



Automatic Asset Onboarding

USING CHATGPT FOR AUTOMATIC ASSET
ONBOARDING FOR INDUSTRIAL IOT PROJECTS

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The Biggest Challenge: Vendor Lock-In

...happens when...

you are forced to use a closed-source **SDK** in your product.

you are forced to use a proprietary **interface** to communicate.

you are forced to use a proprietary **communication protocol**.

you are forced to use a vendor-specific **data model**.

you are forced to run your solution in a specific **software platform**.

you are forced to run your solution on specific **hardware**.

The Key to Reducing Costs: Interoperability

We need...

1. A common **Interface** (Analogy: A Book)
2. A common **Data Format** (Analogy: Latin Alphabet)
3. A common **Data Model** (Analogy: English)
4. Common **Semantics** (Analogy: "Moby Dick")

Only when all 4 things are present can we truly understand each other!

An Interoperability Example for OPC UA-enabled Assets

1. **Interface:** OPC UA Client/Server
2. **Data Format:** OPC UA Binary
3. **Data Model:** OPC UA Information Model
4. **Semantics:** OPC UA Robotics Companion Spec



An Interoperability Example for non-OPC UA-enabled Assets

1. **Interface:** Modbus (later mapped to OPC UA)
2. **Data Format:** JSON-LD
3. **Data Model:** Web of Things Thing Description
4. **Semantics:** Modbus Protocol Binding





IEC 62541 - The Industrial Interoperability Standard

Microsoft is a member of the OPC Foundation since 1996, >900 members

Microsoft supports OPC UA on Azure since 2016

Microsoft has contributed over 5M lines of open-source code to the OPC Foundation

Interoperability

Vendor, Protocol, Platform and OS Independent



Open Source on GitHub (>4.5M source lines contributed by Microsoft)

Scalable from sensor to Cloud, Services Oriented Architecture (SOA)

Owned by a Non-Profit (OPC Foundation)

>100M installed base and exponential growth

Data Modelling

Discoverable, supports complex data types

Graph support, preserves source context

Vendor extendable

Domain-specific Companion Specifications:

- Discrete: Robotics, Machine Vision, ...
- Process: FDI, FDT, PA-DIM, MDIS, NOA..
- Energy: IEC61850, ..

Security

Secure Design from group-up

Based on open security standards

Auditing, Authentication & Encryption

Evolves as security technologies evolve

Vendors can choose level of security

Acceptable by IT departments

Semantic Interoperability via Companion Specs

The VDMA has over 3200 member companies, over 600 are involved in building OPC UA Companion Specs

» Agricultural Machinery

» Air Conditioning & Ventilation

» Air Pollution Control

» Automated Guided Vehicles

» Battery Production

» Building Control and Management

» Building Materials

» Ceramic Machinery

» Cleaning Systems

» Compressors, Compressed Air and Vacuum Technology

» Construction Equipment

» Continuous Conveyors

» Cranes

» Die & Mould

» Drying Technology

» Electrical Automation

» Electronics, Micro & Nano Technologies

» Engines

» Engines & Systems

» Fire Fighting Equipment

» Fluid Power

» Food Processing and Packaging Machinery

» Foundry Machinery

» Glass Machinery

» Hydro Power Plants

» Industrial Trucks

» Integrated Assembly Solutions

» Intralogistic Systems

» Length Measurement Technology

» Lifts & Escalators

» Machine Tools and Manufacturing Systems

» Machine Vision

» Metallurgical Plants and Rolling Mills

» Micro Technologies

» Mining

» Photovoltaic Equipment

» Plastics & Rubber Machinery

» Power Transmission Engineering

» Precision Tools

» Printing & Paper Technology

» Process Plant & Equipment

» Productronic

» Pumps & Systems

» Refrigeration & Heat Pump Technology

» Robotics

» Security Systems

» Software & Digitalization

» Surface Technology

» Testing Technology

» Textile Care, Fabric and Leather Technology

» Textile Machinery

» Thermal Power Plants

» Thermo Process Technology

» Valves

» Waste Treatment & Recycling

» Weighing Technology

» Welding & Pressure Gas Equipment

» Wind Power Plants

» Woodworking Machinery

OPC UA CS Released

OPC UA CS Release Candidate

Joint Working Group with OPC Foundation

OPC UA CS in Progress

OPC UA CS in Planning

























Industrial Connectivity



Industrial IoT Edge Partnerships



Normalized, standardized,
open data model & telemetry
stream for all machines,
including security!

