

SLOVENSKI STANDARD

SIST EN 62541-6:2012

01-februar-2012

Poenotena arhitektura OPC - 6. del: Preslikave (IEC 62541-6:2011)

OPC unified architecture - Part 6: Mappings (IEC 62541-6:2011)

OPC Unified Architecture - Teil 6: Protokollabbildungen (IEC 62541-6:2011)

Architecture unifiée OPC - Partie 6: Correspondances (CEI 62541-6:2011)

Ta slovenski standard je istoveten z: **EN 62541-6:2011**

[SIST EN 62541-6:2012](https://standards.iteh.ai/catalog/standards/sist/2c2e4331-2b5a-4233-94f1-aceef193226e/sist-en-62541-6-2012)

<https://standards.iteh.ai/catalog/standards/sist/2c2e4331-2b5a-4233-94f1-aceef193226e/sist-en-62541-6-2012>

ICS:

25.040.40	Merjenje in krmiljenje industrijskih postopkov	Industrial process measurement and control
35.240.50	Uporabniške rešitve IT v industriji	IT applications in industry

SIST EN 62541-6:2012

en

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 62541-6:2012

<https://standards.iteh.ai/catalog/standards/sist/2c2e4331-2b5a-4233-94f1-aceef193226e/sist-en-62541-6-2012>

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 62541-6

December 2011

ICS 25.040.40; 25.100.01

English version

**OPC unified architecture -
Part 6: Mappings
(IEC 62541-6:2011)**

Architecture unifiée OPC -
Partie 6: Correspondances
(CEI 62541-6:2011)

OPC Unified Architecture -
Teil 6: Protokollabbildungen
(IEC 62541-6:2011)

This European Standard was approved by CENELEC on 2011-11-22. 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, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

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

Management Centre: Avenue Marnix 17, B - 1000 Brussels

Foreword

The text of document 65E/193/FDIS, future edition 1 of IEC 62541-6, 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 62541-6:2011.

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) 2012-08-22
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2014-11-22

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

Endorsement notice

The text of the International Standard IEC 62541-6:2011 was approved by CENELEC as a European Standard without any modification.

(standards.iteh.ai)

[SIST EN 62541-6:2012](https://standards.iteh.ai/catalog/standards/sist/2c2e4331-2b5a-4233-94f1-accef193226e/sist-en-62541-6-2012)

<https://standards.iteh.ai/catalog/standards/sist/2c2e4331-2b5a-4233-94f1-accef193226e/sist-en-62541-6-2012>

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following referenced documents are indispensable for the application 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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC/TR 62541-1	-	OPC unified architecture - Part 1: Overview and concepts	CLC/TR 62541-1	-
IEC/TR 62541-2	-	OPC unified architecture - Part 2: Security model	CLC/TR 62541-2	-
IEC 62541-3	-	OPC unified architecture - Part 3: Address space model	EN 62541-3	-
IEC 62541-4	-	OPC unified architecture - Part 4: Services	EN 62541-4	-
IEC 62541-5	-	OPC unified architecture - Part 5: Information Model	EN 62541-5	-
IEC 62541-7	-	OPC Unified Architecture - Part 7: Profiles	EN 62541-7	-
ITU-T X.509	-	Information technology – Open systems interconnection – The Directory: Public-key and attribute certificate frameworks	-	-
ITU-T X.690	-	Information technology - ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)	-	-
ITU-T X.200	-	Information technology - Open Systems Interconnection - Basic Reference Model: The basic model	-	-
RFC 3548	-	The Base16, Base32, and Base64 Data Encodings	-	-
RFC 2104	-	HMAC: Keyed-Hashing for Message Authentication	-	-
RFC 2437	-	PKCS #1: RSA Cryptography Specifications Version 2.0	-	-
RFC 3280	-	Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile	-	-
RFC 2818	-	HTTP Over TLS	-	-
RFC 2616	-	Hypertext Transfer Protocol - HTTP/1.1	-	-
RFC 2246	-	The TLS Protocol	-	-
RFC 4514	-	Lightweight Directory Access Protocol (LDAP): String Representation of Distinguished Names	-	-
RFC 3629	-	UTF-8, User Datagram Protocol	-	-

