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Poenotena arhitektura OPC - 2. del: Zaščitni model (IEC/TR 62541-2:2020)

OPC unified architecture - Part 2: Security Model (IEC/TR 62541-2:2020)

OPC Unified Architecture - Teil 2: Modell für die IT-Sicherheit (IEC/TR 62541-2:2020)

Architecture unifiée OPC - Partie 2: Modèle de sécurité (IEC/TR 62541-2:2020)

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OPC Unified Architecture - Teil 2: Modell für die IT-Sicherheit (IEC/TR 62541-2:2020)

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

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European foreword

This document (CLC IEC/TR 62541-2:2021) consists of the text of IEC/TR 62541-2:2020, prepared by SC 65E "Devices and integration in enterprise systems" of IEC/TC 65 "Industrial-process measurement, control and automation".

This document supersedes CLC/TR 62541-2:2010.

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Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice

The text of the International Technical Report IEC/TR 62541-2:2020 was approved by CENELEC as a European Technical Report without any modification.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC/TR 62541-1	-	OPC Unified Architecture - Part 1: Overview and Concepts	CLC IEC/TR 62541-1	-
IEC 62541-4	-	OPC Unified Architecture - Part 4: Services	EN IEC 62541-4	-
IEC 62541-5	-	OPC Unified Architecture - Part 5: Information Model	EN IEC 62541-5	-
IEC 62541-6	-	OPC Unified Architecture - Part 6: Mappings	EN IEC 62541-6	-
IEC 62541-7	-	OPC unified architecture - Part 7: Profiles	EN IEC 62541-7	-
IEC 62541-12	-	OPC unified architecture - Part 12: Discovery and global services	EN IEC 62541-12	-
IEC 62541-14	-	OPC unified architecture - Part 14: PubSub	EN IEC 62541-14	-
IEC 62351	series	Power systems management and associated information exchange - Data and communications security	EN IEC 62351	series

IEC TR 62541-2

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TECHNICAL REPORT

colour inside

OPC unified architecture –
Part 2: Security Model

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OPC UNIFIED ARCHITECTURE –

Part 2: Security Model

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.
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The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a technical report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

IEC TR 62541-2, which is a technical report, 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 of IEC TR 62541-2, published in 2016. This edition constitutes a technical revision.

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

a) protection-targets definition change;
b) threat type clarifications;
c) expanded best practices;

d) added Websockets;

e) added Pub/Sub.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
65E/679/DTR	65E/703/RVDR

Full information on the voting for the approval of this technical report 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.

Throughout this document and the referenced other Parts of the series, certain document conventions are used:

Italics are used to denote a defined term or definition that appears in the “Terms and definition” clause 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 often 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 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.

OPC UNIFIED ARCHITECTURE –

Part 2: Security Model

1 Scope

This part of IEC 62541 describes the OPC Unified Architecture (OPC UA) security model. It describes the security threats of the physical, hardware, and software environments in which OPC UA is expected to run. It describes how OPC UA relies upon other standards for security. It provides definition of common security terms that are used in this and other parts of the OPC UA specification. It gives an overview of the security features that are specified in other parts of the OPC UA specification. It references services, mappings, and *Profile*s that are specified normatively in other parts of the OPC UA Specification. It provides suggestions or best practice guidelines on implementing security. Any seeming ambiguity between this part and one of the other normative parts does not remove or reduce the requirement specified in the other normative part.

It is important to understand that there are many different aspects of security that have to be addressed when developing applications. However, since OPC UA specifies a communication protocol, the focus is on securing the data exchanged between applications. This does not mean that an application developer can ignore the other aspects of security like protecting persistent data against tampering. It is important that the developers look into all aspects of security and decide how they can be addressed in the application.

This part is directed to readers who will develop OPC UA *Client* or *Server* applications or implement the OPC UA services layer. It is also for end Users that wish to understand the various security features and functionality provided by OPC UA. It also offers some suggestions that can be applied when deploying systems. These suggestions are generic in nature since the details would depend on the actual implementation of the *OPC UA Application*s and the choices made for the site security.

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 62541-4, *OPC Unified Architecture – Part 4: Services*

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

IEC 62541-14, *OPC Unified Architecture – Part 14: PubSub*

IEC 62351 (all parts), *Power systems management and associated information exchange*

3 Terms, definitions, and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC TR 62541-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1
Access Restriction
limit on the circumstances where an operation, such as a read, write or a call, can be performed on a *Node*

Note 1 to entry: Operations can only be performed on a *Node* if the *Client* has the necessary *Permissions* and has satisfied all of the *Access Restrictions*.

3.1.2
Access Token
digitally signed document that asserts that the subject is entitled to access a *Resource*

Note 1 to entry: The document includes the name of the subject and the *Resource* being accessed.

3.1.3
Application Instance
individual installation of a program running on one computer

Note 1 to entry: There can be several Application Instances of the same application running at the same time on several computers or possibly the same computer.

3.1.4
Application Instance Certificate
Certificate of an individual *Application Instance* that has been installed in an individual host

Note 1 to entry: Different installations of one software product would have different Application Instance Certificates. The use of an *Application Instance Certificate* for uses outside of what is described in the specification could greatly reduce the security provided by the *Application Instance Certificate* and should be discouraged.

3.1.5
Asymmetric Cryptography
Cryptography method that uses a pair of keys, one that is designated the *Private Key* and kept secret, the other called the *Public Key* that is generally made available

Note 1 to entry: Asymmetric Cryptography is also known as "public-key cryptography". In an Asymmetric Encryption algorithm when an entity “A” requires *Confidentiality* for data sent to entity “B”, then entity “A” encrypts the data with a Public Key provided by entity “B”. Only entity “B” has the matching Private Key that is needed to decrypt the data. In an asymmetric Digital Signature algorithm when an entity “A” requires message Integrity or to provide *Authentication* for data sent to entity “B”, entity A uses its Private Key to sign the data. To verify the signature, entity B uses the matching Public Key that entity A has provided. In an asymmetric key agreement algorithm, entity A and entity B each send their own Public Key to the other entity. Then each uses its own Private Key and the other's Public Key to compute the new key value.’ according to IS Glossary.

3.1.6
Asymmetric Encryption
mechanism used by *Asymmetric Cryptography* for encrypting data with the *Public Key* of an entity and for decrypting data with the associated *Private Key*

3.1.7
Asymmetric Signature
mechanism used by *Asymmetric Cryptography* for signing data with the *Private Key* of an entity and for verifying the data's signature with the associated *Public Key*

3.1.8
Auditability
security objective that assures that any actions or activities in a system can be recorded

3.1.9
Auditing
tracking of actions and activities in the system, including security related activities where *Audit* records can be used to review and verify system operations

3.1.10
Authentication
security objective that assures that the identity of an entity such as a *Client*, *Server*, or user can be verified

3.1.11
Authorization
ability to grant access to a system resource

Note 1 to entry: Authorization of access to resources should be based on the need-to-know principle. It is important that access is restricted in a system.

3.1.12
AuthorizationService
Server which validates a request to access a *Resource* and can return an *Access Token* that grants access to the *Resource*

Note 1 to entry: The *AuthorizationService* is also called STS (Security Token Service) in other standards.

3.1.13
Availability
security objective that assures that the system is running normally, that is, no services have been compromised in such a way to become unavailable or severely degraded

3.1.14
Certificate Authority
entity that can issue *Certificate*s, also known as a CA

Note 1 to entry: The *Certificate* certifies the ownership of a Public Key by the named subject of the *Certificate*. This allows others (relying parties) to rely upon signatures or assertions made by the Private Key that corresponds to the *Public Key* that is certified. In this model of trust relationships, a CA is a trusted third party that is trusted by both the subject (owner) of the *Certificate* and the party relying upon the *Certificate*. CAs are characteristic of many Public Key infrastructure (PKI) schemes

3.1.15
CertificateStore
persistent location where *Certificate*s and *Certificate* revocation lists (CRLs) are stored

Note 1 to entry: It may be a disk resident file structure, or, on Windows platforms, it may be a Windows registry location.

3.1.16
Claim
statement in an *Access Token* that asserts information about the subject which the *Authorization Service* knows to be true

Note 1 to entry: Claims can include username, email, and *Roles* granted to the subject.