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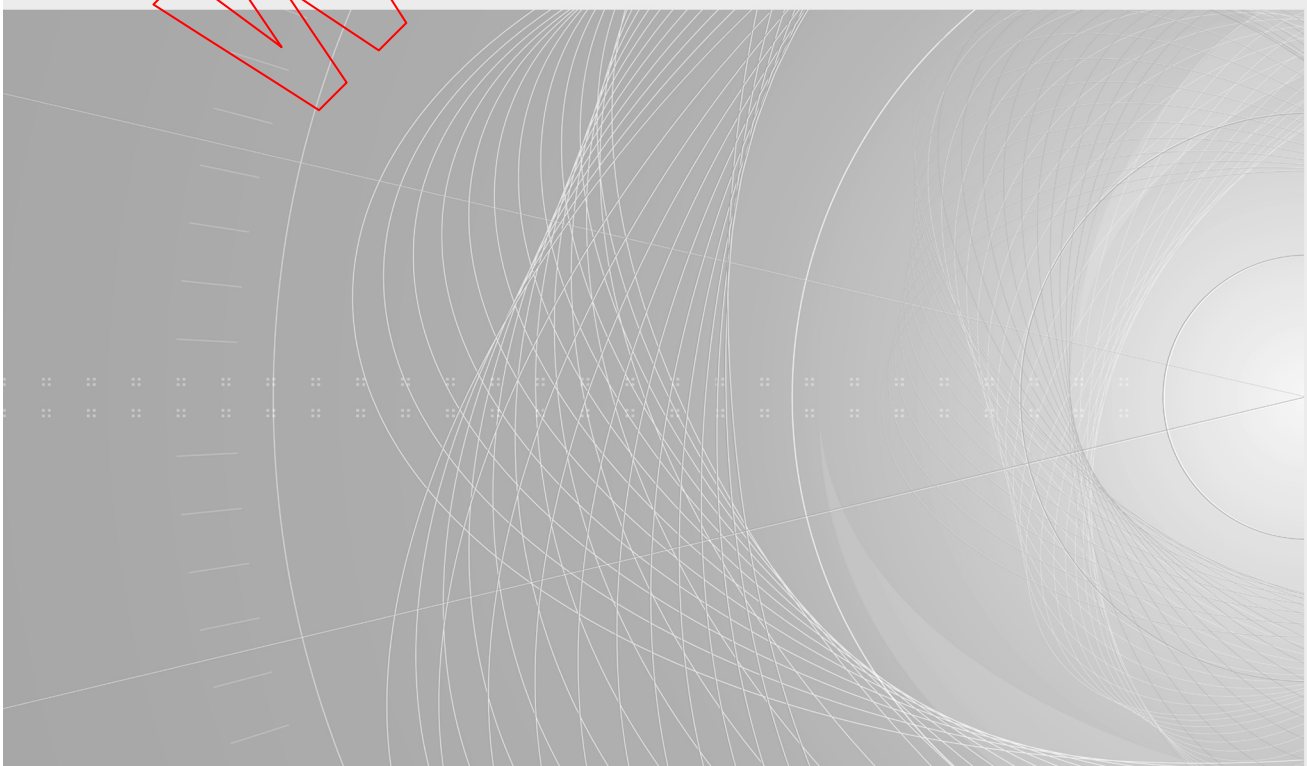
INTERNATIONAL STANDARD

Information technology – UPnP Device Architecture – Part 4-13: Audio Video Device Control Protocol – Level 2 – Rendering Control Service



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The list of all currently available parts of the ISO/IEC 29341 series, under the general title *Universal plug and play (UPnP) architecture*, can be found on the IEC web site.

This International Standard has been approved by vote of the member bodies, and the voting results may be obtained from the address given on the second title page.

