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INTERNATIONAL STANDARD

colour inside

Consumer terminal function for access to IPTV and open internet multimedia services –
Part 1: General

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CONSUMER TERMINAL FUNCTION FOR ACCESS TO IPTV AND OPEN INTERNET MULTIMEDIA SERVICES –

Part 1: General

FOREWORD

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A Category D liaison was set up between TC100 and the OPEN IPTV FORUM in 2011. The OPEN IPTV FORUM was merged with the Hybrid Broadcast Broadband Television (HbbTV) Association in 2014.

International Standard IEC 62766-1 has been prepared by IEC technical committee 100: Audio, video and multimedia systems and equipment.

The text of this International Standard is based on the following documents:

CDV	Report on voting
100/2484/CDV	100/2656/RVC

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62766 series, published under the general title *Consumer terminal function for access to IPTV and open internet multimedia services,* can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

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INTRODUCTION

The IEC 62766 series is based on a series of specifications that was originally developed by the Open IPTV Forum (OIPF). They specify the user-to-network interface (UNI) for consumer terminals to access IPTV and open internet multimedia services over managed or non-managed networks as defined by OIPF.

The Open IPTV Forum (OIPF) IPTV solution provides 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.

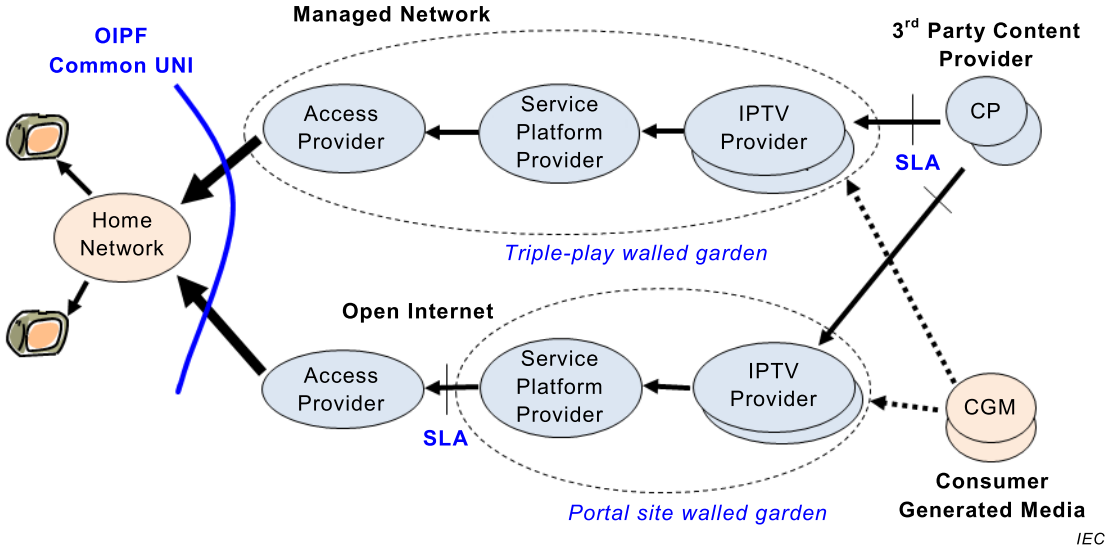

Figure 1 – Open IPTV Forum scope

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.

Managed network IPTV services are provided with QoS guarantees, for example within a triple-play walled garden.

Open Internet IPTV services are accessed via the Internet, without QoS guarantees, for example via a portal.

In both cases, IPTV services are accessed via a service platform that provides supporting facilities for multiple service providers.

Third-party content providers supply media assets that are delivered within the IPTV services.

The Open IPTV Forum (OIPF) specification for consumer terminal function and network interfaces for access to IPTV and open Internet multimedia services consist of the following multiple parts:

- Part 1: General (this document)
- Part 2-1: Media formats
- Part 2-2: HTTP adaptive streaming
- Part 3: Content metadata
- Part 4-1: Protocols
- Part 4-2: Examples of IPTV protocol sequences
- Part 5-1: Declarative application environment
- Part 5-2: Web standards TV profile
- Part 6: Procedural application environment
- Part 7: Authentication, content protection and service protection
- Part 8: Profiles

This document (Part 1) defines general common elements and specifies the document structure, the scopes of, and relationships between the other parts, which deal with specific aspects of the OIPF consumer terminal function and network interfaces.

CONSUMER TERMINAL FUNCTION FOR ACCESS TO IPTV AND OPEN INTERNET MULTIMEDIA SERVICES –

Part 1: General

1 Scope

This part of IEC 62766 defines general common elements and specifies the structure of the IEC 62766 series, the scopes of, and relationships between the other parts.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62766-2-1, *Consumer terminal function for access to IPTV and open internet multimedia services – Part 2-1: Media formats*

IEC 62766-2-2, *Consumer terminal function for access to IPTV and open internet multimedia services – Part 2-2: HTTP adaptive streaming*

IEC 62766-3, *Consumer terminal function for access to IPTV and open internet multimedia services – Part 3: Content metadata*

IEC 62766-4-1, *Consumer terminal function for access to IPTV and open internet multimedia services – Part 4-1: Protocols*

IEC 62766-4-2, *Consumer terminal function for access to IPTV and open internet multimedia services – Part 4-2: Examples of IPTV protocol sequences*

IEC 62766-5-1, *Consumer terminal function for access to IPTV and open internet multimedia services – Part 5-1: Declarative application environment*

IEC 62766-5-2, *Consumer terminal function for access to IPTV and open internet multimedia services – Part 5-2: Web standards TV profile*

IEC 62766-6, *Consumer terminal function for access to IPTV and open internet multimedia services – Part 6: Procedural application environment*

IEC 62766-7, *Consumer terminal function for access to IPTV and open internet multimedia services – Part 7: Authentication, content protection and service protection*

IEC 62766-8, *Consumer terminal function for access to IPTV and open internet multimedia services – Part 8: Profiles*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1
3DTV
plano-stereoscopic three-dimensional television

3.1.2
access network
network infrastructure used by the access provider to deliver IPTV services to the consumer

Note 1 to entry: 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.

3.1.3
application
collection of assets and logic that together provide a service to the user

Note 1 to entry: Assets and logic may reside either in an application server or in the ITF or both.

3.1.4
catch-up TV
service that allows the end user, using an EPG or a portal, to watch linear TV programs that were previously broadcast

3.1.5
consumer domain
domain where the IPTV services are consumed

Note 1 to entry: A consumer domain can consist of a single terminal or a network of terminals and related devices for service consumption.

3.1.6
consumer network
local area network in which the IPTV terminal function is located

Note 1 to entry: Consumer networks include residential networks, wireless hot-spots, hotel networks, etc.

3.1.7
consumer
end user
user
individual who use the IPTV services

Note 1 to entry: End users (consumers) may include, for example, members of the same family.

3.1.8
content
instance of audio, video, audio-video information, or data

3.1.9
content guide
program guide
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.

3.1.10
content on demand
CoD
service where a user can select the individual content items they want to watch from the list of available content

Note 1 to entry: Consumption of the content is started upon user request.

3.1.11
content protection
means to protect content from unauthorized usage

Note 1 to entry: Unauthorized usage includes, for example, redistribution, recording, playback, duplication, etc.

3.1.12
content provider
entity that provides content and associated usage rights to the IPTV service provider

3.1.13
Internet
worldwide, publicly accessible network of interconnected computer networks that transmit data by packet switching using the standard Internet Protocol (IP)

3.1.14
IPTV service provider
entity that offers IPTV services and which has a contractual relationship with the subscriber

3.1.15
IPTV solution
solution defined by the multi-part series of IEC 62766

3.1.16
IPTV terminal function
ITF
functionality within the consumer network that is responsible for terminating the media and control for an IPTV service

3.1.17
local storage
content storage within the administrative realm of the IPTV service provider, but not in their physical environment

Note 1 to entry: 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.

3.1.18
network based personal video recorder
nPVR
provision of PVR functionality whereby the content is stored in the IPTV service provider domain

Note 1 to entry: The nPVR allows a user to schedule the recording of scheduled content programs. The user can later select the content they want to watch from the recorded content.

3.1.19
portal
function of a service platform that provides an entry point to individual IPTV services to users via a GUI

3.1.20
program
segment of scheduled content with a defined beginning and end

3.1.21
push CoD
type of content on demand where the content is pre-loaded to the ITF local storage by the service provider

Note 1 to entry: 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.

3.1.22
residential network
local network of devices (gateways and terminals) at the end user's premises

3.1.23
scheduled content
service where the play-out schedule is fixed by an entity other than the user

Note 1 to entry: The content is delivered to the user for immediate consumption.

3.1.24
service
content and applications provided by service platform providers and service providers

3.1.25
service access protection
means to protect IPTV services from unauthorized usage/access

Note 1 to entry: Such unauthorized usage or access include access from unauthorized users or a DOS attack.

3.1.26
service platform provider
entity which, based on a contractual relationship with IPTV service providers, provides the supporting functions for the delivery of IPTV services, which are not part of the IPTV service, but are required for managing its delivery

Note 1 to entry: Supporting functions for the delivery of IPTV services are, for example, charging, access control and other functions which are not part of the IPTV service.

