Microsoft

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

OPC UA™

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

```
{
    "@context": "https://www.w3.org/2019/wot/td/v1",
    "id": "urn:siemens:pac4200",
    "base": "modbus://192.168.10.100:1502",
    "title": "Siemens SENTRON PAC4200",
    "description": "Multifunctional energy metering device",
    "properties": {
        "Voltage1-N": {
            "@type": "opcua_30141:AcVoltagePe_UL1N",
            "type": "number", "readOnly": true,
            "forms": [{
                "href": "/1?offset=3&length=4","op": ["readproperty","observeproperty"]
            }]
        },
        "VoltageL2-N": {…
        }
    },
    "actions": {
        "changeRate": {
            "@type": "opcua_30141:metering_rate",
            "input": {
                "type": "number","enum":[0,1],
                "description":"0 for high rate, 1 for low rate"
            },
            "forms": [{
                "href": "/1?offset=60006&length=1","op": "invokeaction"
            }]
        }
    },
```

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

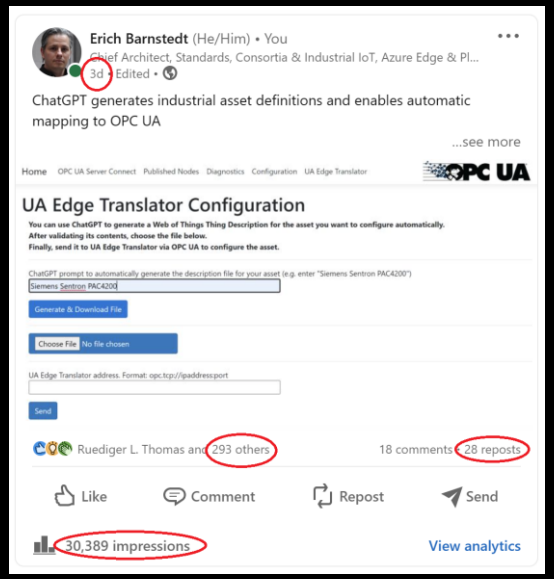
Please check the **errata** for any errors or issues reported since publication.

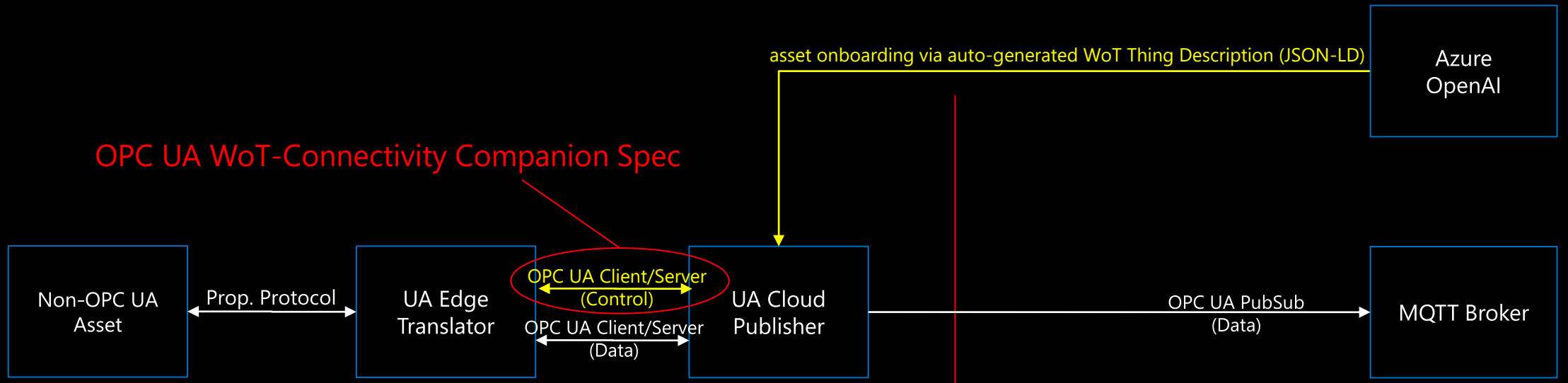
See also **translations**.

Abstract

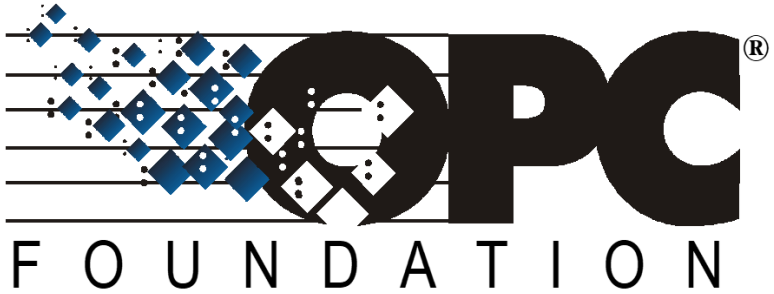
SIEMENS

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





https://github.com/opcfoundation/UA-EdgeTranslator



OPC 10100-1

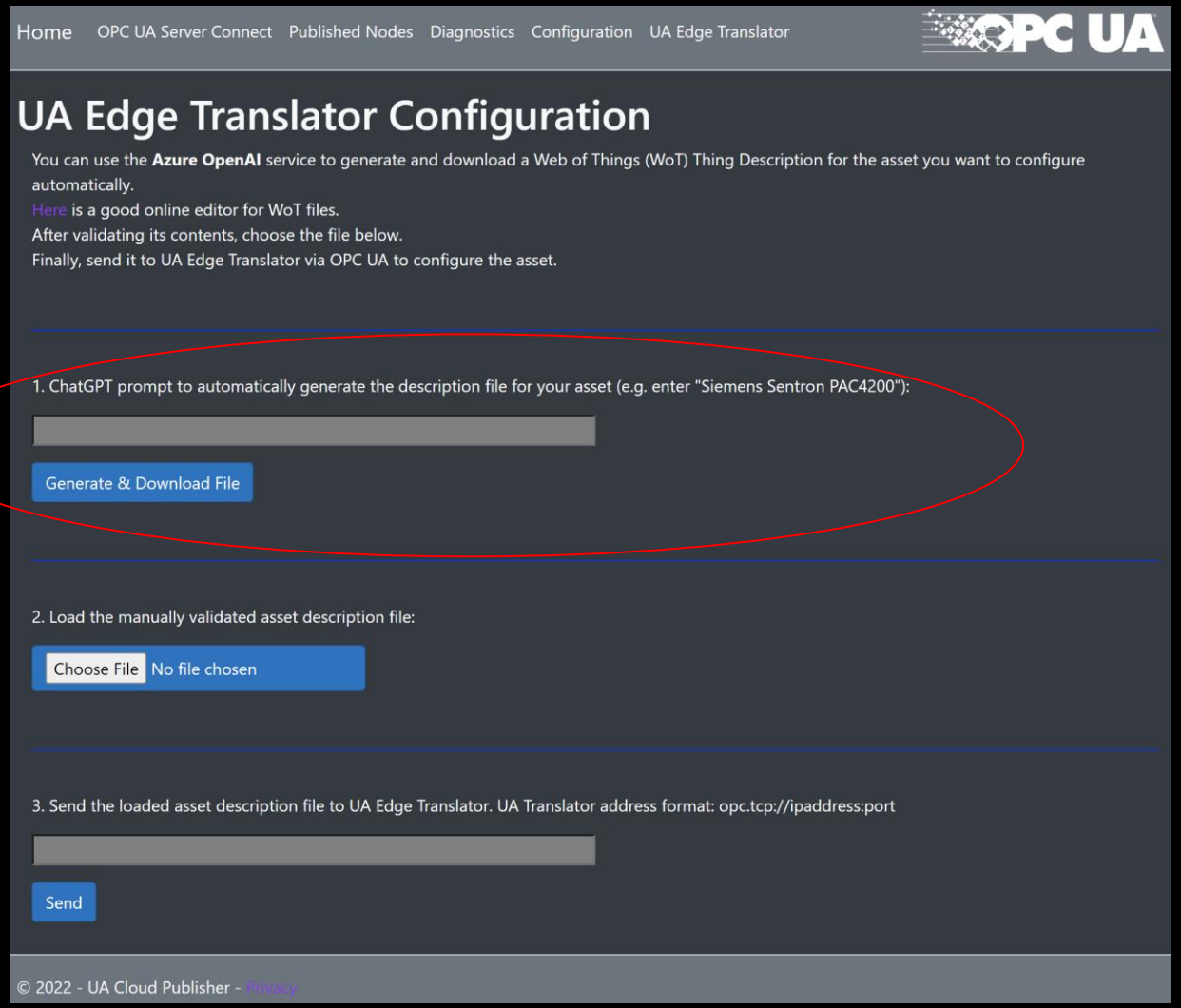
OPC UA for WOT Connectivity
Part 1: API Definition

Release Candidate 1.00

2023-09-28

OPC UA Companion-Specification

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



github.com/barnstee/UA-CloudPublisher

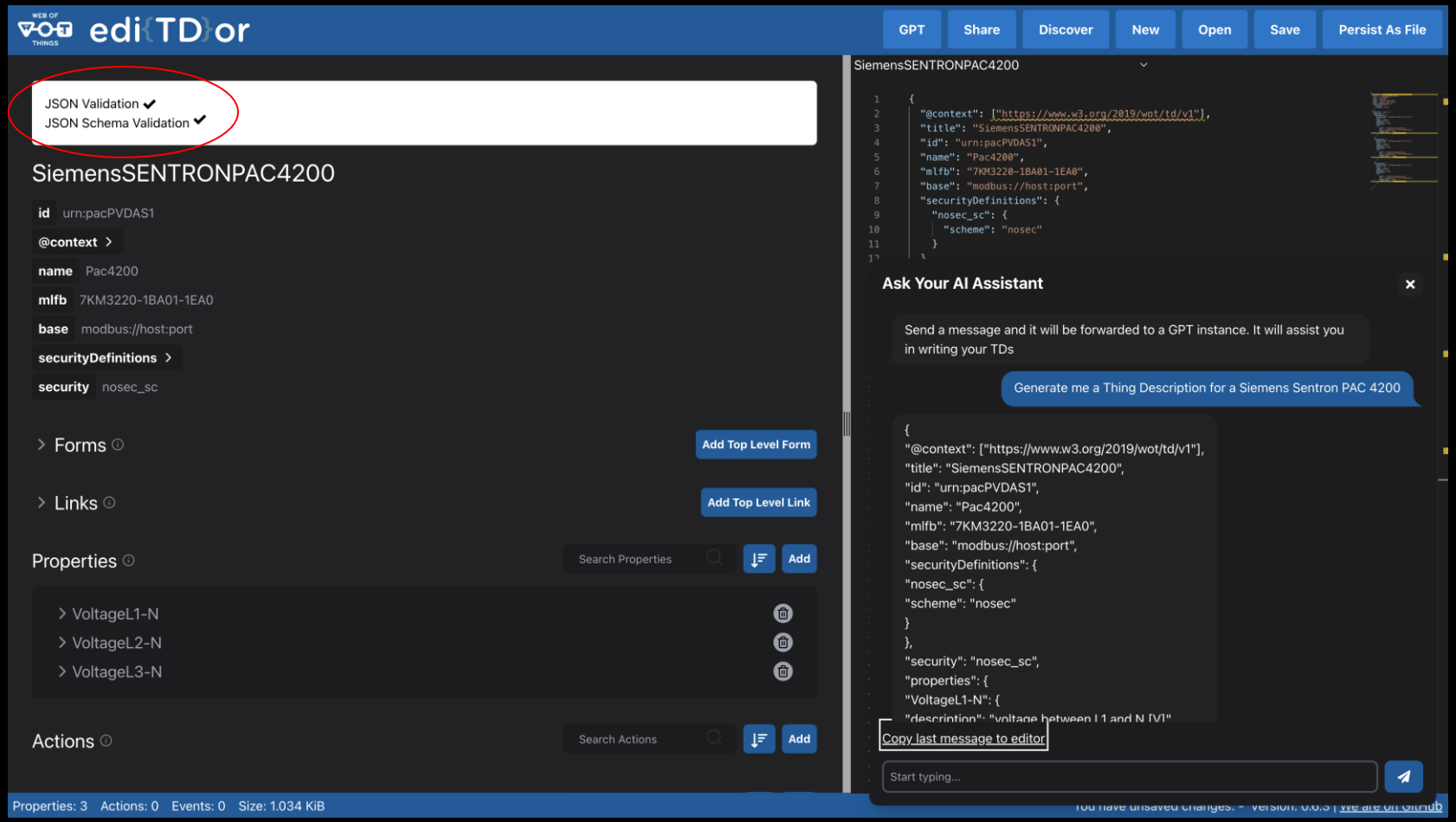
Asset Copilot - Azure OpenAI auto-generated WoT TD File
Including support for OPC UA Companion Specifications

