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STANDARDIZATION SECTOR
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J.205

Corrigendum 1

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

Application for Interactive Digital Television

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

Corrigendum 1

Recommendation ITU-T J.205 (2012) – Corrigendum 1

Recommendation ITU-T J.205

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

Corrigendum 1

Summary

Corrigendum 1 to Recommendation ITU-T J.205 provides corrections to properly identify some of the bibliographic references given within the text of the Recommendation. The full text of the Recommendation is reproduced and the corrections are identified with revision marks.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T J.205	2012-01-13	9
1.1	ITU-T J.205 (2005) Cor. 1	2013-01-18	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

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure, e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

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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 J.205

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

Modify the bibliographic references in clauses 3, 7.3, 7.5 and 8 of Recommendation ITU-T J.205 (2012) as shown below:

1 Scope

This Recommendation defines high-level requirements for an application control framework based on integrated broadcast and broadband (IBB) DTV services where broadcasters or cable operators are continually engaged with their network. This application control framework is intended to harmonize the behaviour and the interaction of a variety of types of applications, provided by network agnostic delivery mechanisms, including applications that are broadcast-delivered, broadband-delivered, pre-installed, installed via an application repository, or home area network delivered. This Recommendation is intended to define a baseline for such an integrated application framework.

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*.

3 Definitions

3.1 Terms defined elsewhere

None.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 application: Any active DTV service content aimed at end-user interaction.

3.2.2 application catalogue: 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.

3.2.3 application catalogue user interface: 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.

3.2.4 application component: A block of data that forms part of an application. Application component types are: code, resources, meta-data, control and user settings.

3.2.5 application component delivery mechanism: A mechanism, channel or medium used to deliver application components to an IBB DTV receiver.

3.2.6 application control data structure: Data structures transmitted within the integrated broadcast and broadband (IBB) DTV service to control IBB applications (e.g., AIT in [b-GINGA-Data Transmission][~~b-GINGA~~, [b-MHP]).

3.2.7 application install package: Application delivery mechanism in which several application components are bundled together in a single file.

3.2.8 application repository: 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.

3.2.9 authorized IBB application provider: An entity allowed to develop and provide integrated broadcast and broadband (IBB) applications within a given implementation of an IBB digital television (DTV) system.

3.2.10 broadband channel: 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.

3.2.11 broadcast channel: A medium used to deliver digital television (DTV) services. Examples: free to air, satellite and cable.

3.2.12 broadcast DTV service: Any digital television (DTV) service, delivered through a broadcast channel.

3.2.13 cable integrated broadcast and broadband DTV service: An integrated broadcast and broadband digital television (DTV) service managed by cable operators.

3.2.14 DTV service: 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.

3.2.15 DTV service component: Each one of the audio, visual or interactive elements that compose a digital television (DTV) service.

3.2.16 DTV service component delivery mechanism: 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.

3.2.17 DTV service content: Audio/visual/interactive components delivered within a digital television (DTV) service as single editorially consistent whole.

3.2.18 IBB application: 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.

3.2.19 IBB application control mechanism: 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.

3.2.20 IBB DTV receiver: A device capable of receiving and displaying DTV Services as well as integrated broadcast and broadband (IBB) DTV services.

3.2.21 IBB DTV service provider: An entity (i.e., broadcasters) making available and delivering IBB DTV services.

3.2.22 IBB installable application: An integrated broadcast and broadband (IBB) application that can be downloaded and saved onto the IBB DTV receiver's persistent storage for later usage.

3.2.23 IBB resident application: An integrated broadcast and broadband (IBB) application embedded into the IBB DTV receiver by the device manufacturer.

3.2.24 integrated broadcast and broadband (IBB) DTV service: 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.

3.2.25 remote application catalogue: 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.

3.2.26 service associated IBB application: An application that is part of the integrated broadcast and broadband (IBB) DTV service tuned by the user at a given time.

3.2.27 service exclusive IBB application: 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.

3.2.28 service shared IBB application: 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.

3.2.29 stand-alone IBB application: 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.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ACF	Application Control Framework
AIP	Application Install Package
AIT	Application Information Table
DAV	Distributed Authoring and Versioning
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
PVR	Personal Video Recorder
RTP	Real Time Protocol
RTSP	Real Time Streaming Protocol
UI	User Interface
URL	Universal Resource Locator

5 Conventions

None.

6 Motivation

With the increasing availability of broadband Internet access services, both consumer electronics manufacturers and DTV service providers have started taking advantage of this trend of providing connected devices and Internet services. The broadband technology also creates opportunities for players in other segments (such as Internet-based multimedia content providers, social networks, messaging, IP telephony, etc.) for delivering audio-visual-interactive content and connected applications to the living-room, traditionally restricted to TV broadcasters, cable TV and satellite TV service providers.

