UPnP AV Datastructure Template

For UPnP Version 1.0
Status: Standardized DCP (SDCP)
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Service Template Version 1.01

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1 Overview and Scope

1.1 Introduction

This document defines the layout of the AV Datastructure Template (AVDT) XML document. An AVDT document describes the format requirements and restrictions of various data structures used within the UPnP AV specifications. Although these data structures are defined very precisely in the appropriate service specification, in most cases, each data structure definition allows for a certain degree of variation in order to accommodate differences between individual devices.

The purpose of an AVDT document is to enable each device to describe (at run-time) its particular variation of these AV data structures. AVDT documents allow users of AV data structures (e.g. UPnP control points) to reduce the number of instances of those data structures that comply with the service specification but are not compatible with the device’s particular capabilities. The ultimate goal of an AVDT document is to reduce those error conditions that are caused by control points creating instances of a data structure that exceed the static (known) capabilities of the device. Unfortunately, the AVDT mechanism will never eliminate all preventable error conditions, but it will help to reduce them by giving the client more information about the device’s particular capabilities.

As described above, an AVDT document is a machine readable, implementation-specific variant of an AV data structure defined by one of the UPnP AV specifications. For a given device, each instance of that data structure must conform to both the specification definition AND the device’s AVDT definition of that data structure.

Ironically, an AVDT document is both a more-restrictive and more-permissive variant of the specification definition. AVDT documents are more restrictive because they limit certain aspects of the data structure (e.g. such as the allowed values for each field) that are otherwise permitted by the specification definition. However, due to limitations of the AVDT constructs, it is simply not possible to express some of the more intricate requirements defined by the specification (e.g. subtle interdependencies between data structure fields). Consequently, instances of a data structure that comply with a given AVDT description may not fully comply with all of the requirements defined in the specification.

The types of data structures that can be described by an AVDT document represent a (non-hierarchitical) set of named property values. The set of allowed property names and their allowed values for a given data structure are defined by one of the UPnP AV specifications. Individual instances of these data structures are manifested via an XML document whose elements and attributes correspond to the set of named properties. In other words, within the XML document that corresponds to a given instance of a certain data structure, each XML element and attribute contains the value of a specific named property.

An AVDT document is conceptually similar to an XML schema in that both entities identify the XML elements and attributes that appear in any given document instance. Additionally, both AVDT documents and XML schemas identify the allowed values that are permitted for each element and/or attribute which corresponds to a specific property. However, unlike an XML schema, an AVDT document can also identify certain dependencies between two or more properties. For example, the set of allowed values of one property may depend on the actual value of another property. This type of interrelationship is difficult to represent using an XML schema. Hence, the AVDT document structure is needed.

In the various AV Architecture scenarios, sometimes there is a need to exchange device capabilities to ensure high level interoperability. In order to express the parameterized capability, an AV specification defines various templates for each purpose. A device uses the template and populates it with values to reflect its capabilities at run-time.

The AV Datastructure Template (AVDT) is a common structure to define various templates, which are called “Datastructure”. This is written in XML and each data structure uses a subset of the AVDT to meet the necessary requirement.
1.2 Notation

- In this document, features are described as Required, Recommended, or Optional as follows:
  
  The keywords “MUST,” “MUST NOT,” “REQUIRED,” “SHALL,” “SHALL NOT,” “SHOULD,” “SHOULD NOT,” “RECOMMENDED,” “MAY,” and “OPTIONAL” in this specification are to be interpreted as described in [RFC 2119].
  
  In addition, the following keywords are used in this specification:
  
  PROHIBITED – The definition or behavior is prohibited by this specification. Opposite of REQUIRED.
  
  CONDITIONALLY REQUIRED – The definition or behavior depends on a condition. If the specified condition is met, then the definition or behavior is REQUIRED, otherwise it is PROHIBITED.
  
  CONDITIONALLY OPTIONAL – The definition or behavior depends on a condition. If the specified condition is met, then the definition or behavior is OPTIONAL, otherwise it is PROHIBITED.
  
  These keywords are thus capitalized when used to unambiguously specify requirements over protocol and application features and behavior that affect the interoperability and security of implementations. When these words are not capitalized, they are meant in their natural-language sense.
  
- Strings that are to be taken literally are enclosed in “double quotes”.
  
- Words that are emphasized are printed in italic.
  
- Keywords that are defined by the UPnP AV Working Committee are printed using the forum character style [DEVICE].
Keywords that are defined by the UPnP Device Architecture specification are printed using the \texttt{arch} character style.

A double colon delimiter, “::”, 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.

### 1.2.1 Data Types

This specification uses data type definitions from two different sources. The UPnP Device Architecture defined data types are used to define state variable and action argument data types [DEVICE]. The XML Schema namespace is used to define property data types [XML SCHEMA-2].

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 MUST 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 MUST be accepted. Nevertheless, it is strongly RECOMMENDED that all Boolean properties be represented as “0” and “1”.

### 1.2.2 Strings Embedded in Other Strings

Some string variables and arguments described in this document contain substrings that MUST 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 Section 1.3.1, “Comma Separated Value (CSV) Lists”) 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

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

### 1.2.3 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 [EBNF].

#### 1.2.3.1 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 MUST 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:

<table>
<thead>
<tr>
<th>Operator</th>
<th>Semantics</th>
</tr>
</thead>
<tbody>
<tr>
<td>: :=</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>alternative separator – separates sequences on the right that are independently allowed definitions for the non-terminal on the left.</td>
</tr>
<tr>
<td>*</td>
<td>null repetition – means the expression to its left MAY occur zero or more times.</td>
</tr>
<tr>
<td>+</td>
<td>non-null repetition – means the expression to its left MUST occur at least once and MAY occur more times.</td>
</tr>
<tr>
<td>[ ]</td>
<td>optional – the expression between the brackets is optional.</td>
</tr>
<tr>
<td>( )</td>
<td>grouping – groups the expressions between the parentheses.</td>
</tr>
<tr>
<td>-</td>
<td>character range – represents all characters between the left and right character operands inclusively.</td>
</tr>
</tbody>
</table>

### 1.3 Derived Data Types

This section 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 applies to both string data types.

