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BSI Standards Publication

Information technology — UPnP Device Architecture

Part 20-10: Audio video device control protocol

Level 4 — Audio video transport service

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Part 20-10: Audio video device control protocol — Level 4 — Audio video transport service

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Partie 20-10: Protocole de contrôle de dispositif audio-vidéo — Niveau 4 — Service de transport audio-vidéo

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ISO/IEC 29341-20-10 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.

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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
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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
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UPnP RenderingControl:2 Service	ISO/IEC 29341-4-13:2011
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UPnP MediaServer:3 Device	ISO/IEC 29341-14-3:2011
UPnP ContentSync:1	ISO/IEC 29341-15-10:2011
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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

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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

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1 Scope

This service definition is compliant with UPnP Device Architecture version 1.0 [14].

This service type enables control over the transport of audio and video streams. The service type defines a common model for A/V transport control suitable for a generic user interface. It can be used to control a wide variety of disc, tape and solid-state based media devices such as CD players, VCRs and MP3 players. A minimal implementation of this service can be used to control tuners.

The service type is related to the ConnectionManager service type, which describes A/V connection setup procedures, and the ContentDirectory service, which offers meta-information about the resource stored on the media. AVTransport also offers an action to retrieve any metadata embedded in the resource itself.

This service type does not offer scheduled recording.

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.

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3 Terms, definitions, symbols and abbreviations

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

3.1 Provisioning terms

3.1.1
allowed
A
The definition or behavior is allowed.

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

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

3.1.4
required
R
The definition or behavior is required.

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

3.1.6
X
Vendor-defined, non-standard.

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

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

3.2 Symbols

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

4 Notations and Conventions

4.1 Notation

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

4.1.1 Data Types

Data type definitions come from three sources:

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

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

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

4.1.2 Strings Embedded in Other Strings

Some string variables and arguments described in this document contain substrings that shall be independently identifiable and extractable for other processing. This requires the definition of appropriate substring delimiters and an escaping mechanism so that these delimiters can also appear as ordinary characters in the string and/or its independent substrings. This document uses embedded strings in two contexts – Comma Separated Value (CSV) lists (see subclause 4.2.2) and property values in search criteria strings. Escaping conventions use the backslash character, “\” (character code U+005C), as follows:

a) Backslash (“\”) is represented as “\\” in both contexts.

b) Comma (“,”) is

   1) represented as “\,” in individual substring entries in CSV lists

   2) not escaped in search strings

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c) Double quote (“"”) is
   1) not escaped in CSV lists
   2) not escaped in search strings when it appears as the start or end delimiter of a property value
   3) represented as “\"” in search strings when it appears as a character that is part of the property value

4.1.3 Extended Backus-Naur Form

Extended Backus-Naur Form is used in this document for a formal syntax description of certain constructs. The usage here is according to the reference [19].

4.1.3.1 Typographic conventions for EBNF

`Non-terminal` symbols are unquoted sequences of characters from the set of English upper and lower case letters, the digits “`0`” through “`9`”, and the hyphen (“`-`”). Character sequences between `'single quotes'` are terminal strings and shall appear literally in valid strings. Character sequences between `(*comment delimiters*)` are English language definitions or supplementary explanations of their associated symbols. White space in the EBNF is used to separate elements of the EBNF, not to represent white space in valid strings. White space usage in valid strings is described explicitly in the EBNF. Finally, the EBNF uses the following operators in Table 1:

Table 1 — EBNF Operators

Operator	Semantics
`::=`	**definition** – the non-terminal symbol on the left is defined by one or more alternative sequences of terminals and/or non-terminals to its right.
`|`	**alternative separator** – separates sequences on the right that are independently allowed definitions for the non-terminal on the left.
`*`	**null repetition** – means the expression to its left may occur zero or more times.
`+`	**non-null repetition** – means the expression to its left shall occur at least once and may occur more times.
`[ ]`	**optional –** the expression between the brackets is allowed.
`( )`	**grouping –** groups the expressions between the parentheses.
`-`	**character range** – represents all characters between the left and right character operands inclusively.

4.2 Derived Data Types

4.2.1 Summary

Subclause 4.2 defines a derived data type that is represented as a string data type with special syntax. This specification uses string data type definitions that originate from two different sources. The UPnP Device Architecture defined **string** data type is used to define state variable and action argument **string** data types. The XML Schema namespace is used to define property xsd:string data types. The following definition in subclause 4.2.2 applies to both string data types.

4.2.2 CSV Lists

The UPnP AV services use state variables, action arguments and properties that represent lists – or one-dimensional arrays – of values. The UPnP Device Architecture, Version 1.0 [14], does not provide for either an array type or a list type, so a list type is defined here. Lists may either be homogeneous (all values are the same type) or heterogeneous (all values can be of different types). Lists may also consist of repeated occurrences of homogeneous or heterogeneous subsequences, all of which have the same syntax and semantics (same number of values, same value types and in the same order). The data type of a homogeneous list is **string** or xsd:string and denoted by CSV (*x*), where *x* is the type of the individual values. The data type of a heterogeneous list is also **string** or xsd:string and denoted by CSV (*x, y, z*), where *x*, *y* and *z* are the types of the individual values. If the number of values in the

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heterogeneous list is too large to show each type individually, that variable type is represented as CSV (heterogeneous), and the variable description includes additional information as to the expected sequence of values appearing in the list and their corresponding types. The data type of a repeated subsequence list is **string** or xsd:string and denoted by CSV ({a,b,c},{*x*, *y*, *z*}), where a, b, c, *x*, *y* and *z* are the types of the individual values in the subsequence and the subsequences may be repeated zero or more times.

- A list is represented as a **string** type (for state variables and action arguments) or xsd:string type (for properties).
- Commas separate values within a list.
- Integer values are represented in CSVs with the same syntax as the integer data type specified in [14] (that is: allowed leading sign, allowed leading zeroes, numeric US-ASCII)
- Boolean values are represented in state variable and action argument CSVs as either "**0**" for false or "**1**" for true. These values are a subset of the defined **boolean** data type values specified in [14]: **0**, **false**, **no**, **1**, **true**, **yes**.
- Boolean values are represented in property CSVs as either "*0*" for false or "*1*" for true. These values are a subset of the defined Boolean data type values specified in [34]: 0, false, 1, true.
- Escaping conventions for the comma and backslash characters are defined in 4.1.2.
- White space before, after, or interior to any numeric data type is not allowed.
- White space before, after, or interior to any other data type is part of the value.

Table 2 — CSV Examples

Type refinement of string	Value	Comments
CSV (**string**) or CSV (xsd:string)	"+artist,-date"	List of 2 property sort criteria.
CSV (**int**) or CSV (xsd:integer)	"1,-5,006,0,+7"	List of 5 integers.
CSV (**boolean**) or CSV (xsd:Boolean)	"0,1,1,0"	List of 4 booleans
CSV (**string**) or CSV (xsd:string)	"Smith\, Fred,Jones\, Davey"	List of 2 names, "Smith, Fred" and "Jones, Davey"
CSV (**i4**,**string**,**ui2**) or CSV (xsd:int, xsd:string, xsd:unsignedShort)	"-29837, string with leading blanks,0"	Note that the second value is " string with leading blanks"
CSV (**i4**) or CSV (xsd:int)	"3, 4"	Illegal CSV. White space is not allowed as part of an integer value.
CSV (**string**) or CSV (xsd:string)	",,"	List of 3 empty string values
CSV (heterogeneous)	"Alice,Marketing,5,Sue,R&D,21,Dave,Finance,7"	List of unspecified number of people and associated attributes. Each person is described by 3 elements: a name **string**, a department **string** and years-of-service **ui2** or a name xsd:string, a department xsd:string and years-of-service xsd:unsignedShort.

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4.3 Management of XML Namespaces in Standardized DCPs

UPnP specifications make extensive use of XML namespaces. This enables separate DCPs, and even separate components of an individual DCP, to be designed independently and still avoid name collisions when they share XML documents. Every name in an XML document belongs to exactly one namespace. In documents, XML names appear in one of two forms: qualified or unqualified. An unqualified name (or no-colon-name) contains no colon (":") characters. An unqualified name belongs to the document's default namespace. A qualified name is two no-colon-names separated by one colon character. The no-colon-name before the colon is the qualified name's namespace prefix, the no-colon-name after the colon is the qualified name's "local" name (meaning local to the namespace identified by the namespace prefix). Similarly, the unqualified name is a local name in the default namespace.

The formal name of a namespace is a URI. The namespace prefix used in an XML document is *not* the name of the namespace. The namespace name shall be globally unique. It has a single definition that is accessible to anyone who uses the namespace. It has the same meaning anywhere that it is used, both inside and outside XML documents. The namespace prefix, however, in formal XML usage, is defined only in an XML document. It shall be locally unique to the document. Any valid XML no-colon-name may be used. And, in formal XML usage, different XML documents may use different namespace prefixes to refer to the same namespace. The creation and use of the namespace prefix was standardized by the W3C XML Committee in [32] strictly as a convenient local shorthand replacement for the full URI name of a namespace in individual documents.

All AV object properties are represented in XML by element and attribute names, therefore, all property names belong to an XML namespace.

For the same reason that namespace prefixes are convenient in XML documents, it is convenient in specification text to refer to namespaces using a namespace prefix. Therefore, this specification declares a "standard" prefix for all XML namespaces used herein. In addition, this specification expands the scope where these prefixes have meaning, beyond a single XML document, to all of its text, XML examples, and certain string-valued properties. This expansion of scope *does not* supersede XML rules for usage in documents, it only augments and complements them in important contexts that are out-of-scope for the XML specifications. For example, action arguments which refer to CDS properties, such as the *SearchCriteria* argument of the *Search()* action or the *Filter* argument of the *Browse()* action, shall use the predefined namespace prefixes when referring to CDS properties ("upnp:", "dc:", etc).

All of the namespaces used in this specification are listed in Table 3 and Table 4. For each such namespace, Table 3 gives a brief description of it, its name (a URI) and its defined "standard" prefix name. Some namespaces included in these tables are not directly used or referenced in this document. They are included for completeness to accommodate those situations where this specification is used in conjunction with other UPnP specifications to construct a complete system of devices and services. For example, since the ScheduledRecording service depends on and refers to the ContentDirectory service, the predefined "srs:" namespace prefix is included. The individual specifications in such collections all use the same standard prefix. The standard prefixes are also used in Table 4 to cross-reference additional namespace information. Table 4 includes each namespace's valid XML document root element(s) (if any), its schema file name, versioning information (to be discussed in more detail below), and a link to the entry in Clause 2 for its associated schema.

The normative definitions for these namespaces are the documents referenced in Table 3. The schemas are designed to support these definitions for both human understanding and as test tools. However, limitations of the XML Schema language itself make it difficult for the UPnP-defined schemas to accurately represent all details of the namespace definitions. As a result, the schemas will validate many XML documents that are not valid according to the specifications.

The Working Committee expects to continue refining these schemas after specification release to reduce the number of documents that are validated by the schemas while violating the specifications, but the schemas will still be informative, supporting documents. Some schemas might become normative in future versions of the specifications.

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Table 3 — Namespace Definitions

Standard Name-space Prefix	Namespace Name	Namespace Description	Normative Definition Document Reference
AV Working Committee defined namespaces			
atrs	urn:schemas-upnp-org:av:AllowedTransformSettings	*AllowedTransformSettings* and *AllowedDefaultTransformSettings* state variables for RenderingControl	[21]
av	urn:schemas-upnp-org:av:av	Common data types for use in AV schemas	[3]
avdt	urn:schemas-upnp-org:av:avdt	Datastructure Template	[2]
avs	urn:schemas-upnp-org:av:avs	Common structures for use in AV schemas	[4]
avt-event	urn:schemas-upnp-org:metadata-1-0/AVT/	Evented *LastChange* state variable for AVTransport	[5]
cds-event	urn:schemas-upnp-org:av:cds-event	Evented *LastChange* state variable for ContentDirectory	[7]
cm-dciu	urn:schemas-upnp-org:av:cm-deviceClockInfoUpdates	Evented *DeviceClockInfoUpdates* state variable for ConnectionManager	[9]
cm-ftrlst	urn:schemas-upnp-org:av:cm-featureList	*FeatureList* state variable for ConnectionManager	[9]
didl-lite	urn:schemas-upnp-org:metadata-1-0/DIDL-Lite/	Structure and metadata for ContentDirectory	[7]
dmo	urn:schemas-upnp.org:av:dmo	Evented *DeviceMode* state variable for ContentDirectory	[7]
dmor	urn:schemas-upnp.org:av:dmor	*A_ARG_TYPE_DeviceModeRequest* state variable for ContentDirectory	[7]
dmos	urn:schemas-upnp.org:av:dmos	*DeviceModeStatus* state variable for ContentDirectory	[7]
pi	urn:schemas-upnp.org:av:pi	*PermissionsInfo* state variable for ContentDirectory	[7]
rcs-event	urn:schemas-upnp-org:metadata-1-0/RCS/	Evented *LastChange* state variable for RenderingControl	[21]
rii	urn:schemas-upnp-org:av:rii	*A_ARG_TYPE_RenderingInfoList* state variable for ConnectionManager	[9]
rpl	urn:schemas-upnp-org:av:rpl	*A_ARG_TYPE_PlaylistInfo* state variable for AVTransport	[5]
srs	urn:schemas-upnp-org:av:srs	Metadata and structure for ScheduledRecording	[25]
srs-event	urn:schemas-upnp-org:av:srs-event	Evented *LastChange* state variable for ScheduledRecording	[25]
trs	urn:schemas-upnp-org:av:TransformSettings	*TransformSettings* and *DefaultTransformSettings* state variables for RenderingControl	[21]
upnp	urn:schemas-upnp-org:metadata-1-0/upnp/	Metadata for ContentDirectory	[7]

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Standard Name-space Prefix	Namespace Name	Namespace Description	Normative Definition Document Reference
Externally defined namespaces			
dc	http://purl.org/dc/elements/1.1/	Dublin Core	[13]
xsd	http://www.w3.org/2001/XMLSchema	XML Schema Language 1.0	[33], [34]
xsi	http://www.w3.org/2001/XMLSchema-instance	XML Schema Instance Document schema	[33] 2.6 & 3.2.7
xml	http://www.w3.org/XML/1998/namespace	The “xml:” Namespace	[30]

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Table 4 — Schema-related Information

Standard Name-space Prefix	Relative URI and File Name [a] • Form 1, Form 2, Form3	Valid Root Element(s)	Schema Reference
AV Working Committee Defined Namespaces			
atrs	AllowedTransformSettings-v*n*-*yyyymmdd*.xsd AllowedTransformSettings-v*n*.xsd AllowedTransformSettings.xsd	`<TransformList>`	[1]
av	av-v*n*-*yyyymmdd*.xsd av-v*n*.xsd av.xsd	*n/a*	[3]
avdt	avdt-v*n*-*yyyymmdd*.xsd avdt-v*n*.xsd avdt.xsd	`<AVDT>`	[2]

avs	avs-v*n*-*yyyymmdd*.xsd
	avs-v*n*.xsd
	avs.xsd
		`<Capabilities>`
		`<Features>`
		`<stateVariableValuePairs>`
			[4]

avt-event	avt-event-v*n*-*yyyymmdd*.xsd avt-event-v*n*.xsd avt-event.xsd	`<Event>`	[6]
cds-event	cds-event-v*n*-*yyyymmdd*.xsd cds-event-v*n*.xsd cds-event.xsd	`<StateEvent>`	[8]
cm-dciu	cm-deviceClockInfoUpdates-v*n*-*yyyymmdd*.xsd cm-deviceClockInfoUpdates-v*n*.xsd cm-deviceClockInfoUpdates.xsd	`<DeviceClockInfoUpdates>`	[10]
cm-ftrlst	cm-featureList-v*n*-*yyyymmdd*.xsd cm-featureList-v*n*.xsd cm-featureList.xsd	`<Features>`	[11]
didl-lite	didl-lite-v*n*-*yyyymmdd*.xsd didl-lite-v*n*.xsd didl-lite.xsd	`<DIDL-Lite>`	[15]
dmo	dmo-v*n*-*yyyymmdd*.xsd dmo-v*n*.xsd dmo.xsd	`<DeviceMode>`	[16]
dmor	dmor-v*n*-*yyyymmdd*.xsd dmor-v*n*.xsd dmor.xsd	`<DeviceModeRequest>`	[17]
dmos	dmos-v*n*-*yyyymmdd*.xsd dmos-v*n*.xsd dmos.xsd	`<DeviceModeStatus>`	[18]

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Standard Name-space Prefix	Relative URI and File Name [a] • Form 1, Form 2, Form3	Valid Root Element(s)	Schema Reference
pi	pi-v*n*-*yyyymmdd*.xsd pi-v*n*.xsd pi.xsd	`<PermissionsInfo>`	[20]
rcs-event	rcs-event-v*n*-*yyyymmdd*.xsd rcs-event-v*n*.xsd rcs-event.xsd	`<Event>`	[22]
rii	rii-*vn-yyyymmdd*.xsd rii-v*n*.xsd rii.xsd	`<rendererInfo>`	[23]
rpl	rpl-*vn-yyyymmdd*.xsd rpl-v*n*.xsd rpl.xsd	`<PlaylistInfo>`	[24]
trs	TransformSettings-*vn*-*yyyymmdd*.xsd TransformSettings-v*n*.xsd TransformSettings.xsd	`<TransformSettings>`	[28]
srs	srs-v*n*-*yyyymmdd*.xsd srs-v*n*.xsd srs.xsd	`<srs>`	[26]
srs-event	srs-event-v*n*-*yyyymmdd*.xsd srs-event-v*n*.xsd srs-event.xsd	`<StateEvent>`	[27]
upnp	upnp-v*n*-*yyyymmdd*.xsd upnp-v*n*.xsd upnp.xsd	*n/a*	[29]
Externally Defined Namespaces			
dc	*Absolute URL*: http://dublincore.org/schemas/xmls/simpledc20021212.xsd		[12]
xsd	*n/a*	`<schema>`	[35]
xsi	*n/a*		*n/a*
xml	*n/a*		[31]
[a] Absolute URIs are generated by prefixing the relative URIs with "http://www.upnp.org/schemas/av/"			

4.3.1 Namespace Prefix Requirements

There are many occurrences in this specification of string data types that contain XML names (property names). These XML names in strings will not be processed under namespace-aware conditions. Therefore, all occurrences in instance documents of XML names in strings shall use the standard namespace prefixes as declared in Table 3. In order to properly process the XML documents described herein, control points and devices shall use namespace-aware XML processors [32] for both reading and writing. As allowed by [32], the namespace prefixes used in an instance document are at the sole discretion of the document creator. Therefore, the declared prefix for a namespace in a document may be different from the standard prefix. All devices shall be able to correctly process any valid XML instance document, even when it uses a non-standard prefix for ordinary XML names. However, it is strongly recommended that all devices use these standard prefixes for all instance documents to avoid confusion on the part of both human and machine readers. These standard prefixes are used in all descriptive text and all XML examples in this and related UPnP specifications. However, each individual specification may assume a default namespace for its descriptive text. In that case, names from that namespace may appear with no prefix.

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The assumed default namespace, if any, for each UPnP AV specification is given in Table 5.

Note: all UPnP AV schemas declare attributes to be “unqualified”, so namespace prefixes are never used with AV Working Committee defined attribute names.

Table 5 — Default Namespaces for the AV Specifications

AV Specification Name	Default Namespace Prefix
AVTransport	avt-event
ConnectionManager	*n/a*
ContentDirectory	didl-lite
MediaRenderer	*n/a*
MediaServer	*n/a*
RenderingControl	rcs-event
ScheduledRecording	srs

4.3.2 Namespace Names, Namespace Versioning and Schema Versioning

The UPnP AV service specifications define several data structures (such as state variables and action arguments) whose format is an XML instance document that complies with one or more specific XML schemas, which define XML namespaces. Each namespace is uniquely identified by an assigned namespace name. The namespace names that are defined by the AV Working Committee are URNs. See Table 3 for a current list of namespace names. Additionally, each namespace corresponds to an XML schema document that provides a machine-readable representation of the associated namespace to enable automated validation of the XML (state variable or action parameter) instance documents.

Within an XML schema and XML instance document, the name of each corresponding namespace appears as the value of an `xmlns` attribute within the root element. Each `xmlns` attribute also includes a namespace prefix that is associated with that namespace in order to qualify and disambiguate element and attribute names that are defined within different namespaces. The schemas that correspond to the listed namespaces are identified by URI values that are listed in the `schemaLocation` attribute also within the root element (see subclause 4.3.3).

In order to enable both forward and backward compatibility, namespace names are permanently assigned and shall not change even when a new version of a specification changes the definition of a namespace. However, all changes to a namespace definition shall be backward-compatible. In other words, the updated definition of a namespace shall not invalidate any XML documents that comply with an earlier definition of that same namespace. This means, for example, that a namespace shall not be changed so that a new element or attribute becomes required in a conforming instance document. Although namespace names shall not change, namespaces still have version numbers that reflect a specific set of definitional changes. Each time the definition of a namespace is changed, the namespace’s version number is incremented by one.

Whenever a new namespace version is created, a new XML schema document (.xsd) is created and published so that the new namespace definition is represented in a machine-readable form. Since a XML schema document is just a representation of a namespace definition, translation errors can occur. Therefore, it is sometime necessary to re-release a published schema in order to correct typos or other namespace representation errors. In order to easily identify the potential multiplicity of schema releases for the same namespace, the URI of each released schema shall conform to the following format (called Form 1):

Form 1: "http://www.upnp.org/schemas/av/" ***schema-root-name*** "-v" ***ver*** "-" ***yyyymmdd*** where

- ***schema-root-name*** is the name of the root element of the namespace that this schema represents.
- ***ver*** corresponds to the version number of the namespace that is represented by the schema.

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- ***yyyymmdd*** is the year, month and day (in the Gregorian calendar) that this schema was released.

Table 4 identifies the URI formats for each of the namespaces that are currently defined by the UPnP AV Working Committee.

As an example, the original schema URI for the "rcs-event" namespace (that was released with the original publication of the UPnP AV service specifications in the year 2002) was "http://www.upnp.org/schemas/av/rcs-event-v1-20020625.xsd". When the UPnP AV service specifications were subsequently updated in the year 2006, the URI for the updated version of the "rcs-event" namespace was "http://www.upnp.org/schemas/av/rcs-event-v2-20060531.xsd". However, in 2006, the schema URI for the newly created "srs-event" namespace was "http://www.upnp.org/schemas/av/srs-event-v1-20060531.xsd". Note the version field for the "srs-event" schema is "v1" since it was first version of that namespace whereas the version field for the "rcs-event" schema is "v2" since it was the second version of that namespace.

In addition to the dated schema URIs that are associated with each namespace, each namepace also has a set of undated schema URIs. These undated schema URIs have two distinct formats with slightly different meanings:

Form 2: "http://www.upnp.org/schemas/av/" *schema-root-name* "-v" ***ver***

where ***ver*** is described above.

Form 3: "http://www.upnp.org/schemas/av/" *schema-root-name*

Form 2 of the undated schema URI is always linked to the most recent release of the schema that represents the version of the namespace indicated by ***ver***. For example, the undated URI "…/av/rcs-event-v2.xsd" is linked to the most recent schema release of version 2 of the "rcs-event" namespace. Therefore, on May 31, 2006 (20060531), the undated schema URI was linked to the schema that is otherwise known as "…/av/rcs-event-v2-20060531.xsd". Furthermore, if the schema for version 2 of the "rcs-event" namespace was ever re-released, for example to fix a typo in the 20060531 schema, then the same undated schema URI ("…/av/rcs-event-v2.xsd") would automatically be updated to link to the updated version 2 schema for the "rcs-event" namespace.

Form 3 of the undated schema URI is always linked to the most recent release of the schema that represents the highest version of the namespace that has been published. For example, on June 25, 2002 (20020625), the undated schema URI "…/av/rcs-event.xsd" was linked to the schema that is otherwise known as "…/av/rcs-event-v1-20020625.xsd". However, on May 31, 2006 (20060531), that same undated schema URI was linked to the schema that is otherwise known as "…/av/rcs-event-v2-20060531.xsd".

When referencing a schema URI within an XML instance document or a referencing XML schema document, the following usage rules apply:

- All instance documents, whether generated by a service or a control point, shall use Form 3.
- All UPnP AV published schemas that reference other UPnP AV schemas shall also use Form 3.

Within an XML instance document, the definition for the `schemaLocation` attribute comes from the XML Schema namespace "http://www.w3.org/2002/XMLSchema-instance". A single occurrence of the attribute can declare the location of one or more schemas. The `schemaLocation` attribute value consists of a whitespace separated list of values that is interpreted as a namespace name followed by its schema location URL. This pair-sequence is repeated as necessary for the schemas that need to be located for this instance document.