As this ecosystem evolves and quickly incorporates new players, recommendations and standardization on how the systems should be designed and implemented will ease the path of this evolution.

At the same time, the standardization of such a framework would help all players to meet their interests:

- Consumer electronics manufacturers would be able to provide connected-TV enabled devices with already integrated off-the-shelf applications. These devices could be extended and customized by the end user by installing additional downloadable applications.
- DTV broadcasters could improve their services by adding non-linear, on-demand, content to their offers and at the same time they could be taking full advantage of the broadband delivery channel for their IBB applications, thus optimizing bandwidth usage in their transport streams.
- Internet-based service providers could use a new channel to offer their services.

In all cases, a single platform would be used, simplifying and reducing the development effort for interactive content and applications.

7 Integrated broadcast and broadband system analysis

7.1 DTV services and IBB DTV services

A DTV service is the unit for delivering audio-visual content to the end users. In a more extensive definition (the one adopted in this document), 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:

- video;
- audio;
- closed caption, subtitles;
- service information (such as EPG info);
- interactive content (applications).

The most traditional case for delivering a DTV service is through a broadcast channel (free to air, satellite, cable, etc.). In this case all the DTV service components are transmitted together, in the same channel.

Due to the one-way nature of the broadcast channel, the broadcast DTV services are linear: exactly the same content is delivered to all the users at a given time.

With the widespread adoption of high-speed broadband Internet services, a new delivery channel becomes available, the broadband channel. This new channel not only allows the delivery of linear content but also, thanks to its two-way nature, non-linear (on-demand) content.

Both kinds of channels have their strong and weak points. By combining both of them, it is possible to deliver DTV services that can take advantage of all the strong points from each one. In this case, some DTV service components can be delivered through the broadcast channel and some other components can be delivered through the broadband channel. These kinds of services are considered to be IBB DTV services, see Figure 1.

As a general rule, this Recommendation will refer to the different ways (mechanism, channel and/or medium) for delivering DTV service components to an IBB DTV receiver as DTV service components delivery mechanism.

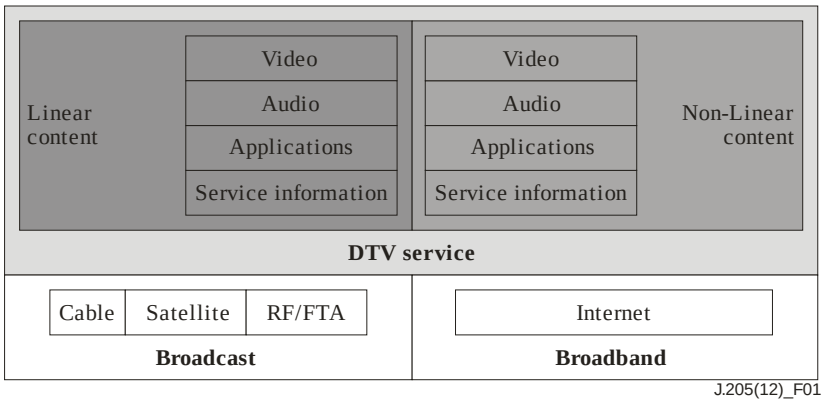

Figure 1 – IBB DTV service

7.2 Interactive content (applications)

Most DTV services' components are of a passive nature (this is for video, audio, closed caption, service information). They do not allow user interaction.

On the other hand, the nature of interactive content or applications is active as they are intended for the user to interact with them. Each interactive content or application usually consists of a set of the following application components (see Figure 2):

- **Code**: compiled binary, bytecode, script (etc.) executables.
- **Resources**: data files, fonts, images, or any other content consumed by the application during code execution.
- **Meta-data**: additional information associated to application execution, that may include: application description (unique identification, version, name, icon, provider, language, settings, etc.), how it should be presented (dimension on the screen, position, states, etc.), security (signature, certificates, etc.), minimal requirements (minimal middleware version, minimal receiver capabilities, etc.), etc.
- **Control**: signalling mechanism used by the application provider or the content provider in order to control when and how the application must be active/inactive, installed/removed, available/unavailable, visible/hidden, etc., or even if control must be left completely to the end user.
- **User settings**: configuration parameters that may define some application customization or store user's preferences for using this application. As an example, user settings can be used to customize the application user interface, the application behaviour and user personal data (name, age, gender, email, address, etc.).

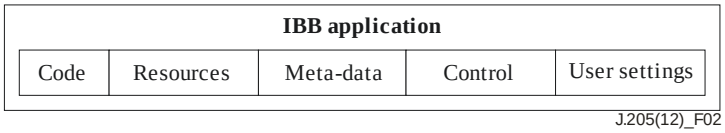

Figure 2 – IBB application components

The IBB application term is used to refer to applications conceived to be managed and executed within an IBB application control framework as defined by this Recommendation.

