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BSI Standards Publication

Information technology — UPnP Device Architecture

Part 20-11: Audio video device control protocol — Level 4 — Connection manager service

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National foreword

This British Standard is the UK implementation of ISO/IEC 29341-20-11:2017.

The UK participation in its preparation was entrusted to Technical Committee ICT/-/1, Information systems co-ordination.

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Part 20-11: Audio video device control protocol — Level 4 — Connection manager service

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Partie 20-11: Protocole de contrôle de dispositif audio-vidéo — Niveau 4 — Service de gestionnaire de connexion

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CONTENTS

1 Scope vi
2 Normative references 1
3 Terms, definitions, symbols and abbreviations 4
3.1 Provisioning terms 4
3.2 Symbols 5
4 Notations and Conventions 5
4.1 Notation 5
4.1.1 Data Types 5
4.1.2 Strings Embedded in Other Strings 6
4.1.3 Extended Backus-Naur Form 6
4.2 Derived Data Types 7
4.2.1 Summary 7
4.2.2 CSV Lists 7
4.3 Management of XML Namespaces in Standardized DCPs 8
4.3.1 Namespace Prefix Requirements 12
4.3.2 Namespace Names, Namespace Versioning and Schema Versioning 13
4.3.3 Namespace Usage Examples 15
4.4 Vendor-defined Extensions 15
4.4.1 Vendor-defined Action Names 15
4.4.2 Vendor-defined State Variable Names 15
4.4.3 Vendor-defined XML Elements and attributes 16
4.4.4 Vendor-defined Property Names 16
5 Service Modeling Definitions 16
5.1 ServiceType 16
5.2 State Variables 17
5.2.1 State Variable Overview 17
5.2.2 *SourceProtocolInfo* 17
5.2.3 *SinkProtocolInfo* 18
5.2.4 *CurrentConnectionIDs* 18
5.2.5 *FeatureList* 18
5.2.6 *ClockUpdateID* 18
5.2.7 *DeviceClockInfoUpdates* 19
5.2.8 *A_ARG_TYPE_ConnectionStatus* 20
5.2.9 *A_ARG_TYPE_ConnectionManager* 20
5.2.10 *A_ARG_TYPE_Direction* 20
5.2.11 *A_ARG_TYPE_ProtocolInfo* 20
5.2.12 *A_ARG_TYPE_ConnectionID* 20
5.2.13 *A_ARG_TYPE_AVTransportID* 20
5.2.14 *A_ARG_TYPE_RcsID* 21
5.2.15 *A_ARG_TYPE_ItemInfoFilter* 21
5.2.16 *A_ARG_TYPE_Result* 22
5.2.17 *A_ARG_TYPE_RenderingInfoList* 22
5.3 Eventing and Moderation 28
5.4 Actions 28
5.4.1 Action Overview 28
5.4.2 *GetProtocolInfo()* 29

