Edition 4.0 2025-12

INTERNATIONAL STANDARD

OPC unified architecture - Part 6: Mappings

ICS 25.040.40; 35.100.05

ISBN 978-2-8327-0848-4

IEC 62541-6:2025-12(en)

IEC Secretariat
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, …). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch
Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

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) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had no received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at https://patents.iec.ch. IEC shall not be held responsible for identifying any or all such patent rights.

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. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2020. This edition constitutes a technical revision.

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

a) addition of support for ECC to UA Secure Conversation;
b) use of the AuthorityKeyIdentifier extension in Certificate Revocation Lists;
c) enhancement of JSON mapping of Unions;
d) addition of Decimal data type encoding.
e) description of ECC keyUsage rules;

g) addition of requirements for user and issuer Certificates;

h) addition of rules which specify what happens when DateTime precision is lost;

i) addition of rules to allow for the truncation of strings containing embedded nulls.

j) definition of a normative string representation for NodeId, ExpandedNodeId and QualifiedName for JSON mapping.

k) requirement that TAI times be converted to UTC;

l) new possibility to omit Symbol if unknown in JSON encoding;

m) addition of fields needed to support RolePermissions to the UANodeSet.

The text of this International Standard is based on the following documents:

Draft	Report on voting
65E/1063/CDV	65E/1131/RVC

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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 the "Terms and definitions" clause in one of the parts of the IEC 62541 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, 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 in 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 webstore.iec.ch in the data related to the specific document. At this date, the document will be

– reconfirmed,

– withdrawn, or

– revised.

This part of IEC 62541 specifies the mapping between the security model described in IEC 62541-2, the abstract service definitions specified 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 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 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 62541-4, *OPC Unified Architecture - Part 4: Services*

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

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

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

IEC 62541-18, *OPC Unified Architecture - Part 18: Role-Based Security*

ISO/IEC 60559, IEEE 754, *Information technology - Microprocessor Systems - Floating-Point arithmetic*

ISO 8601-1, *Date and time - Representations for information interchange - Part 1: Basic rules*

Recommendation ITU-T X.200 | ISO/IEC 7498-1, *Information technology - Open Systems Interconnection - Basic Reference Model: The Basic Model*

Recommendation ITU-T X.690 | ISO/IEC 8825-1, *Information technology - ASN.1 encoding rules - Part 1: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)*

Recommendation ITU-T X.509 | ISO/IEC 9594-8, *Information technology - Open Systems Interconnection - The Directory: Public-key and attribute certificate frameworks*

IETF RFC 2104, Krawczyk H., Bellare M. and Canetti R., “HMAC: Keyed-Hashing for Message Authentication”, February 1997, available at http://www.ietf.org/rfc/rfc2104.txt

IETF RFC 2818, Rescorla E., “HTTPS, HTTP Over TLS”, May 2000, available at http://www.ietf.org/rfc/rfc2818.txt

IETF RFC 3629, Yergeau F., “UTF-8, a transformation format of ISO 10646”, November 2003, available at https://datatracker.ietf.org/doc/html/rfc3629

Generic Syntax", January 2005, available at https://datatracker.ietf.org/doc/html/rfc3986

IETF RFC 4648, Josefsson S., "The Base16, Base32, and Base64 Data Encodings", October 2006, available at https://datatracker.ietf.org/doc/html/rfc4648

IETF RFC 7230, Fielding R. and Reschke J., "HTTP, Hypertext Transfer Protocol (HTTP/1.1): Message Syntax and Routing", June 2014, available at https://datatracker.ietf.org/doc/html/rfc7230

IETF RFC 4514, Zeilenga K., "LDAP: String Representation of Distinguished Names", June 2006, available at https://datatracker.ietf.org/doc/html/rfc4514

IETF RFC 5234, Crocker D, Overell P., "Augmented BNF for Syntax Specifications: ABNF", January 2008, available at https://datatracker.ietf.org/doc/html/rfc5234

IETF RFC 5280, Cooper D., Santesson S., Farrell S., Boeyen S., Housley R., Polk W., "Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile", May 2008, available at https://datatracker.ietf.org/doc/html/rfc5280

