



BSI Standards Publication

OPC Unified Architecture

Part 4: Services

National foreword

This British Standard is the UK implementation of EN IEC 62541-4:2020. It is identical to IEC 62541-4:2020. It supersedes [BS EN 62541-4:2015](#), which will be withdrawn on 17 August 2023.

The UK participation in its preparation was entrusted to Technical Committee GEL/65/3, Industrial communications: process measurement and control, including fieldbus.

A list of organizations represented on this committee can be obtained on request to its committee manager.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2020
Published by BSI Standards Limited 2020

ISBN 978 0 580 51133 2

ICS 25.040.40; 35.100.05; 25.100.01

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 September 2020.

Amendments/corrigenda issued since publication

Date	Text affected
------	---------------

EUROPEAN STANDARD

EN IEC 62541-4

NORME EUROPÉENNE

EUROPÄISCHE NORM

September 2020

ICS 35.100.05; 25.040.40

Supersedes EN 62541-4:2015 and all of its amendments
and corrigenda (if any)

English Version

**OPC Unified Architecture - Part 4: Services
(IEC 62541-4:2020)**Architecture Unifiée OPC - Partie 4: Services
(IEC 62541-4:2020)OPC Unified Architecture - Teil 4: Dienste
(IEC 62541-4:2020)

This European Standard was approved by CENELEC on 2020-08-17. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

The text of document 65E/716/FDIS, future edition 3 of IEC 62541-4, prepared by SC 65E "Devices and integration in enterprise systems" of IEC/TC 65 "Industrial-process measurement, control and automation" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 62541-4:2020.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2021-05-17
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2023-08-17

This document supersedes EN 62541-4:2015 and all of its amendments and corrigenda (if any).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association.

Endorsement notice

The text of the International Standard IEC 62541-4:2020 was approved by CENELEC as a European Standard without any modification.

CONTENTS

FOREWORD	13
1 Scope	15
2 Normative references	15
3 Terms, definitions, abbreviated terms and conventions	16
3.1 Terms and definitions	16
3.2 Abbreviated terms	17
3.3 Conventions for Service definitions	17
4 Overview	19
4.1 Service Set model	19
4.2 Request/response Service procedures	22
5 Service Sets	22
5.1 General	22
5.2 Service request and response header	23
5.3 Service results	23
5.4 Discovery Service Set	24
5.4.1 Overview	24
5.4.2 FindServers	26
5.4.3 FindServersOnNetwork	27
5.4.4 GetEndpoints	29
5.4.5 RegisterServer	31
5.4.6 RegisterServer2	34
5.5 SecureChannel Service Set	35
5.5.1 Overview	35
5.5.2 OpenSecureChannel	36
5.5.3 CloseSecureChannel	40
5.6 Session Service Set	41
5.6.1 Overview	41
5.6.2 CreateSession	41
5.6.3 ActivateSession	46
5.6.4 CloseSession	49
5.6.5 Cancel	50
5.7 NodeManagement Service Set	50
5.7.1 Overview	50
5.7.2 AddNodes	50
5.7.3 AddReferences	52
5.7.4 DeleteNodes	54
5.7.5 DeleteReferences	56
5.8 View Service Set	57
5.8.1 Overview	57
5.8.2 Browse	57
5.8.3 BrowseNext	60
5.8.4 TranslateBrowsePathsToNodeIds	62
5.8.5 RegisterNodes	64
5.8.6 UnregisterNodes	65
5.9 Query Service Set	66
5.9.1 Overview	66

5.9.2	Querying Views	66
5.9.3	QueryFirst	67
5.9.4	QueryNext	70
5.10	Attribute Service Set	71
5.10.1	Overview	71
5.10.2	Read	72
5.10.3	HistoryRead	73
5.10.4	Write	76
5.10.5	HistoryUpdate	79
5.11	Method Service Set	81
5.11.1	Overview	81
5.11.2	Call	81
5.12	MonitoredItem Service Set	84
5.12.1	MonitoredItem model	84
5.12.2	CreateMonitoredItems	89
5.12.3	ModifyMonitoredItems	92
5.12.4	SetMonitoringMode	94
5.12.5	SetTriggering	95
5.12.6	DeleteMonitoredItems	97
5.13	Subscription Service Set	98
5.13.1	Subscription model	98
5.13.2	CreateSubscription	107
5.13.3	ModifySubscription	108
5.13.4	SetPublishingMode	110
5.13.5	Publish	111
5.13.6	Republish	113
5.13.7	TransferSubscriptions	114
5.13.8	DeleteSubscriptions	116
6	Service behaviours	117
6.1	Security	117
6.1.1	Overview	117
6.1.2	Obtaining and installing an Application Instance Certificate	117
6.1.3	Determining if a Certificate is trusted	118
6.1.4	Creating a SecureChannel	121
6.1.5	Creating a Session	123
6.1.6	Impersonating a User	124
6.2	Authorization Services	124
6.2.1	Overview	124
6.2.2	Indirect handshake with an Identity Provider	124
6.2.3	Direct handshake with an Identity Provider	125
6.3	Session-less Service invocation	126
6.3.1	Description	126
6.3.2	Parameters	127
6.3.3	Service results	128
6.4	Software Certificates	128
6.5	Auditing	128
6.5.1	Overview	128
6.5.2	General audit logs	128
6.5.3	General audit Events	129

6.5.4	Auditing for Discovery Service Set.....	129
6.5.5	Auditing for SecureChannel Service Set	129
6.5.6	Auditing for Session Service Set.....	129
6.5.7	Auditing for NodeManagement Service Set.....	130
6.5.8	Auditing for Attribute Service Set	130
6.5.9	Auditing for Method Service Set.....	131
6.5.10	Auditing for View, Query, MonitoredItem and Subscription Service Set	131
6.6	Redundancy.....	131
6.6.1	Redundancy overview.....	131
6.6.2	Server Redundancy	132
6.6.3	Client Redundancy	143
6.6.4	Network Redundancy.....	143
6.6.5	Manually forcing Failover.....	145
6.7	Re-establishing connections	145
6.8	Durable Subscriptions	147
7	Common parameter type definitions.....	148
7.1	ApplicationDescription	148
7.2	ApplicationInstanceCertificate	149
7.3	BrowseResult.....	150
7.4	ContentFilter	151
7.4.1	ContentFilter structure	151
7.4.2	ContentFilterResult.....	151
7.4.3	FilterOperator	152
7.4.4	FilterOperand parameters.....	159
7.5	Counter.....	161
7.6	ContinuationPoint	161
7.7	DataValue	162
7.7.1	General	162
7.7.2	PicoSeconds.....	162
7.7.3	SourceTimestamp.....	162
7.7.4	ServerTimestamp	163
7.7.5	StatusCodes assigned to a value.....	163
7.8	DiagnosticInfo.....	164
7.9	DiscoveryConfiguration parameters	165
7.9.1	Overview	165
7.9.2	MdnsDiscoveryConfiguration	166
7.10	EndpointDescription.....	166
7.11	ExpandedNodeId	167
7.12	ExtensibleParameter.....	167
7.13	Index	167
7.14	IntegerId	167
7.15	MessageSecurityMode	168
7.16	MonitoringParameters.....	168
7.17	MonitoringFilter parameters	169
7.17.1	Overview	169
7.17.2	DataChangeFilter	170
7.17.3	EventFilter	171
7.17.4	AggregateFilter.....	173
7.18	MonitoringMode	174

7.19	NodeAttributes parameters	175
7.19.1	Overview	175
7.19.2	ObjectAttributes parameter	176
7.19.3	VariableAttributes parameter	176
7.19.4	MethodAttributes parameter.....	177
7.19.5	ObjectTypeAttributes parameter	177
7.19.6	VariableTypeAttributes parameter.....	178
7.19.7	ReferenceTypeAttributes parameter	178
7.19.8	DataTypeAttributes parameter	179
7.19.9	ViewAttributes parameter.....	179
7.19.10	GenericAttributes parameter	180
7.20	NotificationData parameters.....	180
7.20.1	Overview	180
7.20.2	DataChangeNotification parameter	181
7.20.3	EventNotificationList parameter	181
7.20.4	StatusChangeNotification parameter.....	182
7.21	NotificationMessage.....	182
7.22	NumericRange	182
7.23	QueryDataSet	183
7.24	ReadValueId	184
7.25	ReferenceDescription.....	185
7.26	RelativePath	186
7.27	RegisteredServer	187
7.28	RequestHeader	187
7.29	ResponseHeader	189
7.30	ServiceFault.....	189
7.31	SessionAuthenticationToken	190
7.32	SignatureData.....	191
7.33	SignedSoftwareCertificate.....	191
7.34	StatusCode	192
7.34.1	General	192
7.34.2	Common StatusCodes	194
7.35	TimestampsToReturn.....	198
7.36	UserIdentityToken parameters	198
7.36.1	Overview	198
7.36.2	Token Encryption and Proof of Possession	199
7.36.3	AnonymousIdentityToken.....	203
7.36.4	UserNameIdentityToken	203
7.36.5	X509IdentityTokens	205
7.36.6	IssuedIdentityToken.....	205
7.37	UserTokenPolicy.....	206
7.38	VersionTime.....	207
7.39	ViewDescription	207
Annex A	(informative) BNF definitions.....	208
A.1	Overview over BNF	208
A.2	BNF of RelativePath	208
A.3	BNF of NumericRange	209
Annex B	(informative) ContentFilter and Query examples	210
B.1	Simple ContentFilter examples.....	210

B.1.1	Overview	210
B.1.2	Example 1	210
B.1.3	Example 2	211
B.2	Complex examples of Query filters	212
B.2.1	Overview	212
B.2.2	Used type model.....	212
B.2.3	Example Notes	215
B.2.4	Example 1	216
B.2.5	Example 2	217
B.2.6	Example 3	218
B.2.7	Example 4	221
B.2.8	Example 5	222
B.2.9	Example 6	223
B.2.10	Example 7	225
B.2.11	Example 8	227
B.2.12	Example 9	228
Figure 1	– Discovery Service Set	19
Figure 2	– SecureChannel Service Set.....	19
Figure 3	– Session Service Set	20
Figure 4	– NodeManagement Service Set	20
Figure 5	– View Service Set.....	20
Figure 6	– Attribute Service Set	21
Figure 7	– Method Service Set.....	21
Figure 8	– MonitoredItem and Subscription Service Sets	22
Figure 9	– Discovery process.....	25
Figure 10	– Using a Gateway Server.....	30
Figure 11	– The registration process – Manually launched servers	32
Figure 12	– The registration process – Automatically launched servers.....	32
Figure 13	– SecureChannel and Session Services	36
Figure 14	– Multiplexing users on a Session	43
Figure 15	– MonitoredItem model.....	84
Figure 16	– Typical delay in change detection.....	86
Figure 17	– Queue overflow handling.....	87
Figure 18	– Triggering model	88
Figure 19	– Obtaining and installing an Application Instance Certificate.....	118
Figure 20	– Determining if an Application Instance Certificate is trusted	121
Figure 21	– Establishing a SecureChannel.....	122
Figure 22	– Establishing a Session	123
Figure 23	– Impersonating a User	124
Figure 24	– Indirect handshake with an Identity Provider	125
Figure 25	– Direct handshake with an Identity Provider.....	126
Figure 26	– Transparent Redundancy setup example.....	133
Figure 27	– Non-Transparent Redundancy setup	134
Figure 28	– Client Start-up steps	138

Figure 29 – Cold Failover.....	139
Figure 30 – Warm Failover.....	140
Figure 31 – Hot Failover	141
Figure 32 – HotAndMirrored Failover	142
Figure 33 – Server proxy for Redundancy	143
Figure 34 – Transparent network Redundancy.....	144
Figure 35 – Non-transparent network Redundancy.....	145
Figure 36 – Reconnect sequence.....	146
Figure 37 – Logical layers of a Server.....	190
Figure 38 – Obtaining a SessionAuthenticationToken	191
Figure 39 – EncryptedSecret layout	200
Figure B.1 – Filter logic tree example.....	210
Figure B.2 – Filter logic tree example.....	211
Figure B.3 – Example Type Nodes	214
Figure B.4 – Example Instance Nodes	215
Figure B.5 – Example 1 Filter.....	216
Figure B.6 – Example 2 Filter logic tree	218
Figure B.7 – Example 3 Filter logic tree	219
Figure B.8 – Example 4 Filter logic tree	221
Figure B.9 – Example 5 Filter logic tree	222
Figure B.10 – Example 6 Filter logic tree	224
Figure B.11 – Example 7 Filter logic tree	226
Figure B.12 – Example 8 Filter logic tree	227
Figure B.13 – Example 9 Filter logic tree	228
Table 1 – Service definition table	18
Table 2 – Parameter Types defined in IEC 62541-3	18
Table 3 – FindServers Service parameters	27
Table 4 – FindServersOnNetwork Service parameters	28
Table 5 – GetEndpoints Service parameters	31
Table 6 – RegisterServer Service parameters	33
Table 7 – RegisterServer Service result codes.....	33
Table 8 – RegisterServer2	34
Table 9 – RegisterServer2 Service result codes	35
Table 10 – RegisterServer2 Operation Level result codes	35
Table 11 – OpenSecureChannel Service parameters	38
Table 12 – OpenSecureChannel Service result codes	40
Table 13 – CloseSecureChannel Service parameters.....	41
Table 14 – CloseSecureChannel Service result codes	41
Table 15 – CreateSession Service parameters.....	44
Table 16 – CreateSession Service result codes	46
Table 17 – ActivateSession Service parameters.....	48
Table 18 – ActivateSession Service result codes	49

Table 19 – CloseSession Service parameters	49
Table 20 – CloseSession Service result codes	50
Table 21 – Cancel Service parameters	50
Table 22 – AddNodes Service parameters	51
Table 23 – AddNodes Service result codes	52
Table 24 – AddNodes Operation Level result codes	52
Table 25 – AddReferences Service parameters	53
Table 26 – AddReferences Service result codes	53
Table 27 – AddReferences Operation Level result codes	54
Table 28 – DeleteNodes Service parameters	55
Table 29 – DeleteNodes Service result codes	55
Table 30 – DeleteNodes Operation Level result codes	56
Table 31 – DeleteReferences Service parameters	56
Table 32 – DeleteReferences Service result codes	57
Table 33 – DeleteReferences Operation Level result codes	57
Table 34 – Browse Service parameters	58
Table 35 – Browse Service result codes	59
Table 36 – Browse Operation Level result codes	60
Table 37 – BrowseNext Service parameters	61
Table 38 – BrowseNext Service result codes	61
Table 39 – BrowseNext Operation Level result codes	62
Table 40 – TranslateBrowsePathsToNodeIds Service parameters	63
Table 41 – TranslateBrowsePathsToNodeIds Service result codes	63
Table 42 – TranslateBrowsePathsToNodeIds Operation Level result codes	64
Table 43 – RegisterNodes Service parameters	65
Table 44 – RegisterNodes Service result codes	65
Table 45 – UnregisterNodes Service parameters	66
Table 46 – UnregisterNodes Service result codes	66
Table 47 – QueryFirst Request parameters	68
Table 48 – QueryFirst Response parameters	69
Table 49 – QueryFirst Service result codes	70
Table 50 – QueryFirst Operation Level result codes	70
Table 51 – QueryNext Service parameters	71
Table 52 – QueryNext Service result codes	71
Table 53 – Read Service parameters	72
Table 54 – Read Service result codes	73
Table 55 – Read Operation Level result codes	73
Table 56 – HistoryRead Service parameters	74
Table 57 – HistoryRead Service result codes	76
Table 58 – HistoryRead Operation Level result codes	76
Table 59 – Write Service parameters	78
Table 60 – Write Service result codes	79
Table 61 – Write Operation Level result codes	79

