
**Information technology — UPnP
Device Architecture —**

**Part 20-12:
Audio video device control protocol —
Level 4 — Content directory service**

Technologies de l'information — Architecture de dispositif UPnP —

*Partie 20-12: Protocole de contrôle de dispositif audio-vidéo —
Niveau 4 — Service d'Annuaire de contenu*





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.....	5
3.1	Provisioning terms	5
3.2	Symbols	5
4	Notations and Conventions	5
4.1	Notation	5
4.1.1	Data Types	6
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	Key Concepts	16
5.2.1	<i>On-line</i> and <i>Off-line</i> Network States.....	16
5.2.2	object	16
5.2.3	Object Identity	17
5.2.4	Object Lifetime.....	18
5.2.5	Object Modification	18
5.2.6	class.....	19
5.2.7	<u><i>item</i></u>	19
5.2.8	<u><i>container</i></u>	19
5.2.9	Container Modification	19
5.2.10	ContentDirectory Tracking Changes Option	20
5.2.11	<u><i>ContainerUpdateIDValue</i></u> Indicator.....	20
5.2.12	ContentDirectory Service Object Organization	21
5.2.13	Hierarchical location	21
5.2.14	Subtree.....	22
5.2.15	Subtree Updates	22
5.2.16	XML Document	23
5.2.17	XML Fragment	23
5.2.18	DIDL-Lite XML Document.....	24
5.2.19	<i>CDS View</i>	25
5.2.20	<i>CDS Properties</i>	26

5.2.21	<i>reference, reference item, referenced item</i>	27
5.2.22	<i>CDS feature</i>	28
5.2.23	<i>Metadata vs. Foreign Metadata</i>	28
5.2.24	<i>Embedded XML Documents</i>	28
5.2.25	<i>Device Protection Option</i>	28
5.2.26	<i>Device Mode Option</i>	30
5.2.27	<i>Shortcut</i>	30
5.3	<i>State Variables</i>	30
5.3.1	<i>State Variable Overview</i>	31
5.3.2	<u><i>SearchCapabilities</i></u>	32
5.3.3	<u><i>SortCapabilities</i></u>	32
5.3.4	<u><i>SortExtensionCapabilities</i></u>	33
5.3.5	<u><i>SystemUpdateID</i></u>	33
5.3.6	<u><i>ContainerUpdateIDs</i></u>	35
5.3.7	<u><i>ServiceResetToken</i></u>	36
5.3.8	<u><i>LastChange</i></u>	37
5.3.9	<u><i>TransferIDs</i></u>	41
5.3.10	<u><i>FeatureList</i></u>	41
5.3.11	<u><i>DeviceMode</i></u>	41
5.3.12	<u><i>DeviceModeStatus</i></u>	42
5.3.13	<u><i>PermissionsInfo</i></u>	43
5.3.14	<u><i>A ARG TYPE ObjectID</i></u>	45
5.3.15	<u><i>A ARG TYPE Result</i></u>	45
5.3.16	<u><i>A ARG TYPE SearchCriteria</i></u>	45
5.3.17	<u><i>A ARG TYPE BrowseFlag</i></u>	47
5.3.18	<u><i>A ARG TYPE Filter</i></u>	47
5.3.19	<u><i>A ARG TYPE SortCriteria</i></u>	49
5.3.20	<u><i>A ARG TYPE Index</i></u>	50
5.3.21	<u><i>A ARG TYPE Count</i></u>	50
5.3.22	<u><i>A ARG TYPE UpdateID</i></u>	50
5.3.23	<u><i>A ARG TYPE TransferID</i></u>	50
5.3.24	<u><i>A ARG TYPE TransferStatus</i></u>	51
5.3.25	<u><i>A ARG TYPE TransferLength</i></u>	51
5.3.26	<u><i>A ARG TYPE TransferTotal</i></u>	51
5.3.27	<u><i>A ARG TYPE TagValueList</i></u>	51
5.3.28	<u><i>A ARG TYPE URI</i></u>	51
5.3.29	<u><i>A ARG TYPE CDSView</i></u>	51
5.3.30	<u><i>A ARG TYPE QueryRequest</i></u>	51
5.3.31	<u><i>A ARG TYPE QueryResult</i></u>	52
5.3.32	<u><i>A ARG TYPE FFQCapabilities</i></u>	53
5.3.33	<u><i>A ARG TYPE CPID</i></u>	54
5.3.34	<u><i>A ARG TYPE DeviceModelID</i></u>	55
5.3.35	<u><i>A ARG TYPE DeviceModeRequest</i></u>	55
5.4	<i>Eventing and Moderation</i>	58
5.5	<i>Actions</i>	59
5.5.1	<i>Action Overview</i>	59
5.5.2	<u><i>GetSearchCapabilities()</i></u>	61
5.5.3	<u><i>GetSortCapabilities()</i></u>	61

5.5.4	<u>GetSortExtensionCapabilities()</u>	61
5.5.5	<u>GetFeatureList()</u>	62
5.5.6	<u>GetSystemUpdateID()</u>	62
5.5.7	<u>GetServiceResetToken()</u>	63
5.5.8	<u>Browse()</u>	63
5.5.9	<u>Search()</u>	65
5.5.10	<u>CreateObject()</u>	66
5.5.11	<u>DestroyObject()</u>	72
5.5.12	<u>UpdateObject()</u>	73
5.5.13	<u>MoveObject()</u>	79
5.5.14	<u>ImportResource()</u>	80
5.5.15	<u>ExportResource()</u>	81
5.5.16	<u>DeleteResource()</u>	82
5.5.17	<u>StopTransferResource()</u>	83
5.5.18	<u>GetTransferProgress()</u>	84
5.5.19	<u>CreateReference()</u>	84
5.5.20	<u>FreeFormQuery()</u>	85
5.5.21	<u>GetFreeFormQueryCapabilities()</u>	87
5.5.22	<u>RequestDeviceMode()</u>	88
5.5.23	<u>ExtendDeviceMode()</u>	89
5.5.24	<u>CancelDeviceMode()</u>	90
5.5.25	<u>GetDeviceMode()</u>	91
5.5.26	<u>GetDeviceModeStatus()</u>	91
5.5.27	<u>GetPermissionsInfo()</u>	92
5.5.28	Non-Standard Actions Implemented by a UPnP Vendor	92
5.5.29	Common Error Codes	92
6	XML Service Description	94
7	Test	106
Annex A	(normative) Schemas	107
A.1	DIDL-Lite	107
A.2	UPnP Elements	107
A.3	Dublin Core Subset Elements	107
A.4	Event Schema	107
A.5	<u>FeatureList</u> State Variable Schema	107
Annex B	(normative) AV Working Committee Properties	108
B.1	Base Properties	117
B.1.1	<u>@id</u>	117
B.1.2	<u>@parentID</u>	118
B.1.3	<u>@refID</u>	118
B.1.4	<u>@restricted</u>	118
B.1.5	<u>@searchable</u>	118
B.1.6	<u>@childCount</u>	118
B.1.7	<u>@childContainerCount</u>	118
B.1.8	<u>dc:title</u>	119
B.1.9	<u>dc:creator</u>	119
B.1.10	<u>res</u>	119
B.1.11	<u>res@id</u>	119
B.1.12	<u>upnp:class</u>	119

B.1.13	<u>upnp:searchClass</u>	121
B.1.14	<u>upnp:createClass</u>	121
B.1.15	<u>upnp:writeStatus</u>	122
B.2	Resource Encoding Characteristics Properties	123
B.2.1	<u>res</u>	123
B.3	Resource Encoding Extension Properties	128
B.3.1	<u>upnp:resExt</u>	128
B.3.2	<u>upnp:resExt::uniqueContentIdentification</u>	129
B.4	Contributor-related Properties	130
B.4.1	<u>upnp:artist</u>	130
B.4.2	<u>upnp:actor</u>	130
B.4.3	<u>upnp:author</u>	130
B.4.4	<u>upnp:producer</u>	131
B.4.5	<u>upnp:director</u>	131
B.4.6	<u>dc:publisher</u>	131
B.4.7	<u>dc:contributor</u>	131
B.5	Affiliation-related Properties	131
B.5.1	<u>upnp:genre</u>	131
B.5.2	<u>upnp:album</u>	132
B.5.3	<u>upnp:playlist</u>	132
B.6	Associated Resources Properties	132
B.6.1	<u>upnp:albumArtURI</u>	132
B.6.2	<u>upnp:artistDiscographyURI</u>	133
B.6.3	<u>upnp:lyricsURI</u>	133
B.6.4	<u>dc:relation</u>	133
B.7	Storage-Related Properties	133
B.7.1	<u>upnp:storageTotal</u>	133
B.7.2	<u>upnp:storageUsed</u>	133
B.7.3	<u>upnp:storageFree</u>	133
B.7.4	<u>upnp:storageMaxPartition</u>	134
B.7.5	<u>upnp:storageMedium</u>	134
B.8	General Description (mainly for UI purposes) Properties	135
B.8.1	<u>dc:description</u>	135
B.8.2	<u>upnp:longDescription</u>	135
B.8.3	<u>upnp:icon</u>	135
B.8.4	<u>upnp:region</u>	136
B.8.5	<u>upnp:rights</u>	136
B.8.6	<u>dc:date</u>	136
B.8.7	<u>dc:language</u>	136
B.8.8	<u>upnp:playbackCount</u>	136
B.8.9	<u>upnp:lastPlaybackTime</u>	137
B.8.10	<u>upnp:lastPlaybackPosition</u>	137
B.8.11	<u>upnp:recordedStartDateTime</u>	137
B.8.12	<u>upnp:recordedEndDateTime</u>	138
B.8.13	<u>upnp:recordedDuration</u>	138
B.8.14	<u>upnp:recordedDayOfWeek</u>	138
B.8.15	<u>upnp:srsRecordScheduleID</u>	139
B.8.16	<u>upnp:srsRecordTaskID</u>	139