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Document Sharing Hub

Full document details: BS ISO/IEC 29341-20-11:2017

5.4.3 *PrepareForConnection()* 29
5.4.4 *ConnectionComplete()* 31
5.4.5 *GetCurrentConnectionIDs()* 32
5.4.6 *GetCurrentConnectionInfo()* 33
5.4.7 *GetRendererItemInfo()* 34
5.4.8 *GetFeatureList()* 35
5.4.9 Common Error Codes 35
6 XML Service Description 36
7 Test 40
Annex A (normative) Protocol Specifics 41
A.1 Application to HTTP Streaming 41
A.1.1 *ProtocolInfo* Definition 41
A.1.2 Implementation of *PrepareForConnection()* 41
A.1.3 Implementation of *ConnectionComplete()* 41
A.1.4 Automatic Connection Cleanup 41
A.2 Application to RTSP/RTP/UDP Streaming 42
A.2.1 *ProtocolInfo* Definition 42
A.2.2 Implementation of *PrepareForConnection()* 42
A.2.3 Implementation of *ConnectionComplete()* 42
A.2.4 Automatic Connection Cleanup 42
A.3 Application to Device-Internal Streaming 42
A.4 Application to IEC61883 Streaming 43
A.4.1 *ProtocolInfo* Definition 43
A.4.2 Implementation of *PrepareForConnection()* 44
A.4.3 Implementation of *ConnectionComplete()* 45
A.4.4 Automatic Connection Cleanup 45
A.5 Application to Vendor-specific Streaming 46
Annex B (normative) *CM features* 47
B.1 Introduction 47
B.2 Requirements for the *CLOCKSYNC feature*, Version 1 47
Annex C (informative) Theory of Operation 53
C.1 Purpose 53
C.2 *ProtocolInfo* Concept 53
C.2.1 4th Field – <additionalInfo> 54
C.2.2 IEC61883 Exception 55
C.2.3 Formal EBNF for the 4th field 55
C.2.4 *ProtocolInfo* Conventions for Protected Content 56
C.3 Typical Control Point Operations 57
C.3.1 Introduction 57
C.3.2 Establishing a New Connection 57
C.3.3 Dealing with Ongoing Connections 58
C.4 Relation to Devices without ConnectionManagers 58
C.5 *PrepareForConnection()* and *ConnectionComplete()* 59
C.5.1 *PrepareForConnection()* 59
C.5.2 *ConnectionComplete()* 59
C.5.3 General Usage Model 59
C.5.4 Relationship to AVTransport and RenderingControl Services 60
C.5.5 *ConnectionIDs* 60

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AVA Documents Document Sharing Hub
Full document details: BS ISO/IEC 29341-20-11:2017

C.5.6 AVTransportIDs and RcsIDs 61
C.6 Determining if ContentDirectory items are playable 61
C.7 *CLOCKSYNC feature* 66
C.7.1 Examples of *CLOCKSYNC* feature 67
Annex D (informative) Bibliography 70

List of Tables

Table 1 — EBNF Operators 7
Table 2 — CSV Examples 8
Table 3 — Namespace Definitions 9
Table 4 — Schema-related Information 11
Table 5 — Default Namespaces for the AV Specifications 13
Table 6 — State Variables 17
Table 7 — allowedValueList for *A_ARG_TYPE_ConnectionStatus* 20
Table 8 — allowedValueList for *A_ARG_TYPE_Direction* 20
Table 9 — Event Moderation 28
Table 10 — Actions 28
Table 11 — Arguments for *GetProtocolInfo()* 29
Table 12 — Arguments for *PrepareForConnection()* 30
Table 13 — Error Codes for *PrepareForConnection()* 31
Table 14 — Arguments for *ConnectionComplete()* 32
Table 15 — Error Codes for *ConnectionComplete()* 32
Table 16 — Arguments for *GetCurrentConnectionIDs()* 32
Table 17 — Error Codes for *GetCurrentConnectionIDs()* 33
Table 18 — Arguments for *GetCurrentConnectionInfo()* 33
Table 19 — Error Codes for *GetCurrentConnectionInfo()* 34
Table 20 — Arguments for *GetRendererItemInfo()* 34
Table 21 — Error Codes for *GetRendererItemInfo()* 35
Table 22 — Arguments for *GetFeatureList()* 35
Table 23 — Error Codes for *GetFeatureList()* 35
Table 24 — Common Error Codes 36
Table A.1 — <contentFormat> for Protocol IEC61883 44
Table B.1 — *CM features* 47
Table B.2 — Required characteristics of the *CLOCKSYNC feature* element 49
Table B.3 — Allowed values for the <`syncProtocolID`> element 50
Table B.4 — Allowed formats for the <`masterClockID`> element. 51
Table B.5 — Allowed values for the <`supportedTimestamps`> element 51
Table C.1 — Defined Protocols and their associated *ProtocolInfo* Values 54

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ISO/IEC 29341-20-11 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.

