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MULTIMEDIA SIGNALS

Application for Interactive Digital Television

Architecture for an application control framework using integrated broadcast and broadband digital television

Recommendation ITU-T J.206



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Architecture for an application control framework using integrated broadcast and broadband digital television

Summary

Consumer electronics devices are more and more connected every day. This tendency has also reached digital television (DTV) receivers, Blu-ray players, personal video recorder (PVR) devices and even games consoles.

Taking advantage of the increasing broadband availability, consumer electronics manufacturers are embedding in their products applications that are able to retrieve content from proprietary services available through the Internet. Additionally, computational capabilities and increasing persistent storage availability in these devices will allow end users to customize their devices by installing new applications; this is already occurring with mobile phones, tablets and games consoles.

In the same way, DTV broadcasters are extending their systems in order to use broadband availability to improve their services by adding interactive non-linear and on-demand content to the services they traditionally offer.

However, most of the current solutions are closed/proprietary solutions and focused on each industry's specific problems.

In alignment with Recommendation ITU-T J.205, *Requirements for an application control framework using integrated broadcast and broadband digital television*, this contribution proposes a study on the architecture and implementation for an application control framework for DTV enabled devices. This framework would be responsible for managing and controlling the interactive content and applications available through DTV services, installed by the end user or embedded by the device manufacturer, and providing a unified execution environment for them.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T J.206	2013-03-01	9

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

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Recommendation ITU-T J.206

Architecture for an application control framework using integrated broadcast and broadband digital television

1 Scope

This Recommendation defines a high-level architecture for an application control framework based on integrated broadcast and broadband (IBB) digital television (DTV) services intended to harmonize the behaviour and the interaction of a variety of types of applications, provided by network agnostic delivery mechanisms which include broadcast delivered, broadband delivered, pre-installed, delivered via application repository and home area network delivered.

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.200] Recommendation ITU-T J.200 (2010), *Worldwide common core – Application environment for digital interactive television services*.
- [ITU-T J.205] Recommendation ITU-T J.205 (2012), *Requirements for an application control framework using integrated broadcast and broadband digital television*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

- 3.1.1 application** [ITU-T J.205]: Any active DTV service content aimed at end-user interaction.
- 3.1.2 application catalogue** [ITU-T J.205]: Data structure listing available applications (interactive content). This data structure is local to the IBB DTV receiver, and describes the IBB applications installed on the IBB DTV receiver.
- 3.1.3 application catalogue user interface** [ITU-T J.205]: A user interface functionality over the IBB DTV receiver, intended to allow the end user to browse the available applications in the application catalogue or to query application catalogues exposed by application repositories. Also, it lists applications that are currently available in the selected IBB DTV service or broadcast DTV service.
- 3.1.4 application component** [ITU-T J.205]: A block of data that forms part of an application. Application component types are: code, resources, metadata, control and user settings.
- 3.1.5 application control data structure** [ITU-T J.205]: Data structures transmitted within the integrated broadcast and broadband (IBB) DTV service to control IBB applications (e.g., AIT in [b-GINGA-J], [b-MHP]).
- 3.1.6 application installation package** [ITU-T J.205]: Application delivery mechanism in which several application components are bundled together in a single file.

3.1.7 application repository [ITU-T J.205]: Entity, reachable through the broadband channel, that provides access to integrated broadcast and broadband (IBB) applications contained in it. These IBB applications can be downloaded and installed on the IBB DTV receiver, manually, by the end user, or, in case of being signalled within an IBB DTV service, launched or installed automatically under the IBB DTV service's control using the IBB application control mechanism. An application repository can be managed by IBB service providers, IBB DTV receiver manufacturers, or other third party entities.

3.1.8 bridge elements [ITU-T J.200]: A mechanism for applications that allows bidirectional mapping between execution engine and presentation engine.

3.1.9 broadband channel [ITU-T J.205]: A medium used to deliver interactive content. Usually this medium is based on the Internet and allows the delivery of non-linear and on-demand content. A broadband channel allows access to servers that may be located in the Internet.

3.1.10 broadcast channel [ITU-T J.205]: A medium used to deliver digital television (DTV) services. Examples: free to air, satellite and cable.

3.1.11 broadcast DTV service [ITU-T J.205]: Any digital television (DTV) service, delivered through a broadcast channel.

3.1.12 cable IBB DTV service [ITU-T J.205]: An integrated broadcast and broadband digital television (DTV) service managed by cable operators.

3.1.13 DTV service [ITU-T J.205]: This is the unit for delivering audio-visual content to the end users. In a more extensive definition (the one adopted in this Recommendation), this unit also comprehends the delivery of interactive content. It constitutes an editorially consistent whole and it is an aggregation of different kinds of service components.