B.8.17	<u>upnp:recordable</u>	139
B.9	Recorded Object-related Properties	140
B.9.1	<u>upnp:programTitle</u>	140
B.9.2	<u>upnp:seriesTitle</u>	140
B.9.3	<u>upnp:programID</u>	141
B.9.4	<u>upnp:seriesID</u>	141
B.9.5	<u>upnp:channelID</u>	141
B.9.6	<u>upnp:episodeType</u>	143
B.9.7	<u>upnp:episodeCount</u>	143
B.9.8	<u>upnp:episodeNumber</u>	143
B.9.9	<u>upnp:episodeSeason</u>	143
B.9.10	<u>upnp:programCode</u>	143
B.9.11	<u>upnp:rating</u>	144
B.9.12	<u>upnp:recommendationID</u>	145
B.10	User Channel and EPG Related Properties	145
B.10.1	<u>upnp:channelGroupName</u>	145
B.10.2	<u>upnp:callSign</u>	146
B.10.3	<u>upnp:networkAffiliation</u>	146
B.10.4	<u>upnp:serviceProvider</u>	146
B.10.5	<u>upnp:price</u>	147
B.10.6	<u>upnp:payPerView</u>	147
B.10.7	<u>upnp:epgProviderName</u>	147
B.10.8	<u>upnp:dateTimeRange</u>	147
B.11	Preserved Program Properties	148
B.11.1	<u>upnp:programPreserved</u>	148
B.11.2	<u>upnp:preservedTimeRange</u>	149
B.11.3	<u>upnp:programList</u>	151
B.12	Radio Broadcast Properties	151
B.12.1	<u>upnp:radioCallSign</u>	151
B.12.2	<u>upnp:radioStationID</u>	151
B.12.3	<u>upnp:radioBand</u>	152
B.13	Video Broadcast Properties	152
B.13.1	<u>upnp:channelNr</u>	152
B.13.2	<u>upnp:channelName</u>	153
B.13.3	<u>upnp:scheduledStartTime</u>	153
B.13.4	<u>upnp:scheduledEndTime</u>	153
B.13.5	<u>upnp:scheduledDuration</u>	154
B.14	Physical Tuner Status-related Properties	154
B.14.1	<u>upnp:signalStrength</u>	154
B.14.2	<u>upnp:signalLocked</u>	154
B.14.3	<u>upnp:tuned</u>	155
B.15	MultiStream-related Properties	156
B.15.1	<u>upnp:resExt::isSyncAnchor</u>	157
B.15.2	<u>upnp:resExt::componentInfo</u>	157
B.16	Segmentation-related Properties	163
B.16.1	<u>upnp:segmentID</u>	164
B.16.2	<u>upnp:resExt::segmentInfo</u>	164
B.17	Bookmark-related Properties	166

B.17.1	<u>@neverPlayable</u>	166
B.17.2	<u>upnp:bookmarkID</u>	167
B.17.3	<u>upnp:bookmarkedObjectID</u>	167
B.17.4	<u>upnp:deviceUDN</u>	167
B.17.5	<u>upnp:stateVariableCollection</u>	167
B.18	Miscellaneous Properties	168
B.18.1	<u>upnp:DVDRegionCode</u>	169
B.18.2	<u>upnp:originalTrackNumber</u>	169
B.18.3	<u>upnp:toc</u>	169
B.18.4	<u>upnp:userAnnotation</u>	169
B.18.5	<u>desc</u>	169
B.19	Object Tracking Properties	170
B.19.1	<u>upnp:containerUpdateID</u>	170
B.19.2	<u>upnp:objectUpdateID</u>	170
B.19.3	<u>upnp:totalDeletedChildCount</u>	171
B.19.4	<u>res@updateCount</u>	171
B.20	Permission Properties	172
B.20.1	<u>upnp:inclusionControl</u>	172
B.21	Ownership Properties	172
B.21.1	<u>upnp:objectOwner</u>	173
B.22	Object Linking Properties	174
B.22.1	<u>upnp:objectLink</u>	174
B.22.2	<u>upnp:objectLinkRef</u>	178
B.23	Foreign Metadata-related Properties	180
B.23.1	<u>upnp:foreignMetadata</u>	180
B.24	Synchronized Playback-related Properties	187
B.24.1	<u>upnp:resExt::clockSync</u>	187
B.25	DRMInfo-related Overview Properties	188
B.25.1	<u>upnp:resExt::DRMInfo</u>	188
Annex C	(normative) AV Working Committee Class Definitions	189
C.1	Class Hierarchy	189
C.1.1	Class name syntax	190
C.1.2	Class Properties Overview	191
C.2	<u>object</u> (Base Class)	203
C.2.1	<u>item:object</u>	203
C.2.2	<u>container:object</u>	211
Annex D	(Informative) Theory of Operation	219
D.1	Introduction	219
D.2	Generating Object ID Values	219
D.3	Content Setup for Browsing and Searching	220
D.4	Browsing	220
D.4.1	Retrieving Sort Capabilities	221
D.4.2	Browsing the Root Level Metadata	221
D.4.3	Browsing the Children of the Root Level	222
D.4.4	Browsing the Children of the My Music Folder	223
D.4.5	Browsing the Children of the Singles Soundtrack Music Album	223
D.4.6	Browsing the Children of the Album Art Folder	224
D.5	Searching	225

D.5.1	Retrieving Search Capabilities.....	225
D.5.2	Search for All Content Created by the performer Sting.....	225
D.5.3	Search for all Photos Taken During the Month of October.....	227
D.5.4	Search for All Objects in the My Photos Folder Containing the Word "Christmas".....	227
D.5.5	Search for all <i>album</i> objects in the ContentDirectory service.....	228
D.6	Browsing, Searching, and References.....	229
D.6.1	Creating a reference to a photo in the Mexico Trip album inside the Christmas album.....	229
D.6.2	Search for All Photos Taken During the Month of October.....	229
D.6.3	Deletion of the Reference to the Photo in the Mexico Trip Album.....	230
D.7	Object Creation.....	230
D.7.1	Creating a New Object.....	230
D.7.2	Creating a New MusicTrack.....	230
D.8	Object Resource Binding (Importing a Resource).....	231
D.8.1	Transfer Using the <i>ImportResource()</i> Action.....	231
D.8.2	Transfer Using Direct HTTP POST.....	232
D.9	Exporting ContentDirectory Resources.....	232
D.9.1	Transfer Using the <i>ExportResource()</i> Action.....	233
D.9.2	Transfer using HTTP GET.....	234
D.10	Playlist Manipulation.....	234
D.10.1	Playlist File Representation in the ContentDirectory Service.....	234
D.10.2	Playlist File Generation.....	234
D.11	Internet Content Representation.....	236
D.12	Multi-component media representation.....	236
D.12.1	Creating a multi-component video object.....	238
D.12.2	Adding a component to a multi-component video object.....	240
D.13	Segments Manipulation.....	243
D.13.1	Segment Item Example.....	243
D.13.2	Creating, Destroying and Updating Segments.....	244
D.13.3	Browse and Search Segment Items.....	246
D.14	Bookmark Manipulation.....	246
D.14.1	<i>bookmarkItem</i> Example.....	246
D.14.2	Creating and Destroying Bookmarks.....	248
D.14.3	Browsing Bookmarks.....	252
D.15	Processing FreeForm Queries.....	257
D.15.1	Retrieving the title of all music albums.....	258
D.15.2	Retrieving the audio items of Album 1.....	258
D.15.3	Retrieving a limited number of photo items.....	259
D.16	Foreign Metadata.....	260
D.16.1	Determining the Supported Foreign Metadata Types.....	260
D.16.2	Determining Whether an Object Contains Foreign Metadata.....	261
D.17	Monitoring Changes.....	262
D.17.1	Monitoring Changes while <i>on-line</i>	263
D.17.2	Monitoring Changes while <i>off-line</i>	268
D.18	Browsing preserved transitory content.....	270
D.18.1	Browsing broadcast items with preserved history.....	270
D.18.2	Browsing program items indicating preserved history (EPG data available but not exposed to control point).....	271