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UPnP Document Title	ISO/IEC 29341 Part
UPnP Device Architecture 1.0	ISO/IEC 29341-1:2008
UPnP Device Architecture Version 1.0	ISO/IEC 29341-1:2011
UPnP Device Architecture 1.1	ISO/IEC 29341-1-1:2011
UPnP Device Architecture 2.0	ISO/IEC 29341-1-2
UPnP Basic:1 Device	ISO/IEC 29341-2
UPnP AV Architecture:1	ISO/IEC 29341-3-1:2008
UPnP AV Architecture:1	ISO/IEC 29341-3-1:2011
UPnP AVTransport:1 Service	ISO/IEC 29341-3-10
UPnP ConnectionManager:1 Service	ISO/IEC 29341-3-11
UPnP ContentDirectory:1 Service	ISO/IEC 29341-3-12
UPnP RenderingControl:1 Service	ISO/IEC 29341-3-13
UPnP MediaRenderer:1 Device	ISO/IEC 29341-3-2
UPnP MediaRenderer:2 Device	ISO/IEC 29341-3-2:2011
UPnP MediaServer:1 Device	ISO/IEC 29341-3-3
UPnP AVTransport:2 Service	ISO/IEC 29341-4-10:2008
UPnP AVTransport:2 Service	ISO/IEC 29341-4-10:2011
UPnP ConnectionManager:2 Service	ISO/IEC 29341-4-11:2008
UPnP ConnectionManager:2 Service	ISO/IEC 29341-4-11:2011
UPnP ContentDirectory:2 Service	ISO/IEC 29341-4-12
UPnP RenderingControl:2 Service	ISO/IEC 29341-4-13:2008
UPnP RenderingControl:2 Service	ISO/IEC 29341-4-13:2011
UPnP ScheduledRecording:1	ISO/IEC 29341-4-14
UPnP ScheduledRecording:2	ISO/IEC 29341-4-14:2011
UPnP MediaRenderer:2 Device	ISO/IEC 29341-4-2
UPnP MediaServer:2 Device	ISO/IEC 29341-4-3
UPnP AV Datastructure Template:1	ISO/IEC 29341-4-4:2008
UPnP AV Datastructure Template:1	ISO/IEC 29341-4-4:2011
UPnP DigitalSecurityCamera:1 Device	ISO/IEC 29341-5-1
UPnP DigitalSecurityCameraMotionImage:1 Service	ISO/IEC 29341-5-10
UPnP DigitalSecurityCameraSettings:1 Service	ISO/IEC 29341-5-11
UPnP DigitalSecurityCameraStillImage:1 Service	ISO/IEC 29341-5-12
UPnP HVAC_System:1 Device	ISO/IEC 29341-6-1
UPnP ControlValve:1 Service	ISO/IEC 29341-6-10
UPnP HVAC_FanOperatingMode:1 Service	ISO/IEC 29341-6-11
UPnP FanSpeed:1 Service	ISO/IEC 29341-6-12
UPnP HouseStatus:1 Service	ISO/IEC 29341-6-13
UPnP HVAC_SetpointSchedule:1 Service	ISO/IEC 29341-6-14
UPnP TemperatureSensor:1 Service	ISO/IEC 29341-6-15
UPnP TemperatureSetpoint:1 Service	ISO/IEC 29341-6-16
UPnP HVAC_UserOperatingMode:1 Service	ISO/IEC 29341-6-17
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UPnP SwitchPower:1 Service	ISO/IEC 29341-7-11
UPnP DimmableLight:1 Device	ISO/IEC 29341-7-2
UPnP InternetGatewayDevice:1 Device	ISO/IEC 29341-8-1
UPnP LANHostConfigManagement:1 Service	ISO/IEC 29341-8-10
UPnP Layer3Forwarding:1 Service	ISO/IEC 29341-8-11
UPnP LinkAuthentication:1 Service	ISO/IEC 29341-8-12
UPnP RadiusClient:1 Service	ISO/IEC 29341-8-13
UPnP WANCableLinkConfig:1 Service	ISO/IEC 29341-8-14
UPnP WANCommonInterfaceConfig:1 Service	ISO/IEC 29341-8-15
UPnP WANDSLLinkConfig:1 Service	ISO/IEC 29341-8-16
UPnP WANEthernetLinkConfig:1 Service	ISO/IEC 29341-8-17
UPnP WANIPConnection:1 Service	ISO/IEC 29341-8-18
UPnP WANPOTSLinkConfig:1 Service	ISO/IEC 29341-8-19
UPnP LANDevice:1 Device	ISO/IEC 29341-8-2
UPnP WANPPPConnection:1 Service	ISO/IEC 29341-8-20
UPnP WLANConfiguration:1 Service	ISO/IEC 29341-8-21
UPnP WANDevice:1 Device	ISO/IEC 29341-8-3
UPnP WANConnectionDevice:1 Device	ISO/IEC 29341-8-4
UPnP WLANAccessPointDevice:1 Device	ISO/IEC 29341-8-5
UPnP Printer:1 Device	ISO/IEC 29341-9-1
UPnP ExternalActivity:1 Service	ISO/IEC 29341-9-10
UPnP Feeder:1.0 Service	ISO/IEC 29341-9-11
UPnP PrintBasic:1 Service	ISO/IEC 29341-9-12
UPnP Scan:1 Service	ISO/IEC 29341-9-13
UPnP Scanner:1.0 Device	ISO/IEC 29341-9-2
UPnP QoS Architecture:1.0	ISO/IEC 29341-10-1
UPnP QosDevice:1 Service	ISO/IEC 29341-10-10
UPnP QosManager:1 Service	ISO/IEC 29341-10-11
UPnP QosPolicyHolder:1 Service	ISO/IEC 29341-10-12
UPnP QoS Architecture:2	ISO/IEC 29341-11-1
UPnP QosDevice:2 Service	ISO/IEC 29341-11-10
UPnP QosManager:2 Service	ISO/IEC 29341-11-11
UPnP QosPolicyHolder:2 Service	ISO/IEC 29341-11-12
UPnP QOS v2 Schema Files	ISO/IEC 29341-11-2
UPnP RemoteUIClientDevice:1 Device	ISO/IEC 29341-12-1
UPnP RemoteUIClient:1 Service	ISO/IEC 29341-12-10
UPnP RemoteUIServer:1 Service	ISO/IEC 29341-12-11
UPnP RemoteUIServerDevice:1 Device	ISO/IEC 29341-12-2
UPnP DeviceSecurity:1 Service	ISO/IEC 29341-13-10
UPnP SecurityConsole:1 Service	ISO/IEC 29341-13-11
UPnP ContentDirectory:3 Service	ISO/IEC 29341-14-12:2011
UPnP MediaServer:3 Device	ISO/IEC 29341-14-3:2011
UPnP ContentSync:1	ISO/IEC 29341-15-10:2011
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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
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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
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1 Scope

