OIPF

Release 2 Specification

Volume 1 – Overview

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Open IPTV Forum

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Foreword

This specification has been produced by the Open IPTV Forum (OIPF).

The Release 2 specifications provide multiple options for some features. The Open IPTV Forum Profiles specification complements the Release 2 specifications by defining the Open IPTV Forum implementation and deployment profiles.

The Open IPTV Forum Release 2 Solution specification consists of ten Volumes:

- Volume 1 – Overview (the present document)
- Volume 2 – Media Formats
- Volume 2a – HTTP Adaptive Streaming
- Volume 3 – Content Metadata
- Volume 4 – Protocols
- Volume 4a – Examples of IPTV Protocol Sequences
- Volume 5 – Declarative Application Environment
- Volume 5a – Web Standards TV Profile
- Volume 6 – Procedural Application Environment
- Volume 7 – Authentication, Content Protection and Service Protection

The Release 1 IPTV Solution specifications were first published in January 2009. They were revised and re-published as V1.1 in October 2009.

The Release 2 Version 2.0 IPTV Solution specifications were based on the Release 1 V1.1 specifications, including all errata that had been resolved by the time of publication. Release 2 adds new functionality compared to Release 1. The additional services and features are described in the Overview.

The Release 2 Version 2.1 IPTV Solution specifications add several new features and improvements, to meet the Release 2 requirements, that could not be added to Release 2 Version 2.0 owing to timing concerns. Errata noted since the publication of Release 2 Version 2.0 and some additional errata identified for Release 1 Version 1.1 have been silently incorporated into Release 2 Version 2.1.

The Release 2 Version 2.2 IPTV Solution specifications add adaptive bitrate streaming based in MPEG-DASH and support for 3D content as well as some additional useful updates to the IPTV Solution.

The Release 2 Version 2.3 IPTV Solution specifications add the features of the Web Standards TV Profile in the new volume 5a, various amendments to the Declarative Application Environments (volume 5), Simple Secure Streaming in volume 7, provider network interfaces for content preparation in the Functional Architecture and in Volume 4, more flexible accommodation of content protection schemes in the Functional Architecture, clarifications on Scheduled Content streaming and hybrid services throughout the IPTV Solution, as well as various minor improvements and updated normative references. These additions are described in more detail in the relevant sections below and in the corresponding volumes.

Thus, implementers are advised to use the Release 2 Version 2.3 specifications, even if it is for services and features described in Release 2 Version 2.0.

The Overview (Volume 1, the present document) is an informative guide to the other Volumes, which deal with the specific aspects of the Release 2 Solution.

1 Scope

The Open IPTV Forum (OIPF) IPTV Solution provides the specifications for an end-to-end platform for the deployment of IPTV Services. Figure 1 shows a high-level logical view of the scope of the OIPF IPTV Solution.

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

To that end, the Open IPTV Forum focuses on standardising the user-to-network interface (UNI) both for a managed and a non-managed network, as depicted in Figure 1.

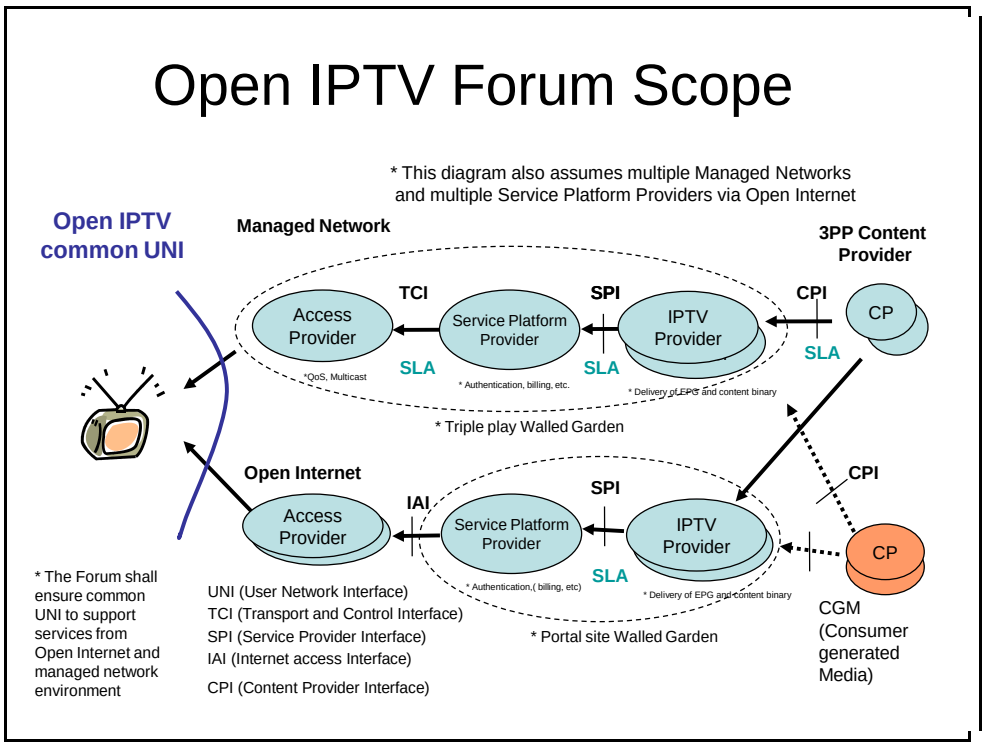

Figure 1: Open IPTV Forum scope

Throughout the specifications, the terms “Open Internet” and “Unmanaged Network” are used interchangeably, to refer to the ability to access any Service Provider using any Access Network Provider without any quality of service guarantees.

Open Internet IPTV Services are accessed via the Internet, without QoS guarantees. Open Internet IPTV services are accessed via a service platform (e.g., a portal) that provides supporting facilities for multiple Service Providers.

2 References

2.1 Normative References

[DVB3D]	ETSI, TS 101 547 V1.1.1 (2012-01), “Digital Video Broadcasting (DVB); Frame Compatible Plano-stereoscopic 3DTV”.

2.2 Open IPTV Forum References

[OIPF_SERV2]	Open IPTV Forum, “Services and Functions for Release 2”, V1.0, October 2008.
[OIPF_REQS2]	Open IPTV Forum, “Service and Platform Requirements”, V2.0, December 2008.
[OIPF_ARCH2]	Open IPTV Forum, “Functional Architecture – V2.3”, January 2014.
[OIPF_MEDIA2]	Open IPTV Forum, “Release 2 Solution Specification, Volume 2 - Media Formats”, V2.3, January 2014.
[OIPF_HAS2]	Open IPTV Forum, “Release 2 Solution Specification, Volume 2a - HTTP Adaptive Streaming”, V2.3, January 2014.
[OIPF_META2]	Open IPTV Forum, “Release 2 Solution Specification, Volume 3 - Content Metadata”, V2.3, January 2014.
[OIPF_PROT2]	Open IPTV Forum, “Release 2 Solution Specification, Volume 4 - Protocols”, V2.3, January 2014.
[OIPF_PROT2_EX]	Open IPTV Forum, “Release 2 Solution Specification, Volume 4a - Examples of IPTV Protocol Sequences”, V2.3, January 2014.
[OIPF_DAE2]	Open IPTV Forum, “Release 2 Solution Specification, Volume 5 - Declarative Application Environment”, V2.3, January 2014.
[OIPF_DAE2_WEB]	Open IPTV Forum, “Release 2 Solution Specification, Volume 5a - Web Standards TV Profile”, V2.3, January 2014.
[OIPF_PAE2]	Open IPTV Forum, “Release 2 Solution Specification, Volume 6 - Procedural Application Environment”, V2.3, January 2014.
[OIPF_CSP2]	Open IPTV Forum, “Release 2 Solution Specification, Volume 7 - Authentication, Content Protection and Service Protection”, V2.3, January 2014.
[OIPF_R1.1_ERR1]	Open IPTV Forum, “Release 1 IPTV Solution Version 1.1 Errata 1”, July 2010.
[OIPF_R1.1_ERR2]	Open IPTV Forum, “Release 1 IPTV Solution Version 1.1 Errata 2”, March 2011.
[OIPF_R2.0_ERR1]	Open IPTV Forum, “Release 2 IPTV Solution Version 2.0 Errata 1”, October 2010.

2.3 Informative References

The present document makes no informative references.

3 Conventions and Terminology

3.1 Conventions

All sections in the present document are informative.

3.2 Terminology

3.2.1 Definitions

Term	Definition
3DTV	Plano-stereoscopic three-dimensional television. Note that this definition is in line with [DVB3D].
Access Network	The network infrastructure used by the Access Provider to deliver IPTV services to the Consumer. The access network infrastructure is used for the delivery of the content and may include quality of service management to ensure that appropriate network resources are available for the delivery of the content.
Application	Collection of assets and logic that together provide a Service to the User. Assets and logic may reside either in an application Server or in the ITF or both.
Catch-up TV	A service that allows the end-user, using an EPG or a portal, to watch linear TV programs that were previously broadcasted.
Consumer Domain	The domain where the IPTV services are consumed. A consumer domain can consist of a single terminal or a network of terminals and related devices for service consumption.
Consumer Network	The local area network in which the IPTV Terminal Function is located. Consumer Networks include Residential Networks, hot spots, hotel networks etc.
Consumer(s)	See End User(s).
Content	An instance of audio, video, audio-video information, or data.
Content Guide	An on-screen guide to Scheduled Content and Content on Demand, allowing a User to navigate, select, and discover content by time, title, channel, genre, etc.
Content on Demand (CoD)	A Content on Demand service is a service where a user can select the individual content items they want to watch from the list of available content. Consumption of the content is started upon user request.
Content Protection	Means to protect content from unauthorized usage such as re-distribution, recording, playback, duplication etc
Content Provider	Entity that provides Content and associated usage rights to the IPTV Service Provider.
End User(s)	The individual(s) (e.g., members of the same family) who actually use the IPTV Services.
Internet	The Internet is the worldwide, publicly accessible network of interconnected computer networks that transmit data by packet switching using the standard Internet Protocol (IP).
IPTV Service Provider	Entity that offers IPTV Services and which has a contractual relationship with the Subscriber.
IPTV Solution	Defined by the Forum's specifications.
IPTV Terminal Function (ITF)	The functionality within the Consumer Network that is responsible for terminating the media and control for an IPTV Service.
Local Storage	Content storage within the administrative realm of the IPTV Service Provider, but not in their physical environment (for example, local storage could be a partition of storage located in the residential network and allocated to the Service Provider to pre-load CoD).
nPVR	Network based Personal Video Recorder. Provision of PVR functionality whereby the content is stored in the IPTV Service Provider domain. The nPVR allows a user to schedule recording of scheduled content programs. The user can later select the content they want to watch from the recorded content.
Portal	A function of a Service Platform that provides an entry point to individual IPTV Services to Users via a GUI.
Program	A segment of Scheduled Content with a defined beginning and end.

Term	Definition
Program Guide	See Content Guide.
Push CoD	A type of Content on Demand where the content is pre-loaded to the ITF local storage by the Service Provider. The user has no direct control of what content is pre-loaded; however the Service Provider may make the choice based on user preferences and habits. Content is available for direct consumption after the user selection is confirmed.
Residential Network	The local network of devices (gateways and terminals) at the End User's premises.
Scheduled Content	A service where the playout schedule is fixed by an entity other than the User. The Content is delivered to the user for immediate consumption.
Service	Content and Applications provided by Service Platform Providers and Service Providers.
Service Access Protection	Means to protect IPTV Services from unauthorized usage/access, such as - Access from unauthorized users - DOS attack
Service Platform Provider	Entity which, based on a contractual relationship with IPTV Service Providers, provides the supporting functions for the delivery of IPTV Services, such as charging, access control and other functions which are not part of the IPTV Service, but required for managing its delivery.
Service Protection	Means to protect Contents (files or streams) during their delivery.
Session Portability	Ability of a given Service/Application to be switched from one device to another for a continuation of a session in real time.
Start-over TV	A service that enables the end user to playback a linear TV program that is currently being broadcasted from its start.
Subscriber	The individual that makes the contract (subscription) with a Service Provider for the consumption of certain Services.
Subscriber Profile	Information associated with a subscription.
Trick Mode	Facility to allow the User to control the playback of Content, such as pause, fast and slow playback, reverse playback, instant access, replay, forward and reverse skipping.
User Profile	Information (e.g., viewing preferences) associated with a specific User who is a part of a subscription.
User(s)	See End User(s).