D.18.3 Browsing program items for recording (EPG exposed to control point).....	272
D.19 Object Linking	274
D.19.1 Displaying Object Link titles	274
D.19.2 Locating the head Object Link property of an Object Linked list.....	275
D.19.3 Starting an Object Linked presentation	275
D.19.4 Object Linking Example.....	275
D.20 <i>DEVICE_MODE</i> feature	282
D.20.1 Initiating and Managing <i>ActionBurst</i> mode	283
D.20.2 Initiating and Managing <i>ExclusiveOwnership</i> mode	287
D.21 Synchronized Playback.....	290
D.21.1 Precision Time Synchronized Playback for RTSP-RTP Transport	290
D.21.2 Precision Time Synchronized Playback for HTTP Transport	293
D.22 Usage of the <i>CONTAINER_SHORTCUTS</i> feature	294
Annex E (normative) EBNF Syntax Definitions	296
E.1 Summary.....	296
E.2 Date&time Syntax.....	296
Annex F (normative) <i>CDS</i> features	297
F.1 Requirements for the <i>EPG</i> feature, Version 1	298
F.2 Requirements for the <i>TUNER</i> feature, Version 1	299
F.3 Requirements for the <i>BOOKMARK</i> feature, Version 1	300
F.4 Requirements for the <i>FOREIGN_METADATA</i> feature, Version 1	300
F.5 Requirements for the <i>FFQ</i> feature, Version 1	301
F.6 Requirements for the <i>MULTI_STREAM</i> feature, Version 1	302
F.7 Requirements for the <i>SEGMENTATION</i> feature, Version 1	303
F.8 Requirements for the <i>DEVICE_MODE</i> feature, Version 1	304
F.9 Requirements for the <i>CLOCKSYNC</i> feature, Version 1	306
F.10 Requirements for the <i>CONTENT_PROTECTION</i> feature, Version 1	306
F.11 Requirements for the <i>CONTAINER_SHORTCUTS</i> feature, Version 1	307
Annex G (normative) <i>CONTENT_PROTECTION</i> feature	312
G.1 AV Roles for <i>CONTENT_PROTECTION</i>	312
G.1.1 Access at action level	313
G.1.2 Restrictable and Non-Restrictable Actions	313
G.1.3 <i>Action Level</i> Access using pre-defined AV Roles	314
G.1.4 Access at object level	315
G.1.5 <i>Role</i> assignments for unrecognized control points.....	316
G.1.6 Implicit role assignments.....	316
G.2 Behavior of actions with <i>CONTENT_PROTECTION</i> feature	317
G.2.1 <u>CreateObject()</u> action with <i>CONTENT_PROTECTION</i> feature	317
G.2.2 <u>UpdateObject()</u> action with <i>CONTENT_PROTECTION</i> feature.....	318
G.2.3 <u>Browse()</u> action with <i>CONTENT_PROTECTION</i> feature	319
G.2.4 <u>Search()</u> action with <i>CONTENT_PROTECTION</i> feature.....	319
G.2.5 <u>FreeFormQuery()</u> action with <i>CONTENT_PROTECTION</i> feature	320
G.2.6 <u>DestroyObject()</u> action with <i>CONTENT_PROTECTION</i> feature.....	320
G.2.7 <u>MoveObject()</u> action with <i>CONTENT_PROTECTION</i> feature	320
G.2.8 <u>DeleteResource()</u> action with <i>CONTENT_PROTECTION</i> feature	320
Annex H (informative) Content Authoring using Object Linking	321
H.1 Introduction	321
H.2 Object Linking Metadata Properties.....	321

H.3	Table of Contents (Index) Lists	322
H.4	Playback and Step Lists.....	323
H.5	References between lists of items	324
H.6	Sharing items in multiple lists.....	324
H.7	Return Model.....	325
H.8	Control Point processing of Object Linked items.....	325
Annex I (informative)	Example ContentDirectory Hierarchy	327
Annex J (informative)	Bibliography	334

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 — Properties in XML	26
Table 7 — State variables.....	31
Table 8 — <u>SearchCapabilities</u> requirements for supporting <i>Tracking Changes Option</i>	32
Table 9 — Sort Modifiers	33
Table 10 — <u>ContainerUpdateIDs</u> Example.....	35
Table 11 — <u>ContainerUpdateIDs</u> Example.....	36
Table 12 — Event moderation	58
Table 13 — Actions.....	60
Table 14 — Arguments for <u>GetSearchCapabilities()</u>	61
Table 15 — Error Codes for <u>GetSearchCapabilities()</u>	61
Table 16 — Arguments for <u>GetSortCapabilities()</u>	61
Table 17 — Error Codes for <u>GetSortCapabilities()</u>	61
Table 18 — Arguments for <u>GetSortExtensionCapabilities()</u>	62
Table 19 — Error Codes for <u>GetSortExtensionCapabilities()</u>	62
Table 20 — Arguments for <u>GetFeatureList()</u>	62
Table 21 — Error Codes for <u>GetFeatureList()</u>	62
Table 22 — Arguments for <u>GetSystemUpdateID()</u>	62
Table 23 — Error Codes for <u>GetSystemUpdateID()</u>	63
Table 24 — Arguments for <u>GetServiceResetToken()</u>	63
Table 25 — Error Codes for <u>GetServiceResetToken()</u>	63
Table 26 — Arguments for <u>Browse()</u>	64
Table 27 — Error Codes for <u>Browse()</u>	65
Table 28 — Arguments for <u>Search()</u>	66
Table 29 — Error Codes for <u>Search()</u>	66
Table 30 — Arguments for <u>CreateObject()</u>	71
Table 31 — Error codes for <u>CreateObject()</u>	71
Table 32 — Arguments for <u>DestroyObject()</u>	73
Table 33 — Error Codes for <u>DestroyObject()</u>	73
Table 34 — Update examples	76
Table 35 — Arguments for <u>UpdateObject()</u>	78
Table 36 — Error Codes for <u>UpdateObject()</u>	78
Table 37 — Arguments for <u>MoveObject()</u>	80
Table 38 — Error Codes for <u>MoveObject()</u>	80
Table 39 — Arguments for <u>ImportResource()</u>	81
Table 40 — Error Codes for <u>ImportResource()</u>	81
Table 41 — Arguments for <u>ExportResource()</u>	82

Table 42 — Error Codes for <u>ExportResource()</u>	82
Table 43 — Arguments for <u>DeleteResource()</u>	83
Table 44 — Error Codes for <u>DeleteResource()</u>	83
Table 45 — Arguments for <u>StopTransferResource()</u>	83
Table 46 — Error Codes for <u>StopTransferResource()</u>	84
Table 47 — Arguments for <u>GetTransferProgress()</u>	84
Table 48 — Error Codes for <u>GetTransferProgress()</u>	84
Table 49 — Arguments for <u>CreateReference()</u>	85
Table 50 — Error Codes for <u>CreateReference()</u>	85
Table 51 — Arguments for <u>FreeFormQuery()</u>	86
Table 52 — Error Codes for <u>FreeFormQuery()</u>	87
Table 53 — Arguments for <u>GetFreeFormQueryCapabilities()</u>	87
Table 54 — Error Codes for <u>GetFreeFormQueryCapabilities()</u>	88
Table 55 — Arguments for <u>RequestDeviceMode()</u>	88
Table 56 — Error Codes for <u>RequestDeviceMode()</u>	89
Table 57 — Arguments for <u>ExtendDeviceMode()</u>	89
Table 58 — Error Codes for <u>ExtendDeviceMode()</u>	90
Table 59 — Arguments for <u>CancelDeviceMode()</u>	90
Table 60 — Error Codes for <u>CancelDeviceMode()</u>	91
Table 61 — Arguments for <u>GetDeviceMode()</u>	91
Table 62 — Error Codes for <u>GetDeviceMode()</u>	91
Table 63 — Arguments for <u>GetDeviceModeStatus()</u>	91
Table 64 — Error Codes for <u>GetDeviceModeStatus()</u>	92
Table 65 — Arguments for <u>GetPermissionsInfo()</u>	92
Table 66 — Error Codes for <u>GetPermissionsInfo()</u>	92
Table 67 — Common Error Codes.....	93
Table B.1 — ContentDirectory Service Properties Overview.....	108
Table B.2 — Base Properties Overview.....	117
Table B.3 — Allowed values for <u>upnp:class</u>	120
Table B.4 — Allowed values for <u>upnp:writeStatus</u>	122
Table B.5 — Resource Encoding Characteristics Properties Overview.....	123
Table B.6 — Allowed values for <u>res@daylightSaving</u>	128
Table B.7 — Resource Encoding Extension Properties Overview.....	128
Table B.9 — Contributor-related Properties Overview.....	130
Table B.10 — Affiliation-related Properties Overview.....	131
Table B.11 — Associated Resources Properties Overview.....	132
Table B.12 — Storage-Related Properties Overview.....	133
Table B.13 — General Description (mainly for UI purposes) Properties Overview.....	135
Table B.14 — Allowed values for <u>upnp:recordedDayOfWeek</u>	139
Table B.15 — Recorded Object-related Properties Overview.....	140
Table B.16 — User Channel and EPG Related Properties Overview.....	145
Table B.17 — Preserved Program Properties Overview.....	148
Table B.18 — Allowed values for <u>upnp:programPreserved</u>	148

Table B.19 — Radio Broadcast Properties Overview	151
Table B.20 — Allowed values for <u>upnp:radioBand</u>	152
Table B.21 — Video Broadcast Properties Overview	152
Table B.22 — Allowed values for <u>upnp:scheduledStartTime@usage</u>	153
Table B.23 — Physical Tuner Status-related Properties Overview	154
Table B.24 — MultiStream Properties Overview	156
Table B.25 — Allowed values for <u>upnp:resExt::componentInfo::componentGroup ::component::componentClass</u>	159
Table B.26 — Segmentation-related Properties Overview	163
Table B.27 — Bookmark-related Properties Overview	166
Table B.28 — Allowed values for <u>upnp:stateVariableCollection@rcsInstanceType</u>	168
Table B.29 — Miscellaneous Properties Overview	168
Table B.30 — Object Tracking Properties Overview	170
Table B.31 — Permission Properties Overview	172
Table B.32 — Ownership Properties Overview	172
Table B.33 — Object Linking Properties Overview	174
Table B.34 — Allowed values for <u>upnp:objectLink::mode</u>	176
Table B.35 — Allowed values for <u>upnp:objectLink::relatedInfo@role</u>	177
Table B.36 — Allowed values for <u>upnp:objectLink::endAction@action</u>	178
Table B.37 — Allowed values for <u>upnp:objectLinkRef::relatedInfo@role</u>	180
Table B.38 — Foreign Metadata-related Properties Overview	180
Table B.39 — Synchronized Playback Properties Overview	187
Table B.40 — DRMInfo-Related Properties Overview	188
Table C.1 — Class Properties Overview	191
Table C.2 — <u>object</u> Properties	203
Table C.3 — <u>item</u> Properties	203
Table C.4 — <u>imageItem:item</u> Properties	204
Table C.5 — <u>photo:imageItem</u> Properties	204
Table C.6 — <u>audioItem:item</u> Properties	204
Table C.7 — <u>musicTrack:audioItem</u> Properties	205
Table C.8 — <u>audioBroadcast:audioItem</u> Properties	205
Table C.9 — <u>audioBook:audioItem</u> Properties	205
Table C.10 — <u>videoItem:item</u> Properties	206
Table C.11 — <u>movie:videoItem</u> Properties	206
Table C.12 — <u>videoBroadcast:videoItem</u> Properties	207
Table C.13 — <u>musicVideoClip:videoItem</u> Properties	207
Table C.14 — <u>playlistItem:item</u> Properties	208
Table C.15 — <u>textItem:item</u> Properties	208
Table C.16 — <u>bookmarkItem:item</u> Properties	209
Table C.17 — <u>epgItem:item</u> Properties	210
Table C.18 — <u>audioProgram:epgItem</u> Properties	211
Table C.19 — <u>videoProgram:epgItem</u> Properties	211
Table C.20 — <u>container</u> Properties	212

Table C.21 — <u>person:container</u> Properties	212
Table C.22 — <u>musicArtist:person</u> Properties	212
Table C.23 — <u>playlistContainer:container</u> Properties	213
Table C.24 — <u>album:container</u> Properties	213
Table C.25 — <u>musicAlbum:album</u> Properties	214
Table C.26 — <u>photoAlbum:album</u> Properties	214
Table C.27 — <u>genre:container</u> Properties	214
Table C.28 — <u>channelGroup:container</u> Properties	215
Table C.29 — <u>epgContainer:container</u> Properties	216
Table C.30 — <u>storageSystem:container</u> Properties	217
Table C.31 — <u>storageVolume:container</u> Properties	217
Table C.32 — <u>storageFolder:container</u> Properties	218
Table C.33 — <u>genre:container</u> Properties	218
Table F.1 — <i>CDS features</i>	298
Table F.2 — Required characteristics of the <i>EPG feature</i> element	299
Table F.3 — Required characteristics of the <i>TUNER feature</i> element	299
Table F.4 — Required characteristics of the <i>BOOKMARK feature</i> element	300
Table F.5 — Required characteristics of the <i>FOREIGN_METADATA feature</i> element	301
Table F.6 — Required characteristics of the <i>FFQ feature</i> element	302
Table F.7 — Required characteristics of the <i>MULTI_STREAM feature</i> element	303
Table F.8 — Required characteristics of the <i>SEGMENTATION feature</i> element	304
Table F.9 — Required characteristics of the <i>DEVICE_MODE feature</i> element	305
Table F.10 — Required characteristics of the <i>CLOCKSYNC feature</i> element	306
Table F.11 — Required characteristics of the <i>CONTENT_PROTECTION feature</i> element	307
Table F.12 — Required characteristics of the <i>CONTAINER_SHORTCUTS feature</i> element	307
Table F.13 — Allowed values for the Shortcut Name element	308
Table G.1 — Pre-defined AV Roles and <i>Public</i>	312
Table G.2 — Error Codes for <i>Action Level Access</i>	313
Table G.3 — Pre-defined settings for <i>Restrictable and Non-Restrictable</i> AV Actions	314
Table G.4 — Pre-defined AV Action to AV Role permissions mapping	315
Table G.5 — Error Codes for <i>Object Level Access</i>	317
Table G.6 — Error Codes for <u>CreateObject()</u> and <u>UpdateObject()</u> action with <u>upnp:objectOwner</u> and <u>upnp:objectOwner</u> property	319
Table G.7 — Error Codes for <u>MoveObject()</u> action with <i>CONTENT_PROTECTION</i> <i>feature</i>	320
Table G.8 — Error Codes for <u>DeleteResource()</u> action with <i>CONTENT_PROTECTION</i> <i>feature</i>	320

List of Figures

Figure 1 — ContentDirectory Service Object Organization	21
Figure 2 — Flattened DIDL-Lite hierarchical structure.....	25
Figure C.1 — Class hierarchy for the item base class	189
Figure C.2 — Class hierarchy for the container base class	190
Figure D.1 — Example Handshaking for <i>DEVICE_MODE feature</i>	283
Figure H.1 — Example of Object Link “Index” list.....	323
Figure H.2 — Example of Object Link list reference	324

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 29341-20-12 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 document specifies the characteristics of the UPnP networked service named ContentDirectory, version 4. This service definition is compliant with UPnP Device Architecture 1.0 [14].