IEEE 754	-	Binary floating-point arithmetic	-	-
XML Schema Part 1	-	XML Schema Part 1: Structures	-	-
XML Schema Part 2	-	XML Schema Part 2	-	-
SOAP Part 1	-	SOAP Version 1.2 Part 1: Messaging Framework	-	-
SOAP Part 2	-	SOAP Version 1.2 Part 2: Adjuncts	-	-
XML Encryption	-	XML Encryption Syntax and Processing	-	-
XML Signature	-	XML-Signature Syntax and Processing	-	-
WS Security	-	SOAP Message Security 1.1	-	-
WS Addressing	-	Web Services Addressing (WS-Addressing)	-	-
WS Trust	-	WS Trust 1.3	-	-
WS Secure Conversation	-	WS Secure Conversation 1.3	-	-
WS Security Policy	-	WS Security Policy 1.2	-	-
WS-I	-	Basic Profile Version 1.1	-	-
WS-I	-	Basic Security Profile Version 1.1	-	-
PKCS #12	-	PKCS 12 v1.0: Personal Information Exchange Syntax	-	-
FIPS 180-2	-	Secure Hash Standard (SHA)	-	-
FIPS 197	-	Advanced Encryption Standard (AES)	-	-

iTeH STANDARD PREVIEW
(standards.iteh.ai)

[SIST EN 62541-6:2012](#)

<https://standards.iteh.ai/catalog/standards/sist/2c2e4331-2b5a-4233-94f1-aceef193226e/sist-en-62541-6-2012>



IEC 62541-6

Edition 1.0 2011-10

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**OPC unified architecture –
Part 6: Mappings**

**Architecture unifiée OPC –
Partie 6: Correspondances**

STANDARD PREVIEW
(standards.iteh.ai)

[SIST EN 62541-6:2012](https://standards.iteh.ai/catalog/standards/sist/2c2e4331-2b5a-4233-94f1-aceef193226e/sist-en-62541-6-2012)
<https://standards.iteh.ai/catalog/standards/sist/2c2e4331-2b5a-4233-94f1-aceef193226e/sist-en-62541-6-2012>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE **XB**
CODE PRIX

ICS 25.040.40; 25.100.01

ISBN 978-2-88912-728-3

CONTENTS

FOREWORD.....	6
INTRODUCTION.....	8
1 Scope.....	9
2 Normative references.....	9
3 Terms, definitions and abbreviations.....	11
3.1 Terms and definitions.....	11
3.2 Abbreviations.....	12
4 Overview.....	12
5 Data Encoding.....	13
5.1 General.....	13
5.1.1 Overview.....	13
5.1.2 Built-in Types.....	14
5.1.3 Guid.....	14
5.1.4 ExtensionObject.....	15
5.1.5 Variant.....	15
5.2 OPC UA Binary.....	15
5.2.1 General.....	15
5.2.2 Built-in Types.....	16
5.2.3 Enumerations.....	24
5.2.4 Arrays.....	24
5.2.5 Structures.....	24
5.2.6 Messages.....	25
5.3 XML.....	26
5.3.1 Built-in Types.....	26
5.3.2 Enumerations.....	31
5.3.3 Arrays.....	32
5.3.4 Structures.....	32
5.3.5 Messages.....	33
6 Security Protocols.....	33
6.1 Security Handshake.....	33
6.2 Certificates.....	34
6.2.1 General.....	34
6.2.2 Application Instance Certificate.....	34
6.2.3 Signed Software Certificate.....	35
6.3 WS Secure Conversation.....	36
6.3.1 Overview.....	36
6.3.2 Notation.....	38
6.3.3 Request Security Token (RST/SCT).....	38
6.3.4 Request Security Token Response (RSTR/SCT).....	39
6.3.5 Using the SCT.....	40
6.3.6 Cancelling Security Contexts.....	40
6.4 OPC UA Secure Conversation.....	41
6.4.1 Overview.....	41
6.4.2 MessageChunk Structure.....	41
6.4.3 MessageChunks and Error Handling.....	44
6.4.4 Establishing a SecureChannel.....	45

6.4.5	Deriving Keys	46
6.4.6	Verifying Message Security	47
7	Transport Protocols	48
7.1	OPC UA TCP	48
7.1.1	Overview	48
7.1.2	Message Structure	48
7.1.3	Establishing a Connection	50
7.1.4	Closing a Connection	51
7.1.5	Error Handling	52
7.1.6	Error Recovery	52
7.2	SOAP/HTTP	54
7.2.1	Overview	54
7.2.2	XML Encoding	55
7.2.3	OPC UA Binary Encoding	55
7.3	Well Known Addresses	56
8	Normative Contracts	56
8.1	OPC Binary Schema	56
8.2	XML Schema and WSDL	56
Annex A (normative)	Constants	57
Annex B (normative)	Type Declarations for the OPC UA Native Mapping	59
Annex C (normative)	WSDL for the XML Mapping	60
Annex D (normative)	Security Settings Management	61
Figure 1 – The OPC UA Stack Overview		13
Figure 2 – Encoding Integers in a Binary Stream		16
Figure 3 – Encoding Floating Points in a Binary Stream		17
Figure 4 – Encoding Strings in a Binary Stream		17
Figure 5 – Encoding GUIDs in a Binary Stream		18
Figure 6 – Encoding XML Elements in a Binary Stream		18
Figure 7 – A String NodeId		19
Figure 8 – A Two Byte NodeId		20
Figure 9 – A Four Byte NodeId		20
Figure 10 – Security Handshake		33
Figure 11 – Relevant XML Web Services Specifications		37
Figure 12 – The WS Secure Conversation Handshake		37
Figure 13 – OPC UA Secure Conversation MessageChunk		41
Figure 14 – OPC UA TCP Message Structure		50
Figure 15 – Establishing a OPC UA TCP Connection		51
Figure 16 – Closing a OPC UA TCP Connection		51
Figure 17 – Recovering an OPC UA TCP Connection		53
Table 1 – Built-in Data Types		14
Table 2 – Guid Structure		14
Table 3 – Supported Floating Point Types		16
Table 4 – NodeId Components		19

Table 5 – NodeId Encoding Values	19
Table 6 – Standard NodeId Binary Encoding	19
Table 7 – Two Byte NodeId Binary Encoding	20
Table 8 – Four Byte NodeId Binary Encoding	20
Table 9 – ExpandedNodeId Binary Encoding	21
Table 10 – DiagnosticInfo Binary Encoding	21
Table 11 – QualifiedName Binary Encoding	22
Table 12 – LocalizedText Binary Encoding	22
Table 13 – Extension Object Binary Encoding	23
Table 14 – Variant Binary Encoding	23
Table 15 – Data Value Binary Encoding	24
Table 16 – Sample OPC UA Binary Encoded Structure	25
Table 17 – XML Data Type Mappings for Integers	26
Table 18 – XML Data Type Mappings for Floating Points	26
Table 19 – Components of NodeId	28
Table 20 – Components of ExpandedNodeId	28
Table 21 – Components of Enumeration	31
Table 22 – SecurityPolicy	34
Table 23 – ApplicationInstanceCertificate	35
Table 24 – SignedSoftwareCertificate	36
Table 25 – WS-* Namespace Prefixes	38
Table 26 – RST/SCT Mapping to an OpenSecureChannel Request	39
Table 27 – RSTR/SCT Mapping to an OpenSecureChannel Response	40
Table 28 – OPC UA Secure Conversation Message Header	42
Table 29 – Asymmetric Algorithm Security Header	42
Table 30 – Symmetric Algorithm Security Header	43
Table 31 – Sequence Header	43
Table 32 – OPC UA Secure Conversation Message Footer	44
Table 33 – OPC UA Secure Conversation Message Abort Body	45
Table 34 – OPC UA Secure Conversation OpenSecureChannel Service	45
Table 35 – Cryptography Key Generation Parameters	46
Table 36 – OPC UA TCP Message Header	48
Table 37 – OPC UA TCP Hello Message	49
Table 38 – OPC UA TCP Acknowledge Message	49
Table 39 – OPC UA TCP Error Message	50
Table 40 – OPC UA TCP Error Codes	52
Table 41 – WS-Addressing Headers	54
Table 42 – Well Known Addresses for Local Discovery Servers	56
Table A.1 – Identifiers Assigned to Attributes	57
Table D.1 – SecuredApplication	62
Table D.2 – CertificateIdentifier	64
Table D.3 – CertificateStoreIdentifier	65
Table D.4 – CertificateTrustList	66

