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SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

IPTV multimedia services and applications for IPTV –
IPTV middleware

Web-based terminal middleware for IPTV services

Recommendation ITU-T H.730



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Recommendation ITU-T H.730

Web-based terminal middleware for IPTV services

Summary

Web-based terminal middleware (WBTM) defines the functional interfaces for high-level resource management over an IPTV terminal device and describes the structure of a web-based presentation engine, which basically supports IPTV multimedia application frameworks in the ITU-T H.76x series of Recommendations. Web-based IPTV terminal middleware is based on ITU-T IPTV functional architecture and ITU-T terminal devices in the H.72x series of Recommendations. ITU-T web-based IPTV terminal middleware is necessary to support basic and advanced interactive IPTV services for IPTV terminal devices.

This Recommendation also describes the general WBTM requirements for IPTV services and any additional functionality for basic and advanced IPTV services. Annex A summarizes the general requirements.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T H.730	2012-06-29	16

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IPTV services, IPTV terminal device, presentation engine, user agent, web-based terminal middleware.

FOREWORD

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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at <http://www.itu.int/ITU-T/ipr/>.

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Recommendation ITU-T H.730

Web-based terminal middleware for IPTV services

1 Scope

The purpose of web-based terminal middleware is to define a web-based presentation engine and the functional interfaces for high-level resource management over an IPTV terminal device [ITU-T Y.1901].

This Recommendation defines web-based terminal middleware, its general architecture and interfaces as required by IPTV services.

This Recommendation is based on the ITU-T H.72x series of Recommendations for the specifications of IPTV terminal devices and the ITU-T H.76x series of Recommendations for multimedia interactivity and web-related technologies.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- [ITU-T H.720] Recommendation ITU-T H.720 (2008), *Overview of IPTV terminal devices and end systems*.
- [ITU-T H.721] Recommendation ITU-T H.721 (2009), *IPTV terminal devices: Basic model*.
- [ITU-T H.760] Recommendation ITU-T H.760 (2009), *Overview of multimedia application frameworks for IPTV services*.
- [ITU-T H.761] Recommendation ITU-T H.761 v2 (2011), *Nested context language (NCL) and Ginga-NCL*.
- [ITU-T H.762] Recommendation ITU-T H.762 (2011), *Lightweight interactive multimedia environment for IPTV services*.
- [ITU-T H.763.1] Recommendation ITU-T H.763.1 (2010), *Cascading style sheets for IPTV services*.
- [ITU-T H.764] Recommendation ITU-T H.764 (2012), *IPTV services enhanced script language*.
- [ITU-T J.200] Recommendation ITU-T J.200 (2010), *Worldwide common core – Application environment for digital interactive television services*.
- [ITU-T Y.1901] Recommendation ITU-T Y.1901 (2009), *Requirements for the support of IPTV services*.
- [ITU-T Y.1910] Recommendation ITU-T Y.1910 (2008), *IPTV functional architecture*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 application [b-ITU-T Y.101]: A structured set of capabilities which provide value-added functionality supported by one or more services.

3.1.2 application programming interface (API) [b-ITU-T Y.110]: This is an implementation interface between equipment and a software module and which does not have any physical realization as it is internal to the equipment.

3.1.3 end user [ITU-T Y.1910]: The actual user of the products or services.

NOTE – An end user consumes the product or service. An end user can optionally be a subscriber.

3.1.4 IPTV terminal device [ITU-T Y.1901]: A terminal device which has ITF functionality, e.g., an STB.

3.1.5 IPTV terminal function (ITF) [ITU-T Y.1901]: An end user function associated with:

- a) receiving and responding to network control channel messages regarding session set-up, maintenance and tear-down;
- b) receiving the content of an IP transport from the network and rendering.

3.1.6 linear TV [ITU-T Y.1901]: A television service in which a continuous stream flows in real time from the service provider to the terminal device and where the user cannot control the temporal order in which content is viewed.

