
**Information technology — UPnP
Device Architecture —**

**Part 28-10:
Multiscreen device control protocol —
Application management service**

Technologies de l'information — Architecture de dispositif UPnP —

*Partie 28-10: Protocole de contrôle de dispositif multi-écran —
Service de gestion des applications*





COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2017, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

CONTENTS

Foreword	v
1 Scope	1
2 Normative references	1
3 Terms, definitions, symbols and abbreviations	2
3.1.1 <i>SECURITY feature</i>	2
3.1.2 <i>AM Roles</i>	2
3.1.3 Application	2
3.1.4 Native Application	2
3.1.5 Web Application	2
4 Notations and Conventions	2
5 Service Modelling Definitions	2
5.1 Service Type	2
5.2 Key Concepts	2
5.2.1 <i>SECURITY feature</i>	2
5.3 State Variables	4
5.3.1 <u><i>A ARG TYPE AppIDs</i></u>	4
5.3.2 <u><i>AppInfoList</i></u>	5
5.3.3 <u><i>A ARG TYPE AppInfo</i></u>	7
5.3.4 <u><i>SupportedTargetFields</i></u>	8
5.3.5 <u><i>A ARG TYPE Target</i></u>	8
5.3.6 <u><i>A ARG TYPE TargetFields</i></u>	8
5.3.7 <u><i>RunningAppList</i></u>	8
5.3.8 <u><i>A ARG TYPE URI</i></u>	8
5.3.9 <u><i>A ARG TYPE Parameters</i></u>	8
5.4 Eventing and Moderation	9
5.5 Actions	9
5.5.1 <u><i>GetAppInfoByIDs()</i></u>	10
5.5.2 <u><i>GetSupportedTargetFields()</i></u>	10
5.5.3 <u><i>GetAppIDList()</i></u>	11
5.5.4 <u><i>GetRunningAppList()</i></u>	12
5.5.5 <u><i>GetRunningStatus()</i></u>	12
5.5.6 <u><i>StartAppByID()</i></u>	13
5.5.7 <u><i>StartAppbyURI()</i></u>	14
5.5.8 <u><i>StopApp()</i></u>	15
5.5.9 <u><i>GetAppConnectionInfo()</i></u>	16
5.5.10 Non-Standard Actions Implemented by a UPnP Vendor	17
5.5.11 Common Error Codes	17
6 XML Service Description	17
7 Test	21
Table 1 — Error Codes for <i>Action Level Access</i>	3
Table 2 — ApplicationManagement <i>Roles</i>	3
Table 3 — Action to <i>Role</i> Permission Mapping	4

Table 4 — State variables	4
Table 5 — Allowed values for <u>function</u> element.....	6
Table 6 — Allowed values for <u>connectionAddress</u> element.....	6
Table 7 — Required fields for <u>SupportedTargetFields</u>	8
Table 8 — Event moderation	9
Table 9 — Actions	9
Table 10 — Arguments for <u>GetAppInfoByIDs()</u>	10
Table 11 — Error Codes for <u>GetAppInfoByIDs()</u>	10
Table 12 — Arguments for <u>GetSupportedTargetFields()</u>	11
Table 13 — Error Codes for <u>GetSupportedTargetFields()</u>	11
Table 14 — Arguments for <u>GetAppIDList()</u>	11
Table 15 — Error Codes for <u>GetAppIDList()</u>	11
Table 16 — Arguments for <u>GetRunningAppList()</u>	12
Table 17 — Error Codes for <u>GetRunningAppList()</u>	12
Table 18 — Arguments for <u>GetRunningStatus()</u>	12
Table 19 — Error Codes for <u>GetRunningStatus()</u>	13
Table 20 — Arguments for <u>StartAppByID()</u>	13
Table 21 — Error Codes for <u>StartAppByID()</u>	13
Table 22 — Arguments for <u>StartAppByURI()</u>	14
Table 23 — Error Codes for <u>StartAppByURI()</u>	15
Table 24 — Arguments for <u>StopApp()</u>	15
Table 25 — Error Codes for <u>StopApp()</u>	16
Table 26 — Arguments for <u>GetAppConnectionInfo()</u>	16
Table 27 — Error Codes for <u>GetAppConnectionInfo()</u>	16
Table 28 — Common Error Codes	17

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see <http://www.iso.org/directives>).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of Standard, the meaning of the ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword – Supplementary information](#)

ISO/IEC 29341-28-10 was prepared by UPnP Forum and adopted, under the PAS procedure, by joint technical committee ISO/IEC JTC 1, *Information technology*, in parallel with its approval by national bodies of ISO and IEC.

The list of all currently available parts of ISO/IEC 29341 series, under the general title *Information technology — UPnP Device Architecture*, can be found on the [ISO web site](#).

Introduction

ISO and IEC draw attention to the fact that it is claimed that compliance with this document may involve the use of patents as indicated below.

ISO and IEC take no position concerning the evidence, validity and scope of these patent rights. The holders of these patent rights have assured ISO and IEC that they are willing to negotiate licenses under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statements of the holders of these patent rights are registered with ISO and IEC.

Intel Corporation has informed IEC and ISO that it has patent applications or granted patents.

Information may be obtained from:

Intel Corporation
Standards Licensing Department
5200 NE Elam Young Parkway
MS: JFS-98
USA – Hillsboro, Oregon 97124

Microsoft Corporation has informed IEC and ISO that it has patent applications or granted patents as listed below:

6101499 / US; 6687755 / US; 6910068 / US; 7130895 / US; 6725281 / US; 7089307 / US;
7069312 / US; 10/783 524 / US

Information may be obtained from:

Microsoft Corporation
One Microsoft Way
USA – Redmond WA 98052

Philips International B.V. has informed IEC and ISO that it has patent applications or granted patents.

Information may be obtained from:

Philips International B.V. – IP&S
High Tech campus, building 44 3A21
NL – 5656 Eindhoven

NXP B.V. (NL) has informed IEC and ISO that it has patent applications or granted patents.

Information may be obtained from:

NXP B.V. (NL)
High Tech campus 60
NL – 5656 AG Eindhoven

Matsushita Electric Industrial Co. Ltd. has informed IEC and ISO that it has patent applications or granted patents.

Information may be obtained from:

Matsushita Electric Industrial Co. Ltd.
1-3-7 Shiromi, Chuoh-ku
JP – Osaka 540-6139

Hewlett Packard Company has informed IEC and ISO that it has patent applications or granted patents as listed below:

5 956 487 / US; 6 170 007 / US; 6 139 177 / US; 6 529 936 / US; 6 470 339 / US; 6 571 388 / US; 6 205 466 / US

Information may be obtained from:

Hewlett Packard Company
1501 Page Mill Road
USA – Palo Alto, CA 94304

Samsung Electronics Co. Ltd. has informed IEC and ISO that it has patent applications or granted patents.

Information may be obtained from:

Digital Media Business, Samsung Electronics Co. Ltd.
416 Maetan-3 Dong, Yeongtang-Gu,
KR – Suwon City 443-742

Huawei Technologies Co., Ltd. has informed IEC and ISO that it has patent applications or granted patents.

Information may be obtained from:

Huawei Technologies Co., Ltd.
Administration Building, Bantian Longgang District
Shenzhen – China 518129

Qualcomm Incorporated has informed IEC and ISO that it has patent applications or granted patents.

Information may be obtained from:

Qualcomm Incorporated
5775 Morehouse Drive
San Diego, CA – USA 92121

Telecom Italia S.p.A. has informed IEC and ISO that it has patent applications or granted patents.

Information may be obtained from:

Telecom Italia S.p.A.
Via Reiss Romoli, 274
Turin - Italy 10148

Cisco Systems informed IEC and ISO that it has patent applications or granted patents.

Information may be obtained from:

Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA – USA 95134

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights other than those identified above. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

Original UPnP Document

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

UPnP Document Title	ISO/IEC 29341 Part
UPnP Device Architecture 1.0	ISO/IEC 29341-1:2008
UPnP Device Architecture Version 1.0	ISO/IEC 29341-1:2011
UPnP Device Architecture 1.1	ISO/IEC 29341-1-1:2011
UPnP Device Architecture 2.0	ISO/IEC 29341-1-2
UPnP Basic:1 Device	ISO/IEC 29341-2
UPnP AV Architecture:1	ISO/IEC 29341-3-1:2008
UPnP AV Architecture:1	ISO/IEC 29341-3-1:2011
UPnP AVTransport:1 Service	ISO/IEC 29341-3-10
UPnP ConnectionManager:1 Service	ISO/IEC 29341-3-11
UPnP ContentDirectory:1 Service	ISO/IEC 29341-3-12
UPnP RenderingControl:1 Service	ISO/IEC 29341-3-13
UPnP MediaRenderer:1 Device	ISO/IEC 29341-3-2
UPnP MediaRenderer:2 Device	ISO/IEC 29341-3-2:2011
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
UPnP HVAC_ZoneThermostat:1 Device	ISO/IEC 29341-6-2

UPnP BinaryLight:1 Device	ISO/IEC 29341-7-1
UPnP Dimming:1 Service	ISO/IEC 29341-7-10
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
UPnP Low Power Architecture:1	ISO/IEC 29341-16-1:2011
UPnP LowPowerProxy:1 Service	ISO/IEC 29341-16-10:2011

UPnP LowPowerDevice:1 Service	ISO/IEC 29341-16-11:2011
UPnP QoS Architecture:3	ISO/IEC 29341-17-1:2011
UPnP QoSDevice:3 Service	ISO/IEC 29341-17-10:2011
UPnP QoSManager:3 Service	ISO/IEC 29341-17-11:2011
UPnP QoSPolicyHolder:3 Service	ISO/IEC 29341-17-12:2011
UPnP QoSDevice:3 Addendum	ISO/IEC 29341-17-13:2011
UPnP RemoteAccessArchitecture:1	ISO/IEC 29341-18-1:2011
UPnP InboundConnectionConfig:1 Service	ISO/IEC 29341-18-10:2011
UPnP RADAConfig:1 Service	ISO/IEC 29341-18-11:2011
UPnP RADASync:1 Service	ISO/IEC 29341-18-12:2011
UPnP RATAConfig:1 Service	ISO/IEC 29341-18-13:2011
UPnP RAClient:1 Device	ISO/IEC 29341-18-2:2011
UPnP RAServer:1 Device	ISO/IEC 29341-18-3:2011
UPnP RADiscoveryAgent:1 Device	ISO/IEC 29341-18-4:2011
UPnP SolarProtectionBlind:1 Device	ISO/IEC 29341-19-1:2011
UPnP TwoWayMotionMotor:1 Service	ISO/IEC 29341-19-10:2011
UPnP AV Architecture:2	ISO/IEC 29341-20-1
UPnP AVTransport:3 Service	ISO/IEC 29341-20-10
UPnP ConnectionManager:3 Service	ISO/IEC 29341-20-11
UPnP ContentDirectory:4 Device	ISO/IEC 29341-20-12
UPnP RenderingControl:3 Service	ISO/IEC 29341-20-13
UPnP ScheduledRecording:2 Service	ISO/IEC 29341-20-14
UPnP MediaRenderer:3 Service	ISO/IEC 29341-20-2
UPnP MediaServer:4 Device	ISO/IEC 29341-20-3
UPnP AV Datastructure Template:1	ISO/IEC 29341-20-4
UPnP InternetGatewayDevice:2 Device	ISO/IEC 29341-24-1
UPnP WANIPConnection:2 Service	ISO/IEC 29341-24-10
UPnP WANIPv6FirewallControl:1 Service	ISO/IEC 29341-24-11
UPnP WANConnectionDevice:2 Service	ISO/IEC 29341-24-2
UPnP WANDevice:2 Device	ISO/IEC 29341-24-3
UPnP Telephony Architecture:2	ISO/IEC 29341-26-1
UPnP CallManagement:2 Service	ISO/IEC 29341-26-10
UPnP MediaManagement:2 Service	ISO/IEC 29341-26-11
UPnP Messaging:2 Service	ISO/IEC 29341-26-12
UPnP PhoneManagement:2 Service	ISO/IEC 29341-26-13
UPnP AddressBook:1 Service	ISO/IEC 29341-26-14
UPnP Calendar:1 Service	ISO/IEC 29341-26-15
UPnP Presense:1 Service	ISO/IEC 29341-26-16
UPnP TelephonyClient:2 Device	ISO/IEC 29341-26-2
UPnP TelephonyServer:2 Device	ISO/IEC 29341-26-3
UPnP Friendly Info Update:1 Service	ISO/IEC 29341-27-1
UPnP MultiScreen MultiScreen Architecture:1	ISO/IEC 29341-28-1
UPnP MultiScreen Application Management:1 Service	ISO/IEC 29341-28-10
UPnP MultiScreen Screen:1 Device	ISO/IEC 29341-28-2
UPnP MultiScreen Application Management:2 Service	ISO/IEC 29341-29-10
UPnP MultiScreen Screen:2 Device	ISO/IEC 29341-29-2
UPnP IoT Management and Control Architecture Overview:1	ISO/IEC 29341-30-1

UPnP DataStore:1 Service	ISO/IEC 29341-30-10
UPnP IoT Management and Control Data Model:1 Service	ISO/IEC 29341-30-11
UPnP IoT Management and Control Transport Generic:1 Service	ISO/IEC 29341-30-12
UPnP IoT Management and Control:1 Device	ISO/IEC 29341-30-2
UPnP Energy Management:1 Service	ISO/IEC 29341-31-1

1 Scope

This document specifies the characteristics of the UPnP networked service named ApplicationManagement, version 1. This service definition is compliant with UPnP Device Architecture 1.0 [1].

This service type enables to manage applications and the communications between applications providing various time-sensitive and interactive services including implementation-specific applications among various display devices, that is, Screen Devices [3] and Screen Control Points.

Screen Devices shall implement this service [3], but this service is allowed to be implemented for any UPnP devices as an add-on service.

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] – *UPnP Device Architecture, version 1.0*, UPnP Forum, October 15, 2008.

Available at: <http://www.upnp.org/specs/arch/UPnP-arch-DeviceArchitecture-v1.0-20081015.pdf>.

Latest version available at: <http://www.upnp.org/specs/arch/UPnP-arch-DeviceArchitecture-v1.0.pdf>.

[2] – *Multi-Screen Architecture:1*, UPnP Forum, September 30, 2014.

Available at: <http://www.upnp.org/specs/ms/UPnP-ms-MultiScreenArchitecture-v1-20140930.pdf>.

Latest version available at: <http://www.upnp.org/specs/ms/UPnP-ms-MultiScreenArchitecture-v1.pdf>.

[3] – *ScreenDevice:1*, UPnP Forum, September 30, 2014.

Available at: <http://www.upnp.org/specs/ms/UPnP-ms-ScreenDevice-v1-Device-20140930.pdf>.

Latest version available at: <http://www.upnp.org/specs/ms/UPnP-ms-ScreenDevice-v1-Device.pdf>.

[4] – *IETF RFC 3986, Uniform Resource Identifiers (URI): Generic Syntax*, January 2005.

Available at: <http://www.ietf.org/rfc/rfc3986.txt>.

[5] – *IETF RFC 1738, Uniform Resource Locators (URL)*, December 1994.

Available at: <http://www.ietf.org/rfc/rfc1738.txt>.

[6] – *IETF RFC 6455, The WebSocket Protocol*, December 2011.

Available at: <http://www.ietf.org/rfc/rfc6455.txt>.

[7] – *IETF RFC-6120, Extensible Messaging and Presence Protocol XMPP: Core*, March 2011.

Available at <http://tools.ietf.org/html/rfc6120>

[8] – *MediaRenderer:3*, UPnP Forum, March 31, 2013.

Available at: <http://www.upnp.org/specs/av/UPnP-av-MediaRenderer-v3-Device-20130331.pdf>.

Latest version available at: <http://www.upnp.org/specs/av/UPnP-AV-MediaRenderer-v3-Device.pdf>.

[9] – *DeviceProtection:1*, UPnP Forum, December 31, 2010.

Available at: <http://www.upnp.org/specs/gw/UPnP-gw-DeviceProtection-v1-Service-20110224.pdf>.

Latest version available at: <http://www.upnp.org/specs/gw/UPnP-gw-DeviceProtection-v1-Service.pdf>.

[10] – *XML Schema for AppInfoList XML Structures*, UPnP Forum, September 30, 2014.

Available at: <http://www.upnp.org/schemas/ms/AppInfoList-v1-20140930.xsd>.
Latest version available at: <http://www.upnp.org/schemas/ms/AppInfoList.xsd>.

3 Terms, definitions, symbols and abbreviations

For the purposes of this document, the terms and definitions given in the UPnP Device Architecture [1], the Multi-Screen Architecture:1 [2] and the following apply.

3.1 Terms specific to ApplicationManagement

3.1.1 *SECURITY feature*

An extension of the DeviceProtection service [9] to the actions (*Action Level Access*) of the ApplicationManagement service (see subclause 5.2.1).

3.1.2 *AM Roles*

Access level of a *Control Point* or *User Identity* to authorize a specific set of the ApplicationManagement actions (see subclauses 5.2.1.1 and 5.2.1.2).

3.1.3 *Application*

A software program designed to help people perform an activity.

3.1.4 *Native Application*

A type of application running directly on an OS platform. Typically, it needs to be installed before it can be started.

3.1.5 *Web Application*

A type of application typically written with web-native languages such as HTML, JavaScript and so on. It runs directly in a web browser. Typically, it does not need to be installed before it can be started.

4 Notations and Conventions

See the Multi-Screen Architecture:1 [2].

5 Service Modelling Definitions

5.1 Service Type

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

urn:[schemas-upnp-org:service:ApplicationManagement:1](#)

5.2 Key Concepts

5.2.1 *SECURITY feature*

The *SECURITY feature* is an extension of the DeviceProtection service [9] to the actions (*Action Level Access*) of the ApplicationManagement service. The *SECURITY feature* is supported on a device which also implements the DeviceProtection service [9], and not allowed otherwise.

By defining *Action Level Access* based on the *Roles* defined by the DeviceProtection service [9] and the ApplicationManagement service, a ScreenDevice is able to restrict access from unidentified Control Points or Users, and to differentiate access levels for identified Control Points or Users with different *Roles*. Additionally, an implementation may define other vendor *Roles* with other *Action Level Access*.

If a Control Point has at least one *Role* that is not restricted from invoking a specific action, then it is said to have *Action Level Access*. Otherwise, the ApplicationManagement service implementation shall issue the error code 606 (see the UPnP Device Architecture [1]) in response to the action invocation.

Table 1 — Error Codes for Action Level Access

errorCode	errorDescription	Description
400-499	TBD	See clause 3 in the UPnP Device Architecture [1].
500-599	TBD	See clause 3 in the UPnP Device Architecture [1].
606	Action not authorized	Action not authorized: The Control Point does not have privileges to invoke this action

5.2.1.1 AM (ApplicationManagement) Roles

The following Table 2 lists pre-defined *AM Roles* for the *SECURITY feature*. These *Roles* shall be supported when the *SECURITY feature* is implemented. This list of pre-defined *Roles* may be extended by the implementer with additional *vendor-defined Roles*.

Table 2 — ApplicationManagement Roles

Role Name	R/A
<u>Public</u>	<u>CR</u>
<u>Basic</u>	<u>CR</u>
<u>Admin</u>	<u>CR</u>
Conditionally required if the <i>SECURITY feature</i> is supported, and not allowed otherwise.	

The Public Role is defined in the DeviceProtection service [9]. This role is assigned limited read-related action permissions including actions revealing non-personalized information among the ApplicationManagement service state variables to control points (see Table 3 for details). This is the default DeviceProtection service Role and therefore default AM Role.

The Basic Role is defined in the DeviceProtection service [9]. This Role is assigned full read-related action permissions including actions revealing information among the ApplicationManagement service state variables to control points. This Role is also assigned limited write-related action permissions including actions changing non-installation-related information among the ApplicationManagement service state variables (see Table 3 for details).

The Admin Role is defined by the DeviceProtection service [9]. The Admin Role has no effect with regards to the ApplicationManagement actions. However, a Control Point with the Admin Role is allowed to add the Roles to any User or Control Point Identity enabling this Identity to have proper permissions for all ApplicationManagement service actions.

5.2.1.2 Restrictable/Non-Restrictable Actions and Action Level Access

ApplicationManagement actions are defined as *Restrictable* or *Non-Restrictable* (see Table 3) only when the *SECURITY feature* is supported.

The Table 3 shows ApplicationManagement actions accessible to a User or Control Point Identity assigned each of the Roles. A User or Control Point Identity possessing more than one of these Roles would be allowed to access to any action permitted by any of the assigned Roles. A YES value indicates that Action Level Access shall be granted by the corresponding Role, while a NO value indicates that Action Level Access shall not granted by this Role. Note that a NO value does not explicitly prohibit Action Level Access. That is, another Role that a User or Control Point Identity possesses may permit Action Level Access.

Table 3 — Action to Role Permission Mapping

Action Name	Category	Role	
		Public	Basic
<u>GetAppInfoByIds()</u>	Restrictable	<u>NO</u>	<u>YES</u>
<u>GetSupportedTargetFields()</u>	Non-Restrictable	<u>YES</u>	<u>YES</u>
<u>GetAppIDList()</u>	Restrictable	<u>NO</u>	<u>YES</u>
<u>GetRunningAppList()</u>	Restrictable	<u>NO</u>	<u>YES</u>
<u>GetRunningStatus()</u>	Restrictable	<u>NO</u>	<u>YES</u>
<u>StartAppByID()</u>	Restrictable	<u>NO</u>	<u>YES</u>
<u>StartAppByURI()</u>	Restrictable	<u>NO</u>	<u>YES</u>
<u>StopApp()</u>	Restrictable	<u>NO</u>	<u>YES</u>
<u>GetAppConnectionInfo()</u>	Restrictable	<u>NO</u>	<u>YES</u>

5.3 State Variables

Note: For a first-time reader, it might be more helpful to read the action definitions before reading the state variable definitions.

Table 4 —State variables

Variable Name	R/A ^a	Data Type	Allowed Value	Default Value	Eng. Units
<u>A_ARG_TYPE_AppIDs</u>	<u>R</u>	<u>string</u>	CSV(<u>string</u>) See subclause 5.3.1		
<u>AppInfoList</u>	<u>R</u>	<u>string</u>	<i>AppInfoList XML Document</i> See subclause 5.3.2		
<u>A_ARG_TYPE_AppInfo</u>	<u>R</u>	<u>string</u>	<i>XML fragment of AppInfoList XML Document</i> See subclause 5.3.3		
<u>SupportedTargetFields</u>	<u>R</u>	<u>string</u>	CSV(<u>string</u>) See subclause 5.3.4		
<u>A_ARG_TYPE_Target</u>	<u>R</u>	<u>string</u>	See subclause 5.3.5		
<u>A_ARG_TYPE_TargetFields</u>	<u>R</u>	<u>string</u>	CSV(<u>string</u>) See subclause 5.3.6		
<u>RunningAppList</u>	<u>R</u>	<u>string</u>	CSV(<u>string</u>) See subclause 5.3.7		
<u>A_ARG_TYPE_URI</u>	<u>A</u>	<u>string</u>	See subclause 5.3.8		
<u>A_ARG_TYPE_Parameters</u>	<u>R</u>	<u>string</u>	See subclause 5.3.9		
<i>Non-standard state variables implemented by a UPnP vendor go here</i>	<u>X</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>

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

^b CR = conditionally required. See referenced subclause for implementation requirements.

