

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**OPC unified architecture –
Part 11: Historical Access**

**Architecture unifiée OPC –
Partie 11: Accès à l'Histoire**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2020 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembe
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 It also gives information on projects, replaced and withdrawn publications.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.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC -

webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**OPC unified architecture –
Part 11: Historical Access**

**Architecture unifiée OPC –
Partie 11: Accès à l'Histoire**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 25.040.40; 35.100.05

ISBN 978-2-8322-8454-4

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD	5
1 Scope	7
2 Normative references	7
3 Terms, definitions, and abbreviated terms	7
3.1 Terms and definitions	7
3.2 Abbreviated terms	9
4 Concepts	9
4.1 General	9
4.2 Data architecture	10
4.3 Timestamps	10
4.4 Bounding Values and time domain	11
4.5 Changes in AddressSpace over time	13
5 Historical Information Model	13
5.1 HistoricalNodes	13
5.1.1 General	13
5.1.2 Annotations Property	13
5.2 HistoricalDataNodes	14
5.2.1 General	14
5.2.2 HistoricalDataConfigurationType	14
5.2.3 HasHistoricalConfiguration ReferenceType	15
5.2.4 Historical Data Configuration Object	16
5.2.5 HistoricalDataNodes Address Space Model	17
5.2.6 Attributes	17
5.3 HistoricalEventNodes	18
5.3.1 General	18
5.3.2 HistoricalEventFilter Property	18
5.3.3 HistoricalEventNodes Address Space Model	18
5.3.4 HistoricalEventNodes Attributes	19
5.4 Exposing supported functions and capabilities	19
5.4.1 General	19
5.4.2 HistoryServerCapabilitiesType	20
5.5 Annotation DataType	22
5.6 Historical Audit Events	23
5.6.1 General	23
5.6.2 AuditHistoryEventUpdateEventType	23
5.6.3 AuditHistoryValueUpdateEventType	24
5.6.4 AuditHistoryAnnotationUpdateEventType	25
5.6.5 AuditHistoryDeleteEventType	25
5.6.6 AuditHistoryRawModifyDeleteEventType	26
5.6.7 AuditHistoryAtTimeDeleteEventType	27
5.6.8 AuditHistoryEventDeleteEventType	27
6 Historical Access specific usage of Services	28
6.1 General	28
6.2 Historical Nodes StatusCodes	28
6.2.1 Overview	28
6.2.2 Operation level result codes	28

6.2.3	Semantics changed	30
6.3	Continuation Points	30
6.4	HistoryReadDetails parameters	31
6.4.1	Overview	31
6.4.2	ReadEventDetails structure	31
6.4.3	ReadRawModifiedDetails structure	33
6.4.4	ReadProcessedDetails structure	35
6.4.5	ReadAtTimeDetails structure	37
6.4.6	ReadAnnotationDataDetails structure	38
6.5	HistoryData parameters returned	39
6.5.1	Overview	39
6.5.2	HistoryData type	39
6.5.3	HistoryModifiedData type	39
6.5.4	HistoryEvent type	39
6.5.5	HistoryAnnotationData type	40
6.6	HistoryUpdateType Enumeration	40
6.7	PerformUpdateType Enumeration	40
6.8	HistoryUpdateDetails parameter	40
6.8.1	Overview	40
6.8.2	UpdateDataDetails structure	42
6.8.3	UpdateStructureDataDetails structure	43
6.8.4	UpdateEventDetails structure	44
6.8.5	DeleteRawModifiedDetails structure	46
6.8.6	DeleteAtTimeDetails structure	47
6.8.7	DeleteEventDetails structure	48
Annex A (informative)	Client conventions	49
A.1	How clients may request timestamps	49
A.2	Determining the first historical data point	50
Bibliography		52
Figure 1	Possible OPC UA Server supporting Historical Access	10
Figure 2	ReferenceType hierarchy	16
Figure 3	Historical Variable with Historical Data Configuration and Annotations	17
Figure 4	Representation of an Event with History in the AddressSpace	19
Figure 5	Server and HistoryServer Capabilities	20
Table 1	Bounding Value examples	12
Table 2	Annotations Property	13
Table 3	HistoricalDataConfigurationType definition	14
Table 4	ExceptionDeviationFormat Values	15
Table 5	HasHistoricalConfiguration ReferenceType	16
Table 6	Historical Access configuration definition	16
Table 7	Historical Events Properties	18
Table 8	HistoryServerCapabilitiesType Definition	21
Table 9	Annotation Structure	23
Table 10	AuditHistoryEventUpdateEventType definition	23

Table 11 – AuditHistoryValueUpdateEventType definition	24
Table 12 – AuditHistoryAnnotationUpdateEventType definition	25
Table 13 – AuditHistoryDeleteEventType definition	26
Table 14 – AuditHistoryRawModifyDeleteEventType definition	26
Table 15 – AuditHistoryAtTimeDeleteEventType definition	27
Table 16 – AuditHistoryEventDeleteEventType definition	27
Table 17 – Bad operation level result codes	29
Table 18 – Good operation level result codes	29
Table 19 – HistoryReadDetails parameterTypeIds	31
Table 20 – ReadEventDetails	32
Table 21 – ReadRawModifiedDetails	33
Table 22 – ReadProcessedDetails	36
Table 23 – NodesToRead and aggregateType parameters	37
Table 24 – ReadAtTimeDetails	37
Table 25 – ReadAnnotationDataDetails	38
Table 26 – HistoryData Details	39
Table 27 – HistoryModifiedData Details	39
Table 28 – HistoryEvent Details	39
Table 29 – HistoryUpdateType Enumeration	40
Table 30 – PerformUpdateType Enumeration	40
Table 31 – HistoryUpdateDetails parameter TypeIds	41
Table 32 – UpdateDataDetails	42
Table 33 – UpdateStructureDataDetails	43
Table 34 – UpdateEventDetails	45
Table 35 – DeleteRawModifiedDetails	47
Table 36 – DeleteAtTimeDetails	47
Table 37 – DeleteEventDetails	48
Table A.1 – Time keyword definitions	50
Table A.2 – Time offset definitions	50

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) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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.

This third edition cancels and replaces the second edition published in 2015. This edition constitutes a technical revision.

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

- a) a new method for determining the first historical point has been added;
- b) added clarifications on how to add, insert, modify, and delete annotations.

The text of this standard is based on the following documents:

FDIS	Report on voting
65E/710/FDIS	65E/728/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

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 definition" 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, also 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 document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document 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 11: Historical Access

1 Scope

This part of IEC 62541 is part of the OPC Unified Architecture standard series and defines the *information model* associated with Historical Access (HA). It particularly includes additional and complementary descriptions of the *NodeClasses* and *Attributes* needed for Historical Access, additional standard *Properties*, and other information and behaviour.

The complete *AddressSpace* Model including all *NodeClasses* 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.

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

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

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, IEC 62541-3, IEC 62541-4, and IEC 62541-13 as well as 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>