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SERIES J: CABLE NETWORKS AND TRANSMISSION OF TELEVISION, SOUND PROGRAMME AND OTHER MULTIMEDIA SIGNALS

Smart TV operating system

Smart television operating system – Functional requirements

Recommendation ITU-T J.1201

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Summary

Recommendation ITU-T J.1201 specifies the functional requirements for a smart television operating system (TVOS) over integrated broadcast and broadband (IBB) cable networks. A smart TVOS is intended to be installed in an IBB-capable cable set top box (STB) and television (TV) and to enable broadcasting and interactive services based on the Internet protocol (IP) provided by cable TV operators and third parties. By running a smart TVOS, the IBB-capable cable STB and TV are able to intelligently provide subscribers with advanced and personalized services by downloading and installing advanced and personalized apps from the platforms of cable operators and third parties, which are interconnected with them.

History

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Functional requirements, smart TV operating system, TVOS.

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Introduction

This Recommendation is the first in a series on a smart television operating system (TVOS). The Recommendations for this smart TVOS cover functional requirements, architecture, and security and application programming interfaces (APIs):

Smart television operating system – Functional requirements (ITU-T J.1201)

Smart television operating system – Architecture [b-ITU-T J.1202]

Smart television operating system – Specification [b-ITU-T J.1203]

Smart television operating system – Security framework [b-ITU-T J.1204]

Smart television operating system – Hardware abstract layer application programming interface [b-ITU-T J.1205]

Recommendation ITU-T J.1201

Smart television operating system – Functional requirements

1 Scope

This Recommendation specifies functional requirements for a smart television operating system (TVOS) over integrated broadcast and broadband (IBB) cable networks. The smart TVOS is intended to be installed in an IBB-capable cable set top box (STB) and TV and to enable broadcasting and interactive services based on the Internet protocol (IP) provided by cable TV operators and third-parties. By running the smart TVOS, the IBB-capable cable STB and TV are able to intelligently provide subscribers with advanced and personalized services by downloading and installing advanced and personalized apps from the platforms of cable operators and third-parties that are interconnected with them.

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 J.205] Recommendation ITU-T J.205 (2012), *Requirements for an application control framework using integrated broadcast and broadband digital television*.

[ITU-T J.218] Recommendation ITU-T J.218 (2007), *Cable modem IPv4 and IPv6 eRouter specification*.

[ITU-T J.295] Recommendation ITU-T J.295 (2012), *Functional requirements for a hybrid cable set-top box*.

[ECMA 262] ECMA-262 (2021), *ECMAScript® 2021 language specification*.

[W3C CSS2.1] W3C CSS2.1 (2011), *Cascading style sheets level 2 revision 1 (CSS 2.1) specification*.

[W3C DOM2 Core] W3C DOM2 Core (2030), *Document object model (DOM) level 2 core specification*.

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[W3C DOM2 Trav] W3C DOM2 Traversal and Range (2020), *Document object model (DOM) level 2 traversal and range specification*.

[W3C DOM2 Views] W3C DOM2 Views (2020), *Document object model (DOM) level 2 views specification*.

[W3C DOM3 Core] W3C DOM3 Core (2004), *Document object model (DOM) level 3 core specification.*

[W3C HTML5] W3C HTML5.2 (2017), *HTML5 A vocabulary and associated APIs for HTML and XHTML*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 integrated broadcast and broadband (IBB) DTV service [ITU-T J.205]: A service that simultaneously provides an integrated experience of broadcasting and interactivity relating to media content, data and applications from multiple sources, where the interactivity is sometimes associated with broadcasting programmes.

3.1.2 second screen [ITU-T J.295]: This refers to a display screen of mobile phones or other network-enabled devices that show services associated with the television screen.

3.1.3 social television [ITU-T J.295]: This is a general term for technology that supports communication and social interaction in either the context of watching television, or related to TV content. It includes the study of television-related social behaviour, devices and networks. Social television systems can for example integrate voice communication, text chat, presence and context awareness, TV recommendations, ratings, or video-conferencing with the TV content, either directly on the screen or by using ancillary devices.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 cable digital television service (cable DTV service): Any DTV service, delivered through cable.

3.2.2 dual-platform version of a smart television operating system (TVOS-C): TVOS software that supports both Java and web applications.

3.2.3 functional component interface: An interface for a software module in the functional component layer.

3.2.4 hardware abstraction interface: An interface for a software module in the hardware abstraction layer.

3.2.5 rich execution environment (REE): An extensible and versatile operating environment that brings flexibility and capability.

3.2.6 single-platform version of a smart television operating system (TVOS-H): TVOS software that supports only web applications.

3.2.7 start-up time: The interval between power-on and appearance of video and sound for an integrated broadcast and broadband -capable cable set top box and television.

3.2.8 smart television operating system (TVOS): A system software running on an integrated broadcast and broadband-capable (IBB-capable) cable set top box (STB) and television (TV) that is capable of managing hardware, software and data resources of the IBB-capable cable STB and TV, supporting and controlling the application software execution.