3.1.7 metadata [ITU-T Y.1901]: Structured, encoded data that describe characteristics of information-bearing entities to aid in the identification, discovery, assessment and management of the described entities.

3.1.8 middleware [b-ITU-T Y.101]: The mediating entity between two information elements. Such an element can be, for example, an application, an infrastructure component, or another mediating entity.

3.1.9 plug-in [ITU-T J.200]: A set of functionalities which can be added to a generic platform in order to provide additional functionality.

3.1.10 terminal device (TD) [ITU-T Y.1901]: An end-user device which typically presents and/or processes the content, such as a personal computer, a computer peripheral, a mobile device, a TV set, a monitor, a VoIP terminal or an audio-visual media player.

3.1.11 user agent [b-W3C WebArch]: One type of web agent; a piece of software acting on behalf of a person.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 script: A script is a program written in a scripting program language. Script is often interpreted from the source code. For example, a program written in ECMAScript is a script. On web-based terminal middleware for IPTV services, scripts are used in order to enable various services in IPTV terminal devices.

3.2.2 scripting program language: A scripting program language is a programming language that allows control of one or more software applications.

3.2.3 WBTM plugin: A WBTM plugin is software that may be added to generic web-based terminal middleware in order to provide additional functionality. WBTM plugins may be resident or be downloaded from the server side. The additional functionality provided by WBTM plugins can

be used by WBTM scripts. A WBTM plugin may be portable for service components, for a resource abstraction layer, for resources, or for none of these.

3.2.4 WBTM plugin API: These APIs are defined by the WBTM to call WBTM plugins to extend the functionalities and abilities provided by WBTM.

3.2.5 WBTM script: A script that is run on web-based terminal middleware in an IPTV terminal device and that enables one or more IPTV services, or a part of an IPTV service. The engine for WBTM scripts is recommended in the multimedia application framework series of Recommendations (ITU-T H.76x series). WBTM scripts may include lines to call additional functions that are implemented by WBTM plugins.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AM	Audience Measurement
API	Application Programming Interface
CAS	Conditional Access System
CSS	Cascading Style Sheet
DHCP	Dynamic Host Configuration Protocol
DOM	Document Object Model
DRM	Digital Rights Management
EPG	Electronic Programme Guide
HTML	Hypertext Markup Language
IDL	Interface Description Language
IGMP	Internet Group Management Protocol
LIME	Lightweight Interactive Multimedia Environment
MAFR	Multimedia Application Framework
MLD	Multicast Listener Discovery protocol
NCL	Nested Context Language
OS	Operating System
PIP	Picture In Picture
PVR	Personal Video Recorder
RAL	Resource Abstraction Layer
RSS	RDF Site Summary
RTP	Real-time Transport Protocol
SADS	Service and Application Discovery and Selection
SCP	Service and Content Protection
SI	Service Information
SNF	Service Navigation Function
SP	Service Provider
STB	Set-Top Box

TD	Terminal Device
TV	Television
VoD	Video on Demand
WBTM	Web-Based Terminal Middleware

5 Conventions

The following conventions are used in this Recommendation:

- The keywords "is required to" indicate a requirement which must be strictly followed and from which no deviation is permitted, if conformance to this Recommendation is to be claimed.
- The keywords "is prohibited from" indicate a requirement which must be strictly followed and from which no deviation is permitted, if conformance to this Recommendation is to be claimed.
- The keywords "is recommended" indicate a requirement which is recommended but which is not absolutely required. Thus, this requirement need not be present to claim conformance.
- The keywords "is not recommended" indicate a requirement which is not recommended but which is not specifically prohibited. Thus, conformance with this Recommendation can still be claimed even if this requirement is present.
- The keywords "can optionally" indicate an optional requirement which is permissible, without implying any sense of being recommended. This term is not intended to imply that the vendor's implementation must provide the option and the feature can be optionally enabled by the network operator/service provider. Rather, it means the vendor may optionally provide the feature and still claim conformance with this Recommendation.

