

ANSI/CTA Standard

Web-based Protocol and Framework
for Remote User Interface on
UPnP™ Networks and the Internet
(Web4CE)

ANSI/CTA-2014-B

(Formerly ANSI/CEA-2014-B)

January 2011



Consumer
Technology
Association

NOTICE

Consumer Technology Association (CTA)TM Standards, Bulletins and other technical publications are designed to serve the public interest through eliminating misunderstandings between manufacturers and purchasers, facilitating interchangeability and improvement of products, and assisting the purchaser in selecting and obtaining with minimum delay the proper product for his particular need. Existence of such Standards, Bulletins and other technical publications shall not in any respect preclude any member or nonmember of the Consumer Technology Association from manufacturing or selling products not conforming to such Standards, Bulletins or other technical publications, nor shall the existence of such Standards, Bulletins and other technical publications preclude their voluntary use by those other than Consumer Technology Association members, whether the standard is to be used either domestically or internationally.

Standards, Bulletins and other technical publications are adopted by the Consumer Technology Association in accordance with the American National Standards Institute (ANSI) patent policy. By such action, the Consumer Technology Association does not assume any liability to any patent owner, nor does it assume any obligation whatever to parties adopting the Standard, Bulletin or other technical publication.

Note: The user's attention is called to the possibility that compliance with this standard may require use of an invention covered by patent rights.

By publication of this standard, no position is taken with respect to the validity of this claim or of any patent rights in connection therewith. The patent holder has, however, filed a statement of willingness to grant a license under these rights on reasonable and nondiscriminatory terms and conditions to applicants desiring to obtain such a license. Details may be obtained from the publisher.

This document does not purport to address all safety problems associated with its use or all applicable regulatory requirements. It is the responsibility of the user of this document to establish appropriate safety and health practices and to determine the applicability of regulatory limitations before its use.

This document is copyrighted by the Consumer Technology Association (CTA)TM and may not be reproduced, in whole or part, without written permission. Federal copyright law prohibits unauthorized reproduction of this document by any means. Organizations may obtain permission to reproduce a limited number of copies by entering into a license agreement. Requests to reproduce text, data, charts, figures or other material should be made to the Consumer Technology Association (CTA)TM.

(Formulated under the cognizance of the CTA **R7 Consumer Electronics Networking Committee**.)

Published by
©CONSUMER TECHNOLOGY ASSOCIATION 2015
Technology & Standards Department
www.cta.tech

All rights reserved

FOREWORD

The current version of this standard was developed under the auspices of the Consumer Electronics Association (CEA) R7 Home Network Committee.

Table of Contents

1	Scope	1
1.1	Purpose	1
1.2	Features	2
1.3	Revision History	3
2	References.....	3
2.1	Normative References.....	3
2.2	Informative References	6
2.3	Reference Acquisition.....	7
3	Conventions and Definitions	8
3.1	Conventions	8
3.2	Definitions and Acronyms.....	8
4	Architectural Overview (Informative)	10
4.1	Remote UI Configuration Models	10
4.1.1	i-Box Remote UI Model	10
4.1.2	2-Box Remote UI Model.....	10
4.1.3	3-Box Remote UI Model.....	11
4.2	Background: DLNA A/V 2-Box and 3-Box Models.....	11
4.3	Configuration Models for combining Remote UI with A/V	12
4.4	Remote UI Server and Client Types.....	12
4.5	Detailed Architecture	14
4.5.1	Remote UI Client Architecture.....	15
4.5.2	Remote UI Server Architecture	17
5	Requirements (Normative)	19
5.1	Setup: Discovery and Connection of Remote UI Devices	20
5.1.1	General Remote UI Server Requirements	20
5.1.2	General Remote UI Client Requirements.....	24
5.1.3	UI Control Point Requirements	28
5.2	Capability Exchange.....	32
5.2.1	UI Capability Profiles.....	32
5.2.2	Profile Matching	45
5.2.3	Browser Area.....	47
5.3	HTTP Headers	49
5.4	XHTML Profile (CE-HTML).....	54
5.4.1	Key-events	60
5.4.2	Window scripting object	64
5.5	In-session Notifications	68
5.5.1	NotifSocket scripting object.....	68
5.5.2	XMLHttpRequest scripting object.....	70
5.6	3 rd Party Notifications	71
5.6.1	Multicast Notifications	71
5.6.2	Polling-based Notifications.....	76
5.6.3	Notification Content and Window	80
5.7	A/V Playback and Control.....	83
5.7.1	A/V Control scripting object	83
5.7.2	Local video object	105
5.7.3	Full-screen video.....	106
5.8	Save and Restore.....	107
5.9	Cookie Support.....	115
5.10	Robustness Requirements	116

5.11 Control Ownership	119
5.12 Home Network Framework.....	122
5.12.1 Home Network scripting object	122
5.12.2 Security Requirements for the home network framework	128
5.13 Content Download.....	131
5.13.1 Download capability	131
5.13.2 Download agent	131
5.13.3 Download protocol(s)	132
5.13.4 Content Access Download Descriptor.....	132
5.13.5 Content Download scripting object.....	132
5.13.6 Extensions to Content Download for managing downloads.....	134
5.13.7 Methods for accessing downloaded content.....	136
5.13.8 Extensions to A/V object for playback of downloaded content.....	137
5.13.9 Security requirements for content download functionality.....	137
5.14 DRM Agent API	139
5.14.1 DRM capability	139
5.14.2 DRM Agent scripting object.....	139
5.14.3 Extensions to the A/V object for conveying DRM errors	140
5.14.4 Security requirements for DRM agent functionality.....	141
5.15 Scalable Vector Graphics (SVG)	142
5.15.1 SVG capability.....	142
5.15.2 SVG integration.....	142
5.16 Parental Rating API	146
5.16.1 Parental Rating capability.....	146
5.16.2 Parental Rating Manager object.....	146
5.16.3 Extensions to the A/V object for conveying Parental Ratings	147
5.17 Secure Session Management	149
5.17.1 Security Protocol.....	149
5.17.2 Remote UI Client authentication	149
5.17.3 Remote UI Server access to privileged APIs	150
Annex A: Remote UI Server UPnP Device Extension Schema (Normative).....	152
Annex B : Remote UI Client UPnP Device Extension Schema (Normative)	156
Annex C: Remote UI Client Capability Description Schema (Normative)	158
Annex D: Remote UI Server Capability Description Schema (Normative).....	162
Annex E: XHTML DTD with Tagged Opcodes (Informative)	163
Annex F: Virtual Key Codes (Normative)	164
Annex G: CE-HTML Tags (Informative).....	167
Annex H: CE-HTML Style Attributes (Informative)	183
Annex I: CE-HTML Scripting Objects/interfaces (Informative)	191
Annex J: Example In-Session Notification Scenarios (Informative)	210
Annex K: Example Multicast Notification Message and SCPD (Informative).....	217
Annex L: Guidelines For Non-Latin Character Codes (Informative).....	218
Annex M: Example Browser Area Configurations (Informative)	219
Annex N: Example Save Restore Scripts And Scenario (Informative)	222
Annex O: XRT Self-Contained Remoting Protocol (Informative).....	226
Annex P: Table of Short Names of Remoting Protocols (Informative)	248
Annex Q: Authoring Guidance For Browser Back-Button (Informative)	249
Annex R: State diagram for A/V object (Informative).....	251
Annex S: Control Ownership - Mutex Client/Server Protocols (Normative)	252
Annex T: UI Example of control ownership (Informative)	254

Annex U: Overview of Home Network Framework (Informative)255
Annex V: Helper objects (Normative)261
Annex W: Content Access Descriptor Format (Normative)269
Annex X: Clarification of Download and DRM interfaces (Informative).....276
Annex Y: Examples of <avcontrol> capability element (Normative).....279
Annex Z: Additional information on UI feedback of buffering A/V (Informative)280
Annex AA: Parental Rating API object hierarchy (Informative)281
Annex AB: Introduction to UI Capability Profiles and Profile Matching (Informative) 282
Annex BB: List of changes between CEA-2014-B and CEA-2014-A (Informative) ...285
Annex CC: Requirements Index (Informative)300

List of Figures

Figure 1: i-Box UI Model 10
Figure 2: 2-Box UI Model 11
Figure 3: 3-Box UI Model 11
Figure 4: Possible 2-Box Configurations For Combining A/V And UI Functionality..... 12
Figure 5: Architecture Overview 14
Figure 6: Detailed Remote UI Client Architecture 15
Figure 7: Detailed Remote UI Server Architecture 17

Web-based Protocol and Framework for Remote User Interface on UPnP™ Networks and the Internet (Web4CE)

1 Scope

The CEA-2014-B “Web-based Protocol and Framework for Remote User Interface on UPnP™ Networks and the Internet (Web4CE)” standard defines the necessary mechanisms to allow a user interface to be remotely displayed on and controlled by devices or control points other than the one hosting the logic.

The basic device operations are based on the UPnP Device Architecture for UPnP networks and UPnP devices in the home. The standard also allows the remote display of user interfaces provided by third party internet services on devices in the home, and covers a wide range of UI capabilities for TVs, mobile phones and portable devices.

This standard includes mechanisms intended to enable flow of content that might be under the control of a content protection system, such as a Digital Rights Management (DRM) system. In such cases certain capabilities defined by this standard may depend on proper, parallel implementation of the appropriate content protection system. Specification of content protection is beyond the scope of this standard.

Note that for CEA-2014-B, the requirements previously identified to remain compatible with CEA-2027-A are no longer required by this specification. These requirements have been identified with the term “obsolete”.

1.1 Purpose

The CEA-2014 protocol provides a structured way of accessing consumer electronics friendly XHTML (and related) content over an IP network.

The main goals of CEA-2014-A were based on the following principles:

- a) Provide a mechanism that allows remote presentation and control of user interfaces directed to consumer devices.
- b) Handle remote UI content that may reside either:
 - On UPnP UI server devices
 - On Internet-based services
- c) Use existing web standards for UI content (e.g. XHTML)
 - Define extensions only when necessary
- d) Support a variety of different consumer client devices
 - STBs, TVs, mobile phones
- e) Allow for dynamic interaction between Remote UI Clients and Servers
 - Provide timely, partial UI updates from a Remote UI Server
- f) Allow clients to receive important UI notifications from server devices at any time (if permitted by the user)
- g) Allow for A/V functionality to be part of the UI experience

The main goals for the CEA-2014-B revision are based on the following principles:

- a) A detailed HTML+A/V definition for IPTV terminal devices
- b) Allow for downloading (protected) content.
- c) Allow for controlling ownership of server resources.
- d) Allow for controlling in-home network UPnP devices.
- e) Allow for conveyance of parental ratings and parental rating settings.
- f) Integration of SVG (Scalable Vector Graphics) for enhanced graphical capabilities
- g) PC and TV monitor-friendly
- h) Support for many client types: Cell Phones to Hi-Def TVs.
- i) Operating System independence
- j) Support existing standards (when possible) for home networking and Internet:
 - o DLNA (for home network)
 - o UPnP (for home network)
 - o HTTP 1.1
 - o XHTML, CSS 2.1.

1.2 Features

CEA-2014-A supported the following features:

Discovery of UIs Remote UI Servers can list their available UIs to the user (using an iconic representation) and expose the UI profiles (and additional UI capabilities) that they require and support. Within a home domain, such Remote UI Servers are discoverable.

Connecting to a UI Clients can connect to a Remote UI Server over an HTTP connection. Connections can also be set up by a separate UI Control Point.

Presenting UI content A Remote UI Server presents a user interface to a Remote UI Client. The content primarily takes the form of XHTML with style sheets and scripts that are delivered via HTTP/1.1. The Remote UI Client's capability profile is conveyed to the Remote UI Server to enable the Remote UI Server to adjust the content to the Remote UI Client's capabilities. Remote UI Clients that support additional content formats (e.g. SVG) can also convey these extensions to the Remote UI Server.

Controlling the UI

- Remote control, keyboard and mouse events can be handled within scripts
- Native control for web forms and spatial navigation
- Client-side scripting control for the playback of A/V content. A/V content can be rendered either within a window of the user interface or full-screen.

Dynamic UI Updates User interfaces can be dynamically updated by the server using a persistent TCP connection or through XML updates over an HTTP connection.

3rd Party Notifications

- Users can subscribe to notifications that can arrive outside of an active interaction with the client.
- Notification messages for UI content are either multicasted within the home domain or are polled by clients for the Internet.

CEA-2014-B adds the following features:

- **Additional UI (graphic) profiles.**
- **Several new Javascript APIs, such as:**
 - o Capabilities Scripting Object.
 - o Control Ownership Scripting Object (Network Mutex).
 - o Home Network Scripting Object.
 - o Content Download Scripting Object .
 - o DRM Agent API.
 - o Parental Rating API.
- **SVG (Scalable Vector Graphics) support .**
- **Lossless Notifications.**
- **Several extensions to the A/V scripting object, such as:**
 - o Additional control over A/V playback.
 - o Extensions for Play control permissions.
 - o Extensions for UI feedback of buffering A/V content.
 - o Extensions for getting video rendering characteristics.
 - o Extensions for playback of selected components.
- **Several extensions to the CE-HTML core.**
- **Numerous editorial clarifications to CEA-2014-A.**

1.3 Revision History

- CEA-2014-A provides clarification of the original CEA-2014 standard.
- CEA-2014-B extends the CEA-2014-A with new functionality. Builds upon CEA-2014-A with applied errata changes. The detailed list of changes between CEA-2014-B and CEA-2014-A (with applied errata changes) is provided in Annex BB.

2 References

2.1 Normative References

The following standards contain provisions that, through reference in this text, constitute normative provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed.

- [1] UPnP™ Device Architecture 1.0, 2008, UPnP forum,
<http://www.upnp.org/specs/arch/UPnP-arch-DeviceArchitecture-v1.0-20080424.pdf>
- [2] DLNA® Networked Device Interoperability Guidelines v1.5 (a.k.a. DLNA Home Networked Device Interoperability Guidelines – Expanded: October 2006),
http://www.dlna.org/members/guidelines/DLNA_Guidelines_-_20070814.zip
- [3] IETF RFC 2616, HyperText Transfer Protocol – HTTP 1.1, June 1999,
<http://www.ietf.org/rfc/rfc2616.txt>
- [4] IETF RFC 2109, HTTP State Management Mechanism, February 1997,
<http://www.ietf.org/rfc/rfc2109.txt>