#### 1.3.1 Comma Separated Value (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 [DEVICE], 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 (values of different types are allowed). 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 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 [DEVICE] (that is: optional leading sign, optional 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 [DEVICE]: 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 [XML SCHEMA-2]: 0, false, 1, true.

• Escaping conventions for the comma and backslash characters are defined in Section 1.2.2, “Strings Embedded in Other Strings”.

• 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 1-2: CSV Examples

<table>
<thead>
<tr>
<th>Type refinement of string</th>
<th>Value</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSV (string) or CSV (xsd:string)</td>
<td>“+artist,-date”</td>
<td>List of 2 property sort criteria.</td>
</tr>
<tr>
<td>CSV (int) or CSV (xsd:integer)</td>
<td>“1,-5,006,0,+7”</td>
<td>List of 5 integers.</td>
</tr>
<tr>
<td>CSV (boolean) or CSV (xsd:Boolean)</td>
<td>“0,1,1,0”</td>
<td>List of 4 booleans</td>
</tr>
<tr>
<td>CSV (string) or CSV (xsd:string)</td>
<td>“Smith, Fred, Jones, Davey”</td>
<td>List of 2 names, “Smith, Fred” and “Jones, Davey”</td>
</tr>
<tr>
<td>CSV (id, string, ui2) or CSV (xsd:int, xsd:string, xsd:unsignedShort)</td>
<td>“-29837, string with leading blanks,0”</td>
<td>Note that the second value is “string with leading blanks”</td>
</tr>
<tr>
<td>CSV (id) or CSV (xsd:int)</td>
<td>“3, 4”</td>
<td>Illegal CSV. White space is not allowed as part of an integer value.</td>
</tr>
<tr>
<td>CSV (string) or CSV (xsd:string)</td>
<td>””</td>
<td>List of 3 empty string values</td>
</tr>
<tr>
<td>CSV (heterogeneous)</td>
<td>“Alice, Marketing, 5, Sue, R&amp;D, 21, Dave, Finance, 7”</td>
<td>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.</td>
</tr>
</tbody>
</table>
1.4 Management of XML Namespaces in Standardized DCPs

UPnP specifications make extensive use of XML namespaces. This allows 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 is, or should 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 must be locally unique to the document. Any valid XML no-colon-name may be used. And, in formal XML usage, no two XML documents are ever required to use the same namespace prefix to refer to the same namespace. The creation and use of the namespace prefix was standardized by the W3C XML Committee in [XML-NMSP] 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, MUST use the predefined namespace prefixes when referring to CDS properties (“upnp:”, “dc:”, etc).

All of the namespaces used in this specification are listed in the Tables “Namespace Definitions” and “Schema-related Information”. For each such namespace, Table 1-3, “Namespace Definitions” 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 Scheduled Recording Service depends on and refers to the Content Directory 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 1-4, “Schema-related Information”, to cross-reference additional namespace information. This second table includes each namespace’s valid XML document root elements (if any), its schema file name, versioning information (to be discussed in more detail below), and links to the entries in the Reference section for its associated schema.

The normative definitions for these namespaces are the documents referenced in Table 1-3. 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
Table 1-3: Namespace Definitions

<table>
<thead>
<tr>
<th>Standard Namespace Prefix</th>
<th>Namespace Name</th>
<th>Namespace Description</th>
<th>Normative Definition Document Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>atrs</td>
<td>urn:schemas-upnp-org:av:AllowedTransformSettings</td>
<td>AllowedTransformSettings and AllowedDefaultTransformSettings state variables for RenderingControl</td>
<td>[RCS]</td>
</tr>
<tr>
<td>av</td>
<td>urn:schemas-upnp-org:av:av</td>
<td>Common data types for use in AV schemas</td>
<td>[AV-XSD]</td>
</tr>
<tr>
<td>avdt</td>
<td>urn:schemas-upnp-org:av:avdt</td>
<td>Datastructure Template</td>
<td>[AVDT]</td>
</tr>
<tr>
<td>avs-event</td>
<td>urn:schemas-upnp-org:av:avs</td>
<td>Common structures for use in AV schemas</td>
<td>[AVS-XSD]</td>
</tr>
<tr>
<td>avt-event</td>
<td>urn:schemas-upnp-org:metadata-1-0/AVT/</td>
<td>Evented LastChange state variable for AVTransport</td>
<td>[AVT]</td>
</tr>
<tr>
<td>cds-event</td>
<td>urn:schemas-upnp-org:av:cds-event</td>
<td>Evented LastChange state variable for ContentDirectory</td>
<td>[CDS]</td>
</tr>
<tr>
<td>cm-dciu</td>
<td>urn:schemas-upnp-org:av:cm-deviceClockInfoUpdates</td>
<td>Evented DeviceClockInfoUpdates state variable for ConnectionManager</td>
<td>[CM]</td>
</tr>
<tr>
<td>cm-ftrList</td>
<td>urn:schemas-upnp-org:av:cm-featureList</td>
<td>FeatureList state variable for ConnectionManager</td>
<td>[CM]</td>
</tr>
<tr>
<td>didl-lite</td>
<td>urn:schemas-upnp-org:metadata-1-0/DIDL-Lite/</td>
<td>Structure and metadata for ContentDirectory</td>
<td>[CDS]</td>
</tr>
<tr>
<td>dmo</td>
<td>urn:schemas-upnp-org:av:dmo</td>
<td>Evented DeviceMode state variable for ContentDirectory</td>
<td>[CDS]</td>
</tr>
<tr>
<td>dmor</td>
<td>urn:schemas-upnp-org:av:dmor</td>
<td>A_ARG_TYPE_DeviceModeRequest state variable for ContentDirectory</td>
<td>[CDS]</td>
</tr>
<tr>
<td>dmos</td>
<td>urn:schemas-upnp-org:av:dmos</td>
<td>DeviceModeStatus state variable for ContentDirectory</td>
<td>[CDS]</td>
</tr>
<tr>
<td>pi</td>
<td>urn:schemas-upnp-org:av:pi</td>
<td>PermissionsInfo state variable for ContentDirectory</td>
<td>[CDS]</td>
</tr>
<tr>
<td>rcs-event</td>
<td>urn:schemas-upnp-org:metadata-1-0/RCS/</td>
<td>Evented LastChange state variable for RenderingControl</td>
<td>[RCS]</td>
</tr>
<tr>
<td>rii</td>
<td>urn:schemas-upnp-org:av:rii</td>
<td>A_ARG_TYPE_RenderingInfoList state variable for ConnectionManager</td>
<td>[CM]</td>
</tr>
<tr>
<td>rpl</td>
<td>urn:schemas-upnp-org:av:rpl</td>
<td>A_ARG_TYPE_PlaylistInfo state variable for AVTransport</td>
<td>[AVT]</td>
</tr>
<tr>
<td>srs</td>
<td>urn:schemas-upnp-org:av:srs</td>
<td>Metadata and structure for ScheduledRecording</td>
<td>[SRS]</td>
</tr>
<tr>
<td>srs-event</td>
<td>urn:schemas-upnp-org:av:srs-event</td>
<td>Evented LastChange state variable for ScheduledRecording</td>
<td>[SRS]</td>
</tr>
<tr>
<td>trs</td>
<td>urn:schemas-upnp-org:av:TransformSettings</td>
<td>TransformSettings and DefaultTransformSettings state variables for RenderingControl</td>
<td>[RCS]</td>
</tr>
<tr>
<td>upnp</td>
<td>urn:schemas-upnp-org:metadata-1-0/upnp/</td>
<td>Metadata for ContentDirectory</td>
<td>[CDS]</td>
</tr>
</tbody>
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### Externally defined namespaces