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

This service-type enables modeling of streaming capabilities of A/V devices, and binding of those capabilities between devices. Each device that is able to send or receive a stream according to the UPnP AV Architecture will have 1 instance of the ConnectionManager service. This service provides a mechanism for control points to:

a) Perform capability matching between source/server devices and sink/renderer devices,

b) Find information about currently ongoing transfers in the network,

c) Setup and teardown connections between devices (when required by the streaming protocol).

The ConnectionManager service is generic enough to properly abstract different kinds of streaming mechanisms, such as HTTP-based streaming, RTSP/RTP-based and 1394-based streaming.

The ConnectionManager enables control points to abstract from physical media interconnect technology when making connections. The term ‘stream’ used in this service template refers to both analog and digital data transfer.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

[1] – *XML Schema for RenderingControl AllowedTransformSettings*, UPnP Forum, March 31, 2013.
Available at: http://www.upnp.org/schemas/av/AllowedTransformSettings-v1-20130331.xsd.
Latest version available at: http://www.upnp.org/schemas/av/AllowedTransformSettings.xsd.

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Available at: http://www.upnp.org/specs/av/UPnP-av-AVDataStructureTemplate-v1-20130331.pdf.
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[3] – *XML Schema for UPnP AV Common XML Data Types*, UPnP Forum, March 31, 2013.
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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.

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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.

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.

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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
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:

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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 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.

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- 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.

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.

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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.

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]

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Standard Name-space Prefix	Namespace Name	Namespace Description	Normative Definition Document Reference
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]
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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Documents Document Sharing Hub

Full document details: BS ISO/IEC 29341-20-11:2017

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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