</xss:documentation>
    </xss:annotation>
  </xss:element>
  <xss:element name="ContentCharacteristics" type="dtg:ContentCharacteristicsType" minOccurs="0">

```

```

        <xs:annotation>
          <xs:documentation>DTG extension element. Audio-visual and language characteristics of this content item. (Provided for
information only.)</xs:documentation>
        </xs:annotation>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
<!-- -->
<!-- Components defined by OIPF -->
<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:annotation>
    <xs:documentation>
      Multiple URLs may be provided but each must be for a different DRMSystemID
    </xs:documentation>
  </xs:annotation>
  <xs:simpleContent>
    <xs:extension base="xs:anyURI">
      <xs:attribute name="DRMSystemID" type="xs:string" use="optional"/>
      <xs:attribute name="TransferType" type="TransferTypeEnum" use="required"/>
      <xs:attribute name="MD5Hash" type="xs:string" use="optional"/>
      <xs:attribute name="Duration" type="xs:time" use="optional"/>
      <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>
<!-- The TransferType is a string in this generic content access descriptor. The values of the TransferTypeEnum are
restricted in the document instance types "application/vnd.oipf.ContentAccessDownloadDescriptor" and
"application/vnd.oipf.ContentAccessStreamingDescriptor" as defined in Annexes E.1 and E.2.-->
<xs:simpleType name="TransferTypeEnum">
  <xs:restriction base="xs:string"/>
</xs:simpleType>
<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="DRMGenericData" minOccurs="0" maxOccurs="unbounded"/>
    <xs:element ref="DRMPublicData" minOccurs="0" maxOccurs="unbounded"/>
  </xs:sequence>
</xs:complexType>
<xs:element name="DRMGenericData" type="DRMGenericDataType"/>
<xs:element name="DRMPublicData" type="DRMPublicDataType"/>
<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="MarlinPrivateDataType" substitutionGroup="DRMPublicData"/>
<xs:element name="HexBinaryPrivateData" type="HexBinaryPrivateDataType" substitutionGroup="DRMPublicData"/>
<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>

```

## Annex III.4: DTG Metadata Definitions Schema

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns="urn:dtg:metadata:2011" xmlns:mpeg7="urn:tva:mpeg7:2008" xmlns:xs="http://www.w3.org/2001/XMLSchema"
  xmlns:xm="http://www.w3.org/XML/1998/namespace" targetNamespace="urn:dtg:metadata:2011" elementFormDefault="qualified"
  attributeFormDefault="unqualified">
  <!-- schema filename is dtg-MetadataDefinitionsSchema-v0_2.xsd -->
  <xs:annotation>
    <xs:documentation xml:lang="en">
      This schema is developed by Digital TV Group (DTG) to define the extensions added to the DTG extended version of the
      Open IPTV Forum ("OIPF") "dtg-AbstractContentAccessDescriptor-v1" schema for use in the DTG Connected TV (CTV) specification (D-Book 7.0 Part
      B),
      and distributed in conjunction with that specification. All the schemas associated with D-Book 7.0 Part B should be co-located.
    </xs:documentation>
  </xs:annotation>
  <xs:documentation>
    Disclaimer
    The DTG members accept no liability whatsoever for any use of this document. This specification provides multiple options for some features.
    The
    DTG Profiling specification will complement the CTV specification by defining the DTG implementation and deployment profiles. Any
    implementation
    based on the DTG Conencted TV specification that does not follow the profiling as described in the CTV specification cannot claim DTG
    Conencted TV
    compliance.
  </xs:documentation>
  <xs:annotation>
    Copyright Notification
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    Copyright 2011 © Members of the Digital TV Group
    All rights reserved.
  </xs:annotation>
  <xs:import namespace="http://www.w3.org/XML/1998/namespace" schemaLocation="http://www.w3.org/2001/xml.xsd"/>
  <xs:import namespace="urn:tva:mpeg7:2008" schemaLocation="tva_mpeg7_2008.xsd"/>
  <!-- -->
  <!-- =====-->
  <!-- CONTENT ITEM METADATA -->
  <!-- =====-->
  <xs:complexType name="GuidanceTextType">
    <xs:annotation>
      <xs:documentation>Provides editorial guidance text as a string with optional language attribute.</xs:documentation>
    </xs:annotation>
    <xs:complexContent>
      <xs:extension base="mpeg7:TextualType"/>
    </xs:complexContent>
  </xs:complexType>
  <xs:simpleType name="CRIDType">
    <xs:restriction base="xs:anyURI">
      <xs:pattern value="(c|C) (r|R) (i|I) (d|D) ://.*.*"/>
    </xs:restriction>
  </xs:simpleType>
  <xs:complexType name="GroupCRIDType">
    <xs:simpleContent>
      <xs:extension base="CRIDType">
        <xs:attribute name="IsRecordList" type="xs:boolean" default="false"/>
        <xs:annotation>
          <xs:documentation>"true" indicates that the Group CRID is a record list.</xs:documentation>
        </xs:annotation>
        <xs:attribute>
          <xs:annotation>
            <xs:extension>
              <xs:simpleContent>
                <xs:annotation>
                  <xs:documentation>The content of this element is an unqualified term identifier defined within the scope of the MPEG-7 Classification Scheme
                  specified in the Scheme attribute.</xs:documentation>
                </xs:annotation>
              </xs:simpleContent>
            </xs:extension>
            <xs:attribute name="Scheme" type="xs:anyURI" use="required">
              <xs:annotation>
                <xs:documentation>The namespace URI of an MPEG-7 Classification Scheme. (The term identifier is specified in the element
                content.)</xs:documentation>
              </xs:annotation>
            </xs:attribute>
          </xs:annotation>
        </xs:extension>
      </xs:simpleContent>
    </xs:extension>
  </xs:complexType>
  <xs:complexType name="GenreType">
    <xs:simpleContent>
      <xs:annotation>
        <xs:documentation>The content of this element is an unqualified term identifier defined within the scope of the MPEG-7 Classification Scheme
        specified in the Scheme attribute.</xs:documentation>
      </xs:annotation>
    </xs:simpleContent>
  </xs:complexType>
  <xs:complexType name="AvailabilityWindowType">
    <xs:annotation>
      <xs:documentation>The period of time for which this content item is available for acquisition by download.</xs:documentation>
    </xs:annotation>
    <xs:attribute name="AvailabilityStart" type="xs:dateTime" use="optional">
      <xs:annotation>
        <xs:documentation>Expressed as an XML schema dateTime.</xs:documentation>
      </xs:annotation>
    </xs:attribute>
    <xs:attribute name="AvailabilityEnd" type="xs:dateTime" use="optional">
      <xs:annotation>
        <xs:documentation>Expressed as an XML schema dateTime.</xs:documentation>
      </xs:annotation>
    </xs:attribute>
  </xs:complexType>
  <xs:complexType name="ConsumptionWindowType">
    <xs:annotation>
      <xs:documentation>The period of time for which this content item is available for consumption following successful download. (Provided for
      information only; a separate DRM system is responsible for policing the consumption of the downloaded content item.)</xs:documentation>
    </xs:annotation>
    <xs:attribute name="EmbargoTime" type="xs:dateTime">
      <xs:annotation>
        <xs:documentation>Expressed as an XML schema dateTime.</xs:documentation>
      </xs:annotation>
    </xs:attribute>
    <xs:attribute name="ExpiryTime" type="xs:dateTime">
      <xs:annotation>
        <xs:documentation>Expressed as an XML schema dateTime.</xs:documentation>
      </xs:annotation>
    </xs:attribute>
  </xs:complexType>

