

# ISO/IEC 29341-1-2:2017-06 (E)

## Information technology - UPnP Device Architecture - Part 1-2: UPnP Device Architecture Version 2.0

---

<b>Contents</b>		<b>Page</b>
Introduction .....		1
<b>0</b>	<b>Addressing .....</b>	<b>7</b>
0.1	Determining whether to use Auto-IP .....	7
0.2	Choosing an address .....	7
0.3	Testing the address .....	8
0.4	Forwarding rules .....	8
0.5	Periodic checking for dynamic address availability .....	9
0.6	Device naming and DNS interaction .....	9
0.7	Name to IP address resolution .....	9
0.8	References .....	9
<b>1</b>	<b>Discovery .....</b>	<b>10</b>
1.1	SSDP message format .....	13
1.1.1	SSDP Start-line .....	13
1.1.2	SSDP message header fields .....	13
1.1.3	SSDP header field extensions .....	14
1.1.4	UUID format and recommended generation algorithms .....	14
1.1.5	SSDP processing rules .....	14
1.2	Advertisement .....	15
1.2.1	Advertisement protocols and standards .....	15
1.2.2	Device available - NOTIFY with ssdp:alive .....	16
1.2.3	Device unavailable -- NOTIFY with ssdp:byebye .....	21
1.2.4	Device Update - NOTIFY with ssdp:update .....	23
1.3	Search .....	25
1.3.1	Search protocols and standards .....	25
1.3.2	Search request with M-SEARCH .....	26
1.3.3	Search response .....	29
1.4	References .....	32
<b>2</b>	<b>Description .....</b>	<b>32</b>
2.1	Generic requirements on HTTP usage .....	35
2.2	Generic requirements on XML usage .....	38
2.3	Device description .....	38
2.4	UPnP Device Template .....	43
2.5	Service description .....	44
2.5.1	Defining and processing extended data types .....	51
2.5.2	String equivalents of extended data types .....	52
2.5.3	Generic requirements .....	53
2.5.4	Ordering of Elements .....	53
2.5.5	Versioning .....	54
2.6	UPnP Service Template .....	54
2.7	Non-standard vendor extensions and limitations .....	54
2.7.1	Placement of Additional Elements and Attributes .....	56
2.8	UPnP Device Schema .....	56
2.9	UPnP Service Schema .....	56
2.10	UPnP Datatype Schema .....	56
2.11	Retrieving a description using HTTP .....	57
2.12	References .....	59
<b>3</b>	<b>Control .....</b>	<b>60</b>

3.1	Control protocols .....	63
3.1.1	SOAP Profile .....	63
3.2	Actions .....	67
3.2.1	Action invocation .....	67
3.2.2	Action Response .....	70
3.2.3	UPnP Action Schema .....	72
3.2.4	Recommendations and additional requirements .....	72
3.2.5	Action error response .....	73
3.2.6	UPnP Error Schema .....	76
3.3	Query for variable .....	76
3.4	References .....	77
4	Eventing .....	77
4.1	Unicast eventing .....	78
4.1.1	Subscription .....	79
4.1.2	SUBSCRIBE with NT and CALLBACK .....	81
4.1.3	Renewing a subscription with SUBSCRIBE with SID .....	84
4.1.4	Canceling a subscription with UNSUBSCRIBE .....	85
4.2	Multicast Eventing .....	86
4.3	Event messages .....	88
4.3.1	Error Cases .....	88
4.3.2	Unicast eventing: Event messages: NOTIFY .....	89
4.3.3	Multicast Eventing: Event messages: NOTIFY .....	92
4.4	UPnP Event Schema .....	95
4.5	Augmenting the UPnP Device and Service Schemas .....	95
4.6	References .....	95
5	Presentation .....	96
5.1	References .....	97
Annex A (normative) IP Version 6 Support .....		98
A.0	Note (informative) .....	98
A.1	Introduction .....	98
A.2	General Principles .....	98
A.2.1	UPnP Device Architecture V1.0 .....	98
A.2.2	UPnP Device Architecture V2.0 .....	99
A.2.3	IPv6 and Dual Stack .....	99
A.2.4	Device operation .....	100
A.2.5	Control point operation .....	101
A.3	Addressing .....	101
A.3.1	UPnP Messaging on IPv6 Interfaces .....	101
A.3.2	Summary of boot/startup process .....	102
A.3.3	Address Selection and RFC 6724 .....	102
A.4	Discovery .....	102
A.4.1	OPT and NLS .....	102
A.4.2	Advertisement .....	103
A.4.3	Advertisement: Device unavailable .....	103
A.4.4	Advertisement: Device update .....	104
A.4.5	Search .....	104
A.4.6	Search response .....	104
A.5	Description .....	104
A.6	Control .....	104
A.7	Eventing .....	105
A.8	Presentation .....	105
A.9	References .....	105
A.9.1	Normative .....	105
A.9.2	Informative .....	106
Annex B Schemas .....		107
B.1	UPnP Device Schema .....	107

B.2	UPnP Service Schema .....	111
B.3	UPnP Control Schema .....	115
B.4	UPnP Error Schema .....	116
B.5	UPnP Event Schema .....	117
B.6	UPnP Cloud Schema .....	118
B.7	Schema references .....	119
Annex C Cloud .....		120
C.1	Introduction .....	120
C.1.1	What is UPnP Cloud Technology (UCA)? .....	120
C.1.2	Audience .....	120
C.1.3	In this Annex .....	120
C.1.4	UDA compared to UCA .....	122
C.1.5	UCA General Communications Paths .....	124
C.1.6	UCA Specific Communication Paths .....	125
C.1.7	UCA Steps as Analogies to UDA .....	126
C.2	Terms and Definitions .....	127
C.2.1	Acronyms .....	127
C.2.2	General Cloud Terms and Definitions .....	128
C.2.3	Device and Control Point Terms and Definitions .....	128
C.2.4	Service Terms and Definitions .....	129
C.2.5	Groups .....	129
C.3	References .....	129
C.4	General XMPP Features .....	130
C.4.1	XMPP Jabber IDs or JIDs .....	130
C.5	Creating a Device or Control Point Resource .....	132
C.5.1	Finding a UCS .....	132
C.5.2	Account Creation .....	132
C.5.3	Authentication .....	133
C.5.4	Binding Devices and Control Points as a Resource .....	135
C.5.5	Embedded Devices .....	138
C.6	Presence and Discovery .....	140
C.6.1	Presence (Analog to NOTIFY with ssdp:alive) .....	140
C.6.2	XMPP disco#items (analog to M-SEARCH for users UCCDs and UCC-CPs) .....	144
C.6.3	Presence update (analog to NOTIFY with ssdp:update) .....	145
C.6.4	Presence "unavailable" (Analog to NOTIFY with ssdp:byebye) .....	145
C.6.5	Service Level Discovery .....	146
C.6.6	IQ:Query for DDD and SCPD Exchange (analog of HTTP GET for DDD and SCPD) .....	146
C.7	PubSub (Analog of Eventing) .....	155
C.7.1	Creating the UCCD PubSub structure .....	159
C.7.2	Creating a UCCD PubSub collection .....	161
C.7.3	Publishing a UCCD PubSub event .....	166
C.7.4	Subscribing to a UCCD PubSub collection .....	169
C.7.5	Unsubscribing to a UCCD PubSub collection .....	171
C.7.6	Permissions model .....	173
C.8	SOAP over XMPP (Analog of Control) .....	173
C.9	Support for Binary (Media) Transport .....	177
C.10	UCA errorCodes .....	177
C.11	UCA Schemas .....	178
C.12	Closing a UCA Session .....	178
C.13	UCA over BOSH and WebSocket .....	178
Figure 1: -- Protocol stack .....		1
Figure 1-1: -- Discovery architecture .....		11
Figure 1-2: -- Advertisement protocol stack .....		15
Figure 1-3: -- Initial and repeat announcements, no announcement spreading .....		17
Figure 1-4: -- Initial and repeat announcements, message spreading of repeat announcements .....		18