3.1.27
service protection
means to protect contents (files or streams) during their delivery

3.1.28
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

3.1.29
start-over TV
service that enables the end user to playback a linear TV program that is currently being broadcasted from its start

3.1.30
subscriber
individual that makes the contract (subscription) with a service provider for the consumption of certain services

3.1.31
trick mode
facility to allow the user to control the playback of content

Note 1 to entry: The playback of content includes facilities such as pause, fast and slow playback, reverse playback, instant access, replay, forward and reverse skipping.

3.1.32
user profile
information associated with a specific user who is a part of a subscription

Note 1 to entry: Information includes, for example, viewing preferences.

3.2 Abbreviated terms

AAC	Advanced Audio Coding
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
AVC	Advanced Video Coding
A/V	Audio and Video
BCG	Broadband Content Guide
BMP	Baseline Managed Profile
BTF	Basic Transport Function
CA	Conditional Access
CAC	Connectivity Admission Control
CAM	CA Module
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
CGM	Consumer Generated Media

CI	Common Interface
CK	Ciphering Key
CoD	Content on Demand
CPE	Customer Premise Equipment
CPI	Content Provider Interface
CSP	Content and Service Protection
CSP-T	CSP Terminal based approach
CSPG	Content and Service Protection Gateway Gateway
CTD	Content Transformation Device
DAE	Declarative Application Environment
DASH	Dynamic Adaptive Streaming over HTTP
DCF	DRM Content Format
DHCP	Dynamic Host Configuration Protocol
DIFFServ	Differentiated Services
DLNA	Digital Living Network Alliance
DLNA DMC	DLNA Digital Media Controller
DLNA DMP	DLNA Digital Media Player
DLNA DMR	DLNA Digital Media Renderer
DLNA DMP	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	ECMA International – European association for standardizing information and communication systems
EIT	Event Information Table
EMP	Enhanced Management Profile
EPG	Electronic Program Guide
FCC	Fast Channel Change
FE	Functional Entity
FLUTE	File Delivery over Unidirectional Transport
GBA	Generic Bootstrapping Architecture
GEM	Globally Executable Multimedia home platform
GENA	General Event Notification Architecture
GPON	Gigabit Ethernet Passive Optical Network
GUI	Graphical User Interface
HAS	HTTP Adaptive Streaming
HD	High Definition
HDMI	High Definition Multimedia Interface
HE-AAC	High Efficiency AAC

HLA	High Level Architecture
HN	Home Network
HNI	Home Network Interfaces
HNI-AGG	HNI between AG and CSPG
HNI-AGI	HNI between AG and IG
HNI-AMNI	HNI – Additional Managed Network Interface
HNI-CSP	HNI – Content and Service Protection
HNI-IGI	HNI – IMS Gateway Interface
HNI-INI	HNI – ITF Network Interface
HSS	Home Subscriber Server
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
IPMP	Intellectual Property Management Protocol
IPTV	Internet Protocol TeleVision
IRCF	ITF Remote Control Function
ISIM	IP Multimedia Services Identity Module
ISO	International Standards Organisation
ISOBMFF	ISO Base Media File Format
ISP	Internet Service Provider
ITF	IPTV Terminal Function
LAN	Local Area Network
MAC	Message Authentication Code
M/C-U/C	Multicast to Unicast
MDTF	Multicast Data Terminating Function
MPEG	Motion Picture Experts Group
MSRP	Message Session Relay Protocol
MUI	Media Interoperability Unit
NAT	Network Address Translation
NPI	Network Provider Interfaces
nPVR	Network Personal Video Recorder
OIP	Open Internet Profile
OIPF	Open IPTV Forum
OITF	Open IPTV Terminal Function
OMA	Open Mobile Alliance
P2P	Peer-to-Peer
PAE	Procedural Application Environment
PC	Personal Computer

PDCF	Packetized DRM Content Format
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
QoS	Quality of Service
RA	Remote Access
RAC	Resource and Admission Control
RADA	Remote Access Discovery Agent
RAND	Random Challenge
RATA	Remote Access Transport Agent
RCEF	Resource Control Enforcement Function
RET	RETransmission
RTP	Real Time Protocol
RTCP	Real Time Control Protocol
RTSP	Real Time Streaming Protocol
RMS	Remote Management System
RUI	Remote User Interface
SAA	Service Access Authentication
SAML	Security Assertion Markup Language
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
SDT	Service Description Table
SIM	Subscriber Identity Module
SIP	Session Initiation Protocol
SLA	Service Level Agreement
SMS	Short Message Service
SOAP	Simple Object Access Protocol
SP	Service Provider
SPI	Service Provider Interface
SPDF	Service-based Policy Decision Function
SPP	Service Platform Provider
SSO	Single Sign-On
STB	Set Top Box
STP	SD&S Transport Protocol
SVG	Scalable Vector Graphics
TBD	To Be Determined
TCI	Transport and Control Interface

TCP/IP	Transmission Control Protocol/Internet Protocol
TVA	TV Anytime
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
WAN	Wide Area Network
WG	WAN Gateway
WLAN	Wireless LAN
XHTML	eXtensible Hypertext Markup Language
XML	eXtensible Markup Language

4 OIPF terminal function and network interfaces overview

4.1 General

Figure 2 shows a high-level logical view of the scope of the OIPF 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 and Service Protection Gateways) in one "box". Clause 5.3.4 of the OIPF Architecture specification [1][1] 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 document.

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.

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1 Numbers in square brackets refer to the Bibliography.

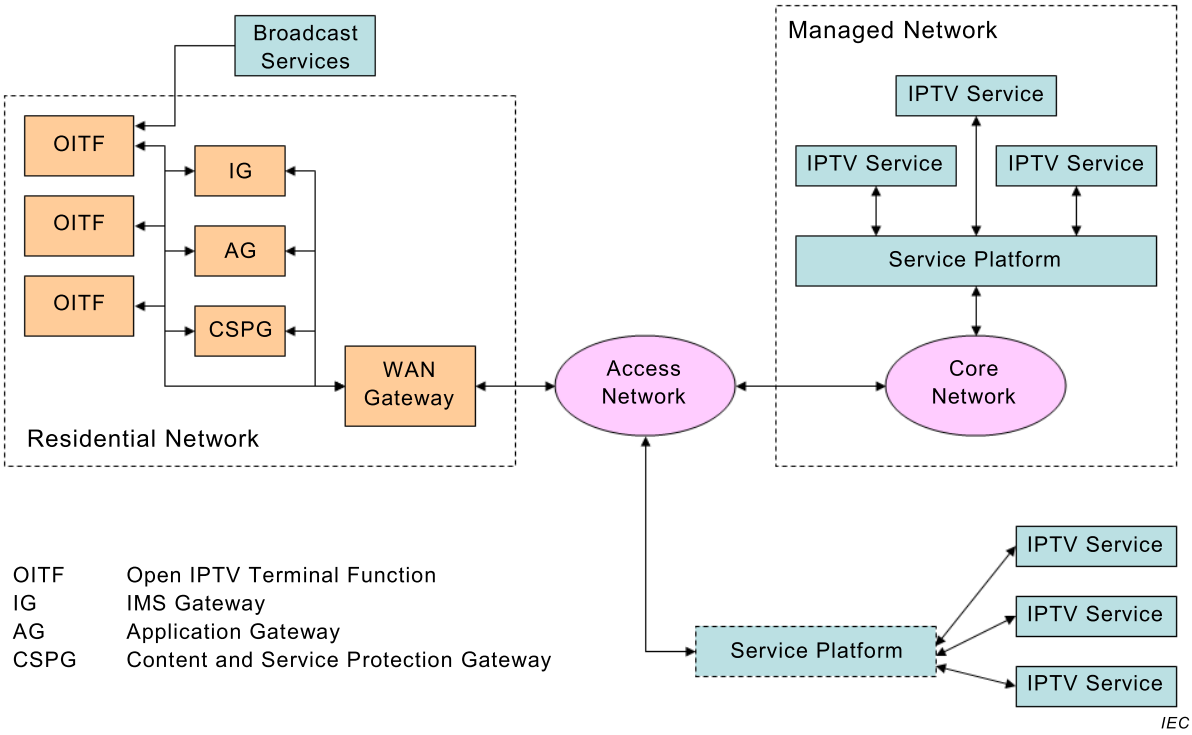

Figure 2 – IPTV solution scope

The document provides 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;
- network PVR and managed local PVR, including timeshift for network PVR and personalised channel services;
- purchase of digital media service;
- information services, both with and without any relation to the content delivery services; and
- notification services (network-generated notifications, user reminders, emergency announcement);
- communication services, including notifications, and their blending with the content delivery services;
- media formats for voice and A/V communication services;
- hybrid (broadcast-broadband) application support.

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 that 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;
- bookmarking of content;
- session continuity and portability between devices;
- adaptive streaming of content over HTTP, specified in IEC 62766-2-2;
- fast-channel change (FCC) and retransmission (RET), based on DVB-IPTV;
- HNI-IGI instantiation using SIP;
- content navigation controls (also known as “forced play-out”);
- DLNA remote UI-based control of the OITF.

These services and functions are derived from the Open IPTV Forum publication “Services and Functions for Release 2”, V1.0, October 2008 [2].

The other parts of the IEC 62766 series are introduced in 4.2 to 4.9.

Annex A provides an informative summary of all the uses of XML schemata in the IEC 62766 series.

Annex B provides the definition of the relevant functional entities and the reference points between them, which are specified normatively in the other parts of the IEC 62766 series.