7.3 Delivery of application components

The possibility of using any combination of channels (broadcast and broadband) and application component delivery mechanisms for delivering the application components of an application, characterizes an IBB application.

Both [b-MHP] and [b-GINGA-Data Transmission]~~[b-GINGA]~~ already include mechanisms for supporting many types of combinations for delivering IBB applications. For instance, in [b-MHP] or in [b-GINGA-Data Transmission]~~[b-GINGA]~~, broadcast signalling done by the AIT may use the transport_protocol_descriptor's protocol_id number 3 (HTTP) to indicate the set of URLs (HTTP Servers on the Internet) from where the application's components must be downloaded. For additional details refer to FR-ACF-03 (see clause 8).

7.4 Service associated IBB applications and stand-alone IBB applications

As service associated IBB applications are part of IBB DTV services, they are delivered or listed as a component part of the DTV service (e.g., applications listed in the DTV Service's AIT).

On the other hand, stand-alone IBB applications are those that are not delivered within the DTV service. Usually, they would be manually launched by the end user from the application catalogue user interface. Applications delivered by any channel except the broadcast channel, such as user-installed IBB applications or resident IBB applications are usually (but not always) stand-alone IBB applications.

In some cases, the DTV service can include signalling for IBB installable applications or even IBB resident applications or application repository's IBB applications.

7.5 Service exclusive and service shared IBB applications

These concepts only apply to service associated IBB applications.

As commonly defined by most of the middleware specifications conformant with [ITU-T J.200] (and also with [b-MHP], [b-GEM], [b-GINGA-NCL], [b-GINGA_J], [b-ACAP], [b-OCAP], [b-ARIB B.23]), applications can be signalled whether they are bounded to the service or not. Defined rules are:

– Execution of service exclusive IBB applications (service bounded) must be terminated when the service exhibition is stopped.

– In case of service shared IBB applications (service unbounded) execution should continue in case of the same application being also signalled in the service that is selected next.

Both service exclusive and service shared IBB applications should be considered service associated IBB applications and should be terminated when no longer being signalled within the IBB DTV service.

8 Functional requirements for IBB DTV application control framework (ACF)

This clause provides a list of requirements that should be met by the IBB application control framework (ACF).

FR-ACF-01: Use the Recommendation ITU-T J.200 series as a basis for a new Recommendation of an ACF

The Recommendation ITU-T J.200 series already provides a major number of definitions for functional requirements, architecture and API that can also be used in the context of IBB applications and IBB DTV services.

The architecture recommended in [ITU-T J.200] should be used as a basis and extended by a new Recommendation in order to fulfil additional requirements listed in this document.

The new Recommendation should also consider extensions to the presentation and execution engines proposed by [ITU-T J.200] and described in [b-ITU-T J.201] and [b-ITU-T J.202].

FR-ACF-02: Coexistence and backward compatibility with current DTV systems adherent to Recommendations ITU-T J.200, J.201, H.761 and J.202

The ACF should be designed in a way to allow the coexistence of IBB applications with conventional broadcast applications, as already supported in [ITU-T J.200], [b-ITU-T J.201], [b-ITU-T H.761] and [b-ITU-T J.202], and applications in the IBB application model seamlessly. Gradual evolution from current DTV services to IBB DTV services should be possible in such a way that:

1) IBB applications could be ignored or not detected by already deployed receivers intended for conventional DTV services and with no support for IBB applications. This also applies to IBB DTV receivers that are not connected to a broadband connection.

2) IBB applications-enabled receivers should be capable of exhibiting content (especially interactive content) from conventional DTV services.

The end user experience when navigating through DTV services and IBB DTV services should be transparent, as much as possible [b-EBU-req].

FR-ACF-03: Support for delivering IBB applications using a combination of delivery mechanisms

The ACF should provide support for handling IBB applications on which their application components are delivered in a combination of the possible delivery mechanisms described in clause 7.3 (broadcast, broadband, stored, application repository and HAN), taking into consideration that:

Technologies already used in systems compliant with [ITU-T J.200] should be considered to be used as application component delivery mechanisms for the broadcast channel.

Any combination of these application component delivery mechanisms should be allowed. See Table 1.