<table>
<thead>
<tr>
<th>Standard Name-space Prefix</th>
<th>Namespace Name</th>
<th>Namespace Description</th>
<th>Normative Definition Document Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>dc</td>
<td><a href="http://purl.org/dc/elements/1.1/">http://purl.org/dc/elements/1.1/</a></td>
<td>Dublin Core</td>
<td>[DC-TERMS]</td>
</tr>
<tr>
<td>xsd</td>
<td><a href="http://www.w3.org/2001/XMLSchema">http://www.w3.org/2001/XMLSchema</a></td>
<td>XML Schema Language 1.0</td>
<td>[XML SCHEMA-1] [XML SCHEMA-2]</td>
</tr>
<tr>
<td>xsi</td>
<td><a href="http://www.w3.org/2001/XMLSchema-instance">http://www.w3.org/2001/XMLSchema-instance</a></td>
<td>XML Schema Instance Document schema</td>
<td>Sections 2.6 &amp; 3.2.7 of [XML SCHEMA-1]</td>
</tr>
</tbody>
</table>

### Table 1-4: Schema-related Information

<table>
<thead>
<tr>
<th>Standard Name-space Prefix</th>
<th>Relative URI and File Name&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Valid Root Element(s)</th>
<th>Schema Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>AV Working Committee Defined Namespaces</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| atrs | • AllowedTransformSettings-vn-yyyyymmdd.xsd  
• AllowedTransformSettings-vn.xsd  
• AllowedTransformSettings.xsd | <TransformList> | [ATRS-XSD] |
| av | • av-vn-yyyyymmdd.xsd  
• av-vn.xsd  
• av.xsd | n/a | [AV-XSD] |
| avdt | • avdt-vn-yyyyymmdd.xsd  
• avdt-vn.xsd  
• avdt.xsd | <AVDT> | [AVDT] |
| avs | • avs-vn-yyyyymmdd.xsd  
• avs-vn.xsd  
• avs.xsd | <Capabilities>  
<Features>  
<stateVariableValuePairs> | [AVS-XSD] |
| avt-event | • avt-event-vn-yyyyymmdd.xsd  
• avt-event-vn.xsd  
• avt-event.xsd | <Event> | [AVT-EVENT-XSD] |
| cds-event | • cds-event-vn-yyyyymmdd.xsd  
• cds-event-vn.xsd  
• cds-event.xsd | <StateEvent> | [CDS-EVENT-XSD] |
| cm-dciu | • cm-deviceClockInfoUpdates-vn-yyyyymmdd.xsd  
• cm-deviceClockInfoUpdates-vn.xsd  
• cm-deviceClockInfoUpdates.xsd | <DeviceClockInfoUpdates> | [CM-DCIU-XSD] |
<table>
<thead>
<tr>
<th>Standard Name-space Prefix</th>
<th>Relative URI and File Name</th>
<th>Valid Root Element(s)</th>
<th>Schema Reference</th>
</tr>
</thead>
</table>
| cm-ftrlst                 | • cm-featureList-vn-yyyyymmdd.xsd  
                        • cm-featureList-vn.xsd  
                        • cm-featureList.xsd | `<Features>`          | [CM-FTRLST-XSD] |
| didl-lite                 | • didl-lite-vn-yyyyymmdd.xsd  
                        • didl-lite-vn.xsd  
                        • didl-lite.xsd | `<DIDL-Lite>`         | [DIDL-LITE-XSD] |
| dmo                       | • dmo-vn-yyyyymmdd.xsd  
                        • dmo-vn.xsd  
                        • dmo.xsd | `<DeviceMode>`        | [DMO-XSD] |
| dmos                      | • dmos-vn-yyyyymmdd.xsd  
                        • dmos-vn.xsd  
                        • dmos.xsd | `<DeviceModeStatus>`  | [DMOS-XSD] |
| pi                        | • pi-vn-yyyyymmdd.xsd  
                        • pi-vn.xsd  
                        • pi.xsd | `<PermissionsInfo>`    | |
| rcs-event                 | • rcs-event-vn-yyyyymmdd.xsd  
                        • rcs-event-vn.xsd  
                        • rcs-event.xsd | `<Event>`             | [RCS-EVENT-XSD] |
| rii                       | • rii-vn-yyyyymmdd.xsd  
                        • rii-vn.xsd  
                        • rii.xsd | `<rendererInfo>`      | [RII-XSD] |
| rpl                       | • rpl-vn-yyyyymmdd.xsd  
                        • rpl-vn.xsd  
                        • rpl.xsd | `<PlaylistInfo>`       | [RPL-XSD] |
| srs                       | • srs-vn-yyyyymmdd.xsd  
                        • srs-vn.xsd  
                        • srs.xsd | `<srs>`               | [SRS-XSD] |
| srs-event                 | • srs-event-vn-yyyyymmdd.xsd  
                        • srs-event-vn.xsd  
                        • srs-event.xsd | `<StateEvent>`        | [SRS-EVENT-XSD] |
| trs                       | • TransformSettings-vn-yyyyymmdd.xsd  
                        • TransformSettings-vn.xsd  
                        • TransformSettings.xsd | `<TransformSettings>`  | [TRS-XSD] |

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### External Namespaces

<table>
<thead>
<tr>
<th>Standard Namespace Prefix</th>
<th>Relative URI and File Name</th>
<th>Valid Root Element(s)</th>
<th>Schema Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>upnp</td>
<td>upnp-av-yyymmddd.xsd</td>
<td>n/a</td>
<td>[UPNP-XSD]</td>
</tr>
<tr>
<td></td>
<td>upnp-vn.xsd</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td></td>
<td>upnp.xsd</td>
<td>n/a</td>
<td></td>
</tr>
</tbody>
</table>

**Externally Defined Namespaces**

- **dc**: Absolute URL: http://dublincore.org/schemas/xmls/simpledc20021212.xsd
  - [DC-XSD]
- **xsd**: n/a
  - `<schema>`
  - [XMLSCHEMA-XSD]
- **xsi**: n/a
  - n/a
- **xml**: n/a
  - [XML-XSD]

1. Absolute URIs are generated by prefixing the relative URIs with "http://www.upnp.org/schemas/av/".

### 1.4.1 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 MUST use the standard namespace prefixes as declared in Table 1-3. In order to properly process the XML documents described herein, control points and devices MUST use namespace-aware XML processors [XML-NMSP] for both reading and writing. As allowed by [XML-NMSP], 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 MUST 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. Also, each individual specification may assume a default namespace for its descriptive text. In that case, names from that namespace may appear with no prefix.

The assumed default namespace, if any, for each UPnP AV specification is given in Table 1-5, “Default Namespaces for the AV Specifications”.

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

### Table 1-5: Default Namespaces for the AV Specifications

<table>
<thead>
<tr>
<th>AV Specification Name</th>
<th>Default Namespace Prefix</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVTransport</td>
<td>avt-event</td>
</tr>
<tr>
<td>ConnectionManager</td>
<td>n/a</td>
</tr>
<tr>
<td>ContentDirectory</td>
<td>didl-lite</td>
</tr>
<tr>
<td>MediaRenderer</td>
<td>n/a</td>
</tr>
<tr>
<td>MediaServer</td>
<td>n/a</td>
</tr>
<tr>
<td>RenderingControl</td>
<td>rcs-event</td>
</tr>
<tr>
<td>ScheduledRecording</td>
<td>srs</td>
</tr>
</tbody>
</table>
1.4.2 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 must comply with one or more specific XML namespaces. Each namespace is uniquely identified by an assigned namespace name. The namespaces that are defined by the AV Working Committee MUST be named by a URN. See Table 1-3, “Namespace Definitions” 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 disambiguate (a.k.a. qualify) 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 Section 1.4.3 “Namespace Usage Examples”)

In order to enable both forward and backward compatibility, namespace names are permanently assigned and MUST NOT change even when a new version of a specification changes the definition of a namespace. However, all changes to a namespace definition MUST be backward-compatible. In other words, the updated definition of a namespace MUST NOT invalidate any XML documents that comply with an earlier definition of that same namespace. This means, for example, that a namespace MUST NOT be changed so that a new element or attribute is required. Although namespace names MUST 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 MUST 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.
- yyyymmdd is the year, month and day (in the Gregorian calendar) that this schema was released.

Table 1-4, “Schema-related Information” 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.

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In addition to the dated schema URIs that are associated with each namespace, each namespace 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, MUST use Form 3.
- All UPnP AV published schemas that reference other UPnP AV schemas MUST 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 MUST contain a version attribute in the <schema> root element. Its value MUST correspond to the format:

ver “." yyyyymmdd where ver and yyyyymmdd are described above.

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”.