```

```

<xs:annotation>
<xs:documentation>Expressed as an XML schema dateTime.</xs:documentation>
</xs:annotation>
</xs:attribute>
<xs:attribute name="ViewingPeriod" type="mpeg7:durationType">
<xs:annotation>
<xs:documentation>Expressed as an ISO 8601 period string.</xs:documentation>
</xs:annotation>
</xs:attribute>
</xs:complexType>
<xs:complexType name="SubtitlesLocatorType">
<xs:annotation>
<xs:documentation>Multiple subtitle URLs may be provided each with associated language and MIME type
</xs:documentation>
</xs:annotation>
<xs:simpleContent>
<xs:extension base="xs:anyURI">
<xs:attribute name="SubtitleLanguage" type="xs:language" use="required"/>
<xs:attribute name="MIMEType" type="mpeg7:mimeType" use="required"/>
</xs:extension>
</xs:simpleContent>
</xs:complexType>

<!-- -->
<!-- ===== -->
<!-- CONTENT CHARACTERISTICS METADATA -->
<!-- ===== -->
<xs:complexType name="AudioTypeType">
<xs:annotation>
<xs:documentation>Indicates what type of audio components are included. Boolean attributes set to true if that type is carried. Multiple attributes may be set.</xs:documentation>
</xs:annotation>
<xs:attribute name="HasMono" type="xs:boolean" default="false"/>
<xs:attribute name="HasStereo" type="xs:boolean" default="false"/>
<xs:attribute name="HasMultiChannel" type="xs:boolean" default="false"/>
</xs:complexType>
<xs:complexType name="SubtitlesTypeType">
<xs:annotation>
<xs:documentation>Indicates what type of subtitle components are included. Boolean attributes set to true if that type is carried. Multiple attributes may be set.</xs:documentation>
</xs:annotation>
<xs:attribute name="HasDVBSD" type="xs:boolean" default="false"/>
<xs:attribute name="HasDVBDH" type="xs:boolean" default="false"/>
<xs:attribute name="HasTimedText" type="xs:boolean" default="false"/>
</xs:complexType>
<xs:complexType name="AudioDescriptionTypeType">
<xs:annotation>
<xs:documentation>Indicates what type of audio description components are included. Boolean attributes set to true if that type is carried. Multiple attributes may be set.</xs:documentation>
</xs:annotation>
<xs:attribute name="HasReceiverMix" type="xs:boolean" default="false"/>
<xs:attribute name="HasBroadcastMix" type="xs:boolean" default="false"/>
</xs:complexType>
<xs:element name="SubtitlesLanguage" type="xs:language">
<xs:annotation>
<xs:documentation>Indicates the languages for the subtitle components provided. No indication of correspondence of language to component is given.
Language coding is to RFC 3066 using a single ISO 639 "alpha-2" or "alpha-3" language code per element.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:complexType name="ContentCharacteristicsType">
<xs:sequence>
<xs:element name="IsHD" type="xs:boolean" default="false" minOccurs="0">
<xs:annotation>
<xs:documentation>"true" indicates that video component is in High Definition format. Default is "false".</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="IsWideScreen" type="xs:boolean" default="true" minOccurs="0">
<xs:annotation>
<xs:documentation>"true" indicates that video component is intended to be presented in a 16:9 picture aspect ratio. Default is "true".</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="AudioType" type="AudioTypeType" minOccurs="0">
<xs:annotation>
<xs:documentation>Indicates the types of the audio components provided. No indication of correspondence of type to component is given.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="AudioLanguage" type="xs:language" minOccurs="0" maxOccurs="unbounded">
<xs:annotation>
<xs:documentation>Indicates the languages for the audio components provided. No indication of correspondence of language to component type is given.
Language coding is to RFC 3066 using a single ISO 639 "alpha-2" or "alpha-3" language code per element.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="SubtitlesType" type="SubtitlesTypeType" minOccurs="0">
<xs:annotation>
<xs:documentation>Indicates the type of the subtitle components provided. No indication of correspondence of type to component is given.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="SubtitlesLanguage" type="xs:language" minOccurs="0" maxOccurs="unbounded">
<xs:annotation>
<xs:documentation>Indicates the languages for the subtitle components provided. No indication of correspondence of language to component is given. Language coding
is to RFC 3066 using a single ISO 639 "alpha-2" or "alpha-3" language code per element. Multiple instances may be carried.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="AudioDescriptionType" type="AudioDescriptionTypeType" minOccurs="0">
<xs:annotation>
<xs:documentation>Indicates the type of the audio description components provided. No indication of correspondence of type to component is

```

```

given.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="AudioDescriptionLanguage" type="xs:language" minOccurs="0" maxOccurs="unbounded">
<xs:annotation>
<xs:documentation>Indicates the languages for the audio description components provided, no indication of correspondence of language to component is given.  
Language coding is to RFC 3066 using a single ISO 639 "alpha-2" or "alpha-3" language code per element. Multiple instances may be carried.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="CleanAudioLanguage" type="xs:language" minOccurs="0" maxOccurs="unbounded">
<xs:annotation>
<xs:documentation>Indicates the languages for the clean audio components provided, no indication of correspondence of language to component is given.  
Language coding is to RFC 3066 using a single ISO 639 "alpha-2" or "alpha-3" language code per element. Multiple instances may be carried.</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:schema>

