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TECHNICAL REPORT

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OPC unified architecture —
Part 1: Overview and concepts

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FOREWORD

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IEC TR 62541-1, 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.

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

Enquiry draft	Report on voting
65E/414/DTR	65E/463/RVC

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 second edition cancels and replaces the first edition of IEC TR 62541-1, published in 2010.

This edition includes no technical changes with respect to the previous edition but includes updates to reflect changes or additions in normative parts of IEC 62541.

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 website 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- withdrawn,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
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OPC UNIFIED ARCHITECTURE –

Part 1: Overview and concepts

1 Scope

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

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC TR 62541-2, *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 62541-13, *OPC Unified Architecture – Part 13: Aggregates*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1
AddressSpace
collection of information that an OPC UA *Server* makes visible to its *Clients*

Note 1 to entry: See IEC 62541-3 for a description of the contents and structure of the *Server* AddressSpace.

3.1.2
Aggregate
a function that calculates derived values from *Raw data*

Note 1 to entry: *Raw data* may be from a historian or buffered real time data. Common *Aggregates* include averages over a given time range, minimum over a time range and maximum over a time range.

3.1.3
Alarm
type of Event associated with a state condition that typically requires acknowledgement

Note 1 to entry: See IEC 62541-9 for a description of Alarms.

3.1.4
Attribute
primitive characteristic of a Node

Note 1 to entry: All Attributes are defined by OPC UA, and may not be defined by *Clients* or *Servers*. Attributes are the only elements in the AddressSpace permitted to have data values.

3.1.5
Certificate
digitally signed data structure that describes capabilities of a *Client* or *Server*

3.1.6
Client
software application that sends *Messages* to OPC UA *Servers* conforming to the *Services* specified in the IEC 62541 series of standards

3.1.7
Condition
generic term that is an extension to an *Event*

Note 1 to entry: A *Condition* represents the conditions of a system or one of its components and always exists in some state.

3.1.8
Communication Stack
layered set of software modules between the application and the hardware that provides various functions to encode, encrypt and format a *Message* for sending, and to decode, decrypt and unpack a *Message* that was received

3.1.9
Complex Data
data that is composed of elements of more than one primitive data type, such as a structure

3.1.10
Discovery
process by which OPC UA Client obtains information about OPC UA Servers, including endpoint and security information

3.1.11
Event
generic term used to describe an occurrence of some significance within a system or system component

3.1.12
EventNotifier
special *Attribute* of a *Node* that signifies that a *Client* may subscribe to that particular *Node* to receive *Notifications* of *Event* occurrences

3.1.13
Information Model
organizational framework that defines, characterizes and relates information resources of a given system or set of systems

Note 1 to entry: The core address space model supports the representation of Information Models in the AddressSpace. See IEC 62541-5 for a description of the base OPC UA Information Model.

3.1.14
Message
data unit conveyed between *Client* and *Server* that represents a specific *Service* request or response

3.1.15
Method
callable software function that is a component of an *Object*

3.1.16
MonitoredItem
Client-defined entity in the *Server* used to monitor Attributes or *EventNotifiers* for new values or Event occurrences and that generates Notifications for them

3.1.17
Node
fundamental component of an AddressSpace

3.1.18
NodeClass
class of a Node in an AddressSpace

Note 1 to entry: NodeClasses define the metadata for the components of the OPC UA Object Model. They also define constructs, such as Views, that are used to organize the AddressSpace.

3.1.19
Notification
generic term for data that announces the detection of an Event or of a changed Attribute value

Note 1 to entry: Notifications are sent in NotificationMessages.

3.1.20
NotificationMessage
Message published from a Subscription that contains one or more Notifications

3.1.21
Object
Node that represents a physical or abstract element of a system

Note 1 to entry: Objects are modelled using the OPC UA Object Model. Systems, subsystems and devices are examples of Objects. An Object may be defined as an instance of an ObjectType.

3.1.22
Object Instance
synonym for Object

Note 1 to entry: Not all Objects are defined by ObjectTypes.

3.1.23
ObjectType
Node that represents the type definition for an Object

3.1.24
Profile
specific set of capabilities to which a *Server* may claim conformance

Note 1 to entry: Each *Server* may claim conformance to more than one Profile.

Note 2 to entry: The set of capabilities are defined in IEC 62541-7.

3.1.25
Program
executable Object that, when invoked, immediately returns a response to indicate that execution has started, and then returns intermediate and final results through Subscriptions identified by the *Client* during invocation

3.1.26
Reference
explicit relationship (a named pointer) from one Node to another

Note 1 to entry: The Node that contains the Reference is the source Node, and the referenced Node is the target Node. All References are defined by ReferenceTypes.

3.1.27
ReferenceType
Node that represents the type definition of a Reference

Note 1 to entry: The ReferenceType specifies the semantics of a Reference. The name of a ReferenceType identifies how source Nodes are related to target Nodes and generally reflects an operation between the two, such as "A Contains B".

3.1.28
RootNode
beginning or top Node of a *hierarchy*

Note 1 to entry: The RootNode of the OPC UA AddressSpace is defined in IEC 62541-5.

3.1.29
Server
software application that implements and exposes the Services specified in the IEC 62541 series of standards

3.1.30
Service
Client-callable operation in an OPC UA *Server*

Note 1 to entry: Services are defined in IEC 62541-4. A Service is similar to a method call in a programming language or an operation in a Web services WSDL contract.

3.1.31
Service Set
group of related *Services*

3.1.32
Session
logical long-running connection between a Client and a Server

Note 1 to entry: A Session maintains state information between Service calls from the Client to the Server.

3.1.33
Subscription
Client-defined endpoint in the Server, used to return Notifications to the Client

Note 1 to entry: "Subscription" is a generic term that describes a set of Nodes selected by the Client (1) that the Server periodically monitors for the existence of some condition, and (2) for which the Server sends Notifications to the Client when the condition is detected.

3.1.34
Variable
Node that contains a value

3.1.35
View
specific subset of the AddressSpace that is of interest to the *Client*

3.2   Abbreviations

A&E	Alarms and Events
API	Application Programming Interface
COM	Component Object Model
DA	Data Access
DCS	Distributed Control System
DX	Data Exchange
HDA	Historical Data Access
HMI	Human-Machine Interface
LDAP	Lightweight Directory Access Protocol
MES	Manufacturing Execution System
OPC	OPC Foundation (a non-profit industry association) formerly an acronym for "OLE for Process Control". No longer used anymore
PLC	Programmable Logic Controller
SCADA	Supervisory Control And Data Acquisition
SOAP	Simple Object Access Protocol
UA	Unified Architecture
UDDI	Universal Description, Discovery and Integration
UML	Unified Modelling Language
WSDL	Web Services Definition Language
XML	Extensible Mark-up Language

4   Structure of the OPC UA series

4.1   Specification organization

OPC UA is organized as a multi-part specification, as illustrated in Figure 1.