SLOVENSKI STANDARD
oSIST prEN IEC 62541-11:2024

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OPC Unified Architecture - Part 11: Historical Access

OPC Unified Architecture - Teil 11: Zugang zu historischen Daten

Architecture unifiée OPC - Partie 11: Accès à l'historique

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COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER: **IEC 62541-11 ED3**	
DATE OF CIRCULATION: **2024-01-26**	CLOSING DATE FOR VOTING: **2024-04-19**
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IEC SC 65E : DEVICES AND INTEGRATION IN ENTERPRISE SYSTEMS

SECRETARIAT: United States of America	SECRETARY: Mr Donald (Bob) Lattimer
OF INTEREST TO THE FOLLOWING COMMITTEES:	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.

FUNCTIONS CONCERNED:

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The CENELEC members are invited to vote through the CENELEC online voting system.

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TITLE:

OPC Unified Architecture - Part 11: Historical Access

PROPOSED STABILITY DATE: 2026

NOTE FROM TC/SC OFFICERS:

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OPC UNIFIED ARCHITECTURE –

Part 11: Historical Access

FOREWORD

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International Standard 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 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) Added functionality to support retrieving of modified events.
b) Added Event to indicate when a backfill occurred.
c) Defined a new ReferenceType that can be used to indicate an external node.
d) Improved text to better explain the concept of annotation and remove conflicting explanations.
e) Defined a default historian configuration (and where to find it).
f) Added HistoricalEventConfigurationType, which provides general configuration information about the historical Event storage.
g) Updated text and added optional fields to HA configuration object to allow configuration to be defined for periodic data collection, not just for exception-based collection.

h) Provided ObjectType that can be used for external event collection and also provided example how histoians can be configured.

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

CDV	Report on voting
65E/XX/CDV	65E/XX/RVC

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, 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 document is part of the OPC Unified Architecture standard series and defines the I*nformation 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 standard 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, 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 and errata) applies.

IEC 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

3 Terms, definitions, and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62541-1, IEC 62541-3, IEC 62541-4, IEC 62541-13 and the following apply.

3.1.1
Annotation
metadata associated with an item at a given instance in time

Note 1 to entry: An *Annotation* is metadata that is associated with an item at a given instance in time.

3.1.2
BoundingValues
values associated with the starting and ending time

Note 1 to entry: *BoundingValues* are the values that are associated with the starting and ending time of a *ProcessingInterval* specified when reading from the historian. *BoundingValues* may be required by *Clients* to determine the starting and ending values when requesting *RawData* over a time range. If a *RawData* value exists at the start or end point, it is considered the bounding value even though it is part of the data request. If no *RawData*

value exists at the start or end point, then the *Server* will determine the boundary value, which may require data from a data point outside of the requested range. See 4.6 for details on using *BoundingValues*.

3.1.3
Historian
application storing time series data and/or time series events

3.1.4
HistoricalNode
Object, *Variable*, *Property* or *View* in the *AddressSpace* where a *Client* can access historical data or *Events*

Note 1 to entry: A *HistoricalNode* is a term used in this document to represent any *Object*, *Variable, Property* or *View* in the *AddressSpace* for which a *Client* may read and/or update historical data or *Events*. The terms "*HistoricalNodes's* history" or "history of a *HistoricalNodes*" will refer to the time series data or *Events* stored for this *HistoricalNode*. The term *HistoricalNode* refers to both *HistoricalDataNodes* and HistoricalEventNodes.

3.1.5
HistoricalDataNode
Variable or *Property* in the *AddressSpace* where a *Client* can access historical data

Note 1 to entry: A *HistoricalDataNode* represents any Variable or Property in the *AddressSpace* for which a *Client* may read and/or update historical data. "*HistoricalDataNode* history" or "history of a *HistoricalDataNode*" refers to the time series data stored for this *HistoricalNode*. Examples of such data are:

- device data (like temperature sensors)
- calculated data
- status information (open/closed, moving)
- dynamically changing system data (like stock quotes)
- diagnostic data

The term *HistoricalDataNodes* is used when referencing aspects of the standard that apply to accessing historical data only.

3.1.6
HistoricalEventNode
Object or *View* in the *AddressSpace* for which a *Client* can access historical *Events*

Note 1 to entry: "*HistoricalEventNode's* history" or "history of a *HistoricalEventNode*" refers to the time series *Events* stored in some historical system. Examples of such data are:

- *Notifications*
- system *Alarms*
- operator action *Events*
- system triggers (such as new orders to be processed)

The term *HistoricalEventNode* is used when referencing aspects of the standard that apply to accessing historical *Events* only.

3.1.7
ModifiedValues
HistoricalDataNode's value that has been changed (or manually inserted or deleted) after it was stored in the historian

Note 1 to entry: For some *Servers*, a lab data entry value is not a *modified value*, but if a user corrects a lab value, the original value would be considered a *modified value*, and would be returned during a request for *ModifiedValues*. Also manually inserting a value that was missed by a standard collection system may be considered a *modified value*. Unless specified otherwise, all historical *Services* operate on the current, or most recent, value for the specified *HistoricalDataNode* at the specified timestamp. Requests for *ModifiedValues* are used to access values that have been superseded, deleted or inserted. It is up to a system to determine what is considered a *modified value*. Whenever a *Server* has modified data available for an entry in the historical collection it shall set the *ExtraData* bit in the *StatusCode.*

3.1.8
RawData
data that is stored within the historian for a *HistoricalDataNode*

Note 1 to entry: The data may be all data collected for the *DataValue* or it may be some subset of the data depending on the historian and the storage rules invoked when the item's values were saved.

3.1.9
StartTime/EndTime
bounds of a history request which define the time domain

Note 1 to entry: For all requests, a value falling at the end time of the time domain is not included in the domain, so that requests made for successive, contiguous time domains will include every value in the historical collection exactly once.

3.1.10
TimeDomain
interval of time covered by a particular request, or response

Note 1 to entry: In general, if the start time is earlier than or the same as the end time, the time domain is considered to begin at the start time and end just before the end time; if the end time is earlier than the start time, the time domain still begins at the start time and ends just before the end time, with time "running backward" for the particular request and response. In both cases, any value which falls exactly at the end time of the *TimeDomain* is not included in the *TimeDomain*. See the examples in 4.6. *BoundingValues* effect the time domain as described in 4.6.

All timestamps which can legally be represented in a *UtcTime DataType* are valid timestamps, and the *Server* may not return an invalid argument result code due to the timestamp being outside of the range for which the *Server* has data. See IEC 62541-3 for a description of the range and granularity of this *DataType*. *Servers* are expected to handle out-of-bounds timestamps gracefully, and return the proper *StatusCodes* to the *Client*.

3.1.11
StructuredHistoryData
structured data stored in a history collection where parts of the structure are used to uniquely identify the data within the data collection

Note 1 to entry: Most historical data applications assume only one current value per timestamp. Therefore, the timestamp of the data is considered the unique identifier for that value. Some data or meta data such as *Annotations* may permit multiple values to exist at a single timestamp. In such cases the *Server* would use one or more parameters of the *StructuredHistoryData* entry to uniquely identify each element within the history collection. *Annotations* are examples of *StructuredHistoryData*.

3.2 Abbreviated terms

DA Data Access
HA Historical Access
HDA Historical Data Access
UA Unified Architecture

4 Concepts

4.1 General

This document defines the handling of historical time series data and historical *Event* data in the OPC Unified Architecture (in a Historian). Included is the specification of the representation of historical data and *Events* in the *AddressSpace.*

4.2 Data architecture

A *Server* supporting Historical Access provides *Clients* with transparent access to different historical data and/or historical *Event* sources (e.g., process *Historians*, event *Historians*, etc.).

The historical data or *Events* may be in a proprietary data collection, database or a short-term buffer within memory. A *Server* supporting Historical Access will provide historical data and *Events* for all or a subset of the available *Variables*, *Objects, Properties* or *Views* within the *Server AddressSpace*.

Figure 1 illustrates how the *AddressSpace* of a UA *Server* might consist of a broad range of different historical data and/or historical *Event* sources.

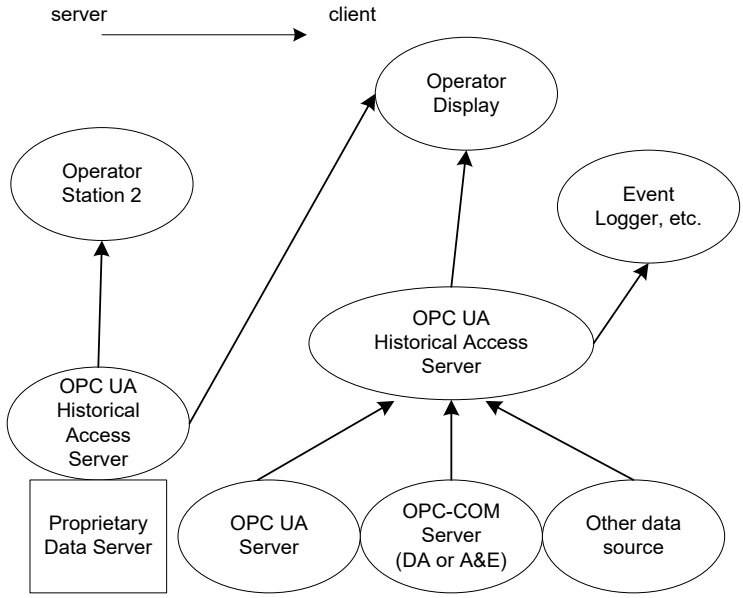

Figure 1 – Possible OPC UA Server supporting Historical Access

The *Historian* may be implemented as a standalone OPC UA *Server* that collects data from another OPC UA *Server* or another data source. The *Historian* may also just aggregate historical data from underlying *Historians*. The *Client* that references the OPC UA *Server* supporting Historical Access for historical data may be simple trending packages that desire values over a given time frame or they may be complex reports that require data in multiple formats.

There are general requirements for *Historians*, but *Historians* can vary in functionality. A consistent requirement for all *Historians* is that they store Historical data including a timestamp. All historical data should include status information for each value, but a *Historian* may compress this to only storing status information that indicates a problem (Bad status) and/or status change, instead of storing a status for every time series data item. The status of historical data can be complex. What is required is that the values returned as part of the timeseries raw data match the data that would have been observed if the *Value* was subscribed to at that point in time.

Historical *Events* are more complicated. In a stream of *Events* each Event can have a different list of fields. *EventTypes* are defined in a hierarchical manner, where each *EventType* inherits fields from its parent type and can add additional fields. Some of these additional fields may be mandatory and are required to understand or process the given *EventType*. A *Historian* that stores *Events*, shall be configurable to store all mandatory fields for any *EventTypes* that it historizes. If it receives for storage an *EventType* that it does not support all mandatory fields for, it may store it as one of its supertype *EventTypes* (one that it does support all mandatory fields for), but then it shall not claim that it supports historizing of that *EventType* (see 5.4.3). The *Historian* shall also provide information about the fields that are currently being historized (see 5.4.3).

4.3 Historians and interruption of data collection

When an *Historian* is collecting and storing data, the data collection may be interrupted. The interruption may have been for collecting the current values of data or for an event stream. The interruption may have been due to an interruption in the source of a value or an interruption of the forwarding of historical data from an underlying *Historian*. The interruption might also have been due to an action that stopped the collection of *HistoricalData* or historical *Events*. Some of these interruptions may recover with no loss of data, others may result in data gaps. The *Historian* shall report any gaps when a client is accessing the stored historical data with an error code of *Bad_DataLost*.