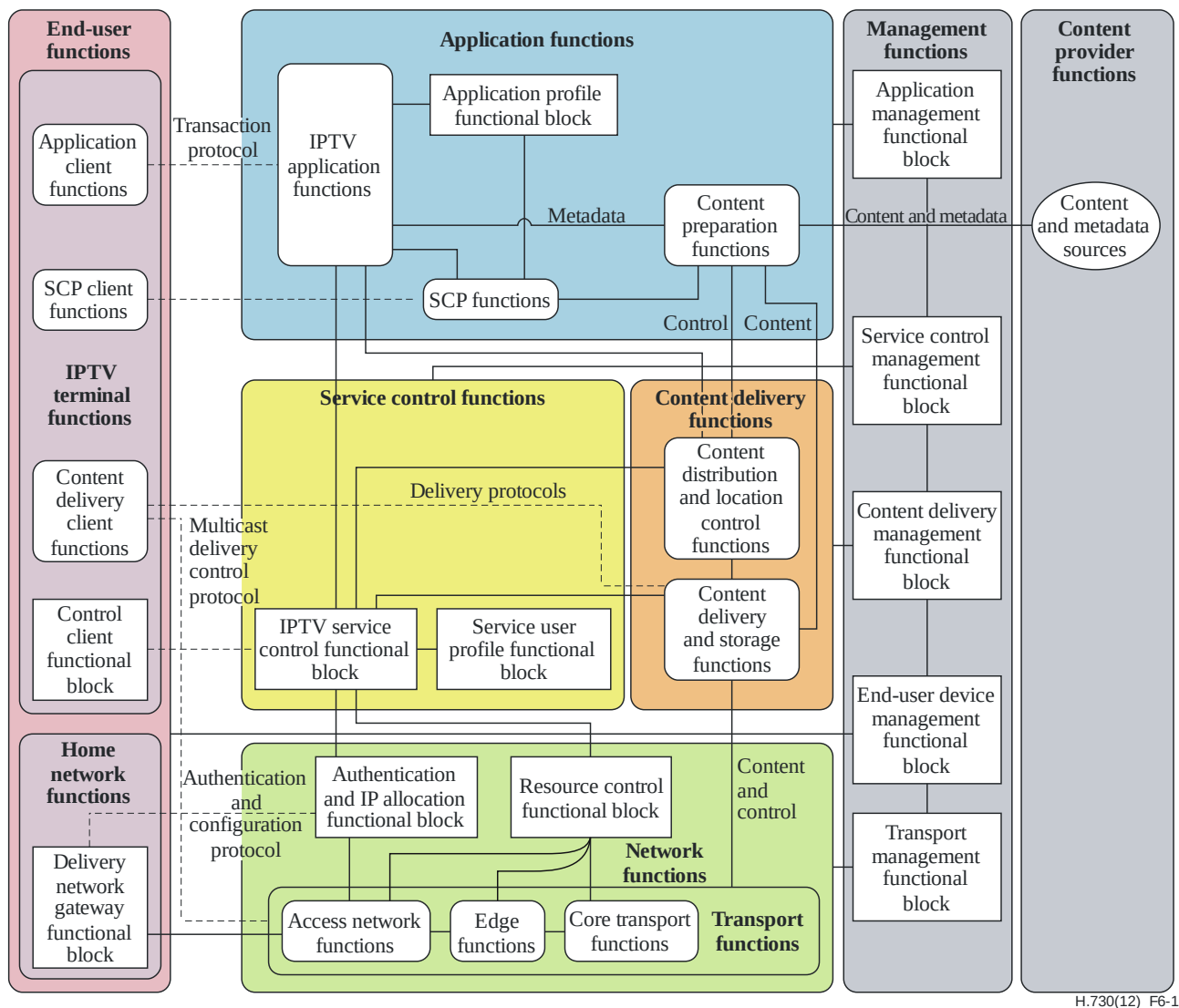
6 Introduction

Web-based terminal middleware is terminal middleware whose characteristic is that it has one central middleware which orchestrates various applications. This orchestrating middleware, generally called "browser" or "user agent", processes a structured document and an interpretive language, usually called a "script", to enable various services. This typical use of web-based services is described in [ITU-T H.760].

Web-based IPTV terminal middleware supports basic and advanced interactive IPTV services in IPTV terminal devices. It is required to review IPTV service requirements and architecture, as well as IPTV terminal devices. IPTV architecture is described in detail in the ITU-T Y.19x series of Recommendations, and IPTV terminals are described in the ITU-T H.72x series of Recommendations. Web-based IPTV terminal middleware is needed to define the interfaces on IPTV terminal functional architecture and the structure of the presentation engine. The presentation engine basically supports the ITU-T H.76x series of Recommendations.

6.1 Application and middleware in IPTV architecture

Figure 6-1 gives the overview of the functional architecture for an IPTV system.



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Figure 6-1 – IPTV functional architecture

According to [ITU-T H.720], terminal middleware is located on the terminal side. It is a mediating entity between two information elements in the terminal device, and WBTM could be various engines along with a set of high-level services (e.g., HTML, CSS, Lua and SESL [ITU-T H.764]).

According to [ITU-T H.720], IPTV terminal middleware is hardware-agnostic. As one type of implementation, WBTM in the IPTV terminal device provides various integrated functional blocks and APIs for high-level services, which could be programmed in a WBTM script or by other methods, to implement IPTV services with the integration of IPTV services such as VoD and linear TV.

6.2 Terminal middleware

Terminal middleware is the middleware which sits in the end user's premises and primarily enables IPTV terminal functions, see Figure 6-2. The terminal middleware in the IPTV terminal device is shown on the left-hand side.

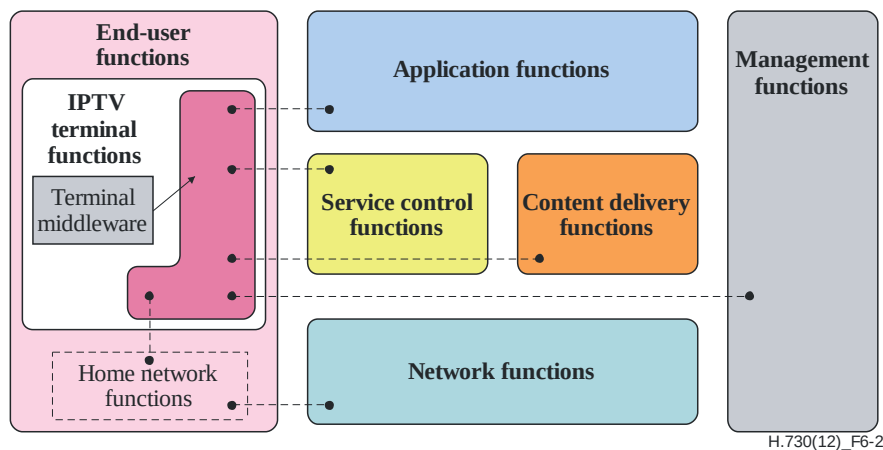


Figure 6-2 – IPTV terminal functions and terminal middleware

6.3 WBTM architectural overview

IPTV services can be deployed with web-based applications as well as middleware-based services for interactive IPTV data services. Many types of IPTV terminal device types can be used, which introduces a wide range of middleware environments: different middleware, application interfaces, content formats, etc. This heterogeneity makes service interoperability difficult. However, most devices have web-based standard user agents, which allow access to web content or support web applications. Therefore, web-based middleware can work as a common cross platform over different devices.

Also, IPTV services need to support seamless capabilities to users, regardless of device type, or across different service providers. Therefore, users can access the same IPTV service independently of the type of IPTV device. In this context, IPTV users and mobile IPTV users can enjoy the same services/applications over different IPTV devices for some types of services, e.g., social networking services, updated content notifications, etc. Therefore, IPTV services need to support interoperability for web-based applications among different devices.

To share such kinds of web applications or content over different IPTV devices, web-based middleware covers some service capabilities, as well as the web-based core engine.

Figure 6-3 gives the layered view of WBTM architecture.

Appendix I describes certain use cases of services using WBTM.

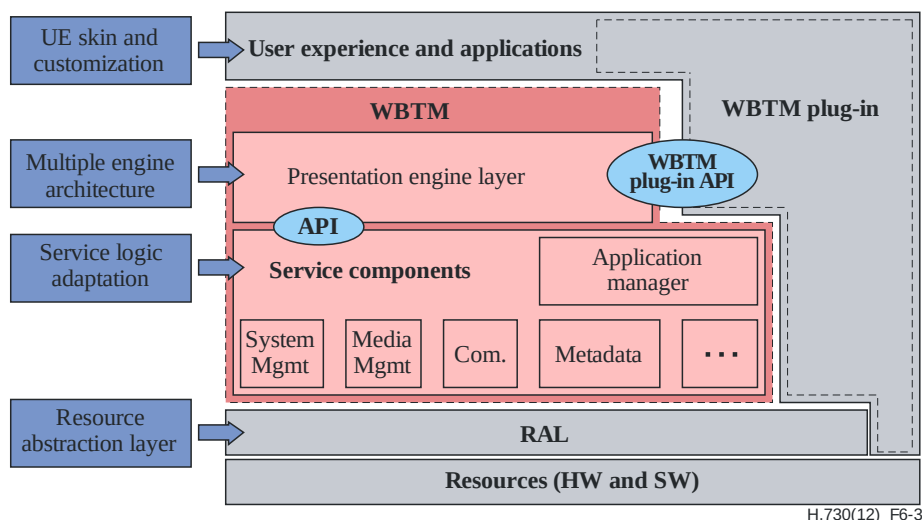


Figure 6-3 – Layered view of IPTV web-based terminal middleware architecture

7 Interfaces

Figure 7-1 shows the IPTV TD functional architecture recommended in [ITU-T H.720]. WBTM is recommended to have interfaces with those functions in IPTV TDs.

