
**Information technology — UPnP
Device Architecture —**

**Part 20-13:
Audio video device control protocol —
Level 4 — Rendering control service**

Technologies de l'information — Architecture de dispositif UPnP —

*Partie 20-13: Protocole de contrôle de dispositif audio-vidéo —
Niveau 4 — Service de contrôle de rendu*

This document is a preview generated by ERS



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
1.1	Introduction	1
1.2	Multi-input Devices	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	7
4.2.1	Summary	7
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	Service Modeling Definitions	16
5.1	Service Type	16
5.2	State Variables	17
5.2.1	State Variable Overview	17
5.2.2	<u>LastChange</u>	20
5.2.3	<u>PresetNameList</u>	23
5.2.4	<u>Brightness</u>	23
5.2.5	<u>Contrast</u>	23
5.2.6	<u>Sharpness</u>	23
5.2.7	<u>RedVideoGain</u>	23
5.2.8	<u>GreenVideoGain</u>	23
5.2.9	<u>BlueVideoGain</u>	24
5.2.10	<u>RedVideoBlackLevel</u>	24
5.2.11	<u>GreenVideoBlackLevel</u>	24
5.2.12	<u>BlueVideoBlackLevel</u>	24
5.2.13	<u>ColorTemperature</u>	24
5.2.14	<u>HorizontalKeystone</u>	24
5.2.15	<u>VerticalKeystone</u>	25
5.2.16	<u>Mute</u>	26
5.2.17	<u>Volume</u>	26
5.2.18	<u>VolumeDB</u>	26
5.2.19	<u>Loudness</u>	27

5.2.20	<u>AllowedTransformSettings</u>	27
5.2.21	<u>TransformSettings</u>	30
5.2.22	<u>AllowedDefaultTransformSettings</u>	31
5.2.23	<u>DefaultTransformSettings</u>	31
5.2.24	<u>A_ARG_TYPE_Channel</u>	32
5.2.25	<u>A_ARG_TYPE_InstanceID</u>	32
5.2.26	<u>A_ARG_TYPE_PresetName</u>	32
5.2.27	<u>A_ARG_TYPE_DeviceUDN</u>	32
5.2.28	<u>A_ARG_TYPE_ServiceType</u>	32
5.2.29	<u>A_ARG_TYPE_ServiceID</u>	33
5.2.30	<u>A_ARG_TYPE_StateVariableValuePairs</u>	33
5.2.31	<u>A_ARG_TYPE_StateVariableList</u>	33
5.2.32	Relationships between State Variables	33
5.3	Eventing and Moderation	34
5.3.1	Eventing and Moderation Overview	34
5.3.2	Event Model	36
5.4	Actions	36
5.4.1	Action Overview	36
5.4.2	<u>ListPresets()</u>	39
5.4.3	<u>SelectPreset()</u>	39
5.4.4	<u>GetBrightness()</u>	40
5.4.5	<u>SetBrightness()</u>	40
5.4.6	<u>GetContrast()</u>	41
5.4.7	<u>SetContrast()</u>	41
5.4.8	<u>GetSharpness()</u>	42
5.4.9	<u>SetSharpness()</u>	42
5.4.10	<u>GetRedVideoGain()</u>	43
5.4.11	<u>SetRedVideoGain()</u>	43
5.4.12	<u>GetGreenVideoGain()</u>	44
5.4.13	<u>SetGreenVideoGain()</u>	45
5.4.14	<u>GetBlueVideoGain()</u>	45
5.4.15	<u>SetBlueVideoGain()</u>	46
5.4.16	<u>GetRedVideoBlackLevel()</u>	46
5.4.17	<u>SetRedVideoBlackLevel()</u>	47
5.4.18	<u>GetGreenVideoBlackLevel()</u>	47
5.4.19	<u>SetGreenVideoBlackLevel()</u>	48
5.4.20	<u>GetBlueVideoBlackLevel()</u>	48
5.4.21	<u>SetBlueVideoBlackLevel()</u>	49
5.4.22	<u>GetColorTemperature()</u>	50
5.4.23	<u>SetColorTemperature()</u>	50
5.4.24	<u>GetHorizontalKeystone()</u>	51
5.4.25	<u>SetHorizontalKeystone()</u>	51
5.4.26	<u>GetVerticalKeystone()</u>	52
5.4.27	<u>SetVerticalKeystone()</u>	52
5.4.28	<u>GetMute()</u>	53
5.4.29	<u>SetMute()</u>	54
5.4.30	<u>GetVolume()</u>	54
5.4.31	<u>SetVolume()</u>	55
5.4.32	<u>GetVolumeDB()</u>	55