In addition to the schema URI naming and usage rules described above, each released schema shall contain a `version` attribute in the `<schema>` root element. Its value shall correspond to the format:

ver "-" ***yyyymmdd*** where ***ver*** and ***yyyymmdd*** are described above.

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The `version` attribute provides self-identification of the namespace version and release date of the schema itself. For example, within the original schema released for the "rcs-event" namespace (.../rcs-event-v2-20020625.xsd), the `<schema>` root element contains the following attribute: `version="2-20020625"`.

4.3.3 Namespace Usage Examples

The `schemaLocation` attribute for XML instance documents comes from the XML Schema instance namespace "http://www.w3.org/2002/XMLSchema-instance". A single occurrence of the attribute can declare the location of one or more schemas. The `schemaLocation` attribute value consists of a whitespace separated list of values: namespace name followed by its schema location URL. This pair-sequence is repeated as necessary for the schemas that need to be located for this instance document.

Example 1:

Sample *DIDL-Lite XML Instance Document*. Note that the references to the UPnP AV schemas do not contain any version or release date information. In other words, the references follow Form 3 from above. Consequently, this example is valid for all releases of the UPnP AV service specifications.

```
<?xml version="1.0" encoding="UTF-8"?>
<DIDL-Lite
   xmlns:dc="http://purl.org/dc/elements/1.1/"
   xmlns="urn:schemas-upnp-org:metadata-1-0/DIDL-Lite/"
   xmlns:upnp="urn:schemas-upnp-org:metadata-1-0/upnp/"
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xsi:schemaLocation="
      urn:schemas-upnp-org:metadata-1-0/DIDL-Lite/
         http://www.upnp.org/schemas/av/didl-lite.xsd
      urn:schemas-upnp-org:metadata-1-0/upnp/
         http://www.upnp.org/schemas/av/upnp.xsd">
   <item id="18" parentID="13" restricted="0">
      ...
   </item>
</DIDL-Lite>
```

4.4 Vendor-defined Extensions

Whenever vendors create additional vendor-defined state variables, actions or properties, their assigned names and XML representation shall follow the naming conventions and XML rules as specified below in subclauses 4.4.1 to 4.4.4.

4.4.1 Vendor-defined Action Names

Vendor-defined action names shall begin with "X_". Additionally, it should be followed by an ICANN assigned domain name owned by the vendor followed by the underscore character ("_"). It shall then be followed by the vendor-assigned action name. The vendor-assigned action name shall not contain a hyphen character ("-", 2D Hex in UTF-8) nor a hash character ("#", 23 Hex in UTF-8). Vendor-assigned action names are case sensitive. The first character of the name shall be a US-ASCII letter ("A"-"Z", "a"-"z"), US-ASCII digit ("0"-"9"), an underscore ("_"), or a non-experimental Unicode letter or digit greater than U+007F. Succeeding characters shall be a US-ASCII letter ("A"-"Z", "a"-"z"), US-ASCII digit ("0"-"9"), an underscore ("_"), a period ("."), a Unicode combiningchar, an extender, or a non-experimental Unicode letter or digit greater than U+007F. The first three letters shall not be "XML" in any combination of case.

4.4.2 Vendor-defined State Variable Names

Vendor-defined state variable names shall begin with "X_". Additionally, it should be followed by an ICANN assigned domain name owned by the vendor, followed by the underscore character ("_"). It shall then be followed by the vendor-assigned state variable name. The vendor-assigned state variable name shall not contain a hyphen character ("-", 2D Hex in UTF-8). Vendor-assigned action names are case sensitive. The first character of the name shall be a US-ASCII letter ("A"-"Z", "a"-"z"), US-ASCII digit ("0"-"9"), an underscore ("_"), or a non-experimental Unicode letter or digit greater than U+007F. Succeeding characters shall be

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a US-ASCII letter ("A"-"Z", "a"-"z"), US-ASCII digit ("0"-"9"), an underscore ("_"), a period ("."), a Unicode combiningchar, an extender, or a non-experimental Unicode letter or digit greater than U+007F. The first three letters shall not be "XML" in any combination of case.

4.4.3 Vendor-defined XML Elements and attributes

UPnP vendors may add non-standard elements and attributes to a UPnP standard XML document, such as a device or service description. Each addition shall be scoped by a vendor-owned XML namespace. Arbitrary XML shall be enclosed in an element that begins with "**X_**," and this element shall be a sub element of a standard complex type. Non-standard attributes may be added to standard elements provided these attributes are scoped by a vendor-owned XML namespace and begin with "**X_**".

4.4.4 Vendor-defined Property Names

UPnP vendors may add non-standard properties to the ContentDirectory service. Each property addition shall be scoped by a vendor-owned namespace. The vendor-assigned property name shall not contain a hyphen character ("-", 2D Hex in UTF-8). Vendor-assigned property names are case sensitive. The first character of the name shall be a US-ASCII letter ("A"-"Z", "a"-"z"), US-ASCII digit ("0"-"9"), an underscore ("_"), or a non-experimental Unicode letter or digit greater than U+007F. Succeeding characters shall be a US-ASCII letter ("A"-"Z", "a"-"z"), US-ASCII digit ("0"-"9"), an underscore ("_"), a period ("."), a Unicode combiningchar, an extender, or a non-experimental Unicode letter or digit greater than U+007F. The first three letters shall not be "XML" in any combination of case.

5 Service Modeling Definitions

5.1 ServiceType

The following service type identifies a service that is compliant with this template:

urn:schemas-upnp-org:service:*AVTransport:3*

5.2 State Variables

5.2.1 State Variable Overview

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Table 6 — State Variables

Variable Name	R/A [a]	Data Type	Allowed Value	Default Value	Eng. Units
TransportState	*R*	string	See 5.2.2		
TransportStatus	*R*	string	See 5.2.3		
CurrentMediaCategory	*R*	string	See 5.2.4		
PlaybackStorageMedium	*R*	string	See 5.2.5		
RecordStorageMedium	*R*	string	See 5.2.6		
PossiblePlaybackStorageMedia	*R*	string	CSV [b] (string) See 5.2.7		
PossibleRecordStorageMedia	*R*	string	CSV (string) See 5.2.8		
CurrentPlayMode	*R*	string	See 5.2.9	"*NORMAL*"	
TransportPlaySpeed	*R*	string	See 5.2.10	"*1*"	
RecordMediumWriteStatus	*R*	string	See 5.2.11		
CurrentRecordQualityMode	*R*	string	See 5.2.12		
PossibleRecordQualityModes	*R*	string	CSV (string) See 5.2.13		
NumberOfTracks	*R*	ui4	See 5.2.14		
CurrentTrack	*R*	ui4	See 5.2.15		
CurrentTrackDuration	*R*	string	See 5.2.16		
CurrentMediaDuration	*R*	string	See 5.2.17		
CurrentTrackMetaData	*R*	string	See 5.2.18		
CurrentTrackURI	*R*	string	See 5.2.19		
AVTransportURI	*R*	string	See 5.2.20		
AVTransportURIMetaData	*R*	string	See 5.2.21		
NextAVTransportURI	*R*	string	See 5.2.22		
NextAVTransportURIMetaData	*R*	string	See 5.2.23		
RelativeTimePosition	*R*	string	See 5.2.24		
AbsoluteTimePosition	*R*	string	See 5.2.25		
RelativeCounterPosition	*R*	i4	See 5.2.26		
AbsoluteCounterPosition	*R*	ui4	See 5.2.27		
CurrentTransportActions	*CR* [c]	string	CSV (string) See 5.2.28		
LastChange	*R*	string	See 5.2.29		
DRMState	*CR* [c]	string	See 5.2.30	"*UNKNOWN*"	
SyncOffset	*CR* [c]	string	See 5.2.31		
A_ARG_TYPE_SeekMode	*R*	string	See 5.2.32		
A_ARG_TYPE_SeekTarget	*R*	string	See 5.2.33		
A_ARG_TYPE_InstanceID	*R*	ui4	See 5.2.34		
A_ARG_TYPE_DeviceUDN	*CR* [c]	string	See 5.2.35		
A_ARG_TYPE_ServiceType	*CR* [c]	string	See 5.2.36		
A_ARG_TYPE_ServiceID	*CR* [c]	string	See 5.2.37		
A_ARG_TYPE_StateVariableValuePairs	*CR* [c]	string	See 5.2.38		
A_ARG_TYPE_StateVariableList	*CR* [c]	string	CSV (string) See 5.2.39		

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Variable Name	R/A [a]	Data Type	Allowed Value	Default Value	Eng. Units
A_ARG_TYPE_PlaylistData	*CR* [c]	**string**	See 5.2.40		
A_ARG_TYPE_PlaylistDataLength	*CR* [c]	**ui4**	See 5.2.41		
A_ARG_TYPE_PlaylistOffset	*CR* [c]	**ui4**	See 5.2.42		
A_ARG_TYPE_PlaylistTotalLength	*CR* [c]	**ui4**	See 5.2.43		
A_ARG_TYPE_PlaylistMIMEType	*CR* [c]	**string**	3rd field of *res@protocolInfo* See 5.2.44		
A_ARG_TYPE_PlaylistExtendedType	*CR* [c]	**string**	4th field of *res@protocolInfo* See 5.2.45		
A_ARG_TYPE_PlaylistStep	*CR* [c]	**string**	See 5.2.46		
A_ARG_TYPE_PlaylistType	*CR* [c]	**string**	See 5.2.47		
A_ARG_TYPE_PlaylistInfo	*CR* [c]	**string**	See 5.2.48		
A_ARG_TYPE_PlaylistStartObjID	*CR* [c]	**string**	See 5.2.49		
A_ARG_TYPE_PlaylistStartGroupID	*CR* [c]	**string**	See 5.2.50		
A_ARG_TYPE_SyncOffsetAdj	*CR* [c]	**string**	See 5.2.51		
A_ARG_TYPE_PresentationTime	*CR* [c]	**string**	See 5.2.52		
A_ARG_TYPE_ClockId	*CR* [c]	**string**	See 5.2.53		
Non-standard state variables implemented by a UPnP vendor go here	*X*	*TBD*	*TBD*	*TBD*	*TBD*

[a] For a device this column indicates whether the state variable shall be implemented or not, where *R* = required, *A* = allowed, *CR* = conditionally required, *CA* = conditionally allowed, *X* = non-standard, add *-D* when deprecated (e.g., *R-D*, *A-D*).

[b] CSV stands for Comma-Separated Value list. The type between brackets denotes the UPnP data type used for the elements inside the list. CSV is defined more formally in the ContentDirectory service template.

[c] See referenced subclause for conditions under which implementation of this state variable is required.

5.2.2 *TransportState*

This required state variable forms the core of the AVTransport service. It defines the conceptually top-level state of the transport, for example, whether it is playing, recording, etc. Device vendors do not need to implement all allowed values of this variable, for example, non-recordable media will not implement the "*RECORDING*" state.

The "*PAUSED_RECORDING*" state is different from the "*STOPPED*" state in the sense that the transport is already prepared for recording and can respond faster or more accurately. The "*PAUSED_PLAYBACK*" state is different from the "*PAUSED_RECORDING*" state in the sense that in case the media contains video, it indicates output of a still image. The other *TransportState* values are self explanatory.

Note that *dubbing* of media at various speeds is not supported in this version of the AVTransport, mainly because there are no standards for cross-device dubbing speeds.

Device vendors are allowed to implement additional vendor-defined transport states. However, since the semantic meaning of these transport states is not specified, control points that find a AVTransport service in a transport state that they do not understand are encouraged to refrain from interacting with that AVTransport service (for example, forcing the service into the "*STOPPED*" state). Rather, they are encouraged to wait until the service transits back into a transport state that they understand.

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Table 7 — allowedValueList for *TransportState*

Value	R/A
"*STOPPED*"	*R*
"*PLAYING*"	*R*
"*TRANSITIONING*"	*R*
"*PAUSED_PLAYBACK*"	*CR*, required if *Pause()* action is implemented
"*PAUSED_RECORDING*"	*CR*, required if both *Pause()* and *Record()* actions are implemented
"*RECORDING*"	*CR*, required if *Record()* action is implemented
"*NO_MEDIA_PRESENT*"	*A*
Vendor-defined	*X*

5.2.3 *TransportStatus*

This required state variable is used to indicate if asynchronous errors haved occurred, during operation of the AVTransport service, that cannot be returned by a normal action. For example, some time after playback of a stream has been started (via *SetAVTransportURI()* and *Play()* actions), there can be network congestion or server problems causing hiccups in the rendered media. These types of situations can be signaled to control points by setting this state variable to value "*ERROR_OCCURRED*". More specific error descriptions may also be used as vendor extensions. The value of *TransportState* after an error has occurred is implementation-dependent; some implementations may go to "*STOPPED*" while other implementations may be able to continue playing after an error. The time at which this state variable returns to "*OK*" after an error situation is also implementation dependent.