Table 1 – Application components and applicable delivery transports

Application component	Delivery channel				
	Broadcast Ch.[a)]	**Broadband Ch.**	**Previously installed in the receiver's persistent storage**	**Via application repository**	**Home area network (HAN)**
Code	Yes – (mechanisms such as DSMCC DC/ OC, FLUTE)	Yes – (using http protocol; code can be delivered in packages such as zip, jar files or an application installation package)[c)]	Yes	Yes – (using http protocol; code can be delivered in packages such as zip, jar files or an application installation package)	Yes, using an application installation package
Resources	Yes – (mechanisms such as DSMCC DC/ OC, FLUTE)	Yes – (using http, https, rtp/rtsp protocols; resources can be delivered as series of files, streams or in packages such as zip, jar files or an application installation package as well)[c)]	Yes	Yes – (using http, https, rtp/rtsp protocols; resources can be delivered as single files or in packages such as zip, jar files or an application installation package as well)	Yes, using an application installation package. Media resources (such as pictures, music, video files, video streams or audio streams) could be shared by other devices in the HAN and used as application resources.

Table 1 – Application components and applicable delivery transports

Application component	Delivery channel				
	Broadcast Ch.[a)]	**Broadband Ch.**	**Previously installed in the receiver's persistent storage**	**Via application repository**	**Home area network (HAN)**
					(Using protocols such as http, https, rtp/rtsp , nfs, DAV, DLNA, etc.; resources can be retrieved as single files or streams)
Meta-data (such as application id, name, version, locations for retrieving other application components, etc.)	Yes – (using mechanism such as AIT table, DSMCC stream events or DSMCC DC/OC)	Yes – (using http protocol; this meta-data can be delivered as an application description file both as a single file or within packages such as zip, jar files or an application installation package)	Yes – (this meta-data can be stored as an application descriptor file both as a single file or within packages such as zip, jar files or an application installation package)	Yes – (this meta-data can be stored as an application descriptor file both as a single file or within packages such as zip, jar files or an application installation package)	Yes, using an application installation package
Meta-data (such as application signatures, certificate files, permission files, etc.)	Yes – (mechanisms such as DSMCC DC/OC, FLUTE)	Yes – (using http protocol; this meta-data can be delivered both as single files or within packages such as zip, jar files or an application installation package)[c)]	Yes – (this meta-data can be stored both as a single file or within packages such as zip, jar files or an application installation package)	Yes – (this meta-data can be stored both as a single file or within packages such as zip, jar files or an application installation package)	Yes, using an application installation package.

Table 1 – Application components and applicable delivery transports

Application component	Delivery channel				
	Broadcast Ch.[a)]	**Broadband Ch.**	**Previously installed in the receiver's persistent storage**	**Via application repository**	**Home area network (HAN)**
Control	Service associated IBB applications. (can be controlled by the IBB DTV service provider) (using mechanisms such as AIT table or DSMCC stream events)[b)]	Service associated IBB applications (can be controlled by the IBB DTV service provider)	Stand-alone IBB applications Launched by the user from the application catalogue user interface.	Stand-alone IBB applications Launched by the user from the application catalogue user interface.	Stand-alone IBB applications Launched by the user from the application catalogue user interface.
User settings	–	Yes – when the user can login using a previously registered account to the relevant servers.	Yes – stored as properties or custom files in the receiver's persistent storage.	Yes – when the user can login using a previously registered account in an application repository.	Yes – (using protocols such as http, https, rtp/rtsp, nfs, WebDAV, DLNA, etc.; to share properties among devices in HAN).

a) In this case, they can be transmitted using the mechanisms already provided by middleware specifications in conformance with [ITU-T J.200] such as [b-MHP], [b-ARIB B.24], [b-ARIB B.23] or [b-GINGA-Data Transmission]~~[b-GINGA]~~ (DSMCC OC, DSMCC DC and AIT) or [ITU-R BT.1888].

b) As an alternative, in order to clearly differentiate IBB Applications from conventional applications and preclude compatibility problems in already deployed devices, a mechanism accepted only by IBB DTV Receivers can be used for the Broadcast Channel (see requirement FR-ACF-02).

c) [b-GINGA-J] and [b-JAVADTV] specification already defines the use of package files (.jar or .zip files) for transmitting applications components from the Internet.

In case of code, resources, and meta-data the use of more than one delivery mechanism at the same time should be allowed.

From the end user point of view, the IBB application delivery mechanism should be as much transparent as possible ([b-EBU-req]).

When using an application installation package, code, resources and meta-data would usually be bundled together in the same package.