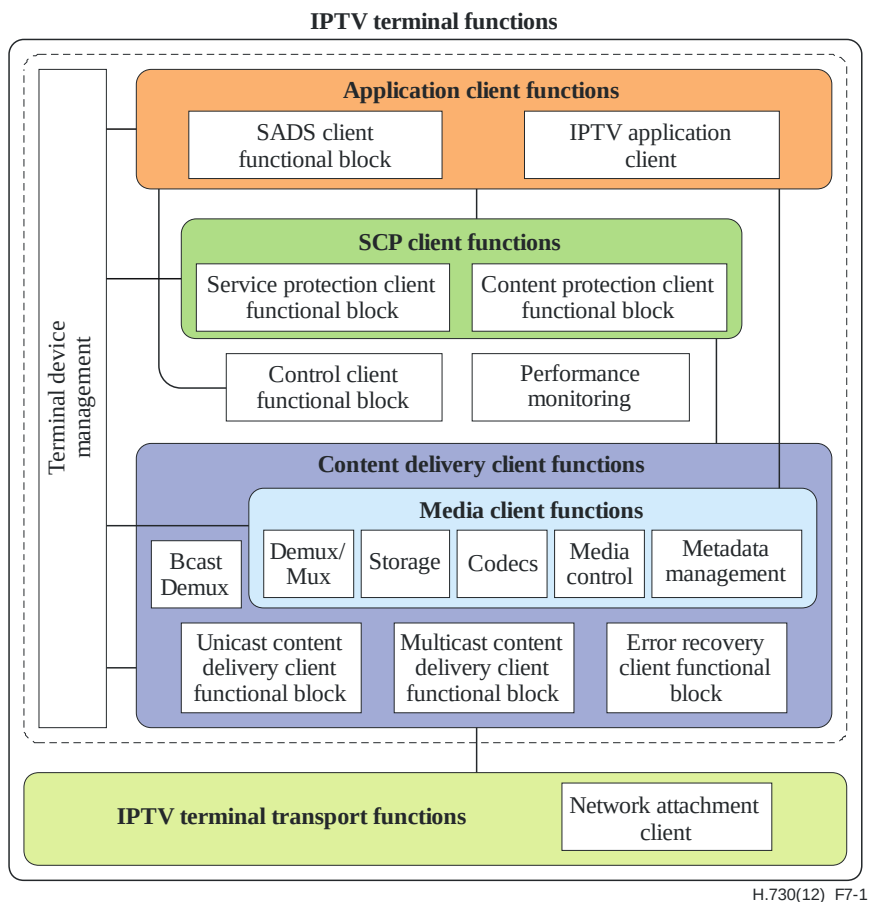


Figure 7-1 – Functional architecture block diagram of IPTV terminal devices [ITU-T H.720]

7.1 IPTV terminal transport functions interfaces

This is the interface between WBTM and the IPTV TD transport functions.

The handling of the IP-based connection between the delivery network gateway and IPTV TD, or between the IPTV network and IPTV TD is performed through this interface.

7.1.1 Network attachment client interface

This is the interface between WBTM and the IPTV TD network attachment client component.

In a web-based service discovery scenario, the network attachment client interface may be relevant. Otherwise, this lies beyond the scope of this Recommendation.

7.2 Content delivery client functions interface

This is the interface between WBTM and IPTV TD content delivery client functions.

Reception and control of content delivery from the content delivery and storage functions is enabled through this interface.

7.2.1 Broadcast demux interface

This is the interface between WBTM and an IPTV TD in a hybrid environment.

IPTV TD supports both IP content reception and non-IP content reception for terrestrial, cable or satellite broadcast services.

7.2.2 Multicast content delivery client functional block interface

This is the interface between WBTM and an IPTV TD multicast client functional block.

Multicast protocols, such as IGMP for IPv4 or MLD for IPv6, are handled through this interface.

7.2.3 Unicast content delivery client functional block interface

This is the interface between WBTM and the IPTV TD unicast content delivery client functional block.

For example, RTP and HTTP (for unicast content on-demand) are supported through this interface.

7.2.4 Error recovery client functional block interface

This is the interface between WBTM and IPTV TD error recovery client functional block.

This lies beyond the scope of this Recommendation.

7.3 Media client functions interfaces

This is the interface between WBTM and IPTV TD media client functions.

7.3.1 Media control interface

This is the interface between WBTM and the IPTV TD media control functional entity.

Control of video and audio components, as well as other components (such as metadata handling, content storage including PVR control, and play/reproduction of content including streaming data), is handled through this interface.

7.3.1.1 Video interface

This is the interface between WBTM and the IPTV TD video control component.

7.3.1.2 Audio interface

This is the interface between WBTM and the IPTV TD audio control component.

7.3.1.3 Other data format interface

This is the interface between WBTM and an IPTV TD for other multimedia data formats that are commonly used, such as text (i.e., closed caption) and graphics.

7.3.2 Storage interface

This is the interface between WBTM and the IPTV TD storage functional entity.

Caching and storage of content and other application data is enabled through this interface.

7.3.3 Metadata management interfaces

This is the interface between WBTM and the IPTV TD metadata management functional entity.

Accessing and retrieving metadata and management of the local cached metadata is enabled through this interface.

7.4 SCP client functions interfaces

This is the interface between WBTM and IPTV TD SCP client functions.

7.4.1 Service protection client interface

This is the interface between WBTM and the IPTV TD for the commonly used service protection function. This interface mediates service protection such as service authentication, service channel protection, etc.

7.4.2 Content protection client interface

This is the interface between WBTM and the IPTV TD for commonly used content protection functions. This interface mediates content protection functions such as content decryption, rights and keys management.