5.3.1 [A_ARG_TYPE_AppIDs](#)

This required state variable provides type information for the various [application@id](#)-related arguments in various actions. This state variable is a CSV list of the [application@id](#) values defined in the [AppInfoList](#) state variable (see subclause 5.3.2).

5.3.2 ***AppInfoList***

This required state variable contains overall information of applications which a Screen Device is having for *multi-screen services*. The following is the XML template for the ***AppInfoList*** state variable. See the schema in [10] for more details on the structure.

```
<?xml version="1.0" encoding="UTF-8"?>
<AppInfoList
  xmlns="urn:schemas-upnp-org:ms:AppInfoList"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="
    urn:schemas-upnp-org:ms:AppInfoList
    http://www.upnp.org/schemas/ms/AppInfoList.xsd">
  <application id="Unique Identifier of the Application">
    <marketAppID market="Market Name Providing the Application"
      version="Application Version">
      Market-assigned ID of Application</marketAppID>
    <friendlyName language="Language of friendlyName">
      Short User-friendly Title</friendlyName>
    <alternativeID org="Organization Name">Standard Organization-assigned ID of
      Application</alternativeID>
    <function org="Organization Name">Standard Organization-assigned ID of
      functionality implemented by Application</function>
    <runningStatus>Activation Status of Application</runningStatus>
    <startURI deviceType="Applicable Device Type">URI for Activation of the
      Application</startURI>
    <usagePolicy>Restriction Information</usagePolicy>
    <apptoAppInfo>
      <matchingProtocolName>User-friendly protocol name</matchingProtocolName>
      <protocol required="1 or 0">Protocol name</protocol>
      <connectionAddress>Information needed to establish a connection to the
        Application</connectionAddress>
    </apptoAppInfo>
  </application>
</AppInfoList>
```

<xml>

Allowed. Case sensitive.

<AppInfoList>

Required. <XML>. Shall include a namespace declaration for the XML Schema for AppInfoList XML Structures [10] ("urn:schemas-upnp-org:ms:AppInfoList"). Shall include zero or more of the following elements.

<application>

Required. <XML>. Shall appear once for each application. Contains the following attributes and sub-elements:

@id

Required. xsd:string. Provide a unique identity (i.e., UUID. See the UPnP Device Architecture [1].) for the application within the ApplicationManagement service.

<marketAppID>

Allowed. xsd:string. Provides the identifier of an application which is assigned by an application market. Contains the following attributes:

@market

Required. xsd:string. Indicates the identification of the digital distribution platform which the application is provided by.

@version

Required. xsd:string. Provides a version of the application. This is a literal string that denotes a version. String comparison will be done to determine if a version is higher. For example, 123.345.456 is higher than 123.245.999, BetaVersion_1 is higher than Alphaversion_2.

<friendlyName>

Required. xsd:string. Provides a short description (e.g., title) of the application for end user. Shall appear once for each different friendly name. This value can be used for Screen Control Point(s) to search an appropriate application when the <marketAppID> element is not correctly interpreted. May be localized (see @language).

@language

Allowed. xsd:string. Indicates the language of the <friendlyName> element. See RFC 1766 language tag(s).

<alternativeID>

Allowed. xsd:string. Provides an identifier of the application used for standard organizations. Shall appear once for each different alternative ID.

@org

Required. xsd:string. Provides the domain name of the organization using the [<alternativeID>](#) value.

<function>

Allowed. xsd:string. Provides an identifier of the functionality implemented by the application. Shall appear once for each different functionality identifier. See Table for details.

@org

Required. xsd:string. Provides the domain name of the organization that has defined the [<function>](#) value.

<runningStatus>

Required. xsd:string. Indicates the activation status of the application on the Screen Device. The allowed values are ["Inactive"](#), ["Transitioning"](#), ["Transitioning Pending Input"](#), ["Running"](#), and ["Unknown"](#).

<startURI>

Allowed. xsd:anyURI. Contains a URI which Screen Control Point(s) can access in order to start the application. Shall appear once for each different device type.

@deviceType

Required. xsd:string. Indicates the device type which the application is applicable to. The allowed values are ["Both"](#), ["Main Screen Device"](#), and ["Companion Screen Device"](#).

<usagePolicy>

Allowed. xsd:string. Indicates permission related information for using the application. The allowed values are ["No Restriction"](#), ["Purchase Required"](#), ["Trial Only"](#), ["Parental Consent Required"](#), ["Sign-in Required"](#) and ["Unknown"](#).

<apptoAppInfo>

Allowed. <XML>. Provides the information to make an app-to-app connection to the application. Shall appear once for each different connection information. Contains all of the following attribute and sub-element:

<matchingProtocolName>

Required. xsd:string. Provides a [vendor/organization-defined](#) protocol name used for the App-to-App communication over a transport layer specified by the [<protocol>](#) element. This contains the ICANN assigned domain name owned by the vendor/organization followed by underscore "_" and the version number of the application's communication protocol. This field can be used to find a communication-compatible application(s).

<protocol>

Required. xsd:string. Provides the protocol of the transport layer for the App-to-App communication. The allowed values are ["HTTP"](#), ["Websocket"](#), ["XMPP"](#), ["UPnP"](#) and [vendor-defined](#).

@required

Required. xsd:boolean. Indicates whether the Screen Control Point is required to use the communication channel described in the [<protocol>](#) to communicate to the running application. ["1"](#) means that the [<protocol>](#) is required and ["0"](#) means that it is not required.

<connectionAddress>

Allowed. xsd:string. Provides the access information for the App-to-App communication. The syntax of this element varies depending on the value of the [<protocol>](#). See Table for details. Note that when the [<runningStatus>](#) is not set to ["Running"](#), this element is allowed to be omitted. The omission of this element is implementation dependent.

Table 5 — Allowed values for [function](#) element

@org value	function value	Reference
upnp.org	urn:schemas-upnp-org:device:deviceType:v	[1]
upnp.org	urn:schemas-upnp-org:service:serviceType:v	[1]
vendor-defined	vendor-defined	

Table 6 — Allowed values for [connectionAddress](#) element

protocol value	connectionAddress value	Reference
HTTP	An absolute http or https URI	[4], [5]
Websocket	WebSocket URI	[6]
UPnP	uuid:device-uuid	[1]
vendor-defined	vendor-defined	

The following is an example where the [AppInfoList](#) state variable contains information about two applications, "SimpleMediaPlayer" and "AdvancedMediaPlayer".

Example:

```
<?xml version="1.0" encoding="UTF-8"?>
<AppInfoList
  xmlns="urn:schemas-upnp-org:ms:AppInfoList"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="
    urn:schemas-upnp-org:ms:AppInfoList
    http://www.upnp.org/schemas/ms/AppInfoList.xsd">
  <application id="F58E1D3B-859A-40EC-928E-A5889EF0B458">
    <marketAppID market="MyAppStore" version="1">
      SimpleMediaPlayer/OSZ/64bit/v1</marketAppID>
    <friendlyName>Simple Media Player</friendlyName>
    <runningStatus>Inactive</runningStatus>
    <usagePolicy>No_Restriction</usagePolicy>
  </application>
  <application id="CB0D5D97-29F9-488B-AE6B-7D6B4136112B">
    <marketAppID market="MyAppStore" version="1">
      AdvancedMediaPlayer/OSZ/64bit/v1</marketAppID>
    <friendlyName>Advanced Media Player</friendlyName>
    <runningStatus>Running</runningStatus>
    <usagePolicy>No_Restriction</usagePolicy>
    <apptoAppInfo>
      <matchingProtocolName>HTTP_UPnP.org_v1</matchingProtocolName>
      <protocol required="1">HTTP</protocol>
      <connectionAddress>
        http://192.168.0.50:34567/apps/AdvancedMediaPlayer/connect
      </connectionAddress>
    </apptoAppInfo>
  </application>
</AppInfoList>
```

The following is an example where the [AppInfoList](#) state variable contains information about an application called, “MediaRendererApp”. This app implements a UPnP MediaRenderer:3 device [8].

