



INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

H.762

(05/2011)

SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

IPTV multimedia services and applications for IPTV –
IPTV multimedia application frameworks

Lightweight interactive multimedia environment (LIME) for IPTV services

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Recommendation ITU-T H.762

Lightweight interactive multimedia environment (LIME) for IPTV services

ITU-T H.762 (05/2011) – Prepublished version

Recommendation ITU-T H.762

Lightweight interactive multimedia environment (LIME) for IPTV services

Summary

Recommendation ITU-T H.762 describes the high-level functionalities of the lightweight interactive multimedia environment (LIME) for IPTV. LIME supports functionalities in IPTV terminal devices to provide interactivity and a variety of content such as audio, video, graphics and text. Expected services include additional data such as text to enrich television programmes, and two-way portal pages.

This Recommendation describes the profile called "LIME-HTML" of W3C Recommendation XHTML 1.0, the profile called "LIME-CSS" of cascading style sheets 1 (CSS1), and a part of CSS2, the profile of document object model (DOM) called "LIME-DOM", and a script language called "LIME-Script" that is a subset of ECMAScript but has functional extensions required for IPTV services. It describes the use of IP-based protocols for transport of LIME and IPTV-related services.

This revision includes the addition of explanatory text and definitions to enhance readability and improve the understanding of the extended functions. Specifically the change of the string "BML" to "LIME" and the addition of explanations of the browser pseudo-object methods were considered. These changes do not modify any accepted functions nor introduce any new functionality.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T H.762	2009-12-14	16
2.0	ITU-T H.762	2011-xx-xx	16

Keywords

Application multimedia framework, character encoding, CSS, delivery protocol, DOM, ECMA script, HTML, metadata, monomedia, multimedia coding, XML.

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Draft revised Recommendation ITU-T H.762

Lightweight interactive multimedia environment (LIME) for IPTV services

1 Scope

This Recommendation describes the high-level functionalities of the lightweight interactive multimedia framework (LIME) for IPTV. LIME supports functionalities in IPTV terminal devices to provide interactivity and a variety of content such as audio, video, graphics and text. Expected services include additional data such as text to enrich TV programmes, and two-way portal pages.

This Recommendation describes the profile (called "LIME-HTML") of XHTML1.0 [b-W3C XHTML], the profile (called "LIME-CSS") of cascading style sheets 1(CSS1), and a part of CSS2, the profile of document object model (DOM) (called "LIME-DOM"), and a script language (called "LIME-Script") that is a subset of ECMAScript but has functional extensions required for IPTV services. It describes the use of IP-based protocols for transport of LIME and IPTV-related services.

2 References

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

- | | |
|-----------------|--|
| [ITU-T H.262] | Recommendation ITU-T H.262 (2000) ISO/IEC 13818-2:2000, <i>Information technology – Generic coding of moving pictures and associated audio information: Video.</i> |
| [ITU-T H.264] | Recommendation ITU-T H.264 (2011), <i>Advanced video coding for generic audiovisual services.</i> |
| [ITU-T H.720] | Recommendation ITU-T H.720 (2008), <i>Overview of IPTV terminal devices and end system.</i> |
| [ITU-T H.721] | Recommendation ITU-T H.721 (2009), <i>IPTV terminal devices: Basic mode.</i> |
| [ITU-T H.760] | Recommendation ITU-T H.760 (2009), <i>Overview of multimedia application frameworks for IPTV services.</i> |
| [ITU-T H.761] | Recommendation ITU-T H.761 (2011), <i>Nested context language (NCL) and Ginga-NCL.</i> |
| [ITU-T T.81] | Recommendation ITU-T T.81 (1992) ISO/IEC 10918-1:1994, <i>Information technology – Digital compression and coding of continuous-tone still images – Requirements and guidelines.</i> |
| [ISO/IEC 9899] | ISO/IEC 9899:1999, <i>Programming Languages-C.</i> |
| [ISO/IEC 15948] | ISO/IEC 15948:2004, <i>Information technology – Computer graphics and image processing – Portable Network Graphics (PNG): Functional specification.</i> |

- [ISO/IEC 11172-3] ISO/IEC 11172-3:1993, *Information technology – Coding of moving pictures and associated audio for digital storage media at up to about 1,5 Mbit/s – Part 3: Audio*.
- [ISO/IEC 13818-7] ISO/IEC 13818-7:1997, *Information Technology – Generic Coding of Moving Pictures and Associated Audio Information – Part 7: Advanced Audio Coding (AAC)*.
- [IETF RFC 2616] IETF RFC 2616 (1999), *Hypertext Transfer Protocol – HTTP/1.1*.
- [IETF RFC 2965] IETF RFC 2965 (2000), *HTTP State Management Mechanism*.
- [ARIB STD-B24] ARIB STD-B24 V.5.2 (2008), *Data coding and Transmission Specification for Digital Broadcasting*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 application [b-ITU-T Y.101]: A functional implementation realized as software running in one or spread over several interplaying hardware entities.

3.1.2 broadcast markup language (BML) [ARIB STD-B24]: The XML application language specified in [ARIB STD-B24] to be solely responsible for tags and attributes for multimedia representation.

3.1.3 ECMAScript [b-ISO/IEC 16262]: The programming language defined by [b-ISO/IEC 16262].

3.1.4 electronic programme guide (EPG) [b-ITU-T Y.1901]: A structured set of data, intended to provide information on available content that may be accessed by end-users.

NOTE – In some traditional broadcast services, EPG is defined as an on-screen guide used to display information on scheduled live broadcast television programmes, allowing a viewer to navigate, select and discover programmes by time, title, channel, genre. This traditional definition does not cover "catalogues" for on-demand and download services (sometimes called electronic content guide (ECG) and broadband content guide (BCG) and bidirectional interactive service (sometimes called interactive programme guide (IPG)) for end-user interaction with a server or head-end.

3.1.5 Internet Protocol Television (IPTV) [b-ITU-T Y.1901]: Multimedia services such as television/video/audio/text/graphics/data delivered over IP-based networks managed to support the required level of QoS/QoE, security, interactivity and reliability.

3.1.6 IPTV terminal device [b-ITU-T Y.1901]: A terminal device which has IPTV terminal function (ITF) functionality, e.g., a set-top box (STB).

3.1.7 IPTV terminal function (ITF) [b-ITU-T Y.1901]: The end-user function(s) associated with a) receiving and responding to network control channel messages regarding session set-up, maintenance, and tear-down, and b) receiving the content of an IP transport from the network and rendering.

3.1.8 video-on-demand (VoD) [b-ITU-T Y.1901]: A service in which the end-user can, on demand, select and view a video content and where the end-user can control the temporal order in which the video content is viewed (e.g., the ability to start the viewing, pause, fast forward, rewind, etc.).

NOTE – The viewing may occur some time after the selection of the video content.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 LIME-CSS: The profile of cascading style sheets (CSS) defined in this Recommendation that composes lightweight interactive multimedia environment (LIME).

3.2.2 LIME-DOM: The profile of the document object model (DOM) defined in this Recommendation that composes lightweight interactive multimedia environment (LIME).

3.2.3 LIME-HTML: The profile of extensible hypertext markup language (XHTML) defined in this Recommendation that composes lightweight interactive multimedia environment (LIME).

3.2.4 LIME-Script: The subset of ECMAScript defined in this Recommendation that composes lightweight interactive multimedia environment (LIME).

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AAC-LC	Advanced Audio Coding – Low Complexity
API	Application Programming Interface
BCG	Broadband Content Guide
BML	Broadcast Markup Language
CAS	Conditional Access System
CSS	Cascading Style Sheets
DOM	Document Object Model
DRM	Digital Rights Management
DTD	Data Type Definition
ECG	Electronic Content Guide
ECMA	European Computer Manufacturers Association
EPG	Electronic Programme Guide
ES	Elementary Stream
EUC-JP	Extended UNIX Code – Japanese
GMT	Greenwich Mean Time
HTML	Hypertext Markup Language
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure
IP	Internet Protocol
IPG	Interactive Programme Guide
ISDB-T	Integrated Services Digital Broadcasting – Terrestrial
ITF	Internet protocol television Terminal Function

MAFR	Multimedia Application Framework
MHEG	Multimedia and Hypermedia information coding Experts Group
MNG	Multiple-image Network Graphics
LIME	Lightweight Interactive Multimedia Environment for IPTV
NPT	Normal Play Time
OSD	On-Screen Display
PES	Packetized Elementary Stream
PNG	Portable Network Graphics
SSL	Secure Socket Layer
STB	Set-Top Box
TCP	Transport Control Protocol
TLS	Transport Layer Security
TS	Transport Stream
URI	Uniform Resource Identifier
URL	Uniform resource locator
VoD	Video on demand
XHTML	eXtensible HyperText Markup Language
XML	eXtensible Markup Language

5 Conventions

The following conventions are used to describe operational guidelines:

- R1 Basic service required item. An IPTV terminal device designed for basic service should appropriately interpret the attribute if it is present in the content.
- R2 Basic service required item. It is assumed the value for this attribute is not present in the content. An IPTV terminal device designed for basic service assumes the default value for this attribute.
- Item not required for basic service. It is assumed the value for this attribute is not present in the content. An IPTV terminal device designed for basic service does not need to handle the attribute even if it is present in the content.

The following conventions apply to operational restrictions on attributes and properties:

- RW Read/write for basic services. The corresponding attribute or property can be read and written. An IPTV terminal device designed for basic services should support read/write of the corresponding attribute or property in the content.
- R Read for basic services. The corresponding attribute can be read but cannot be written. An IPTV terminal device designed for basic services should support read/write of the corresponding attribute or property in the content. Write operations to this item may be ignored.

6 Overview

This Recommendation describes the lightweight interactive multimedia environment (LIME) for IPTV services, the services such as those described in [ITU-T H.720]. It is expected to provide interactivity using multimedia to embedded IPTV terminal devices, such as those described in [ITU-T H.721]. LIME has been specified especially for the operation of portal service, as is described in [ITU-T H.721]. LIME has evolved from [b-ARIB TR-B14] volume 3, Section 2 (profile A), as well as [ARIB STD-B24], the so-called BML, but due to the differences in requirements and the environment between the data broadcasting service targeted by the original BML specifications and the IPTV service, some modifications were needed, resulting in LIME.

The main part of LIME consists of the following components:

- The profile hereinafter called "LIME-HTML" of XHTML 1.0. This profile is compliant with the "HTML for IPTV services" Recommendation of the multimedia application framework (MAFR) series currently under development.
- The profile hereinafter called "LIME-CSS" of CSS1 and a part of CSS2. This profile is compliant with the "CSS for IPTV services" Recommendation of the MAFR series currently under development.
- The profile of DOM, hereinafter called "LIME-DOM". This profile is compliant with the "DOM for IPTV services" Recommendation of the MAFR series currently under development.
- The script language hereinafter called "LIME-Script", which is a subset of ECMAScript but has functional extensions required for IPTV services. LIME-Script is compliant with the "ECMAScript for IPTV services" Recommendation of the MAFR series currently under development.

7 LIME-HTML

7.1 LIME-HTML document

A LIME-HTML document is an XHTML document, which includes CSS and script, i.e., ECMAScript. This clause describes requirements for a LIME-HTML document as an XHTML document.