Table D.5 – CertificateValidationOptions.....	66
Table D.6 – ApplicationAccessRule.....	67
Table D.7 – ApplicationSecurityPolicy.....	67

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[SIST EN 62541-6:2012](https://standards.iteh.ai/catalog/standards/sist/2c2e4331-2b5a-4233-94fl-aceef193226e/sist-en-62541-6-2012)

[https://standards.iteh.ai/catalog/standards/sist/2c2e4331-2b5a-4233-94fl-
aceef193226e/sist-en-62541-6-2012](https://standards.iteh.ai/catalog/standards/sist/2c2e4331-2b5a-4233-94fl-aceef193226e/sist-en-62541-6-2012)

INTERNATIONAL ELECTROTECHNICAL COMMISSION

OPC UNIFIED ARCHITECTURE –

Part 6: Mappings

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 62541-6 has been prepared by subcommittee 65E: Devices and integration in enterprise systems, of IEC technical committee 65: Industrial-process measurement, control and automation.

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

FDIS	Report on voting
65E/193/FDIS	65E/215/RVD

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

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

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 publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication 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.

iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN 62541-6:2012](https://standards.iteh.ai/catalog/standards/sist/2c2e4331-2b5a-4233-94f1-aceef193226e/sist-en-62541-6-2012)

<https://standards.iteh.ai/catalog/standards/sist/2c2e4331-2b5a-4233-94f1-aceef193226e/sist-en-62541-6-2012>

INTRODUCTION

This International Standard is the specification for developers of OPC UA applications. The specification is a result of an analysis and design process to develop a standard interface to facilitate the development of applications by multiple vendors that will inter-operate seamlessly together.

iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN 62541-6:2012](https://standards.iteh.ai/catalog/standards/sist/2c2e4331-2b5a-4233-94f1-aceef193226e/sist-en-62541-6-2012)

<https://standards.iteh.ai/catalog/standards/sist/2c2e4331-2b5a-4233-94f1-aceef193226e/sist-en-62541-6-2012>

OPC UNIFIED ARCHITECTURE –

Part 6: Mappings

1 Scope

This part of IEC 62541 specifies the OPC Unified Architecture (OPC UA) mapping between the security model described in IEC 62541-2, the abstract service definitions, described in IEC 62541-4, the data structures defined in IEC 62541-5 and the physical network protocols that can be used to implement the OPC UA specification.

2 Normative references

The following referenced documents are indispensable for the application 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 62541-2, *OPC Unified architecture: Part 2 – Security Model*

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

IEC 62541-4¹, *OPC Unified architecture: Part 4 – Services*

<https://standards.iteh.ai/catalog/standards/sist/2c2e4331-2b5a-4233-94f1-2c2e4331-2b5a-4233-94f1-2c2e4331-2b5a-4233-94f1>

IEC 62541-5², *OPC Unified architecture: Part 5 – Information Model*

IEC 62541-7³, *OPC Unified architecture: Part 7 – Profiles*

ITU-T X.690: *Information technology – ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)*

available at <<http://www.itu.int/ITU-T/studygroups/com17/languages/X.690-0207.pdf>>

ITU-T X.200: *Information technology – Open Systems Interconnection – Basic Reference Model*

available at <<http://www.itu.int/rec/T-REC-X.200-199407-I/en>>

ITU-T X.509: *Information technology – Open Systems Interconnection – The directory: Public Key and Attribute Certificate Frameworks*

available at <<http://www.itu.int/rec/T-REC-X.509/en>>

XML Schema Part 1: *XML Schema Part 1: Structures (Second Edition)*

available at <<http://www.w3.org/TR/xmlschema-1/>>

XML Schema Part 2: *XML Schema Part 2: Datatypes (Second Edition)*

available at <<http://www.w3.org/TR/xmlschema-2/>>

¹ To be published.

² To be published.

³ To be published.