Example:

```
<?xml version="1.0" encoding="UTF-8"?>
<AppInfoList
  xmlns="urn:schemas-upnp-org:ms:AppInfoList"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="
    urn:schemas-upnp-org:ms:AppInfoList
    http://www.upnp.org/schemas/ms/AppInfoList.xsd">
  <application id="5E0E4EC1-6CC4-4D12-9995-7F996B709726">
    <marketAppID market="MyAppStore" version="1">
      MediaRendererApp/OSZ/64bit/v1</marketAppID>
    <friendlyName>Media Renderer</friendlyName>
    <function org="upnp.org">
      urn:schemas-upnp-org:device:MediaRenderer:3
    </function>
    <runningStatus>Running</runningStatus>
    <usagePolicy>No_Restriction</usagePolicy>
    <apptoAppInfo>
      <matchingProtocolName>UPnP_3</matchingProtocolName>
      <protocol required="1">XMPP</protocol>
      <connectionAddress>
        uuid:18306773-E98C-4309-A5FB-EEB38C2A1F75
      </connectionAddress>
    </apptoAppInfo>
  </application>
</AppInfoList>
```

5.3.3 A ARG TYPE AppInfo

This required state variable provides type information for arguments in various actions. The state variable shall be an XML fragment of the XML document for the [AppInfoList](#) state

variable (see subclause 5.3.2). It shall contain zero or more [<application>](#) element(s), its (their) attributes and sub-elements which depend on the invoked actions.

5.3.4 [SupportedTargetFields](#)

This required state variable provides an unordered CSV list of the searchable fields by the [GetAppIDList\(\)](#) action (see subclause 5.5.3), that is, elements or attributes of the [AppInfoList](#) state variable of the Screen Device. The value which each component of the CSV list is allowed to have is any element name without its parent element name, or any attribute name following its element name without its parent element name. For example, [usagePolicy](#), [alternativeID@org](#) and so on. This state variable shall contain the required fields in Table 7. The required fields can be expanded in future versions of the specification.

Table 7 — Required fields for [SupportedTargetFields](#)

Value	Parameter in AppInfoList	R/A
friendlyName	application::friendlyName	R
matchingProtocolName	application::apptoAppInfo::matchingProtocolName	R

5.3.5 [A_ARG_TYPE_Target](#)

This required state variable provides type information the [Target](#) input argument in the [GetAppIDList\(\)](#) action (see subclause 5.5.3)

5.3.6 [A_ARG_TYPE_TargetFields](#)

This required state variable provides type information for the [TargetFields](#) input argument in the [GetAppIDList\(\)](#) action (see subclause 5.5.3). This state variable is an unordered CSV list of the values in the CSV list of the [SupportedTargetFields](#) state variable.

5.3.7 [RunningAppList](#)

This required state variable provides a list of running applications for the [RunningAppList](#) output argument in the [GetRunningAppList\(\)](#) action and eventing. The state variable is a CSV list of the [@id](#) values of the [<application>](#) elements of which their [<runningStatus>](#) value are set to ["Running"](#) in the [AppInfoList](#) state variable (see subclause 5.3.2). This state variable shall have an empty string when there are no applications with the [<runningStatus>](#) element set to ["Running"](#).

5.3.8 [A_ARG_TYPE_URI](#)

This allowed state variable provides type information for the [StartURI](#) input argument in the [StartAppByURI\(\)](#) action (see subclause 5.5.7). This state variable shall be properly escaped as described in [4]. In addition, it shall be escaped according to the requirements in [5].

5.3.9 [A_ARG_TYPE_Parameters](#)

This required state variable provides type information for the [StartParameters](#) input arguments in various actions (see subclauses 5.5.6 and 5.5.7). The arguments are used for the according actions to be successfully accepted, and the proper values are application-specific.

5.4 Eventing and Moderation

Table 8 — Event moderation

Variable Name	Evented	Moderated Event	Min Event Interval ^a (seconds)	Logical Combination	Min Delta per Event ^b
<u>A_ARG_TYPE_AppIDs</u>	<u>NO</u>	<u>NO</u>			
<u>AppInfoList</u>	<u>NO</u>	<u>NO</u>			
<u>A_ARG_TYPE_AppInfo</u>	<u>NO</u>	<u>NO</u>			
<u>SupportedTargetFields</u>	<u>NO</u>	<u>NO</u>			
<u>A_ARG_TYPE_Target</u>	<u>NO</u>	<u>NO</u>			
<u>A_ARG_TYPE_TargetFields</u>	<u>NO</u>	<u>NO</u>			
<u>RunningAppList</u>	<u>YES</u>	<u>YES</u>	0.2		
<u>A_ARG_TYPE_URI</u>	<u>NO</u>	<u>NO</u>			
<u>A_ARG_TYPE_Parameters</u>	<u>NO</u>	<u>NO</u>			
<i>Non-standard state variables implemented by a UPnP vendor go here</i>	<i>TBD</i>	<i>TBD</i>	<i>TBD</i>	<i>TBD</i>	<i>TBD</i>
^a Max event rate is determined by N , where $Rate = 1/N$, where N is the Min Event Interval in seconds. ^b $(N) * (\text{allowedValueRange Step})$					

5.5 Actions

The following tables and subclauses define the various ApplicationManagement service actions.

Except where noted, if an invoked action returns an error, the state of the device will be unaffected.

Table 9 — Actions

Name	R/A ^a	Control Point R/A ^b
<u>GetAppInfoByIds()</u>	<u>R</u>	<u>R</u>
<u>GetSupportedTargetFields()</u>	<u>R</u>	<u>A</u>
<u>GetAppIDList()</u>	<u>R</u>	<u>R</u>
<u>GetRunningAppList()</u>	<u>R</u>	<u>A</u>
<u>GetRunningStatus()</u>	<u>R</u>	<u>A</u>
<u>StartAppById()</u>	<u>R</u>	<u>A</u>
<u>StartAppByURI()</u>	<u>A</u>	<u>A</u>
<u>StopApp()</u>	<u>A</u>	<u>A</u>
<u>GetAppConnectionInfo()</u>	<u>A</u>	<u>A</u>
<i>Non-standard actions implemented by an UPnP vendor go here.</i>	<u>X</u>	<u>X</u>
^a For a device this column indicates whether the action shall be implemented or not, where <u>R</u> = required, <u>A</u> = allowed, <u>CR</u> = conditionally required, <u>CA</u> = conditionally allowed, <u>X</u> = Non-standard, add <u>-D</u> when deprecated (e.g., <u>R-D</u> , <u>A-D</u>). ^b For a control point this column indicates whether a control point shall be capable of invoking this action, where <u>R</u> = required, <u>A</u> = allowed, <u>CR</u> = conditionally required, <u>CA</u> = conditionally allowed, <u>X</u> = Non-standard, add <u>-D</u> when deprecated (e.g., <u>R-D</u> , <u>A-D</u>). ^c See action description for conditions under which implementation of this action is required. ^d See action description for conditions under which implementation of this action is allowed. If the condition is not met implementation of this action is not allowed.		

Note that non-standard actions shall be implemented in such a way that they do not interfere with the basic operation of the ApplicationManagement service, that is: these actions shall be allowed and do not need to be invoked for the ApplicationManagement service to operate normally.

5.5.1 GetAppInfoByIds()

This required action enables a Screen Control Point to retrieve information of applications which are specified by the AppIDs input argument.

5.5.1.1 Arguments

- AppIDs: Specifies applications to retrieve their information. See subclause 5.3.1. The special value "*" means everything, i.e., the whole AppInfoList state variable will be retrieved.
- AppInfo: an XML fragment of the AppInfoList state variable (see subclauses 5.3.2 and 5.3.3). It shall contain the <application> elements (of which their @id values are identical to the values of the AppIDs input argument), and all their supported attributes and sub-elements. If any value of the AppIDs input argument is not valid, it shall return either error code 701 or respond with an AppInfo output argument containing <application> elements corresponding only to the valid values of the AppIDs input argument. The number of <application> elements of the AppInfo output argument shall be less than or equal to the number of application@ids included in the AppIDs input argument.