FR-ACF-04: User Interface for application discovery, selection, acquisition and launching

A user interface for application discovery and selection is a function intended for listing the applications available that can be launched by the user. This concept is already present in DTV middleware standards such as [b-GINGA-Data Coding][~~b-GINGA~~] or [b-MHP]. As an extension to the concepts in conventional DTV middleware specifications, the user interface for application discovery and selection in the ACF may include the following functionalities:

– Listing applications available to the user including:
  - Conventional DTV services interactive content that can be launched by the user. For example, signalled with AIT control codes AUTOSTART ([b-MHP], [b-GINGA-Data Transmission]), PRESENT ([b-MHP], [b-GINGA-Data Transmission]), STORED ([b-GINGA-Data Transmission]), REMOTE ([b-GINGA-Data Transmission]), UNBOUND ([b-GINGA-Data Transmission]), etc. and visibility flag enabled ([b-GINGA-Data Transmission], [b-MHP]). This functionality may not be present if the middleware for conventional DTV services does not provide such a feature.
  - Service associated IBB application meeting the same signalled requirements as for conventional DTV services interactive content.
  - Stand-alone IBB applications (both IBB installable applications and IBB resident applications).
– Allowing the IBB DTV service provider to determine the appearance of the order of the applications' list to be presented to the user in accordance with the IBB DTV service tuned by the user. This ordering control should be applicable to the service associated IBB applications and, whenever it is supported by the conventional DTV middleware, it may be also applied to the "conventional DTV services interactive content". The purpose of this functionality is to highlight those applications related to the active IBB DTV service.
– Providing the application search function based on the user's search query.
– When the user chooses an application from the list, one of the following actions is selectable by the user:
  - View the application attribute metadata, e.g., application name, provider name, version, etc.
  - Purchase the application.
  - Install the application.
  - Launch the application.
  - Register the application as the bookmark and/or any shortcut.

FR-ACF-05: Installable IBB application support and management

IBB DTV receivers may have a persistent storage space for installing IBB installable applications. Once installed, these applications become available to the user at anytime. The ACF must define the mechanisms to support such functionality.

A mechanism and policies for installing IBB applications and managing the persistent storage in the IBB DTV receiver should be considered by the Recommendation. Installation can occur when indicated by the IBB DTV service provider or by a specific action from the user as described in FR-ACF-04. The following cases should be also handled by the ACF.

IBB applications can be installed in the IBB DTV receiver's persistent storage:

– Automatically installed: when signalled in a selected IBB DTV service, a special signalling can be used in order to indicate that the application is to be installed in the receiver. Such a mechanism can be provided by the AIT's UNBOUND control code in [b-GINGA-Data Transmission]. In this case, application components delivery can happen by using any of the application component delivery mechanisms.

  Automatically installed applications may require authorization from the end user.

– User installed application. In this case, the IBB installable application's sources can be very diversified. For example,

  • a server reached through the broadband channel (i.e.: a server in the Internet);
  • application repository;
  • another device in the HAN;
  • pluggable storage device (such a USB stick or external Hard Disk); etc.

  In the case of application repository, the installable application manager should retrieve a remote application catalogue from the application repository.

  In the case where there is another device in the HAN or pluggable storage device (such as a USB stick or external hard disk), the device should be inspected looking for application install packages and a list should be presented to the end user in order to choose which IBB applications to install.

  In all cases, for a user installed application, the IBB application should be installed from application install packages.

In the case of usage of IBB installable applications, rules for application storage management that must be considered by the IBB DTV service provider and the IBB DTV receiver should be defined. For example:

– For automatically installed applications, a least recently used algorithm may be used for uninstalling IBB applications under low storage space available conditions.

– For user installed applications, IBB DTV receivers should provide some mechanism for the user being able to request the IBB application uninstalling.

– In both cases, when installing a newer version of an IBB application, the older version must be removed.

The IBB installable application management should also consider an application update mechanism. For example, periodically checking the installation source (e.g., the application repository from where the IBB application has been downloaded) looking for recent versions of the already installed applications.

Additionally, a mechanism and policies for controlling the version of the IBB installable applications should be included in the ACF Recommendation.

The IBB installable application management sub-system should also provide a mechanism for the end user to manage the available persistent space and for removing installed applications.

The IBB installable application management sub-system may allow the end user to arrange the installed IBB applications in a customizable hierarchical directory structure.

FR-ACF-06: Standardized application repository – remote application catalogue

Application repositories are entities intended to distribute applications for on-demand installation. The following use cases will be provided by application repositories:

– The end user can browse and search through the applications made available on each repository. Browsing the catalogue and the search results should support pagination.

– The end user can retrieve application information details such as name a brief description, icon, screen shots, price, version, required storage space, vendor, etc.

– The end user can choose an application to install in the IBB DTV receiver.

– The end user can login to the application repository with a previously registered user account.

– Some content may not be free. End users can purchase such applications with credits previously charged to his user account. Once the payment is confirmed, the application will become available for installing.

– An application search can be available by using the following filters:

  • predefined keywords (using a list of predefined keywords that could be retrieved from the application repositories);

  • application name;

  • custom keywords (user entered);

  • other.

NOTE – All end user interactions with the remote application catalogue described above, are meant to be executed through the application catalogue user interface.