```

## Annex III.5: BBFC Classification Scheme

```

<?xml version="1.0" encoding="UTF-8"?>
<ClassificationScheme uri=" urn:dtg:cs:BBFCCContentRatingCS:2002">
<!-- scheme filename is DTG_BBFCCContentRatingCS_2002_1.xml -->
<!--
This schema is copyrighted by the Digital TV Group ("DTG") to be aligned with the Parental Rating field of the
"dtg-AbstractContentAccessDescriptor-v1" developed by DTG as an extended version of the Open IPTV Forum ("OIPF")
schema ("AbstractContentAccessDescriptor") and relevant for use in conjunction with the Connected TV Solution
specification (D-Book 7.0 Part B).

Other associated schemas developed by Open Internet TV Forum and Digital TV Group are also required and should be
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-->
<Term termId="U">
<Name xml:lang="en">Universal</Name>
<Definition xml:lang="en">Suitable for all</Definition>
</Term>
<Term termId="PG">
<Name xml:lang="en">Parental Guidance</Name>
<Definition xml:lang="en">Suitable for children of all ages, but some scenes may be unsuitable for young children</Definition>
</Term>
<Term termId="12">
<Name xml:lang="en">Video content suitable for children over 12 only</Name>
<Definition xml:lang="en">Children under 12 may not rent or buy this type of content</Definition>
</Term>
<Term termId="12A">
<Name xml:lang="en">Cinema content suitable for children over 12 only</Name>
<Definition xml:lang="en">Children under 12 must be accompanied at cinemas showing this type of content</Definition>
</Term>
<Term termId="15">
<Name xml:lang="en">Content not suitable for children under 15</Name>
<Definition xml:lang="en">No-one under 15 may watch (cinema), rent or buy this type of content</Definition>
</Term>
<Term termId="18">
<Name xml:lang="en">Content only suitable for adults (over 18)</Name>
<Definition xml:lang="en">No-one under 18 may watch (cinema), rent or buy this type of content</Definition>
</Term>
<Term termId="R18">
<Name xml:lang="en">Content only shown in licenced cinemas, or sold through licensellicenced sex shops, for adults only (over 18)</Name>
<Definition xml:lang="en">No-one under 18 may watch (cinema), rent or buy this type of content</Definition>
</Term>
</ClassificationScheme>

```

## Annex III.6: DTG Genre Classification Scheme

```

<?xml version="1.0" encoding="UTF-8"?>
<!-- edited with Oxygen v12 (http://www.oxygenxml.com) by Dave Walton (Echostar Europe) & Richard Bradbury (BBC R&D) -->
<ClassificationScheme uri=" urn:dtg:urn:dtg:metadata:cs:DTGenreCS:2010-11">
<!-- schema filename is "DTG_GenreCS_2011-1.xml" -->
<!--
This schema is copyrighted by the Digital TV Group ("DTG") to be aligned with the Parental Rating field of the
"dtg-AbstractContentAccessDescriptor-v1" developed by DTG as an extended version of the Open IPTV Forum ("OIPF")
schema ("AbstractContentAccessDescriptor") and relevant for use in conjunction with the Connected TV Solution
specification (D-Book 7.0 Part B).

```

Other associated schemas developed by Open Internet TV Forum and Digital TV Group are also required and should be co-located.

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Reference 8.5.3.2 table 8.7 of D-Book 6.2.1 -->

```
-->
<Term termId="0">
  <Name xml:lang="en">Unclassified</Name>
  <Definition xml:lang="en"></Definition>
</Term>
<Term termId="1">
  <Name xml:lang="en">Movie</Name>
  <Definition xml:lang="en"></Definition>
</Term>
<Term termId="2">
  <Name xml:lang="en">News and factual</Name>
  <Definition xml:lang="en"></Definition>
</Term>
<Term termId="2.1">
  <Name xml:lang="en">News/Current affairs</Name>
  <Definition xml:lang="en"></Definition>
</Term><Term termId="2.2">
  <Name xml:lang="en">Arts/Culture (without music)</Name>
  <Definition xml:lang="en"></Definition>
</Term><Term termId="2.3">
  <Name xml:lang="en">Social/Political Issues/Economics</Name>
  <Definition xml:lang="en"></Definition>
</Term>
<Term termId="3">
  <Name xml:lang="en">Entertainment</Name>
  <Definition xml:lang="en"></Definition>
</Term>
<Term termId="3.1">
  <Name xml:lang="en">Show/Game show</Name>
  <Definition xml:lang="en"></Definition>
</Term>
<Term termId="3.2">
  <Name xml:lang="en">Music/Ballet/Dance</Name>
  <Definition xml:lang="en"></Definition>
</Term>
<Term termId="4">
  <Name xml:lang="en">Sport</Name>
  <Definition xml:lang="en"></Definition>
</Term>
<Term termId="5">
  <Name xml:lang="en">Children's/Youth's programming</Name>
  <Definition xml:lang="en"></Definition>
</Term>
<Term termId="6">
  <Name xml:lang="en">Education/Science/Factual topics</Name>
  <Definition xml:lang="en"></Definition>
</Term>
<Term termId="7">
  <Name xml:lang="en">Lifestyle/Leisure hobbies</Name>
  <Definition xml:lang="en"></Definition>
</Term>
<Term termId="8">
  <Name xml:lang="en">Drama</Name>
  <Definition xml:lang="en"></Definition>
</Term>
</ClassificationScheme>
```

## Annex III.7 DTG Content Warning Classification Scheme

```
<?xml version="1.0" encoding="UTF-8"?>
<!-- edited with Oxygen v12 (http://www.oxygenxml.com) by Richard Bradbury (BBC R&amp;D) &amp; Dave Walton (Echostar Europe) --&gt;
&lt;ClassificationScheme uri="urn:dtg:metadata:cs:DTGContentWarningCS:2011-1"&gt;
  &lt;!-- scheme filename is "DTGContentWarningCS_2011-1.xml" --&gt;
  &lt;!--
    This schema is copyrighted by the Digital TV Group ("DTG") to be aligned with the Open IPTV Forum ("OIPF") Parental Rating field of the
    contentAccessDescriptor and relevant for use in conjunction with Release 1 of the Connected TV Solution Specification.
  --&gt;
  This schema is developed by Digital TV Group (DTG) based on the Open IPTV Forum ("OIPF") Abstract
  Content Access Descriptor schema and distributed in conjunction with version 1 of the DTG Connected TV
  Solution Specification (D-Book 7.0 Part B).

  Other associated schemas developed by Open Internet TV Forum and Digital TV Group are required
  with this schema and should be co-located.

  Disclaimer
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  This specification provides multiple options for some features. The DTG Profiling specification will complement the version 1 specifications by defining the DTG implementation and deployment profiles. Any implementation based on DTG Connected TV specifications that does not follow the Profiling specifications cannot claim DTG Connected TV</pre>

```

compliance.

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For use with <tva:ParentalGuidance><mpeg7:ParentalRating>

```
-->
<Term termID="G">
  <Name xml:lang="en">Guidance</Name>
  <Definition xml:lang="en">This programme contains material requiring guidance.</Definition>
  <Term termID="W">
    <Name xml:lang="en">WATERSHED</Name>
    <Definition xml:lang="en">This programme contains post-watershed material.</Definition>
  </Term>
</Term>
</ClassificationScheme>
```

## 6. Annex III.8: Mapping of properties across JavaScript Objects for metadata exchanges

### Broadcast content (inc. BRL) and IP linear content

"Action by The Terminal" is only specified when some specific functionality is defined.

The Recording Objects is used to manage the process of recording of content until completed or aborted using some information from the Channel and Programme Objects, and to provide the metadata to the application to expose stored content in the UI. Therefore some properties may seem to be redundant for one or other of those operations.

Action by Terminal	Channel Class Property	Programme Class Property	ScheduledRecording Class Property	Recording Class Property (See note I)	Download Class Property
	<b>idType</b> Provided by terminal for broadcast item. Set by application for linear IP item	N/A	N/A	N/A	N/A
Populated with value from terminal service list following LCN processing for broadcast content.	<b>ccid</b> Provided by terminal for broadcast channel. "Undefined" for IP linear channel.	N/A See "channelID"	See "channelID"	N/A	N/A
tunerID set based on resource usage	<b>tunerID</b> Set by terminal for broadcast items, set to "Undefined" for linear IP items	N/A	N/A	N/A	N/A
Populated from SDT.onid for broadcast content	<b>onid</b> Provided from SI data for broadcast items, or by createChannel() for linear IP items	N/A	N/A	N/A	N/A
tsid Populated from SDT.tsid for broadcast content	<b>tsid</b> Provided from SI data for broadcast items, or by createChannel() for linear IP items	N/A	N/A	N/A	N/A
Populated from SDT.sid	<b>sid</b> Provided from SI data for	N/A	N/A	N/A	N/A

Action by Terminal	Channel Class Property	Programme Class Property	ScheduledRecording Class Property	Recording Class Property (See note I)	Download Class Property
for broadcast content	broadcast items, or by createChannel() for IP linear items May be "Undefined" for IP content				
N/A	<b>sourcelD</b> Not used	N/A	N/A	N/A	N/A
N/A	<b>Freq</b> Not used	N/A	N/A	N/A	N/A
N/A	<b>cni</b> Not used	N/A	N/A	N/A	N/A
Populated from SDT/service descriptor/service name for broadcast content	<b>name</b> Set by terminal for broadcast item. Set by application for IP linear item	N/A	N/A	<b>channelName</b> Inherited from Channel Object Used for UI	N/A
	<b>longChannelName</b> Not used	N/A	N/A	N/A	N/A
	<b>channelDescription</b> Not used	N/A	N/A	N/A	N/A
Populated with value from terminal service list following LCN processing for broadcast content.	<b>majorChannel</b> Set by terminal for broadcast content. "Undefined" for IP linear item	N/A	N/A	N/A	N/A
	<b>minorChannel</b> Not used	N/A	N/A	N/A	N/A
	<b>dsd</b> Not used	N/A	N/A	N/A	N/A
Set to indicate whether a member of a favourite list	<b>favourite</b> Set by terminal	N/A	N/A	N/A	N/A
Reference to favourite list	<b>favIDs</b> Set by terminal	N/A	N/A	N/A	N/A
Set based on parental control information	<b>locked</b> Set by terminal for broadcast	<b>locked</b> Set by terminal for broadcast	N/A	<b>locked</b> Derived from Programme object.	N/A

Action by Terminal	Channel Class Property	Programme Class Property	ScheduledRecording Class Property	Recording Class Property (See note 1)	Download Class Property
	and IP linear item	and IP linear item			
User setting	<b>manualBlock</b> Set by terminal	N/A	N/A	<b>manualBlock</b> Used for UI	N/A
Set based on parental control settings for broadcast	N/A	<b>blocked</b> Set by terminal	N/A	<b>blocked</b> Set by terminal	N/A
	<b>ipBroadcastID</b> Set to “Undefined” for broadcast Provided by createChannel() for IP linear channel.	N/A See “channelID”	N/A	N/A	N/A
	<b>channelMaxBitrate</b> Not used	N/A	N/A	N/A	N/A
	<b>channelTTR</b> Not used	N/A	N/A	N/A	N/A
	<b>authorised</b> Set by terminal	N/A	N/A	N/A	N/A
Populated from NIT.service_attribute_d descriptor or NIT HD_simulcast_logical_channel_descriptor for broadcast content	<b>hidden</b> Set by terminal, only needed for UI/EPG. Set by terminal for broadcast content Set for linear IP content set by application	N/A	N/A	N/A	N/A
On-going status of recording process for user indication after start of recording if “state” = “DOWNLOAD_FAILED”	N/A	N/A	N/A	<b>state</b> Set and updated by terminal as recording continues. Used during recording	<b>state</b> Set by terminal, ref 7.4.4.1
Values as defined in OIPF DAE rel 2 See note 4	N/A	N/A	N/A	<b>reason</b> Set by terminal, depending on value of “state” Used during recording	<b>reason</b> Set by terminal, ref DAE Release 2 7.4.4.2