Table 10 — Arguments for GetAppInfoByIds()

Argument	Direction	Related State Variable
<u>AppIDs</u>	<u>IN</u>	<u>A_ARG_TYPE_AppIDs</u>
<u>AppInfo</u>	<u>OUT</u>	<u>A_ARG_TYPE_AppInfo</u>

5.5.1.2 Dependency on State

None.

5.5.1.3 Effect on State

None.

5.5.1.4 Errors

Table 11 — Error Codes for GetAppInfoByIds()

errorCode	errorDescription	Description
400-499	TBD	See clause 3 in the UPnP Device Architecture [1].
500-599	TBD	See clause 3 in the UPnP Device Architecture [1].
600-699	TBD	See clause 3 in the UPnP Device Architecture [1].
701	Invalid ID	One or more of the <u>@ids</u> in the <u>AppIDs</u> are not valid.
702	Too many IDs	Too many <u>@ids</u> specified in the <u>AppIDs</u> .

5.5.2 GetSupportedTargetFields()

This required action enables a Screen Control Point to retrieve the SupportedTargetFields state variable. This action is used to list the values that are allowed to be used for the TargetFields input argument in the GetAppIDList() action (see subclause 5.5.3) on the Screen Device.

5.5.2.1 Arguments**Table 12 — Arguments for GetSupportedTargetFields()**

Argument	Direction	Related State Variable
<u>SupportedTargetFields</u>	<u>OUT</u>	<u>SupportedTargetFields</u>

5.5.2.2 Dependency on State

None.

5.5.2.3 Effect on State

None.

5.5.2.4 Errors**Table 13 — Error Codes for GetSupportedTargetFields()**

errorCode	errorDescription	Description
400-499	TBD	See clause 3 in the UPnP Device Architecture [1].
500-599	TBD	See clause 3 in the UPnP Device Architecture [1].
600-699	TBD	See clause 3 in the UPnP Device Architecture [1].

5.5.3 GetAppIDList()

This required action enables a Screen Control Point to retrieve a CSV list of the @id values of specific <application> elements in the AppInfoList state variable on the Screen Device. The <application> elements of the returned application@id values shall have a sub-string(s) matched to the specified string by the Target input argument (see subclause 5.3.5) among any of their sub-elements specified by the TargetFields input argument.

The allowed values for the TargetFields input argument are listed in the SupportedTargetFields state variable (see subclauses 5.3.4 and 5.3.6).

5.5.3.1 Arguments**Table 14 — Arguments for GetAppIDList()**

Argument	Direction	Related State Variable
<u>Target</u>	<u>IN</u>	<u>A_ARG_TYPE Target</u>
<u>TargetFields</u>	<u>IN</u>	<u>A_ARG_TYPE TargetFields</u>
<u>AppIDs</u>	<u>OUT</u>	<u>A_ARG_TYPE AppIDs</u>

5.5.3.2 Dependency on State

None.

5.5.3.3 Effect on State

None.

5.5.3.4 Errors**Table 15 — Error Codes for GetAppIDList()**

errorCode	errorDescription	Description
400-499	TBD	See clause 3 in the UPnP Device Architecture [1].
500-599	TBD	See clause 3 in the UPnP Device Architecture [1].
600-699	TBD	See clause 3 in the UPnP Device Architecture [1].
703	Invalid TargetFields	<u>TargetFields</u> contains unsupported values.

5.5.4 GetRunningAppList()

This required action enables a Screen Control Point to retrieve a list of running applications, i.e., the RunningAppList state variable, on the Screen Device (see subclause 5.3.7).

5.5.4.1 Arguments**Table 16 — Arguments for GetRunningAppList()**

Argument	Direction	Related State Variable
<u>RunningAppList</u>	<u>OUT</u>	<u>RunningAppList</u>

5.5.4.2 Dependency on State

None.

5.5.4.3 Effect on State

None.

5.5.4.4 Errors**Table 17 — Error Codes for GetRunningAppList()**

errorCode	errorDescription	Description
400-499	TBD	See clause 3 in the UPnP Device Architecture [1].
500-599	TBD	See clause 3 in the UPnP Device Architecture [1].
600-699	TBD	See clause 3 in the UPnP Device Architecture [1].

5.5.5 GetRunningStatus()

This required action enables a Screen Control Point to retrieve the running status of applications specified by the AppIDs argument.

5.5.5.1 Arguments

- AppIDs: Specifies applications to retrieve their running status. See subclause 5.3.1.
- RunningStatus: an XML fragment of the AppInfoList state variable (see subclauses 5.3.2 and 5.3.3). It shall contain the <application> elements (of which their @id values are identical to the values of the AppIDs input argument), their attributes, and their <runningStatus> sub-elements. If any value of the AppIDs input argument is not valid, it shall return either error code 701 or respond with a RunningStatus output argument containing <application> elements corresponding only to the valid values of the AppIDs input argument. The number of <application> elements of the RunningStatus output argument shall be less than or equal to the number of application@ids included in the AppIDs input argument.

Table 18 — Arguments for GetRunningStatus()

Argument	Direction	Related State Variable
<u>AppIDs</u>	<u>IN</u>	<u>A_ARG_TYPE_AppIDs</u>
<u>RunningStatus</u>	<u>OUT</u>	<u>A_ARG_TYPE_AppInfo</u>

5.5.5.2 Dependency on State

None.

5.5.5.3 Effect on State

None.

5.5.5.4 Errors

Table 19 — Error Codes for GetRunningStatus()

errorCode	errorDescription	Description
400-499	TBD	See clause 3 in the UPnP Device Architecture [1].
500-599	TBD	See clause 3 in the UPnP Device Architecture [1].
600-699	TBD	See clause 3 in the UPnP Device Architecture [1].
701	Invalid ID	One or more of the <u>@ids</u> in the <u>AppIDs</u> are not valid.
702	Too many IDs	Too many <u>@ids</u> specified in the <u>AppIDs</u> .

5.5.6 StartAppByID()

This required action runs an application of which its information is contained in the AppInfoList state variable on the Screen Device when successfully accepted. In addition, this action can be used to provide the StartParameters on an application in a status of “Transitioning Pending Input” or “Running”.

5.5.6.1 Arguments

- AppID: Specifies the application to be started. See subclause 5.3.1. This argument shall contain only a single application@id value.
- StartParameters: see subclause 5.3.9.

Table 20 — Arguments for StartAppByID()

Argument	Direction	Related State Variable
<u>AppID</u>	<u>IN</u>	<u>A_ARG_TYPE_AppIDs</u>
<u>StartParameters</u>	<u>IN</u>	<u>A_ARG_TYPE_Parameters</u>

5.5.6.2 Dependency on State

None.

5.5.6.3 Effect on State

This action will affect the AppInfoList state variable. This action changes the AppInfoList::application::runningStatus value of “Inactive” to “Running”. If it takes a noticeable amount of time before a human user is actually served by an application, it may temporarily enter “Transitioning” status before entering “Running”.

If a Screen Device requests user input during starting an application, it enters the “Transitioning Pending Input” before entering “Running”. Once the user input is provided (possibly by invoking this action again with a StartParameters), the status will change to “Running”.

Consequently, this action will also affect the RunningAppList state variable. The AppInfoList::application@id of the application will be included in the RunningAppList state variable when its AppInfoList::application::runningStatus is set to “Running”.

5.5.6.4 Errors

Table 21 — Error Codes for StartAppByID()

Error Code	Error Description	Description
400-499	TBD	See clause 3 in the UPnP Device Architecture [1].
500-599	TBD	See clause 3 in the UPnP Device Architecture [1].
600-699	TBD	See clause 3 in the UPnP Device Architecture [1].
701	Invalid ID	One or more of the <u>@ids</u> in the <u>AppIDs</u> are not valid.
702	Too many IDs	Too many <u>@ids</u> specified in the <u>AppIDs</u> , i.e. more than one.