3.2.9 trusted execution environment (TEE): A secure area of the main processor in an integrated broadcast and broadband-capable cable set top box and television to ensure that sensitive data is stored, processed and protected in an isolated and trusted environment. It offers isolated safe execution of authorized security software providing end-to-end security by enforcement of

protected execution of authenticated code, confidentiality, authenticity, privacy, system integrity and data access rights.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

API	Application Programming Interface
AV	Audio/Video
DTV	Digital Television
EPG	Electronic Programme Guide
HAL	Hardware Abstraction Layer
HCI	Human-Computer Interaction
IBB	Integrated Broadcast and Broadband
IP	Internet Protocol
JS	JavaScript
REE	Rich Execution Environment
STB	Set Top Box
TEE	Trusted Execution Environment
TV	Television
TVOS	Television Operating System
TVOS-C	dual-platform version of a smart Television Operating System
TVOS-H	single-platform version of a smart Television Operating System
VOD	Video On Demand

5 Conventions

In this Recommendation:

The phrase "is required to" indicates a requirement that must be strictly followed and from which no deviation is permitted if conformity with this document is to be claimed.

The phrase "is recommended" indicates a requirement that is recommended but which is not absolutely required. Thus this requirement needs not be present to claim conformity.

The phrase "is prohibited from" indicates a requirement that must be strictly followed and from which no deviation is permitted if conformity with this document is to be claimed.

The phrase "can optionally" indicates 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 or service provider. Rather, it means the vendor may optionally provide the feature and still claim conformity with this Recommendation.

In the body of this document and its annexes, the words *shall*, *shall not*, *should*, and *may* sometimes appear, in which case they are to be interpreted, respectively, as *is required to, is prohibited from*, *is recommended* and *can optionally*. The appearance of such phrases or keywords in an appendix or in material explicitly marked as *informative* are to be interpreted as having no normative intent.

6 General requirements

6.1 System functional requirements

6.1.1 Cable digital television service

A smart TVOS is required to support playback of the content provided by broadcast DTV services as specified in [ITU-T J.295]. See also [b-GB/T 28160] and [b-ETSI EN 301 192].

6.1.2 Video-on-demand service

A TVOS is required to support playback of the content provided by IP-based video on demand (VOD) and pay-per-view services as specified in [ITU-T J.295], and shall support playback of the content provided by IP quadrature amplitude modulation-based VOD services.

6.1.3 Integrated broadcast and broadband digital television service

A TVOS is required to support playback of the content provided by IBB DTV services as specified in [ITU-T J.205]. See also [b-ETSI TS 102 809].

6.1.4 Local media playing

A TVOS is required to support playback of the medial files stored in the local storage medium of the IBB-capable cable STB and TV.

6.1.5 Media processing

A TVOS media processing is required to support unified media processing of both Java and web-based media applications, and is required to support video and audio decoder as specified in [ITU-T J.295]. See also [b-ISO/IEC 14496-12].

6.1.6 Electronic programme guide

A TVOS is required to support parsing and presentation of electronic programme guide (EPG) information as specified in [ITU-T J.295]. See also [b-GB/T 28161] and [b-ETSI TS 102 851].

6.1.7 Second screen interaction capability

A TVOS is required to have second screen interaction capabilities as specified in [ITU-T J.295].

6.1.8 Smart home

A TVOS is recommended to have smart home capabilities that can identify, establish connection with and control smart home devices.

6.1.9 Terminal control

A TVOS is required to have terminal control capability that can query, count, configure and monitor the information and parameters of the IBB-capable cable STB and TV, and report the information to the terminal control head-end, so that it can configure terminal restart and trigger software upgrade of the IBB-capable cable STB and TV as specified in [ITU-T J.295].

6.1.10 Management of subscriber information

A TVOS is required to support a gathering function of subscriber information including viewing history and application usage as specified in [ITU-T J.295].

6.1.11 Application software support

A TVOS-H platform is required to support web applications. A TVOS-C platform is required to support both Java applications and web applications.

6.1.12 Application management

A TVOS is required to support management functions of installation, uninstallation and updating applications through unidirectional broadcast network or IP network.

6.1.13 Upgrade support

A TVOS is required to support secure local system upgrade, and remote system upgrade through unidirectional broadcast network or IP network as specified in [ITU-T J.295].

6.1.14 Power saving

A TVOS is required to support power saving states of IBB-capable cable STB and TV as specified in [ITU-T J.295].

6.1.15 Dual-IPv4/v6 stack

A TVOS is required to have a dual-stack function to support both IPv4 and IPv6 as specified in [ITU-T J.218].

6.1.16 Social television

A TVOS is required to support social TV services as specified in [ITU-T J.295].

6.2 System architecture requirements

A TVOS is required to consist of a REE and TEE.