Compared with the ITU-T IPTV architecture, as specified in ITU-T Recommendation Y.1910 [3], the OIPF Functional Architecture [1] applies different terminology for functional entities and reference points, but there is a clear logical mapping between the two architectures, hence they are not in contradiction in any respect.

The OIPF IPTV terminal function (OITF), as described above, is a logical functional entity that can be implemented in any kind of appropriate terminal device. The OITF implements the UNI specified in the present document but there is no prescription of the actual terminal device. This is in contrast, to a certain extent, to the approach for ITU-T terminal devices introduced in ITU-T Recommendation H.720 [4], but the two approaches are not in contradiction.

4.2 Media formats

IEC 62766-2-1 specifies the complete set of adopted media formats, including audio, video and systems layers, also ancillary content such as 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 [5] 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. Sub-picture video profiles for PiP and other services are also specified.

Systems layers are specified based on MPEG-2 systems (transport stream) and the 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.

Additional features related to media formats are:

- 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 [6].

4.3 Adaptive streaming

IEC 62766-2-2 is the specification for HTTP adaptive streaming. There are two methods specified for enabling adaptive bit-rate streaming with IPTV services.

The first, and preferred method, is based on MPEG DASH [7], whereby OIPF-specific interoperability points are defined for DASH usage with MPEG-2 TS and ISOBMFF [8] container content.

The second is the OIPF HTTP adaptive streaming (HAS) format, which is based on 3GPP Release 9 PSS. 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.

4.4 Content metadata

IEC 62766-3 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) [9], and broadband content guide (BCG) [10].

Whereas DVB SD&S foresees the delivery of metadata within XML documents, the IPTV solution also enables service discovery via CE-HTML [11] 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.

IEC 62766-3 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 DVB SD&S Transport Protocol [9] 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.

4.5 Protocols

IEC 62766-4-1 brings together the specification of the complete set of protocols for the IPTV solution, covering the reference point interfaces defined in the OIPF Architecture [1]. 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 [12].

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 HNI-AGG and HNI-AGI interfaces are not specified.

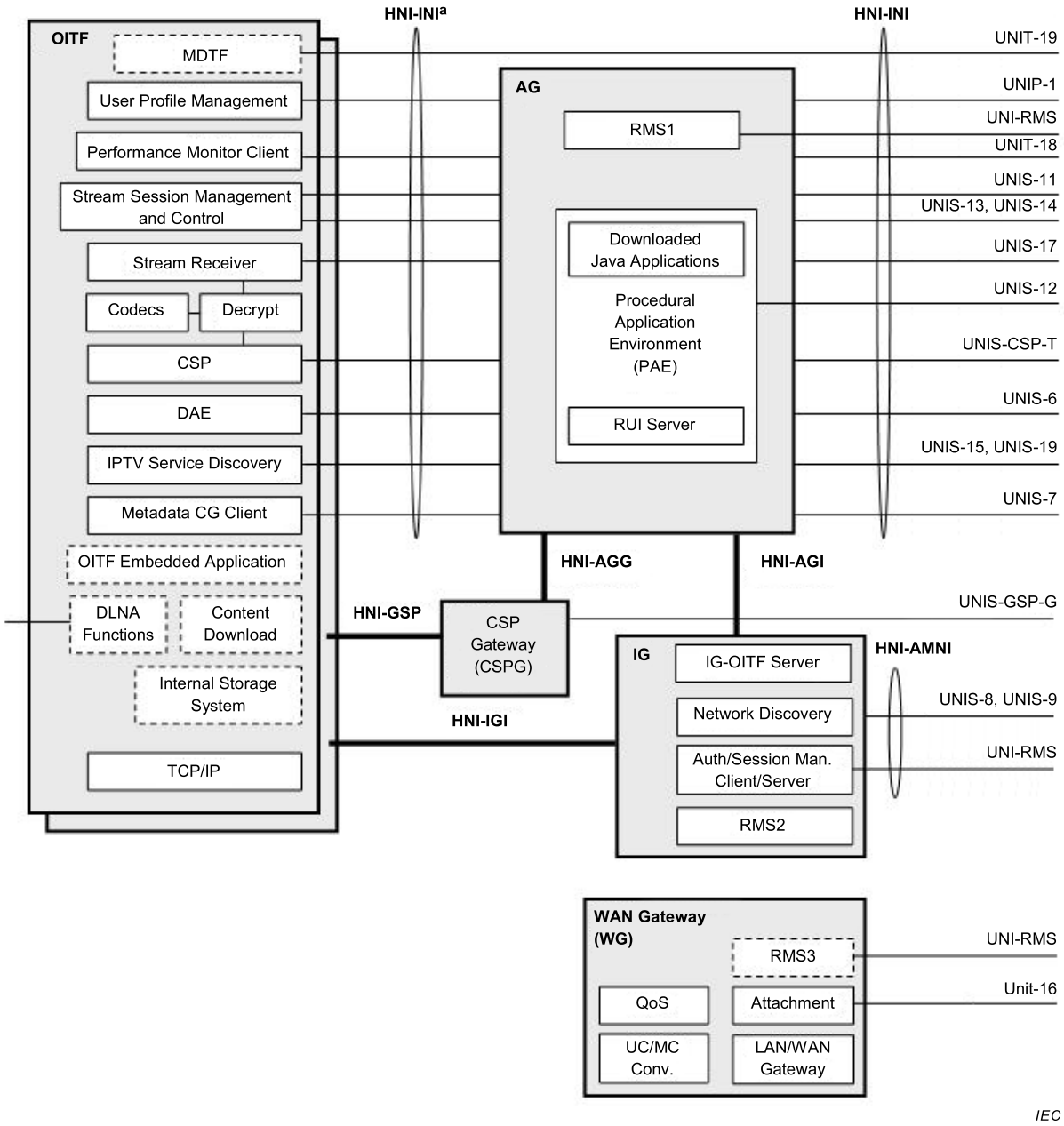

Figure 3 – Residential network, functional entities, UNI and HNI reference points

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 [13], including TR-104 [14] and TR-135[15].	HTTP/TR-069
UNIS-CSP-T	Rights management for protected content – including key management and rights expression.	HTTP/MARLIN

IEC 62766-4-1 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.

IEC 62766-4-2 is informative. It contains a set of examples of IPTV protocol sequences for various services as defined in this document.

4.6 Declarative application environment

IEC 62766-5-1 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 [11], 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 [16]; ECMA-262 Java-script [17] and W3C (working draft) XMLHttpRequest [18]. 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, such as:

– the adoption of some properties of CSS-3 (cascaded style sheets version 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 [19].

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.

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

IEC 62766-5-2 (Web standards TV profile) defines the profile of the set of World Wide Web Consortium (W3C) specifications upon which the DAE is based, i.e. HTML5 [20] and other related web technologies. IEC 62766-5-1 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.

4.7 Procedural application environment

IEC 62766-6 specifies the Java-based procedural application environment (PAE) that runs in the application gateway (AG) functional entity.

The PAE is based on DVB's IPTV profile of GEM (globally executable multimedia) home platform) [21]. 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.

4.8 Authentication, content protection and service protection

IEC 62766-7 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 consuming terminals for IPTV services delivering protected content. CSP-T is an end-to-end protection system based on Marlin Broadband[2], 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.

Marlin DMZ is used to provide support for content navigation controls (also known as “forced play-out”).

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 Plus, the 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 specification also includes support for the delivery of HDCP and DTCP system renewability messages.

The CI Plus based option relies on the provision of a separate CSPG device in the form of a CI Plus CAM 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 Plus host can route protected content received via the IP interface to the CI Plus interface and hence the CI Plus 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. A generalized HTTP digest authentication procedure using credentials from the IMS gateway is also specified.

An informative annex 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 is also included.

4.9 Profiles

IEC 62766-8 contains the definition of three informative profiles of the OIPF IPTV solution, corresponding to three typical deployment environments.

The three profiles are summaried as follows:

- The open internet profile (OIP). This profile is intended for “over-the-top” services that do not utilise any QoS provision or terminal management features.

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[2] Marlin Broadband is the trade name of a product supplied by Marlin Developer Community (MDC). This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

- The baseline managed profile (BMP). This profile adds support for the scheduled content and streamed CoD services including all associated features that facilitate QoS provision for content delivery in a managed network, compared to the OIP.
- The enhanced managed profile (EMP). This profile adds native support for advanced managed-network features such as IMS [22], Broadband Content Guide [10] and TR-069 [23] based remote management, compared to the BMP.

Annex A
(informative)

XML schemas

A.1 Imports

Table A.1 lists the schema files that are imported into other schemas, but that are not defined by the Open IPTV Forum.

Table A.1 – Imported XML schema files

Schema namespace	Schema 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	PssMbmsconnamd.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_v1.4r10_modded.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

Table A.2 lists the classification schemes that may be used in XML documents, but that are not defined by the Open IPTV Forum.

Table A.2 – 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

Table A.3 lists 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 A.3 – OIPF XML schema include files

Datatype	Definition	Filename
DRMPrivateDataType	IEC 62766-7	csp-DRMPrivateDataType.xsd
Marlin PrivateDataType	IEC 62766-7	csp-MarlinPrivateDataType.xsd
HexBinaryPrivateDataType	IEC 62766-7	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 IEC 62766-5-1.

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

Table A.4 lists the XML schemas defined by the Open IPTV Forum.