Table 8 — allowedValueRange for *TransportStatus*

Value	R/A
"*OK*"	*R*
"*ERROR_OCCURRED*"	*R*
Vendor-defined	*X*

5.2.4 *CurrentMediaCategory*

This required state variable indicates whether the current media is track-aware (both single and multi-track) or track-unaware (e.g. VHS-tape). The semantics of state variables *RelativeTimePosition*, *AbsoluteTimePosition*, *RelativeCounterPosition*, *AbsoluteCounterPosition* and of the *Seek()* action change, depending on this state variable.

Table 9 — allowedValueList for *CurrentMediaCategory*

Value	R/A
"*NO_MEDIA*"	*R*
"*TRACK_AWARE*"	*R*
"*TRACK_UNAWARE*"	*R*

5.2.5 *PlaybackStorageMedium*

This required state variable indicates the storage medium of the resource specified by *AVTransportURI*. If no resource is specified, then the state variable is set to "*NONE*". If *AVTransportURI* refers to a resource received from the UPnP network, the state variable is set to "*NETWORK*". Device vendors may extend the specified allowed value list of this variable. For example, various types of solid-state media formats can be added in a vendor-specific way.

Note that this variable is not intended for signal- or content-formats such as MPEG2. Such type of information is exposed by the ConnectionManager service associated with this service.

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Table 10 — allowedValueList for *PlaybackStorageMedium*

Value	R/A	Description
"*UNKNOWN*"	*A*	Unknown medium
"*DV*"	*A*	Digital Video Tape medium
"*MINI-DV*"	*A*	Mini Digital Video Tape medium
"*VHS*"	*A*	VHS Tape medium
"*W-VHS*"	*A*	W-VHS Tape medium
"*S-VHS*"	*A*	Super VHS Tape medium
"*D-VHS*"	*A*	Digital VHS Tape medium
"*VHSC*"	*A*	Compact VHS medium
"*VIDEO8*"	*A*	8 mm Video Tape medium
"*HI8*"	*A*	High resolution 8 mm Video Tape medium
"*CD-ROM*"	*A*	Compact Disc-Read Only Memory medium
"*CD-DA*"	*A*	Compact Disc-Digital Audio medium
"*CD-R*"	*A*	Compact Disc-Recordable medium
"*CD-RW*"	*A*	Compact Disc-Rewritable medium
"*VIDEO-CD*"	*A*	Video Compact Disc medium
"*SACD*"	*A*	Super Audio Compact Disc medium
"*MD-AUDIO*"	*A*	Mini Disc Audio medium
"*MD-PICTURE*"	*A*	Mini Disc Picture medium
"*DVD-ROM*"	*A*	DVD Read Only medium
"*DVD-VIDEO*"	*A*	DVD Video medium
"*DVD+R*"	*A*	DVD Recordable medium
"*DVD-R*"	*A*	DVD Recordable medium
"*DVD+RW*"	*A*	DVD Rewritable medium
"*DVD-RW*"	*A*	DVD Rewritable medium
"*DVD-RAM*"	*A*	DVD RAM medium
"*DVD-AUDIO*"	*A*	DVD Audio medium
"*DAT*"	*A*	Digital Audio Tape medium
"*LD*"	*A*	Laser Disk medium
"*HDD*"	*A*	Hard Disk Drive medium
"*MICRO-MV*"	*A*	Micro MV Tape medium
"*NETWORK*"	*A*	Network Interface medium
"*NONE*"	*A*	No medium present
"*NOT_IMPLEMENTED*"	*A*	Medium type discovery is not implemented
"*SD*"	*A*	SD (Secure Digital) Memory Card medium
"*PC-CARD*"	*A*	PC Card medium
"*MMC*"	*A*	MultimediaCard medium
"*CF*"	*A*	Compact Flash medium
"*BD*"	*A*	Blu-ray Disc medium
"*MS*"	*A*	Memory Stick medium
"*HD_DVD*"	*A*	HD DVD medium
Vendor-defined	*X*	

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5.2.6 *RecordStorageMedium*

This required state variable indicates the storage medium where the resource specified by *AVTransportURI* will be recorded when a Record action is issued. If no resource is specified, then the state variable is set to "*NONE*". Device vendors may extend the allowed value list of this variable. For example, various types of solid-state media formats can be added in a vendor-specific way.

Note that this variable is not intended for signal- or content-formats such as MPEG2. Such type of information is exposed by the ConnectionManager service associated with this service. If the service implementation does not support recording, then this state variable shall be set to "*NOT_IMPLEMENTED*". The allowed values for this state variable are the same as the *PlaybackStorageMedium* state variable.

5.2.7 *PossiblePlaybackStorageMedia*

This required state variable contains a static, comma-separated list of storage media that the device can play. Recommended values are defined in the allowed value list for state variable *PlaybackStorageMedium*.

5.2.8 *PossibleRecordStorageMedia*

This required state variable contains a static, comma-separated list of storage media onto which the device can record. Recommended values are defined in the allowed value list for state variable *RecordStorageMedium*. If the service implementation does not support recording, then this state variable shall be set to "*NOT_IMPLEMENTED*".

5.2.9 *CurrentPlayMode*

This required state variable indicates the current play mode (for example, random play, repeated play, etc.). This notion is typical for CD-based audio media, but is generally not supported by tape-based media. Value "*DIRECT_1*" indicates playing a single track and then stop (don't play the next track). Value "*INTRO*" indicates playing a short sample (typically 10 seconds or so) of each track on the media. Other play mode values are self explanatory.

Table 11 — allowedValueList for *CurrentPlayMode*

Value	R/A
"*NORMAL*"	*R*
"*SHUFFLE*"	*A*
"*REPEAT_ONE*"	*A*
"*REPEAT_ALL*"	*A*
"*RANDOM*"	*A*
"*DIRECT_1*"	*A*
"*INTRO*"	*A*
Vendor-defined	*X*

5.2.10 *TransportPlaySpeed*

This required state variable is a string representation of a rational fraction that indicates the speed relative to normal speed. Example values are "1", "1/2", "2", "-1", "1/10", etc. Value "1" is required, value "0" is not allowed. Device vendors may support additional play speeds. Negative values indicate reverse playback. Actually supported speeds can be retrieved from the allowed value list of this state variable in the AVTransport service description.

