

ISO/IEC 29341-14-12:2011-09 (E)

Information technology - UPnP Device Architecture - Part 14-12: Audio Video Device Control Protocol - Level 3 - Audio Video Content Directory Service

Contents	Page
1 Overview and Scope.....	10
1.1 Introduction	10
1.2 Notation	10
1.2.1 Data Types	11
1.2.2 Strings Embedded in Other Strings.....	11
1.2.3 Extended Backus-Naur Form.....	11
1.3 Derived Data Types	12
1.3.1 Comma Separated Value (CSV) Lists	12
1.4 Management of XML Namespaces in Standardized DCPs.....	13
1.4.1 Namespace Prefix Requirements.....	16
1.4.2 Namespace Names, Namespace Versioning and Schema Versioning.....	17
1.4.3 Namespace Usage Examples	19
1.5 Vendor-defined Extensions	19
1.5.1 Vendor-defined Action Names	19
1.5.2 Vendor-defined State Variable Names	19
1.5.3 Vendor-defined XML Elements and attributes	20
1.5.4 Vendor-defined Property Names.....	20
1.6 References.....	20
2 Service Modeling Definitions.....	23
2.1 Service Type	23
2.2 Key Concepts.....	24
2.2.1 <i>On-line</i> and <i>Off-line</i> Network States.....	24
2.2.2 <i>object</i>	24
2.2.3 <i>Object Identity</i>	25
2.2.4 <i>Object Lifetime</i>	25
2.2.5 <i>Object Modification</i>	26
2.2.6 <i>class</i>	26
2.2.7 <i>item</i>	26
2.2.8 <i>container</i>	27
2.2.9 <i>Container Modification</i>	27
2.2.10 <i>ContentDirectory Tracking Changes Option</i>	27
2.2.11 <i>ContainerUpdateIDValue</i> Indicator.....	28
2.2.12 <i>ContentDirectory Service Object Organization</i>	29
2.2.13 <i>Hierarchical location</i>	29
2.2.14 <i>Subtree</i>	30
2.2.15 <i>Subtree Updates</i>	30
2.2.16 <i>XML Document</i>	31
2.2.17 <i>XML Fragment</i>	31
2.2.18 <i>DIDL-Lite XML Document</i>	32
2.2.19 <i>CDS View</i>	34
2.2.20 <i>property</i>	34
2.2.21 <i>reference, reference item, referenced item</i>	35
2.2.22 <i>CDS feature</i>	36
2.2.23 <i>Metadata vs. Foreign Metadata</i>	36
2.2.24 <i>Embedded XML Documents</i>	37

2.3	State Variables.....	37
2.3.1	State Variable Overview.....	37
2.3.2	<u>SearchCapabilities</u>	38
2.3.3	<u>SortCapabilities</u>	39
2.3.4	<u>SortExtensionCapabilities</u>	39
2.3.5	<u>SystemUpdateID</u>	39
2.3.6	<u>ContainerUpdateIDs</u>	41
2.3.7	<u>ServiceResetToken</u>	43
2.3.8	<u>LastChange</u>	44
2.3.9	<u>TransferIDs</u>	47
2.3.10	<u>FeatureList</u>	47
2.3.11	<u>A ARG TYPE ObjectID</u>	48
2.3.12	<u>A ARG TYPE Result</u>	48
2.3.13	<u>A ARG TYPE SearchCriteria</u>	48
2.3.14	<u>A ARG TYPE BrowseFlag</u>	50
2.3.15	<u>A ARG TYPE Filter</u>	50
2.3.16	<u>A ARG TYPE SortCriteria</u>	52
2.3.17	<u>A ARG TYPE Index</u>	53
2.3.18	<u>A ARG TYPE Count</u>	53
2.3.19	<u>A ARG TYPE UpdateID</u>	53
2.3.20	<u>A ARG TYPE TransferID</u>	53
2.3.21	<u>A ARG TYPE TransferStatus</u>	53
2.3.22	<u>A ARG TYPE TransferLength</u>	54
2.3.23	<u>A ARG TYPE TransferTotal</u>	54
2.3.24	<u>A ARG TYPE TagValueList</u>	54
2.3.25	<u>A ARG TYPE URI</u>	54
2.3.26	<u>A ARG TYPE CDSView</u>	54
2.3.27	<u>A ARG TYPE QueryRequest</u>	54
2.3.28	<u>A ARG TYPE QueryResult</u>	55
2.3.29	<u>A ARG TYPE FFQCapabilities</u>	55
2.4	Eventing and Moderation.....	57
2.5	Actions.....	58
2.5.1	<u>GetSearchCapabilities()</u>	59
2.5.2	<u>GetSortCapabilities()</u>	60
2.5.3	<u>GetSortExtensionCapabilities()</u>	60
2.5.4	<u>GetFeatureList()</u>	61
2.5.5	<u>GetSystemUpdateID()</u>	61
2.5.6	<u>GetServiceResetToken()</u>	62
2.5.7	<u>Browse()</u>	62
2.5.8	<u>Search()</u>	64
2.5.9	<u>CreateObject()</u>	65
2.5.10	<u>DestroyObject()</u>	69
2.5.11	<u>UpdateObject()</u>	71
2.5.12	<u>MoveObject()</u>	76
2.5.13	<u>ImportResource()</u>	77
2.5.14	<u>ExportResource()</u>	78
2.5.15	<u>DeleteResource()</u>	79
2.5.16	<u>StopTransferResource()</u>	80
2.5.17	<u>GetTransferProgress()</u>	81

2.5.18	<i>CreateReference()</i>	82
2.5.19	<i>FreeFormQuery()</i>	82
2.5.20	<i>GetFreeFormQueryCapabilities()</i>	84
2.5.21	Non-Standard Actions Implemented by a UPnP Vendor	85
2.5.22	Common Error Codes	85
2.6	Theory of Operation (Informative)	86
2.6.1	Introduction	86
2.6.2	Generating Object ID Values	87
2.6.3	Content Setup for Browsing and Searching	87
2.6.4	Browsing	88
2.6.5	Searching	93
2.6.6	Browsing, Searching, and References	97
2.6.7	Object Creation	98
2.6.8	Object Resource Binding (Importing a Resource)	99
2.6.9	Exporting ContentDirectory Resources	101
2.6.10	Playlist Manipulation	102
2.6.11	Internet Content Representation	104
2.6.12	Bookmark Manipulation	104
2.6.13	Processing FreeForm Queries	116
2.6.14	Foreign Metadata	119
2.6.15	Monitoring Changes	121
	XML Service Description	129
	Test	138
Annex A	(normative) Schemas	139
A.1	DIDL-Lite	139
A.2	UPnP Elements	139
A.3	Dublin Core Subset Elements	139
A.4	Event Schema	139
A.5	<i>FeatureList</i> State Variable Schema	139
Annex B	(normative) AV Working Committee Properties	141
B.1	Base Properties	145
B.1.1	<i>@id</i>	146
B.1.2	<i>@parentID</i>	146
B.1.3	<i>@refID</i>	146
B.1.4	<i>@restricted</i>	147
B.1.5	<i>@searchable</i>	147
B.1.6	<i>@childCount</i>	147
B.1.7	<i>dc:title</i>	147
B.1.8	<i>dc:creator</i>	147
B.1.9	<i>res</i>	148
B.1.10	<i>upnp:class</i>	148
B.1.11	<i>upnp:searchClass</i>	149
B.1.12	<i>upnp:createClass</i>	150
B.1.13	<i>upnp:writeStatus</i>	151
B.2	Resource Encoding Characteristics Properties	151
B.2.1	<i>res</i>	152
B.3	Contributor-related Properties	157
B.3.1	<i>upnp:artist</i>	158

B.3.2	<u>upnp:actor</u>	158
B.3.3	<u>upnp:author</u>	158
B.3.4	<u>upnp:producer</u>	159
B.3.5	<u>upnp:director</u>	159
B.3.6	<u>dc:publisher</u>	159
B.3.7	<u>dc:contributor</u>	159
B.4	Affiliation-related Properties	159
B.4.1	<u>upnp:genre</u>	160
B.4.2	<u>upnp:album</u>	160
B.4.3	<u>upnp:playlist</u>	160
B.5	Associated Resources Properties	161
B.5.1	<u>upnp:albumArtURL</u>	161
B.5.2	<u>upnp:artistDiscographyURL</u>	161
B.5.3	<u>upnp:lyricsURL</u>	161
B.5.4	<u>dc:relation</u>	161
B.6	Storage-Related Properties	161
B.6.1	<u>upnp:storageTotal</u>	162
B.6.2	<u>upnp:storageUsed</u>	162
B.6.3	<u>upnp:storageFree</u>	162
B.6.4	<u>upnp:storageMaxPartition</u>	162
B.6.5	<u>upnp:storageMedium</u>	162
B.7	General Description (mainly for UI purposes) Properties	163
B.7.1	<u>dc:description</u>	163
B.7.2	<u>upnp:longDescription</u>	163
B.7.3	<u>upnp:icon</u>	164
B.7.4	<u>upnp:region</u>	164
B.7.5	<u>upnp:rights</u>	164
B.7.6	<u>dc:date</u>	164
B.7.7	<u>dc:language</u>	165
B.7.8	<u>upnp:playbackCount</u>	165
B.7.9	<u>upnp:lastPlaybackTime</u>	165
B.7.10	<u>upnp:lastPlaybackPosition</u>	166
B.7.11	<u>upnp:recordedStartDateTime</u>	166
B.7.12	<u>upnp:recordedDuration</u>	167
B.7.13	<u>upnp:recordedDayOfWeek</u>	167
B.7.14	<u>upnp:srsRecordScheduleID</u>	167
B.7.15	<u>upnp:srsRecordTaskID</u>	167
B.7.16	<u>upnp:recordable</u>	168
B.8	Recorded Object-related Properties	168
B.8.1	<u>upnp:programTitle</u>	168
B.8.2	<u>upnp:seriesTitle</u>	169
B.8.3	<u>upnp:programID</u>	169
B.8.4	<u>upnp:seriesID</u>	169
B.8.5	<u>upnp:channelID</u>	170
B.8.6	<u>upnp:episodeCount</u>	171
B.8.7	<u>upnp:episodeNumber</u>	171
B.8.8	<u>upnp:programCode</u>	171
B.8.9	<u>upnp:rating</u>	172
B.8.10	<u>upnp:episodeType</u>	172

B.9	User Channel and EPG Related Properties	173
B.9.1	<u>upnp:channelGroupName</u>	173
B.9.2	<u>upnp:callSign</u>	174
B.9.3	<u>upnp:networkAffiliation</u>	174
B.9.4	<u>upnp:serviceProvider</u>	174
B.9.5	<u>upnp:price</u>	174
B.9.6	<u>upnp:payPerView</u>	175
B.9.7	<u>upnp:epgProviderName</u>	175
B.9.8	<u>upnp:dateTimeRange</u>	175
B.10	Radio Broadcast Properties	176
B.10.1	<u>upnp:radioCallSign</u>	176
B.10.2	<u>upnp:radioStationID</u>	176
B.10.3	<u>upnp:radioBand</u>	176
B.11	Video Broadcast Properties	176
B.11.1	<u>upnp:channelNr</u>	177
B.11.2	<u>upnp:channelName</u>	177
B.11.3	<u>upnp:scheduledStartTime</u>	177
B.11.4	<u>upnp:scheduledEndTime</u>	178
B.11.5	<u>upnp:scheduledDuration</u>	179
B.12	Physical Tuner Status-related Properties	179
B.12.1	<u>upnp:signalStrength</u>	179
B.12.2	<u>upnp:signalLocked</u>	179
B.12.3	<u>upnp:tuned</u>	180
B.13	Bookmark-related Properties	180
B.13.1	<u>@neverPlayable</u>	180
B.13.2	<u>upnp:bookmarkID</u>	180
B.13.3	<u>upnp:bookmarkedObjectID</u>	181
B.13.4	<u>upnp:deviceUDN</u>	181
B.13.5	<u>upnp:stateVariableCollection</u>	181
B.14	Miscellaneous Properties	183
B.14.1	<u>upnp:DVDRegionCode</u>	183
B.14.2	<u>upnp:originalTrackNumber</u>	183
B.14.3	<u>upnp:toc</u>	183
B.14.4	<u>upnp:userAnnotation</u>	183
B.14.5	<u>desc</u>	183
B.15	Object Tracking Properties	184
B.15.1	<u>upnp:containerUpdateID</u>	184
B.15.2	<u>upnp:objectUpdateID</u>	185
B.15.3	<u>upnp:totalDeletedChildCount</u>	186
B.15.4	<u>res@updateCount</u>	186
B.16	Foreign Metadata-related Properties	186
B.16.1	<u>upnp:foreignMetadata</u>	187
Annex C (normative)	AV Working Committee Class Definitions	194
C.1	Class Hierarchy	194
C.1.1	Class name syntax	195
C.1.2	Class Properties Overview	196
C.2	<u>object</u> (Base Class)	200
C.2.1	<u>item:object</u>	200
C.2.2	<u>container:object</u>	208

Annex D (normative) EBNF Syntax Definitions.....	215
D.1 Date&time Syntax.....	215
Annex E (normative) CDS features.....	216
E.1 Requirements for the <i>EPG feature</i> , Version 1	217
E.2 Requirements for the <i>TUNER feature</i> , Version 1.....	218
E.3 Requirements for the <i>BOOKMARK feature</i> , Version 1	218
E.4 Requirements for the <i>FOREIGN_METADATA feature</i> , Version 1	219
E.5 Requirements for the <i>FFQ feature</i> , Version 1	220
Annex F (informative) Example ContentDirectory Hierarchy	222
Figure 1 — ContentDirectory Service Object Organization.	29
Figure 2 — Flattened DIDL-Lite hierarchical structure.....	33
Figure 3 — Class hierarchy for the item base class.	195
Figure 4 — Class hierarchy for the container base class.....	195
Table 1-1 — EBNF Operators.....	12
Table 1-2 — CSV Examples.....	13
Table 1-3 — Namespace Definitions.....	14
Table 1-4 — Schema-related Information	15
Table 1-5 — Default Namespaces for the AV Specifications.....	16
Table 2-1 — Properties in XML	35
Table 2-2 — State variables.....	37
Table 2-3 — <u>SearchCapabilities</u> requirements for supporting <i>Tracking Changes Option</i>	38
Table 2-4 — Sort Modifiers	39
Table 2-5 — <u>ContainerUpdateIDs</u> Example.....	42
Table 2-6 — <u>ContainerUpdateIDs</u> Example.....	42
Table 2-7 — Event moderation.....	57
Table 2-8 — Actions	58
Table 2-9 — Arguments for <u>GetSearchCapabilities()</u>	59
Table 2-10 — Error Codes for <u>GetSearchCapabilities()</u>	59
Table 2-11 — Arguments for <u>GetSortCapabilities()</u>	60
Table 2-12 — Error Codes for <u>GetSortCapabilities()</u>	60
Table 2-13 — Arguments for <u>GetSortExtensionCapabilities()</u>	60
Table 2-14 — Error Codes for <u>GetSortExtensionCapabilities()</u>	60
Table 2-15 — Arguments for <u>GetFeatureList()</u>	61
Table 2-16 — Error Codes for <u>GetFeatureList()</u>	61
Table 2-17 — Arguments for <u>GetSystemUpdateID()</u>	61
Table 2-18 — Error Codes for <u>GetSystemUpdateID()</u>	61
Table 2-19 — Arguments for <u>GetServiceResetToken()</u>	62
Table 2-20 — Error Codes for <u>GetServiceResetToken()</u>	62
Table 2-21 — Arguments for <u>Browse()</u>	63
Table 2-22 — Error Codes for <u>Browse()</u>	63
Table 2-23 — Arguments for <u>Search()</u>	64
Table 2-24 — Error Codes for <u>Search()</u>	65