3.1.14 DTV service component delivery mechanism [ITU-T J.205]: Used to refer to any mechanism, channel or medium to deliver digital television (DTV) service components to an integrated broadcast and broadband (IBB) DTV receiver.

3.1.15 DTV service content [ITU-T J.205]: Audio/visual/interactive components delivered within a digital television (DTV) service as single editorially consistent whole.

3.1.16 execution engine [ITU-T J.200]: A subsystem in a receiver that evaluates and executes procedural applications consisting of computer language instructions and associated data and media content. An execution engine may be implemented with an operating system, computer language compilers, interpreters and application programming interfaces (APIs), which a procedural application may use to present audiovisual content, interact with a user, or execute other tasks that are not evident to the user. A common example of an execution engine is the JavaTV software environment, using the Java programming language and byte code interpreter, JavaTV APIs, and a Java virtual machine for program execution.

3.1.17 IBB application [ITU-T J.205]: An application that is meant to be handled and executed within an integrated broadcast and broadband (IBB) application control framework defined by this Recommendation. Such applications can have their application contents delivered using different application component delivery mechanisms.

3.1.18 IBB application control mechanism [ITU-T J.205]: A mechanism used by integrated broadcast and broadband (IBB) digital television (DTV) service providers to signal and control IBB applications associated to their respective IBB DTV services. The mechanism contemplates the transmission of an IBB DTV service's application control data structure within the IBB DTV service. Such data structure can support the signalling of IBB applications that are retrievable from the broadcast channel or through the broadband channel from HTTP servers or application repositories.

3.1.19 IBB DTV receiver [ITU-T J.205]: A device capable of receiving and displaying DTV services as well as integrated broadcast and broadband (IBB) DTV services.

3.1.20 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.

3.1.21 IBB DTV service provider [ITU-T J.205]: An entity (i.e., broadcasters) making available and delivering IBB DTV services.

3.1.22 IBB installable application [ITU-T J.205]: An integrated broadcast and broadband (IBB) application that can be downloaded and saved onto the IBB DTV receiver's persistent storage for later usage.

3.1.23 IBB resident application [ITU-T J.205]: An integrated broadcast and broadband (IBB) application embedded into the IBB DTV receiver by the device manufacturer.

3.1.24 presentation engine [ITU-T J.200]: A subsystem in a receiver that evaluates and presents declarative applications consisting of content, such as audio, video, graphics, and text, primarily based on presentation rules defined in the presentation engine. A presentation engine also responds to formatting information, or "markup", associated with the content, to user inputs, and to script statements, which control presentation behaviour and initiate other processes in response to user input and other events. A common example of a presentation engine is an HTML browser, capable of displaying text and graphic content formatted in HTML [b-W3C HTML], with interactive behaviour programmed in ECMAScript [b-ECMAScript].

3.1.25 remote application catalogue [ITU-T J.205]: application catalogue exported from an application repository. This differs from the normal application catalogue in that, if the remote application catalogue is very large, there must be a mechanism for querying it and retrieving it in small parts that can be handled in an efficient way by the integrated broadcast and broadband (IBB) DTV receiver.

3.1.26 service associated IBB application [ITU-T J.205]: An application that is part of the integrated broadcast and broadband (IBB) DTV service tuned by the user at a given time.

3.1.27 service exclusive IBB application [ITU-T J.205]: An application that is listed as a component of an integrated broadcast and broadband (IBB) DTV service and its life cycle is strictly tied to the exhibition of such an IBB DTV service.

3.1.28 service shared IBB application [ITU-T J.205]: An application that is listed as a component of several different integrated broadcast and broadband (IBB) DTV services. Its life cycle is for as long as any of those IBB DTV services are being exhibited.

3.1.29 stand-alone IBB application [ITU-T J.205]: Resident or downloaded integrated broadcast and broadband (IBB) installable application that is not part of an IBB DTV service. Such an application can be created by an authorized IBB application provider, and typically delivered through the application repository.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 application descriptor file: A file containing metadata information for an application.

3.2.2 IBB application provider: An organization that makes available an IBB application; in the most common case, it is the application developer.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ACF	Application Control Framework
AIP	Application Install Package
AIT	Application Information Table
API	Application Programming Interface
AppCatUI	Application Catalogue User Interface
DAV	Distributed Authoring and Versioning
DRM	Digital Right Management
DSMCC DC	Digital Storage Media Command and Control – Data Carousel
DSMCC OC	Digital Storage Media Command and Control – Object Carousel
DTV	Digital Television
EPG	Electronic Programme Guide
HAN	Home Area Network
HTTP	Hyper Text Transfer Protocol
HTTPS	Secure Hyper Text Transfer Protocol
IBB	Integrated Broadcast and Broadband
NFS	Network File System
OSD	On-Screen Display
PVR	Personal Video Recorder
ROM	Read-Only Memory
RTP	Real Time Protocol
RTSP	Real Time Streaming Protocol
URL	Universal Resource Locator

5 Conventions

None.

6 Overall architecture

Based on the system analysis described in clause 7 of [ITU-T J.205], a system covered by this Recommendation should implement the overall architecture shown in Figure 6-1.

The DTV service provider broadcasts the DTV service in which IBB application components can be multiplexed for one or more IBB applications. At the same time, the DTV service provider can make available the same or different sets of IBB application components in a server or IBB application repository reachable through the Internet.

In the same way, other entities can make available IBB application components, as well as IBB application repositories.

The IBB DTV receiver has the capabilities to decode the DTV service and also support an implementation of the IBB application control framework (IBB ACF). The IBB ACF is the system's

component in charge of collecting IBB application components from several possible sources and interpreting and/or executing them in the IBB DTV receiver.

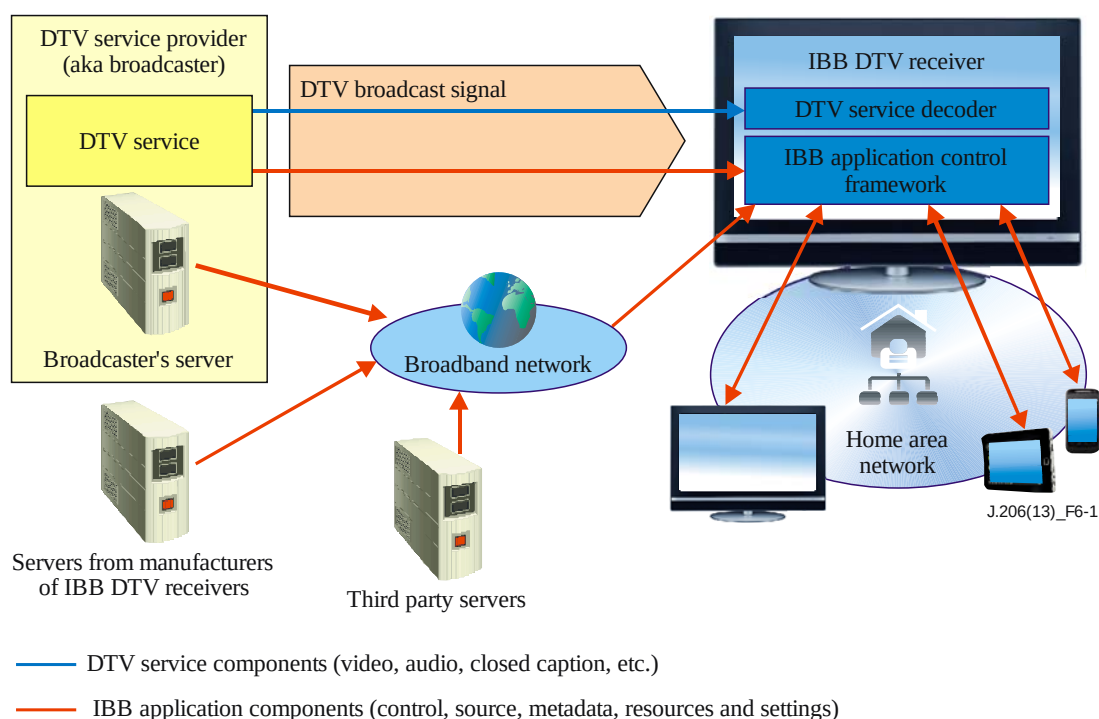


Figure 6-1 – Overview of the integrated broadcast and broadband system architecture

When the DTV service provider delivers the control type of the IBB application component, the IBB ACF will present the IBB application seamlessly integrated with the DTV service. In another case, if the user launches an IBB application that is not related to the DTV service (a stand-alone IBB application), the IBB ACF will handle the application in such a way that it is completely separate from the DTV service.

Figure 6-1 also depicts how the IBB application components can be delivered to the IBB DTV receiver using different channels and shows that they can also be shared among devices in the same home area network (HAN). For more details, refer to clause 8.3.

The architecture recommended in [ITU-T J.200] is used as a basis (FR-ACF-01 of [ITU-T J.205]) and extended by this Recommendation in order to fulfil additional requirements listed in this document.

This Recommendation also defines extensions to the presentation and execution engines as proposed by [ITU-T J.200] and described in [b-ITU-T J.201], [b-ITU-T H.761] and [b-ITU-T J.202].

6.1 The IBB application structure

An IBB application usually consists of a set of IBB application components (see Figure 6-2) classified in any of the following types:

- **Code:** compiled binary, byte code, script (etc.) executables.
- **Resources:** data files, fonts, images or any other content consumed by the application during code execution.
- **Metadata:** additional information associated with the application, containing information for the user and for application execution. Metadata can be classified as: