IEC 62541-11

Edition 3.0 2025-12

INTERNATIONAL STANDARD

REDLINE VERSION

OPC unified architecture -
Part 11: Historical Access

ICS 25.040.40; 35.100.05

ISBN 978-2-8327-0974-0

CONTENTS

FOREWORD 5
1 Scope 8
2 Normative references 8
3 Terms, definitions and abbreviations 8
3.1 Terms and definitions 8
3.2 Abbreviated terms 10
4 Concepts 11
4.1 General 11
4.2 Data architecture 11
4.3 Historians and interruption of data collection 12
4.4 Modification of Historical Data/Events 12
4.5 Timestamps 13
4.6 Bounding Values and time domain 13
4.7 Changes in AddressSpace over time 15
5 Historical Information Model 16
5.1 HistoricalNodes 16
5.1.1 General 16
5.1.2 Annotations Property 16
5.2 HistoricalDataNodes 17
5.2.1 General 17
5.2.2 HistoricalDataConfigurationType 17
5.2.3 Attributes 19
5.2.4 Historical Data Configuration Object 19
5.3 References 20
5.3.1 Overview 20
5.3.2 HasHistoricalConfiguration ReferenceType 21
5.3.3 HasCurrentData ReferenceType 21
5.3.4 HasCurrentEvent ReferenceType 22
5.4 HistoricalEventNodes 22
5.4.1 General 22
5.4.2 HistoricalEventFilter Property 22
5.4.3 HistoricalEventConfigurationType 23
5.4.4 HistoricalEventNode Attributes 23
5.5 External History sources 24
5.5.1 General 24
5.5.2 External Historical Event Node 24
5.6 Example Object Models in Historian Servers (informative) 25
5.6.1 Overview 25
5.6.2 HistoricalDataNodes Address Space Model 25
5.6.3 Historical data 27
5.6.4 HistoricalEventNodes Address Space Model 27
5.6.5 Historical Events 30
5.7 Exposing supported functions and capabilities 30
5.7.1 General 30
5.7.2 HistoryServerCapabilitiesType 32
5.7.3 Default configuration 35
5.8 Historical Audit Events 36

5.8.1 General 36
5.8.2 AuditHistoryEventUpdateEventType 36
5.8.3 AuditHistoryValueUpdateEventType 37
5.8.4 AuditHistoryAnnotationUpdateEventType 37
5.8.5 AuditHistoryDeleteEventType 38
5.8.6 AuditHistoryRawModifyDeleteEventType 39
5.8.7 AuditHistoryAtTimeDeleteEventType 40
5.8.8 AuditHistoryEventDeleteEventType 40
5.8.9 AuditHistoryConfigurationChangeEventType 41
5.8.10 AuditHistoryBulkInsertEventType 41
6 Historical Access specific usage of Services 42
6.1 General 42
6.2 Historical Nodes StatusCodes 43
6.2.1 Overview 43
6.2.2 Operation level result codes 43
6.2.3 Semantics changed 45
6.3 Continuation Points 45
6.4 Arrays, index ranges and substrings 45
6.5 HistoryReadDetails parameters 47
6.5.1 Overview 47
6.5.2 ReadEventDetails structure 49
6.5.3 ReadRawModifiedDetails structure 52
6.5.4 ReadProcessedDetails structure 55
6.5.5 ReadAtTimeDetails structure 57
6.5.6 ReadAnnotationDataDetails structure 58
6.6 HistoryData parameters returned 59
6.6.1 Overview 59
6.6.2 HistoryData type 59
6.6.3 HistoryModifiedData type 59
6.6.4 HistoryEvent ~~type~~ DataType 60
~~6.5.5 HistoryAnnotationData type ..... .~~
6.6.5 HistoryModifiedEvent DataType 61
6.6.6 Annotation DataType 62
6.7 HistoryUpdateType Enumeration 62
6.8 PerformUpdateType Enumeration 63
6.9 HistoryUpdateDetails parameter 63
6.9.1 Overview 63
6.9.2 UpdateDataDetails structure 65
6.9.3 UpdateStructureDataDetails structure 67
6.9.4 UpdateEventDetails structure 69
6.9.5 DeleteRawModifiedDetails structure 71
6.9.6 DeleteAtTimeDetails structure 72
6.9.7 DeleteEventDetails structure 73
Annex A (informative) Client conventions 75
A.1 How clients can request timestamps 75
A.2 Determining the first or last historical data point 76
Bibliography 78

Figure 1 – Possible OPC UA Server supporting Historical Access 11
Figure 2 – ReferenceType hierarchy 20
Figure 3 – Historical Variable with Historical Data Configuration and Annotations 26
Figure 4 – Historical Variable with Historical Data Configuration and Annotations 27
Figure 5 – Representation of an Event with History in the AddressSpace 29
Figure 6 – Event History configuration example 30
Figure 7 – Server and HistoryServer Capabilities 32
Figure 8 – History Array example 46
Figure 9 – Historian Array Illustration 2 47

Table 1 – Bounding Value examples 14
Table 2 – Annotations Property 16
Table 3 – HistoricalDataConfigurationType definition 17
Table 4 – ExceptionDeviationFormat ~~Values~~ Items 18
Table 5 – ExceptionDeviationFormat definition 19
Table 6 – Historical Access configuration definition 20
Table 7 – HasHistoricalConfiguration ReferenceType 21
Table 8 – HasCurrentData ReferenceType 21
Table 9 – HasCurrentEvent ReferenceType 22
Table 10 – Standard Historical Events Properties 23
Table 11 – HistoricalEventConfigurationType definition 23
Table 12 – HistoricalExternalEventSourceType definition 24
Table 13 – HistoryServerCapabilitiesType Definition 33
Table 14 – DefaultHAConfiguration definition 35
Table 15 – DefaultHEConfiguration definition 35
Table 16 – AuditHistoryEventUpdateEventType definition 36
Table 17 – AuditHistoryValueUpdateEventType definition 37
Table 18 – AuditHistoryAnnotationUpdateEventType definition 38
Table 19 – AuditHistoryDeleteEventType definition 39
Table 20 – AuditHistoryRawModifyDeleteEventType definition 39
Table 21 – AuditHistoryAtTimeDeleteEventType definition 40
Table 22 – AuditHistoryEventDeleteEventType definition 41
Table 23 – AuditHistoryConfigurationChangeEventType definition 41
Table 24 – AuditHistoryBulkInsertEventType definition 42
Table 25 – Bad operation level result codes 43
Table 26 – Good operation level result codes 44
Table 27 – HistoryReadDetails ~~parameterTypeIds~~ parameter Symbolic Names 48
Table 28 – HistoryReadDetails definition 49
Table 29 – ReadEventDetails Structure 49
Table 30 – ReadEventDetails definition 49
Table 31 – ReadEventDetails2 Structure 51
Table 32 – ReadEventDetails2 definition 51
Table 33 – ReadRawModifiedDetails structure 52

Table 34 – ReadRawModifiedDetails definition 52
Table 35 – ReadProcessedDetails structure 55
Table 36 – ReadProcessedDetails definition 55
Table 37 – ReadAtTimeDetails structure 57
Table 38 – ReadAtTimeDetails definition 57
Table 39 – ReadAnnotationDataDetails Structure 58
Table 40 – ReadAnnotationDataDetails definition 58
Table 41 – HistoryData ~~Details~~ structure 59
Table 42 – HistoryData definition 59
Table 43 – HistoryModifiedData ~~Details~~ structure 60
Table 44 – HistoryModifiedData definition 60
Table 45 – HistoryEvent ~~Details~~ structure 60
Table 46 – HistoryEvent definition 61
Table 47 – HistoryModifiedEvent structure 61
Table 48 – HistoryModifiedEvent definition 61
Table 49 – Annotation Structure 62
Table 50 – *Annotation* definition 62
Table 51 – HistoryUpdateType ~~Enumeration~~ Items 62
Table 52 – HistoryUpdateType definition 63
Table 53 – PerformUpdateType ~~Enumeration~~ Items 63
Table 54 – PerformUpdateType definition 63
Table 55 – HistoryUpdateDetails parameter ~~TypeIds~~ Symbolic Names 64
Table 56 – HistoryUpdateDetails Structure 65
Table 57 – HistoryUpdateDetails definition 65
Table 58 – UpdateDataDetails Structure 66
Table 59 – UpdateDataDetails definition 66
Table 60 – UpdateStructureDataDetails Structure 67
Table 61 – UpdateStructureDataDetails definition 68
Table 62 – UpdateEventDetails Structure 69
Table 63 – UpdateEventDetails definition 70
Table 64 – DeleteRawModifiedDetails Structure 72
Table 65 – DeleteRawModifiedDetails definition 72
Table 66 – DeleteAtTimeDetails Structure 73
Table 67 – DeleteAtTimeDetails definition 73
Table 68 – DeleteEventDetails Structure 73
Table 69 – DeleteEventDetails definition 74
Table A.1 – Time keyword definitions 76
Table A.2 – Time offset definitions 76

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

OPC unified architecture - Part 11: Historical Access

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.

This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 62541-11:2020. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC 62541-11 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) a functionality has been added to support retrieving of modified events;
b) an Event has been added to indicate when a backfill occurred;
c) a new ReferenceType that can be used to indicate an external node has been defined;
d) the text has been improved to better explain the concept of annotation and remove conflicting explanations;
e) a default historian configuration (and where to find it) has been defined;
f) HistoricalEventConfigurationType, which provides general configuration information about the historical Event storage, has been added;
g) the text has been updated and optional fields have been added to HA configuration object to allow configuration to be defined for periodic data collection, not just for exception-based collection;
h) an ObjectType that can be used for external event collection has been provided as well as an example how historians can be configured.

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

Draft	Report on voting
65E/1058/CDV	65E/1096/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.

1 Scope

This part of IEC 62541 belongs to the OPC Unified Architecture standards series and defines the *Information Model* associated with Historical Access (HA). It particularly includes additional and complementary descriptions of the *NodeClass*es and *Attributes* needed for Historical Access, additional standard *Properties*, and other information and behaviour.

The complete *AddressSpace* Model including all *NodeClass*es and *Attributes* is specified in IEC 62541-3. The predefined *Information Model* is defined in IEC 62541-5. The *Services* to detect and access historical data and events, and description of the *ExtensibleParameter* types are specified in IEC 62541-4.

This document includes functionality to compute and return *Aggregates* like minimum, maximum, average etc. The *Information Model* and the concrete working of *Aggregates* are defined in IEC 62541-13.

Conventions for Historical Access Clients are informatively provided in Annex A.

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 62541-3, *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 62541-8, *OPC Unified Architecture - Part 8: Data Access*

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