Table 2-25 — Arguments for <u>CreateObject()</u>	69
Table 2-26 — Error codes for <u>CreateObject()</u>	69
Table 2-27 — Arguments for <u>DestroyObject()</u>	70
Table 2-28 — Error Codes for <u>DestroyObject()</u>	71
Table 2-29 — Update examples	73
Table 2-30 — Arguments for <u>UpdateObject()</u>	75
Table 2-31 — Error Codes for <u>UpdateObject()</u>	75
Table 2-32 — Arguments for <u>MoveObject()</u>	77
Table 2-33 — Error Codes for <u>MoveObject()</u>	77
Table 2-34 — Arguments for <u>ImportResource()</u>	78
Table 2-35 — Error Codes for <u>ImportResource()</u>	78
Table 2-36 — Arguments for <u>ExportResource()</u>	79
Table 2-37 — Error Codes for <u>ExportResource()</u>	79
Table 2-38 — Arguments for <u>DeleteResource()</u>	80
Table 2-39 — Error Codes for <u>DeleteResource()</u>	80
Table 2-40 — Arguments for <u>StopTransferResource()</u>	80
Table 2-41 — Error Codes for <u>StopTransferResource()</u>	81
Table 2-42 — Arguments for <u>GetTransferProgress()</u>	81
Table 2-43 — Error Codes for <u>GetTransferProgress()</u>	81
Table 2-44 — Arguments for <u>CreateReference()</u>	82
Table 2-45 — Error Codes for <u>CreateReference()</u>	82
Table 2-46 — Arguments for <u>FreeFormQuery()</u>	83
Table 2-47 — Error Codes for <u>FreeFormQuery()</u>	84
Table 2-48 — Arguments for <u>GetFreeFormQueryCapabilities()</u>	84
Table 2-49 — Error Codes for <u>GetFreeFormQueryCapabilities()</u>	85
Table 2-50 — Common Error Codes.....	85
Table B.1 — ContentDirectory Service Properties Overview.....	141
Table B.2 — Base Properties Overview	145
Table B.3 — allowedValueList for the <u>upnp:class</u> Property.....	148
Table B.4 — allowedValueList for the <u>upnp:writeStatus</u> Property.....	151
Table B.5 — Resource Encoding Characteristics Properties Overview	151
Table B.6 — allowedValueList for the <u>res@daylightSaving</u> Property	157
Table B.7 — Contributor-related Properties Overview	157
Table B.8 — Affiliation-related Properties Overview	159
Table B.9 — Associated Resources Properties Overview	161
Table B.10 — Storage-Related Properties Overview	161
Table B.11 — General Description (mainly for UI purposes) Properties Overview	163
Table B.12 — allowedValueList for the <u>upnp:recordedDayOfWeek</u> Property	167
Table B.13 — Recorded Object-related Properties Overview.....	168
Table B.14 — User Channel and EPG Related Properties Overview.....	173
Table B.15 — Radio Broadcast Properties Overview.....	176
Table B.16 — allowedValueList for the <u>upnp:radioBand</u> Property	176
Table B.17 — Video Broadcast Properties Overview	176

Table B.18 — allowedValueList for the upnp:scheduledStartTime@usage Property	178
Table B.19 — Physical Tuner Status-related Properties Overview	179
Table B.20 — Bookmark-related Properties Overview	180
Table B.21 — allowedValueList for the upnp:stateVariableCollection@rcsInstanceType Property	182
Table B.22 — Miscellaneous Properties Overview	183
Table B.23 — Object Tracking Properties Overview	184
Table B.24 — Foreign Metadata-related Properties Overview	186
Table C.1 — Class Properties Overview	196
Table C.2 — object Properties	200
Table C.3 — item Properties	201
Table C.4 — imageItem:item Properties	201
Table C.5 — photo:imageItem Properties	201
Table C.6 — audioItem:item Properties	202
Table C.7 — musicTrack:audioItem Properties	202
Table C.8 — audioBroadcast:audioItem Properties	202
Table C.9 — audioBook:audioItem Properties	203
Table C.10 — videoItem:item Properties	203
Table C.11 — movie:videoItem Properties	203
Table C.12 — videoBroadcast:videoItem Properties	204
Table C.13 — musicVideoClip:videoItem Properties	204
Table C.14 — playlistItem:item Properties	205
Table C.15 — textItem:item Properties	205
Table C.16 — bookmarkItem:item Properties	206
Table C.17 — epgItem:item Properties	206
Table C.18 — audioProgram:epgItem Properties	207
Table C.19 — videoProgram:epgItem Properties	208
Table C.20 — container Properties	208
Table C.21 — person:container Properties	208
Table C.22 — musicArtist:person Properties	209
Table C.23 — playlistContainer:container Properties	209
Table C.24 — album:container Properties	209
Table C.25 — musicAlbum:album Properties	210
Table C.26 — photoAlbum:album Properties	210
Table C.27 — genre:container Properties	210
Table C.28 — channelGroup:container Properties	211
Table C.29 — epgContainer:container Properties	212
Table C.30 — storageSystem:container Properties	213
Table C.31 — storageVolume:container Properties	213
Table C.32 — storageFolder:container Properties	214
Table C.33 — genre:container Properties	214
Table E.1 — <i>CDS features</i>	216
Table E.2 — REQUIRED characteristics of the <i>EPG Feature</i> element	217

Table E.3 — REQUIRED characteristics of the <i>TUNER Feature</i> element.....	218
Table E.4 — REQUIRED characteristics of the <i>BOOKMARK feature</i> element	219
Table E.5 — REQUIRED characteristics of the <i>FOREIGN_METADATA Feature</i> element	220
Table E.6 — REQUIRED characteristics of the <i>FFQ Feature</i> element.....	221