3.2.2 Abbreviations

Acronym	Definition
ADSL	Asymmetric Digital Subscriber Line
AG	Application Gateway
AKA	Authentication and Key Agreement
AP	Access Point and Authentication Proxy
API	Application Programming Interface
A-RACF	Access Resource Admission Control Function
AS	Application Server
ASM	Authentication and Session Management
AV	Authentication Vector
A/V	Audio and Video
BCG	Broadband Content Guide
BTF	Basic Transport Function
CAC	Connectivity Admission Control

Acronym	Definition
CAS	Conditional Access System
CC	Cluster Controller
CD	Content Delivery
CDC	Connected Device Configuration
CDF	Content Delivery Function
CDN	Content Delivery Network
CDNC	CDN Controller
CDS	Content Directory Service
CE	Consumer Equipment
CENC	Common Encryption (in ISO base media file format files)
CG	Content Guide
CK	Ciphering Key
COD	Content on Demand
CPE	Customer Premise Equipment
CPI	Content Provider Interface
CSP	Content and Service Protection
CSPG	Content and Service Protection Gateway
DAE	Declarative Application Environment
DASH	Dynamic Adaptive Streaming over HTTP
DHCP	Dynamic Host Configuration Protocol
DLNA	Digital Living Network Alliance
DLNA DMC	DLNA Digital Media Controller
DLNA DMP	DLNA Digital Media Player
DLNA DMR	DLNA Digital Media Renderer
DLNA DMS	DLNA Digital Media Server
DOS	Denial of Service
DRM	Digital Rights Management
DSCP	DIFFServ Code Point
DSL	Digital Subscriber Line
DTCP-IP	Digital Transmission Content Protection over Internet Protocol
DTT	Digital Terrestrial Television
DVB-IP	Digital Video Broadcasting (over) Internet Protocol
ECMA	European Computer Manufacturers Association, ECMA International - European association for standardizing information and communication systems
EPG	Electronic Program Guide
FE	Functional Entity
GBA	Generic Bootstrapping Architecture
GENA	General Event Notification Architecture
GPON	Gigabit Ethernet Passive Optical Network

Acronym	Definition
GUI	Graphical User Interface
HAS	HTTP Adaptive Streaming
HD	High Definition
HDMI	High Definition Multimedia Interface
HLA	High Level Architecture
HN	Home Network
HSS	Home Subscriber Server
HTML	HyperText Markup Language
HTTP	Hypertext Transfer Protocol
IAI	Internet Access Interface
IG	IMS Gateway
IGMP	Internet Group Management Protocol
IMPI	IMS Private User Identity
IMPU	IMS Public User identity
IMS	IP Multimedia Subsystem
IP	Internet Protocol
IPTV	Internet Protocol Television
ISIM	IMS Subscriber Identity Module
ISP	Internet Service Provider
ITF	IPTV Terminal Function
LAN	Local Area Network
M/C-U/C	Multicast to Unicast
MAC	Message Authentication Code
MDTF	Multicast Data Terminating Function
MSRP	Message Session Relay Protocol
NAT	Network Address Translation
nPVR	Network Personal Video Recorder
OIPF	Open IPTV Forum
OITF	Open IPTV Terminal Function
OMA	Open Mobile Alliance
PAE	Procedural Application Environment
P2P	Peer-to-Peer
PC	Personal Computer
PIM	Protocol Independent Multicast
PiP	Picture-in-picture
PLMN	Public Land Mobile Network
POTS	Plain Old Telephony Service
PSS	(3GPP) Packet-switched Streaming Service
PVR	Personal Video Recorder

Acronym	Definition
QoS	Quality of Service
RAC	Resource and Admission Control
RAND	Random Challenge
RCEF	Resource Control Enforcement Function
RTP	Real-time Transport Protocol
RTCP	Real Time Control Protocol
RTSP	Real Time Streaming Protocol
RMS	Remote Management System
RUI	Remote User Interface
SAA	Service Access Authentication
SCART	Syndicat des Constructeurs d'Appareils Radiorécepteurs et Téléviseurs
S-CSCF	Serving Call Session Control Function
SD	Standard Definition
SD&S	Service Discovery and Selection
SDP	Session Description Protocol
SLA	Service Level Agreement
SIM	Subscriber Identity Module
SIP	Session Initiation Protocol
SMS	Short Message Service
SP	Service Provider
SPI	Service Provider Interface
SPDF	Service-based Policy Decision Function
SPP	Service Platform Provider
SSL	Secure Sockets Layer
SSO	Single Sign-On
STB	Set Top Box
TBD	To Be Determined
TCI	Transport and Control Interface
TCP/IP	Transmission Control Protocol/Internet Protocol
UE	User Entity
UI	User Interface
UICC	Universal Integrated Circuit Card
UNI	User Network Interface
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
USIM	Universal Subscriber Identity Module
UUID	Universally Unique IDentifier
VOD	Video on Demand
xDSL	Any DSL

Acronym	Definition
WLAN	Wireless LAN
WG	WAN Gateway
WAN	Wide Area Network
XHTML	eXtensible Hypertext Markup Language
XML	eXtensible Markup Language

4 Release 2 Specifications Overview

4.1 General

The Release 2 IPTV Solution specifications build upon the Release 1 specifications, which were initially published as V1.0 in January 2009 and revised as V1.1 in October 2009.

The Release 2 Version 2.1 IPTV Solution includes several additional features, which conform to the Release 2 requirements, but which could not be completed in time for publication of Release 2 Version 2.0. This latest version also incorporates all previous errata identified for Release 1 Version 1.1 [OIPF_R1.1_ERR1] [OIPF_R1.1_ERR2] and Release 2 Version 2.0 [OIPF_R2.0_ERR1].

In the following sections, the term “Release 2” will be used to refer to Versions 2.0, 2.1,2.2 and 2.3 without making any distinction unless it is essential to an understanding of the text.

The Release 2 specifications provide an end-to-end solution for the deployment of the set of IPTV services described in [OIPF_SERV2], and enable any consumer end-device, compliant to the OIPF specifications, to access enriched and personalised IPTV services either in a managed or a non-managed network. The solution adheres to the Open IPTV Platform and Service Requirements for Release 2 [OIPF_REQS2] and is based on the Release 2 Architecture [OIPF_ARCH2].

Figure 2 shows a high-level logical view of the scope of the Release 2 Solution in terms of networks and functional entities in the residential network. Note that there is no prescription about how these functional entities are mapped to physical device implementations. For example, it is conceivable that a single residential device could host a terminal (OITF) function and any of the gateway functions (IMS-, Application-, and/or Content & Service Protection Gateways) in one “box”. Section 5.3.4 of the Release 2 Architecture specification [OIPF_ARCH2] describes many plausible deployment scenarios involving allocation of these functional entities to physical entities such as a TV or a STB.

Managed Network IPTV Services are provided from within an operator’s core network, enabling the Service Provider to make use of service enhancement facilities like multicast delivery and QoS provision. A managed network may rely on the IMS architecture, but non-IMS based managed networks are also in the scope of this specification.

Open Internet IPTV Services are accessed via an independently operated access network, with or without QoS guarantees. Open Internet IPTV services may be accessed via a service platform (e.g., a portal) that provides supporting facilities for multiple Service Providers.