Action by Terminal	Channel Class Property	Programme Class Property	ScheduledRecording Class Property	Recording Class Property (See note I)	Download Class Property
Local index to storage, set by terminal.	N/A	N/A	N/A	<b>id</b> Set by terminal Set during recording Used in UI	<b>id</b> Set by terminal
User defined, set by terminal	N/A	N/A	<b>startPadding</b> Set by terminal	<b>startPadding</b> Set by terminal	N/A
User defined, set by terminal	N/A	N/A	<b>endPadding</b> Set by terminal	<b>endPadding</b> Set by terminal	N/A
Set by terminal based on combination of user choice and terminal contention functionality	N/A	N/A	<b>repeatDays</b> Set by terminal	<b>repeatDays</b> Set by terminal	N/A
Populated from EIT/short_event_descrip tor/event name for broadcast content	N/A	<b>name</b> Set by terminal for broadcast and by application for IP linear content	<b>name</b> Derived from Programme object when recording is scheduled	<b>name</b> Derived from Programme object	<b>name</b> CADD.Title
	N/A	<b>longName</b> Not used	<b>longName</b> Not used	N/A	N/A
Populated from EIT/short_event_descrip tor/description for broadcast content	N/A	<b>description</b> Set by terminal from EIT.description for broadcast and by application for IP linear content	<b>description</b> Derived from Programme object when recording is scheduled	<b>description</b> Derived from Programme object	<b>description</b> CAD.Synopsis
	N/A	<b>longDescription</b> Not used	<b>longDescription</b> Not used	N/A	N/A
Populated from EIT/event/start_time for broadcast content For download use startTime from RegisterDownload(), possibly deferred by terminal.	N/A	<b>startTime</b> Set by terminal for broadcast content (based on schedule and BRL) from EIT.start_time. Set by application for IP linear content.	<b>startTime</b> Derived from Programme object when recording is scheduled	<b>startTime</b> Derived from ScheduledRecording object when recording starts	<b>startTime</b> Set by terminal
For linear content, set at time of recording by	N/A	N/A	N/A	<b>recordingStartTime</b> set by terminal	N/A

Action by Terminal	Channel Class Property	Programme Class Property	ScheduledRecording Class Property	Recording Class Property (See note I)	Download Class Property
terminal					
For download provide timeElapsed	N/A	N/A	N/A	N/A	<b>timeElapsed</b> Set by terminal
For download provide timeRemaining (estimated)	N/A	N/A	N/A	N/A	<b>timeRemaining</b> Set by terminal
Populated from EIT/event/duration for broadcast content. For IP download content use contentURL@duration	N/A	<b>duration</b> Set by terminal for broadcast content For IP linear content set by application.	<b>duration</b> Derived from Programme object when recording is scheduled	<b>duration</b> Derived from ScheduledRecording object when recording starts	<b>duration</b> Set by terminal
For linear content, set at end of recording	N/A	N/A	N/A	<b>recordingDuration</b> set by terminal	N/A
Reference to broadcast channel where content is available. Set to broadcast content location.	N/A	<b>channel</b> Set by terminal for broadcast. Set by application for IP linear.	<b>channel</b> Derived from Programme object when recording is scheduled	<b>channel</b> Derived from ScheduledRecording object when recording starts	N/A
Provides "ccid" for broadcast content item	N/A	<b>channelID</b> "ccid" provided by terminal for broadcast content. "ipBroadcastID" provided by application for IP linear content from Channel object	N/A	N/A	N/A
Set in presence of EIT/content_identifier_descriptor/CRID_type 0x32, for broadcast content	N/A	N/A	<b>isSeries</b> Derived from Programme object when recording is scheduled	<b>isSeries</b> Derived from the scheduledRecording object when recording starts	N/A
Terminal provides indication of type of ID for broadcast content.	N/A	<b>programmeIDType</b> Set by terminal for broadcast content and by application for IP linear	<b>programmeIDType</b> Derived from Programme object when recording is scheduled	<b>programmeIDType</b> Derived from the scheduledRecording object when recording starts	N/A

Action by Terminal	Channel Class Property	Programme Class Property	ScheduledRecording Class Property	Recording Class Property (See note I)	Download Class Property
		content.			
N/A	N/A	<b>episode</b> Not used	<b>episode</b> Not used	N/A	N/A
N/A	N/A	<b>totalEpisodes</b> Not used	<b>totalEpisodes</b> Not used	N/A	N/A
Populated from EIT/guidance_descriptor/guidance_type/guidance_mode, where present, for broadcast content	N/A	<b>parentalRating (string collection)</b> Set by terminal for broadcast content	<b>parentalRating (string collection)</b> Derived from Programme object when recording is scheduled	<b>parentalRating (string collection)</b> Derived from ScheduledRecording object when recording starts	<b>parentalRating (string collection)</b> CADD.parentalRating
Populated from EIT/guidance_descriptor/guidance_text, where present, for broadcast content.	N/A	<b>guidance</b> Text string format Set by terminal for broadcast items and by application for IP linear items. Uses parentalRatings for "Warningtype" flag.	<b>guidance</b>	<b>guidance</b>	<b>guidance</b> CADD.Guidance
Populated from EIT/content_descriptor/content_nibble_level_1 for broadcast content.	<b>genres (stringCollection)</b> Set by terminal for broadcast content and by application for IP linear content	<b>genres (string collection)</b> Set by terminal for broadcast content Set by application for IP linear content	N/A	<b>genres (string collection)</b> Derived from ScheduledRecording object when recording starts	<b>genres (string collection)</b> CADD.Genre
Populated from EIT/content_identifier_d descriptor/crid_type=0x31/CRID, where present, otherwise from EIT/event_id for broadcast content.	N/A	<b>programmeID</b> (Content identifier). Set by terminal for scheduled broadcast or BRL content. Set by application for IP linear content. For manual recording set to "undefined"	<b>programmeID</b> Derived from Programme object when recording is scheduled	<b>programmeID</b> Derived from ScheduledRecording object when recording starts Used in UI	<b>contentID</b> CADD.contentID
As contentID	N/A	<b>programmeCRID</b>	<b>programmeCRID</b> Derived from Programme object when recording is scheduled	<b>programmeCRID</b> Derived from ScheduledRecording object when recording starts	N/A