5.4.33	<u>SetVolumeDB()</u>	56
5.4.34	<u>GetVolumeDBRange()</u>	57
5.4.35	<u>GetLoudness()</u>	57
5.4.36	<u>SetLoudness()</u>	58
5.4.37	<u>GetStateVariables()</u>	59
5.4.38	<u>SetStateVariables()</u>	59
5.4.39	<u>GetAllowedTransforms()</u>	60
5.4.40	<u>GetTransforms()</u>	61
5.4.41	<u>SetTransforms()</u>	62
5.4.42	<u>GetAllowedDefaultTransforms()</u>	62
5.4.43	<u>GetDefaultTransforms()</u>	63
5.4.44	<u>SetDefaultTransforms()</u>	64
5.4.45	<u>GetAllAvailableTransforms()</u>	65
5.4.46	Relationships Between Actions	65
5.4.47	Common Error Codes	66
6	XML Service Description	66
7	Test	83
Annex A	(informative) Theory of Operation	84
A.1	Multi-input Devices	84
A.2	Presets	85
A.3	Controlling the Display of Visual Content	85
A.4	Controlling Audio Content	86
A.5	Transforms	88
A.5.1	Retrieving Transforms	88
A.5.2	Get Allowed Transforms from an instance	89
A.5.3	Setting Transforms	91
A.5.4	Retrieving Current values of the Transforms	91
A.5.5	Querying and setting default values for a Transform	92
Annex B	(normative) Pre-defined Transforms	94
B.1	Summary	94
B.2	<u>Rotation</u>	96
B.3	<u>RedEye</u>	96
B.4	<u>Zoom</u>	97
B.4.1	Additional units for the <u>Zoom</u> Transform	97
B.5	<u>HorizontalPan</u>	98
B.5.1	Additional units for the HorizontalPan Transform	98
B.6	<u>VerticalPan</u>	99
B.6.1	Additional units for the <u>VerticalPan</u> Transform	100
B.7	<u>ImageDisplayTime</u>	101
B.8	<u>ImageTransitionEffects</u>	102
B.9	<u>Equalization</u>	102
B.10	<u>BandEq [XX] [YY]</u>	103
B.10.1	Additional units for the <u>BandEq [XX] [YY]</u> Transform	104
B.11	<u>SpeakerConfiguration</u>	104
B.12	<u>OutputSelection [Name]</u>	105
B.13	<u>AudioTrackSelection</u>	106
B.14	<u>ClosedCaptioning</u>	107
B.15	<u>Subtitle</u>	108

B.16	<u>CameraAngle</u>	109
B.17	<u>PiP</u>	109
B.18	<u>ComponentInfoSelection</u>	110
B.19	<u>3DSettings3DScreen</u>	111
B.20	<u>3DSettings2DScreen</u>	113
B.21	Legacy compatible transforms	113
B.21.1	<u>Volume [Channel]</u>	113
B.21.2	<u>VolumeDB [Channel]</u>	114
B.21.3	<u>Mute [Channel]</u>	114
B.21.4	<u>Loudness [Channel]</u>	115
B.21.5	<u>Brightness</u>	116
B.21.6	<u>Sharpness</u>	116
B.21.7	<u>Contrast</u>	117
B.21.8	<u>RedVideoGain</u>	117
B.21.9	<u>GreenVideoGain</u>	117
B.21.10	<u>BlueVideoGain</u>	118
B.21.11	<u>RedVideoBlackLevel</u>	118
B.21.12	<u>GreenVideoBlackLevel</u>	119
B.21.13	<u>BlueVideoBlackLevel</u>	119
B.21.14	<u>ColorTemperature</u>	120
B.21.15	<u>HorizontalKeystone</u>	120
B.21.16	<u>VerticalKeystone</u>	121
Annex C (informative)	Bibliography	122

List of Tables

Table 1 — EBNF Operators.....	7
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 — State Variables	17
Table 7 — allowedValueRange for <u>Brightness</u>	18
Table 8 — allowedValueRange for <u>Contrast</u>	18
Table 9 — allowedValueRange for <u>Sharpness</u>	18
Table 10 — allowedValueRange for <u>RedVideoGain</u>	18
Table 11 — allowedValueRange for <u>GreenVideoGain</u>	18
Table 12 — allowedValueRange for <u>BlueVideoGain</u>	18
Table 13 — allowedValueRange for <u>RedVideoBlackLevel</u>	19
Table 14 — allowedValueRange for <u>GreenVideoBlackLevel</u>	19
Table 15 — allowedValueRange for <u>BlueVideoBlackLevel</u>	19
Table 16 — allowedValueRange for <u>ColorTemperature</u>	19
Table 17 — allowedValueRange for <u>HorizontalKeystone</u>	19
Table 18 — allowedValueRange for <u>VerticalKeystone</u>	19
Table 19 — allowedValueRange for <u>Volume</u>	19
Table 20 — allowedValueRange for <u>VolumeDB</u>	19
Table 21 — allowedValueList for <u>A_ARG_TYPE_Channel</u>	20
Table 22 — allowedValueList for <u>A_ARG_TYPE_PresetName</u>	20
Table 23 — Allowed values for the <code>unit</code> attribute.....	29
Table 24 — Allowed values for the <code>scale</code> attribute.....	29
Table 25 — Predefined Names of Some Common Presets	32
Table 26 — Event moderation	35
Table 27 — Actions.....	37
Table 28 — Arguments for <u>ListPresets()</u>	39
Table 29 — Error Codes for <u>ListPresets()</u>	39
Table 30 — Arguments for <u>SelectPreset()</u>	39
Table 31 — Error Codes for <u>SelectPreset()</u>	40
Table 32 — Arguments for <u>GetBrightness()</u>	40
Table 33 — Error Codes for <u>GetBrightness()</u>	40
Table 34 — Arguments for <u>SetBrightness()</u>	40
Table 35 — Error Codes for <u>SetBrightness()</u>	41
Table 36 — Arguments for <u>GetContrast()</u>	41
Table 37 — Error Codes for <u>GetContrast()</u>	41
Table 38 — Arguments for <u>SetContrast()</u>	41
Table 39 — Error Codes for <u>SetContrast()</u>	42
Table 40 — Arguments for <u>GetSharpness()</u>	42
Table 41 — Error Codes for <u>GetSharpness()</u>	42

Table 42 — Arguments for <u>SetSharpness()</u>	43
Table 43 — Error Codes for <u>SetSharpness()</u>	43
Table 44 — Arguments for <u>GetRedVideoGain()</u>	43
Table 45 — Error Codes for <u>GetRedVideoGain()</u>	43
Table 46 — Arguments for <u>SetRedVideoGain()</u>	44
Table 47 — Error Codes for <u>SetRedVideoGain()</u>	44
Table 48 — Arguments for <u>GetGreenVideoGain()</u>	44
Table 49 — Error Codes for <u>GetGreenVideoGain()</u>	44
Table 50 — Arguments for <u>SetGreenVideoGain()</u>	45
Table 51 — Error Codes for <u>SetGreenVideoGain()</u>	45
Table 52 — Arguments for <u>GetBlueVideoGain()</u>	45
Table 53 — Error Codes for <u>GetBlueVideoGain()</u>	46
Table 54 — Arguments for <u>SetBlueVideoGain()</u>	46
Table 55 — Error Codes for <u>SetBlueVideoGain()</u>	46
Table 56 — Arguments for <u>GetRedVideoBlackLevel()</u>	46
Table 57 — Error Codes for <u>GetRedVideoBlackLevel()</u>	47
Table 58 — Arguments for <u>SetRedVideoBlackLevel()</u>	47
Table 59 — Error Codes for <u>SetRedVideoBlackLevel()</u>	47
Table 60 — Arguments for <u>GetGreenVideoBlackLevel()</u>	48
Table 61 — Error Codes for <u>GetGreenVideoBlackLevel()</u>	48
Table 62 — Arguments for <u>SetGreenVideoBlackLevel()</u>	48
Table 63 — Error Codes for <u>SetGreenVideoBlackLevel()</u>	48
Table 64 — Arguments for <u>GetBlueVideoBlackLevel()</u>	49
Table 65 — Error Codes for <u>GetBlueVideoBlackLevel()</u>	49
Table 66 — Arguments for <u>SetBlueVideoBlackLevel()</u>	49
Table 67 — Error Codes for <u>SetBlueVideoBlackLevel()</u>	50
Table 68 — Arguments for <u>GetColorTemperature()</u>	50
Table 69 — Error Codes for <u>GetColorTemperature()</u>	50
Table 70 — Arguments for <u>SetColorTemperature()</u>	50
Table 71 — Error Codes for <u>SetColorTemperature()</u>	51
Table 72 — Arguments for <u>GetHorizontalKeystone()</u>	51
Table 73 — Error Codes for <u>GetHorizontalKeystone()</u>	51
Table 74 — Arguments for <u>SetHorizontalKeystone()</u>	52
Table 75 — Error Codes for <u>SetHorizontalKeystone()</u>	52
Table 76 — Arguments for <u>GetVerticalKeystone()</u>	52
Table 77 — Error Codes for <u>GetVerticalKeystone()</u>	52
Table 78 — Arguments for <u>SetVerticalKeystone()</u>	53
Table 79 — Error Codes for <u>SetVerticalKeystone()</u>	53
Table 80 — Arguments for <u>GetMute()</u>	53
Table 81 — Error Codes for <u>GetMute()</u>	53
Table 82 — Arguments for <u>SetMute()</u>	54
Table 83 — Error Codes for <u>SetMute()</u>	54
Table 84 — Arguments for <u>GetVolume()</u>	54

Table 85 — Error Codes for <u>GetVolume()</u>	55
Table 86 — Arguments for <u>SetVolume()</u>	55
Table 87 — Error Codes for <u>SetVolume()</u>	55
Table 88 — Arguments for <u>GetVolumeDB()</u>	56
Table 89 — Error Codes for <u>GetVolumeDB()</u>	56
Table 90 — Arguments for <u>SetVolumeDB()</u>	56
Table 91 — Error Codes for <u>SetVolumeDB()</u>	57
Table 92 — Arguments for <u>GetVolumeDBRange()</u>	57
Table 93 — Error Codes for <u>GetVolumeDBRange()</u>	57
Table 94 — Arguments for <u>GetLoudness()</u>	58
Table 95 — Error Codes for <u>GetLoudness()</u>	58
Table 96 — Arguments for <u>SetLoudness()</u>	58
Table 97 — Error Codes for <u>SetLoudness()</u>	58
Table 98 — Arguments for <u>GetStateVariables()</u>	59
Table 99 — Error Codes for <u>GetStateVariables()</u>	59
Table 100 — Arguments for <u>SetStateVariables()</u>	60
Table 101 — Error Codes for <u>SetStateVariables()</u>	60
Table 102 — Arguments for <u>GetAllowedTransforms()</u>	61
Table 103 — Error Codes for <u>GetAllowedTransforms()</u>	61
Table 104 — Arguments for <u>GetTransforms()</u>	61
Table 105 — Error Codes for <u>GetTransforms()</u>	61
Table 106 — Arguments for <u>SetTransforms()</u>	62
Table 107 — Error Codes for <u>SetTransforms()</u>	62
Table 108 — Arguments for <u>GetAllowedDefaultTransforms()</u>	63
Table 109 — Error Codes for <u>GetAllowedDefaultTransforms()</u>	63
Table 110 — Arguments for <u>GetDefaultTransforms()</u>	63
Table 111 — Error Codes for <u>GetDefaultTransforms()</u>	64
Table 112 — Arguments for <u>SetDefaultTransforms()</u>	64
Table 113 — Error Codes for <u>SetDefaultTransforms()</u>	65
Table 114 — Arguments for <u>GetAllAvailableTransforms()</u>	65
Table 115 — Error Codes for <u>GetAllAvailableTransforms()</u>	65
Table 116 — Common Error Codes	66
Table B.1 — Pre-defined Transforms	95
Table B.2 — Recommended properties for <u>Rotation</u>	96
Table B.3 — allowedValueRange for <u>Rotation</u>	96
Table B.4 — Recommended properties for <u>RedEye</u>	96
Table B.5 — allowedValueList for <u>RedEye</u>	96
Table B.6 — Recommended properties for <u>Zoom</u>	97
Table B.7 — allowedValueRange for <u>Zoom</u>	97
Table B.8 — Alternative properties for <u>Zoom</u>	98
Table B.9 — allowedValueList for <u>Zoom</u> pre-defined values	98
Table B.10 — Recommended properties for <u>HorizontalPan</u>	98
Table B.11 — allowedValueRange for <u>HorizontalPan</u>	98

Table B.12 — Alternative properties for <u>HorizontalPan</u> (percentage unit).....	99
Table B.13 — allowedValueRange for <u>HorizontalPan</u> (percentage unit)	99
Table B.14 — Alternative properties mm for <u>HorizontalPan</u>	99
Table B.15 — allowedValueRange for <u>HorizontalPan (mm)</u>	99
Table B.16 — Recommended properties for <u>VerticalPan</u>	100
Table B.17 — allowedValueRange for <u>VerticalPan</u>	100
Table B.18 — Alternative properties for <u>VerticalPan</u> (percentage unit).....	100
Table B.19 — allowedValueRange for <u>VerticalPan</u> (percentage unit)	101
Table B.20 — Alternative properties for <u>VerticalPan</u> (mm unit)	101
Table B.21 — allowedValueRange for <u>VerticalPan</u> (mm unit).....	101
Table B.22 — Recommended properties for <u>ImageDisplayTime</u>	101
Table B.23 — allowedValueRange for <u>ImageDisplayTime</u> (sec unit)	102
Table B.25 — allowedValueList for <u>ImageTransitionEffects</u>	102
Table B.26 — Recommended properties for <u>Equalization</u>	102
Table B.27 — allowedValueList for <u>Equalization</u>	103
Table B.28 — Recommended properties for <u>BandEq [XX] [YY]</u>	104
Table B.29 — allowedValueRange for each <u>BandEq [XX] [YY]</u>	104
Table B.30 — Alternative properties for <u>BandEq [XX] [YY]</u> (Equalization volume unit)	104
Table B.31 — allowedValueRange for <u>BandEq [XX] [YY]</u> (Equalization volume unit)	104
Table B.32 — Recommended properties for <u>SpeakerConfiguration</u>	105
Table B.33 — allowedValueList for <u>SpeakerConfiguration</u>	105
Table B.34 — Transform names based on <u>OutputSelection [Name]</u>	105
Table B.35 — Recommended properties for <u>OutputSelection [Name]</u>	106
Table B.36 — allowedValueList for <u>OutputSelection [Name]</u>	106
Table B.37 — Recommended properties for <u>AudioTrackSelection</u>	106
Table B.38 — allowedValueList for <u>AudioTrackSelection</u> (language mode)	106
Table B.39 — Alternative properties for <u>AudioTrackSelection</u>	107
Table B.40 — allowedValueList for <u>AudioTrackSelection</u> (track indication mode)	107
Table B.41 — Recommended properties for <u>ClosedCaptioning</u>	107
Table B.42 — allowedValueList for <u>ClosedCaptioning</u>	107
Table B.43 — Alternative properties for <u>ClosedCaptioning</u>	108
Table B.44 — allowedValueList for <u>ClosedCaptioning</u> (indication mode).....	108
Table B.45 — Recommended properties for <u>Subtitle</u>	108
Table B.46 — allowedValueList for <u>Subtitle</u>	108
Table B.47 — Alternative properties for <u>Subtitle</u>	109
Table B.48 — allowedValueList for <u>Subtitle</u> (track indication mode).....	109
Table B.49 — Recommended properties for <u>CameraAngle</u>	109
Table B.50 — allowedValueList for <u>CameraAngle</u>	109
Table B.51 — Recommended properties for <u>PiP</u>	110
Table B.52 — allowedValueList for <u>PiP</u>	110
Table B.53 — Recommended properties for <u>ComponentInfoSelection</u>	110
Table B.54 — allowedValueList for <u>ComponentInfoSelection</u>	110
Table B.55 — Recommended properties for <u>3DSettings3DScreen</u>	111