ORIGINAL UPNP DOCUMENTS
(informative)

Reference may be made in this document to original UPnP documents. These references are retained in order to maintain consistency between the specifications as published by ISO/IEC and by UPnP Implementers Corporation. The following table indicates the original UPnP document titles and the corresponding part of ISO/IEC 29341:

UPnP Document Title	ISO/IEC 29341 Part
UPnP Device Architecture 1.0	ISO/IEC 29341-1
UPnP Basic:1 Device	ISO/IEC 29341-2
UPnP AV Architecture:1	ISO/IEC 29341-3-1
UPnP MediaRenderer:1 Device	ISO/IEC 29341-3-2
UPnP MediaServer:1 Device	ISO/IEC 29341-3-3
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: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
UPnP AVTransport:2 Service	ISO/IEC 29341-4-10
UPnP ConnectionManager:2 Service	ISO/IEC 29341-4-11
UPnP ContentDirectory:2 Service	ISO/IEC 29341-4-12
UPnP RenderingControl:2 Service	ISO/IEC 29341-4-13
UPnP ScheduledRecording:1	ISO/IEC 29341-4-14
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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
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UPnP HVAC_ZoneThermostat:1 Device	ISO/IEC 29341-6-2
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UPnP HVAC_UserOperatingMode:1 Service	ISO/IEC 29341-6-17
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UPnP Document Title	ISO/IEC 29341 Part
UPnP QosManager:2 Service	ISO/IEC 29341-11-11
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UPnP RemoteUIServer:1 Service	ISO/IEC 29341-12-11
UPnP DeviceSecurity:1 Service	ISO/IEC 29341-13-10
UPnP SecurityConsole:1 Service	ISO/IEC 29341-13-11

1 Overview and Scope

This service template is compliant with the UPnP Device Architecture version 1.0. It defines a service type referred to herein as RenderingControl.

1.1 Introduction

Most rendering devices contain a number of dynamically configurable attributes that affect how the current content is rendered. For example, video rendering devices, such as TVs, allow user control of display characteristics such as brightness and contrast, whereas audio rendering devices allow control of audio characteristics such as volume, balance, equalizer settings, etc. The RenderingControl service is intended to provide control points with the ability to query and/or adjust any rendering attribute that the device supports.

The RenderingControl service enables a control point to:

- Discover the set of attributes supported by the device.
- Retrieve the current setting of any supported attribute
- Change the setting of (that is: control) any modifiable attribute
- Restore the settings defined by a named Preset

The RenderingControl service DOES NOT:

- Control the flow of the associated content (for example, Play, Stop, Pause, Seek, etc.).
- Provide a mechanism to enumerate locally stored content.
- Provide a mechanism to select the content that is to be rendered.
- Provide a mechanism to send content to another device (via the home network or direct connection).

1.2 Multi-input Devices

Some high-end AV device are capable of receiving multiple pieces of content at the same time and combining that content together so that it can be rendered together using a single set of output hardware. For example, while displaying a TV program, high-end TVs can also display additional content (for example, VCR content) in a PIP (Picture-In-Picture) window. Similarly, a Karaoke machine can mix together the background music with a singer's voice so that both sounds are played together on the same set of speakers.

As with all devices, the RenderingControl service allows a control point to adjust the output characteristics of the post-mixed content before it is actually rendered. However, in many cases, control points may need to control the output characteristics of the individual input content before it is mixed together with the other input content. In order to support this, the RenderingControl service includes an *InstanceID* argument with each action that allows the control point to identify on which content the action is to be applied (for example, the post-mixed content or one of the pre-mixed input content items).

By convention, an *InstanceID* of 0 indicates that the invoked action MUST be applied to the post-mixed content. Similarly, each pre-mixed input content is assigned a unique *InstanceID* whose value is a non-zero, positive integer. Refer to Section 2.5, "Theory of Operation" for additional information.

1.3 Notation

- In this document, features are described as Required, Recommended, or Optional as follows:

  The key words "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 an absolute prohibition of 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.
- Keywords that are defined by the UPnP Device Architecture are printed using the **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.

1.3.1 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 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 properties be represented as “*0*” and “*1*”.

1.3.2 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 1.4.1, “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

1.3.3 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].

1.3.3.1 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: