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**Information technology — UPnP  
Device Architecture —**

**Part 30-1:  
IoT management and control device  
control protocol — IoT management  
and control architecture overview**

*Technologies de l'information — Architecture de dispositif UPnP —*

*Partie 30-1: Protocole de contrôle de dispositif de gestion et de  
contrôle de l'Internet des objets — Aperçu général de l'architecture de  
gestion et de contrôle de l'Internet des objets*



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ISO/IEC 29341-30-1 was prepared by UPnP Forum and adopted, under the PAS procedure, by joint technical committee ISO/IEC JTC 1, *Information technology*, in parallel with its approval by national bodies of ISO and IEC.

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

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**Original UPnP Document**

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

<b>UPnP Document Title</b>	<b>ISO/IEC 29341 Part</b>
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
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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
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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

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

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

### 1.1 Introduction

This document describes the overall UPnP IoTManagementAndControl Architecture, which forms the foundation for the UPnP IoTManagementAndControl device [11] and UPnP DataStore service [13] specifications. The IoTManagementAndControl device hosts services to bridge sensor devices connected to both UPnP networks as well as non-UPnP based networks. The DataStore service provides persistent retention and distribution of both sensor data as well as data from mobile devices which may leave the UPnP network at any time. This service can be hosted within the UPnP IoTManagementAndControl device as well as within other UPnP compliant devices.

### 1.2 Goals

The UPnP IoTManagementAndControl Architecture was explicitly defined to meet the following goals:

- Describe sensors and actuators residing on both UPnP and non-UPnP networks.
- Provide data transport services for sensors and actuators to UPnP network clients.
- Define a service to describe, retain and distribute data received from sensors as well as other non-persistent data sources.
- Define an allowed device protection model for both the sensor and data retention components.

### 1.3 Non-Goals

The following are not initial goals of the IoTManagementAndControl architecture:

- Low-level control of bridged networks  
The initial version of UPnP IoTManagementAndControl treats Sensors and Actuators as abstract data sources and sinks and does not expose details or provide direct access to bridging network protocols. Low-level control of selected bridged network protocols will be considered in subsequent versions of the architecture.
- Low-latency control of sensors and actuators  
The initial version of UPnP IoTManagementAndControl treats sensors and actuators as autonomous objects requiring relatively infrequent supervision from home-network clients. Closed loop control of sensor and actuator pairs is better accomplished directly within the internal vendor-device sensor/actuator architecture with UPnP home-network clients providing overall supervision. However, UPnP IoTManagementAndControl does support sensors which have substantial throughput requirements using transport connections.

## 1.4 IoTManagementAndControl and DataStore Specification Map

### IoTManagementAndControl Architecture Overview [10]

- Sensor Discovery and Description
  - IoTManagementAndControl Detail Overview
  - Sensor Protection Model
  - DataStore Detail Overview
  - DataStore Protection Model
  - Dataltem Description and Semantics
  - Sample Implementation Theory of Operation

### IoTManagementAndControl Device

#### IoTManagementAndControl Device Specification [11]

- Sensor Components High-Level Overview
- IoTManagementAndControl Required/Allowed Services

IoTManagementAndControl Specification [14]	Sensor	DataModel	Service
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- Sensor Discovery and Description
  - Sensor URN Description
  - Sensor Event Model Description
  - ConfigurationManagement service action(s)
  - Mandatory Dataltem(s)
  - Common Sensor Collection types
  - Sensor Data Model
  - IEEE-11073 Medical Device Data Model

#### SensorTransportGeneric Service Specification [12]

- Sensor Transport (SOAP/HTTP)
  - Sensor Transport action(s)
  - Sensor Data Record(s)

#### DataStore Service Specification [13]

- Persistent Data Retention
  - DataStore URN Description
  - DataStore (LastChange) Event Model
  - DataStore action(s)
  - DataTable schema(s)

#### Device Protection Service Specification [15]

- Device Protection
  - Device Protection action(s)