FR-ACF-07: Application installation package

IBB installable applications should be delivered in a form of package file.

FR-ACF-08: Resident IBB application support

ACF should support the possibility of the IBB DTV receiver's manufacturer to embed resident IBB applications in its products. Usually such applications would be stored in the receiver's ROM, or bundled within the receiver's firmware.

In spite of these applications being managed seamlessly by the ACF as any other IBB installable application, they should not be uninstalled by the end user. Installation, updating and removal of these applications should be actions exclusive to the IBB DTV receiver's manufacturer.

Since the ACF is also intended to manage IBB resident applications, which are embedded in the IBB DTV receiver and controlled by the manufacturer, an update mechanism should be provided in order to meet this need from devices' manufacturers.

FR-ACF-09: Application life cycle model

The IBB application life cycle model should be equivalent to each one defined by the middleware implementations adherent to [ITU-T J.200]. For example, these are Xlet life cycle model defined by [b-CDC] and adopted in [b-MHP], [b-ARIB B.23], and [b-GINGA-J] or application life cycle model used in [b-ARIB B.24], [b-ITU-T H.761] and [b-GINGA-NCL].

FR-ACF-10: User interface for application life cycle manager

Application life cycle manager is a function intended to manage the task/execution of currently running applications consistent with service integrity. If the ACF allows the end user to manage the application lifecycle, the following functionalities should be provided in the user interface for the application lifecycle manager:

– Allowing the end user to bring to focus any listed application already in execution.

– Allowing the end user to terminate any listed application already in execution.

– Show only the currently running IBB DTV service applications that can be terminated by the user. In the case of service associated IBB applications, only those that are allowed by the IBB DTV service provider to be terminated by the user should be displayed.

– Optionally providing access to the available user-oriented application meta-data (such as application name, provider, version, etc.).

FR-ACF-11: IBB application control

ACF should allow the IBB DTV service provider to control the execution, availability and visibility of only the service associated IBB applications.

Usually, the DTV service providers cannot control IBB applications which are not signalled in their DTV service and manually started by the user.

The ACF should provide an IBB application control mechanism (to be used by the IBB DTV service provider) suitable for the application repository scenarios in addition to those used in broadcast channel scenarios. The application control data structure refers to the data structures transmitted within the IBB DTV service that enables the IBB service provider to use the IBB application control mechanism for controlling service associated IBB applications.

An example of such an IBB DTV service's application control data structure are those structures used in [ITU-T J.200] compliant middleware implementations: DTV service providers can control the execution, availability and visibility of the applications, using mechanisms such as those available through the AIT ([b-GEM], [b-MHP], [b-ACAP], [b-OCAP], [b-GINGA-Data Transmission]~~[b-GINGA]~~, [b-ARIB B.23]).

In IBB DTV systems derived by enhancing existing DTV systems, it would be desired to evolve the IBB application control mechanism from the mechanism currently used in these systems.

In case of signalling an IBB application located in an application repository as an IBB DTV service component, a link to the remote application catalogue (belonging to the proper application repository) must be included within the IBB DTV service's application control data structure or implicitly well known to the application. Depending on the control code in such data structure, the application could be installed or executed directly from the application repository.

The ACF should be capable of handling service associated and stand-alone IBB applications as described in clause 7.4).

In the case of service associated IBB applications, it should be possible for the ACF to handle both service exclusive and service shared IBB applications, according to what is described in clause 7.5.This is already considered in [b-MHP] and ~~[b-GINGA-J]~~[b-GINGA-Data Transmission].

The ACF should allow for IBB applications being launched in the following ways:

a) signalled to be auto-started in the current selected IBB DTV Service;

b) starts by an already existing application by using some middleware provided API;

c) starts by the instruction from the application catalogue user interface.

IBB application termination should occur if:

a) signalled to be KILLed or DESTROYed in the current selected IBB DTV service;

b) it was started as a service associated application and it has been removed from the DTV service's application control data structure;

c) the other service associated application (with proper permissions) stops the application by using some middleware provided API;

d) a user stops the application by using a mechanism described in FR-ACF-10;

e) a service change occurs and the application is a service exclusive IBB application;

f) a service change occurs and the application is a service shared IBB application, but conditions to keep the application alive are not met (application is not signalled in the new selected service);

g) the application terminates itself by calling a specific middleware provided API;

h) an exception is raised and it is not handled by the application; or

i) an IBB DTV receiver runs out of enough resources to execute the application.

Most of these mechanisms (from a to i) are already defined in [b-MHP], [b-GINGA-Data Transmission]~~[b-GINGA]~~, and [b-ARIB B.23].