Many devices within the home network contain various types of content that other devices would like to access (for example, music, videos, still images, etc). As an example, a MediaServer device might contain a significant portion of the homeowner's audio, video, and still-image library. In order for the homeowner to enjoy this content, the homeowner needs to be able to browse the objects stored on the MediaServer, select a specific one, and cause it to be played on an appropriate rendering device (for example, an audio player for music objects, a TV for video content, an Electronic Picture Frame for still-images, etc).

For maximum convenience, it is highly desirable to let the homeowner to initiate these operations from a variety of UI devices. In most cases, these UI devices will either be a UI built into the rendering device, or it will be a stand-alone UI device such as a wireless PDA or tablet. In any case, it is unlikely that the homeowner will interact directly with the device containing the content (that is: the homeowner won't have to walk over to the server device). In order to enable this capability, the server device needs to provide a uniform mechanism for UI devices to browse the content on the server and to obtain detailed information about individual content objects. This is the purpose of the ContentDirectory service.

The ContentDirectory service additionally provides a lookup/storage service that enables clients (for example, UI devices) to locate (and possibly store) individual objects (for example, songs, movies, pictures, etc) that the (server) device is capable of providing. For example, this service can be used to enumerate a list of songs stored on an MP3 player, a list of still-images comprising various slide-shows, a list of movies stored in a DVD-Jukebox, a list of TV shows currently being broadcast (a.k.a an EPG), a list of songs stored in a CD-Jukebox, a list of programs stored on a PVR (Personal Video Recorder) device, etc. Nearly any type of content can be enumerated via this ContentDirectory service. For devices that contain multiple types of content (for example, MP3, MPEG2, JPEG, etc.), a single instance of the ContentDirectory service can be used to enumerate all objects, regardless of their type.

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/rri-v1-20101231.xsd>.
Latest version available at: <http://www.upnp.org/schemas/av/rri.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] – *DeviceProtection:1*, UPnP Forum, February 24, 2011.
Available at: <http://www.upnp.org/specs/gw/UPnP-gw-DeviceProtection-v1-Service-20110224.pdf>.
Latest version available at: <http://www.upnp.org/specs/gw/UPnP-gw-DeviceProtection-v1-Service.pdf>.

[37] – *IETF RFC 4122, A Universally Unique Identifier (UUID) URN Namespace*, P. Leach, Microsoft, M. Mealling, Refactored Networks LLC, R. Salz, DataPower Technology, Inc., July 2005.
Available at: <http://www.ietf.org/rfc/rfc4122.txt>.

[38] – *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>.

[39] – *Unicode Standard Annex #15, Unicode Normalization Forms, version 4.1.0, revision 25*, M. Davis, M. Dürst, March 25, 2005.
Available at: <http://www.unicode.org/reports/tr15/tr15-25.html>.

[40] – *IETF RFC 3986, Uniform Resource Identifiers (URI): Generic Syntax*, January 2005.
Available at: <http://www.ietf.org/rfc/rfc3986.txt>.

[41] – *IETF RFC 1738, Uniform Resource Locators (URL)*, Tim Berners-Lee, et. Al., December 1994.
Available at: <http://www.ietf.org/rfc/rfc1738.txt>.

[42] – *XQuery 1.0 An XML Query Language*. W3C Recommendation, 23 January 2007.
Available at: <http://www.w3.org/TR/2007/REC-xquery-20070123>.

[43] – ISO/IEC CD 21000-2:2001, *Information Technology - Multimedia Framework - Part 2: Digital Item Declaration*, July 2001.

[44] – *IETF RFC 1321, The MD5 Message-Digest Algorithm*, R. Rivest, April 1992.
Available at: <http://tools.ietf.org/html/rfc1321>.

[45] – *IETF RFC 3174, US Secure Hash Algorithm 1 (SHA1)*, D. Eastlake et al, September 2001.
Available at: <http://tools.ietf.org/html/rfc3174>.

[46] – *IETF RFC 4078, The TV-Anytime Content Reference Identifier (CRID)*, N. Earnshaw et al, May 2005.
Available at: <http://www.ietf.org/rfc/rfc4078.txt>.

[47] – *Data elements and interchange formats – Information interchange -- Representation of dates and times*, International Standards Organization, December 21, 2000.
Available at: [ISO 8601:2000](http://www.iso.org/iso/8601).

[48] – *IETF RFC 3339, Date and Time on the Internet: Timestamps*, G. Klyne, Clearswift Corporation, C. Newman, Sun Microsystems, July 2002.
Available at: <http://www.ietf.org/rfc/rfc3339.txt>.

[49] – *IETF RFC 2045, Multipurpose Internet Mail Extensions (MIME) Part 1:Format of Internet Message Bodies*, N. Freed, N. Borenstein, November 1996.
Available at: <http://www.ietf.org/rfc/rfc2045.txt>.