### 1.4.3 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
<?xml version="1.0" encoding="UTF-8"?>
<DIDL-Lite
 xmlns:dc="http://purl.org/dc/elements/1.1/
 xmlns:schema-upnp-urp-org:metadata-1-0/DIDL-Lite/
 xmlns:urn:schemas-upnp-org:metadata-1-0/upnp/
 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>
```

### 1.5 Vendor-defined Extensions

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

#### 1.5.1 Vendor-defined Action Names

Vendor-defined action names MUST begin with “X_”. Additionally, it SHOULD be followed by an ICANN assigned domain name owned by the vendor followed by the underscore character (“_”). It MUST then be followed by the vendor-assigned action name. The vendor-assigned action name MUST 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 MUST 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. The first three letters MUST NOT be “XML” in any combination of case.

#### 1.5.2 Vendor-defined State Variable Names

Vendor-defined state variable names MUST begin with “X_”. Additionally, it SHOULD be followed by an ICANN assigned domain name owned by the vendor, followed by the underscore character (“_”). It MUST then be followed by the vendor-assigned state variable name. The vendor-assigned state variable name MUST NOT contain a hyphen character (“-”), 2D Hex in UTF-8). Vendor-assigned action names are case sensitive. The first character of the name MUST 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 MUST 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 MUST NOT be “XML” in any combination of case.

#### 1.5.3 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 MUST be scoped by a vendor-owned XML namespace. Arbitrary XML MUST be enclosed in an element that begins with “X_”, and this element MUST 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_”.

1.5.4 Vendor-defined Property Names
UPnP vendors MAY add non-standard properties to the ContentDirectory service. Each property addition MUST be scoped by a vendor-owned namespace. The vendor-assigned property name MUST NOT contain a hyphen character (“-”), 2D Hex in UTF-8). Vendor-assigned property names are case sensitive. The first character of the name MUST 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 MUST 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 MUST NOT be “XML” in any combination of case.

1.6 References
This section lists the normative references used in the UPnP AV specifications and includes the tag inside square brackets that is used for each such reference:

Available at: http://www.upnp.org/schemas/av/AllowedTransformSettings-v1-20101231.xsd.

Available at: http://www.upnp.org/specs/av/UPnP-av-AVArchitecture-v2-20101231.pdf.


Available at: http://www.upnp.org/schemas/av/avdt-v1-20080930.xsd.

Available at: http://www.upnp.org/schemas/av/av-v2-20101231.xsd.

Available at: http://www.upnp.org/schemas/av/avs-v3-20101231.xsd.

Available at: http://www.upnp.org/specs/av/UPnP-av-AVTransport-v3-Service-20101231.pdf.

Available at: http://www.upnp.org/schemas/av/avt-event-v2-20080930.xsd.

Available at: http://www.upnp.org/specs/av/UPnP-av-ContentDirectory-v4-Service-20101231.pdf.

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Available at: [http://www.iec.ch](http://www.iec.ch).
Available at: [http://www.iec.ch](http://www.iec.ch).

Available at: [http://www.ieee802.org/1/pages/802.1as.html](http://www.ieee802.org/1/pages/802.1as.html).

Available at: [http://grouper.ieee.org/groups/1733](http://grouper.ieee.org/groups/1733).

Available at: [ISO 8601:2000](http://www.iso.org/iso-8601).


Available at: [http://www.upnp.org/schemas/av/pi-v1-20101231.xsd](http://www.upnp.org/schemas/av/pi-v1-20101231.xsd).
Latest version available at: [http://www.upnp.org/schemas/av/pi.xsd](http://www.upnp.org/schemas/av/pi.xsd).


Available at: [http://www.upnp.org/schemas/av/racs-event-v3-20101231.xsd](http://www.upnp.org/schemas/av/racs-event-v3-20101231.xsd).


Available at: http://www.faqs.org/rfcs/rfc2119.html.

Available at: http://www.ietf.org/rfc/rfc2396.txt.

Available at: http://www.ietf.org/rfc/rfc3339.txt.

Available at: http://www.upnp.org/schemas/av/rii-v1-20101231.xsd.

Available at: http://www.upnp.org/schemas/av/rpl-v1-20101231.xsd.

Available at: http://www.ietf.org/rfc/rfc3550.txt.

Available at: http://www.ietf.org/rfc/rfc2326.txt.

Available at: http://www.upnp.org/specs/av/UPnP-av-ScheduledRecording-v2-Service-20101231.pdf.

Available at: http://www.upnp.org/schemas/av/srs-v2-20080930.xsd.

Available at: http://www.upnp.org/schemas/av/srs-event-v1-20080930.xsd.

Available at: http://www.upnp.org/schemas/av/TransformSettings-v1-20101231.xsd.

Available at: http://www.unicode.org/reports/tr15/tr15-15.html.

Available at: http://www.unicode.org/reports/tr10/tr10-14.html.

Available at: http://www.upnp.org/schemas/av/upnp-v4-20101231.xsd.

Available at: http://www.unicode.org/reports/tr10/tr10-14.html.
2 AV Datastructure Template

The following shows the generalized layout of an AVDT Template. More elements and/or attributes MAY be added in future versions of AVDT templates.

The forum character style is used to indicate names defined by the AVWC. Implementations need to fill out the parts that are printed in vendor character style.