A TVOS REE is required to employ a hierarchical and modular software architecture that typically consists of five loosely coupled functional software layers of: kernel; hardware abstraction layer (HAL); functional component; execution environment; and application framework. Each functional software layer shall consist of multiple loosely coupled software modules. A TVOS TEE shall consist of the secure operating system, TEE HAL, and trusted application.

A TVOS functional component layer is required to support conveniently adding and tailoring components according to system functional requirements and is required to support multiple execution environments. TVOS functional components are required to be independent from each other.

A TVOS execution environment layer is required to support conveniently adding and tailoring execution environments. TVOS execution environments are required to be independent from each other. Each TVOS execution environment is required to have its own application framework.

A TVOS application framework layer is required to have independent application frameworks corresponding to execution environments.

A TVOS is required to support, independently, multiple types of applications such as Java applications and web applications.

6.3 Software code tree requirements

The TVOS code is recommended to be managed in a hierarchical manner and should be allocated carefully to create binary code for different platforms easily.

6.4 System interface requirements

To provide ease of application development and system extension, a TVOS is required to include application programming interfaces (APIs), functional component interfaces and hardware abstract interfaces. TVOS APIs are used to provide a common application environment for various IBB-capable cable STB and TV implementations; see [b-ETSI TS 102 809]. TVOS functional component interfaces are used to expand IBB-capable cable STB and TV functionalities.

TVOS hardware abstract interfaces are used to provide facility to extend the hardware of IBB-capable cable STB and TV. These purposes can be achieved by following example structures.

TVOS APIs include those for the web and Java.

TVOS Java APIs consist of functional interface units of the Digital Audio Video Council (DAVIC), unidirectional broadcast network access, broadcast protocol processing, bidirectional broadband access, human-computer interaction (HCI), audio/video (AV) setting, media processing, message management and application engine. The Java functional interface units implement Java native interface encapsulation for interfaces of software modules in TVOS functional component layers, and provide Java applications with invocation interfaces in Java object mode, and assist applications in implementing IBB DTV services such as an EPG channel list, and TV programme playing. TVOS Java APIs are recommended to be compatible with Android APIs.

TVOS web APIs consist of HTML5-related functional interface units and TVOS specific functional interface units.

The HTML5-related functional interface units support the HTML5 interface [W3C HTML5], cascading style sheet interface [W3C CSS2.1], JavaScript (JS) interface [ECMA 262] and document object model (DOM) interface [W3C DOM3 Core], [W3C DOM2 HTML], [W3C DOM2 Core], [W3C DOM2 Events], [W3C DOM2 Style], [W3C DOM2 Trav], [W3C DOM2 Views].

TVOS specific functional interface units consist of unidirectional broadcast network access, broadcast protocol processing, bidirectional broadband access, HCI, AV setting, media processing, message management, application engine, conditional access and broadcast information service units (see [b-ETSI EN 301 192]).

TVOS specific functional interface units implement JS interface encapsulation for interfaces of software modules in the TVOS functional component layer, and provide web applications with invocation interfaces in JS object mode, and assist applications in implementing IBB DTV services such as an EPG, channel list and TV programme playing.

There shall be some functional component interfaces that support invocation of the functional interface units of Java and web applications.

The hardware abstract interfaces mask the lower-layer hardware differences and allow functional components to invoke hardware functions through unified interfaces.

6.5 System security requirements

TVOS security is required to provide the following aspects: a TVOS security mechanism, security architecture, fundamental security capabilities and basic functionalities.

A TVOS security mechanism shall include a secure computational mechanism based on a TEE, a secure trust mechanism based on a digital certificate, a secure trust chain verification mechanism based on a secure chipset and hardware trust root as well as a video content protection mechanism based on a secure video path (see [b-OIFR-APP]).

TVOS security architecture should establish how TVOS fundamental security capabilities can be built and expanded based on TVOS software architecture and the security mechanism, and shall include the protection methods of runtime software security, which determine how TVOS system software and application software can be sandboxed.

TVOS fundamental security capabilities shall include hardware security, software security, network security, data security (see [b-ISO/IEC 23001-7]) and application security. The hardware security capability shall include a secure storage area and hardware trust root key, and shall support a TEE.

TVOS basic functionalities shall include content security, service security and payment security. TVOS basic functionalities also shall include secure upgrade and boot based on hardware security. TVOS basic functionalities shall be able continuously to be enhanced and expanded through the

improvement of TVOS fundamental capabilities and addition of more secure functional components.

6.6 Performance requirements

6.6.1 Start-up time requirements

With typical hardware configuration or computational environment support, a TVOS with basic software settings is recommended to support an IBB-capable cable STB with a time interval between power-on and appearance of the first screen of a few seconds, and a TVOS with basic software settings is recommended to support an IBB-capable cable STB with the minimized start-up time so that viewers' viewing experiences are not impaired.

6.6.2 Live channel switching time requirements

With a typical hardware configuration or computational environment support, a TVOS with basic software settings is recommended to support an IBB-capable cable STB with minimum switchover time between high definition channels.

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