 Matrikon Data Broker By Honeywell System Integrators (SIs), engineers, and IT professionals, use Matrikon® Data Broker to easily setup, manag... Get it now 	 ThingWorx Kepware Edge for Azure By PTC Inc. PTC's ThingWorx Kepware Edge is a Linux-based connectivity platform providing a single source of industrial... Get it now 	 OPC Router – The Communication... By Inray Industriesoftware GmbH The central Industry 4.0 platform enables data exchange in your networked production processes to be automa... Get it now 	 edgeConnector 840D By Softing Industrial Automation GmbH Run the IoT Edge Module and connect up to 20 Siemens SINUMERIK 840D SolutionLine and PowerLine Controllers... Get it now 	 edgeConnector Siemens By Softing Industrial Automation GmbH Run the IoT Edge Module and connect up to 20 Siemens S7-300/400 or S7-1200/1500 PLCs. Acts as OPC UA server... Get it now 	 edgeConnector Modbus By Softing Industrial Automation GmbH Softing edgeConnector Modbus is a containerized Modbus TCP connectivity module adding OPC UA Server and MQT... Get it now 
 zenon on IoT Edge: Free Trial By COPA-DATA zenon on IoT Edge brings the data acquisition and processing power of the zenon Runtime to your IoT Edge de... Get it now 	 edgeAggregator By Softing Industrial Automation GmbH Container-based flexible OT/IT integration solution built on OPC UA with MQTT connectivity to IoT solutions Get it now 	 Kalki.io Edge (IoT Module) By Kalkitech.com Kalki.io Edge simplifies data acquisition at the edge from field devices such as Sensors, Controllers, PLC,... Get it now 	 ogamma Visual Logger for OPC IoT Edge Module By One-Way Automation Inc. Integration tool to collect, store and forward, visualize, analyze OPC UA data. Get it now 	 IcoEdgeAgent By ICONICS IcoEdgeAgent for IoT Edge devices is a required module to be deployed as part of a complete ICONICS IoTWorX... Get it now 	 edgeConnector FANUC CNC By Softing Industrial Automation GmbH Run the IoT Edge Module and connect up to 20 FANUC CNC Controllers. Acts as OPC UA server on Azure IoT Edge... Get it now 

[All products – Microsoft Azure Marketplace](#)

Industrial Asset Data Model Kinds and how to Map to OPC UA (Estimated WW Numbers!)



1. Discoverable (~10%)

a) OPC UA-enabled (PLC) (~4%)

-> No ind. conn. software required!

b) Non-OPC UA-enabled (PLC) (~6%)

-> Automatic mapping by ind. conn. software

2. Non-Discoverable (~90%)

a) Fixed function/data model (~63%)

-> Automatic mapping based on WoT Thing Description sent to ind. conn. software

b) Programmable (PLC) (~27%)

-> Manual mapping via ind. conn. software

Web of Things Thing Description

Standardized machine and human readable device descriptions

```
1 {
2   "@context": "https://www.w3.org/2019/wot/td/v1",
3   "id": "urn:siemens:pac4200",
4   "base": "modbus://192.168.10.100:1502",
5   "title": "Siemens SENTRON PAC4200",
6   "description": "Multifunctional energy metering device",
7   "properties": {
8     "VoltageL1-N": {
9       "@type": "opcua_30141:AcVoltagePe_UL1N",
10      "type": "number", "readOnly": true,
11      "forms": [{
12        "href": "/1?offset=3&length=4", "op": ["readproperty", "observeproperty"]
13      }]
14    },
15    "VoltageL2-N": { ...
32  }
33  },
34  "actions": {
35    "changeRate": {
36      "@type": "opcua_30141:metering_rate",
37      "input": {
38        "type": "number", "enum": [0, 1],
39        "description": "0 for high rate, 1 for low rate"
40      },
41      "forms": [{
42        "href": "/1?offset=60006&length=1", "op": "invokeaction"
43      }]
44    }
45  },
46  ...
}
```



W3C Recommendation

Web of Things (WoT) Thing Description

W3C Recommendation 9 April 2020 (Link errors corrected 23 June 2020)



This version:

<https://www.w3.org/TR/2020/REC-wot-thing-description-20200409/>

Latest published version:

<https://www.w3.org/TR/wot-thing-description/>

Latest editor's draft:

<https://w3c.github.io/wot-thing-description/>

Implementation report:

<https://w3c.github.io/wot-thing-description/testing/report.html>

Previous version:

<https://www.w3.org/TR/2020/PR-wot-thing-description-20200130/>

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Participate:

[GitHub w3c/wot-thing-description](#)
[File a bug](#)
[Commit history](#)
[Pull requests](#)

Contributors:

[In the GitHub repository](#)

Repository:

[We are on GitHub](#)
[File a bug](#)

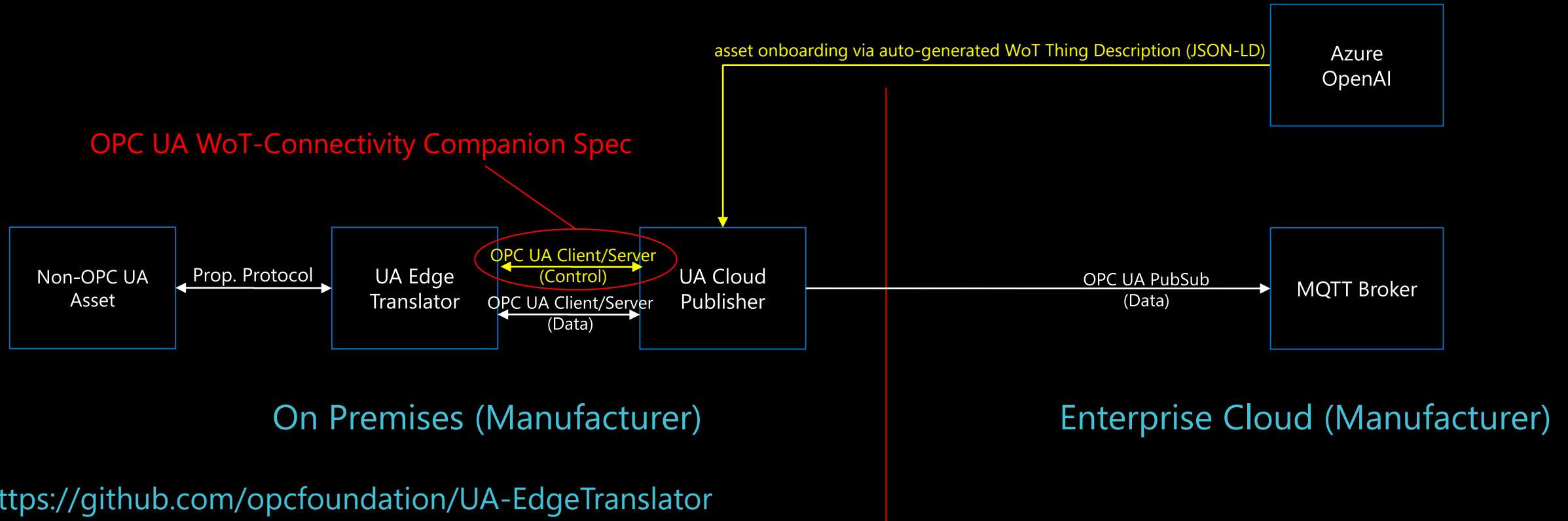
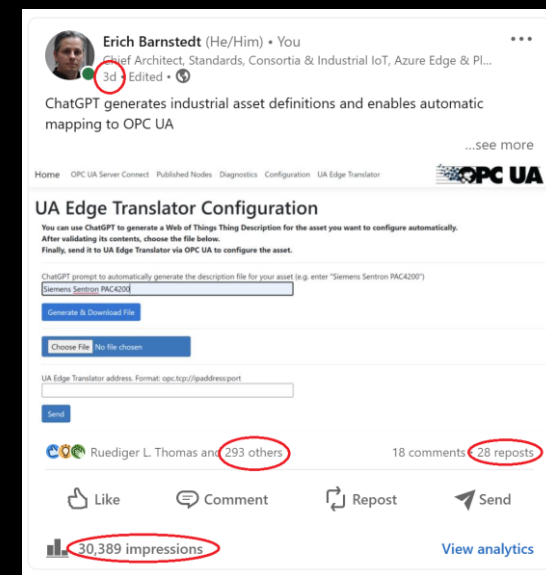
Please check the [errata](#) for any errors or issues reported since publication.

See also [translations](#).

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Abstract

UA Edge Translator Standardized Industrial Connectivity Integration & OpenAI-Powered Automatic Asset Onboarding in 3 Steps!





OPC 10100-1


OPC UA for WOT Connectivity Part 1: API Definition

Release Candidate 1.00

2023-09-28

1. User enters make and model of asset in Chat prompt

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UA Edge Translator Configuration

You can use the **Azure OpenAI** service to generate and download a Web of Things (WoT) Thing Description for the asset you want to configure automatically.
[Here](#) is a good online editor for WoT files.
After validating its contents, choose the file below.
Finally, send it to UA Edge Translator via OPC UA to configure the asset.

1. ChatGPT prompt to automatically generate the description file for your asset (e.g. enter "Siemens Sentron PAC4200"):

Generate & Download File

2. Load the manually validated asset description file:

Choose File No file chosen

3. Send the loaded asset description file to UA Edge Translator. UA Translator address format: opc.tcp://ipaddress:port

Send

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Asset Copilot - Azure OpenAI auto-generated WoT TD File

Including support for OPC UA Companion Specifications



```
pac4200.jsonld
Schema: https://json.schemastore.org/jsonld.json

1 {
2   "@context": [
3     "https://www.w3.org/2019/wot/td/v1",
4     "https://si-ra.github.io/ontologies/td-context.jsonld",
5     "http://opcfoundation.org/UA/PNEM/"
6   ],
7   "id": "urn:pac4200",
8   "securityDefinitions": {
9     "nosec_sc": {
10       "scheme": "nosec"
11     }
12   },
13   "security": [
14     "nosec_sc"
15   ],
16   "@type": [
17     "Thing"
18   ],
19   "name": "modbus-pac4200-sn324",
20   "base": "modbus://192.168.10.100:502",
21   "title": "Siemens SENTRON PAC4200",
22   "properties": {
23     "VoltageL1-N": {
24       "type": "number",
25       "readOnly": true,
26       "observable": true,
27       "forms": [
28         {
29           "href": "/1?address=1&quantity=2",
30           "op": [
31             "readproperty",
32             "observeproperty"
33           ],
34           "opcua:type": "nsu=http://opcfoundation.org/UA/PNEM/;i=6098",
35           "modbus:type": "float",
36           "modbus:entity": "holdingregister",
37           "modbus:pollingTime": 2000
38         }
39       ]
40     },
41     "VoltageL2-N": {
42       "type": "number",
43       "readOnly": true
44     }
45   }
46 }
```

2. User edits auto-generated WoT Thing Description

The screenshot displays the Eclipse WoT Editor (editDor) interface. The top bar shows the application name and navigation buttons: GPT, Share, Discover, New, Open, Save, and Persist As File. The left sidebar contains a validation status section with "JSON Validation" and "JSON Schema Validation" both marked as successful. Below this, the Thing Description for "SiemensSENTRONPAC4200" is shown, including its ID, context, name, mlfb, base, and security definitions. The central panel displays the Thing Description metadata and a list of properties (VoltageL1-N, VoltageL2-N, VoltageL3-N). The right panel features a code editor showing the JSON representation of the Thing Description and an AI assistant chat window. The AI assistant chat window has a message input field and a "Generate me a Thing Description for a Siemens Sentron PAC 4200" button. The bottom status bar indicates the number of properties, actions, and events, along with the file size.

JSON Validation ✓
JSON Schema Validation ✓

SiemensSENTRONPAC4200

id urn:pacPVDAS1

@context >

name Pac4200

mlfb 7KM3220-1BA01-1EA0

base modbus://host:port

securityDefinitions >

security nsec_sc

> Forms

> Links

Properties

> VoltageL1-N

> VoltageL2-N

> VoltageL3-N

Actions

Properties: 3 Actions: 0 Events: 0 Size: 1.034 KiB

SiemensSENTRONPAC4200

```
1 {
2   "@context": ["https://www.w3.org/2019/wot/td/v1"],
3   "title": "SiemensSENTRONPAC4200",
4   "id": "urn:pacPVDAS1",
5   "name": "Pac4200",
6   "mlfb": "7KM3220-1BA01-1EA0",
7   "base": "modbus://host:port",
8   "securityDefinitions": {
9     "nsec_sc": {
10       "scheme": "nsec"
11     }
12   }
13 }
```

Ask Your AI Assistant

Send a message and it will be forwarded to a GPT instance. It will assist you in writing your TDs

Generate me a Thing Description for a Siemens Sentron PAC 4200

```
{
  "@context": ["https://www.w3.org/2019/wot/td/v1"],
  "title": "SiemensSENTRONPAC4200",
  "id": "urn:pacPVDAS1",
  "name": "Pac4200",
  "mlfb": "7KM3220-1BA01-1EA0",
  "base": "modbus://host:port",
  "securityDefinitions": {
    "nsec_sc": {
      "scheme": "nsec"
    }
  },
  "security": "nsec_sc",
  "properties": {
    "VoltageL1-N": {
      "description": "voltage between L1 and N IV1"
    }
  }
}
```


Copy last message to editor

Start typing...

You have unsaved changes. - version: 0.0.3 | we are on github

3. User sends edited WoT Thing Description to UA Edge Translator

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Generate & Download File

2. Load the manually validated asset description file:

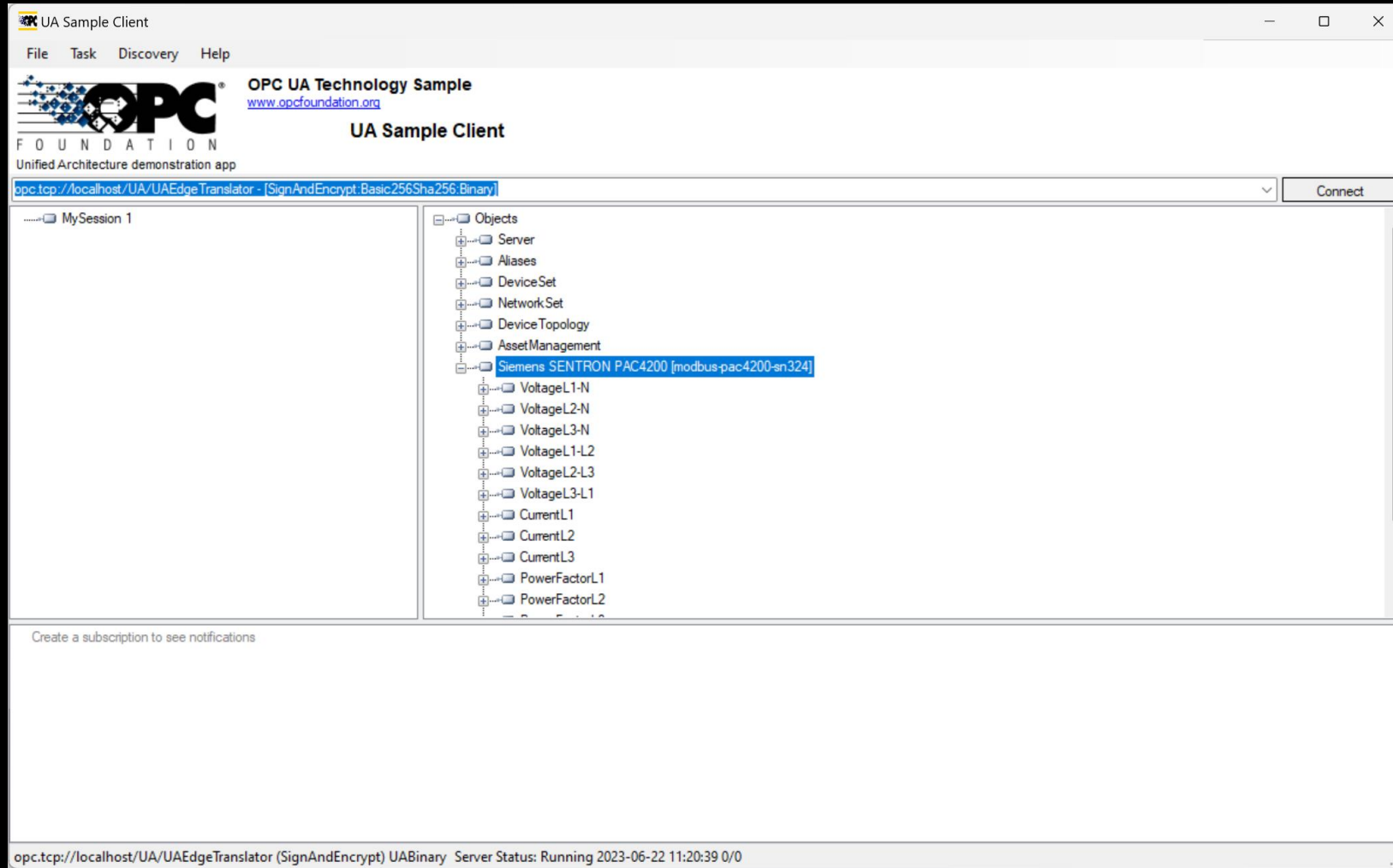
Choose File No file chosen

3. Send the loaded asset description file to UA Edge Translator. UA Translator address format: opc.tcp://ipaddress:port

Send

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UA Edge Translator Automatically Maps the Modbus I/F to OPC UA



github.com/OPCFoundation/UA-EdgeTranslator

Conclusion

Standardized Interfaces and Data Models is a requirement for

1. Cost Reduction
2. Automation
3. ... and Generative AI!