Table A.4 – OIPF XML schemas

Schema Namespace	Definition	Filename
urn:oipf:config:ig:2009	IEC 62766-4-1	config-ig.xsd
urn:oipf:config:oitfCapabilities:2011-1	IEC 62766-5	config-oitf-oitfCapabilities.xsd
urn:oipf:csp:MIPPVControlMessage:2008	IEC 62766-7	csp-MIPPVControlMessage.xsd
urn:oipf-org:device:ag:1	IEC 62766-4-1	device-ag.xsd
urn:oipf-org:device:cspg-dtcp:1	IEC 62766-4-1	device-cspg.xsd
urn:oipf-org:device:ig:1	IEC 62766-4-1	device-ig.xsd
ChannelConfig	IEC 62766-5	iptv-ChannelConfig.xsd
urn:oipf:iptv:ContentAccessDownloadDescriptor:2008	IEC 62766-5	iptv-ContentAccessDownloadDescriptor.xsd
urn:oipf:iptv:ContentAccessStreamingDescriptor:2008	IEC 62766-5	iptv-ContentAccessStreamingDescriptor.xsd
AbstractContentAccessDescriptor	IEC 62766-5	iptv-AbstractContentAccessDescriptor.xsd
urn:oipf:iptv:bookmark:2011	IEC 62766-4-1	iptv-bookmark.xsd
urn:oipf:iptv:IPTVProfile:2011	IEC 62766-4-1	iptv-IPTVProfile.xsd
SynchronizeType	IEC 62766-5	iptv-SynchronizeType.xsd
urn:oipf:protocol:fluteFDT:2009	IEC 62766-4-1	protocol-fluteFDT.xsd
urn:oipf:iptv:UEProfile:2010	IEC 62766-4-1	iptv-UEProfile.xsd
urn:oipf:service:oitfpresence:2011	IEC 62766-4-1	service-oitfpresence.xsd
urn:oipf:service:PVR:2011	IEC 62766-4-1	service-pvr.xsd
urn:oipf:service:PVR:report:2010	IEC 62766-4-1	service-pvr-report.xsd
urn:oipf:iptv:IPTVAction:2009	IEC 62766-4-1	iptv-IPTVAction.xsd
urn:oipf:service:RelatedMaterial:2011	IEC 62766-4-1	service-RelatedMaterial.xsd
urn:oipf:service:PurchaseRequest:2011	IEC 62766-4-1	service-PurchaseRequest.xsd
urn:oipf:iptv:WhatsOnTv:2011	IEC 62766-4-1	iptv-WhatsOnTv.xsd
urn:oipf:iptv:parentalcontrol:2011	IEC 62766-4-1	iptv-parentalcontrol.xsd
urn:oipf:iptv:reminder:2011	IEC 62766-4-1	iptv-reminder.xsd
urn:oipf:iptv:transfer:2011	IEC 62766-4-1	iptv-transfer.xsd
urn:oipf:iptv:pchcontentswitch:2011	IEC 62766-4-1	iptv-pchcontentswitch.xsd

Schema Namespace	Definition	Filename
urn:oipf:iptv:fdt:2010	IEC 62766-4-1	iptv-fdt.xsd
urn:oipf:service:sdns:2010-1	IEC 62766-3	service-sdns.xsd
urn:oipf:service:bcg:2010-1	IEC 62766-3	service-bcg.xsd
urn:oipf:iptv:has:2010	IEC 62766-2-2	iptv-HAS.xsd
urn:oipf:iptv:KeyAndSignaling:2013	IEC 62766-4-1	iptv-KeyAndSignaling.xsd KeyAndSignaling.wsdl IKeyAndSignaling.wsdl
urn:oipf:base:CommonTypes:2011	IEC 62766-4-1	base-CommonTypes.xsd

A.5 Classification schemes

Table A.5 lists the XML classification schemes defined by the Open IPTV Forum for use in XML instance documents.

Table A.5 – OIPF XML examples

Classification scheme	Definition	Filename
urn:oipf:cs:AudioCodingFormatCS:2010	IEC 62766-3	cs-AudioCodingFormatCS.xml
urn:oipf:cs:AVMediaFormatCS:2008	IEC 62766-3	cs-AVMediaFormatCS.xml
urn:oipf:cs:GermanyFSKCS:2008	IEC 62766-3	cs-GermanyFSKCS.xml
urn:oipf:cs:ProtocolCS:2012	IEC 62766-3	cs-ProtocolCS.xml
urn:oipf:cs:VisualCodingFormatCS:2013	IEC 62766-3	cs-VisualCodingFormatCS.xml
urn:oipf:cs:ApplicationUsageCS:2010	IEC 62766-3	cs-ApplicationUsageCS.xml

A.6 Examples

Table A.6 lists the XML instance documents provided as examples of the OIPF specifications.

Table A.6 – OIPF XML examples

Example	Definition	Filename
Adaptive streaming MPD	IEC 62766-2-2	HAS-example.xml
OITF presence	IEC 62766-4	oipf-presence-example.xml
Application discovery record	IEC 62766-3	OIPF_ADR.xml
Broadcast discovery record	IEC 62766-3	OIPF_BDR.xml
Package discovery record	IEC 62766-3	OIPF_PDR.xml
Service provider discovery	IEC 62766-3	OIPF_SPD.xml

Annex B
(informative)

High-level architecture

B.1 Reference points identification

Figure B.1 shows the UNI interface between the consumer domain and the network provider, the service platform provider and the IPTV service provider (collectively called “provider(s) network”) domains, which is one area of standardization within the IEC 62766 series. Additional interfaces in the network provider domain are also described in this architecture.

The UNI interface is expressed as several sub-interfaces, each of which map to the various functional entities required to provide the necessary support for the end-to-end IPTV service. Reference points are assigned to each of these sub-interfaces. The notation used to identify the sub-interfaces of the UNI, as well as a detailed description for all the reference points, is described later.

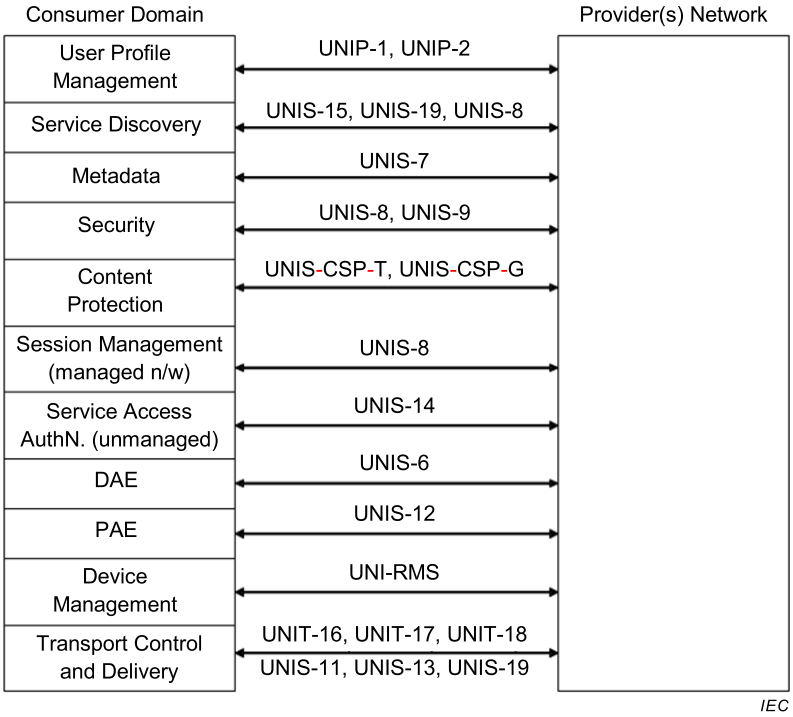

Figure B.1 – Mapping functional entities to UNI reference points

This mapping is useful to verify compliance of the architecture against the requirements and to be able to document the various functionality supported by the various sub-interfaces in order to fulfill the desired features.

B.2 Reference points description

The user-network interface (UNI) is expressed as several reference points, each of which map to the various functional entities required to provide the necessary support for the end-to-end IPTV service (see Table B.1). The notation used to identify the reference points of the UNI, as well as a detailed description for all the reference points, is described later.

Table B.1 – UNI reference points

Reference point	Description
UNIP-1	Reference point for user initiated IPTV user profile management
UNIP-2	Reference point for user initiated profile management of person-to-person communication enablers, such as presence privacy, resource list management, group management, etc. Note that group management is included to support the management of pre-defined groups that can be reused for several purposes, such as presence privacy, presence request, messaging, chatting, etc.
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 is used to interface between the DAE and the IPTV application function in both the managed and unmanaged models.
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. It is based on DVB-IPTV BCG.
UNIS-8	Authentication and session management for the managed network model.
UNIS-9	Authentication for GBA single sign-on.
UNIS-11	Reference point for control of real time streaming (e.g. control for pause, rewind, skip forward). This reference point is optionally secured. The reference point includes content delivery session setup in case of the unmanaged model.
UNIS-12	Reference point between the AG and the provider specific application functional entity. Encompasses two functions: Signalling and download of applications in a generic format. (Subject to standardization) Interaction of generic applications with the provider network. (Not subject to standardization)
UNIS-13	User stream control for multicast of real time content and data for the managed network model. The protocol used on this interface is IGMP.
UNIS-14	Reference point used for authorization of service access for the managed and unmanaged network models.
UNIS-15	Reference point to the IPTV service discovery FE to obtain information about IPTV services offered by an IPTV Service Provider.
UNIT-16	Network attachment functions connected to this reference point include: DHCP server and relay.
UNIT-17	Content stream including content; content encryption (for protected services) and content encoding. This reference point can be used for both multicast and unicast (UNIT-17M and UNIT-17U, respectively). This could be RTP and HTTP (unicast only). It can also be used for bidirectional RTP-based transfer of voice and real-time video with predefined formats, i.e., media to support conversational multimedia communications.
UNIT-18	Performance monitoring interface for reporting the performance monitoring results. A possible protocol is RTCP.
UNIT-19	Multicast data channel. Used to deliver data of different kinds to the OITF by means of multicast. This reference point can carry discrete data that is carried over unicast through e.g. the interfaces UNIS-6, and UNIS-7. Other uses e.g. UNI-RMS are not excluded.
UNIS-19	Reference point to the IPTV service provider discovery functional entity to obtain the list of service providers, and related information.
UNI-RMS	Remote management of end user devices (based on the DSL Forum TR-069 framework and related extensions based on DVB-IP-RMS specification)
UNIS-CSP-T	Rights management for protected content, including key management and rights expression.
UNIS-CSP-G	Reference point to support a service and content protection solution which is specific to the IPTV service provider. This interface may be used to obtain licenses for purchased/subscribed content, control content and service protection system and also deliver content.