Error Code	Error Description	Description
704	Invalid Parameter	Application cannot start due that the specified parameter is invalid
705	Application is running	Application's <runningStatus> is already "Running" and no StartParameters specified.
706	Rejected	This request is rejected, e.g., by Screen Device implementation or end user.
712	No such Application is installed	Any of applications' <installationStatus>s is not "Installed", and installation is required to start.

5.5.7 StartAppbyURI()

This allowed action runs an application by using a URI on the Screen Device when successfully accepted. In addition, this action can be used to provide the StartParameters on an application in a status of "Transitioning Pending Input".

5.5.7.1 Arguments

- **StartURI**: Provides the <startURI> to start an application. See subclause 5.3.8.
- **AppInfo**: an XML fragment of the AppInfoList state variable (see subclauses 5.3.2 and 5.3.3). Provides the additional information for the application to be started. The <friendlyName> is required.
- **StartParameters**: see subclause 5.3.9.
- **AppID**: Provides the newly-assigned application@id value, or the @id value of the <application> of which its <startURI> is identical to the StartURI input argument. This argument shall contain only a single application@id value.

When an application can be started without being installed, by using a URI, i.e. a Web-application, and the Screen Device does not have the <startURI> in its AppInfoList state variable, then this action shall be invoked to start the application on the Screen Device. If the action is successfully accepted, the Screen Device shall follow the procedures as below:

- create a new <application> element in its AppInfoList state variable. The new <application> shall include the <startURI> and the additional information provided by the StartURI and AppInfo input arguments.
- assign a new value for the application@id attribute.
- return the AppID output argument of the newly-assigned application@id value.

Table 22 — Arguments for StartAppByURI()

Argument	Direction	Related State Variable
StartURI	IN	A_ARG_TYPE_URI
AppInfo	IN	A_ARG_TYPE_AppInfo
StartParameters	IN	A_ARG_TYPE_Parameters
AppID	OUT	A_ARG_TYPE_AppIDs

5.5.7.2 Dependency on State

None.

5.5.7.3 Effect on State

This action will affect the AppInfoList state variable. This action adds a new <application> element in the AppInfoList state variable if there is no <application> element of which its <startURI> is identical to the StartURI input argument. Its AppInfoList::application::runningStatus value will be "Running". If it takes a noticeable amount of time before a human user is actually served by an application, it may temporarily enter "Transitioning" status before entering "Running".

If a Screen Device requests user input during starting an application, it enters the "Transitioning Pending Input" before entering "Running". Once the user input is provided

(possibly by invoking this action again with a [StartParameters](#)), the status will change to ["Running"](#).

Consequently, this action will also affect the [RunningAppList](#) state variable. The [AppInfoList::application@id](#) of the application will be included in the [RunningAppList](#) state variable when its [AppInfoList::application::runningStatus](#) is set to ["Running"](#).

5.5.7.4 Errors

Table 23 — Error Codes for [StartAppByURI\(\)](#)

Error Code	Error Description	Description
400-499	TBD	See clause 3 in the UPnP Device Architecture [1].
500-599	TBD	See clause 3 in the UPnP Device Architecture [1].
600-699	TBD	See clause 3 in the UPnP Device Architecture [1].
704	Invalid Parameter	Application cannot start due that the specified parameter is invalid
705	Application is running	Application is already running and no StartParameters specified.
706	Rejected	This request is rejected, e.g., by Screen Device implementation or end user.
707	Invalid URI	The StartURL is invalid, e.g., does not represent an endpoint that can be started.
708	Invalid AppInfo	AppInfo is invalid.
717	Installation required	The application is required to be installed before it can be started.

5.5.8 [StopApp\(\)](#)

This allowed action stops applications specified by the [AppIDs](#) input argument on the Screen Device when successfully accepted.

5.5.8.1 Arguments

- [AppIDs](#): Specifies the applications to be stopped. See subclause 5.3.1.
- [StoppedAppIDs](#): The list of the [application@id](#) values of the stopped applications among the requested ones shall be returned with the [StoppedAppIDs](#) output argument. If any value of the [AppIDs](#) input argument is not valid, it shall return either error code 701 or respond with a [StoppedAppIDs](#) output argument containing [application@ids](#) which are valid and stopped by this action invocation. The output argument shall have an empty string when all values of the [AppIDs](#) input argument are valid but no application is stopped by this action invocation.

Table 24 — Arguments for [StopApp\(\)](#)

Argument	Direction	Related State Variable
AppIDs	IN	A_ARG_TYPE_AppIDs
StoppedAppIDs	OUT	A_ARG_TYPE_AppIDs

5.5.8.2 Dependency on State

None.

5.5.8.3 Effect on State

This action will affect the [AppInfoList](#) state variable. This action changes the [AppInfoList::application::runningStatus](#) value to ["Inactive"](#).

Consequently, this action will also affect the [RunningAppList](#) state variable. The [AppInfoList::application@id](#) of the application will be excluded from the [RunningAppList](#) state variable when its [AppInfoList::application::runningStatus](#) is set to any other value than ["Running"](#).

5.5.8.4 Errors

Table 25 — Error Codes for StopApp()

Error Code	Error Description	Description
400-499	TBD	See clause 3 in the UPnP Device Architecture [1].
500-599	TBD	See clause 3 in the UPnP Device Architecture [1].
600-699	TBD	See clause 3 in the UPnP Device Architecture [1].
701	Invalid ID	One or more of the <u>@ids</u> in the <u>AppIDs</u> are not valid.
706	Rejected	This request is rejected, e.g., by Screen Device implementation or end user.
709	No such Application is running	Any of applications' <u><runningStatus></u> s is not " <u>Running</u> ".
710	Not stoppable application	Any of applications listed by the <u>@ids</u> in the <u>AppIDs</u> cannot be stopped.

5.5.9 GetAppConnectionInfo()

This allowed action enables a Screen Control Point to retrieve the app-to-app connection information of applications specified by the AppIDs input argument.

5.5.9.1 Arguments

- AppIDs: Specifies the application to retrieve their app-to-app connection information. See subclause 5.3.1.
- ConnectionInfo: an XML fragment of the AppInfoList state variable (see subclauses 5.3.2 and 5.3.3). It shall contain <application> elements (of which their @id values are identical to the values of the AppIDs input arguments), their attributes, and their <apptoAppInfo> sub-elements if supported. If the <apptoAppInfo> sub-element of an <application> element is not supported, then it shall contain <application> and its attribute only. If any value of the AppIDs input argument is not valid, it shall return either error code 701 or respond with a ConnectionInfo output argument containing <application> elements corresponding only to the valid values of the AppIDs input argument. The number of <application> elements of the ConnectionInfo output argument shall be less than or equal to the number of application@ids included in the AppIDs input argument.

Table 26 — Arguments for GetAppConnectionInfo()

Argument	Direction	Related State Variable
<u>AppIDs</u>	<u>IN</u>	<u>A_ARG_TYPE_AppIDs</u>
<u>ConnectionInfo</u>	<u>OUT</u>	<u>A_ARG_TYPE_AppInfo</u>

5.5.9.2 Dependency on State

None.

5.5.9.3 Effect on State

None.

5.5.9.4 Errors

Table 27 — Error Codes for GetAppConnectionInfo()

errorCode	errorDescription	Description
400-499	TBD	See clause 3 in the UPnP Device Architecture [1].
500-599	TBD	See clause 3 in the UPnP Device Architecture [1].
600-699	TBD	See clause 3 in the UPnP Device Architecture [1].
701	Invalid ID	One or more of the <u>@ids</u> in the <u>AppIDs</u> are not valid.

errorCode	errorDescription	Description
709	No such Application is running	Any of applications' <runningStatus>s is not "Running".

5.5.10 Non-Standard Actions Implemented by a UPnP Vendor

To facilitate certification, non-standard actions implemented by a UPnP vendor shall be included in the device's service template. The UPnP Device Architecture lists naming requirements for non-standard actions (see clause 2 of the UPnP Device Architecture specification [1]).

