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GEM Companion Screen Service Framework

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ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
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Contents

Intellectual Property Rights 5
Foreword 5
Modal verbs terminology 5
Introduction 5
1 Scope 7
2 References 7
2.1 Normative references 7
2.2 Informative references 8
3 Definitions and abbreviations 8
3.1 Definitions 8
3.2 Abbreviations 10
4 Companion Screen Service Framework 10
4.1 Introduction 10
4.1.0 Overview 10
4.1.1 Core Framework Functions 11
4.1.2 Application-Defined Functions 11
4.2 Framework Architecture 12
5 GEM Companion Service Model 13
5.1 GEM Companion Service 13
5.1.0 Overview 13
5.1.1 Service Types 14
5.1.2 Publishing Services 14
5.1.3 Protocol Endpoints 14
5.1.4 Resources and State variables 14
5.1.5 Notifications 14
5.1.6 Naming of Companion Service 15
5.2 Service Manager 15
5.2.0 Overview 15
5.2.1 Service lifecycle 16
5.2.2 Private Mode 16
5.3 Service deployment 17
6 Discovery and Association 17
6.0 Overview 17
6.1 Service use without discovery (Phase 1) 17
6.2 Service Discovery on the local network (Phase 1+) 17
6.2.0 Dynamic service discovery 17
6.2.1 Introduction (informative) 18
6.2.1.0 Outline 18
6.2.1.1 UPnP Device Architecture 18
6.2.1.2 UPnP Application Management 19
6.2.1.3 GEM companion service mapping on Application Management 20
6.2.1.4 CSA behaviour 21
6.2.2 UPnP Device requirements for the GEM Device 24
7 External Service Interface 25
7.0 Services 25
7.1 REST Companion Service 25
7.1.0 Overview 25
7.1.1 Notifications 25
7.1.2 JSON Data Format 25
7.1.3 REST Companion Service API 26
7.2 Web sockets 26
7.3 Core Services 27

7.3.1 Device State Service 27
7.3.1.0 Overview 27
7.3.1.1 APIs for DeviceStateService 27
7.3.2 Companion Synchronization Service (CSS) 28

8 Framework API 29

9 API Sequence Diagrams (informative) 30
9.0 Overview 30
9.1 REST service provided by an application 31
9.2 CSS CII Service 33
9.3 Service with subscription 34

Annex A (informative): Bibliography 35

History 36

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Foreword

This Technical Specification (TS) has been produced by Joint Technical Committee (JTC) Broadcast of the European Broadcasting Union (EBU), Comité Européen de Normalisation ELECtrotechnique (CENELEC) and the European Telecommunications Standards Institute (ETSI).

NOTE: The EBU/ETSI JTC Broadcast was established in 1990 to co-ordinate the drafting of standards in the specific field of broadcasting and related fields. Since 1995 the JTC Broadcast became a tripartite body by including in the Memorandum of Understanding also CENELEC, which is responsible for the standardization of radio and television receivers. The EBU is a professional association of broadcasting organizations whose work includes the co-ordination of its members' activities in the technical, legal, programme-making and programme-exchange domains. The EBU has active members in about 60 countries in the European broadcasting area; its headquarters is in Geneva.

European Broadcasting Union
CH-1218 GRAND SACONNEX (Geneva)
Switzerland
Tel: +41 22 717 21 11
Fax: +41 22 717 24 81

The Digital Video Broadcasting Project (DVB) is an industry-led consortium of broadcasters, manufacturers, network operators, software developers, regulatory bodies, content owners and others committed to designing global standards for the delivery of digital television and data services. DVB fosters market driven solutions that meet the needs and economic circumstances of broadcast industry stakeholders and consumers. DVB standards cover all aspects of digital television from transmission through interfacing, conditional access and interactivity for digital video, audio and data. The consortium came together in 1993 to provide global standardization, interoperability and future proof specifications.

Modal verbs terminology

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Introduction

Enhanced TV DVB-services, based on the "Digital Convergence" paradigm, are becoming available today in a variety of forms in the digital marketplace. The market has seen an explosion in the distribution and consumption of audio and video content through a variety of connected devices, like smart phones, tablets, PCs, and hybrid STBs and TVs (typically connected to the broadcast and to the broadband channels).

