

INTERNATIONAL STANDARD

**OPC unified architecture -
Part 1: Overview and concepts**

CONTENTS

FOREWORD	3
1 Scope	5
2 Normative references	5
3 Terms, definitions and abbreviated terms	5
3.1 Terms and definitions	5
3.2 Abbreviated terms	9
4 Structure of the IEC 62541 series	10
4.1 Series organization	10
4.2 IEC 62541 series parts	10
5 Overview	12
5.1 Scope	12
5.2 General	12
5.3 Design goals	12
5.4 Integrated models and services	14
5.4.1 Security model	14
5.4.2 Integrated AddressSpace model	15
5.4.3 Integrated object model	16
5.4.4 Integrated services	16
5.5 Sessions	16
6 Systems concepts	17
6.1 Client Server Overview	17
6.2 OPC UA Clients	17
6.3 OPC UA Servers	18
6.3.1 General	18
6.3.2 Real objects	18
6.3.3 Server application	18
6.3.4 OPC UA AddressSpace	19
6.3.5 Subscription entities	19
6.3.6 OPC UA Service interface	20
6.3.7 Server to Server interactions	20
6.4 Redundancy	21
6.5 Publish-Subscribe	21
6.6 Synergy of models	22
6.7 Global Services	23
6.7.1 General	23
6.7.2 Discovery Services	23
6.7.3 Certificate management	24
6.7.4 KeyCredential management	24
6.7.5 Authorization services	24
6.7.6 Device Onboarding	24
6.7.7 Alias Names	24
6.7.8 Security Key Service (SKS)	24
7 Client/Server Service Sets	25
7.1 General	25
7.2 Discovery Service Set	25
7.3 SecureChannel Service Set	25

7.4	Session Service Set.....	26
7.5	NodeManagement Service Set.....	26
7.6	View Service Set.....	26
7.7	Query Service Set.....	26
7.8	Attribute Service Set.....	26
7.9	Method Service Set.....	27
7.10	MonitoredItem Service Set.....	27
7.11	Subscription Service Set.....	27
Bibliography.....		29
Figure 1 – OPC UA target applications.....		13
Figure 2 – OPC UA system architecture.....		17
Figure 3 – OPC UA Client architecture.....		17
Figure 4 – OPC UA Server architecture		18
Figure 5 – Peer-to-peer interactions between Servers.....		20
Figure 6 – Chained Server example		21
Figure 7 – Integrated Client Server and PubSub models		23
Figure 8 – SecureChannel and Session Services		26

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**OPC unified architecture -
Part 1: Overview and concepts****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 not 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 62541-1 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 first edition cancels and replaces IEC TR 62541-1 published in 2020.

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

Draft	Report on voting
65E/1039/CDV	65E/1093/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 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 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 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.

1 Scope

This part of IEC 62541 presents the concepts and overview of the OPC Unified Architecture (OPC UA). Reading this document is helpful to understand the remaining parts of the IEC 62541 series. Each of the other parts is briefly explained along with a suggested reading order.

2 Normative references

There are no normative references in this document.

Bibliography

IEC 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety-related systems*

IEC 61784-3:2021, *Industrial communication networks - Profiles - Part 3: Functional safety fieldbuses - General rules and profile definitions*

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 62541-6, *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 62541-9, *OPC Unified Architecture - Part 9: Alarms and Conditions*

IEC 62541-10, *OPC Unified Architecture - Part 10: Programs*

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

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

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

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

IEC 62541-15, *OPC Unified Architecture - Part 15: Safety*

IEC 62541-16, *OPC Unified Architecture - Part 16: State Machines*

IEC 62541-17, *OPC Unified Architecture - Part 17: Alias Names*

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

IEC 62541-19, *OPC Unified Architecture - Part 19: Dictionary References*

IEC 62541-20, *OPC Unified Architecture - Part 20: File Transfer*

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

IEC 62541-22, *OPC Unified Architecture - Part 22: Base Network Model*

IEC 62541-23, *OPC Unified Architecture - Part 23: Common ReferenceTypes*

IEC 62541-24, *OPC Unified Architecture - Part 24: Scheduler*

Recommendation ITU-T X.509 (2019) | ISO/IEC 9594-8:2020, *Information technology - Open Systems Interconnection - The Directory: Public-key and attribute certificate frameworks*