7.5 Application client functions interface

This is the interface between WBTM and IPTV TD application client functions. There are three types of application client functions:

- 1) Basic functions: applications include software components capable of enabling functional and observable behaviour. Examples include GUI, SNF, VoD controls, SCP applications and other service-related applications.
- 2) Management functions: some applications are responsible for basic management of the IPTV TD, such as power management and event management.
- 3) Service support functions: some applications are responsible for support services, including inter alia plugin applications, browser applications, media player applications or user agents in general.

7.5.1 IPTV application client interface

This is the interface between WBTM and IPTV TD application client functions.

This interface accesses the following service-specific functional blocks:

- 1) On-demand client functional block: This functional block interacts with its server-side counterpart to perform session management, service authorization, presentation of the content metadata, and execution of the service logic for on-demand applications.
- 2) Linear TV client functional block: This functional block interacts with its server-side counterpart to perform session management, service authorization, presentation of the content metadata, and execution of the service logic for linear TV applications.
- 3) Other client functional blocks: These functional blocks interact with the other server-side blocks relevant to the delivery and presentation of additional IPTV services and their content (e.g., games, distant learning, audience measurement), and for the support and management of modification, adaptation or integration of services and content (e.g., uploading through a USB client interface of a family picture with a particular template postcard provided from a server, or a video taken with a personal recorder with additional text).

7.5.2 SADS client functional block interface

This is the interface between WBTM and the IPTV TD service and application discovery and selection (SADS) client functional block.

This interface provides the end user's discovery and selection of IPTV services and applications.

7.6 Connection and session management interface

This is the interface between WBTM and the IPTV TD connection and session management.

7.7 Terminal device management interface

This is the interface between WBTM and the IPTV TD terminal device management functional entity.

Setting terminal configuration values, e.g., local configuration, network interface, AV interface, is enabled through this interface.

7.8 Performance monitoring interface

This is the interface between WBTM and the IPTV TD performance monitoring component.

8 Web-based engine structure

This clause identifies the modules that compose the structure of presentation engines for web-based IPTV terminal middleware. Web-based IPTV terminal middleware defines a user agent (e.g., browser and document renderer) as a presentation engine. Web-based middleware is based on web standards with declarative formats as illustrated in Figure 8-1.

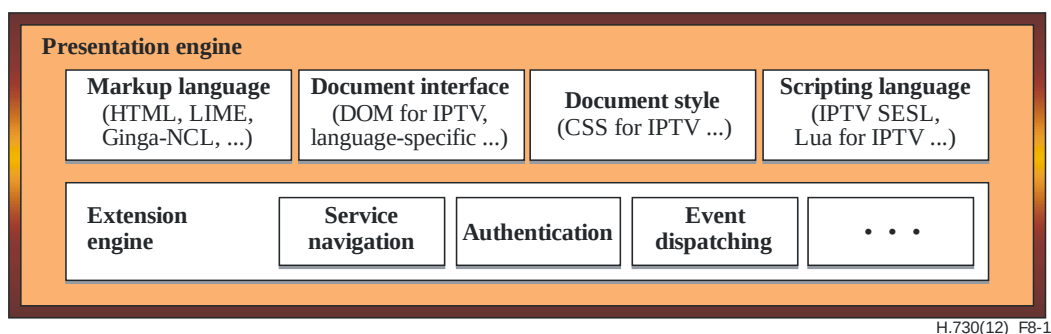


Figure 8-1 – Web-based engine structure

8.1 Markup language

Markup language support for IPTV applications includes a specialization of HTML for IPTV services (currently under study within ITU-T), LIME [ITU-T H.762] and Ginga-NCL [ITU-T H.761].

8.2 Document access interface

Document access interface is the interface specification that provides document access and editing, such as the DOM profile for IPTV (currently under study within ITU-T) or NCL editing commands in [ITU-T H.761].

8.3 Document style

Document style is the style description for web documents, such as the CSS profile for IPTV [ITU-T H.763.1].

8.4 Scripting language

The scripting language is the element that allows for embedding imperative behaviour to web documents, like the service enhanced script language (SESL) profile for IPTV in [ITU-T H.764] or the Lua profile for IPTV currently under study within ITU-T.