The ACF should allow two or more IBB applications to be executed simultaneously. As defined in FR-ACF-10, the UI for the application lifecycle manager should allow the user to bring the different applications to focus. Additionally, the ACF should grant the isolation between the running applications, and the IBB DTV receiver should provide isolation from other platform applications. This is important for stand-alone IBB applications that may not be aware of other applications executed in the system.

FR-ACF-12: Rules for choosing service associated IBB application's source

It may be possible that the same IBB application could be made available through different channels (or delivery mechanisms) at the same time. In addition, criteria for IBB installable application or application versioning should be defined. Table 2 shows an example of these criteria.

Table 2 – Proposed application source decision table

Action	Already INSTALLED or RESIDENT	Version of the installed IBB application is same or newer	Is it an IBB installable application?	Is the IBB application transmitted in the current selected service?
Download from the available source, avoiding interruption of the service exhibition.	No	–	No	No
Download from the current selected service.	No	–	No	Yes
Download from the available source, avoiding interruption of the service exhibition, and install.	No	–	Yes	No
Download from the current selected service and install.	No	–	Yes	Yes
	Yes	No and App is not Resident	Yes	Yes
Use the installed application.	Yes	Yes	Yes	–
	Yes	No or App is Resident	Yes	No and service exhibition needs to be interrupted to download the latest version or application is not currently available for downloading.
Download and install.	Yes	No and App is not Resident	Yes	No. Service exhibition can continue for downloading the latest version.

FR-ACF-13: Mechanism for authenticating IBB applications

ACF should consider the inclusion of security definitions as those included in [ITU-T J.200] adherent implementations such as [b-MHP], [b-GINGA-NCL] and [b-~~GINGA~~JAVADTV], considering:

- application authentication mechanisms;
- application permission granting mechanism;
- policies to restrict the usage of API and functionalities in accordance with the trustworthiness of applications.

FR-ACF-14: Ensure DTV service integrity and IBB application permissions policy

As previously defined, a DTV service is a unit for delivering audio-visual interactive content to the end users, and constitutes an editorially consistent whole.

It is a requirement for the ACF to ensure that the DTV service is always consistent to the service provider editorial as described in [b-EBU-req].

Service associated IBB applications can be allowed to be displayed combined and interact with the other DTV service components (audio, video, closed caption and other interactive content) belonging to the same DTV service (rationale behind this is that service associated IBB applications are part of the same editorial unit). In this case, application authentication and permission rules such as those defined by chapter 12 of [b-MHP] and [b-JAVADTV] should be applicable.

IBB DTV service providers may desire to explicitly grant permissions to specific stand-alone IBB applications (such as installed IBB applications) or applications associated to different services in order to behave as if they were part of the service. A mechanism should be also defined for this, in order to allow those applications to:

a) overlay over other service's contents such as the service's video or other service's applications;

b) manage or change service exhibition such as video control (video freeze, stop, scaling, etc.), audio control (audio stop, volume level change, etc.) and starting or stopping any other service component (subtitles, closed captions, alternate audio, alternate video, etc.);

c) interact with, communicate with or control (start/pause/destroy) other IBB applications from the IBB DTV service.

When executing stand-alone IBB applications or IBB applications from other service providers with no explicit permissions granted from the currently selected IBB DTV service provider, the service exhibition should be compliant, with the general principles of broadcasting content integrity, such as those defined in [b-EBU-req]. For example, such a content integrity policy should be notified by the service provider in such a way that IBB applications should not change the form of nor otherwise interfere with the broadcasting content, nor distort the intention of the service providers. In any of these cases, distinction between stand-alone IBB applications and DTV service content must be very clear to the end user, giving him/her a clear perception of content integrity policies in order to make a decision that may override such policies by his/her own choice.

FR-ACF-15: Ensure user privacy and user data protection

In order to protect user privacy and data, the ACF should define a policy on which kind of applications have the privileges to connect to servers on the Internet or access to sensible information that may be stored in the IBB DTV receiver.

FR-ACF-16: Service content protection

A mechanism for protection of copyrighted content delivered within the DTV service must be considered ([b-EBU-req]).

Control access mechanism for non-universally free content and content usability rules (like parental control and content rating/classification) should be also considered.

FR-ACF-17: User account management

The user account could be associated with:

- IBB application's custom user settings stored in an IBB DTV receiver device, other devices in the HAN or HTTP servers reached through the broadband channel (see FR-ACF-20).
- Grant access to a set of applications and services.
- Account of credits or payment information for accessing non-free content.

- Other accounts used in Internet services (such as email, social networks, instant messaging, voice and video calls, etc.).

Many devices are usually shared among several users (for example, a TV set is shared by the members of a family). On the other hand, some devices are mostly used by a single person (PDA, mobile phone, etc.). The ACF should be aware of this and support the ability to handle several user accounts.