IETF RFC 5392, Chen M., Zhang R., Duan X., "OSPF Extensions in Support of Inter-Autonomous System (AS) MPLS and GMPLS Traffic Engineering", January 2009, available at https://datatracker.ietf.org/doc/html/rfc5392

IETF RFC 5869, Krawczyk H, Eronen P., "HMAC-based Extract-and-Expand Key Derivation Function (HKDF)", May 2010, available at https://datatracker.ietf.org/doc/html/rfc5869

IETF RFC 5905, Mills D., Delaware U., Martin J., Burbank J., Kasch W., "Network Time Protocol Version 4: Protocol and Algorithms Specification", June 2010, available at https://datatracker.ietf.org/doc/html/rfc5905

IETF RFC 6455, Fette I., Melnikov A., "The WebSocket Protocol", December 2011, available at https://datatracker.ietf.org/doc/html/rfc6455

IETF RFC 6749, Hardt D., "The OAuth 2.0 Authorization Framework", October 2012, available at https://datatracker.ietf.org/doc/html/rfc6749

IETF RFC 6750, Jones M., Hardt D., "The OAuth 2.0 Authorization Framework: Bearer Token Usage", October 2012, available at https://datatracker.ietf.org/doc/html/rfc6750

IETF RFC 6960, Santesson S., Myers M., Ankney R., Malpani A., Galperin S. and Adams C., "X.509 Internet Public Key Infrastructure - Online Certificate Status Protocol - OCSP", June 2013, available at https://datatracker.ietf.org/doc/html/rfc6960

IETF RFC 7292, Moriarty K., Nystrom M., Parkinson S., Rusch A. and Scott M., "PKCS #12: Personal Information Exchange Syntax v1.1", July 2014, available at https://datatracker.ietf.org/doc/html/rfc7292

IETF RFC 7523, Jones M., Campbell B., Mortimore C., "JSON Web Token (JWT) Profile for OAuth 2.0 Client Authentication and Authorization Grants", May 2015, available at https://datatracker.ietf.org/doc/html/rfc7523

IETF RFC 8017, Moriarty K., Kaliski B., Jonsson J., "PKCS #1, RSA Cryptography Specifications Version 2.2", November 2016, available at https://datatracker.ietf.org/doc/html/rfc8017

available at https://datatracker.ietf.org/doc/html/rfc8141

IETF RFC 8259, Bray T., “The JavaScript Object Notation (JSON) Data Interchange Format”, December 2017, available at https://datatracker.ietf.org/doc/html/rfc8259

IETF RFC 8422, Nir Y., Josefsson S., Pegourie-Gonnard M., “Elliptic Curve Cryptography (ECC) Cipher Suites for Transport Layer Security (TLS) Versions 1.2 and Earlier”, August 2018, available at https://datatracker.ietf.org/doc/html/rfc8422

IETF RFC 8446, Rescorla E., “The Transport Layer Security (TLS) Protocol Version 1.3”, August 2018, available at https://datatracker.ietf.org/doc/html/rfc8446

FIPS 180-4, Secure Hash Standard (SHS), available at
https://csrc.nist.gov/publications/detail/fips/180/4/final

FIPS 197, Advanced Encryption Standard (AES), available at
https://www.nist.gov/publications/advanced-encryption-standard-aes

SOAP Part 1, SOAP Version 1.2 Part 1: Messaging Framework
http://www.w3.org/TR/soap12-part1/

WS Addressing, Web Services Addressing (WS-Addressing)
http://www.w3.org/Submission/ws-addressing/

XML Schema Part 2: XML Schema Part 2: Datatypes
http://www.w3.org/TR/xmlschema-2/

OpenID-Core, OpenID Connect Core 1.0
http://openid.net/specs/openid-connect-core-1_0.html

OpenID-Discovery, OpenID Connect Discovery 1.0
https://openid.net/specs/openid-connect-discovery-1_0.html

SemVer, Semantic Versioning 2.0.0
https://semver.org/spec/v2.0.0.html

IEC 62541-21, *OPC Unified Architecture - Part 21: Device Onboarding*

_____