Action by Terminal	Channel Class Property	Programme Class Property	ScheduledRecording Class Property	Recording Class Property (See note I)	Download Class Property
Populated from EIT/content_identifier_descriptor/crid_type=0x32/crid, where present, for broadcast content (may be multiple).	N/A	<b>groupCRIDs</b> (string collection) Set by terminal for broadcast content and by application for IP linear content.	<b>groupCRIDs</b> (string collection) Derived from Programme object when recording is scheduled	<b>groupCRIDs</b> (string collection) Derived from ScheduledRecording object when recording starts	<b>groupCRIDs</b> (string collection) CADD.GroupCRID
Populated from EIT/content_identifier_descriptor/crid_type=0x33/crid, where present, for broadcast content (may be multiple).	N/A	<b>recommendationCRIDs</b> (string collection) Set by Terminal for broadcast content and by Application for IP linear content.	<b>recommendationCRIDs</b> (string collection) Derived from Programme object when recording is scheduled	<b>recommendationCRIDs</b> (string collection) Derived from ScheduledRecording object when recording starts	<b>recommendationCRIDs</b> (string collection) CADD.DTGRecommendationCRID
	N/A	<b>IMI</b> Not used	<b>IMI</b> Not used	<b>IMI</b> Not used	<b>IMI</b> Not used
Source = BRL record list data carousel for broadcast content	N/A	<b>expiryTime</b> Set by Terminal for broadcast content. May be “Undefined”	N/A	N/A	<b>expiryTime</b> CADD.ConsumptionWindow.ExpiryTime
Source = BRL record list data carousel for broadcast content	N/A	N/A	N/A	N/A	<b>embargoTime</b> CADD. ConsumptionWindow.EmbargoTime
	N/A	<b>viewingPeriod</b> Set by Terminal for broadcast content. Set by Application for IP linear content. May be “Undefined”	N/A	<b>viewingPeriod</b> Inherited from Programme Object	<b>viewingPeriod</b> CADD. ConsumptionWindow.ViewingPeriod
For linear content, set at time of recording by terminal	N/A	N/A	N/A	<b>recordingStartTime</b> set by terminal	N/A
For linear content, set at end of recording	N/A	N/A	N/A	<b>recordingDuration</b> set by terminal	N/A
	N/A	<b>showType</b> Not used	N/A	<b>showType</b> Not used	N/A
Set in the presence of EIT/subtitle component descriptor for broadcast	N/A	<b>subtitles</b> Set by terminal for scheduled broadcast or	N/A	<b>subtitles</b> set by terminal	<b>subtitles</b> Derived from presence of “subtitlesLanguage” element(s) in

Action by Terminal	Channel Class Property	Programme Class Property	ScheduledRecording Class Property	Recording Class Property (See note I)	Download Class Property
content for content within schedule. For BRL recordings off schedule set from BRL.PushDownloadProgram.AVAttributes. For IP linear content set by Terminal at time of recording		BRL content. Set by application for IP linear content. For manual recording set to "undefined"			CADD.ContentCharacteristics element
Set in the presence of an appropriate EIT/component descriptor for DVB subtitles for broadcast content.	N/A	<b>subtitlesType</b> Set by terminal to "I" ("DVBSubtitles") for broadcast content. Set by application for IP Linear content.	N/A	<b>subtitlesType</b> Inherited from Programme Object	<b>CADD.ContentCharacteristics.SubtitlesType</b> CADD.SubtitlesType
Set in the presence of an appropriate EIT/component descriptor for broadcast content within scope of schedule. For BRL recordings off schedule set from BRL.PushDownloadProgram.AVAttributes	N/A	<b>isHD</b> Set by terminal for scheduled broadcast or BRL content. Set by application for IP linear content. For manual recording set to "undefined"	N/A	<b>isHD</b> set by terminal	<b>isHD</b> CAD. DTGContentCharacteristics.IsHD
Set in the presence of an appropriate EIT/component descriptor for broadcast content within scope of schedule. For BRL recordings off schedule set from BRL.PushDownloadProgram.AVAttributes	N/A	<b>isWidescreen</b> Set by terminal for scheduled broadcast or BRL content. Set by application for IP linear content. For manual recording set to "undefined."	N/A	<b>isWidescreen</b> set by terminal	<b>isWidescreen</b> CADD.ContentCharacteristics.IsWidescreen
Derived from an appropriate EIT/component	N/A	<b>audioType</b> Set by terminal for scheduled broadcast or	N/A	<b>audioType</b> Derived from ScheduledRecording object when	<b>audioType</b> CADD.ContentCharacteristics.AudioType

Action by Terminal	Channel Class Property	Programme Class Property	ScheduledRecording Class Property	Recording Class Property (See note I)	Download Class Property
descriptor for broadcast content within scope of schedule. For BRL recordings off schedule set from BRL.PushDownloadProgram.AVAttributes		BRL content. Set by application for IP linear content. For manual recording set to “undefined”		recording starts	
Set in the presence of an appropriate EIT/component descriptor for broadcast content within scope of schedule. For BRL recordings off schedule set from BRL.PushDownloadProgram.AVAttributes	N/A	<b>isMultilingual</b> Set by terminal for scheduled broadcast or BRL content. Set by application for IP linear content. For manual recording set to “undefined”	N/A	<b>isMultilingual</b> Derived from ScheduledRecording object when recording starts	<b>isMultilingual</b> Derived from CADD.ContentCharacteristics, set if more than one “AudioLanguage” elements with different language codes are present
Derived from language code(s) present in appropriate EIT/component descriptor(s) for broadcast content within scope of schedule. For BRL recordings off schedule set from BRL.PushDownloadProgram.AVAttributes	N/A	<b>audioLanguages</b> (string collection) Set by terminal for scheduled broadcast or BRL content. Set by application for IP linear content. For manual recording set to “undefined”	N/A	<b>audioLanguages</b> Derived from ScheduledRecording object when recording starts	<b>audioLanguages</b> CAD.ContentCharacteristics.DTGAudioLanguage There may be multiple instances of this element
Derived from language code(s) present in appropriate EIT/component descriptor(s) for broadcast content within scope of schedule. For BRL recordings off schedule set from	N/A	<b>subtitleLanguages</b> (string collection) Set by terminal for scheduled broadcast or BRL content. Set by application for IP linear content. For manual recording set to “undefined”	N/A	<b>subtitleLanguages</b> Derived from ScheduledRecording object when recording starts	<b>subtitleLanguages</b> CADD.ContentCharacteristics.SubtitleLanguage There may be multiple instances of this element

Action by Terminal	Channel Class Property	Programme Class Property	ScheduledRecording Class Property	Recording Class Property (See note I)	Download Class Property
BRL.PushDownloadProgram.AVAttributes					
Set in the presence of an appropriate EIT/component descriptor for broadcast content within scope of schedule. For BRL recordings off schedule set from BRL.PushDownloadProgram.AVAttributes	N/A	<b>hasAD</b> Set by terminal for scheduled broadcast or BRL content. Set by application for IP linear content. For manual recording set to "undefined"	<b>hasAD</b> Derived from Programme object when recording is scheduled	<b>hasAD</b> Derived from ScheduledRecording object when recording starts	<b>hasAD</b> CADD.DTGContentCharacteristics.DTGHASAD
Derived from language code(s) present in appropriate EIT/component descriptor(s) for broadcast content within scope of schedule. For BRL recordings off schedule set from BRL.PushDownloadProgram.AVAttributes	N/A	<b>ADLanguages (string collection)</b> Set by Terminal for scheduled broadcast or BRL content. Set by Application for IP linear content. For manual recording set to "undefined"	<b>ADLanguages (string collection)</b> Derived from Programme object when recording is scheduled	<b>ADLanguages (string collection)</b> Derived from ScheduledRecording object when recording starts	<b>ADLanguages (string collection)</b> CADD.ContentCharacteristics.DTGADLanguage elements
Derived from language code(s) present in appropriate EIT/component descriptor(s) for broadcast content within scope of schedule. For BRL recordings off schedule set from BRL.PushDownloadProgram.AVAttributes	N/A	<b>HasCleanAudio</b> Set by Terminal for scheduled broadcast or BRL content or by Application for IP linear content For manual recording set to "undefined"	<b>HasCleanAudio</b> Derived from Programme object when recording is scheduled	<b>HasCleanAudio</b> Derived from ScheduledRecording object when recording starts	<b>HasCleanAudio</b> Derived from CADD.ContentCharacteristics, set if one or more "CleanAudio" elements are present
Derived from language code(s) present in appropriate EIT/component	N/A	<b>CleanAudioLanguages</b> Set by Terminal for scheduled broadcast or BRL content or by	<b>CleanAudioLanguages</b> Derived from Programme object when recording is scheduled	<b>CleanAudioLanguages</b> Derived from ScheduledRecording object when recording starts	<b>CleanAudioLanguages</b> Derived from CADD.ContentCharacteristics.CleanAudioLanguage elements

Action by Terminal	Channel Class Property	Programme Class Property	ScheduledRecording Class Property	Recording Class Property (See note I)	Download Class Property
descriptor(s) for broadcast content within scope of schedule. For BRL recordings off schedule set from BRL.PushDownloadProgram.AVAttributes		Application for IP linear content For manual recording set to "undefined"			
Set if the content item is already recorded on Terminal based storage.	N/A	<b>hasRecording</b> Set by terminal, used when content exposed in UI	N/A	N/A	N/A
Set by Terminal for manual record mode, For manual recording set to "true" Otherwise set to "false"	N/A	N/A	N/A	<b>isManual</b> Set by terminal	N/A
Set by End-user for all stored content types to mark content to be kept. Flag set in stored MD, to be exposed in UI	N/A	N/A	N/A	<b>doNotDelete</b> Set by terminal	<b>doNotDelete</b> Set by terminal
Set by End-user	N/A	N/A	N/A	<b>saveDays</b> Set by terminal	N/A
Set by End-user	N/A	N/A	N/A	<b>saveEpisodes</b> Set by terminal	N/A
Inserted by End-user except for mandatory "LastViewed" bookmark	N/A	N/A	N/A	<b>bookmarks (collection)</b> Set by terminal	<b>bookmarks (collection)</b> Set by terminal
For download content set to value provided in CADD, then updated to actual size on disk at end of recording "Undefined" for broadcast content.	N/A	N/A	N/A	N/A	<b>totalSize</b> Set by terminal
On-going tracking of download	N/A	N/A	N/A	N/A	<b>amountDownloaded</b> Set by terminal

Action by Terminal	Channel Class Property	Programme Class Property	ScheduledRecording Class Property	Recording Class Property (See note I)	Download Class Property
	N/A	N/A	N/A	N/A	<b>contentURL</b> CADD.contentURL
	N/A	N/A	N/A	N/A	<b>drmControl (object)</b> CADD.DRMControllInformation
	N/A	N/A	N/A	N/A	<b>transferType</b> CAD.contentURL.transferType
	N/A	N/A	N/A	N/A	<b>originSite</b> CADD.originSite
	N/A	N/A	N/A	N/A	<b>originSiteName</b> CAD.originSiteName
	<b>logoURL</b> Set by terminal for broadcast content and by application for IP linear content	N/A	N/A	N/A	<b>iconURL</b> CADD.iconURL
	N/A	N/A	N/A	N/A	N/A
	N/A	N/A	N/A	N/A	N/A
Set based on recording viewing status	N/A	N/A	N/A	<b>viewed</b> Set by terminal	<b>viewed</b> Set by terminal

# Annex IV: Measurement

## I. Metadata mappings

	CTV Audience Measurement data		Metadata Mapping by consumption type		Key
	Field	Type	Linear IP	Linear Broadcast	
<b>Linear Consumption</b>					
I01	Content ID	CRID	programmeID (provided by application for IP linear recording from Programme object)	EIT/content_identifier_descriptor/crid_type=0x31/CRID	optional reported field
I02	Content title	String	name (provided by application for IP linear recording from Programme object)	EIT/short_event_descriptor/event name	mandatory reported field
I03	Content locator	URL		DVB URL, with onid/tsid/sid/event_id/start time etc. populated from PSI/SI	
I04	Identifier of browser / player playing the content	User-Agent	per B.6.9	per B.6.9	
I05	Additional industry-standard unique user	Cookie, registration ID			
I06	Viewing start date / time	YYYY-DD-MM / 00:00:00			
I07	Viewing duration	Seconds	Duration of connection to stream		

Non-Linear Consumption			Recorded Linear IP	Recorded Linear Broadcast	Content on Demand	Download
n01	Content ID	CRID	programmeID (provided by application for IP linear recording from Programme object)	EIT/content_identifier_descriptor/crid_type=0x31/CRID	CADD.ContentID (CRID)	CADD.ContentID (CRID)
n02	Content title	String	name (provided by application for IP linear recording from Programme object)	EIT/short_event_descriptor/event name	CADD.Title	CADD.Title
n03	Content locator	URL	ipBroadcastID (provided by application for IP linear recording from Channel object)	DVB URL, with onid/tsid/sid/event_id/start time etc. populated from PSI/SI	CADD.ContentURL	CADD.ContentURL
n04	Identifier of browser / player	User-Agent	per B.6.9	per B.6.9	per B.6.9	per B.6.9