Table B.56 — allowedValueList for <u>3DSettings3DScreen</u>	112
Table B.57 — Recommended properties <u>3DSettings2DScreen</u>	113
Table B.58 — allowedValueList for <u>3DSettings2DScreen</u>	113
Table B.59 — Recommended properties for <u>Volume [Channel]</u>	114
Table B.60 — allowedValueRange for <u>Volume [Channel]</u>	114
Table B.61 — Recommended properties for <u>VolumeDB [Channel]</u>	114
Table B.62 — allowedValueRange for <u>VolumeDB [Channel]</u>	114
Table B.63 — Recommended properties for <u>Mute [Channel]</u>	115
Table B.64 — allowedValueList for <u>Mute [Channel]</u>	115
Table B.65 — Recommended properties for <u>Loudness [Channel]</u>	115
Table B.66 — allowedValueList for <u>Loudness [Channel]</u>	116
Table B.67 — Recommended properties for <u>Brightness</u>	116
Table B.68 — allowedValueRange for <u>Brightness</u>	116
Table B.69 — Recommended properties for <u>Sharpness</u>	116
Table B.70 — allowedValueRange for <u>Sharpness</u>	116
Table B.71 — Recommended properties for <u>Contrast</u>	117
Table B.72 — allowedValueRange for <u>Contrast</u>	117
Table B.73 — Recommended properties for <u>RedVideoGain</u>	117
Table B.74 — allowedValueRange for <u>RedVideoGain</u>	117
Table B.75 — Recommended properties for <u>GreenVideoGain</u>	118
Table B.76 — allowedValueRange for <u>GreenVideoGain</u>	118
Table B.77 — Recommended properties for <u>BlueVideoGain</u>	118
Table B.78 — allowedValueRange for <u>BlueVideoGain</u>	118
Table B.79 — Recommended properties for <u>RedVideoBlackLevel</u>	119
Table B.80 — allowedValueRange for <u>RedVideoBlackLevel</u>	119
Table B.81 — Recommended properties for <u>GreenVideoBlackLevel</u>	119
Table B.82 — allowedValueRange for <u>GreenVideoBlackLevel</u>	119
Table B.83 — Recommended properties for <u>BlueVideoBlackLevel</u>	120
Table B.84 — allowedValueRange for <u>BlueVideoBlackLevel</u>	120
Table B.85 — Recommended properties for <u>ColorTemperature</u>	120
Table B.86 — allowedValueRange for <u>ColorTemperature</u>	120
Table B.87 — Recommended properties for <u>HorizontalKeystone</u>	121
Table B.88 — allowedValueRange for <u>HorizontalKeystone</u>	121
Table B.89 — Recommended properties for <u>VerticalKeystone</u>	121
Table B.90 — allowedValueRange for <u>VerticalKeystone</u>	121

List of Figures

Figure 1 — Horizontal Keystone	25
Figure 2 — Vertical Keystone	26
Figure 3 — Relationship between <u>Volume</u> and <u>VolumeDB</u>	34
Figure 4 — Virtual Instances of RCS	84
Figure 5 — 6-channel Volume Control	86
Figure 6 — Graphical presentation of an implementation of the <u>3D-2D-TopBottom</u> transform, in this case showing only the Top image of a 3D stream as a 2D image on the 2D display.....	111
Figure 7 — Graphical presentation of an implementation of the <u>3D-2D-SideBySide</u> transform, in this case showing only the Right image of a 3D stream as a 2D image on the 2D display.....	111
Figure 8 — Graphical presentation of an implementation of the <u>3D-3D-TopBottom</u> transform.....	112
Figure 9 — Graphical presentation of an implementation of the <u>3D-3D-SideBySide</u> transform.....	112

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 29341-20-13 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](#).

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

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.

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

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

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

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

1 Scope

This service template is compliant with the UPnP Device Architecture version 1.0 [14]. It defines a service type referred to herein as RenderingControl.

1.1 Introduction

Most rendering devices contain a number of dynamically configurable attributes that affect how the current content is rendered. For example, video rendering devices, such as TVs, allow user control of display characteristics such as brightness and contrast, whereas audio rendering devices allow control of audio characteristics such as volume, balance, equalizer settings, etc. The RenderingControl service is intended to provide control points with the ability to query and/or adjust any rendering attribute that the device supports.

The RenderingControl service enables a control point to:

- a) Discover the set of attributes supported by the device.
- b) Retrieve the current setting of any supported attribute
- c) Change the setting of (that is: control) any modifiable attribute
- d) Perform a set of content transforms, which, in addition to the above, also enables functionality for selecting content depended options, for example:
 - 1) Selecting a specific sub-stream in a composite stream for rendering.
 - 2) Turning subtitling on or off.
- e) Restore the settings defined by a named Preset

The RenderingControl service does not:

- a) Control the flow of the associated content (for example, Play, Stop, Pause, Seek, etc.).
- b) Provide a mechanism to enumerate locally stored content.
- c) Provide a mechanism to send content to another device (via the home network or direct connection).

1.2 Multi-input Devices

Some high-end AV device are capable of receiving multiple pieces of content at the same time and combining that content together so that it can be rendered together using a single set of output hardware. For example, while displaying a TV program, high-end TVs can also display additional content (for example, VCR content) in a PIP (Picture-In-Picture) window. Similarly, a Karaoke machine can mix together the background music with a singer's voice so that both sounds are played together on the same set of speakers.

As with all devices, the RenderingControl service allows a control point to adjust the output characteristics of the post-mixed content before it is actually rendered. However, in many cases, control points may need to control the output characteristics of the individual input content before it is mixed together with the other input content. In order to support this, the RenderingControl service includes an *InstanceID* argument with each action that allows the control point to identify on which content the action is to be applied (for example, the post-mixed content or one of the pre-mixed input content items).

By convention, an *InstanceID* of 0 indicates that the invoked action shall be applied to the post-mixed content. Similarly, each pre-mixed input content is assigned a unique *InstanceID* whose value is a non-zero, positive integer. Refer to Annex A for additional information.

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 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>.
- [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>.

[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>.
- [36] – *Extensible Markup Language (XML) 1.0 (Third Edition)*, François Yergeau, Tim Bray, Jean Paoli, C. M. Sperberg-McQueen, Eve Maler, eds., W3C Recommendation, February 4, 2004.
Available at: <http://www.w3.org/TR/2004/REC-xml-20040204>.
- [37] – *Unit conversion.org website, definitions of more than 2100 units in 78 categories*.
Available at: <http://www.unitconversion.org>.

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.