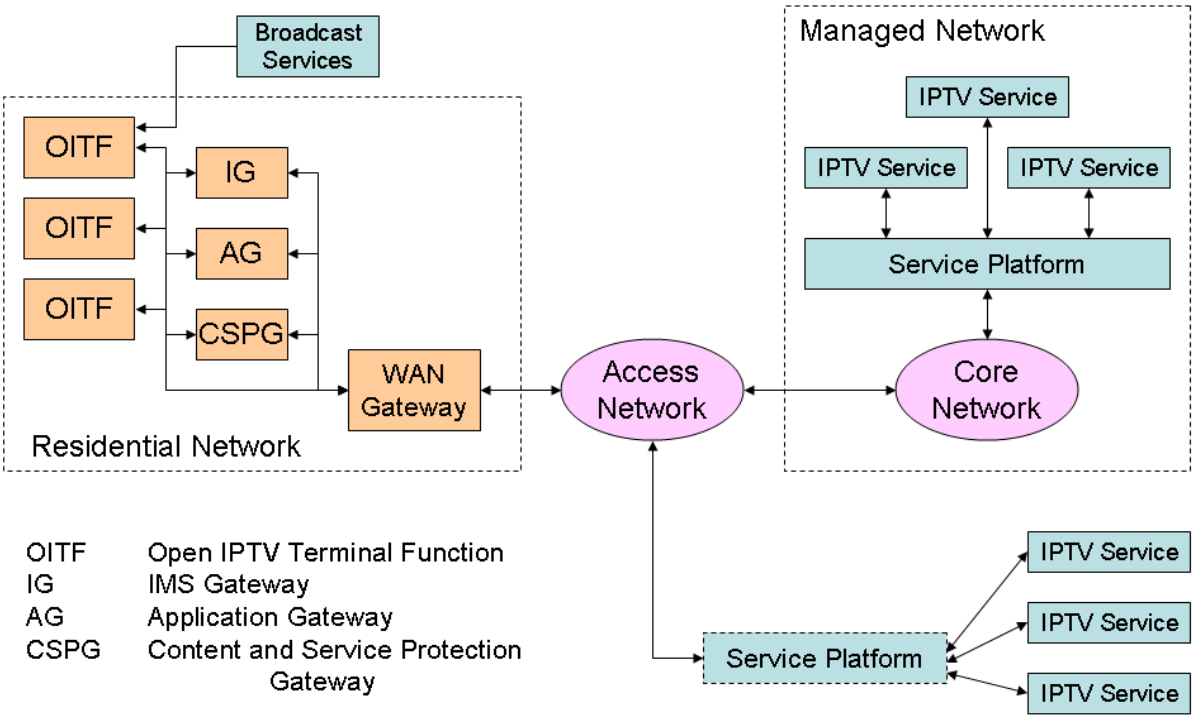

Figure 2: IPTV Solution scope

The Release 2 specifications provide an end-to-end solution that can provide any of the following IPTV Services:

- Scheduled content services (linear TV) possibly hybrid (combining the usage of IPTV and broadcast delivery), including their recording (PVR) and Electronic Programme Guide (EPG);
- Content on demand (both streaming and download) services;
- Information services, both with and without any relation to the content delivery services; and
- Communication services, including notifications, and their blending with the content delivery services.

These IPTV services can be provided generally in both the managed network and open internet modes of operation, but there may be differences in how each service is provided between these two modes of operation. IPTV services in managed networks may use service enhancement facilities like multicast delivery and QoS provision.

Functions are specified which enable attractive and innovative ways to provide the services listed above. They can be summarised as:

- Service provisioning, including network attachment, User management, including the management of multiple users within a household, where applicable, Quality-of-Service (QoS) provisioning, Remote management of the devices in the home network, including configuration, fault diagnosis and software upgrade;
- Service access and control;
- Service and content navigation;
- Interactive application platforms;
- Content and service protection, where applicable;
- Interworking with DLNA-compliant home network devices.

As is the stated goal of OIPF, wherever possible, relevant existing standards and specifications from industry initiatives are reused. The specifications refer to published specifications from various branches of the industry in order to build the Release 2 IPTV Solution, including most notably: 3GPP, Broadband Forum, CEA, CI Plus LLP, DLNA, DVB, ETSI TISPAN, IETF, JCP, Marlin Developer Community (MDC), MPEG, Open Mobile Alliance (OMA) and W3C. The specifications essentially provide the “glue” between these to build the IPTV Solution. The OIPF also engages with these fora to address gaps or necessary refinements, as appropriate.

Release 1 Version 1.1 of the IPTV Solution specification contained some minor new features, errata, and editorial improvements compared to Version 1.0.

The Release 2 Solution specifications add the following major features compared to Release 1:

- Services and applications:
    - Sub-picture video formats (reduced picture resolution compared to SD);
    - Signalling and presentation of 3D content;
    - Voice and A/V communication services;
    - Content services via mobile networks to mobile terminals;
    - Added network PVR and managed local PVR;
    - Timeshift for network PVR and personalised channel services;
    - Purchase of digital media service;
    - Bookmarking of content;

- Session continuity and portability between devices;
- Content sharing between peers, with the content consumed on a preferred device
- Notification services (network-generated notifications, user reminders, emergency announcement);
- Hybrid (broadcast-broadband) application support
- Packaged applications

- Features:
  - Adaptive streaming of content over HTTP. This feature is contained in the new Volume 2a;
  - Fast-channel change (FCC) and Retransmission (RET), based on DVB-IPTV V1.4;
  - HNI-IGI instantiation using SIP;
  - Content navigation controls (also known as “forced play-out”);
  - HTML5 <video> tag
  - DLNA Remote UI - control of OITF

The Release 2 Solution specifications are organised as ten Volumes, whereby Volumes 2-7, also 2a, 4a and 5a, specify particular aspects of the IPTV Solution, as summarised in the following sub-sections.

Annex A of the present document provides an informative summary of all XML schema usage in the Release 2 Solution specifications.

4.2 Media formats

Volume 2 specifies the complete set of media formats adopted in Release 2, including audio, video and systems layers, also ancillary content like subtitles and resources used by other parts of the Solution, namely graphics and audio clip formats for the interactive application environments.

Support for H.264/AVC video and HE-AAC audio for content delivery services is mandatory, but further optional codecs are included in order to cater for specific regional requirements and migration from legacy deployments.

Video formats for A/V content services are specified for HD and SD formats. Release 2 adds sub-picture video profiles for PiP and other services.

Systems layers are specified based on MPEG-2 Systems (Transport Stream) and MP4 File Format, both of which are mandatory to be supported for unprotected content in the OITF. For protected files, three variants are specified – OMA DCF, OMA PDCF and Marlin IPMP.

Release 2 adds the following features related to media formats:

- Extended set of optional audio codecs for A/V content services;
- Clean Audio function, referring to the solution specified by DVB;
- Media formats for voice and A/V communication services;
- Media formats for A/V content services via mobile networks to mobile terminals.
- Signalling for the delivery of DAE applications in-band within MPEG-2 TS.

Release 2 also adds Volume 2a, a specification for HTTP Adaptive Streaming (HAS). This is based on 3GPP Release 9 PSS, but an extension is specified in order to accommodate the MPEG-2 TS systems layer as well as MP4 File Format. HAS also provides efficient management and delivery of component media streams (e.g. alternative audio languages) with adaptively streamed content.

In version 2.2 of Volume 2a, an alternative method for adaptive bitrate content delivery based on MPEG DASH is also specified. This replaces HAS as the preferred format for adaptive streaming.

4.3 Content Metadata

Volume 3 specifies all aspects of content metadata, including service provider information and metadata delivery.

Two levels of service and content discovery and selection are defined, mirroring the DVB specifications, standardised by ETSI, for Service Discovery and Selection (SD&S), and Broadband Content Guide (BCG).

Whereas DVB SD&S foresees the delivery of metadata within XML documents, the IPTV Solution also enables service discovery via CE-HTML content as part of an interactive application hosted by the Declarative Application Environment (DAE), described below.

Provision is also made for metadata to be delivered within the content i.e. the MPEG-2 Transport Stream, namely as DVB Service Information, EIT present/following, without accompanying SDT information. This method ensures that at least a minimum of metadata is available to the OITF in every circumstance, e.g. when unicast retrieval of the metadata might be overloaded at the server. It is also very convenient for quick retrieval e.g. when the OITF is zapping through linear TV services.

Volume 3 specifies some extensions to DVB SD&S. Extensions are defined for the following purposes: DAE application signalling, bandwidth renegotiation, content and service protection control information, and file format indication.

Several extensions are also specified for BCG, namely: transport protocol indication, content protection information, and content format information, comprising audio, video, file format, transport protocol, and parental guidance information.

Metadata delivery is performed as specified in DVB SD&S and BCG, i.e. using DVBSTP for multicast delivery, and HTTP for unicast delivery.

As specified by DVB, BCG data can be delivered in containers via unicast or multicast, including updates via TVA fragments. The OITF may also implement the SOAP Query mechanism to selectively retrieve BCG data.

Release 1 V1.1 of Volume 3 contained the following major changes compared to V1.0:

- The Service Provider discovery extensions for DVB SD&S (section 3.2.1) are deprecated.
- Application signalling - The method for signalling interactive applications via Service Provider Discovery extensions, specified in section 3.2.1 of Vol. 3, is deprecated. It is replaced by Application Announcement and Signalling based on ETSI TS 102 809 V1.1.1 (originally DVB blue book A137r1), specified in the new section 3.2.3.
- Service Provider related application signalling and the application usage schema have been extended to include applications providing non-native HNI-IGI functionality.

Release 2 of Volume 3 contains all amendments of metadata resources for the inclusion of the Release 2 services and functions.

4.4 Protocols

Volume 4 brings together the specification of the complete set of protocols for the IPTV Solution, covering the reference point interfaces defined in the Release 2 Architecture [OIPF_ARCH2]. These reference points are classified as:

- The UNI interfaces, between the network or service provider domains and the consumer domain;
- The HNI interfaces, between the functional entities in the consumer network domain;
- The NPI interfaces, between the functional entities in the network and service provider domains; and
- Interfaces to external systems, e.g. the DLNA home network.

Figure 3 shows the functions inside each of the residential network functional entities and the set of UNI and HNI reference points that interface to them.

Note that the Application Gateway (AG) functional entity is optional, so that in its absence, OITFs communicate with services via the HNI-INI set of interfaces directly. This mode is also still possible when an AG is deployed.

Note also that Release 2 does not define the HNI-AGG and HNI-AGI interfaces.

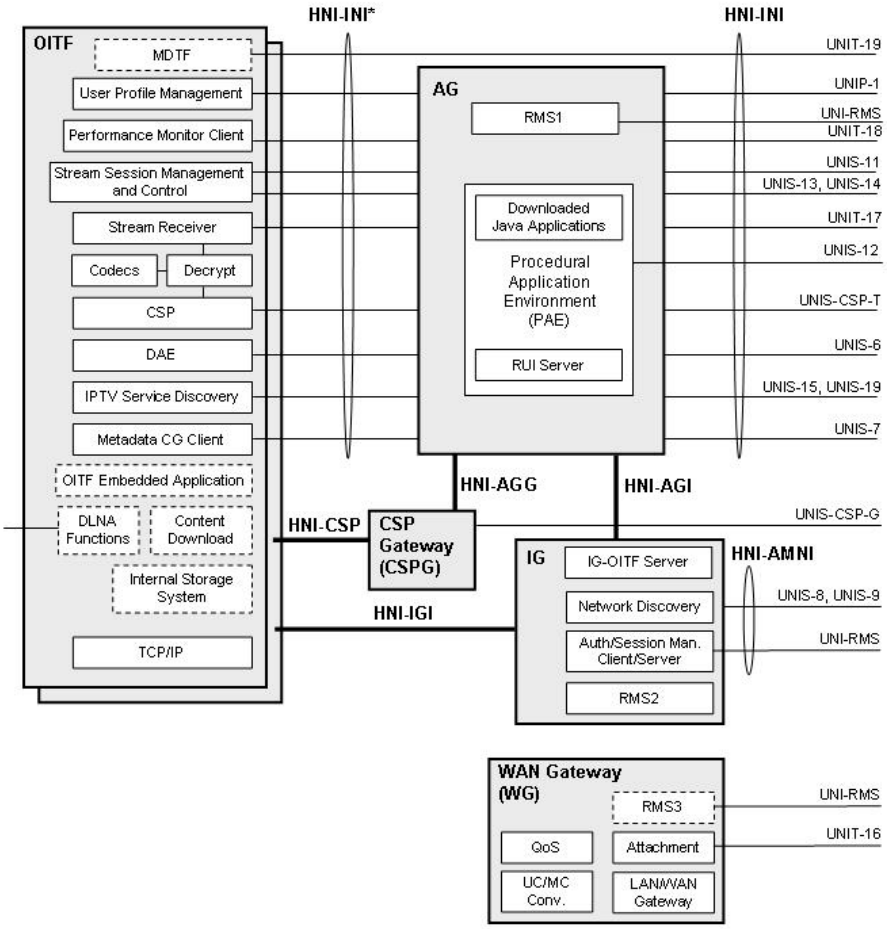

Figure 3: Residential Network; Functional Entities, UNI and HNI Reference Points

Table 1 gives a description of each of the UNI reference points and indicates which protocols have been specified for their realisation.