<b>Non-Linear Consumption</b>		<b>Recorded Linear IP</b>	<b>Recorded Linear Broadcast</b>	<b>Content on Demand</b>	<b>Download</b>
	playing the content				
n05	Additional industry-standard unique user	Cookie, registration ID			
n06	Viewing start date / time	YYYY-DD-MM / 00:00:00			
n07	Content Length	Seconds	recordingDuration	recordingDuration	recordingDuration
n08	Start point play indicator	Seconds			
n09	Play duration	Seconds			
n10	Playback speed	Ix / >Ix / <Ix / -Ix / >-Ix / <-Ix 0x			
n11	Aquisition date / time	YYYY-DD-MM / 00:00:00	recordingStartTime	recordingStartTime	recordingStartTime

## 2. Measurement report example

```

<?xml version="1.0" encoding="UTF-8"?>
<p:CTVMeasurementRecord xmlns:p="urn:dtg:measurement:2011" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="urn:dtg:measurement:2011 dtg-MeasurementSchema-v0_4.xsd"
  UserAgent="CTVReferenceUserAgent" RecordRangeStart="2011-02-14T00:00:00" RecordRangeEnd="2011-02-14T23:59:59">
  <!-- ===== -->
  <!-- IP Linear Example -->
  <!-- ===== -->
  <p:LinearConsumptionRecord ConsumptionType="Linear IP">
    <p:ContentLocator>http://www.bbc.co.uk/iplayer/tv/bbc_one_london/watchlive</p:ContentLocator>
    <p:ViewingStart>2011-02-14T16:21:07</p:ViewingStart>
    <p:UserBrowserID>user01234567</p:UserBrowserID>
    <p:ViewingDuration>843</p:ViewingDuration>
  </p:LinearConsumptionRecord>
  <!-- ===== -->
  <!-- Broadcast Linear Example -->
  <!-- ===== -->
  <p:LinearConsumptionRecord ConsumptionType="Linear Broadcast">
    <p:ContentLocator>dvb://233a.1041.1041;b6b3~20110214T165500Z</p:ContentLocator>
    <p:ViewingStart>2011-02-14T16:55:37</p:ViewingStart>
    <p:ContentID>crid://fp.bbc.co.uk/sijiv</p:ContentID>
    <p>Title>Shaun the Sheep - Whistleblower</p>Title>
    <p:ViewingDuration>558</p:ViewingDuration>
  </p:LinearConsumptionRecord>
  <!-- ===== -->
  <!-- Stored IP Linear Example -->
  <!-- ===== -->
  <p:NonLinearConsumptionRecord ConsumptionType="Recorded Linear IP">
    <p:ContentLocator>http://www.bbc.co.uk/iplayer/tv/bbc_one_london/watchlive</p:ContentLocator>
    <p:ViewingStart>2011-02-14T17:08:32</p:ViewingStart>
    <p:UserBrowserID>user01234567</p:UserBrowserID>
    <p:ContentAcquired>2011-02-14T16:21:07</p:ContentAcquired>
    <p:ContentLength>1703</p:ContentLength>
    <p:ConsumptionEvent StartPoint="156" Duration="451" Speed="1.0"/>
    <p:ConsumptionEvent StartPoint="607" Duration="15" Speed="6.0"/>
    <p:ConsumptionEvent StartPoint="697" Duration="471" Speed="1.0"/>
  </p:NonLinearConsumptionRecord>
  <!-- ===== -->
  <!-- Stored Broadcast Linear Example -->
  <!-- ===== -->
  <p:NonLinearConsumptionRecord ConsumptionType="Recorded Linear Broadcast">
    <p:ContentLocator>dvb://123.5ac.100;1e4a@2001-12-07T15:00:00.00+01P02:10</p:ContentLocator>
    <p:ViewingStart>2011-02-14T18:32:12</p:ViewingStart>
    <p:ContentAcquired>2011-02-14T16:55:00</p:ContentAcquired>
    <p:ContentLength>570</p:ContentLength>
    <p:ConsumptionEvent StartPoint="0" Duration="531" Speed="1.0"/>
  </p:NonLinearConsumptionRecord>
  <!-- ===== -->
  <!-- Streamed Example -->
  <!-- ===== -->
  <p:NonLinearConsumptionRecord ConsumptionType="Content on Demand">
    <p:ContentLocator>http://www.bbc.co.uk/iplayer/episode/b00s116j/Shawn_the_Sheep_Series_2_Whistleblower</p:ContentLocator>
    <p:ViewingStart>2011-02-14T21:03:41</p:ViewingStart>
    <p:UserBrowserID>user01234567</p:UserBrowserID>
  </p:NonLinearConsumptionRecord>

```

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<p:ContentID>crid://fp.bbc.co.uk/sijiv</p:ContentID>
<p:Title>Shaun the Sheep Series 2 Whistleblower</p:Title>
<p:ContentAcquired>2011-02-14T21:03:41</p:ContentAcquired>
<p:ContentLength>570</p:ContentLength>
<p:ConsumptionEvent StartPoint="0" Duration="301" Speed="1.0"/>
<p:ConsumptionEvent StartPoint="301" Duration="30" Speed="-2.0"/>
<p:ConsumptionEvent StartPoint="201" Duration="90" Speed="1.0"/>
</p:NonLinearConsumptionRecord>
<!-- ===== -->
<!-- Stored IP Download -->
<!-- ===== -->
<p:NonLinearConsumptionRecord ConsumptionType="Download">

<p:ContentLocator>http://www.bbc.co.uk/iplayer/episode/b00s116j/Shaun_the_Sheep_Series_2_Whistleblower/</p
:ContentLocator>
<p:ViewingStart>2011-02-14T21:57:29</p:ViewingStart>
<p:UserBrowserID>user00000003</p:UserBrowserID>
<p:ContentID>crid://fp.bbc.co.uk/sijiv</p:ContentID>
<p:Title>Shaun the Sheep Series 2 Whistleblower</p:Title>
<p:ContentAcquired>2011-02-14T21:52:02</p:ContentAcquired>
<p:ContentLength>570</p:ContentLength>
<p:ConsumptionEvent StartPoint="0" Duration="432" Speed="1.0"/>
</p:NonLinearConsumptionRecord>
</p:CTVMeasurementRecord>
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