It is recognized that a new, emerging trend is expanding the focus of interactive services from the main TV screen only to a wide range of different connected companion screens, extending the range of possibilities and providing new levels of engagement to end users.

The commercial success of personal and portable devices, often used as a second or companion screen by the user to search and retrieve information or additional content while watching traditional TV services, creates new opportunities to provide compelling services based on interactions among users, devices and content.

For the DVB GEM Middleware (specified in ETSI TS 102 728 [1]), a deeper investigation of the evolution of interactive TV services has happened, envisaging how those services will integrate companion devices to meet user's expectations in the near future.

Based on clear use cases to support interactions with the main TV screen and related content consumption also from companion screens, a set of GEM extensions has been defined which are described by the present document.

These extensions are called the *GEM Companion Screen Service Framework*.

The GEM *Companion Screen Service Framework* includes a service capable of delivering synchronization information as defined by ETSI TS 103 286-2 [2]: "Digital Video Broadcasting (DVB); Companion Screens and Streams; Part 2: Content Identification and Media Synchronization".

1 Scope

The present document specifies the *GEM Companion Screen Service Framework*, which is addressing the Phase 1 and 1+ of DVB's companion screen requirements. These requirements ask for extensions of the GEM middleware specification ETSI TS 102 728 [1], to support information exchange and synchronization between the companion screen and the primary service.

The *Companion Screen Service Framework* provides the infrastructure for GEM companion services that offer their functionality to companion devices in the home network. GEM companion services allow broadcasters and content providers to dynamically provide companion services that integrate screen devices, such as mobile phones, tablets, PCs etc. into the viewing experience.

GEM *companion services* can be deployed via regular GEM applications and enable the broadcaster and content provider to dynamically add companion services, thus augmenting the experience of the viewer to companion devices.

These companion devices can communicate with the GEM companion services via standardized protocols (e.g. UPnP, REST, WebSockets) or can chose to implement proprietary communication protocols.

The framework defines a common discovery mechanism based on the UPnP Application Management Service for these services.

The companion screen service framework as defined by the present document is orthogonal to GEM profiles and versions and can be used on all GEM platforms and derived platforms (MHP, OCAP, BD-J).

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

[1] ETSI TS 102 728: "Digital Video Broadcasting (DVB); Globally Executable MHP (GEM) Specification 1.3 (including OTT and hybrid broadcast/broadband)".

NOTE: Available at http://www.etsi.org/deliver/etsi_ts/102700_102799/102728/01.02.01_60/ts_102728v010201p.pdf.

[2] ETSI TS 103 286-2: "Digital Video Broadcasting (DVB); Companion Screens and Streams; Part 2: Content Identification and Media Synchronization".

NOTE: Available at http://www.etsi.org/deliver/etsi_ts/103200_103299\10328602/01.01.01_60/ts_10328602v010101p.pdf.

[3] ISO/IEC 29341 (September 2014): "UPnP ApplicationManagement:1 Service".

NOTE: Available at http://upnp.org/specs/ms/UPnP-ms-ApplicationManagement-v1-Service.pdf.

[4] IETF RFC 2616 (1999): "Hypertext Transfer Protocol -- HTTP/1.1".

NOTE: Available at http://www.ietf.org/rfc/rfc2616.txt.

[5] IETF RFC 6455 (December 2011): "The WebSocket Protocol".

NOTE: Available at http://tools.ietf.org/html/rfc6455.

[6] ETSI EN 300 468 (V1.14.1): "Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB systems".

NOTE: Available at http://www.etsi.org/deliver/etsi_en/300400_300499/300468/01.14.01_60/en_300468v011401p.pdf.

[7] ETSI TS 102 809: "Digital Video Broadcasting (DVB); Signalling and carriage of interactive applications and services in Hybrid broadcast/broadband environments".

NOTE: Available at http://www.etsi.org/deliver/etsi_ts/102800_102899/102809/01.02.01_60/ts_102809v010201p.pdf.

[8] ISO/IEC 29341-1:2011: "Information technology -- UPnP Device Architecture -- Part 1: UPnP Device Architecture Version 1.0".

NOTE: Available at http://upnp.org/specs/arch/UPnP-arch-DeviceArchitecture-v1.0.pdf.

[9] IETF RFC 2818 (2000): "HTTP Over TLS".

NOTE: Available at http://tools.ietf.org/html/rfc2818.

[10] IETF RFC 7159 (2014): "The JavaScript Object Notation (JSON) Data Interchange Format".

NOTE: Available at http://tools.ietf.org/html/rfc7159.

[11] Java API for JSON (JSON in Java).

NOTE: Available at http://www.json.org/java/index.html.

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] "Principled Design of the Modern Web Architecture", ROY T. FIELDING and RICHARD N. TAYLOR, May 2002.

NOTE: Available at http://www.ics.uci.edu/~taylor/documents/2002-REST-TOIT.pdf.

[i.2] ETSI TR 103 286-1: "Digital Video Broadcasting (DVB); Companion Screens and Streams; Part 1: Architecture".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

application: functional implementation realized as software running in one or spread over several interplaying hardware entities

association: process or act of establishing a link between a primary TV device and a companion screen application

NOTE: The link does not need to be exclusive or permanent.

companion screen: personal and usually portable device such as a smart phone, a tablet PC or a laptop with broadband connectivity

NOTE: It is sometimes referred also as "second screen".

companion screen application: software application that executes on a companion screen and enhances the main TV screen experience

companion screen event: event sent to companion screen application related to a change in primary device state

companion screen service framework: extension of GEM that is integrated in the GEM platform to expose primary screen functions to companion screens

NOTE: The companion screen framework is specified by the present document.

companion service: feature provided by the primary device to the companion devices

GEM application: application running upon a GEM middleware

GEM device: device running GEM middleware

GEM companion service: companion service offered by a GEM device

GEM middleware: middleware which agrees to GEM specification and requirements

GEM platform: GEM device

hybrid STBs: STB connectable to internet

home network: local network within the home

NOTE: Devices are connected via Wifi or Ethernet. A router/gateway device connects the home network to the Internet via an ISP.

middleware: computer software that provides services to software applications beyond those available from the operating system

notification: message from a primary device to a companion screen application that is sent upon the state changes in the state of the primary device

primary device: TV or STB for receiving and decoding digital television services

NOTE: It may include (personal) video recorder functions, access to additional IP based on-demand services, interactive applications, etc. It is a shared device that, in the context of the present document, could be hierarchically referenced with a companion screen (i.e. a personal portable device).

primary device state: body of information which describes the state of the primary device at a particular time

NOTE: It is composed by information related to TV service (present & following) and information about primary device settings.

primary GEM device: primary device running GEM middleware

primary screen: primary device

primary service: TV service played by the primary device

service: grouping (usually defined by a PMT) of one or more data streams which are offered as a whole to the user

subscription: mechanism for a companion screen application to register itself to primary device in order to receive notifications

transient application: interactive application running upon primary device in agreement to GEM application lifecycle

NOTE: It can be provided both from broadcast and broadband feed.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AIT	Application Information Table
AMS	Application Management Service
API	Application Programming Interface
BD-J	Blu-ray Disc Java
CII	Content Identification and Information
CSA	Companion Screen Application
CSS	Companion Screen Services
CSS-WC	CSS-Wall Clock
DCP	Device Control Protocol
DDD	Device Description Document
DVB	Digital Video Broadcasting
GEM	Globally Executable MHP
GENA	General Event Notification Architecture
HTTP	HyperText Transfer Protocol
HTTPS	HyperText Transfer Protocol Secure
IETF	Internet Engineering Task Force
IP	Internet Protocol
JSON	JavaScript Object Notation
MHP	Multimedia Home Platform
MUG	MHP Users Group
OCAP	OpenCable Application Platform
PC	Personal Computer
PMT	Program Map Table
QR-code	Quick Response Code
REST	REpresentational State Transfer
RFC	IETF Request for Comments
RPC	Remote Procedure Call
SI	Service Information
SOAP	Simple Object Access Protocol
SSDP	Simple Service Discovery Protocol
STB	Set Top Box
TCP	Transmission Control Protocol
TE	Trigger Event
TS	Timeline Synchronization
TV	Television
UDA	UPnP Device Architecture
UDN	Unique Device Name
UDP	User Datagram Protocol
UI	User Interface
UPnP	Universal Plug and Play
URI	Uniform Resource Identifier
WC	Wall Clock
XML	eXtensible Markup Language

4 Companion Screen Service Framework

4.1 Introduction

4.1.0 Overview

The model of interaction between companion screen applications and a GEM device is based on the concept of the *Companion Screen Service Framework*. This framework is included in the GEM middleware; it is able to expose functions of the primary GEM device to companion screens directly or via a GEM application. Those functions, conceptually equivalent to APIs, may be used to retrieve information about the status of the primary device or to control its behaviour. The availability of these functions is not related or influenced by the GEM application lifecycle when companion screens interact directly with functions provided by the *Companion Screen Service Framework*.

4.1.1 Core Framework Functions

The *Companion Screen Service Framework* provides a set of functions defined as *core functions* that can be accessed directly by companion screen applications. This is a subset of all the possible functions exposed by the primary device. In line with the GEM traditional model, specific sensitive controls or information (typically those more content-related) can only be accessed through a GEM application, therefore with a direct control by the broadcaster.

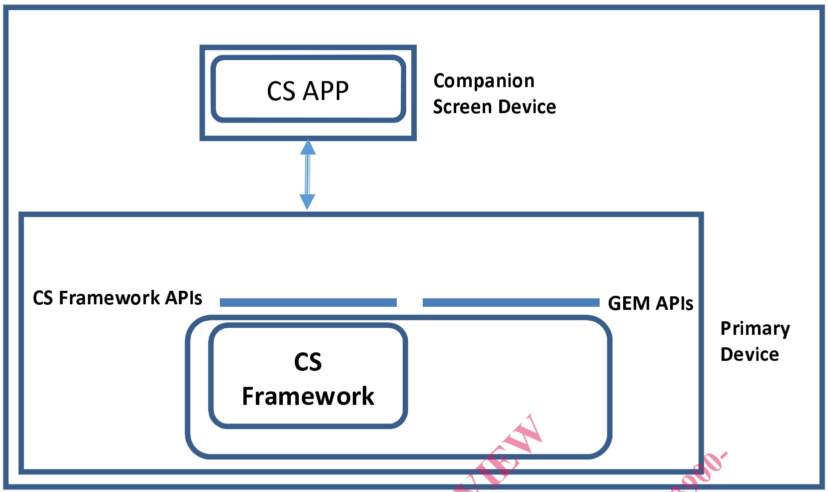

Figure 1: Core Framework Functions

4.1.2 Application-Defined Functions

A companion screen application can access a richer set of functions (including those provided by the *Companion Screen Service Framework*) when a GEM application, designed to support it, is active on the primary device. This model of interaction is directly under the control of the broadcaster.

In this case, as depicted in Figure 2, the GEM application can implement specific logic to handle the requests coming from a companion screen application, and can then access *Companion Screen Service Framework* functions via local GEM APIs. In this model, constraints imposed by the GEM application lifecycle apply.

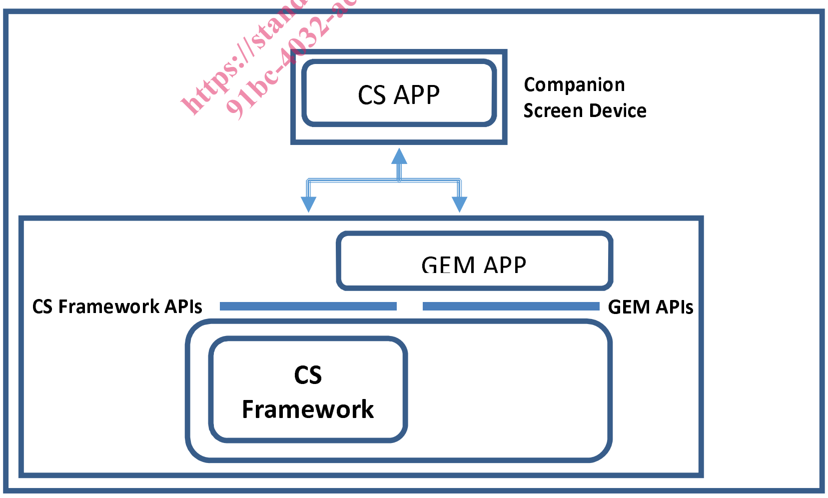

Figure 2: Application-Defined Functions

Through a GEM application, the broadcaster can implement companion screens functionalities with customized and flexible authentication and authorization mechanisms (if required), and can access a variety of sensitive functions exposed by the *Companion Screen Service Framework* (e.g.: interaction with the TV service on the main TV, redirection of content, etc.).