From the IBB application point of view, it should only be possible to access resources and settings associated only to the currently logged in account.

FR-ACF-18: IBB application's user settings management

The ACF should include a standardized application settings configuration feature in order to be able to integrate seamlessly to the system settings configuration UI.

It should be possible that the user settings could be stored and retrieved in different ways such as:

- storing in the receiver persistent storage (most usual case);
- sharing among several devices present in the HAN;
- retrieval from an HTTP server using some user identification method such as a user account through the broadband channel.

FR-ACF-19: Location awareness

The ACF should provide mechanisms for the IBB application to retrieve location information.

Additionally, IBB DTV receivers should be capable of retrieving IBB application content selectively based on their location ([b-EBU-req]).

FR-ACF-20: Home area network integration

The ACF should provide mechanisms for interacting with other devices in the Home area network.

FR-ACF-21: IBB DTV receiver capabilities

Conformity to current trends on devices with DTV service reception capabilities should be taken into account for the ACF. Other than TV sets and set-top boxes, IBB DTV services may be delivered, directly or via home network, to computers, game consoles, PVR devices, Blu-ray players, hand held devices and mobile phones.

This requirement is intended to consider the following aspects:

- screen resolution;
- device computational capabilities;
- user input method (remote control, pointer device, multi-touch-screen, alphanumeric keyboard, etc.).

FR-ACF-22: DTV service synchronization (stream events)

The ACF should be in accordance with recommendations and mechanisms defined in [b-MHP], [b-GINGA-NCL], [b-ITU-T H.761] and [b-GINGA-J].

FR-ACF-23: Mono-media formats, encodings and protocols

Mono-media formats and protocols already used in [b-MHP], [b-ARIB B.23], [b-ARIB B.24], [b-GINGA-NCL] [b-ITU-T H.761] and [b-GINGA-J] should also be used in the ACF.

Additional consideration is required for:

- Protocols and encoding formats for streaming multimedia content, such as audio and video.
- File and encoding formats for on demand multimedia content and minimal capabilities required for the IBB DTV receiver.

IBB DTV receivers may have stream capture capabilities as described in FR-ACF-28. It should be considered that specific encodings and protocols would be used for the captured media.

FR-ACF-24: Download feature

It should be considered the inclusion of an API for allowing applications to download and store contents in the IBB DTV receiver's persistent storage with mechanisms already available in [b-MHP] and [b-GINGA-J].

FR-ACF-25: PVR feature

Provision of APIs for PVR features should be considered to IBB DTV receivers, which are capable of PVR control so that IBB applications can:

- query the recording schedule;
- query the recorder events;
- schedule or cancelling recording events;
- start, pause or stop and the speed of the playback of recorded content; and
- identify if the IBB application is being executed within the context of a recorded event. In such a case, it should be possible for the IBB application to show when it was recorded.

These APIs can be integrated with other APIs used to query the schedule information such as used by an EPG.

FR-ACF-26: Streaming capabilities

Streaming capabilities exposed as an API extension to [b-ITU-T J.202] would allow implementing applications such as VOIP and video calls.

In case of implementing such applications, stream playback capabilities should be also exposed to the interactive content and applications such as API extensions to [b-ITU-T J.202], allowing the implementation of client applications and players for Internet services such as Internet multimedia content providers and content aggregators.

FR-ACF-27: Content purchase

A mechanism for allowing the user to make payments should be included in the ACF. An API for cryptography and certificate management should be considered. Cryptographic capabilities defined in [b-MHP] or [b-GINGA-J] are example of this capability. These also include an API for accessing functionalities available in devices such as smart cards or cryptographic USB tokens.

The list of use cases to be covered includes the purchase of:

- multimedia content to be streamed to the IBB DTV receiver;
- multimedia content to be stored into the applicable IBB DTV receiver;
- access to non-free IBB DTV services (paid DTV services); and
- IBB applications (usually IBB installable applications).

Additionally, the list of use cases should include the purchase of any other goods or general services not to be directly related to the IBB DTV receiver (T-Commerce).

Payment methods to be included would depend on the availability (credit cards, bank account transfers, debts on the cable or telephone bill, or credits previously acquired from some Internet Service providers, etc.).

FR-ACF-28: System updating and expandability

The ACF should consider a mechanism to support expandability and upgradability, in order to be future-proof and evolve by embracing new features ([b-EBU-req]).

FR-ACF-29: Pluggable modules support

The ACF should consider an extension mechanism based on pluggable software components that, once installed in the IBB DTV receiver, would extend the functionality of the ACF by exposing new APIs to the applications.

The mechanism should consider APIs for the pluggable module publishing its services and another API for applications discovering and making use of them.

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