```xml
<?xml version="1.0"?>
<AVDT
 xmlns:xsd="http://www.w3.org/2001/XMLSchema"
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
 xsi:schemaLocation="urn:schemas-upnp-org:av:avdt
  http://www.upnp.org/schemas/av/avdt.xsd"
 xmlns="urn:schemas-upnp-org:av:avdt">
  <contextID>data structure identification context</contextID>
  <dataStructType>data structure name</dataStructType>
  <fieldTable>
    <field>
      <name>field name</name>
      <dataType>csv data type maxSize=max length</dataType>
      <minCountTotal>minimum total occurrences</minCountTotal>
      <maxCountTotal>maximum total occurrences</maxCountTotal>
      <minListSizeTotal>min # of entries in CSV</minListSizeTotal>
      <maxListSizeTotal>max # of entries in CSV</maxListSizeTotal>
      <allowedValueDescriptor>
        <dependentField defaultDependency="1|0">
          <name>field name</name>
          <anyValue/>
          <valueList>
            <value>enumerated value</value>
          </valueList>
          <valueRange>
            <minimum>minimum value</minimum>
            <maximum>maximum value</maximum>
            <step>increment value</step>
          </valueRange>
        </dependentField>
        // Other value ranges go here
      </allowedValueDescriptor>
    </field>
    // Other dependent fields go here
  </fieldTable>
</AVDT>
```
<maximum>maximum value</maximum>  
<step>increment value</step>  
</allowedValueRange>  
// Other allowed value Ranges go here  
</allowedValueDescriptor>  
// Other allowed value descriptors go here  
</field>  
// Other field declarations go here  
</fieldTable>  
</AVDT>  

xml  
REQUIRED for all XML documents. Case sensitive.  

AVDT  
REQUIRED. Must have “urn:schemas-upnp-org:av:avdt” as the value for the xmlns attribute; this references the UPnP AV Working Committee Datastructure Template Schema. As long as the same xmlns is used, the data structure template MUST be backward compatible, i.e. usable by legacy implementations. Contains all other elements describing the service, i.e., contains the following sub elements:  

contextID  
REQUIRED. xsd:anyType. Identifies the context in which the data structure type has meaning. Typically, this element contains a unique identifier for the device-specific service instance that contains this data structure.  
For example, uuid:device-UUID::urn:schemas-upnp-org:service:scheduleRecording:1.  

dataStructType  
REQUIRED. xsd:QName. Identifies the data structure type. The name of the data structure type is vendor-dependent. It MUST be a QName as defined in section 3 of the W3C document “Namespaces in XML” [XML-NMSP]. Identical data structure types MUST be identified by the same name. Likewise, data structure types that are different MUST have different names.  

fieldTable  
REQUIRED. Begins the description section for the fields that are defined for this data structure type. Contains zero or more of the following sub element(s):  

field  
REQUIRED. Repeat once for each field that is contained within this data structure type. Contains the following sub elements:  

name  
REQUIRED. xsd:string. Identifies the name of the field that is described within this field element. MUST be one of the following formats:  
• QName  
• QName “@” NCName  
• “@” NCName  
• NCName “::@” NCName  
where QName and NCName are defined in Section 3 of the W3C document “Namespaces in XML” [XML-NMSP]. For fields that correspond to an XML element (within the data structure’s dataStructType XML document) name MUST contain the name of the XML element using the QName format e.g. element-name. For fields that correspond to an XML attribute (within the data structure’s dataStructType XML document) name MUST contain the name of the XML attribute using any of the forms other than the QName format e.g. element-name@interface-name.  

datatype  
REQUIRED. xsd:string. Identifies the data type of this field. MUST be a QName with a namespace prefix of “xsd”. QName is defined in Section 3 of the W3C document “Namespaces in XML” [XML-NMSP]. MUST be one, and only one, of the data types defined by “XML Schema Part-2” [XML SCHEMA-2]. Contains the following attributes:
@csv
  OPTIONAL. xsd:string. If present, indicates that this string field contains a
  CSV list of values (called "entries") of the data type specified by the CSV
  attribute. MUST comply with the CSV data type notation identified in
  Section 1.3.1, “Comma Separated Value (CSV) Lists”. For example, a
  value of "xsd:int" indicates a CSV of integer values. AVDT does not
  impose any restrictions on the data type value that may be specified.
  However, each data structure defined by an AVDT instance
  (dataStructType) will use only a limited number of CSV data types. MUST
  ONLY be specified when datatype equals "string" and the field is intended
  to contain a CSV list of values. The minimum and maximum number of
  entries in the CSV list are specified by minListSizeTotal, maxListSizeTotal,
  minListSize, and maxListSize defined below.

@maxSize
  OPTIONAL. xsd:unsignedInt. Meaningful only when datatype equals
  "string". Indicates the maximum number of bytes allowed for this field.
  Note: Since some character sets consume multiple bytes per character (e.g.
  UTF-16), maxSize does not necessarily indicate the maximum number of
  characters that are allowed.

minCountTotal
  OPTIONAL. xsd:unsignedInt. Minimum number of occurrences of this field within the
  entire XML document. The default value is 0 which means this field is optional and
  might not be included in some instances of this data structure (dataStructType). A
  value of 1 or more means that this field is required and MUST be present in every
  instance of this data structure at least the specified number of times.

maxCountTotal
  OPTIONAL. xsd:string. Maximum number of occurrences of this field within the entire
  XML document. Its value MUST be either an unsigned integer or the value
  "UNBOUNDED". The default value is 1 which means this field MUST NOT be present
  more than once within any instance of this data structure (dataStructType). A value
  of 0 indicates that this field is prohibited and MUST NOT be present in any instance of
  this data structure. A value of "UNBOUNDED" indicates that there is no
  predetermined limit on the number of times this field may be present. The value of
  maxCountTotal MUST be greater than or equal to minCountTotal.

minListSizeTotal
  OPTIONAL. xsd:unsignedInt. Valid only for a CSV-type field i.e. when the @csv
  attribute is specified within name. Minimum number of entries in each instance of
  this CSV field. The default value is 0 which means this field, when present, may
  contain an empty CSV list. A value of 1 or more means that this field, when present,
  MUST contain at least the specified number of entries in the CSV list.

maxListSizeTotal
  OPTIONAL. xsd:string. Valid only for a CSV-type field i.e. when the @csv attribute is
  specified within name. Maximum number of entries in each instance of this CSV field.
  Its value MUST be either a positive integer or the value "UNBOUNDED". The default
  value is 1 which means this CSV field MUST NOT contain more than one entry at a
  time. A value of "UNBOUNDED" indicates that there is no predetermined limit on the