## 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, June 13, 2000. Available at: [http://upnp.org/specs/arch/UPnPDA10\\_20000613.pdf](http://upnp.org/specs/arch/UPnPDA10_20000613.pdf). Latest version available at: <http://upnp.org/specs/arch/UPnP-arch-DeviceArchitecture-v1.0.pdf>.
- [2] ISO 8601 Data elements and interchange formats – Information interchange -- Representation of dates and times, International Standards Organization, December 21, 2000. Available at: [ISO 8601:2000](http://www.iso.org/iso/8601).
- [3] IETF RFC 2119, Key words for use in RFCs to Indicate Requirement Levels, S. Bradner, 1997. Available at: <http://www.faqs.org/rfcs/rfc2119.html>.
- [4] HyperText Transport Protocol – HTTP/1.1, R. Fielding, J. Gettys, J. Mogul, H. Frystyk, L. Masinter, P. Leach, T. Berners-Lee, June 1999. Available at: <http://www.ietf.org/rfc/rfc2616.txt>.
- [5] IETF RFC 3339, Date and Time on the Internet: Timestamps, G. Klyne, Clearswift Corporation, C. Newman, Sun Microsystems, July 2002. Available at: <http://www.ietf.org/rfc/rfc3339.txt>.
- [6] Extensible Markup Language (XML) 1.0 (Third Edition), François Yergeau, Tim Bray, Jean Paoli, C. M. Sperberg-McQueen, Eve Maler, eds., W3C Recommendation, February 4, 2004. Available at: <http://www.w3.org/TR/2004/REC-xml-20040204>.
- [7] XML Schema Part 2: Data Types, Second Edition, Paul V. Biron, Ashok Malhotra, W3C Recommendation, 28 October 2004. Available at: <http://www.w3.org/TR/2004/REC-xmlschema-2-20041028>.
- [8] XML Path Language (XPath) Version 1.0. James Clark, Steve DeRose, W3C Recommendation 16 November 1999. Available from: <http://www.w3.org/TR/1999/REC-xpath-19991116>.
- [9] ISO/IEEE-11073-20601 Health informatics - Personal health device communication - Part 20601: Application Profile - Optimized exchange protocol, 2010. Available at: <http://www.iso.org/iso/search.htm?qt=11073&searchSubmit=Search&sort=rel&type=simple&published=true>
- [10] UPnP Sensor and DataStore Architecture Overview, UPnP Forum, July 1, 2013. Available at: <http://www.upnp.org/specs/smg/UPnP-smgt-IoTManagementAndControlArchitectureOverview-v1-20130701.pdf>. Latest version available at: <http://www.upnp.org/specs/smg/UPnP-smgt-IoTManagementAndControlArchitectureOverview-v1.pdf>.
- [11] UPnP IoTManagementAndControl:1 Device, UPnP Forum July 1, 2013. Available at: <http://www.upnp.org/specs/smg/UPnP-smgt-IoTManagementAndControl-v1-Device-20130701.pdf>. Latest version available at: <http://www.upnp.org/specs/smg/UPnP-smgt-IoTManagementAndControl-v1-Device.pdf>.
- [12] UPnP SensorTransportGeneric:1 Service, UPnP Forum July 1, 2013. Available at: <http://www.upnp.org/specs/smg/UPnP-smgt-SensorTransportGeneric-v1-Service-20130701.pdf>. Latest version available at: <http://www.upnp.org/specs/smg/UPnP-smgt-SensorTransportGeneric-v1-Service.pdf>.
- [13] UPnP DataStore:1 Service, UPnP Forum, July 1, 2013. Available at: <http://www.upnp.org/specs/smg/UPnP-smgt-DataStore-v1-Service-20130701.pdf>. Latest version available at: <http://www.upnp.org/specs/smg/UPnP-smgt-DataStore-v1-Service.pdf>.

- [14] UPnP IoTManagementAndControl Sensor DataModel Service, UPnP Forum, July 1, 2013. Available at: <http://www.upnp.org/specs/smgt/UPnP-smgt-SensorDataModel-v1-Service-20130701.pdf>. Latest version available at: <http://www.upnp.org/specs/smgt/UPnP-smgt-SensorDataModel-v1-Service.pdf>.
- [15] UPnP DeviceProtection:1 Service, UPnP Forum, February 24, 2011. 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>.
- [16] UPnP ConfigurationManagement:2 Service, UPnP Forum, February 16, 2012. Available at: <http://www.upnp.org/specs/dm/UPnP-dm-ConfigurationManagement-v2-Service-20120216.pdf>. Latest version available at: <http://www.upnp.org/specs/dm/UPnP-dm-ConfigurationManagement-v2-Service.pdf>.
- [17] XML Schema DataStore LastChange Eventing, UPnP Forum, July 1, 2013. Available at: <http://www.upnp.org/schemas/ds/dsevent-v1-20130701.xsd>. Latest version available at: <http://www.upnp.org/schemas/ds/dsevent.xsd>.
- [18] XML Schema UPnP DataStore DataStoreInfo, UPnP Forum, July 1, 2013. Available at: <http://www.upnp.org/schemas/ds/dsinfo-v1-20130701.xsd>. Latest version available at: <http://www.upnp.org/schemas/ds/dsinfo.xsd>.
- [19] XML Schema UPnP DataStore DataTableInfo, UPnP Forum, July 1, 2013. Available at: <http://www.upnp.org/schemas/ds/dtinfo-v1-20130701.xsd>. Latest version available at: <http://www.upnp.org/schemas/ds/dtinfo.xsd>.
- [20] XML Schema UPnP DataStore DataStoreGroups, UPnP Forum, July 1, 2013. Available at: <http://www.upnp.org/schemas/ds/dsgroups-v1-20130701.xsd>. Latest version available at: <http://www.upnp.org/schemas/ds/dsgroups.xsd>.
- [21] XML Schema UPnP DataStore DataRecord, UPnP Forum, July 1, 2013. Available at: <http://www.upnp.org/schemas/ds/drecs-v1-20130701.xsd>. Latest version available at: <http://www.upnp.org/schemas/ds/drecs.xsd>.
- [22] XML Schema UPnP DataStore DataRecordFilter, UPnP Forum, July 1, 2013. Available at: <http://www.upnp.org/schemas/ds/drecfilter-v1-20130701.xsd>. Latest version available at: <http://www.upnp.org/schemas/ds/drecfilter.xsd>.
- [23] XML Schema UPnP DataStore DataRecord Status, UPnP Forum, July 1, 2013. Available at: <http://www.upnp.org/schemas/ds/drecstatus-v1-20130701.xsd>. Latest version available at: <http://www.upnp.org/schemas/ds/drecstatus.xsd>.
- [24] XML Schema UPnP IoTManagementAndControl DataRecord Information, UPnP Forum, July 1, 2013. Available at: <http://www.upnp.org/schemas/smgt/srecinfo-v1-20130701.xsd>. Latest version available at: <http://www.upnp.org/schemas/smgt/srecinfo.xsd>.
- [25] XML Schema UPnP IoTManagementAndControl Sensor DataModel DataItem Description, UPnP Forum, July 1, 2013. Available at: <http://www.upnp.org/schemas/smgt/sdmdid-v1-20130701.xsd>. Latest version available at: <http://www.upnp.org/schemas/smgt/sdmdid.xsd>.