5.2.11 *RecordMediumWriteStatus*

This required state variable reflects the write protection status of the currently loaded media. "*NOT_WRITABLE*" indicates an inherent *read-only* media (for example, a DVD-ROM disc) or the device doesn't support recording on the current media. "*PROTECTED*" indicates a writable media that is currently write-protected (for example, a protected VHS tape). If no media is loaded, the write status will be "*UNKNOWN*". If the service implementation does not support recording, then this state variable shall be set to "*NOT_IMPLEMENTED*".

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Table 12 — allowedValueList for *RecordMediumWriteStatus*

Value	R/A
"*WRITABLE*"	*A*
"*PROTECTED*"	*A*
"*NOT_WRITABLE*"	*A*
"*UNKNOWN*"	*A*
"*NOT_IMPLEMENTED*"	*A*
Vendor-defined	*X*

5.2.12 *CurrentRecordQualityMode*

This required state variable indicates the currently set record quality mode. Such a setting takes the form of "Quality Ordinal:label". The Quality Ordinal indicates a particular relative quality level available in the device, from 0 (lowest quality) to n (highest quality). The label associated with the ordinal provides a human-readable indication of the ordinal's meaning. If the service implementation does not support recording, then this state variable shall be set to "*NOT_IMPLEMENTED*".

Table 13 — allowedValueList for *CurrentRecordQualityMode*

Value	R/A
"*0:EP*"	*A*
"*1:LP*"	*A*
"*2:SP*"	*A*
"*0:BASIC*"	*A*
"*1:MEDIUM*"	*A*
"*2:HIGH*"	*A*
"*NOT_IMPLEMENTED*"	*A*
Vendor-defined	*X*

5.2.13 *PossibleRecordQualityModes*

This required state variable contains a static, comma-separated list of recording quality modes that the device supports. For example, for an analog VHS recorder the string would be "*0:EP,1:LP,2:SP*", while for a PVR the string would be "*0:BASIC,1:MEDIUM,2:HIGH*". The string specifics depend on the type of device containing the AVTransport. Note that record quality modes are independent of the *content-format* that may be exposed to the network through a ConnectionManager service. If the service implementation does not support recording, then this state variable shall be set to "*NOT_IMPLEMENTED*".

5.2.14 *NumberOfTracks*

This required state variable contains the number of tracks controlled by the AVTransport instance. If no resource is associated with the AVTransport instance (via *SetAVTransportURI()*), and there is no *default* resource (for example, a loaded disc) then *NumberOfTracks* shall be 0. Also, if the implementation is never able to determine the number of tracks in the currently selected media, *NumberOfTracks* shall be set to 0. Otherwise, it shall be 1 or higher. In some cases, for example, large playlist, it can take a long time to determine the exact number of tracks. Until the exact number is determined, the value of the state variable is implementation dependent, for example, keeping it to 1 until determined or updating the value periodically. Note that in any case, the AVTransport service shall generate a *LastChange* event with defined moderation period when the exposed value is updated.

For track-unaware media, this state variable will always be set to 1. For LD and DVD media, a track is defined as a chapter number. For Tuners that provide an indexed list of channels, a track is defined as an index number in such a list. This state variable has to be consistent with the resource identified by *AVTransportURI*. For example, if *AVTransportURI* points to a single

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MP3 file, then *NumberOfTracks* shall be set to 1. However, if *AVTransportURI* points to a playlist file, then *NumberOfTracks* shall be equal to the number of entries in the playlist.

Table 14 — allowedValueRange for *NumberOfTracks*

	Value	R/A
minimum	*0*	*R*
maximum	*vendor-defined*	*R*

5.2.15 *CurrentTrack*

This is a required state variable. If *NumberOfTracks* is 0, then *CurrentTrack* will be 0. Otherwise, this state variable contains the sequence number of the currently selected track, starting at value 1, up to and including *NumberOfTracks*. For track-unaware media, this state variable is always 1. For LD and DVD media, the notion of track equals the notion of chapter number. For Tuners that provide an indexed list of channels, the current track is defined as the current index number in such a list.

Table 15 — allowedValueRange for *CurrentTrack*

	Value	R/A
minimum	*0*	*R*
maximum	*vendor-defined*	*R*
step	*1*	*R*

5.2.16 *CurrentTrackDuration*

This required state variable contains the duration of the current track, specified as a string of the following form:

H+:MM:SS[.F+] or H+:MM:SS[.F0/F1]

where:

- H+: one or more digits to indicate elapsed hours,
- MM: exactly 2 digits to indicate minutes (00 to 59),
- SS: exactly 2 digits to indicate seconds (00 to 59),
- F+: one or more digits to indicate fractions of seconds,
- F0/F1: a fraction, with F0 and F1 at least one digit long, and F0 < F1.

The string may be preceded by an allowed "+" or "–" sign, and the decimal point itself shall be omitted if there are no fractional second digits. This variable does not apply to Tuners. If the implementation is never able to determine the duration of the current track, *CurrentTrackDuration* shall be set to “00:00:00”. If the optional fractional components are included, they shall be set to either “0” or “0/<F1>”. In some cases, it can take a long time to determine the exact duration of tracks. Until the exact duration is determined, the value of the state variable is implementation dependent, for example, keeping it to “00:00:00” or updating the value periodically. Note that in any case, the AVTransport service shall generate a *LastChange* event with defined moderation period when the exposed value is updated. If the service implementation does not support track duration information then this state variable shall be set to “*NOT_IMPLEMENTED*”.

5.2.17 *CurrentMediaDuration*

This required state variable contains the duration of the media, as identified by state variable *AVTransportURI*. In case the *AVTransportURI* represents only 1 track, this state variable is equal to *CurrentTrackDuration*. The format of this variable is the same as the format for *CurrentTrackDuration*, described above in 5.2.16. If no content is associated with the AVTransport instance (via *SetAVTransportURI()*), and there is no default content (for example, a loaded disc) then *CurrentMediaDuration* shall be set to “*00:00:00*”. Also, if the implementation is never able to determine the duration of the currently selected media

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