Table 1: UNI Reference Point Descriptions and Protocols

Reference Point	Description	Protocols
UNIP-1	Reference point for user initiated IPTV service profile management.	HTTP, XCAP
UNIS-6	Reference point for user interaction with application logic for transfer of user requests and interactive feedback of user responses (provider specific GUI). HTTP and FLUTE is used to interface between the DAE and the IPTV Application Function.	HTTP, FLUTE
UNIS-7	Requests for transport and encoding of content guide metadata. The reference point includes the metadata and the protocols used to deliver the metadata, and SHALL be based on DVB-IP BCG.	HTTP, DVBSTP
UNIS-8	Authentication and session management for managed network relying on IMS.	IMS SIP
UNIS-9	Authentication for GBA Single-Sign on.	HTTP
UNIS-11	Reference point for control of real time streaming (e.g. control for pause, rewind, skip forward). The reference point includes content delivery session setup when not relying on IMS.	RTSP

UNIS-12	Reference point between the AG and the provider specific application functional entity.	HTTP, FLUTE
UNIS-13	User Stream control for multicast of real time content and data.	IGMP
UNIS-14	Reference point used for authorization of service access.	HTTP
UNIS-15	Reference point to the IPTV Service Discovery FE to obtain information about IPTV services offered by an IPTV Service Provider.	HTTP, DVBSTP
UNIT-16	Reference point used for Network Attachment.	DHCP
UNIT-17	Content stream including content; content encryption (for protected services) and content encoding. This reference point MAY be used for both multicast and unicast (UNIT-17M and UNIT-17U, respectively).	RTP, HTTP, UDP
UNIT-18	Performance monitoring interface for reporting the performance monitoring results.	RTCP, RTSP
UNIS-19	Reference point to the IPTV Service Provider Discovery functional entity to obtain the list of Service Providers, and related information.	HTTP
UNI-RMS	Remote Management using the Broadband Forum TR-069 framework.	HTTP/TR-069
UNIS-CSP-T	Rights management for protected content – including key management and rights expression.	HTTP/MARLIN

The Volume 4 specification is organised in terms of each of the major protocols used, whereby the specific usage of each protocol for a particular IPTV Service or function is then stated.

For Release 2 the major additions are:

- Protocols for the new Release 2 Services - network PVR and managed local PVR; timeshift for network PVR and personalised channel services; purchase of digital media service; bookmarking of content; session continuity and portability between devices; notification services (network-generated notifications, user reminders, emergency announcement);
- Fast-channel change (FCC) and Retransmission (RET), based on DVB-IPTV V1.4;
- HNI-IGI instantiation using SIP, in addition to the existing instantiation using HTTP;
- Remote control/access from a mobile terminal.

4.5 Declarative Application Environment

Volume 5 specifies the browser-based Declarative Application Environment (DAE) that runs in the OITF functional entity. The DAE enables web technologies to be used to provide access to IPTV (and other) services deployed via both managed networks and the open internet.

The starting point for the DAE specification is CEA-2014, also known as CE-HTML. The CEA-2014 specification makes a selection from among the various available web technologies, namely XHTML 1.0 transitional or strict; DOM level 2 core, style, events and a subset of the HTML DOM; CSS TV 1.0; ECMA-262 Java-script and W3C (working draft) XMLHttpRequest. Both CEA-2014 and the DAE specification define more detail on these including exactly which parts are required and which are optional.

In addition the DAE specification also defines several extensions – the adoption of some properties of CSS-3 that avoid the use of Java-script for simple user interface navigation; tagged opcode replacement, for more streamlined user event generation; and most importantly, the capability exchange mechanism. This allows the IPTV server to customise offerings based on the signalled capabilities of the OITF. Examples of OITF capabilities that can be provided are media format and DRM-specific capabilities, local broadcast tuner control, PVR and content recording or download control.

The DAE specification also defines how SVG (Scalable Vector Graphics) can be included, either within an HTML document (the same way as Flash is typically used) or as a stand-alone document. The version of SVG used is SVG Tiny 1.2, recently finalised by the W3C.

The specification provides several methods for service lifecycle management for use depending on the kind of application at hand. A security model is defined to control access from services to device capabilities, based on fine-grained permissions for each capability. Examples of such permissions are access to OITF configuration and settings,

diagnostics and remote management functions, and interaction with the content and service protection agent. Note that a mechanism for services to request particular permissions and a mechanism to configure terminals to grant or refuse permissions have been deferred for later consideration and are not included in the Release 1 or Release 2 specification.

The specification contains the complete set of Java-script API definitions for the DAE.

For Release 2, as well as the inclusion of many amendments to accommodate the Release 2 services and functions, the major DAE-specific addition is media control via subset of the HTML5 <video> tag.

In Release 2 version 2.3, the profile of the set of W3C specifications upon which the DAE is based – HTML5 and other related web technologies - is contained in the new volume 5a – "Web Standards TV Profile". Volume 5 specifies how the OIPF Web Standards TV Profile is used for the presentation of user interfaces, including scripting support for interaction with network server-side applications and access to the APIs of the other OITF functions.

4.6 Procedural Application Environment

Volume 6 specifies the Java-based Procedural Application Environment (PAE) that runs in the Application Gateway (AG) functional entity.

The PAE is based on the DVB IPTV profile of GEM – Globally Executable Multimedia Home Platform. This is a powerful open Java execution environment that can allow multiple applications to run in parallel on the host device. Applications can be user-centric, such as EPG, PVR control or VoD client, or interactive applications associated with particular content, or system services like remote management, audience metering, data access tools and protocol handlers. The GEM platform provides a set of Java APIs that define a common core of TV-specific functionality for various markets. This includes user interface, access to content metadata, media (also TV-specific) decoding and rendering control.

Various deployment options exist for the AG. When deployed in a gateway device with no direct user interaction this is referred to as "headless" operation. PAE applications are also able to serve remote user interface elements for the DAE of connected OITFs. When combined with an OITF in a terminal device the PAE can provide direct interaction via the local user interface.

4.7 Authentication, Content Protection and Service Protection

Volume 7 specifies the set of tools and methods to protect IPTV services and content, and for User authentication.

Two approaches are specified for content and service protection (CSP) - the terminal-centric approach (CSP-T), and the gateway-centric approach (CSP-G).

The terminal-centric approach provides the common protected content delivery solution deployed in compliant terminals, thereby offering a huge population of secure sinks for IPTV Services delivering protected content. CSP-T is an end-to-end protection system based on Marlin Broadband, defined by the Marlin Developer Community (MDC). With CSP-T the CSP-T client in the OITF interacts directly with the CSP-T server function in the network to acquire protected content.