  number of entries in the CSV list. The value of maxListSizeTotal MUST be greater
  than or equal to minListSizeTotal.

allowedValueDescriptor
  REQUIRED. Begins the description of an allowed value data set for this field. Multiple
  allowedValueDescriptor elements are permitted. The total span of allowed values
  for this field is simply a concatenation of the individual allowed values within each
  allowedValueDescriptor. MUST contain either
  • allowAny or
  • allowedValueList and/or allowedValueRange
  Contains the following sub element(s):
dependentField

OPTIONAL. Identifies the values of a “dependent” field which define a “validity context” for the allowed value data set being defined within this allowedValueDescriptor. In other words, when the dependentField is set to one of the values defined within the dependentField’s sub elements anyValue, valueList and/or valueRange sub element, then this field MUST contain one of the values identified by the allowedValueDescriptor’s sub elements allowAny, allowedValueList and/or allowedValueRange. If multiple dependentField elements exist within a given allowedValueDescriptor element, the “validity context” for the allowed value data set exists whenever all of the dependentFields are set to their specified value/range i.e. multiple dependentField entries are “ANDed” together to define a specific “context” for the allowed values that follow. A missing dependentField element indicates that the allowed values of this allowedValueDescriptor are valid in all contexts except for those contexts that are identified by other peer allowedValueDescriptor blocks defined within this field.

MUST contain either

- anyValue or
- valueList and/or valueRange

Contains the following attributes and sub element(s):

@defaultDependency

OPTIONAL. xsd:boolean. A value of 1 indicates that the value/valueRange(s) defined within this dependentField include the default value (defaultValue) of the dependentField. The default value for defaultDependency is 0 which means that the default value of this dependentField IS NOT included in the value/valueRange(s) defined within this dependentField. Used by control points that do not support the dependentField in order to identify the set of allowed values that reflect the device’s capabilities when the dependentField contains its default value.

name

REQUIRED. xsd:string. Identifies the name of a dependentField whose value affects the set of allowed values for this field. In other words, the set of allowed values for this field depends on the value of the dependentField. MUST follow the format rules defined in the name sub element of field.

anyValue

OPTIONAL. xsd:string. The existence of this element indicates that this dependentField may be set to any value allowed by the dependentField’s data type. The content of this element MUST be empty. anyValue MUST NOT be included along with the valueList or valueRange elements.

valueList

OPTIONAL. Enumerates a set of values for the dependentField that constrain this field to the set of allowed values defined within this allowedValueDescriptor. Multiple valueList elements MUST NOT be specified. MUST NOT be included along with the anyValue element. Contains the following sub elements:

value

REQUIRED. xsd:anyType. Identifies a legal value of this field. Legal values are typically defined by the UPnP Forum AV Working Committee. However, vendors MAY, if the working committee permits it, add vendor-specific allowed values. An empty value element means that when the dependentField is empty, then this field MUST contain one of the allowed values defined within this allowedValueDescriptor.
valueRange
OPTIONAL. Defines a range and resolution for a set of values for the dependentField that constrain this field to the set of allowed values defined within this allowedValueDescriptor. Valid only for numeric data types. Multiple valueRange elements may be specified. MUST NOT be included along with the anyValue element. Contains the following sub elements:

minimum
REQUIRED. xsd:string. Single numeric value. Inclusive lower bound. MUST be less than maximum.
Note: Care must be taken when dealing with floating-point values so that conversion and/or rounding errors do not cause inaccurate comparison operations.

maximum
REQUIRED. xsd:string. Single numeric value. Inclusive upper bound. MUST be greater than minimum.
Note: Care must be taken when dealing with floating-point values so that conversion and/or rounding errors do not cause inaccurate comparison operations.

step
OPTIONAL. xsd:string. Single positive numeric value. Indicates the numeric difference between adjacent supported values within the valueRange. The value of step MUST divide the inclusive range from minimum to maximum into an integral number of equal parts. In other words, maximum = minimum + N*step where N is a positive integer. When step is omitted AND the data type of the dependentField is an integer, the default value of step is 1. Otherwise, when step is omitted, all values within the inclusive range from minimum to maximum are valid.
Note: Care must be taken when dealing with floating-point values so that conversion and/or rounding errors do not cause inaccurate comparison operations.

minCount
OPTIONAL. xsd:unsignedInt. Minimum number of occurrences of this field that has one of the values defined within this allowedValueDescriptor. Indicates the minimum number of times (within the entire XML document) that this field MUST be set to one of the values defined within this allowedValueDescriptor. The default value is 0 which means that the XML document might not contain any occurrences of this field whose value is set to one of the values defined within this allowedValueDescriptor. A value of 1 or greater means that this field is required and MUST be present at least the specified number of times. Additionally, each of those occurrences MUST be set to one of the values defined within this allowedValueDescriptor. Other instances of this field MAY occur but they MUST have a value defined within a different allowedValueDescriptor. For each field, the value of minCount MUST be less than or equal to minCountTotal.

maxCount
OPTIONAL. xsd:string. Maximum number of occurrences of this field that has one of the values defined within this allowedValueDescriptor. Indicates the maximum number of times this field can be set to one of the values defined within this allowedValueDescriptor. The value of maxCount MUST be either an unsigned integer or the value “UNBOUNDED”. A value of 1 or greater indicates that this field MUST NOT be present more than the specified number of times with a value set to one of the values defined within this allowedValueDescriptor. The default value is 1. A value of 0 means that the data structure MUST NOT include any occurrences of this field other than those occurrences whose value is defined within a different allowedValueDescriptor. In this case, the
allowedValueDescriptor MUST contain an empty allowedValueList and no allowedValueRange. A value of “UNBOUNDED” indicates that there is no predetermined limit on the number of occurrences of this field that may contain one of the values defined within this allowedValueDescriptor. The value of maxCount MUST be greater than or equal to minCount. For each occurrence of allowedValueDescriptor, the value of maxCount MUST be less than or equal to maxCountTotal for this field. Other instances of this field MAY occur but they MUST have a value defined within a different allowedValueDescriptor.