Figure 1-5: -- Search protocol stack .....	25
Figure 2-1: -- Description architecture .....	33
Figure 2-2: -- Description retrieval protocol stack .....	57
Figure 3-1: -- Control architecture .....	61
Figure 3-2: -- Control protocol stack .....	63
Figure 4-1: -- Unicast eventing architecture .....	78
Figure 4-2: -- Unicast eventing protocol stack .....	79
Figure 4-3: -- Multicast eventing architecture .....	86
Figure 4-4: -- Multicast eventing protocol stack .....	87
Figure 5-1: -- Presentation architecture .....	96
Figure 5-2: -- Presentation protocol stack .....	96
Figure C-1: -- Protocol stacks UDA versus UCA .....	122
Figure C-2: -- Protocol stack UCA UCCD/UCC-CP and UCA Servers (UCS or UCOD) .....	123
Figure C-3: -- General UCA Configuration .....	124
Figure C-4: -- Specific UCA communications .....	125
Figure C-5: -- XMPP Authentication Negotiation .....	133
Figure C-6: -- Stanza routing for applications with UCA and other XMPP functionality .....	138
Figure C-7: -- UDA to UCA Mapping of embedded devices .....	140
The individual presence exchange between the UCCDs, UCC-CPs, and UCS for an N connected UPnP scenario is illustrated in .....	143
Figure C-8: -- Self <presence> stanza flows .....	144
Figure C-9: -- Combined Connect, Announce and Describe Message Flow .....	153
Figure C-10: -- PubSub Hierarchy Event Structure Creation .....	158
Figure C-11: -- BOSH and WebSocket UCA Stack .....	178
Figure C-12: -- BOSH and WebSocket at UCA component stacks .....	180
Table 1 -- Acronyms .....	4
Table 1-1 -- Root device discovery messages .....	16
Table 1-2 -- Embedded device discovery messages .....	16
Table 1-3 -- Service discovery messages .....	16
Table 2-1: -- Vendor extensions .....	54
Table 3-1: -- SOAP 1.1 UPnP Profile .....	64

<b>Table 3-2: -- mustUnderstand attribute .....</b>	<b>65</b>
<b>Table 3-3: -- UPnP Defined Action error codes .....</b>	<b>75</b>
<b>Table 4-4: -- HTTP Status Codes indicating a Subscription Error .....</b>	<b>83</b>
<b>Table 4-5: -- HTTP Status Codes indicating a Resubscription Error .....</b>	<b>85</b>
<b>Table 4-6: -- HTTP Status Codes indicating a Cancel Subscription Error .....</b>	<b>86</b>
<b>Table 4-7: -- HTTP Status Codes indicating a Notify Error .....</b>	<b>92</b>
<b>Table 4-8: -- Multicast event levels .....</b>	<b>94</b>
<b>Table A-1: -- Matching of Device Address to Multicast Scope .....</b>	<b>100</b>
<b>Table C-1: -- Acronyms .....</b>	<b>127</b>
<b>Table C-2: -- Mapping of DDD iconList to [XEP-0084] .....</b>	<b>150</b>
<b>Table C-3: -- Summary of Requirements for DDD elements .....</b>	<b>154</b>
<b>Table C-4: -- PubSub Node Types .....</b>	<b>155</b>
<b>Table C-5: -- PubSub Node Access Models .....</b>	<b>155</b>
<b>Table C-6: -- PubSub Affiliations and their Privileges to "publishing" as defined by [XEP-0060] and further restricted by UCA (see footnotes) .....</b>	<b>156</b>
<b>Table C-7: -- PubSub Affiliations and their Privileges to "subscribers" .....</b>	<b>157</b>