INTERNATIONAL STANDARD

ISO/IEC 29341-20-2

First edition
2017-09

Information technology — UPnP Device Architecture —

Part 20-2: Audio video device control protocol — Level 4 — Media renderer device

Technologies de l'information — Architecture de dispositif UPnP —

Partie 20-2: Protocole de contrôle de dispositif audio-vidéo — Niveau 4 — Dispositif de moteur de rendu de média

Reference number
ISO/IEC 29341-20-2:2017(E)

© ISO/IEC 2017



COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2017, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

CONTENTS

1 Scope 1
2 Normative references 1
3 Terms, definitions, symbols and abbreviations 4
3.1 Provisioning terms 4
3.2 Symbols 5
4 Notations and Conventions 5
4.1 Notation 5
4.1.1 Data Types 5
4.1.2 Strings Embedded in Other Strings 6
4.1.3 Extended Backus-Naur Form 6
4.2 Derived Data Types 6
4.2.1 Summary 6
4.2.2 CSV Lists 7
4.3 Management of XML Namespaces in Standardized DCPs 8
4.3.1 Namespace Prefix Requirements 12
4.3.2 Namespace Names, Namespace Versioning and Schema Versioning 13
4.3.3 Namespace Usage Examples 15
4.4 Vendor-defined Extensions 15
4.4.1 Vendor-defined Action Names 15
4.4.2 Vendor-defined State Variable Names 15
4.4.3 Vendor-defined XML Elements and attributes 16
4.4.4 Vendor-defined Property Names 16
5 Device Definitions 16
5.1 Device Type 16
5.2 Device Model 16
5.2.1 Description of Device Requirements 17
5.2.2 Relationships Between Services 17
6 XML Device Description 17
7 Test 19
Annex A (informative) Theory of Operation 20
A.1 Device Discovery 20
A.2 Preparing to Transfer the Content 20
A.3 Controlling the Transfer of the Content 20
A.4 Controlling How the Content is Rendered 21
Annex B (informative) Bibliography 22

© ISO/IEC 2017 – All rights reserved

List of Tables

Table 1 — EBNF Operators....6
Table 2 — CSV Examples....8
Table 3 — Namespace Definitions....9
Table 4 — Schema-related Information....11
Table 5 — Default Namespaces for the AV Specifications....13
Table 6 — Device Requirements....16

List of Figures

Figure 1 — MediaRenderer Functional Diagram....1

 © ISO/IEC 2017 – All rights reserved

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see http://www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of Standard, the meaning of the ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword – Supplementary information

ISO/IEC 29341-20-2 was prepared by UPnP Forum and adopted, under the PAS procedure, by joint technical committee ISO/IEC JTC 1, *Information technology*, in parallel with its approval by national bodies of ISO and IEC.

The list of all currently available parts of ISO/IEC 29341 series, under the general title *Information technology — UPnP Device Architecture*, can be found on the ISO web site.

© ISO/IEC 2017 – All rights reserved

Introduction

ISO and IEC draw attention to the fact that it is claimed that compliance with this document may involve the use of patents as indicated below.

ISO and IEC take no position concerning the evidence, validity and scope of these patent rights. The holders of -these patent rights have assured ISO and IEC that they are willing to negotiate licenses under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statements of the holders of these patent rights are registered with ISO and IEC.

Intel Corporation has informed IEC and ISO that it has patent applications or granted patents.

Information may be obtained from:

Intel Corporation
Standards Licensing Department
5200 NE Elam Young Parkway
MS: JFS-98
USA – Hillsboro, Oregon 97124

Microsoft Corporation has informed IEC and ISO that it has patent applications or granted patents as listed below:

6101499 / US; 6687755 / US; 6910068 / US; 7130895 / US; 6725281 / US; 7089307 / US; 7069312 / US; 10/783 524 /US

Information may be obtained from:

Microsoft Corporation
One Microsoft Way
USA – Redmond WA 98052

Philips International B.V. has informed IEC and ISO that it has patent applications or granted patents.

Information may be obtained from:

Philips International B.V. – IP&S
High Tech campus, building 44 3A21
NL – 5656 Eindhoven

NXP B.V. (NL) has informed IEC and ISO that it has patent applications or granted patents.

Information may be obtained from:

NXP B.V. (NL)
High Tech campus 60
NL – 5656 AG Eindhoven

Matsushita Electric Industrial Co. Ltd. has informed IEC and ISO that it has patent applications or granted patents.

Information may be obtained from:

Matsushita Electric Industrial Co. Ltd.
1-3-7 Shiromi, Chuoh-ku
JP – Osaka 540-6139

 © ISO/IEC 2017 – All rights reserved

Hewlett Packard Company has informed IEC and ISO that it has patent applications or granted patents as listed below:

5 956 487 / US; 6 170 007 / US; 6 139 177 / US; 6 529 936 / US; 6 470 339 / US; 6 571 388 / US; 6 205 466 / US

Information may be obtained from:

Hewlett Packard Company
1501 Page Mill Road
USA – Palo Alto, CA 94304

Samsung Electronics Co. Ltd. has informed IEC and ISO that it has patent applications or granted patents.

Information may be obtained from:

Digital Media Business, Samsung Electronics Co. Ltd.
416 Maetan-3 Dong, Yeongtang-Gu,
KR – Suwon City 443-742

Huawei Technologies Co., Ltd. has informed IEC and ISO that it has patent applications or granted patents.

Information may be obtained from:

Huawei Technologies Co., Ltd.
Administration Building, Bantian Longgang District
Shenzhen – China 518129

Qualcomm Incorporated has informed IEC and ISO that it has patent applications or granted patents.

Information may be obtained from:

Qualcomm Incorporated
5775 Morehouse Drive
San Diego, CA – USA 92121

Telecom Italia S.p.A.has informed IEC and ISO that it has patent applications or granted patents.

Information may be obtained from:

Telecom Italia S.p.A.
Via Reiss Romoli, 274
Turin - Italy 10148

Cisco Systems informed IEC and ISO that it has patent applications or granted patents.

Information may be obtained from:

Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA – USA 95134

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights other than those identified above. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

© ISO/IEC 2017 – All rights reserved

Original UPnP Document

Reference may be made in this document to original UPnP documents. These references are retained in order to maintain consistency between the specifications as published by ISO/IEC and by UPnP Implementers Corporation and later by UPnP Forum. The following table indicates the original UPnP document titles and the corresponding part of ISO/IEC 29341:

UPnP Document Title	ISO/IEC 29341 Part
UPnP Device Architecture 1.0	ISO/IEC 29341-1:2008
UPnP Device Architecture Version 1.0	ISO/IEC 29341-1:2011
UPnP Device Architecture 1.1	ISO/IEC 29341-1-1:2011
UPnP Device Architecture 2.0	ISO/IEC 29341-1-2
UPnP Basic:1 Device	ISO/IEC 29341-2
UPnP AV Architecture:1	ISO/IEC 29341-3-1:2008
UPnP AV Architecture:1	ISO/IEC 29341-3-1:2011
UPnP AVTransport:1 Service	ISO/IEC 29341-3-10
UPnP ConnectionManager:1 Service	ISO/IEC 29341-3-11
UPnP ContentDirectory:1 Service	ISO/IEC 29341-3-12
UPnP RenderingControl:1 Service	ISO/IEC 29341-3-13
UPnP MediaRenderer:1 Device	ISO/IEC 29341-3-2
UPnP MediaRenderer:2 Device	ISO/IEC 29341-3-2:2011
UPnP MediaServer:1 Device	ISO/IEC 29341-3-3
UPnP AVTransport:2 Service	ISO/IEC 29341-4-10:2008
UPnP AVTransport:2 Service	ISO/IEC 29341-4-10:2011
UPnP ConnectionManager:2 Service	ISO/IEC 29341-4-11:2008
UPnP ConnectionManager:2 Service	ISO/IEC 29341-4-11:2011
UPnP ContentDirectory:2 Service	ISO/IEC 29341-4-12
UPnP RenderingControl:2 Service	ISO/IEC 29341-4-13:2008
UPnP RenderingControl:2 Service	ISO/IEC 29341-4-13:2011
UPnP ScheduledRecording:1	ISO/IEC 29341-4-14
UPnP ScheduledRecording:2	ISO/IEC 29341-4-14:2011
UPnP MediaRenderer:2 Device	ISO/IEC 29341-4-2
UPnP MediaServer:2 Device	ISO/IEC 29341-4-3
UPnP AV Datastructure Template:1	ISO/IEC 29341-4-4:2008
UPnP AV Datastructure Template:1	ISO/IEC 29341-4-4:2011
UPnP DigitalSecurityCamera:1 Device	ISO/IEC 29341-5-1
UPnP DigitalSecurityCameraMotionImage:1 Service	ISO/IEC 29341-5-10
UPnP DigitalSecurityCameraSettings:1 Service	ISO/IEC 29341-5-11
UPnP DigitalSecurityCameraStillImage:1 Service	ISO/IEC 29341-5-12
UPnP HVAC_System:1 Device	ISO/IEC 29341-6-1
UPnP ControlValve:1 Service	ISO/IEC 29341-6-10
UPnP HVAC_FanOperatingMode:1 Service	ISO/IEC 29341-6-11
UPnP FanSpeed:1 Service	ISO/IEC 29341-6-12
UPnP HouseStatus:1 Service	ISO/IEC 29341-6-13
UPnP HVAC_SetpointSchedule:1 Service	ISO/IEC 29341-6-14
UPnP TemperatureSensor:1 Service	ISO/IEC 29341-6-15
UPnP TemperatureSetpoint:1 Service	ISO/IEC 29341-6-16
UPnP HVAC_UserOperatingMode:1 Service	ISO/IEC 29341-6-17
UPnP HVAC_ZoneThermostat:1 Device	ISO/IEC 29341-6-2

 © ISO/IEC 2017 – All rights reserved

UPnP BinaryLight:1 Device	ISO/IEC 29341-7-1
UPnP Dimming:1 Service	ISO/IEC 29341-7-10
UPnP SwitchPower:1 Service	ISO/IEC 29341-7-11
UPnP DimmableLight:1 Device	ISO/IEC 29341-7-2
UPnP InternetGatewayDevice:1 Device	ISO/IEC 29341-8-1
UPnP LANHostConfigManagement:1 Service	ISO/IEC 29341-8-10
UPnP Layer3Forwarding:1 Service	ISO/IEC 29341-8-11
UPnP LinkAuthentication:1 Service	ISO/IEC 29341-8-12
UPnP RadiusClient:1 Service	ISO/IEC 29341-8-13
UPnP WANCableLinkConfig:1 Service	ISO/IEC 29341-8-14
UPnP WANCommonInterfaceConfig:1 Service	ISO/IEC 29341-8-15
UPnP WANDSLLinkConfig:1 Service	ISO/IEC 29341-8-16
UPnP WANEthernetLinkConfig:1 Service	ISO/IEC 29341-8-17
UPnP WANIPConnection:1 Service	ISO/IEC 29341-8-18
UPnP WANPOTSLinkConfig:1 Service	ISO/IEC 29341-8-19
UPnP LANDevice:1 Device	ISO/IEC 29341-8-2
UPnP WANPPPConnection:1 Service	ISO/IEC 29341-8-20
UPnP WLANConfiguration:1 Service	ISO/IEC 29341-8-21
UPnP WANDevice:1 Device	ISO/IEC 29341-8-3
UPnP WANConnectionDevice:1 Device	ISO/IEC 29341-8-4
UPnP WLANAccessPointDevice:1 Device	ISO/IEC 29341-8-5
UPnP Printer:1 Device	ISO/IEC 29341-9-1
UPnP ExternalActivity:1 Service	ISO/IEC 29341-9-10
UPnP Feeder:1.0 Service	ISO/IEC 29341-9-11
UPnP PrintBasic:1 Service	ISO/IEC 29341-9-12
UPnP Scan:1 Service	ISO/IEC 29341-9-13
UPnP Scanner:1.0 Device	ISO/IEC 29341-9-2
UPnP QoS Architecture:1.0	ISO/IEC 29341-10-1
UPnP QosDevice:1 Service	ISO/IEC 29341-10-10
UPnP QosManager:1 Service	ISO/IEC 29341-10-11
UPnP QosPolicyHolder:1 Service	ISO/IEC 29341-10-12
UPnP QoS Architecture:2	ISO/IEC 29341-11-1
UPnP QosDevice:2 Service	ISO/IEC 29341-11-10
UPnP QosManager:2 Service	ISO/IEC 29341-11-11
UPnP QosPolicyHolder:2 Service	ISO/IEC 29341-11-12
UPnP QOS v2 Schema Files	ISO/IEC 29341-11-2
UPnP RemoteUIClientDevice:1 Device	ISO/IEC 29341-12-1
UPnP RemoteUIClient:1 Service	ISO/IEC 29341-12-10
UPnP RemoteUIServer:1 Service	ISO/IEC 29341-12-11
UPnP RemoteUIServerDevice:1 Device	ISO/IEC 29341-12-2
UPnP DeviceSecurity:1 Service	ISO/IEC 29341-13-10
UPnP SecurityConsole:1 Service	ISO/IEC 29341-13-11
UPnP ContentDirectory:3 Service	ISO/IEC 29341-14-12:2011
UPnP MediaServer:3 Device	ISO/IEC 29341-14-3:2011
UPnP ContentSync:1	ISO/IEC 29341-15-10:2011
UPnP Low Power Architecture:1	ISO/IEC 29341-16-1:2011
UPnP LowPowerProxy:1 Service	ISO/IEC 29341-16-10:2011

© ISO/IEC 2017 – All rights reserved

UPnP LowPowerDevice:1 Service	ISO/IEC 29341-16-11:2011
UPnP QoS Architecture:3	ISO/IEC 29341-17-1:2011
UPnP QosDevice:3 Service	ISO/IEC 29341-17-10:2011
UPnP QosManager:3 Service	ISO/IEC 29341-17-11:2011
UPnP QosPolicyHolder:3 Service	ISO/IEC 29341-17-12:2011
UPnP QosDevice:3 Addendum	ISO/IEC 29341-17-13:2011
UPnP RemoteAccessArchitecture:1	ISO/IEC 29341-18-1:2011
UPnP InboundConnectionConfig:1 Service	ISO/IEC 29341-18-10:2011
UPnP RADAConfig:1 Service	ISO/IEC 29341-18-11:2011
UPnP RADASync:1 Service	ISO/IEC 29341-18-12:2011
UPnP RATAConfig:1 Service	ISO/IEC 29341-18-13:2011
UPnP RAClient:1 Device	ISO/IEC 29341-18-2:2011
UPnP RAServer:1 Device	ISO/IEC 29341-18-3:2011
UPnP RADiscoveryAgent:1 Device	ISO/IEC 29341-18-4:2011
UPnP SolarProtectionBlind:1 Device	ISO/IEC 29341-19-1:2011
UPnP TwoWayMotionMotor:1 Service	ISO/IEC 29341-19-10:2011
UPnP AV Architecture:2	ISO/IEC 29341-20-1
UPnP AVTransport:3 Service	ISO/IEC 29341-20-10
UPnP ConnectionManager:3 Service	ISO/IEC 29341-20-11
UPnP ContentDirectory:4 Device	ISO/IEC 29341-20-12
UPnP RenderingControl:3 Service	ISO/IEC 29341-20-13
UPnP ScheduledRecording:2 Service	ISO/IEC 29341-20-14
UPnP MediaRenderer:3 Service	ISO/IEC 29341-20-2
UPnP MediaServer:4 Device	ISO/IEC 29341-20-3
UPnP AV Datastructure Template:1	ISO/IEC 29341-20-4
UPnP InternetGatewayDevice:2 Device	ISO/IEC 29341-24-1
UPnP WANIPConnection:2 Service	ISO/IEC 29341-24-10
UPnP WANIPv6FirewallControl:1 Service	ISO/IEC 29341-24-11
UPnP WANConnectionDevice:2 Service	ISO/IEC 29341-24-2
UPnP WANDevice:2 Device	ISO/IEC 29341-24-3
UPnP Telephony Architecture:2	ISO/IEC 29341-26-1
UPnP CallManagement:2 Service	ISO/IEC 29341-26-10
UPnP MediaManagement:2 Service	ISO/IEC 29341-26-11
UPnP Messaging:2 Service	ISO/IEC 29341-26-12
UPnP PhoneManagement:2 Service	ISO/IEC 29341-26-13
UPnP AddressBook:1 Service	ISO/IEC 29341-26-14
UPnP Calendar:1 Service	ISO/IEC 29341-26-15
UPnP Presense:1 Service	ISO/IEC 29341-26-16
UPnP TelephonyClient:2 Device	ISO/IEC 29341-26-2
UPnP TelephonyServer:2 Device	ISO/IEC 29341-26-3
UPnP Friendly Info Update:1 Service	ISO/IEC 29341-27-1
UPnP MultiScreen MultiScreen Architecture:1	ISO/IEC 29341-28-1
UPnP MultiScreen Application Management:1 Service	ISO/IEC 29341-28-10
UPnP MultiScreen Screen:1 Device	ISO/IEC 29341-28-2
UPnP MultiScreen Application Management:2 Service	ISO/IEC 29341-29-10
UPnP MultiScreen Screen:2 Device	ISO/IEC 29341-29-2
UPnP IoT Management and Control Architecture Overview:1	ISO/IEC 29341-30-1

 © ISO/IEC 2017 – All rights reserved

UPnP DataStore:1 Service	ISO/IEC 29341-30-10
UPnP IoT Management and Control Data Model:1 Service	ISO/IEC 29341-30-11
UPnP IoT Management and Control Transport Generic:1 Service	ISO/IEC 29341-30-12
UPnP IoT Management and Control:1 Device	ISO/IEC 29341-30-2
UPnP Energy Management:1 Service	ISO/IEC 29341-31-1

© ISO/IEC 2017 – All rights reserved

1 Scope

This device specification is compliant with the Universal Plug and Play Device Architecture version 1.0 [14]. It defines a device type referred to herein as MediaRenderer.

The MediaRenderer specification defines a general-purpose device template that can be used to instantiate any Consumer Electronics (CE) device that is capable of rendering AV content from the home network. It exposes a set of rendering controls in which a control point can control how the specified AV content is rendered. This includes controlling various rendering features such as brightness, contrast, volume, etc.

Example instances of a MediaRenderer include traditional devices such as TVs and stereo systems. Some more contemporary examples include digital devices such as MP3 players and Electronic Picture Frames (EPFs). Although most of these examples typically render one specific type of content (for example, a TV typically renders video content), a MediaRenderer is able to support a number of different data formats and transfer protocols. For example, a sophisticated implementation of a TV MediaRenderer could also support MP3 data so that its speakers could be used to play MP3 audio content.

The MediaRenderer device specification is very lightweight and is easy to implement on low-resource devices such as an MP3 player. However, it can also be used to expose the high-end capabilities of devices such as a PC.

A full-featured MediaRenderer exposes the following capabilities:

- Control various rendering characteristics
- Expose the supported transfer protocols and data formats
- Control the flow of the content (for example, FF, REW, etc), if appropriate depending on the transfer protocol.

The MediaRenderer DOES not enable control points to:

- Send AV content to another device

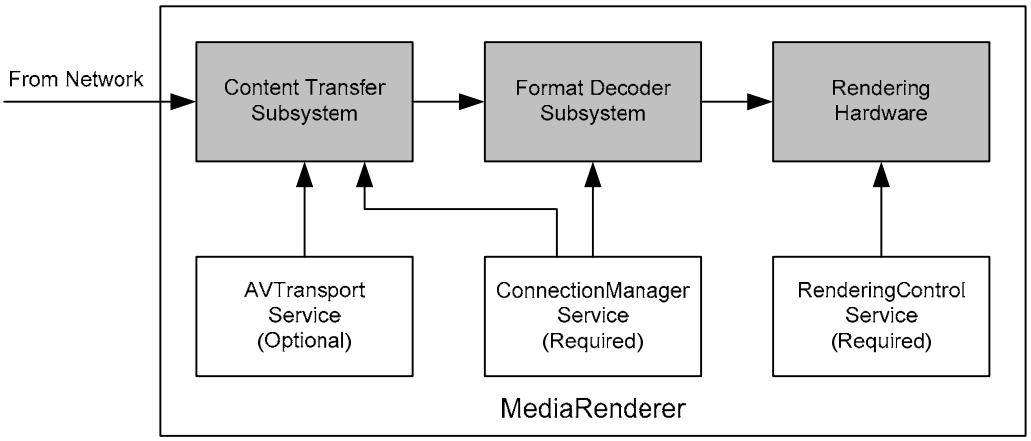


Figure 1 — MediaRenderer Functional Diagram

The un-shaded blocks represent the UPnP services that are contained by a MediaRenderer. The shaded blocks represent various device-specific modules that the UPnP services might interact with. However, the internal architecture of a MediaRenderer device is vendor specific.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For

© ISO/IEC 2017 – All rights reserved

undated references, the latest edition of the referenced document (including any amendments) applies.

[1] – *XML Schema for RenderingControl AllowedTransformSettings*, UPnP Forum, March 31, 2013.
Available at: http://www.upnp.org/schemas/av/AllowedTransformSettings-v1-20130331.xsd.
Latest version available at: http://www.upnp.org/schemas/av/AllowedTransformSettings.xsd.

[2] – *AV Datastructure Template:1*, UPnP Forum, March 31, 2013.
Available at: http://www.upnp.org/specs/av/UPnP-av-AVDataStructureTemplate-v1-20130331.pdf.
Latest version available at: http://www.upnp.org/specs/av/UPnP-av-AVDataStructureTemplate-v1.pdf.

[3] – *XML Schema for UPnP AV Common XML Data Types*, UPnP Forum, March 31, 2013.
Available at: http://www.upnp.org/schemas/av/av-v3-20130331.xsd.
Latest version available at: http://www.upnp.org/schemas/av/av.xsd.

[4] – *XML Schema for UPnP AV Common XML Structures*, UPnP Forum, March 31, 2013.
Available at: http://www.upnp.org/schemas/av/avs-v3-20130331.xsd.
Latest version available at: http://www.upnp.org/schemas/av/avs.xsd.

[5] – *AVTransport:3*, UPnP Forum, March 31, 2013.
Available at: http://www.upnp.org/specs/av/UPnP-av-AVTransport-v3-Service-20130331.pdf.
Latest version available at: http://www.upnp.org/specs/av/UPnP-av-AVTransport-v3-Service.pdf.

[6] – *XML Schema for AVTransport LastChange Eventing*, UPnP Forum, September 30, 2008.
Available at: http://www.upnp.org/schemas/av/avt-event-v2-20080930.xsd.
Latest version available at: http://www.upnp.org/schemas/av/avt-event.xsd.

[7] – *ContentDirectory:4*, UPnP Forum, March 31, 2013.
Available at: http://www.upnp.org/specs/av/UPnP-av-ContentDirectory-v4-Service-20130331.pdf.
Latest version available at: http://www.upnp.org/specs/av/UPnP-av-ContentDirectory-v4-Service.pdf.

[8] – *XML Schema for ContentDirectory LastChange Eventing*, UPnP Forum, September 30, 2008.
Available at: http://www.upnp.org/schemas/av/cds-event-v1-20080930.xsd.
Latest version available at: http://www.upnp.org/schemas/av/cds-event.xsd.

[9] – *ConnectionManager:3*, UPnP Forum, March 31, 2013.
Available at: http://www.upnp.org/specs/av/UPnP-av-ConnectionManager-v3-Service-20130331.pdf.
Latest version available at: http://www.upnp.org/specs/av/UPnP-av-ConnectionManager-v3-Service.pdf.

[10] – *XML Schema for ConnectionManager DeviceClockInfoUpdates*, UPnP Forum, December 31, 2010.
Available at: http://www.upnp.org/schemas/av/cm-deviceClockInfoUpdates-v1-20101231.xsd.
Latest version available at: http://www.upnp.org/schemas/av/cm-deviceClockInfoUpdates.xsd.

[11] – *XML Schema for ConnectionManager Features*, UPnP Forum, December 31, 2010.
Available at: http://www.upnp.org/schemas/av/cm-featureList-v1-20101231.xsd.
Latest version available at: http://www.upnp.org/schemas/av/cm-featureList.xsd.

[12] – *XML Schema for UPnP AV Dublin Core*.
Available at: http://www.dublincore.org/schemas/xmls/simpledc20020312.xsd.

[13] – *DCMI term declarations represented in XML schema language*.
Available at: http://www.dublincore.org/schemas/xmls.

 © ISO/IEC 2017 – All rights reserved

[14] – *UPnP Device Architecture, version 1.0*, UPnP Forum, October 15, 2008.
Available at: http://www.upnp.org/specs/arch/UPnP-arch-DeviceArchitecture-v1.0-20081015.pdf.
Latest version available at: http://www.upnp.org/specs/arch/UPnP-arch-DeviceArchitecture-v1.0.pdf.

[15] – *XML Schema for ContentDirectory Structure and Metadata (DIDL-Lite)*, UPnP Forum, March 31, 2013.
Available at: http://www.upnp.org/schemas/av/didl-lite-v3-20130331.xsd.
Latest version available at: http://www.upnp.org/schemas/av/didl-lite.xsd.

[16] – *XML Schema for ContentDirectory DeviceMode*, UPnP Forum, December 31, 2010.
Available at: http://www.upnp.org/schemas/av/dmo-v1-20101231.xsd.
Latest version available at: http://www.upnp.org/schemas/av/dmo.xsd.

[17] – *XML Schema for ContentDirectory DeviceModeRequest*, UPnP Forum, December 31, 2010.
Available at: http://www.upnp.org/schemas/av/dmor-v1-20101231.xsd.
Latest version available at: http://www.upnp.org/schemas/av/dmor.xsd.

[18] – *XML Schema for ContentDirectory DeviceModeStatus*, UPnP Forum, December 31, 2010.
Available at: http://www.upnp.org/schemas/av/dmos-v1-20101231.xsd.
Latest version available at: http://www.upnp.org/schemas/av/dmos.xsd.

[19] – ISO/IEC 14977, *Information technology - Syntactic metalanguage - Extended BNF*, December 1996.

[20] – *XML Schema for ContentDirectory PermissionsInfo*, UPnP Forum, December 31, 2010.
Available at: http://www.upnp.org/schemas/av/pi-v1-20101231.xsd.
Latest version available at: http://www.upnp.org/schemas/av/pi.xsd.

[21] – *RenderingControl:3*, UPnP Forum, March 31, 2013.
Available at: http://www.upnp.org/specs/av/UPnP-av-RenderingControl-v3-Service-20130331.pdf.
Latest version available at: http://www.upnp.org/specs/av/UPnP-av-RenderingControl-v3-Service.pdf.

[22] –*XML Schema for RenderingControl LastChange Eventing*, UPnP Forum, December 31, 2010.
Available at: http://www.upnp.org/schemas/av/rcs-event-v3-20101231.xsd.
Latest version available at: http://www.upnp.org/schemas/av/rcs-event.xsd.

[23] – *XML Schema for ConnectionManager RendererInfo*, UPnP Forum, December 31, 2010.
Available at: http://www.upnp.org/schemas/av/rii-v1-20101231.xsd.
Latest version available at: http://www.upnp.org/schemas/av/rii.xsd.

[24] – *XML Schema for AVTransport PlaylistInfo*, UPnP Forum, March 31, 2013.
Available at: http://www.upnp.org/schemas/av/rpl-v1-20130331.xsd.
Latest version available at: http://www.upnp.org/schemas/av/rpl.xsd.

[25] – *ScheduledRecording:2*, UPnP Forum, March 31, 2013.
Available at: http://www.upnp.org/specs/av/UPnP-av-ScheduledRecording-v2-Service-20130331.pdf.
Latest version available at: http://www.upnp.org/specs/av/UPnP-av-ScheduledRecording-v2-Service.pdf.

[26] – *XML Schema for ScheduledRecording Metadata and Structure*, UPnP Forum, March 31, 2013.
Available at: http://www.upnp.org/schemas/av/srs-v2-20130331.xsd.
Latest version available at: http://www.upnp.org/schemas/av/srs.xsd.

© ISO/IEC 2017 – All rights reserved

[27] – *XML Schema for ScheduledRecording LastChange Eventing*, UPnP Forum, September 30, 2008.
Available at: http://www.upnp.org/schemas/av/srs-event-v1-20080930.xsd.
Latest version available at: http://www.upnp.org/schemas/av/srs-event.xsd.

[28] – *XML Schema for RenderingControl TransformSettings*, UPnP Forum, March 31, 2013.
Available at: http://www.upnp.org/schemas/av/TransformSettings-v1-20130331.xsd.
Latest version available at: http://www.upnp.org/schemas/av/TransformSettings.xsd.

[29] – *XML Schema for ContentDirectory Metadata*, UPnP Forum, March 31, 2013.
Available at: http://www.upnp.org/schemas/av/upnp-v4-20130331.xsd.
Latest version available at: http://www.upnp.org/schemas/av/upnp.xsd.

[30] – *The "xml:" Namespace*, November 3, 2004.
Available at: http://www.w3.org/XML/1998/namespace.

[31] – *XML Schema for the "xml:" Namespace*.
Available at: http://www.w3.org/2001/xml.xsd.

[32] – *Namespaces in XML*, Tim Bray, Dave Hollander, Andrew Layman, eds., W3C Recommendation, January 14, 1999.
Available at: http://www.w3.org/TR/1999/REC-xml-names-19990114.

[33] – *XML Schema Part 1: Structures, Second Edition*, Henry S. Thompson, David Beech, Murray Maloney, Noah Mendelsohn, W3C Recommendation, 28 October 2004.
Available at: http://www.w3.org/TR/2004/REC-xmlschema-1-20041028.

[34] – *XML Schema Part 2: Data Types, Second Edition*, Paul V. Biron, Ashok Malhotra, W3C Recommendation, 28 October 2004.
Available at: http://www.w3.org/TR/2004/REC-xmlschema-2-20041028.

[35] – *XML Schema for XML Schema*.
Available at: http://www.w3.org/2001/XMLSchema.xsd.

3 Terms, definitions, symbols and abbreviations

For the purposes of this document, the terms and definitions given in [14] and the following subclauses 3.1 and 3.2 apply.

3.1 Provisioning terms

3.1.1
allowed
A
The definition or behavior is allowed.

3.1.2
conditionally allowed
CA
The definition or behavior depends on a condition. If the specified condition is met, then the definition or behavior is allowed, otherwise it is not allowed.

3.1.3
conditionally required
CR
The definition or behavior depends on a condition. If the specified condition is met, then the definition or behavior is required. Otherwise the definition or behavior is allowed as default unless specifically defined as not allowed.

3.1.4
required
R
The definition or behavior is required.

 © ISO/IEC 2017 – All rights reserved

3.1.5
R/A
Used in a table column heading to indicate that each abbreviated entry in the column declares the provisioning status of the item named in the entry's row.

3.1.6
X
Vendor-defined, non-standard.

3.1.7
-D
Declares that the item referred to is deprecated, when it is appended to any of the other abbreviated provisioning terms.

3.1.8
CSV list (or CSV)
Comma separated value list. List—or one-dimensional array—of values contained in a string and separated by commas

3.2 Symbols

3.2.1
::
Signifies a hierarchical parent-child (parent::child) relationship between the two objects separated by the double colon. This delimiter is used in multiple contexts, for example: Service::Action(), Action()::Argument, parentProperty::childProperty.

4 Notations and Conventions

4.1 Notation

- UPnP interface names defined in the UPnP Device Architecture specification [14] are styled in **green bold underlined** text.
- UPnP interface names defined outside of the UPnP Device Architecture specification [14] are styled in *red italic underlined* text.
- Some additional non-interface names and terms are styled in *italic* text.
- Words that are emphasized are also styled in *italic* text. The difference between italic terms and italics for emphasis will be apparent by context.
- Strings that are to be taken literally are enclosed in “double quotes”.

4.1.1 Data Types

Data type definitions come from three sources:

- All state variable and action argument data types are defined in [14].
- Basic data types for properties are defined in [34].
- Additional data types for properties are defined in the XML schema(s) (see [3]) associated with this service.

For UPnP Device Architecture defined **boolean** data types, it is strongly recommended to use the value “**0**” for false, and the value “**1**” for true. However, when used as input arguments, the values “**false**”, “**no**”, “**true**”, “**yes**” may also be encountered and shall be accepted. Nevertheless, it is strongly recommended that all **boolean** state variables and output arguments be represented as “**0**” and “**1**”.

For XML Schema defined Boolean data types, it is strongly recommended to use the value “*0*” for false, and the value “*1*” for true. However, when used as input properties, the values “*false*”, “*true*” may also be encountered and shall be accepted. Nevertheless, it is strongly recommended that all Boolean properties be represented as “*0*” and “*1*”.

© ISO/IEC 2017 – All rights reserved