minListSize
OPTIONAL. xsd:unsignedInt. Valid only for a CSV-type field i.e. when the @csv attribute is specified within the name sub element of field. Minimum number of entries in each instance of this CSV field that MUST contain one of the values defined within this allowedValueDescriptor. The default value is 0 which means this field, when present, might not contain any entries that are defined within this allowedValueDescriptor. A value of 1 or more means that this field, when present, MUST contain at least the specified number of entries whose value is defined within this allowedValueDescriptor. Other instances of this field MAY occur but they MUST have a value defined within a different allowedValueDescriptor.

maxListSize
OPTIONAL. xsd:string. Valid only for a CSV-type field i.e. when the @csv attribute is specified within the name sub element of field. Maximum number of entries in each instance of this CSV field that are allowed to contain one of the values defined within this allowedValueDescriptor. The value of maxListSize MUST be either an unsigned integer or the value “UNBOUNDED”. The default value is 1 which means this CSV field MUST contain more than one entry whose value is defined within this allowedValueDescriptor. A value of 0 means that no entries within any instance of this CSV field are allowed to contain one of the values defined within this allowedValueDescriptor. In this case, the allowedValueDescriptor MUST contain an allowedValueList with a single, empty allowedValue and no allowedValueRange. A value of “UNBOUNDED” indicates that there is no predetermined limit on the number entries that contain one of the values defined within this allowedValueDescriptor. Other instances of this field MAY occur but they MUST have a value defined within a different allowedValueDescriptor. The value of maxListSize MUST be greater than or equal to minListSize and less than or equal to maxListSizeTotal.

defaultValue
OPTIONAL. xsd:anyType. Identifies the default value assigned to this field if no value is present in the XML document. The contents MUST match the data type (datatype) of this field and it MUST belong to the set of allowed values defined within this allowedValueDescriptor i.e. allowAny, allowedValueList, and/or allowedValueRange. If this field appears as a dependentField within another field, then that dependentField element MUST contain the defaultDependency attribute with a value of 1.

allowAny
OPTIONAL. xsd:string. The existence of this element indicates that this field may be set to any value allowed by this field’s data type. The content of this element MUST be empty. allowAny MUST NOT be included along with the allowedValueList or allowedValueRange elements.

allowedValueList
OPTIONAL. Enumerates a set of values that are allowed for this field subject to the constraints defined by the dependentField element, if present. Multiple allowedValueLists MUST NOT be specified. allowedValueList MUST NOT be included along with the allowAny element. Contains the following sub elements:
allowedValue
REQUIRED. xsd:anyType. Identifies one of the values that are allowed for this field. Legal values are typically defined by the UPnP Forum AV Working Committee. However, vendors MAY, if the working committee permits it, add vendor-specific allowed values. An empty allowedValue element means that the content of this field is permitted to be empty. An allowedValueList with only an empty allowedValue means that when this field exists, its value MUST be empty. For a CSV-type field (@csv), an allowedValue entry indicates one possible value of an entry in the CSV list. It does not indicate one of the possible combinations of values for the entire CSV list.
Note: For a heterogeneous CSV-type field, it may not be practical to enumerate all of the allowed values that are possible. In this case, it is recommended to specify allowAny.

allowedValueRange
OPTIONAL. Defines a range and resolution for a set of numeric values that are allowed for this field subject to the contraints defined by the dependentField element, if present. Valid only for numeric data types. Multiple allowedValueRange elements MAY be specified. MUST NOT be included along with the allowAny element. Contains the following sub elements:

minimum
REQUIRED. xsd:string. Single numeric value. Inclusive lower bound. MUST be less than maximum.
Note: Care must be taken when dealing with floating-point values so that conversion and/or rounding errors do not cause inaccurate comparison operations.

maximum
REQUIRED. xsd:string. Single numeric value. Inclusive upper bound. MUST be greater than minimum.
Note: Care must be taken when dealing with floating-point values so that conversion and/or rounding errors do not cause inaccurate comparison operations.

step
OPTIONAL. xsd:string. Single positive numeric value. Indicates the numeric difference between adjacent valid values within the allowedValueRange. The value of step MUST divide the inclusive range from minimum to maximum into an integral number of equal parts. In other words, maximum = minimum + N*step where N is a positive integer. When step is omitted and the data type of the field is an integer, the default value of step is 1. Otherwise, if step is omitted, all values within the inclusive range from minimum to maximum MUST be supported.
Note: Care must be taken when dealing with floating-point values so that conversion and/or rounding errors do not cause inaccurate comparison operations.
3 AV Datastructure Schema

The AV Datastructure XML schema defines the structure of an AVDT document. A machine readable file containing this schema can be found at [AVDT-XSD]. Although the XML schema does not include any extensibility mechanisms (e.g. the inclusion of <xsd:any> tags), AVDT documents are permitted to include additional XML elements and/or attributes beyond those defined in this schema. This allows for vendor-defined extensions and/or for future (standardized) enhancements to the AVDT structure. Consequently, when parsing an AVDT document any unrecognized elements and/or attributes MUST be gracefully ignored.

Each Datastructure (identified by the <contextID> and <dataStructType> elements) is described by an AVDT Document which in turn is an instantiation of a particular version of the AVDT schema. As the AVDT schema is enhanced over time, each version is assigned a unique number as indicated by the latter part of the schema URN as follows (see Section 1.4.2, “Namespace Names, Namespace Versioning and Schema Versioning”):

```
xsi:schemaLocation="
  urn:schemas-upnp-org:av:avdt
  http://www.upnp.org/schemas/av/avdt.xsd"
```

where the number 1 after the “v” is the version number. Each AVDT schema version update must be backward compatible with the previous version. Specifically, XML elements and/or attributes may be added to more recent AVDT schema versions, but must not ever be removed. As a result, when examining the schema version value, implementations will likely want to perform a greater-than-or-equal-to comparison rather than just a plain equality check.