The gateway-centric approach provides a content protection solution whereby the service provider is able to deploy any preferred protection system, or continue to use their current solution, to deliver protected content to the user, but the delivery protection is terminated in the CSP Gateway (CSPG) function and a common local protection solution is used to maintain protection on the content on the final link between the CSPG and the OITF.

Two methods are defined to realise the gateway-centric approach, one based on DTCP-IP – home network link encryption, and one based on CI+, the recently published enhancement of the DVB Common Interface, providing a secure channel for the content sourced by the module and for communications between module and host.

The DTCP-IP based option relies on a common CSPG function in the residential network that terminates the Service Provider protection solution and sources content streams protected with DTCP-IP link protection to one or more terminals in the home.

The CI+ based option relies on the provision of a separate CSPG device in the form of a CI+ CAM module which is hosted by each OITF device that is to have access to content and services provided by this means. Although originally targeted towards protected broadcast stream reception, the IPTV Solution foresees that the CI+ host can route protected content received via the IP interface to the CI+ interface and hence the CI+ host acting as CSPG.

As for user authentication, several methods are specified for use by IPTV Services, if required. User authentication can be performed by HTTP basic and digest authentication, network-side authentication, web-based authentication with user-entered credentials within a DAE application, GBA authentication using the ISIM in the IMS Gateway, or SAML web-based single sign-on authentication.

Release 1 V1.1 of Volume 7 added the following major changes compared to V1.0:

- Support of HDCP and DTCP System Renewability Message delivery independently from Marlin;
- Addition of Marlin Action Token in the MarlinPrivateData schema, to enable delivery of the Marlin Token in the Content Access Descriptor, triggering license acquisition; and
- Addition of IMS AKA Registration for consistency with Volume 4 [OIPF_PROT2].

For Release 2, the major new features added to Volume 7 are:

- Content navigation controls (also known as “forced play-out”), based on Marlin DMZ;
- A generalized HTTP digest authentication procedure using credentials from the IMS Gateway.

Release 2 also adds an informative appendix on how the Gateway-Centric Approach (CSPG) can be applied to an embedded CSPG that terminates any chosen CA/DRM solution in a device that hosts both that CSPG and the OITF.

Annex A. XML Schemas, Classification Schemes and Examples

A.1 Imports

The following table lists the XML schema files that are imported into other schemas, but that are not defined by the Open IPTV Forum.

Table 2: Imported XML schema files

Schema Namespace	Filename
urn:3gpp:bookmark:2009:IMS-PSS-MBMS	3gpp-bookmark-2009-IMS-PSS-MBMS.xsd
urn:3GPP:ns:PSS:AdaptiveHTTPStreamingMPD:2009	3GPP-MPD-009.xsd
<<unnamed>>	ce-html-profiles-1-0.xsd
urn:ietf:params:xml:ns:enum-token-1.0	enum-token-1.0.xsd
urn:ietf:params:xml:ns:enum-tokendata-1.0	enum-tokendata-1.0.xsd
http://www.example.com/flute	Flute_FDT.xsd
urn:org:etsi:ngn:params:xml:ns:iptvbcserviceactiondata	iptvbcserviceactiondata.xsd
urn:org:etsi:ngn:params:xml:ns:iptvcodserviceactiondata	iptvcodserviceactiondata.xsd
urn:org:etsi:ngn:params:xml:ns:iptvnpvrserviceactiondata	iptvnpvrserviceactiondata.xsd
urn:org:etsi:ngn:params:xml:ns:MbmsContentSwitchData	MbmsSwitchData.xsd
urn:dvb:mhp:2009	mis_xmlait.xsd
urn:dvb:mhp:2006	mhpiptv.xsd
urn:org:etsi:ngn:params:xml:ns:PssMbmscommand	PssMbmscommand.xsd
urn:org:etsi:ngn:params:xml:ns:PssContentSwitchData	PssSwitchData.xsd
urn:dvb:ipi:sdns:2006	sdns3r7.xsd
urn:dvb:metadata:iptv:sdns:2008-1	sdns_v1.4r13.xsd
urn:dvb:metadata:iptv:sdns:2012-1	sdns_v1.5r23.xsd
urn:tva:metadata:2011	tva_metadata_3-1_v171.xsd
urn:tva:metadata:2005	tva_metadata_3-1_v131.xsd
urn:tva:mpeg7:2005	tva_mpeg7.xsd
urn:tva:mpeg7:2008	tva_mgeg7_2008.xsd
http://www.w3.org/2000/09/xmldsig#	xmldsig-core-schema.xsd

The following table lists the Classification Schemes that may be used in XML documents, but that are not defined by the Open IPTV Forum.

Table 3: Imported Classification Schemes

Classification Scheme	Filename
urn:tva:metadata:cs:ActionTypeCS:2010	ActionTypeCS.xml
urn:tva:metadata:cs:AtmosphereCS:2005	AtmosphereCS.xml
urn:tva:metadata:cs:AudioPurposeCS:2007	AudioPurposeCS.xml
urn:tva:metadata:cs:CaptionCodingFormatCS:2010	CaptionCodingFormatCS.xml
urn:tva:metadata:cs:ContentAlertCS:2005	ContentAlertCS.xml
urn:tva:metadata:cs:ContentCommercialCS:2005-03	ContentCommercialCS.xml
urn:tva:metadata:cs:ContentCS:2011	ContentCS.xml
urn:tva:metadata:cs:DerivationReasonCS:2007	DerivationReasonCS.xml
urn:tva:metadata:cs:FormatCS:2011	FormatCS.xml
urn:tva:metadata:cs:HowRelatedCS:2011	HowRelatedCS.xml
urn:tva:metadata:cs:IntendedAudienceCS:2011	IntendedAudienceCS.xml
urn:tva:metadata:cs:IntentionCS:2005	IntentionCS.xml
urn:tva:metadata:cs:MediaTypeCS:2010	MediaTypeCS.xml
urn:tva:metadata:cs:OriginationCS:2011	OriginationCS.xml
urn:tva:metadata:cs:PictureFormatCS:2011	PictureFormatCS.xml
urn:tva:metadata:cs:PurchaseTypeCS:2004	PurchaseTypeCS.xml
urn:mpeg:mpeg7:cs:RoleCS:2011	RoleCS.xml
urn:tva:metadata:cs:TVARoleCS:2011	TVARoleCS.xml
urn:tva:metadata:cs:UnitTypeCS:2007	UnitTypeCS.xml

A.2 Includes

The following are the schema files that are included into other schemas, i.e. they are not used independently to form XML documents. These schemas are defined by the Open IPTV Forum.