5.5.11 Common Error Codes

The following table lists error codes common to actions for this service type. If a given action results in multiple errors, the most specific error shall be returned.

Table 28 — Common Error Codes

errorCode	errorDescription	Description
400-499	TBD	See clause 3 in the UPnP Device Architecture [1].
500-599	TBD	See clause 3 in the UPnP Device Architecture [1].
600-699	TBD	See clause 3 in the UPnP Device Architecture [1].
701	Invalid ID	One or more of the @ids in the AppIDs are not valid.
702	Too many IDs	Too many @ids specified in the AppIDs.
703	Invalid TargetFields	TargetFields contains unsupported values.
704	Invalid Parameter	The specified parameter is invalid
705	Application is running	Application is already running.
706	Rejected	This request is rejected, e.g., by Screen Device implementation or end user.
707	Invalid URI	The specified URL is invalid.
708	Invalid AppInfo	AppInfo is invalid.
709	No such Application is running	Any of applications' <runningStatus>s is not "Running".
710	Not stoppable application	Any of applications listed by the @ids in the AppIDs cannot be stopped.
712	No such Application is installed	Any of applications' <installationStatus>s is not "Installed".
717	Installation required	The application is required to be installed before it can be started.

Note: The errorDescription field returned by an action does not necessarily contain human-readable text (for example, as indicated in the second column of the Error Code tables). It can contain machine-readable information that provides more detailed information about the error. It is therefore not advisable for a control point to blindly display the errorDescription field contents to the user.

Note that 800-899 Error Codes are not permitted for standard actions. See subclause 3.3.2 of the UPnP Device Architecture specification [1] for more details.

6 XML Service Description

```
<?xml version="1.0"?>
<scpd xmlns="urn:schemas-upnp-org:service-1-0">
  <specVersion>
    <major>1</major>
    <minor>0</minor>
  </specVersion>
  <actionList>
```

```

<action>
  <name>GetAppInfoByIDs</name>
  <argumentList>
    <argument>
      <name>AppIDs</name>
      <direction>in</direction>
      <relatedStateVariable>
        A ARG TYPE AppIDs
      </relatedStateVariable>
    </argument>
    <argument>
      <name>AppInfo</name>
      <direction>out</direction>
      <relatedStateVariable>
        A ARG TYPE AppInfo
      </relatedStateVariable>
    </argument>
  </argumentList>
</action>
<action>
  <name>GetSupportedTargetFields</name>
  <argumentList>
    <argument>
      <name>SupportedTargetFields</name>
      <direction>out</direction>
      <relatedStateVariable>
        SupportedTargetFields
      </relatedStateVariable>
    </argument>
  </argumentList>
</action>
<action>
  <name>GetAppIDList</name>
  <argumentList>
    <argument>
      <name>Target</name>
      <direction>in</direction>
      <relatedStateVariable>
        A ARG TYPE Target
      </relatedStateVariable>
    </argument>
    <argument>
      <name>TargetFields</name>
      <direction>in</direction>
      <relatedStateVariable>
        A ARG TYPE TargetFields
      </relatedStateVariable>
    </argument>
    <argument>
      <name>AppIDs</name>
      <direction>out</direction>
      <relatedStateVariable>
        A ARG TYPE AppIDs
      </relatedStateVariable>
    </argument>
  </argumentList>
</action>
<action>
  <name>GetRunningAppList</name>
  <argumentList>
    <argument>
      <name>RunningAppList</name>
      <direction>out</direction>
      <relatedStateVariable>
        RunningAppList
      </relatedStateVariable>
    </argument>
  </argumentList>
</action>

```

```

<action>
  <name>GetRunningStatus</name>
  <argumentList>
    <argument>
      <name>AppIDs</name>
      <direction>in</direction>
      <relatedStateVariable>
        A ARG TYPE AppIDs
      </relatedStateVariable>
    </argument>
    <argument>
      <name>RunningStatus</name>
      <direction>out</direction>
      <relatedStateVariable>
        A ARG TYPE AppInfo
      </relatedStateVariable>
    </argument>
  </argumentList>
</action>
<action>
  <name>StartAppByID</name>
  <argumentList>
    <argument>
      <name>AppID</name>
      <direction>in</direction>
      <relatedStateVariable>
        A ARG TYPE AppIDs
      </relatedStateVariable>
    </argument>
    <argument>
      <name>StartParameters</name>
      <direction>in</direction>
      <relatedStateVariable>
        A ARG TYPE Parameters
      </relatedStateVariable>
    </argument>
  </argumentList>
</action>
<action>
  <name>StartAppByURI</name>
  <argumentList>
    <argument>
      <name>StartURI</name>
      <direction>in</direction>
      <relatedStateVariable>
        A ARG TYPE URI
      </relatedStateVariable>
    </argument>
    <argument>
      <name>AppInfo</name>
      <direction>in</direction>
      <relatedStateVariable>
        A ARG TYPE AppInfo
      </relatedStateVariable>
    </argument>
    <argument>
      <name>StartParameters</name>
      <direction>in</direction>
      <relatedStateVariable>
        A ARG TYPE Parameters
      </relatedStateVariable>
    </argument>
    <argument>
      <name>AppID</name>
      <direction>out</direction>
      <relatedStateVariable>
        A ARG TYPE AppIDs
      </relatedStateVariable>
    </argument>
  </argumentList>

```

```

    </argumentList>
  </action>
  <action>
    <name>StopApp</name>
    <argumentList>
      <argument>
        <name>AppIDs</name>
        <direction>in</direction>
        <relatedStateVariable>
          A ARG TYPE AppIDs
        </relatedStateVariable>
      </argument>
      <argument>
        <name>StoppedAppIDs</name>
        <direction>out</direction>
        <relatedStateVariable>
          A ARG TYPE AppIDs
        </relatedStateVariable>
      </argument>
    </argumentList>
  </action>
  <action>
    <name>GetAppConnectionInfo</name>
    <argumentList>
      <argument>
        <name>AppIDs</name>
        <direction>in</direction>
        <relatedStateVariable>
          A ARG TYPE AppIDs
        </relatedStateVariable>
      </argument>
      <argument>
        <name>ConnectionInfo</name>
        <direction>out</direction>
        <relatedStateVariable>
          A ARG TYPE AppInfo
        </relatedStateVariable>
      </argument>
    </argumentList>
  </action>
  <!--Declarations for other actions added by UPnP vendor
  (if any) go here-->
</actionList>
<serviceStateTable>
  <stateVariable sendEvents="no">
    <name>A ARG TYPE AppIDs</name>
    <dataType>string</dataType>
  </stateVariable>
  <stateVariable sendEvents="no">
    <name>AppInfoList</name>
    <dataType>string</dataType>
  </stateVariable>
  <stateVariable sendEvents="no">
    <name>A ARG TYPE AppInfo</name>
    <dataType>string</dataType>
  </stateVariable>
  <stateVariable sendEvents="no">
    <name>SupportedTargetFields</name>
    <dataType>string</dataType>
  </stateVariable>
  <stateVariable sendEvents="no">
    <name>A ARG TYPE Target</name>
    <dataType>string</dataType>
  </stateVariable>
  <stateVariable sendEvents="no">
    <name>A ARG TYPE TargetFields</name>
    <dataType>string</dataType>
  </stateVariable>
  <stateVariable sendEvents="yes">

```



```

    <name>RunningAppList</name>
    <dataType>string</dataType>
  </stateVariable>
  <stateVariable sendEvents="no">
    <name>A_ARG_TYPE_URI</name>
    <dataType>string</dataType>
  </stateVariable>
  <stateVariable sendEvents="no">
    <name>A_ARG_TYPE_Parameters</name>
    <dataType>string</dataType>
  </stateVariable>
  <!--Declarations for other state variables added by
UPnP vendor (if any) go here-->
</serviceStateTable>
</scpd>

```

7 Test

No semantic tests have been specified for this service.

