

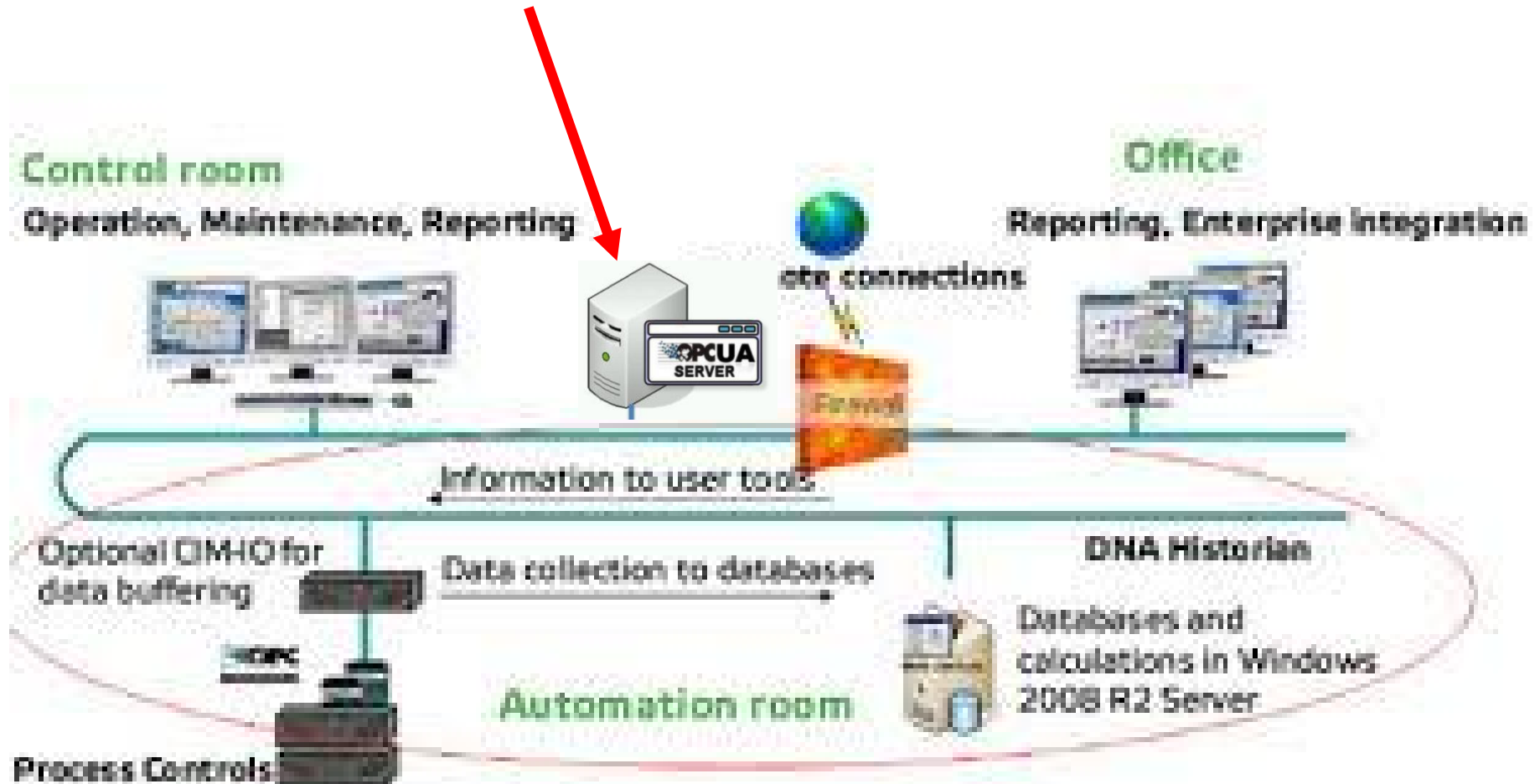


OPC UA new possibilities

Features and some facts

DNA OPC UA Server & Client

DNA OPC UA Server Overview



DNA OPC UA Components & licenses

Y Components

- DNA OPC UA Server software
 - Y DNA-OPCUA-Server
 - Y DNA-OPCUA-Client
 - Y DNA-OPCUA-AutoConfig
 - Y DNA-OPCUA-Discovery
- Diagnostic templates: Server, Session, Subscription

Y Licenses:

- Start
- Capacity
 - Y UaVariables (subscription based)
- Features (on/off):
 - Y Historical Access (HA)
 - Y Alarms & Events (AE)

DNA OPC UA Server

- ÿ Provides full Valmet DNA address space:
 - Configuration can be done manually (node + type + DNA tag)
 - Automatic scan will lookup and create all ports into OPC UA Server
- ÿ Security can be configured:
 - User & passwd
 - Certificates
- ÿ UA Expert used to test & show server address space, views and call server methods (execute them)

DNA OPC UA Server – Server Diagnostics

Integrated into Valmet DNA, can be used with other OPC UA Servers

OPC UA Server State **Running=0** Seconds till shutdown **1** Current time **17-11-30 09:54:14** D1UA
 Shutdown reason Start time **17-11-30 08:47:25**

Version information

ProductUri	DNA-NodeOPCUA	Architecture	Windows_NT
ManufacturerName	Valmet Automation	Bytes read	1977920
ProductName	NODEOPCUA-SERVER	Bytes written	7011068
SoftwareVersion	0.1.0-12	Connections	1 bytes
BuildNumber	1.1.0-snapshot.259	CPU count	4
BuildDate	Thu Nov 30 2017 08:38:05	Memory used	39
		Transactions	21867
		Memory free/total	5178900480 /8467476480

Diagnostics Off

Capabilities		OperationLimits	
ServerViewCount	0	MinSupportedSampleRate	100
CurrentSessionCount	1	MaxBrowseContinuationPoints	0
CumulatedSessionCount	1	MaxQueryContinuationPoints	0
SecurityRejectedSessionCount	0	MaxHistoryContinuationPoints	0
RejectedSessionCount	0	MaxArrayLength	0
SessionTimeoutCount	0	MaxStringLength	0
SessionAbortCount	0		
PublishingIntervalCount	0		
CurrentSubscriptionCount	1		
CumulatedSubscriptionCount	1		
SecurityRejectedRequestsCount	0		
RejectedRequestCount	0		

Sessions **Subscriptions**

DNA OPC UA Server – Session Diagnostics

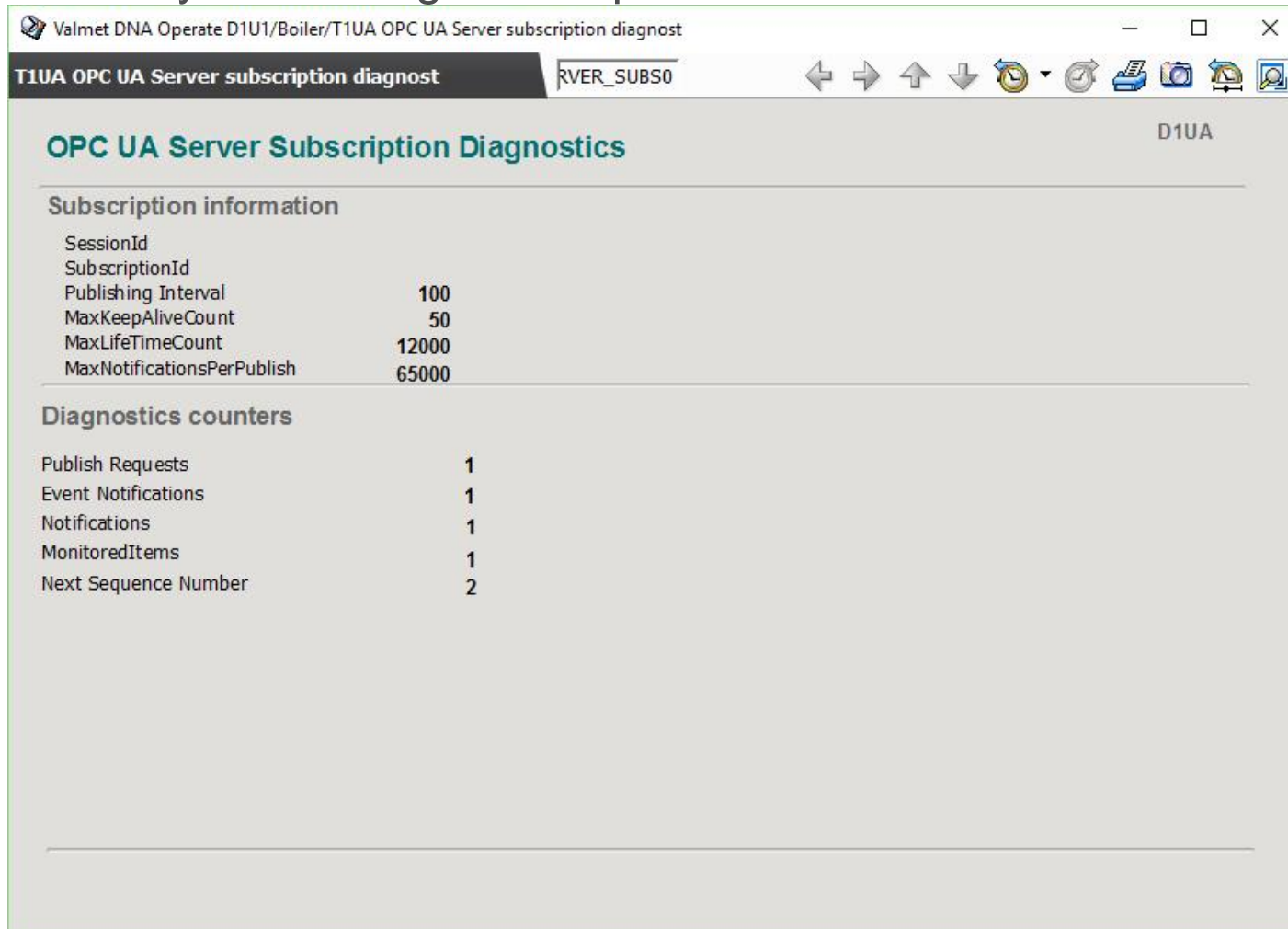
As many as open sessions

Session information		Connection time	18-02-07 15:40:25
SessionId		Last contact time	18-02-07 16:48:11
SessionName	urn:TREL12019440:UnifiedA	ActualSessionTimeout	OVF
ApplicationUri	urn:TREL12019440	Current Subscriptions	0
ProductUri	urn:UnifiedAutomat	Current Items	112
ApplicationName	Unified Automati	Publish queue	4
ApplicationType	CLIENT	Unauthorized requests	0

Diagnostics counters		
	Total	Errors
Requests	28213	0
Reads	851	0
Writes	0	0
Calls	1	0
CreateItems	20	0
DeleteItems	20	-1
CreateSubscriptions	4	-1
Publish	22964	0
DeleteSubscriptions	0	0
Browse	269	0
BrowsePaths to NodeIds	21	0

DNA OPC UA Server – Subscription Diagnost.

As many as running subscriptions



The screenshot shows a web-based diagnostic tool for an OPC UA server. The window title is "Valmet DNA Operate D1U1/Boiler/T1UA OPC UA Server subscription diagnost". The main content area is titled "OPC UA Server Subscription Diagnostics" and displays the following information:

Subscription information

SessionId	
SubscriptionId	
Publishing Interval	100
MaxKeepAliveCount	50
MaxLifeTimeCount	12000
MaxNotificationsPerPublish	65000

Diagnostics counters

Publish Requests	1
Event Notifications	1
Notifications	1
MonitoredItems	1
Next Sequence Number	2

OPC UA DNA objects

Timestamp from DNA (UTC time)

ÿ Basic types

- ana -> Float + Quality
- bin -> Uns16 + Quality
- ints > Int16 + Quality
- intl -> INt32 + Quality
- binev -> Uns16 + SourceTimestamp + Quality (timestamp from the IO-channel)

ÿ Function blocks supported

- Am, bin, mtrX, mgvX, pid, etc.

ÿ Table types supported

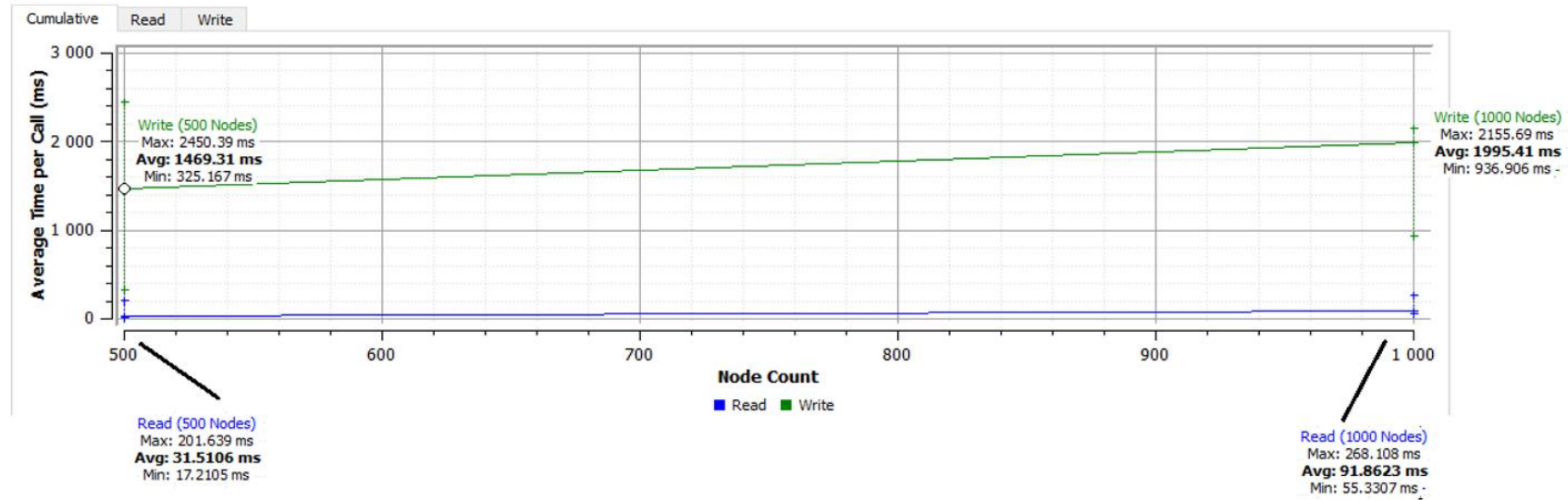
- 1 / 2 / 3 dimensions
- QCS profile data & Condition monitoring vibration data

ÿ Diagnostic types

- Dhart, dpbus, etc.

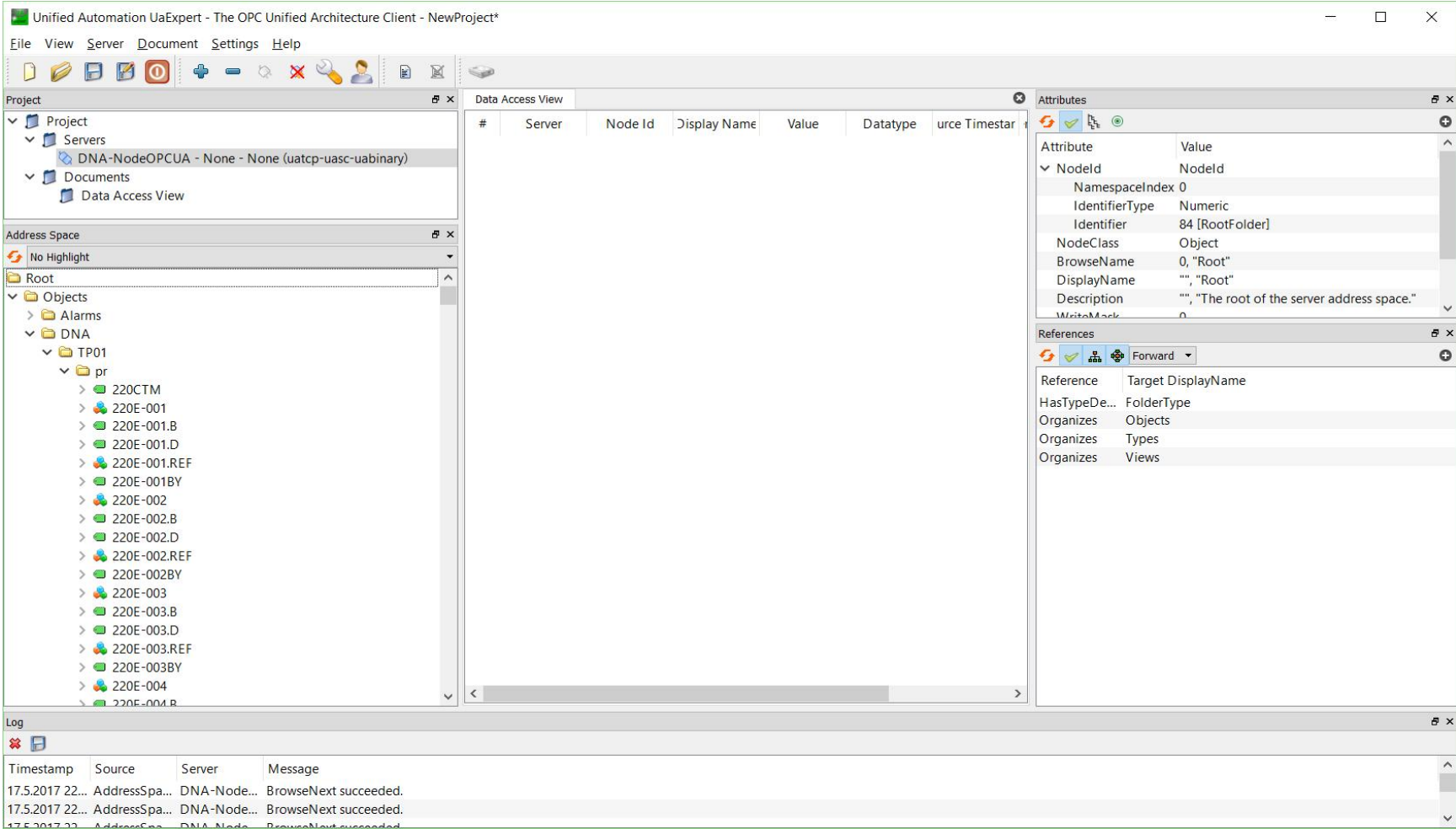
DNA OPC UA Performance

Read blue 1000 items ~100ms, write green 1000 items ~2000ms



OPC UA Address space

DNA folders: pr, di, sn, li etc. available (note: AP01 node before pr)



OPC UA Address space

DNA direct access port **pr:270GI1-105** type **am** member **av**

The screenshot shows the Unified Automation UaExpert interface. The main window displays the 'Data Access View' for a specific node. The 'Address Space' tree on the left shows the hierarchy of nodes, with '270GI1-105' expanded to show its members, including 'av'. The 'Data Access View' table shows the following data:

#	Server	Node Id	Display Name	Value	Datatype	Update Time
1	DN...	NS1 String 220CTM	220CTM	0	UInt16	22.37.51
2	DN...	NS1 String 270GI1-105/av	av	12.5	Float	22.38.45

The 'Attributes' panel on the right shows the configuration for the selected node 'av':

Attribute	Value
NodeId	NodeId
NamespaceIndex	1
IdentifierType	String
Identifier	270GI1-105/av
NodeClass	Variable
BrowseName	0, "av"
DisplayName	""; "av"
Description	""; ""
WriteMask	0

The 'References' panel shows the following reference:

Reference	Target	DisplayName
HasTypeDe...	BaseDataVariableType	

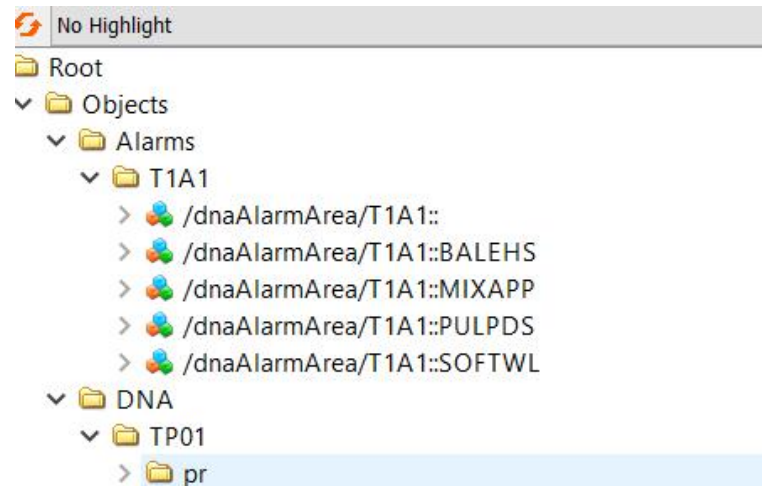
The 'Log' panel at the bottom shows the following messages:

Timestamp	Source	Server	Message
17.5.2017 22:...	DA Plugin	DNA-Node...	Item 'NS1 String 220E-001.REF/av' succeeded [ret = Good]
17.5.2017 22:...	DA Plugin	DNA-Node...	DeleteMonitoredItems succeeded [ret = Good]
17.5.2017 22:...	TypeCache	DNA-Node...	Reading type info of NodeId NS1 String 270GI1-105/av succeeded

DNA Alarms

- ÿ Automatic DNA ALS -> OPC UA event mapping
- ÿ DNAalarmLimit
- ÿ DNAdiscreteAlarm

- ÿ State synchronized
- ÿ Alarm can be “acknowledged” by OPC UA client
- ÿ Alarms are in alarm hierarchy
- ÿ Timestamp from DNA



DNA Alarms

Controller pid control disturbance

The screenshot displays the Unified Automation UaExpert interface. The main window is titled 'Unified Automation UaExpert - The OPC Unified Architecture Client - NewProject*'. The interface is divided into several panes:

- Project Tree (Left):** Shows a project structure with 'Servers' containing 'DNA-NodeOPCUA - None - None (uatcp-uasc-uabinary)' and 'Documents' containing 'Data Access View' and 'Event View'.
- Address Space (Left):** Shows a tree view starting with 'Root' and 'Objects'. Under 'Objects', there is a folder 'Alarms' containing 'T1A1'. Under 'T1A1', there are several sub-folders: '/dnaAlarmArea/T1A1:', '/dnaAlarmArea/T1A1::BALEHS', '/dnaAlarmArea/T1A1::MIXAPP', '/dnaAlarmArea/T1A1::PULPDS', and '/dnaAlarmArea/T1A1::SOFTWL'. Below this is a 'DNA' folder containing a 'TP01' folder with a 'pr' sub-folder and several '220E-001' through '220E-003.D' entries.
- Data Access View (Center):** Shows the configuration for 'Server/Object' as '> DNA-NodeOPCUA - None - None (uatcp-uasc-uabinary) / T1A1'. There is an 'Apply' button.
- Events (Center):** A table showing a list of events. The selected row is highlighted in blue.

Events	Alarms	Event History
A	C	
⚠		22.39.35 900 DNA-Node... 270ES11-005C Breaker Open DNAdiscret... Active
✓		22.39.35 700 DNA-Node... 2841 I-00? Acknowledge DNAlimitAl... Active
✓		22.39.35 500 DNA-Node... TEST-AM Acknowledge DNAlimitAl... Active
⚠		22.39.35 700 DNA-Node... TM2-BWRL.opr Cntrl disturb. DNAdiscret... Active
✓		22.39.35 700 DNA-Node... TM2-CRC1.opr Acknowledge DNAlimitAl... Active
⚠		22.39.35 700 DNA-Node... TM2-ODFF.opr Cntrl disturb. DNAdiscret... Active
⚠		22.39.35 700 DNA-Node... TM2-ODRL.opr Cntrl disturb. DNAdiscret... Active
- Details (Center):** A table showing details for the selected event.

Name	Value
AckedState/Id	False
ActiveState	"" "Active"
ActiveState/Id	True
BranchId	NodeId
NamespaceIndex	0
IdentifierType	Numeric
Identifier	0
- Attributes (Right):** A table showing attributes for the selected object.

Attribute	Value
NodeId	NodeId
NamespaceIndex	1
IdentifierType	String
Identifier	T1A1
NodeClass	Object
BrowseName	0, "T1A1"
DisplayName	"" "T1A1"
Description	"" "DNA Alarm server"
WriteMask	0
UsedWriteMask	0
- References (Right):** A table showing references for the selected object.

Reference	Target DisplayName
HasTypeDe...	FolderType
HasCompo...	/dnaAlarmArea/T1A1::SOFTWL
HasNotifier	/dnaAlarmArea/T1A1::SOFTWL
HasCompo...	/dnaAlarmArea/T1A1::PULPDS
HasNotifier	/dnaAlarmArea/T1A1::PULPDS
HasCompo...	/dnaAlarmArea/T1A1::BALEHS
HasNotifier	/dnaAlarmArea/T1A1::BALEHS
HasCompo...	/dnaAlarmArea/T1A1::
HasNotifier	/dnaAlarmArea/T1A1::
HasCompo...	/dnaAlarmArea/T1A1::MIXAPP
HasNotifier	/dnaAlarmArea/T1A1::MIXAPP
HasCompo...	/dnaAlarmArea/T1A1::HOOD
HasNotifier	/dnaAlarmArea/T1A1::HOOD
HasCompo...	/dnaAlarmArea/T1A1::TM
HasNotifier	/dnaAlarmArea/T1A1::TM
HasCompo...	/dnaAlarmArea/T1A1::DRIVES
HasNotifier	/dnaAlarmArea/T1A1::DRIVES
HasCompo...	/dnaAlarmArea/T1A1::ETREAT
HasNotifier	/dnaAlarmArea/T1A1::ETREAT
- Log (Bottom):** A table showing log entries.

Timestamp	Source	Server	Message
17.5.2017 22:...	TypeCache	DNA-Node...	Reading type info of NodeId NS1 Numeric 1006 succeeded
17.5.2017 22:...	TypeCache	DNA-Node...	Reading type info of NodeId NS1 Numeric 1005 succeeded
17.5.2017 22:...	TypeCache	DNA-Node...	Reading type info of NodeId NS1 Numeric 1004 succeeded

DNA – OPC UA Client

DNA OPC UA Client

Communicate with 3rd party OPC UA Server

Y Configuration:

- OPC UA Server variable address + type
- DNA tag + type

Y Read -> Write

Y Parameters for tuning communication and logging in client_cpu.json

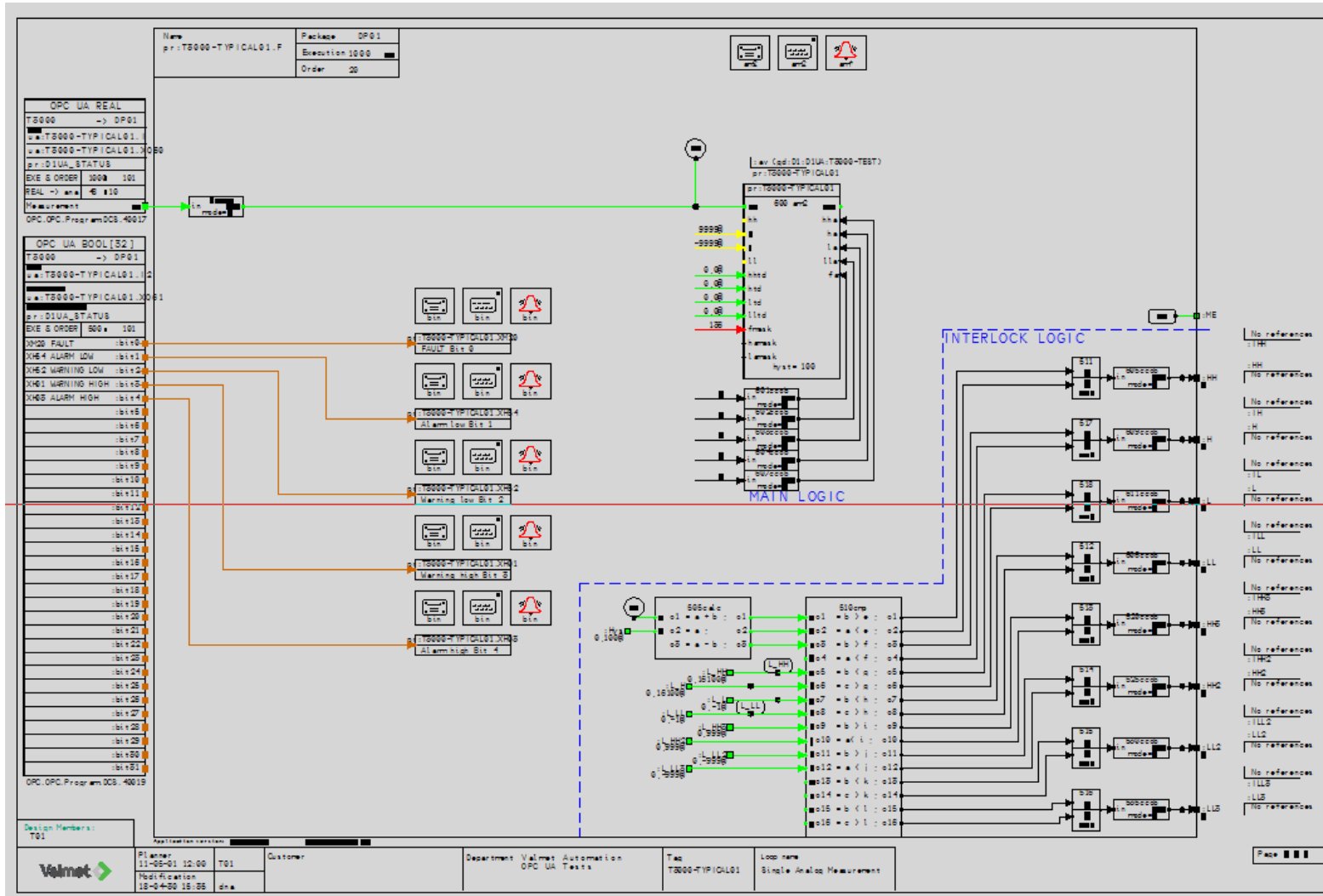
DNA OPC UA Client

Configuration file example

```
Y ReadName1 Type1 WriteName2 Type2
Y // Server CurrentTime
Y ns=0;i=2258 UtcTime ua:D1UA-STATUS.TIME binev // Watchdog if client if not updated do set fail bits
Y // Typical 01, Single Analog Measurement
Y ns=2;s="OPC.OPC.Program.DCS.40017" Float ua:T3000-TYPICAL01.XQ60 ana // Value
Y ns=2;s="OPC.OPC.Program.DCS.40019" Boolean[16] ua:T3000-TYPICAL01.XQ61 bin_5 // Status
Y // End of example
```

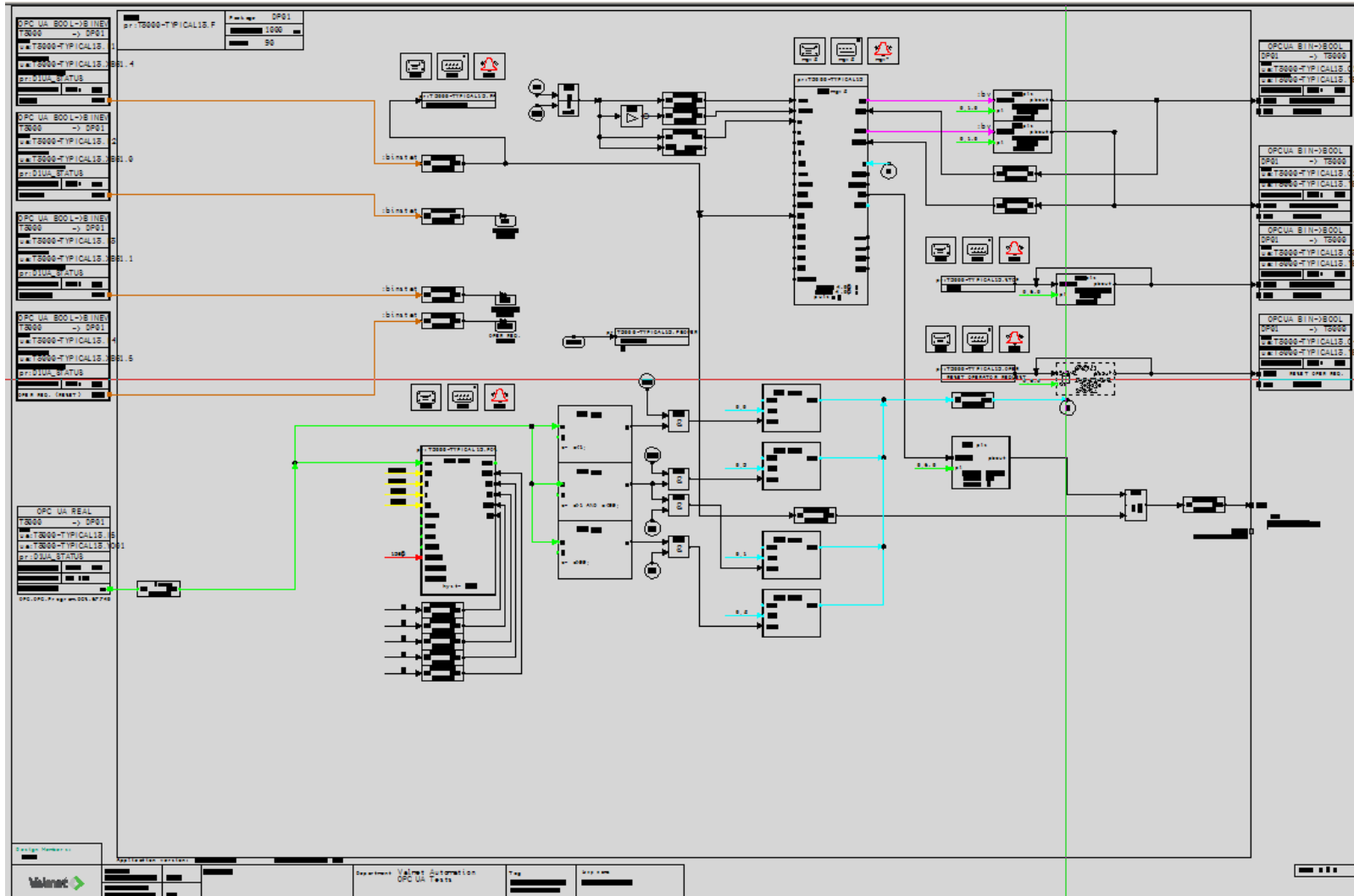

DNA OPC UA Client – DNA application

FbCAD with OPC UA IO-symbols: Analog measurement



DNA OPC UA Client – DNA application

FbCAD with OPC UA IO-symbols: Valve actuator



DNA OPC UA – Siemens T3000 typicals

- ÿ Tested at Erlangen with Siemens
- ÿ Siemens 18 typicals <-> FbCAD templates
- ÿ Demonstrated functionality to Stora Enso Maxau



DNA – OPC UA Server Advanced features

OPC UA will provide more functionality

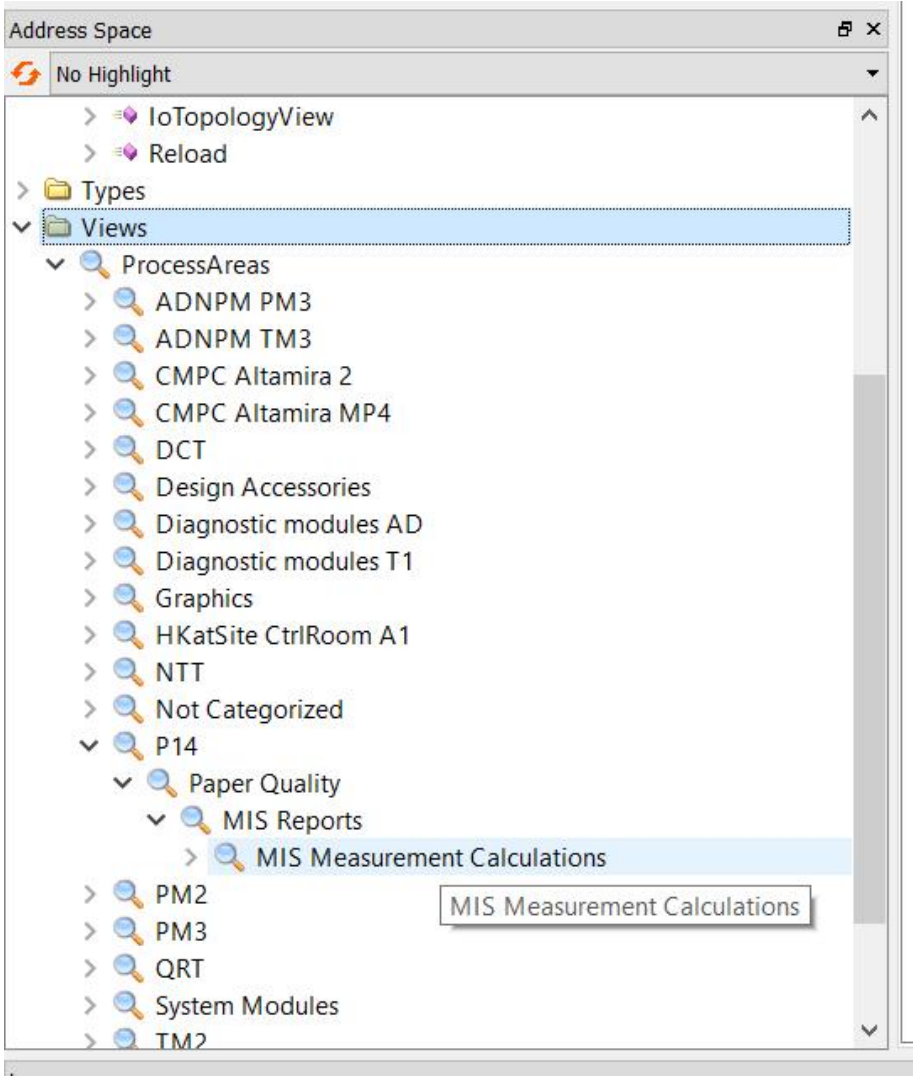
NOTE: Features are not yet available – not fully tested

- ÿ OPC UA can be extended and used dynamically
- ÿ Some features are not supported by all frameworks
 - Will cause some interoperability issues
 - But these can be solved
- ÿ Views:
 - Hierarchy to organize objects in multiple ways
 - Does not actually use much more memory
 - Reference (pointer) used for variables
- ÿ Methods:
 - Server can execute functions (not widely used)

NEXT: Some practical examples

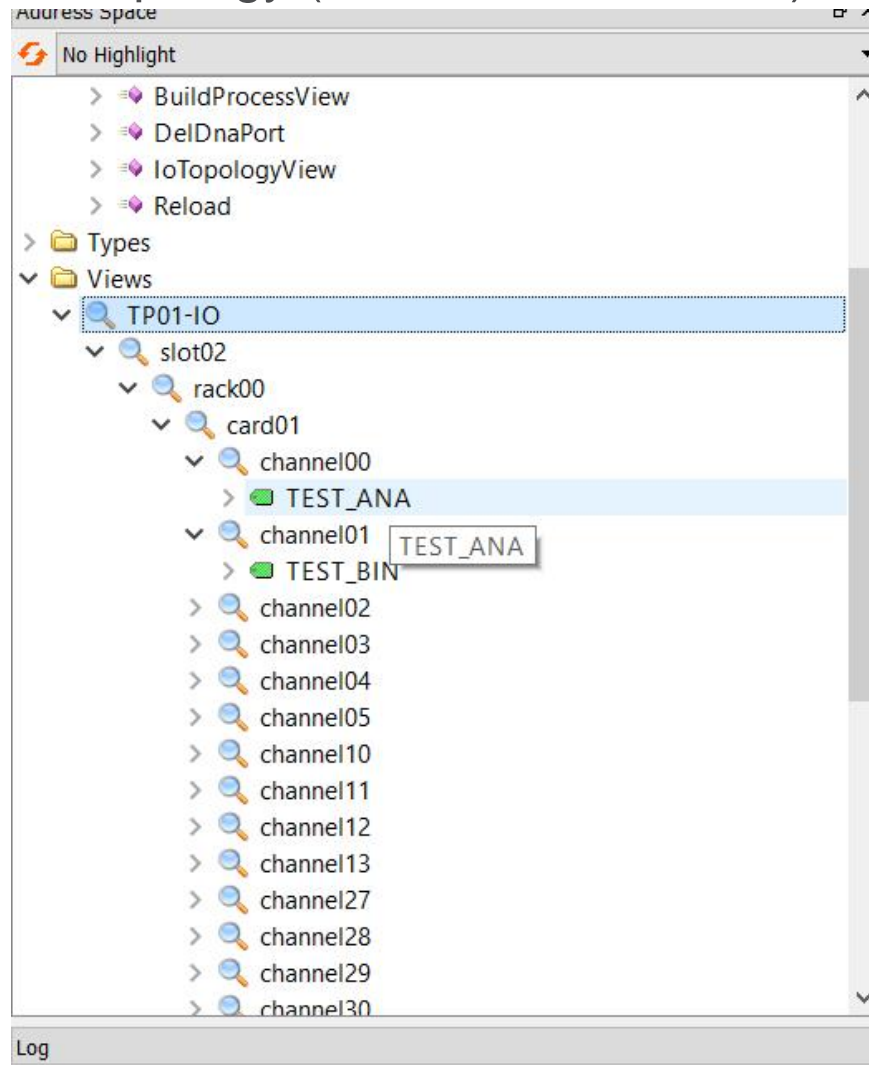
Views

ProcessAreas (XML export from EAS)



Views

IO-Topology (can be used for FDI)

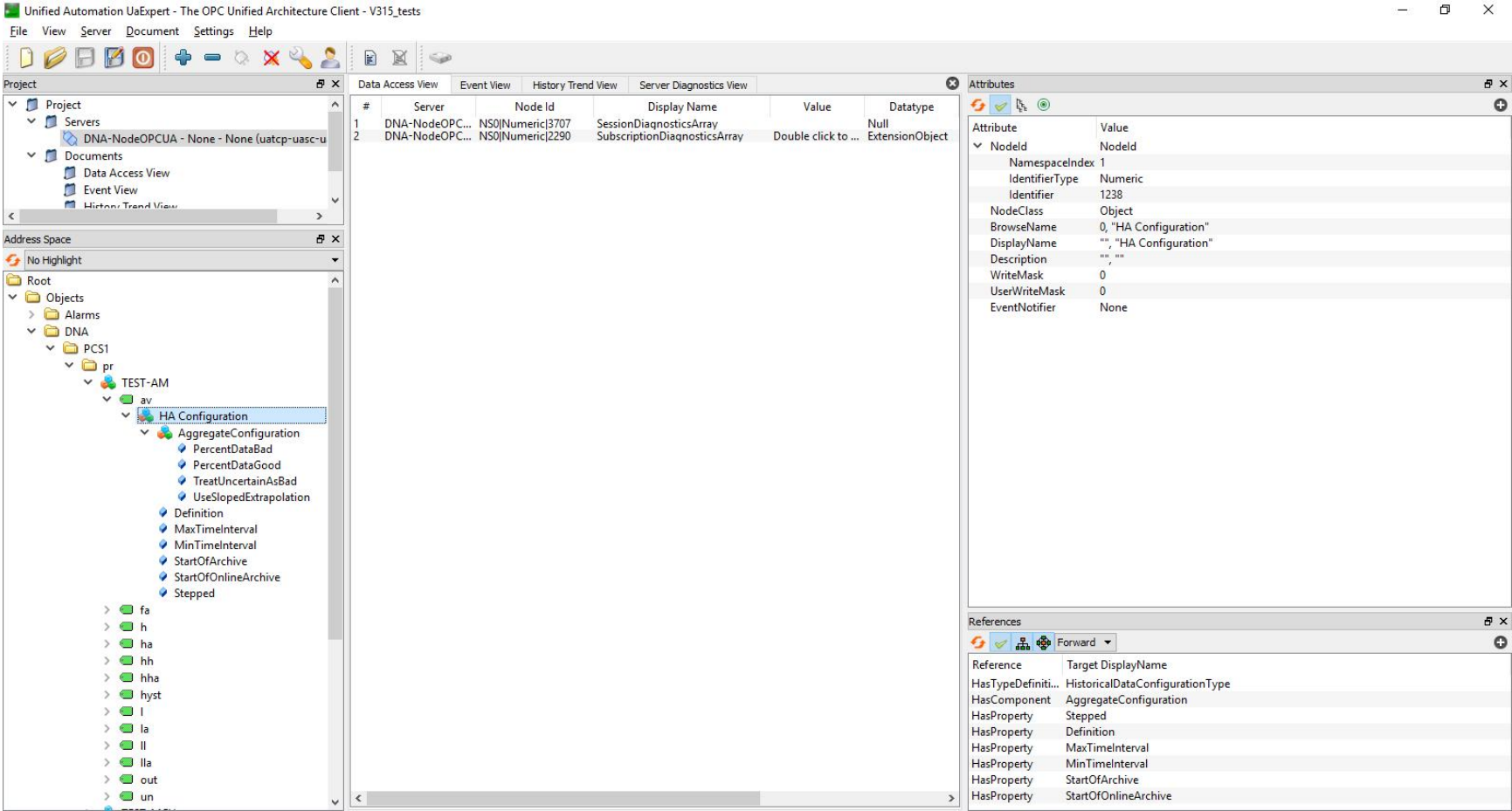


IO-data can be read by BsGUI
or
BsTool from the DNA system

IoTopologyView command reads
data from the file and populates
view.

OPC UA Historian

Collects values in memory – no database (test version)



OPC UA Historian

Values can be accessed from Views – Historian variables

The screenshot displays the OPC UA Historian software interface. The main window is titled "Unified Automation UaExpert - The OPC Unified Architecture Client - V315_tests*". The interface is divided into several panes:

- Project:** Shows a tree view of the project structure, including Servers, Documents, and Address Space.
- Configuration:** Shows the configuration for the selected variable. It includes a table with columns for Server, DisplayName, and Node Id. The configuration is set to "Single Update" with a Start Time of 12.01.18 11:00:00.000 and an End Time of 12.01.18 11:30:00.000. The Update Interval is 00:00:01. The variable is identified as "NS1|String|TEST-AM/av".
- History Data:** Shows a line graph of the variable's value over time. The Y-axis represents the value (ranging from 3300 to 3700) and the X-axis represents time (ranging from 12.1.2018 11:21:45 to 12.1.2018 11:22:10). The graph shows a steady increase in the value from approximately 3350 to 3650. A legend indicates the variable is "NS1|String|TEST-AM/av".
- Attributes:** Shows the attributes of the variable. The variable is identified as "TEST-AM/av" and is of type "Float". It has a Value of 8989.5 and a StatusCode of "Good (0x00000000)".
- References:** Shows the references of the variable, including "BaseDataVariableType" and "HA Configuration".

OPC UA & Machine Learning

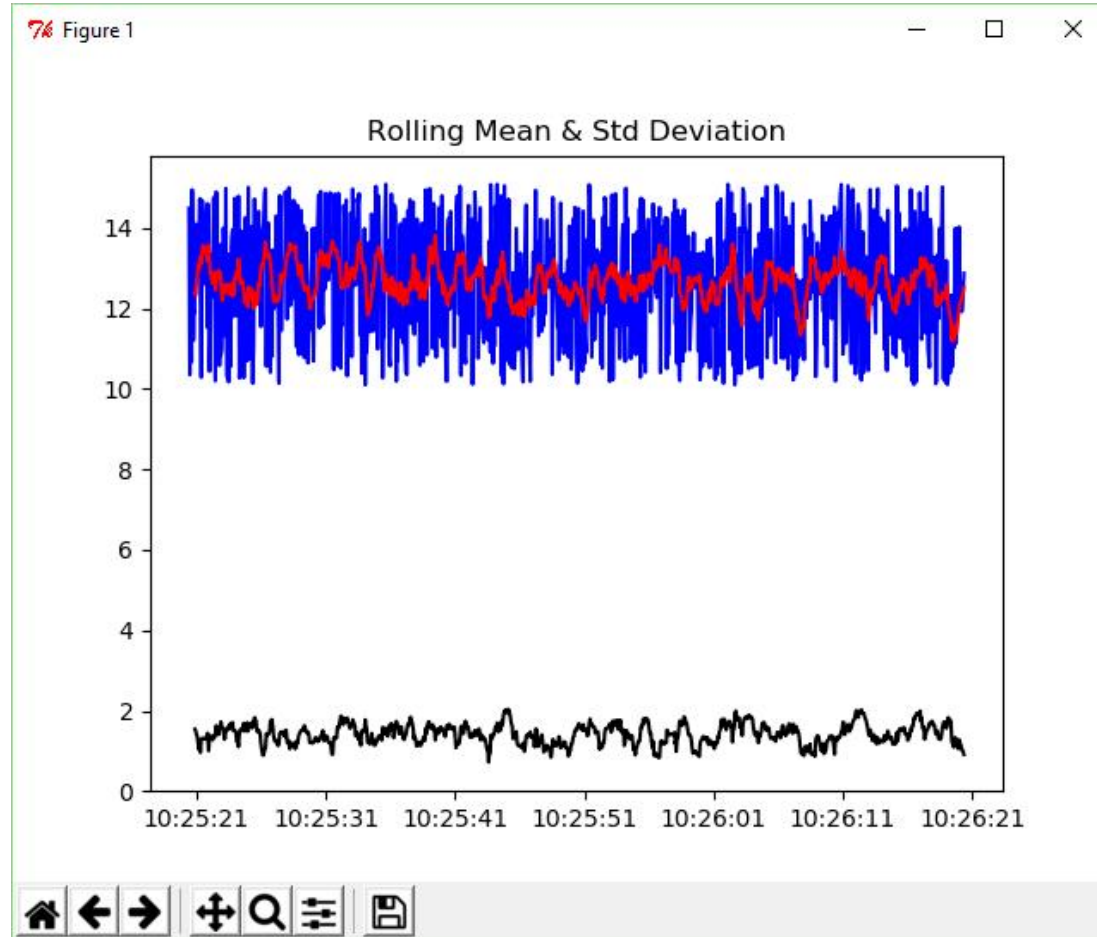
Trend data

The screenshot displays the Unified Automation UaExpert interface. The main window is titled "Unified Automation UaExpert - The OPC Unified Architecture Client - V315_tests*". The interface is divided into several panes:


- Project:** Shows a tree view of the project structure, including Servers, Documents, and Address Space.
- Address Space:** Shows a tree view of the address space, including Objects, Types, and Views.
- Configuration:** Shows the configuration for the selected variable, including Server, DisplayName, Node Id, Color, and Update options (Single Update or Cyclic Update).
- History Data:** Shows a line graph of the variable's value over time. The graph is titled "Numeric Values" and shows a highly volatile signal. The x-axis represents time from 15.1.2018 12:25:00 to 15.1.2018 12:26:10. The y-axis represents the value, ranging from 10 to 16. A legend indicates the variable is "NS1[String]TEST-AM/av".
- Attributes:** Shows the attributes of the selected variable, including NamespaceIndex, IdentifierType, Identifier, NodeClass, BrowseName, DisplayName, Description, WriteMask, and UserWriteMask.
- References:** Shows the references of the selected variable, including Reference, Target DisplayName, HasTypeDefiniti..., PropertyType, and HasModellingR...

OPC UA & Python Machine Learning

Analysis from HA data -> Dataframe



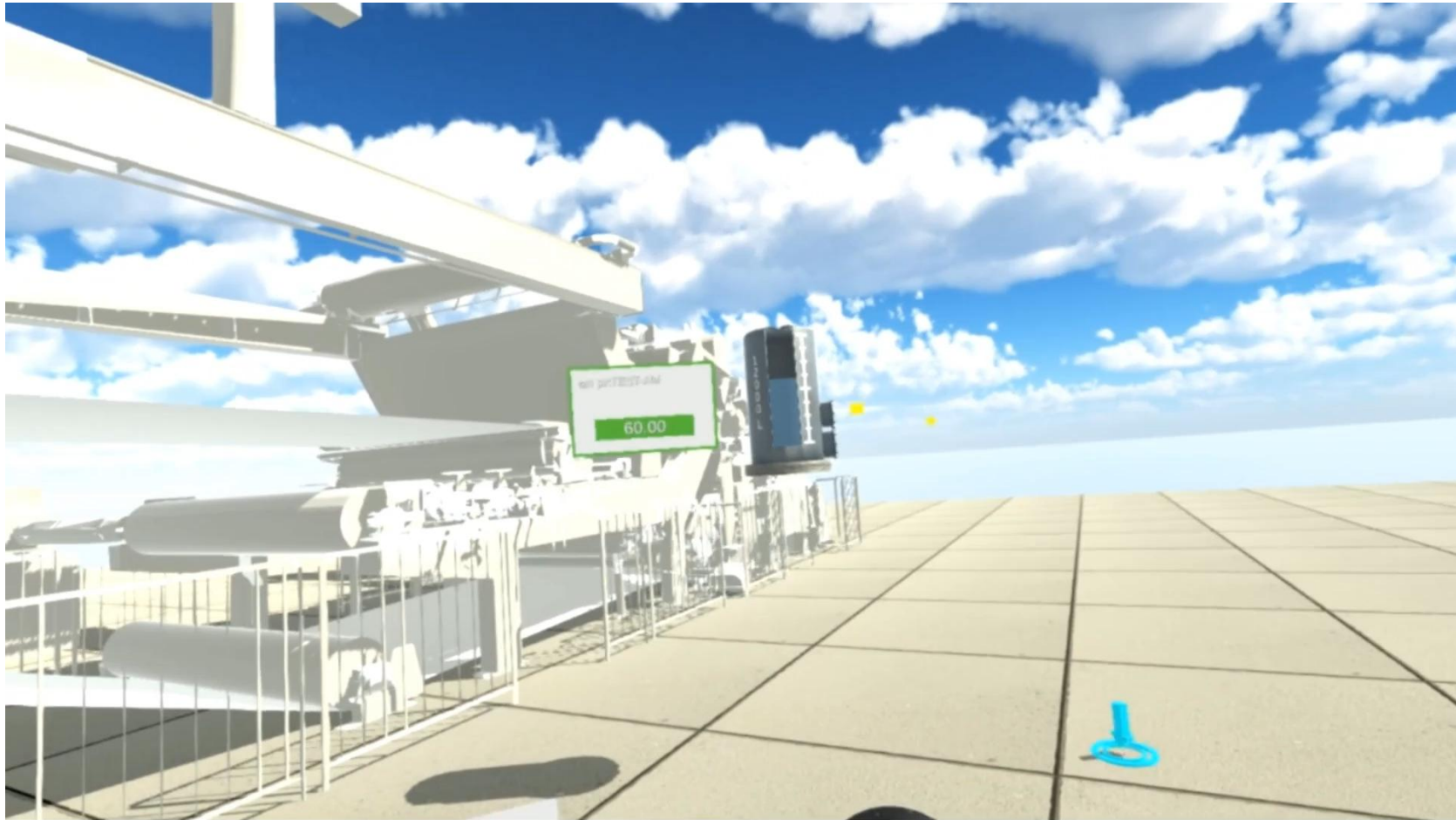
`df.rolling(window=10).mean() and std()`



HoloMill – XR application OPC UA based communication

MR HoloMill

Live values animated on domain objects like Tank, Pump etc.



MR HoloMill – Teleport to active alarm location

Tag and description



OPC UA - Vision

- ÿ OPC UA can be extended
- ÿ OPC UA usage grows fast
- ÿ More runtime behavior through Views and Methods
- ÿ Standardization will be needed even more:
 - To support different vendors & versions
 - Share use cases & agree formats