Table 4: OIPF XML Schema Include Files

Datatype	Definition	Filename
DRMPrivateDataType	[OIPF_CSP2]	csp-DRMPrivateDataType.xsd
MarlinPrivateDataType	[OIPF_CSP2]	csp-MarlinPrivateDataType.xsd
HexBinaryPrivateDataType	[OIPF_CSP2]	csp-HexBinaryPrivateDataType.xsd

A.3 Redefines

A.3.1 General

The following are the schema files that have types which are used by the Open IPTV Forum through the use of redefine.

A.3.2 ce-html-profiles-1-0.xsd

This schema is specified normatively in Volume 5 [OIPF_DAE2].

Due to constraints within the XML schema syntax, this file is also modified to include an additional enumeration value in scalingType, “0.33x0.33”.

```
<xs:simpleType name="scalingType">
    <xs:restriction base="xs:string">
            <xs:enumeration value="arbitrary"/>
            <xs:enumeration value="quartersize"/>
            <xs:enumeration value="none"/>
            <xs:enumeration value="0.33x0.33"/>
    </xs:restriction>
</xs:simpleType>
```

A.4 Schemas

The following table lists the XML schemas defined by the Open IPTV Forum.

Table 5: OIPF XML Schemas

Schema Namespace	Definition	Filename
urn:oipf:config:ig:2009	[OIPF_PROT2]	config-ig.xsd
urn:oipf:config:oitfCapabilities:2011-1	[OIPF_DAE2]	config-oitf-oitfCapabilities.xsd
urn:oipf:csp:MIPPVControlMessage:2008	[OIPF_CSP2]	csp-MIPPVControlMessage.xsd
urn:oipf-org:device:ag:1	[OIPF_PROT2]	device-ag.xsd
urn:oipf-org:device:cspg-dtcp:1	[OIPF_PROT2]	device-cspg.xsd
urn:oipf-org:device:ig:1	[OIPF_PROT2]	device-ig.xsd
ChannelConfig	[OIPF_DAE2]	iptv-ChannelConfig.xsd
urn:oipf:iptv:ContentAccessDownloadDescriptor:2008	[OIPF_DAE2]	iptv-ContentAccessDownloadDescriptor.xsd
urn:oipf:iptv:ContentAccessStreamingDescriptor:2008	[OIPF_DAE2]	iptv-ContentAccessStreamingDescriptor.xsd
AbstractContentAccessDescriptor	[OIPF_DAE2]	iptv-AbstractContentAccessDescriptor.xsd
urn:oipf:iptv:bookmark:2011	[OIPF_PROT2]	iptv-bookmark.xsd
urn:oipf:iptv:IPTVProfile:2011	[OIPF_PROT2]	iptv-IPTVProfile.xsd
SynchronizeType	[OIPF_DAE2]	iptv-SynchronizeType.xsd
urn:oipf:protocol:fluteFDT:2009	[OIPF_PROT2]	protocol-fluteFDT.xsd

Schema Namespace	Definition	Filename
urn:oipf:iptv:UEProfile:2010	[OIPF_PROT2]	iptv-UEProfile.xsd
urn:oipf:service:oitfpresence:2011	[OIPF_PROT2]	service-oitfpresence.xsd
urn:oipf:service:PVR:2011	[OIPF_PROT2]	service-pvr.xsd
urn:oipf:service:PVR:report:2010	[OIPF_PROT2]	service-pvr-report.xsd
urn:oipf:iptv:IPTVAction:2009	[OIPF_PROT2]	iptv-IPTVAction.xsd
urn:oipf:service:RelatedMaterial:2011	[OIPF_PROT2]	service-RelatedMaterial.xsd
urn:oipf:service:PurchaseRequest:2011	[OIPF_PROT2]	service-PurchaseRequest.xsd
urn:oipf:iptv:WhatsOnTv:2011	[OIPF_PROT2]	iptv-WhatsOnTv.xsd
urn:oipf:iptv:parentalcontrol:2011	[OIPF_PROT2]	iptv-parentalcontrol.xsd
urn:oipf:iptv:reminder:2011	[OIPF_PROT2]	iptv-reminder.xsd
urn:oipf:iptv:transfer:2011	[OIPF_PROT2]	iptv-transfer.xsd
urn:oipf:iptv:pchcontentswitch:2011	[OIPF_PROT2]	iptv-pchcontentswitch.xsd
urn:oipf:iptv:fdt:2010	[OIPF_PROT2]	iptv-fdt.xsd
urn:oipf:service:sdns:2010-1	[OIPF_META2]	service-sdns.xsd
urn:oipf:service:bcg:2010-1	[OIPF_META2]	service-bcg.xsd
urn:oipf:iptv:has:2010	[OIPF_HAS2]	iptv-HAS.xsd
urn:oipf:iptv:KeyAndSignaling:2013	[OIPF_PROT2]	iptv-KeyAndSignaling.xsd KeyAndSignaling.wsdl IKeyAndSignaling.wsdl
urn:oipf:base:CommonTypes:2011	[OIPF_PROT2]	base-CommonTypes.xsd

A.5 Classification Schemes

The following table lists the XML classification Schemes defined by the Open IPTV Forum for use in XML instance documents.

Table 6: OIPF XML Classification Schemes

Classification Scheme	Definition	Filename
urn:oipf:cs:AudioCodingFormatCS:2010	[OIPF_META2]	cs-AudioCodingFormatCS.xml
urn:oipf:cs:AVMediaFormatCS:2008	[OIPF_META2]	cs-AVMediaFormatCS.xml
urn:oipf:cs:GermanyFSKCS:2008	[OIPF_META2]	cs-GermanyFSKCS.xml
urn:oipf:cs:ProtocolCS:2012	[OIPF_META2]	cs-ProtocolCS.xml
urn:oipf:cs:VisualCodingFormatCS:2013	[OIPF_META2]	cs-VisualCodingFormatCS.xml
urn:oipf:cs:ApplicationUsageCS:2010	[OIPF_META2]	cs-ApplicationUsageCS.xml

A.6 Examples

The following table lists the XML instance documents provided as examples of the OIPF specifications.

Table 7: OIPF XML Examples

Example	Definition	Filename
Adaptive Streaming MPD	[OIPF_HAS2]	HAS-example.xml
OITF presence	[OIPF_PROT2]	oipf-presence-example.xml
Application Discovery Record	[OIPF_META2]	OIPF_ADR.xml
Broadcast Discovery Record	[OIPF_META2]	OIPF_BDR.xml
Package Discovery Record	[OIPF_META2]	OIPF_PDR.xml
Service Provider Discovery	[OIPF_META2]	OIPF_SPD.xml