Table 62 – HistoryUpdate Service parameters	80
Table 63 – HistoryUpdate Service result codes	80
Table 64 – HistoryUpdate Operation Level result codes	81
Table 65 – Call Service parameters	82
Table 66 – Call Service result codes	83
Table 67 – Call Operation Level result codes	83
Table 68 – Call Input Argument Result Codes	84
Table 69 – CreateMonitoredItems Service parameters	91
Table 70 – CreateMonitoredItems Service result codes	92
Table 71 – CreateMonitoredItems Operation Level result codes	92
Table 72 – ModifyMonitoredItems Service parameters	93
Table 73 – ModifyMonitoredItems Service result codes	94
Table 74 – ModifyMonitoredItems Operation Level result codes	94
Table 75 – SetMonitoringMode service parameters	95
Table 76 – SetMonitoringMode Service result codes	95
Table 77 – SetMonitoringMode Operation Level result codes	95
Table 78 – SetTriggering Service parameters	96
Table 79 – SetTriggering Service result codes	96
Table 80 – SetTriggering Operation Level result codes	97
Table 81 – DeleteMonitoredItems Service parameters	97
Table 82 – DeleteMonitoredItems Service result codes	98
Table 83 – DeleteMonitoredItems Operation Level result codes	98
Table 84 – Subscription states	101
Table 85 – Subscription state table	102
Table 86 – State variables and parameters	105
Table 87 – Functions	106
Table 88 – CreateSubscription Service parameters	107
Table 89 – CreateSubscription Service result codes	108
Table 90 – ModifySubscription Service parameters	109
Table 91 – ModifySubscription Service result codes	110
Table 92 – SetPublishingMode Service parameters	110
Table 93 – SetPublishingMode Service result codes	110
Table 94 – SetPublishingMode Operation Level result codes	111
Table 95 – Publish Service parameters	112
Table 96 – Publish Service result codes	112
Table 97 – Publish Operation Level Result Codes	113
Table 98 – Republish Service parameters	113
Table 99 – Republish Service result codes	113
Table 100 – TransferSubscriptions Service parameters	115
Table 101 – TransferSubscriptions Service result codes	115
Table 102 – TransferSubscriptions Operation Level result codes	116
Table 103 – DeleteSubscriptions Service parameters	116
Table 104 – DeleteSubscriptions Service result codes	117

Table 105 – DeleteSubscriptions Operation Level result codes	117
Table 106 – Certificate validation steps	119
Table 107 – SessionlessInvoke Service parameters.....	127
Table 108 – SessionlessInvoke Service result codes	128
Table 109 – ServiceLevel ranges	136
Table 110 – Server Failover modes.....	137
Table 111 – Redundancy Failover actions.....	138
Table 112 – ApplicationDescription	149
Table 113 – ApplicationInstanceCertificate	150
Table 114 – BrowseResult	150
Table 115 – ContentFilter structure.....	151
Table 116 – ContentFilterResult structure	151
Table 117 – ContentFilterResult result codes.....	152
Table 118 – ContentFilterResult Operand result codes	152
Table 119 – Basic FilterOperator definition	152
Table 120 – Complex FilterOperator definition	155
Table 121 – Wildcard characters.....	156
Table 122 – Conversion rules	157
Table 123 – Data Precedence rules	158
Table 124 – Logical AND Truth table	159
Table 125 – Logical OR Truth table.....	159
Table 126 – FilterOperand parameter Typelds	159
Table 127 – ElementOperand	160
Table 128 – LiteralOperand	160
Table 129 – AttributeOperand.....	160
Table 130 – SimpleAttributeOperand	161
Table 131 – DataValue	162
Table 132 – DiagnosticInfo	165
Table 133 – DiscoveryConfiguration parameterTypelds	165
Table 134 – MdnsDiscoveryConfiguration	166
Table 135 – EndpointDescription	166
Table 136 – ExpandedNodeId.....	167
Table 137 – ExtensibleParameter base type	167
Table 138 – MessageSecurityMode values	168
Table 139 – MonitoringParameters	168
Table 140 – MonitoringFilter parameterTypelds	169
Table 141 – DataChangeFilter	170
Table 142 – EventFilter structure	172
Table 143 – EventFilterResult structure	172
Table 144 – EventFilterResult result codes	173
Table 145 – AggregateFilter structure	174
Table 146 – AggregateFilterResult structure	174
Table 147 – MonitoringMode values.....	175

Table 148 – NodeAttributes parameterTypelds	175
Table 149 – Bit mask for specified Attributes	176
Table 150 – ObjectAttributes	176
Table 151 – VariableAttributes	177
Table 152 – MethodAttributes	177
Table 153 – ObjectTypeAttributes	178
Table 154 – VariableTypeAttributes	178
Table 155 – ReferenceTypeAttributes	179
Table 156 – DataTypeAttributes	179
Table 157 – ViewAttributes	180
Table 158 – GenericAttributes	180
Table 159 – NotificationData parameterTypelds	181
Table 160 – DataChangeNotification	181
Table 161 – EventNotificationList	182
Table 162 – StatusChangeNotification	182
Table 163 – NotificationMessage	182
Table 164 – NumericRange	183
Table 165 – QueryDataSet	184
Table 166 – ReadValueId	185
Table 167 – ReferenceDescription	186
Table 168 – RelativePath	186
Table 169 – RegisteredServer	187
Table 170 – RequestHeader	188
Table 171 – ResponseHeader	189
Table 172 – ServiceFault	190
Table 173 – SignatureData	191
Table 174 – SignedSoftwareCertificate	192
Table 175 – StatusCode bit assignments	193
Table 176 – DataValue InfoBits	194
Table 177 – Common Service result codes	195
Table 178 – Common Operation Level result codes	197
Table 179 – TimestampsToReturn values	198
Table 180 – UserIdentityToken parameterTypelds	199
Table 181 – Legacy UserIdentityToken Encrypted Token Secret Format	200
Table 182 – EncryptedSecret layout	202
Table 183 – EncryptedSecret DataTypes	202
Table 184 – RsaEncryptedSecret structure	203
Table 185 – AnonymousIdentityToken	203
Table 186 – UserNameIdentityToken	204
Table 187 – EncryptionAlgorithm selection	204
Table 188 – X.509 v3 Identity Token	205
Table 189 – IssuedIdentityToken	206
Table 190 – UserTokenPolicy	206

Table 191 – ViewDescription.....	207
Table A.1 – RelativePath	208
Table A.2 – <i>RelativePath</i> Examples	209
Table B.1 – ContentFilter example	211
Table B.2 – ContentFilter example	211
Table B.3 – Example 1 NodeTypeDescription	216
Table B.4 – Example 1 ContentFilter.....	216
Table B.5 – Example 1 QueryDataSets	217
Table B.6 – Example 2 NodeTypeDescription	217
Table B.7 – Example 2 ContentFilter.....	218
Table B.8 – Example 2 QueryDataSets	218
Table B.9 – Example 3 NodeTypeDescription	219
Table B.10 – Example 3 ContentFilter.....	220
Table B.11 – Example 3 QueryDataSets	221
Table B.12 – Example 4 NodeTypeDescription.....	221
Table B.13 – Example 4 ContentFilter	222
Table B.14 – Example 4 QueryDataSets	222
Table B.15 – Example 5 NodeTypeDescription.....	222
Table B.16 – Example 5 ContentFilter.....	223
Table B.17 – Example 5 QueryDataSets	223
Table B.18 – Example 6 NodeTypeDescription.....	223
Table B.19 – Example 6 ContentFilter	224
Table B.20 – Example 6 QueryDataSets	224
Table B.21 – Example 6 QueryDataSets without additional information.....	225
Table B.22 – Example 7 NodeTypeDescription.....	225
Table B.23 – Example 7 ContentFilter	226
Table B.24 – Example 7 QueryDataSets	226
Table B.25 – Example 8 NodeTypeDescription.....	227
Table B.26 – Example 8 ContentFilter	227
Table B.27 – Example 8 QueryDataSets	228
Table B.28 – Example 9 NodeTypeDescription.....	228
Table B.29 – Example 9 ContentFilter	229
Table B.30 – Example 9 QueryDataSets	229

INTERNATIONAL ELECTROTECHNICAL COMMISSION

OPC UNIFIED ARCHITECTURE –**Part 4: Services****FOREWORD**

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62541-4 has been prepared by subcommittee 65E: Devices and integration in enterprise systems, of IEC technical committee 65: Industrial-process measurement, control and automation.

This third edition cancels and replaces the second edition published in 2015. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) Added ability to resend all data of monitored items in a Subscription using the ResendData Method.
- b) Added support for durable Subscriptions (lifetime of hours or days).
- c) Added Register2 and FindServersOnNetwork Services to support network-wide discovery using capability filters.
- d) Removed definition of software certificates. Will be defined in a future edition.

- e) Extended and partially revised the redundancy definition. Added sub-range definitions for ServiceLevel and added more terms for redundancy.
- f) Added a section on how to use Authorization Services to request user access tokens.
- g) Added JSON Web Tokens (JWTs) as a new user token.
- h) Added the concept of session-less service invocation.
- i) Added a generic structure that allows passing any number of attributes to the AddNodes Service.
- j) Added requirement to protect against user identity token attacks.
- k) Added new EncryptedSecret format for user identity tokens.

The text of this standard is based on the following documents:

FDIS	Report on voting
65E/716/FDIS	65E/732/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

Throughout this document and the other parts of the IEC 62541 series, certain document conventions are used:

Italics are used to denote a defined term or definition that appears in Clause 3 in one of the parts of the series.

Italics are also used to denote the name of a service input or output parameter or the name of a structure or element of a structure that are usually defined in tables.

The *italicized terms and names* are also, with a few exceptions, written in camel-case (the practice of writing compound words or phrases in which the elements are joined without spaces, with each element's initial letter capitalized within the compound). For example the defined term is *AddressSpace* instead of Address Space. This makes it easier to understand that there is a single definition for *AddressSpace*, not separate definitions for Address and Space.

A list of all parts of the IEC 62541 series, published under the general title *OPC Unified Architecture*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

OPC UNIFIED ARCHITECTURE –

Part 4: Services

1 Scope

This part of IEC 62541 defines the OPC Unified Architecture (OPC UA) *Services*. The *Services* defined are the collection of abstract Remote Procedure Calls (RPC) that are implemented by OPC UA *Servers* and called by OPC UA *Clients*. All interactions between OPC UA *Clients* and *Servers* occur via these *Services*. The defined *Services* are considered abstract because no particular RPC mechanism for implementation is defined in this document. IEC 62541-6 specifies one or more concrete mappings supported for implementation. For example, one mapping in IEC 62541-6 is to XML Web Services. In that case the *Services* described in this document appear as the Web service methods in the WSDL contract.

Not all OPC UA *Servers* will need to implement all of the defined *Services*. IEC 62541-7 defines the *Profiles* that dictate which *Services* need to be implemented in order to be compliant with a particular *Profile*.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC TR 62541-1, *OPC Unified Architecture – Part 1: Overview and Concepts*

IEC TR 62541-2, *OPC Unified Architecture – Part 2: Security Model*

IEC 62541-3, *OPC Unified Architecture – Part 3: Address Space Model*

IEC 62541-5, *OPC Unified Architecture – Part 5: Information Model*

IEC 62541-6, *OPC Unified Architecture – Part 6: Mappings*

IEC 62541-7, *OPC Unified Architecture – Part 7: Profiles*

IEC 62541-8, *OPC Unified Architecture – Part 8: Data Access*

IEC 62541-11, *OPC Unified Architecture – Part 11: Historical Access*

IEC 62541-12¹, *OPC Unified Architecture – Part 12: Discovery and Global Services*

IEC 62541-13, *OPC Unified Architecture – Part 13: Aggregates*

¹ Under preparation. Stage at the time of publication: IEC CDV 62541-12:2018.