7.1.1 Character encoding scheme

Refer to Annex C for the character encoding scheme used. Only one scheme must be used in any single LIME-HTML document and any external data, including LIME-Script files and LIME-CSS files, referenced by the document.

7.1.2 Declarations in a LIME-HTML document

7.1.2.1 XML declaration

A LIME-HTML document is required to begin with an XML declaration which specifies the version of XML being used. The XML version in the XML declaration is required to be 1.0.

In an encoding declaration, if the encoding is in the various encodings and transformations of Unicode/ISO/IEC 10646, the values "UTF-8", "UTF-16", "ISO-10646-UCS-2", and "ISO-10646-UCS-4" are required to be used. If the encoding is in JIS X-0208-1997, the value "euc-jp" is required to be used. It is recommended that character encodings registered (as charsets) with the Internet Assigned Numbers Authority (IANA), other than those just listed above, be referred to using their registered names.

7.1.3 XHTML elements of LIME-HTML

This clause describes elements that can be used in a LIME-HTML document.

7.1.3.1 Core modules

7.1.3.1.1 Structure module

This module includes elements: "body", "head" and "title".

7.1.3.1.2 Text module

This module includes elements: "br", "div", "p" and "span".

7.1.3.1.3 Hypertext module

This module defines an element for specifying hypertext links to other LIME-HTML documents. The module consists of the element: "a".

7.1.3.1.4 List module

This module defines elements for providing list-style presentations. This module does not include elements used in a LIME-HTML document.

7.1.3.2 Text extension modules

These modules are used to add textual presentations. A LIME-HTML document does not use elements from these modules.

7.1.3.3 Forms modules

7.1.3.3.1 Basic forms module and forms module

These modules define elements for controlling interactive data input operations. These modules for LIME-HTML include the element "input".

7.1.3.4 Table module

7.1.3.4.1 Basic table module and tables module

These modules define elements for providing table-style presentations. The elements from these modules are not used in LIME-HTML.

7.1.3.5 Image module

This module defines an element for embedding images in a LIME-HTML document. The module consists of the "img" element.

7.1.3.6 Client-side map module

This module defines elements for ensuring image mapping that is responsible for an IPTV terminal device or client. The elements from this module are not used in a LIME-HTML document.

7.1.3.7 Server-side map module

This module defines elements for ensuring image mapping that is responsible for a server. The elements from this module are not used in a LIME-HTML document.

7.1.3.8 Object module

This module defines elements for generic objects that represent images, video and audio. The module consists of the "object" element.

7.1.3.9 Frames module

This module defines elements for frame-style presentations. The elements from this module are not used in a LIME-HTML document.

7.1.3.10 Target module

This module defines attributes for describing target-related information. The elements from this module are not used in a LIME-HTML document.

7.1.3.11 Iframe module

This module defines elements for inserting frames into text. The module consists of the `iframe` element. The element from this module is not used in a LIME-HTML document.

7.1.3.12 Intrinsic events module

This module defines attributes that correspond to events generated by user operation. The attributes include the `onclick` attribute. The elements from this module are not used in a LIME-HTML document.

7.1.3.13 Meta-information module

This module defines elements for presenting meta-information of a document. The module consists of the `meta` element.

7.1.3.14 Scripting module

This module defines elements for scripts that describe behaviours and elements for controlling scripts. The module consists of the `script` element.

7.1.3.15 Style sheet module

This module defines elements for describing style sheets. The module consists of the `style` element.

7.1.3.16 Style attribute module

This module defines the style attribute.

7.1.3.17 Link module

This module defines an element for providing document-related information for a browser. The module consists of the `link` element.

7.1.3.18 Basic module

This module defines an element for defining a base uniform resource indicator (URI). The element from this module is not used in a LIME-HTML document.

7.1.3.19 Extension modules (LIME/basic LIME modules)

LIME-HTML has the following extension modules to define the following elements and attributes. The basic LIME module is limited to the basic features.

7.1.3.19.1 Basic LIME module

The elements from this module are not used in a LIME-HTML document.

7.1.3.19.2 LIME module

The LIME module supports the necessary features. This module includes elements: `bml`, `bevent`, `beitem`, `body&`, `div&`, `p&`, `span&`, `object&`.

7.1.4 Attributes

The following HTML attributes are used in a LIME-HTML document.

Table 7-1 – HTML attributes used in LIME-HTML document

Elements	Attributes	Operation	Restrictions for operation
Common attributes Core attributes			
	id	R1	Character string with a maximum of 128 bytes
	class	R1	
	title	–	
I18N attributes			
	xml:lang	R2	(Note 4)
Events attributes			
	onclick	R1	
	ondblclick	–	
	onmousedown	–	
	onmouseup	–	
	onmouseover	–	
	onmousemove	–	
	onmouseout	–	
	onkeypress	–	
	onkeydown	R1	
	onkeyup	R1	
Style attributes			
	style	R1	
Core modules Structure module			
body	%Common.attrib		
	%Core.attrib	R1	
	%I18n.attrib	R2	
	%Events.attrib	–	
	%Style.attrib	R1	
head	%I18n.attrib	R2	
	profile	–	
title	%I18n.attrib	R2	
Text module			
br	%Core.attrib	R1	
	%Style.attrib	R1	
div	%Common.attrib	R1	
p	%Common.attrib	R1	

Table 7-1 – HTML attributes used in LIME-HTML document

Elements	Attributes	Operation	Restrictions for operation
span	%Common.attrib	R1	
Hypertext module			
a	%Common.attrib	R1	
	accesskey	R1	
	charset	R2	(Note 5)
	href	R1	
	hreflang	–	
	rel	–	
	rev	–	
	tabindex	–	
	type	–	
Forms module			
input	%Common.attrib	–	
	%Core.attrib	R1	
	%I18n.attrib	R2	
	%Events.attrib	R1	Cannot be specified when "inputmode attribute" is "direct" or "indirect"
	%Style.attrib	R1	
	accesskey	R1	
	checked	–	
	disabled	R1	
	readonly	R1	
	maxlength	R1	From 1 to 40 (Note 1)
	alt		
	name	–	
	size	–	
	src	–	
	tabindex	–	
	accept	–	
	type	R1	Either "text" or "password"
	value	R1	
	inputmode	R1	
	charctertype	R1	
Client-side image map			
a&	cords	–	
	shape	–	
input&	usemap	–	

Table 7-1 – HTML attributes used in LIME-HTML document

Elements	Attributes	Operation	Restrictions for operation
object&	usemap	–	
Server-side image map			
input&	ismap	–	
Object module			
object	%Common.attrib	R1	
	archive	–	
	classid	–	
	codebase	–	
	codetype	–	
	data	R1	
	declare	–	
	height	–	
	name	–	
	standby	–	
	tabindex	–	
	type	R1	
	width	–	
Target module			
a&	target	–	
Intrinsic events module			
a&	onblur	R1	
	onfocus	R1	
body&	onload	R1	
	onunload	R1	(Note 3)
input&	onfocus	R1	
	onblur	R1	
	onselect	–	
	onchange	R1	(Note 2)
Metainformation module			
meta	%I18n.attrib	R2	
	http-equiv	–	
	name	R1	
	content	R1	
	scheme	–	

Table 7-1 – HTML attributes used in LIME-HTML document

Elements	Attributes	Operation	Restrictions for operation
Scripting module			
script	charset	R2	(Note 5)
	type	R2	(Note 6)
	src	R1	
	defer	–	
	xml:space	–	
Style sheet module			
style	%I18n.attrib	R2	
	type	R2	Fixed to "text/css"
	media	R2	Fixed to "tv"
	title	–	
	xml:space	–	
Link module			
link	%Common.attrib	–	
	charset	R2	(Note 5)
	href	R1	
	hreflang	–	
	media	R2	Fixed to "tv"
	rel	R2	Fixed to "stylesheet"
	rev	–	
	type	R2	Fixed to "text/css"
LIME module			
bml	%I18n.attrib	R2	
	version	–	
	xmlns	–	
bevent	id	R1	
beitem	id	R1	
	type	R1	One of the following is taken: "TimerFired", "CCStatusChanged", "MediaStopped", "DataButtonPressed"
	onoccur	R1	
	es_ref	R1	
	message_group_id	R1	It is "0" or "1". When omitted, specification of "0" is assumed.
	message_id	R1	
	message_version	R1	
	module_ref	R1	

Table 7-1 – HTML attributes used in LIME-HTML document

Elements	Attributes	Operation	Restrictions for operation
	language_tag	R1	
	register_id	–	
	service_id	–	
	event_id	–	
	peripheral_ref	–	
	time_mode	R1	The following is taken: "absolute"
	time_value		
	object_id	R1	Only the object element ID that indicates data transmitted by carousel and type attribute is either "audio/X-arib-mpeg2-aac"
	subscribe	R1	
iframe&	align	–	
body&	invisible	R1	
div&	accesskey	R1	
	onfocus	R1	
	onblur	R1	
p&	accesskey	R1	
	onfocus	R1	
	onblur	R1	
span&	accesskey	R1	
	onfocus	R1	
	onblur	R1	
a&	effect	–	
bdo&	orientation	–	
object&	streamposition	R1	The frame number is specified (type="image/X-arib-mng") when the monomedia that refers to the relevant object element is MNG. In case of other media, it is "0".
	streamlooping	R2	Fixed to "1"
	streampositionnumerator	–	
	streampositiondenominator	–	
	streamstatus	R1	An initial value must be specified depending on the monomedia referenced by the relevant object element (Note 7)
	streamlevel	–	
	remain	R1	Applicability depends on the monomedia referenced by the object element (Note 8)
	accesskey	R1	

Table 7-1 – HTML attributes used in LIME-HTML document

Elements	Attributes	Operation	Restrictions for operation
	onfocus	R1	
	onblur	R1	

Table 7-1 – HTML attributes used in LIME-HTML document

NOTE 1 – When the input exceeds the maximum length, then it is rounded down. If it goes beyond the frame, the exceeded part will not be displayed.

NOTE 2 – Generated timing of the change event is when the focus is shifted to a different element.

NOTE 3 – The only extended functions for broadcasting that can be used in the "onunload" event handler are "writePersistentArray()" and "unlockModuleOnMemory()". Processing contents should be limited to processes that end in a short time, such as set-up to Ureg, where quick document transition is possible and processes for simple status checking, etc.

NOTE 4 – This is currently fixed to "ja" in Japan.

NOTE 5 – This is currently fixed to "EUC-JP" in Japan. Other codings are for further study.

NOTE 6 – This is currently fixed to "text/X-arib-ecmascript"; charset="euc-jp". Other codings are for further study.

NOTE 7 – The values of streamstatus for an object referencing media of type attribute are summarized as follows (other type attributes are for further study):

type attribute	streamstatus
video/X-arib-mpeg2	play (initial value: play)
video/X-arib-mpeg1	play (initial value: play)
audio/X-arib-mpeg2-aac	play, stop (initial value: stop)
image/jpeg	play (initial value: play)
image/X-arib-png	play (initial value: play)
image/X-arib-mng	play, stop, pause (initial value: stop)
text/X-arib-jis8text	play (initial value: play)

NOTE 8 – Applicability of the remaining attribute depends on the type attribute according to the following list (other type attributes are for further study):

type attribute	applicability
video/X-arib-mpeg2	yes
video/X-arib-mpeg1	yes
audio/X-arib-mpeg2-aac	only when the scheme is "arib: (PES)"
image/jpeg	yes (lockModuleOnMemory is also used)
image/X-arib-png	no
image/X-arib-mng	no
text/X-arib-jis8text	no

7.1.5 used-key-list

This Recommendation specifies the use of used-key-list features as indicated in Tables 7-2 through 7-4.

Table 7-2 – used-key-list

Items	Features
Value of <key-group> (Note 1)	"special-1" is used for video on demand (VoD) playback control key group (Note 3)
Key code (Note 2)	To be eventually added in the vendor-dependent keys (key code 150-)
Access key characters (Note 2)	Not specified (Note 2)
Behaviour	When an LIME document contains a description of playback control procedure, it is desirable to mask "special-1", the VOD playback control <key-group>, to avoid confusion of the user. When masked, events from the VoD playback control keys are received by the LIME browser. Since key codes depend on implementation, it is not recommended that such key information is included in LIME content.
NOTE 1 – Refer to Table 7-3. NOTE 2 – Refer to Table 7-4. NOTE 3 – This refers to keys for, e.g., playback, stop, rewind, fast forward, chapter-jump. These are software keys implemented in the on-screen display (OSD), and whether this is implemented as physical keys or not depends on each implementation.	

Table 7-3 – Values Applicable to <key-group>

Value of <key-group>	Semantics	
Basic	Up, down, right and left arrow keys, enter key and back key	
data-button	Keys for data broadcasting operations (e.g., red, green, blue and yellow colour keys)	(Note 1)
numeric-tuning	Channel keypad (0 to 9, or 0 to 12)	(Note 2)
Other-tuning	Other channel keys (e.g., up/down and direct selection)	(Note 2)
special-1	Special key 1	(Note 3)
special-2	Special key 2	(Note 3)
special-3	Special key 3	(Note 3)
special-4	Special key 4	(Note 3)
Misc	Keys except the above keys and power key (e.g., volume control keys)	(Note 4)
NOTE 1 – Additional keys for data broadcasting services, as needed, are specified in an operational standard regulation. NOTE 2 – Actual usage of channel keys is specified in an operational standard regulation or optionally implemented by the vendor. NOTE 3 – The broadcaster specifies this key for each medium. NOTE 4 – Any receiver must provide a power key. Masking of the power key by the LIME content is not allowed.		

Table 7-4 – Relationship among remote control keys, key codes and access keys

Remote control key	Key code	Access key character
Up arrow	1	N/A
Down arrow	2	N/A
Left arrow	3	N/A
Right arrow	4	N/A
0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	5-17	N/A
"Enter"	18	N/A
"Back"	19	"X"
"Data" (Note 1)	20	N/A
Colour key (blue)	21	"B"
Colour key (red)	22	"R"
Colour key (green)	23	"G"
Colour key (yellow)	24	"Y"
Data button 1	25	"E"
Data button 2	26	"F"
Data button 3	27	N/A
Data button 4	28	N/A
Reserved for ARIB data broadcast standard	29-99	Reserved
"Bookmark" key (Note 2)	100	N/A
Reserved for future extended features	101-149	Reserved
Vendor-dependent	150-	Not defined
NOTE 1 – An event DataButtonPressed occurs and no keydown nor keyup event occurs.		
NOTE 2 – Implementing a "bookmark" key is optional.		

7.1.6 Media types used in LIME

Media types are required to comply with Table 7-5 and the following points.

CSS data (media type "text/css") may appear in LIME documents in some cases and may be transmitted as independent resources in other cases. CSS data transmitted as monomedia is required to be a complete description of the style sheet, as defined by CSS, on its own.

LIME-Script data may appear in LIME HTML documents in some cases and may be transmitted as independent resources in other cases. LIME-Script data transmitted as monomedia is required to be a complete description of the scripting, as defined by LIME-Script, on its own.

Table 7-5 – List of media types and monomedia schemes

Scheme	Media type	Used	Operation (referenced by object/element)	Remarks
http:, https:	multipart/mixed	Yes	—	

Table 7-5 – List of media types and monomedia schemes

Scheme	Media type	Used	Operation (referenced by object/ element)	Remarks
	text/css	Yes	—	
	text/X-arib-bml; charset=" "	Yes	—	(Note 1)
	text/X-arib-ecmascript; charset=" "	Yes	—	(Note 1)
	image/jpeg	Yes	Yes	
	image/X-arib-png	Yes	Yes	
	image/X-arib-mng	Yes	Yes	
	audio/X-arib-mpeg2-aac	Yes	Yes	
	application/X-arib-bmlclut	Yes	—	
	application/X-arib-btable	Yes	—	
	application/X-arib-resourceList	Yes	—	
	application/X-arib-contentPlayControl	Yes	Yes	(Note 2)
Arib:	application/X-arib-mpeg2-tts	Yes	Yes	
romsound:	audio/X-arib-romsound	Yes	—	
NOTE 1 – The "charset" specification cannot be omitted.				
NOTE 2 – "application/X-arib-contentPlayControl" is the media type assigned to the metafile used for VoD streaming playback control. The server specifies this media type in the Content-Type of the HTTP message header so that the IPTV terminal device can identify the metafile.				

7.2 Display control of LIME

7.2.1 Display control of linear IPTV streaming

Table 7-6 shows the guideline for the use of "type", "streamposition", "streamstatus" and "streamlooping" attributes when presenting the audio and video of linear IPTV streaming content as part of an "object" element.

Table 7-6 – Use of attribute for displaying stream

type attribute	Streamposition	streamstatus	Streamlooping
application/X-arib-mpeg2-tts (Note 1)	Not used	play stop (Notes 2, 3)	1 (fixed)
NOTE 1 – The linear IPTV service is expected to be specified in the "data" attribute using the namespace.			
NOTE 2 – The dynamic change of "type" attribute and of schema following the change of "data" attribute is not expected.			
NOTE 3 – In this Recommendation, the initial value of streamstatus for this type attribute is "play".			

