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

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

Contents

Page

Introduction 1

0 Addressing 7
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

1 Discovery 10
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

2 Description 32
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

3 Control 60

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 UPnPTM 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: -- Mulitcast 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

Table 3-2: -- mustUnderstand attribute 65

Table 3-3: -- UPnP Defined Action error codes 75

Table 4-4: -- HTTP Status Codes indicating a Subscription Error 83

Table 4-5: -- HTTP Status Codes indicating a Resubscription Error 85

Table 4-6: -- HTTP Status Codes indicating a Cancel Subscription Error 86

Table 4-7: -- HTTP Status Codes indicating a Notify Error 92

Table 4-8: -- Multicast event levels 94

Table A-1: -- Matching of Device Address to Multicast Scope 100

Table C-1: -- Acronyms 127

Table C-2: -- Mapping of DDD iconList to [XEP-0084] 150

Table C-3: -- Summary of Requirements for DDD elements 154

Table C-4: -- PubSub Node Types 155

Table C-5: -- PubSub Node Access Models 155

Table C-6: -- PubSub Affiliations and their Privileges to "publishing" as defined by [XEP-0060] and further restricted by UCA (see footnotes) 156

Table C-7: -- PubSub Affiliations and their Privileges to "subscribers" 157