B.3 Residential network high-level architectural overview

B.3.1 Architecture

The architecture of the consumer domain (referred to hereafter as the residential network) is as shown in Figure B.2 and composed of 5 functional entities, with well-defined interfaces between them, and where each functional entity includes a number of functions. As shown in Figure B.2, the entire collection of these functional entities is called the IPTV terminal function (ITF).

The residential network architecture is designed to:

- support multiple deployment scenarios;
- allow non-IPTV applications to co-exist with IPTV services, but be able to execute independently from the IPTV service.

The architecture chosen to comply with the above is depicted in Figure B.5 below.

There are two main interface groups between the Residential Network and the Provider(s) Network domain: the HNI-INI and the HNI-AMNI. The mapping between these key functional groupings and UNI reference points is depicted in Figure B.2.

Note also that while not shown explicitly in Figure B.2, all communications are mediated by the WAN gateway.

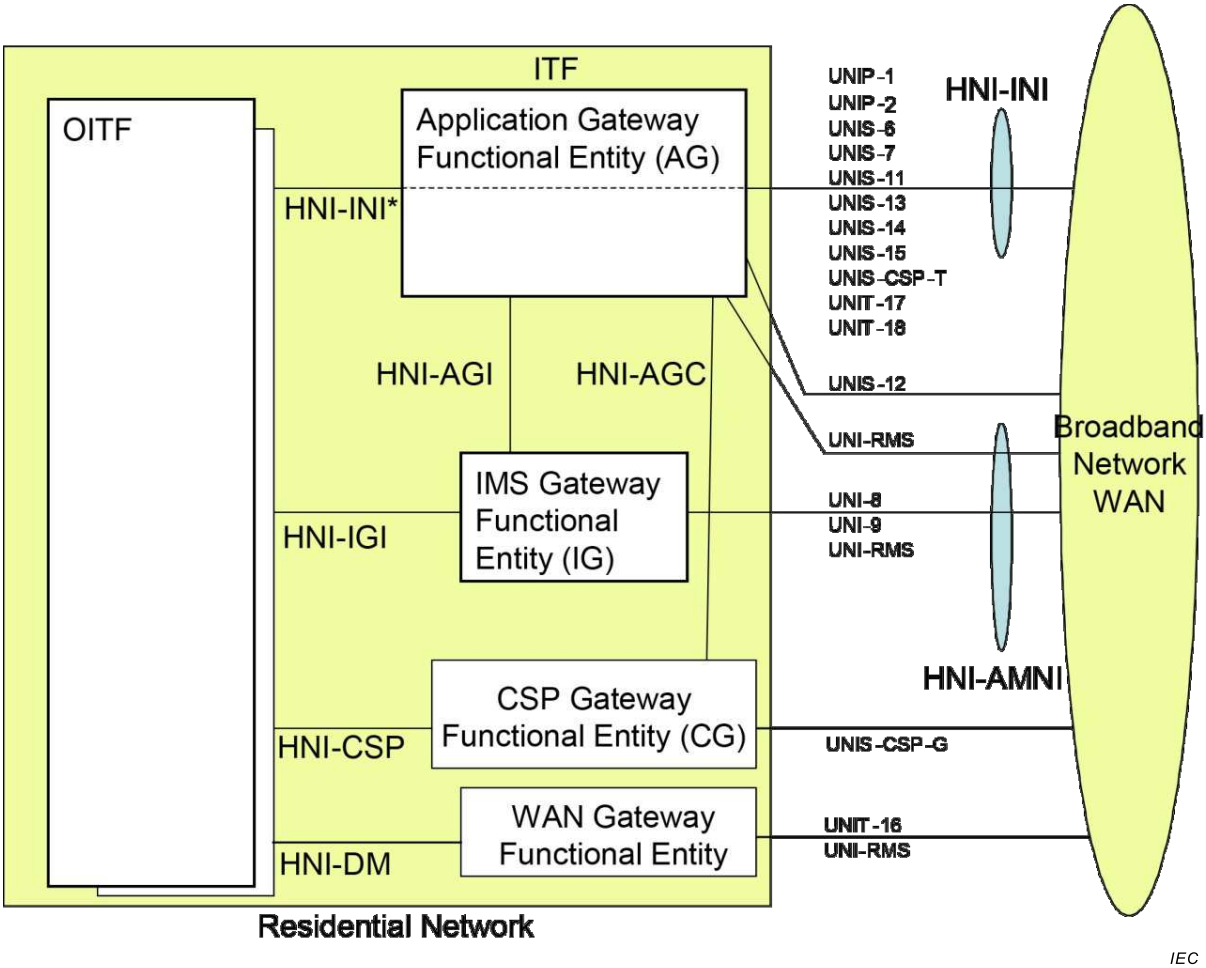

Figure B.2 – Residential network architecture

B.3.2 Functional entities

B.3.2.1 General

Below is a brief description of the functional entities in the residential network.

B.3.2.2 Open IPTV terminal functional entity (OITF)

The OITF includes the functionality required to access IPTV service for both the unmanaged and the managed network models through the HNI-INI and HNI-IGI interfaces.

- To access the IPTV services using the unmanaged model, the OITF only needs to use the HNI-INI interface. Thus, the minimum set of functional entities needed to access unmanaged IPTV services are the OITF and the WAN gateway.
- To access IPTV service using the managed network model, the OITF needs to use both the HNI-INI and the HNI-IGI interfaces. Thus, the minimum set of functional entities needed to access the managed IPTV services are the OITF, the IG and the WAN gateway (as it provides the physical connection between the residential network and the WAN). The HNI-IGI interface requires special protection, as it carries credentials/secrets.

The OITF has its own direct user interaction (e.g., remote control, keyboard) and audio/video rendering and, optionally, grabbing functionalities (e.g. display, speakers, cameras, microphones) or can be directly connected with other audio/video rendering/grabbing devices without passing through home network communication.

All residential network deployments will have at least one instance of the OITF.

The OITF may include functions to allow Open IPTV Forum defined services to be accessed on DLNA devices [24].

B.3.2.3 IMS gateway functional entity (IG)

The IG includes the necessary functionality to allow an OITF device to access managed network services, based on an IMS core network, through the HNI-IGI interface. The IG provides an IPTV end user with access to managed network IPTV services and to blended person-to-person communication services such as chat, messaging, presence, etc. Support for unsolicited notification is also included for such services as presence, caller ID, etc.

The IG is able to offer its functionality to the AG via the HNI-AGI interface.

Support for new or enhanced applications can be realized by a firmware upgrade to the IG without any impacts on the OITF functionality.

In a device that implements both the OITF and IG, the use of the HNI-IGI interface is optional.

B.3.2.4 Application gateway functional entity (AG)

The application gateway (AG) is an optional gateway function that incorporates a procedural language-based application execution environment where applications can be remotely downloaded for execution. This functionality is required by certain service providers that wish to have generic procedural language-based applications related or unrelated to IPTV services downloaded for execution in the home environment. Examples of applications related to IPTV services include:

– an EPG generating a remote UI;

– proxying for signaling protocols when not involving SIP;

and when client and server are not in the same IP domain:

– support for proprietary or non-standard content download protocols (where the AG has A/V content storage capability);
– insertion of personalized advertisements in the media stream; and
– full blended person-to-person communication services (e.g., videoconference using a TV set as a display).

An example of an application unrelated to IPTV services is one that collects alarms from home devices.

To interface to the AG, an OITF uses the HNI-INI* interface. The HNI-INI* is a subset of the reference points in the HNI-INI interface in addition to support for discovery of an AG by an OITF.

When present, the AG, via an application running in the executable application environment, can perform any of the following functionalities:

- Manipulate media streams.

  Note that for protected content, this is only addressed when the AG and the CSPG are combined in the same device and that the IEC 62766 series does not define the routing of media content (for the purposes of media control) via an AG that is not also a CSPG.

- Filter content guide (CG) data. Insertion of its own CG data.

  Note that in the release 1 solution, this is only addressed where the resulting content guide is output from the AG to the OITF in the form of a remote UI. The release 1 solution does not define how an AG may output CG data in broadcast content guide (BCG) format to an OITF, or how an OITF may discover that BCG format information is available from an AG.

  – Support proprietary applications through a remote user interface (RUI).
  – Support for proprietary or non-standard content download protocols.
  – Support advanced blended communication services.

When the AG is deployed in a device with local graphics rendering (e.g. combined with an OITF), applications running in the PAE can offer a wide range of applications and services directly using that local graphics rendering system without using a remote UI.

The AG is able to make use of the services of the IG via the HNI-AGI interface. This interface is not defined in the release 1 solution. However, where an AG and an OITF are combined in the same device, the device may use the HNI-IGI interface for both DAE and PAE applications.

B.3.2.5 Content and service protection (CSP) gateway functional entity (CSPG)

The CSP gateway (CSPG) is an optional gateway functional entity that provides a conversion from a content and service protection solution in the network to a secure authenticated channel between the CSPG and the OITF.

B.3.2.6 WAN gateway functional entity (WG)

The WAN gateway function supports the physical connection between the residential LAN and the access network WAN. A WAN gateway functional entity will exist in all deployments although not all its functions will be required in all cases.

B.4 Residential network functional entities

B.4.1 General

The following is a more detailed description of the various functional entities identified above.

For ease of understanding of the detailed functional description of the residential network, this document uses a stepwise buildup of the residential network functional entities comprising of the following steps:

- OITF and WAN gateway (WG);
- OITF, WG and IG;
- OITF, WG, IG and the optional functional entities AG and CSPG.

This buildup of functions does not imply that these combinations of functions are the only deployment options possible. Each of the OITF, IG, AG, CSPG and WAN gateway functional entities may be deployed as separate physical devices in the residential network or in combinations or may not be deployed at all in the case of the optional entities AG and CSPG.

B.4.2 Open IPTV terminal functional entity (OITF)

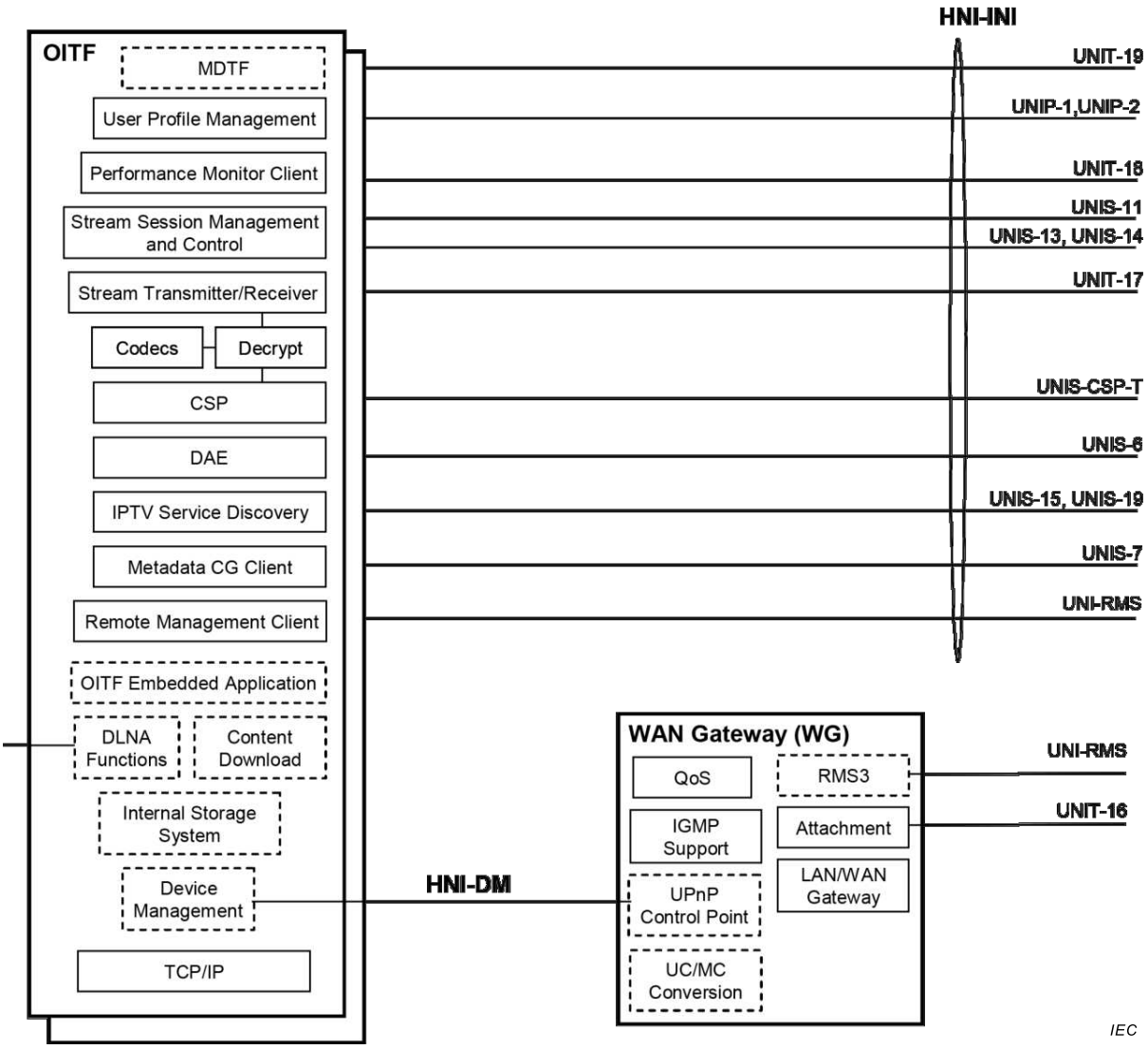

Figure B.3 – OITF functions and exposed interfaces

The **OITF** functional entity shown in Figure B.3 includes the following functions.

- **User profile management**: manages subscription information associated with a specific user, e.g., viewing preferences. The user profile management functions include the ability to create, fetch, modify, delete, and replace user profiles.

- **Stream session management and control**: initiates and terminates content delivery sessions. Manages content delivery sessions, including trick play control of unicast streams and multicast stream control. It applies to both the unmanaged and the managed models.
- **Stream transmitter/receiver**: receives streamed content from the network and includes stream buffering in the case of progressive download. It also transmits real-time audio and video in the case of multimedia telephony. The function applies to both the managed and unmanaged models, although different technologies might be chosen for each case.
- **Codecs**: A/V codecs for all streamed and downloaded content. It includes decoding, scaling and rendering functions.
- **CSP**: client side key management for the terminal centric approach to service protection and content protection. Enforces content usage rules in the client. It applies to both the managed and the unmanaged models. See CSP gateway functional entity for the alternative gateway centric approach to service and content protection.
- **Content download**: reception of content downloaded to the client in non-real time. Content download might be unicast or multicast. For multicast, the MDTF is used. Local storage is required for content download. It applies to both the managed and the unmanaged models. This function is optional.
- **MDTF (multicast data terminating function)**: this function receives generic data sent over multicast. Content types that can be distributed to MDTF include content guide data, static DAE content, video content, interactivity information, notifications, software releases and patches.
- **Decrypt**: removes any encryption applied to the content, under the control of the CSP function. This function is not used for unencrypted content. It applies to both the managed and the unmanaged models.
- **DAE (declarative application environment)**: a declarative language based environment (browser) based on CEA-2014 for presentation of user interface and including scripting support for interaction with network server-side applications and access to the APIs of the other OITF functions.

  The specification of the DAE declarative language environment including the APIs available to the downloaded applications is within the scope of the Forum.

  The DAE can also query, internally to the OITF, the Metadata-based content guide client in order to extract any data it may contain.

  The downloaded applications that run in the DAE are considered to be service provider specific and therefore will not be defined by the Forum's specifications.
- **Metadata-based content guide client**: client for metadata-based content guides. The user interface including the presentation of metadata-based content guide is OITF vendor dependent and is out of scope of this document. This function may also make the metadata available to residential network devices via the DLNA functions function. It applies to both the managed and the unmanaged models.
- **Remote management client:** provides the client-side functions to remotely manage the OITF, for both provisioning and assurance purposes. The functions provided relate to configuration management (including firmware upgrade) and fault management (including troubleshooting and diagnostics). When realized as a standard TR-069 client, it uses the UNI-RMS interface (providing also performance monitoring). Otherwise, remote management is supported as a DAE application, which uses the UNIS-6 interface.
- **IPTV Service Discovery**: function for discovering IPTV service providers and related services. It applies to both the unmanaged and the managed models. Note that different aspects of DVB SD&S may apply to different models.
- **Integral storage system**: storage for content download and PVR based functions. This function is optional but will be required if content download is supported.
- **DLNA functions**: implements DLNA DMS functions to expose and distribute content in a DLNA compliant manner through the residential network. The DLNA functions function may also offer a DLNA DMP function to locate and select content available from other

DMS in the residential network. The selected content can be streamed across the residential network and rendered by the OITF. The DLNA functions may also support the DLNA RUI source capability (+RUISRC+) to provide remote UI content to the DLNA RUI pull controller capability (+RUIPL+), which can be used to support an ITF remote control function (IRCF). This function is optional.

- **OITF embedded application**: this optional function provides embedded applications for IPTV services, e.g. local PVR, using the standardized interfaces which are defined as UNI and HNI-IGI. The user interaction with this function is OITF vendor specific.
- **Performance monitor client**: client for providing feedback on service quality, for example, pixilation, frame loss, packet loss and delay (the exact information to be provided is to be specified in other specifications). It applies to both the managed and the unmanaged models.
- **Device Management**: this function acts as a UPnP device management client for remote management operations such as configuration management (including triggering of a software upgrade) and fault management (including troubleshooting and diagnostics).

The **WAN gateway** functional entity shown in Figure B.3 contains the following functions:

- **LAN/WAN gateway**: supports the physical termination of the access network (e.g. xDSL, GPON etc.) and the layer 2, layer 3 and higher services (such as NAT, IGMP proxy-routing) required to support IPTV and other services terminated in the residential network that share the WAN connection.
- **Attachment**: the attachment function is responsible for the attachment of the residential network to the network provider.
- **RMS3**: Depending on the provider model, the WAN gateway may be remotely monitored and configured by the access service provider. The RMS function supports the interface to the remote manager (i.e. TR-069 CWMP remote management protocol plus TR-098 device data model with possible extensions.)
- **QoS:** the QoS function provides classification, marking, re-marking, policing, and queuing of Ethernet and IP traffic that goes between the WAN and LAN interfaces. Marking and re-marking of Ethernet priority and Diffserv code points (DSCP) is supported. Classification can occur through a variety of characteristics of IP traffic, including Ethernet priority, DSCP, origination and destination IP address, and application protocol.
- **IGMP support**: provides the functions for IGMP proxy and IGMP snooping. The IGMP proxy allows multiple in-home devices in the residential network to be able to join the same multicast stream. IGMP snooping is the process of listening to IGMP traffic to allow, when present, the switch to "listen in" on the IGMP conversation between hosts and routers by processing the layer 3 IGMP packets sent in a multicast network to avoid flooding (see section 5.3.3.1 of [1]).
- **UN/MC conv**: the WAN gateway may have this function to avoid some problems due to the low efficiency and unreliability of multicast on wireless networks. This function is not specified in the release 1 solution.
- **UPnP control point:** the UPnP control point interacts with the UPnP device management client in the OITF for remote management operations.

B.4.3 OITF and IG

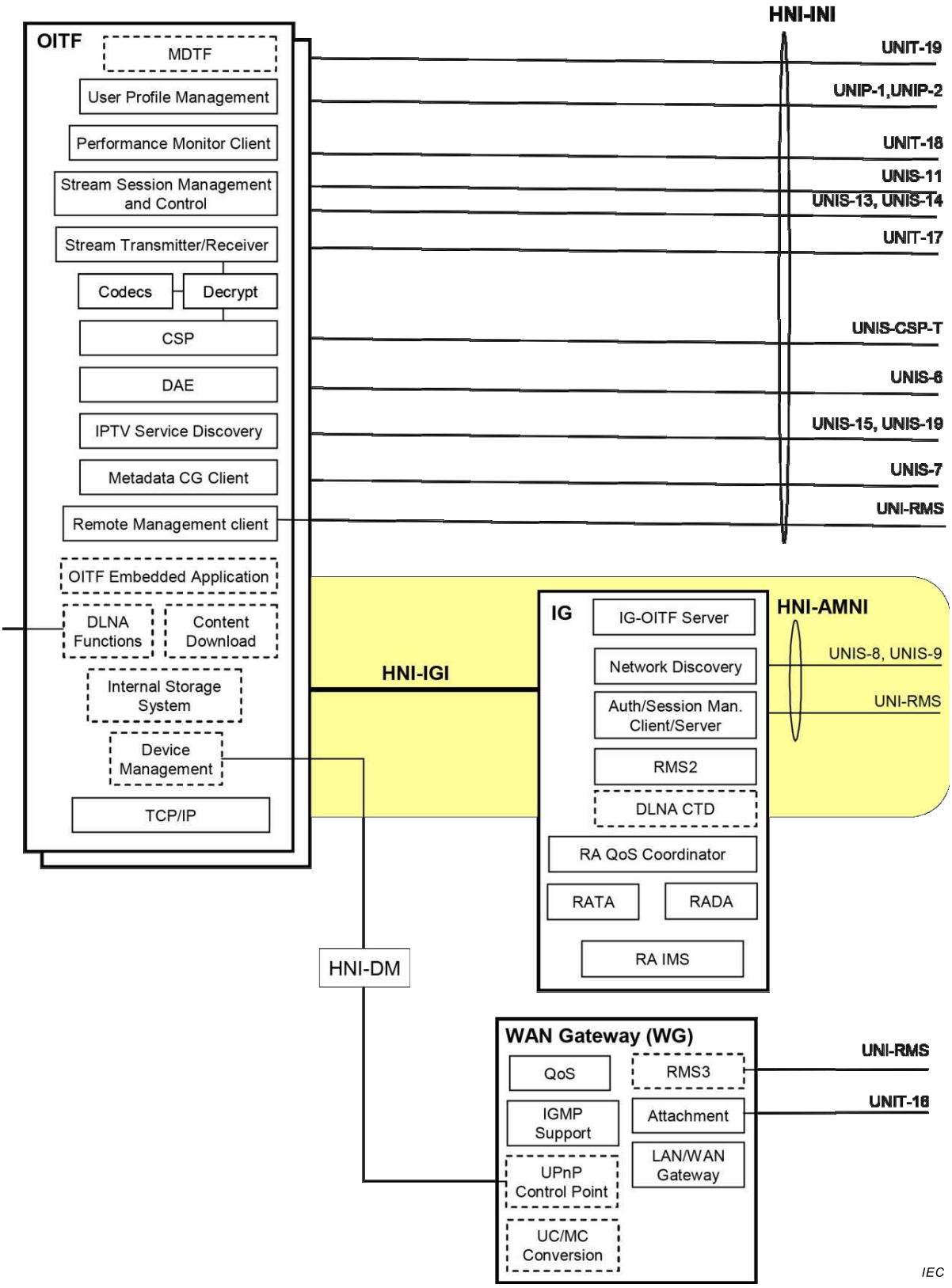

Figure B.4 – OITF and IG

In a device that implements both the OITF and IG, the use of the HNI-IGI interface is optional.

The IG depicted in Figure B.4 includes the following additional functions with respect to the IMS gateway (IG):

- **Authentication/session management client/server**: responsible for subscriber authentication and any session management required for managed networks (e.g., managed IPTV services and person-to-person communication services). The authentication performed by this function is (re-) used for content and service protection (CSP) purposes.

  The authentication/session management client/server interacts with the network servers through the UNIS-8 interface.

  This function includes the implicit connectivity admission control (CAC) request for the WAN side. No explicit CAC function is required on the LAN side.

- **IG-OITF server**: the IG-OITF server exposes authentication and session management client/server functionalities to the OITF for managed IPTV services and blended person-to-person communication application support (e.g., caller id display, messaging etc.) via HTTP and/or other protocols as required. If required, the interaction between the IG-OITF Server and the OITF may result in a UI on the OITF display or the delivery of execution script(s) to the DAE function on the OITF.

- **RMS2**: client application for remote management functions in a managed environment. It provides a standard interface for provisioning and assurance tasks on managed devices with the IG function (i.e. TR-069 CWMP remote management protocol, plus TR-104 IMS data model with possible extensions). It includes functions for configuration management, firmware upgrade, troubleshooting/diagnostics, performance management and monitoring of IMS/SIP services.

- **Network discovery**: network discovery function is responsible for the discovery of and attachment to an IMS service provider.

- **Remote access discovery agent (RADA)**: the remote access discovery agent manages the DLNA device discovery procedure between the remote device and DLNA devices in the residential network. The RADA maps to the following functional components in the UPnP RA architecture (RADA Sync, RADASync CP, Inbound Connection Config, RADA Listener/Relay and RADA Config).

- **Remote access transport agent (RATA)**: the remote access transport agent is used during the key exchanges for setting up IPSec-based security over the IMS tunnel between the remote device and the residential network. The RATA maps to the following functional components in the UPnP RA architecture (RA Transport Agent, RATA Config).

- **Remote access for establishing IMS tunnel (RA-IMS)**: this handles the IMS procedures for session setup, modification and termination (including the QoS aspects) between the remote device and the residential network.

- **QoS Coordinator:** this maps the procedures between the DLNA QoS and the IMS QoS to coordinate the QoS on the IMS side with that on the UPnP side to ensure end-to-end QoS between the UPnP RA-enabled device in the residential network and the remote device.

- **DLNA content transformation device (DLNA CTD)**: this optional function provides media transformation, e.g. transcoding for remote access. The DLNA content transformation device implements the DLNA media interoperability unit (MUI) device class or DLNA devices which implement the DLNA virtual device functionality with content transformation function.

B.4.4 OITF, IG, AG and CSPG

B.4.4.1 Residential network

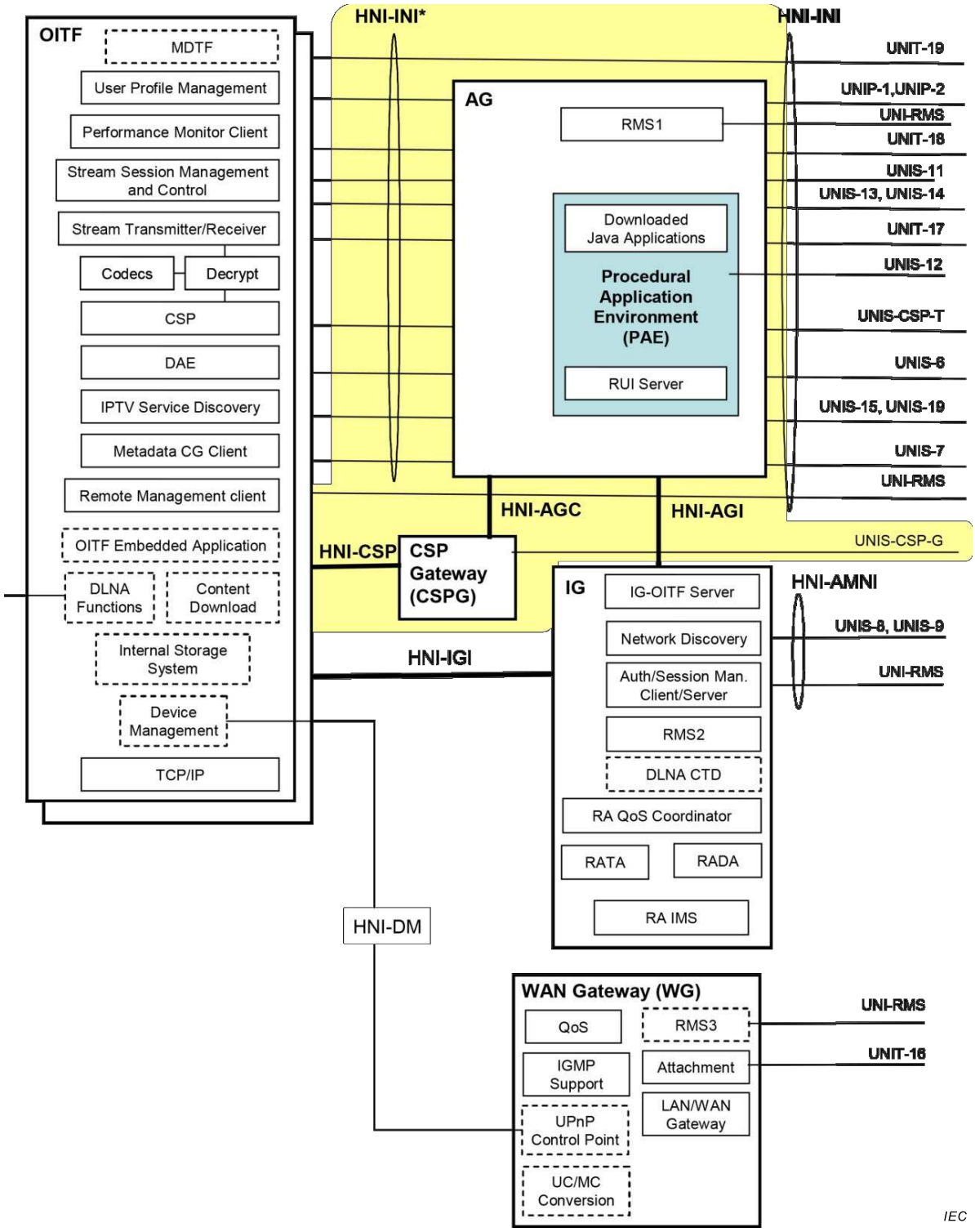

Figure B.5 – All HN functional entities

A residential network with the addition of the optional application gateway and the optional CSP gateway functional entities is depicted in Figure B.5. This represents a residential network with all the HN functional entities. The AG and CSPG are independent optional functional entities that may be required in a specific residential network configuration. Additional functions are identified in B.4.4.2.

B.4.4.2 Application gateway (AG)

- **Procedural application environment (PAE)**: a local procedural language execution environment based on Java connected device configuration (CDC) for IPTV service provider-specific downloaded applications. If required, these applications can present a UI via the CEA-2014 based Remote UI function on the OITF's DAE. When the PAE is deployed in a device with local graphics rendering (e.g., combined with an OITF), these applications also can also directly access that local graphics system.

  The definition of the full capabilities of the PAE is within the scope of the Forum's specifications. The specification of the service provider specific applications that are downloaded and executed in the environment are outside of the scope of the Forum's specifications.

  The PAE is a multipurpose execution environment capable of supporting many IPTV-specific and general services. These capabilities include support of the following service provider-specific applications:

  – **Media control**: enables the service provider to locally intercept the media stream (media, control, CSP) for the purpose of adding or inserting content generated or stored in the AG into that media stream. The operation of media control shall be under the control of applications running in the PAE via defined APIs.

    Note that for protected content, this is only possible when the AG and the CSPG are combined in the same device and that the IPTV solution does not define the routing of media content (for the purposes of media control) via an AG which is not also a CSPG.

  – **CG**: client with the following functions:

    i) discovery and description of available services and content;

    ii) at least one of the following:

      a) presentation of a CG on the OITF via the DAE;

      b) passing all or some subset of the metadata to the "Metadata CG client" on the OITF, depending on the policy of either the Service Platform Provider or the IPTV Service Provider; note that this is not addressed in the release 1 specifications;

      c) when present, this application terminates the UNIS-7 interface in addition to the CG application client in the OITF, which also directly handles the UNIS-7 interface.

  – **IPTV Service Discovery:** client with the following functions:

    i) discovery of available service providers;

    ii) discovery and description of available services and content.

  – **Fully blended communication services**: possibly requiring additional hardware to support advanced applications such as video telephony. The HNI-AGI interface allows applications in the AG implementing advanced communication services to access the authorization and session management functions in the IG.

  – **RUI Server**: this function enables applications running in the PAE to serve declarative language applications running on the DAE in the OITF.

  – **Proprietary or non-standard content download protocols:** implementation of proprietary, non-standard or other service provider-specific protocols in a PAE application.

RMS1: Client application for remote management functions in a managed environment. It provides a standard interface for provisioning and assurance tasks on managed devices with the AG function (i.e. TR-069 CWMP remote management protocol, plus TR-135 /TR-140 IPTV/storage data model with possible extensions). It includes functions for configuration management, firmware upgrade, troubleshooting/diagnostics, performance management and monitoring of streaming services.

B.4.4.3 CSP Gateway (CSPG)

The CSP gateway is required when a gateway centric approach to service and content protection is deployed as an alternative to the Marlin based CSP functions of the OITF. A secure authenticated channel is used between the CSPG and the OITF.

Bibliography

[1] Open IPTV Forum, *Functional Architecture – V2.0*, September 2009

[2] Open IPTV Forum, *Services and Functions for Release 2*, V1.0, October 2008

[3] ITU-T Recommendation Y.1910 (2008), *IPTV Functional Architecture*

[4] ITU-T Recommendation H.720 (2008), *Overview of IPTV terminal devices and end systems*

[5] ITU-T Recommendation H.264, *Advanced video coding for generic audiovisual services*

[6] ISO/IEC 13818-1:2015, *Information technology – Generic coding of moving pictures and associated audio information – Part 1: Systems*

[7] ISO/IEC 23009-1:2014, *Information technology – Dynamic adaptive streaming over HTTP (DASH) – Part 1: Media presentation description and segment formats*

[8] ISO/IEC 14496-12:2012, *Information technology – Coding of audio-visual objects – Part 12: ISO base media file format*

[9] ETSI TS 102 034 V1.5.1 (2014-05), *Digital Video Broadcasting: Transport of MPEG-2 Based DVB Services over IP Based Networks*

[10] ETSI TS 102 539, *Digital Video Broadcasting (DVB);Carriage of Broadband Content Guide (BCG) information over Internet Protocol (IP)*

[11] Consumer Electronics Association CEA-2014-A (including the August 2008 Errata), Web-based Protocol Framework for Remote User Interface on UPnP Networks and the Internet (Web4CE)

[12] IEC 62481-1:2007, *Digital living network alliance (DLNA) home networked device interoperability guidelines – Part 1: Architecture and protocols*

[13] Broadband Forum TR-098, Internet Gateway Device Data Model for TR-069

[14] Broadband Forum TR-104, DSLHome™[3] Provisioning Parameters for VoIP CPE

[15] Broadband Forum TR-135, Data Model for a TR-069 Enabled STB

[16] W3C CSS TV Profile 1.0, http://www.w3.org/TR/css-tv

[17] ECMAscript Language Specification (Third Edition), December 1999, ECMA-262.pdf, http://www.ecma-international.org/publications/standards/Ecma-262.htm

[18] W3C Working Draft, XMLHttpRequest; Julian Aubourg et al, 6 December 2012.

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[3] DSLHome is the trademark of a product supplied by the DSL Forum. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

[19] Scalable Vector Graphics (SVG) Tiny 1.2 Specification, W3C Recommendation, 22 December 2008, http://www.w3.org/TR/2008/REC-SVGTiny12-20081222/

[20] W3C Candidate Recommendation, *HTML5*; Robin Berjon, Steve Faulkner, Travis Leithead, Erika Doyle Navara, Edward O'Connor, Silvia Pfeiffer, 6 August 2013

[21] ETSI, TS 102 728 V1.2.1 (2011-09), Digital Video Broadcasting (DVB); Globally Executable MHP (GEM) Specification 1.3 (including OTT and hybrid broadcast/broadband)

[22] 3GPP TS 24.237, IP Multimedia (IM) Core Network (CN) subsystem IP Multimedia Subsystem (IMS) service continuity; Stage 3

[23] Broadband Forum TR-069 Amendment 2, CPE WAN Management Protocol v1.1

[24] Open IPTV Forum, *Service and Platform Requirements*, V2.0, December 2008

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