7.2.2 Display control of VoD streaming

Table 7-7 shows the guideline for the use of "type", "streamposition", "streamstatus", and "streamlooping" attributes when presenting the audio and video of VoD streaming content as part of an "object" element.

Table 7-7 – Use of attribute for displaying stream

Type attribute	Streamposition	streamstatus	Streamlooping
application/X-arib-contentPlayControl (Note 1)	Read only (Note 4)	play/stop/pause (Notes 2, 3, 5, 6)	1 (fixed)
NOTE 1 – Metadata file for stream playback control is required to be specified in the "data" attribute. NOTE 2 – The dynamic change of the "type" attribute and change of schema due to a change of the "data" attribute are not allowed. NOTE 3 – When the playback ends, the streamstatus changes to "stop" automatically. NOTE 4 – As an exception, the initial value of "streamposition" attribute of the "object" element in a LIME document can optionally be specified. NOTE 5 – When the state of the media player changes, the value of streamstatus must automatically change. The timing for this automatic change is implementation dependent. NOTE 6 – The initial value of streamstatus is "play".			

8 Use of LIME-CSS in LIME

Table 8-1 shows the LIME-CSS profile which includes CSS 1 and CSS 2 properties.

Table 8-1 – Profile of CSS properties in LIME

Property	Operation	Property	Operation
Selector		Visual formatting model	
*	R1	position	R1
E	R1	left	R1
EF	–	top	R1
E:focus	R1	width	R1
E:active	R1	height	R1
E:myclass	R1	z-index	R1
#myid	R1	line-height	R1
Value assignment/inheritance		vertical-align	–
@import	–	display	R1
!important	–	bottom	–
Media type		right	–
@media	R1	float	–
Box model		clear	–
margin-top	–	direction	–
margin-right	–	unicode-bidi	–
margin-bottom	–	min-width	–

Table 8-1 – Profile of CSS properties in LIME

Property	Operation
margin-left	–
Margin	R1
padding-top	R1
padding-right	R1
padding-bottom	R1
Padding-left	R1
Padding	–
border-top-width	–
border-right-width	–
border-bottom-width	–
border-left-width	–
border-width	R1
border-top-color	–
border-right-color	–
border-bottom-color	–
border-left-color	–
border-color	–
border-top-style	–
border-right-style	–
border-bottom-style	–
border-left-style	–
border-style	R1
border-top	–
border-right	–
border-bottom	–
border-left	–
Border	-
Background	
background	–
background-color	–
background-image	R1
background-repeat	R1
background-position	–
background-attachment	–
Font	
color	–

Property	Operation
max-width	–
min-height	–
max-height	–
Other visual effects	
visibility	R1
overflow	R1
clip	–
Generated content/auto numbering list	
content	–
quotes	–
counter-reset	–
counter-increment	–
marker-offset	–
list-style-type	–
list-style-image	–
list-style-position	–
list-style	–
Page media	
"@page"	–
size	–
marks	–
page-break-before	–
page-break-after	–
page-break-inside	–
page	–
orphans	–
widows	–
User interface	
outline-color	–
outline-width	–
outline-style	–
outline	–
cursor	–
Voice style sheet	
volume	–
speak	–

Table 8-1 – Profile of CSS properties in LIME

Property	Operation
font-family	R1
font-style	–
font-size	R1
font-variant	–
font-weight	R1
font	–
font-stretch	–
font-size-adjust	–
Text	
text-indent	–
text-align	R1
text-decoration	–
text-shadow	–
letter-spacing	R1
word-spacing	–
text-transform	–
white-space	R1
Pseudo class/pseudo element	
:link	–
:visited	–
:active	R1
:hover	–
:focus	R1
:lang	–
:first-child	–
:first-line	–
:first-letter	–
:before	–
:after	–
Table	
caption-side	–
border-collapse	–
border-spacing	–
table-layout	–
empty-cells	–
speak-header	–

Property	Operation
pause-before	–
pause-after	–
Pause	–
cue-before	–
cue-after	–
cue	–
play-during	–
azimuth	–
elevation	–
speech-range	–
voice-family	–
pitch	–
pitch-range	–
stress	–
richness	–
speak-punctuation	–
peak-numeral	–
Extended property	
clut	R1
color-index	R1
background-color-index	R1
border-color-index	–
border-top-color-index	R1
border-right-color-index	R1
border-bottom-color-index	R1
border-left-color-index	R1
outline-color-index	–
resolution	R1
display-aspect-ratio	R1
grayscale-color-index	R1
nav-index	R1
nav-up	R1
nav-down	R1
nav-left	R1
nav-right	R1
used-key-list	R1

A value defined as a fixed value should be specified as the most important rule (`!important`) in the default style sheet. This most important rule always takes priority over the normal rules. This most import rule is not operated in the LIME-CSS and the normal rules are operated. Therefore, the value specified as a fixed value is always obtained.

9 Use of LIME-Script

This clause describes the use of LIME-Script in LIME.

9.1 Profile of built-in objects

Table 9-1 is the profile of built-in objects for LIME-Script.

Table 9-1 – Profile of the LIME-Script built-in objects

Built-in object	Method/property	Operation	Remarks
(global)			
	NaN	R1	
	Infinity	–	(Note 1)
	eval(x)	–	
	parseInt(string, radix)	R1	(Note 7)
	parseFloat(string)	–	(Note 1)
	escape(string)	–	(Note 2)
	unescape(string)	–	(Note 2)
	isNaN(number)	R1	
	isFinite(number)	–	(Note 1)
Object			
	prototype	R1	
	Object([value])	R1	
	new Object([value])	R1	
Object.prototype			
	constructor	R1	
	toString()	R1	
	valueOf()	R1	
Function			
	prototype	R1	
	Length	R1	
	Function(p1,p2,...pn,body)	–	
	new Function(p1,p2,...pn,body)	–	
Function.prototype			
	constructor	R1	
	toString()	R1	(Note 3)
Array			
	prototype	R1	

Table 9-1 – Profile of the LIME-Script built-in objects

Built-in object	Method/property	Operation	Remarks
	Length	R1	
	Array(item0, item1, ...)	R1	
	new Array(item0, item1,...)	R1	
	new Array([len])	R1	
Array.prototype			
	constructor	R1	
	toString()	R1	
	join([separator])	R1	
	reverse()	R1	
	sort([comparefn])	R1	
String			
	prototype	R1	
	Length	R1	
	String([value])	R1	
	new String([value])	R1	
	String.fromCharCode(char0[,char1, ...])	R1	
String.prototype			
	constructor	R1	
	toString()	R1	
	valueOf()	R1	
	charAt(pos)	R1	
	charCodeAt(pos)	R1	
	indexOf(searchString, position)	R1	
	lastIndexOf(searchString, position)	R1	
	split(separator)	R1	
	substring(start[,end])	R1	
	toLowerCase()	R1	
	toUpperCase()	R1	
Boolean			
	prototype	R1	
	Boolean([value])	R1	
	new Boolean([value])	R1	
Boolean.prototype			
	constructor	R1	
	toString()	R1	
	valueOf()	R1	
Number			

Table 9-1 – Profile of the LIME-Script built-in objects

Built-in object	Method/property	Operation	Remarks
	prototype	R1	
	MAX_VALUE	R1	
	MIN_VALUE	R1	
	NaN	R1	
	NEGATIVE_INFINITY	–	(Note 1)
	POSITIVE_INFINITY	–	(Note 1)
	Number([value])	R1	
	new Number([value])	R1	
Number.prototype			
	constructor	R1	
	toString([radix])	R1	
	valueOf()	R1	
Math			
	E	–	
	LN10	–	
	LN2	–	
	LOG 2E	–	
	LOG 10E	–	
	PI	–	
	SQRT1 2	–	
	SQRT2	–	
	abs(x)	–	
	acos(x)	–	
	asin(x)	–	
	atan(x)	–	
	atan2(y, x)	–	
	cos(x)	–	
	exp(x)	–	
	floor(x)	–	
	log(x)	–	
	max(x, y)	–	
	min(x, y)	–	
	pow(x, y)	–	
	random()	–	
	round(x)	–	
	sin(x)	–	
	sqrt(x)	–	

Table 9-1 – Profile of the LIME-Script built-in objects

Built-in object	Method/property	Operation	Remarks
	tan(x)	–	
Date			
	prototype	R1	
	Date([year, month [, date [, hours [, minutes [, seconds [, ms]]]]]])	R1	
	new Date([year, month [, date [, hours [, minutes [, seconds [, ms]]]]]])	R1	
	Date(value)	–	(Note 4)
	new Date(value)	–	(Note 4)
	Date.parse(string)	–	(Note 4)
	Date.UTC([year, month [, date [, hours [, minutes [, seconds [, ms]]]]]])	–	(Note 4)
Date.prototype			
	constructor	R1	
	toString()	R1	(Note 3)
	valueOf()	–	(Note 4)
	getTime()	–	(Note 4)
	getFullYear()	–	(Note 5)
	getFullYear()	R1	
	getUTCFullYear()	R1	
	getMonth()	R1	
	getUTCMonth()	R1	
	getDate()	R1	
	getUTCDate()	R1	
	getDay()	R1	
	getUTCDay()	R1	
	getHours()	R1	
	getUTCHours()	R1	
	getMinutes()	R1	
	getUTCMinutes()	R1	
	getSeconds()	R1	
	getUTCSeconds()	R1	
	getMilliseconds()	R1	
	getUTCMilliseconds()	R1	
	getTimezoneOffset()	R1	
	setTime(time)	–	(Note 4)
	setMilliseconds(ms)	R1	(Note 6)
	setUTCMilliseconds(ms)	R1	(Note 6)

Table 9-1 – Profile of the LIME-Script built-in objects

Built-in object	Method/property	Operation	Remarks
	setSeconds(sec, [, ms])	R1	(Note 6)
	setUTCSeconds(sec, [, ms])	R1	(Note 6)
	setMinutes(min [, sec, [, ms]])	R1	(Note 6)
	setUTCMinutes(min [, sec, [, ms]])	R1	(Note 6)
	setHours(hour [, min [, sec, [, ms]]])	R1	(Note 6)
	setUTCHours(hour [, min [, sec, [, ms]]])	R1	(Note 6)
	setDate(date)	R1	(Note 6)
	setMonth(mon [, date])	R1	(Note 6)
	setUTCMonth(mon [, date])	R1	(Note 6)
	setFullYear(year [, mon [, date]])	R1	(Note 6)
	setUTCFullYear(year [, mon [, date]])	R1	(Note 6)
	setYear(year)	–	(Note 5)
	toLocaleString()	R1	(Note 3)
	toUTCString()	R1	(Note 3)
	toGMTString()	–	(Note 5)
NOTE 1 – Not operated because it is related to Float. NOTE 2 – Not operated because it is related to Unicode. NOTE 3 – Result of Function.prototype.toString() ([b-ISO/IEC 16262], page 69) "function FUNCTIONNAME() {}" (FUNCTIONNAME is the name of a specified function). Results of Date.prototype.toLocaleString() and Date.prototype.toUTCString() must be of the same output format as Date.prototype.toString() NOTE 4 – Not operated because it is related to Number. NOTE 5 – Not operated because it is specified to maintain compatibility with old source codes. NOTE 6 – Operated with restricted specification because it is related to Number. NOTE 7 – The radix of parseInt() is 8, 10 and 16 (0 is interpreted as 10).			

9.2 Extensions to ECMAScript

Table 9-2 describes the browser pseudo-object profile of LIME-Script. This object provides the interfaces for the following functions:

- 1) EPG: The function to tune from EPG.
- 2) Non-volatile memory: The function to read and to write in the persistent array.
- 3) Bidirectional function over TCP/IP: The function to transmit text-data over IP and to set cache resources over IP.

Table 9-2 – Browser pseudo-object of LIME-Script

	Function	Operation	Remarks
EPG functions			
	epgGetEventStartTime()	R1	
	epgGetEventDuration()	R1	

Table 9-2 – Browser pseudo-object of LIME-Script

	Function	Operation	Remarks
	epgTune()	R1	
	epgTuneToDocument()	R1	
	epgIsReserved()	R1	
	epgReserve()	R1	
	epgCancelReservation()	R1	
	epgRecIsReserved()	R1	
	epgRecReserve()	R1	
	epgRecCancelReservation()	R1	
Interaction channel communication – TCP/IP			
	setISPParams()	R1	
	getISPParams()	R1	
	connectPPP()	R1	
	connectPPPWithISPParams()	R1	
	disconnectPPP()	R1	
	getConnectionType()	R1	
	isIPConnected()	R1	
	sendTextMail()	Optional	
	sendMIMEMail()	Optional	
	transmitTextDataOverIP()	R1	
	setCacheResourceOverIP()	Optional	
Operational control functions			
	reloadActiveDocument	R1	
	getNPT()	R1	
	getProgramRelativeTime()	R1	
	isBeingBroadcast()	R1	
	lockModuleOnMemory()	R1	
	unlockModuleOnMemory()	R1	
	setCachePriority()	R1	
	getIRDID()	R1	
	getBrowserVersion()	R1	
	getProgramID()	R1	
	getActiveDocument()	R1	
	lockScreen()	R1	
	unlockScreen()	R1	
	getBrowserSupport()	R1	
	launchDocument()	R1	
	launchDocumentRestricted()	R1	

Table 9-2 – Browser pseudo-object of LIME-Script

	Function	Operation	Remarks
	quitDocument()	R1	
	launchExApp()	Optional	(Note)
	getFreeContentsMemory()	R1	
	isSupportedMedia()	R1	
	detectComponent()	R1	
	lockModuleOnMemoryEx()	R1	
	unlockModuleOnMemoryEx()	R1	
	unlockAllModulesOnMemory()	R1	
	getLockedModuleInfo()	R1	
	getBrowerStatus()	R1	
	getResidentAppVersion()	R1	
	isRootCertificateExisting()	R1	
	getRootCertificateInfo()	R1	
	startResidentApp()	Optional	
Receiver audio control			
	playRomSound()	R1	
Timer functions			
	sleep()	R1	
	setInterval()	R1	
	clearTimer()	R1	
	pauseTimer()	R1	
	resumeTimer()	R1	
	setCurrentDateMode()	R1	
External character functions			
	loadDRCS()	R1	
Other functions			
	random()	R1	
	subDate()	R1	
	addDate()	R1	
	formatNumber()	R1	
Closed caption display control functions			
	setCCDisplayStatus()	R1	
	getCCDisplayStatus()	R1	
	getCCLanguageStatus()	R1	
NOTE – Even when using independent services.			

9.2.1 Explanations of the Methods

epgGetEventStartTime()

Obtains the start time of a program described in EIT.

Syntax

```
Date epgGetEventStartTime(input String event_ref)
```

Argument

event_ref: Specifies an event

Return values

Start time of a program: Success

null: Could not obtain the event information specified by event_ref.

Description

The description of event_ref conforms to the conventions defined in 9.2.1.1.

```
epgGetEventDuration()
```

Obtains the duration time of a program described in EIT.

Syntax

```
Number epgGetEventDuration(input String event_ref)
```

Argument

event_ref: Specifies an event

Return values

Duration time of a program (in seconds): Success

NaN: Obtained no event information, as specified by event_ref.

Description

The description of event_ref conforms to the conventions defined in clause 9.2.1.1.

```
epgTune()
```

Quits displaying the presented LIME document and selects a specified service.

Syntax

```
Number epgTune(input String service_ref)
```

Arguments

service_ref: Specifies a service.

Return values

1: Success

NaN: Failure

Description

The description of event_ref conforms to the conventions defined in clause 9.2.1.1.

- The scripts after the epgTune() are not executed.
- If epgTune() is executed in a global code, the “load” event and “unload” are not occurred.
- If epgTrue() fails, it is not ensured that the following scripts are executed.

epgTuneToDocument ()

Quits displaying the presented LIME document and presents the specified LIME document.

Syntax

Number epgTuneToDocument(input String documentName)

Argument

DocumentName: String specifying the LIME document to be presented

Return values

1: Success

NaN: Failure

Description

The description of documentName conforms to the conventions defined in clause 9.2.1.2. This object selects the service transmitting the LIME document specified in documentName and presents the specified LIME document.

- The scripts following epgTuneToDocument() are not executed.
- If epgTuneToDocument() is executed in the global code, the “load” event and “unload” are not occurred
- If epgTuneToDocument() fails, it is not ensured that the following scripts are executed.

epgIsReserved ()

Verifies whether or not the specified event is reserved for watching.

Syntax

Number epgIsReserved(input String event_ref
[,input Date startTime]
)

Arguments

event_ref: Specifies an event

startTime: Start time of an event

Return values

1: Reserved for watching

0: Not reserved

NaN: Failure