pac4200.jsonld

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

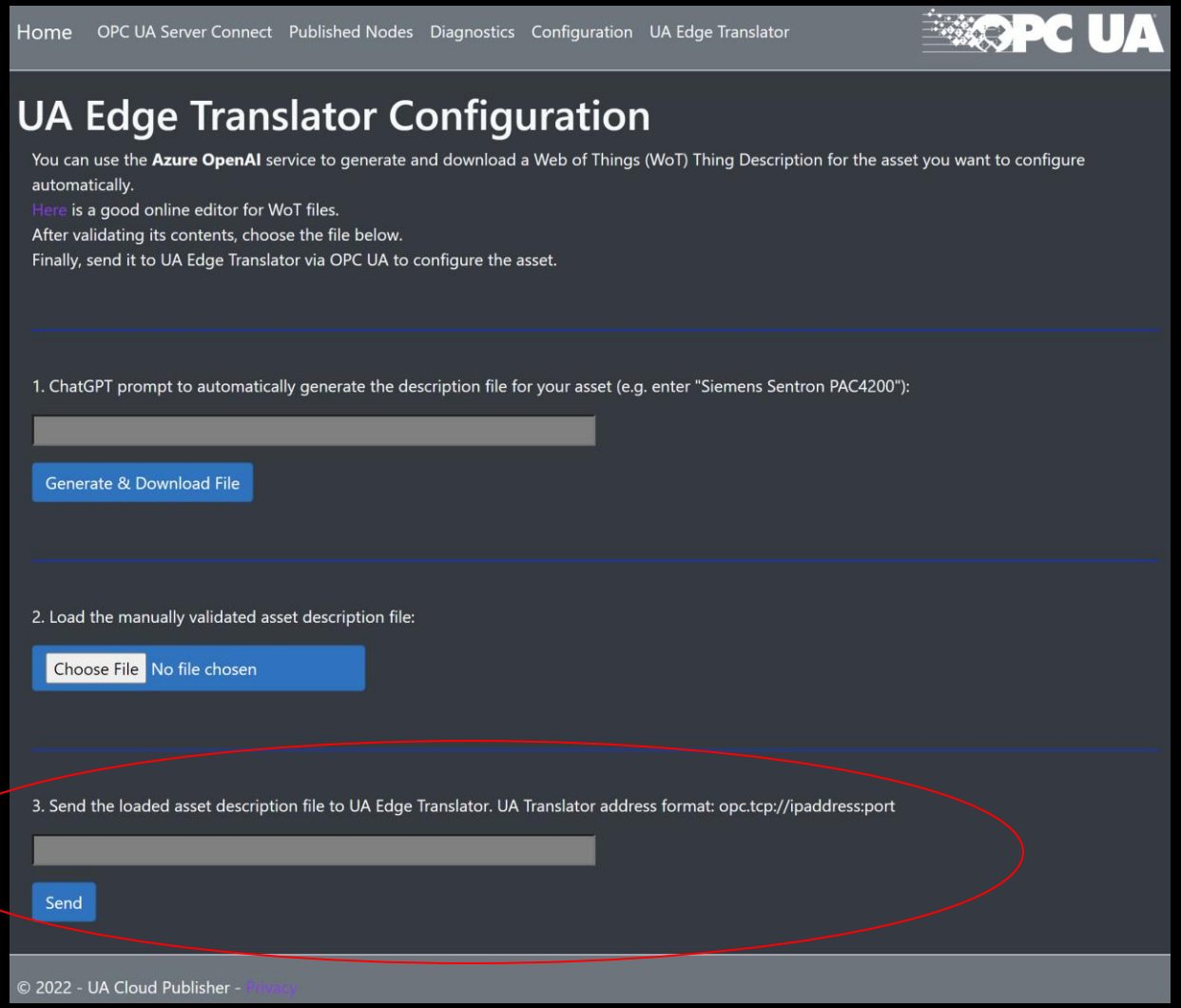
```jsonld
{
  "@context": [
    "https://www.w3.org/2019/wot/td/v1",
    "https://si-ra.github.io/ontologies/td-context.jsonld",
    "http://opcfoundation.org/UA/PNEM/"
  ],
  "id": "urn:pac4200",
  "securityDefinitions": {
    "nosec_sc": {
      "scheme": "nosec"
    }
  },
  "security": [
    "nosec_sc"
  ],
  "@type": [
    "Thing"
  ],
  "name": "modbus-pac4200-sn324",
  "base": "modbus://192.168.10.100:502",
  "title": "Siemens SENTRON PAC4200",
  "properties": {
    "VoltageL1-N": {
      "type": "number",
      "readOnly": true,
      "observable": true,
      "forms": [
        {
          "href": "/1?address=1&quantity=2",
          "op": [
            "readproperty",
            "observeproperty"
          ],
          "opcua:type": "nsu=http://opcfoundation.org/UA/PNEM/;i=6098",
          "modbus:type": "float",
          "modbus:entity": "holdingregister",
          "modbus:pollingTime": 2000
        }
      ]
    },
    "VoltageL2-N": {
      "type": "number",
      "readOnly": true,
```

2. User edits auto-generated WoT Thing Description



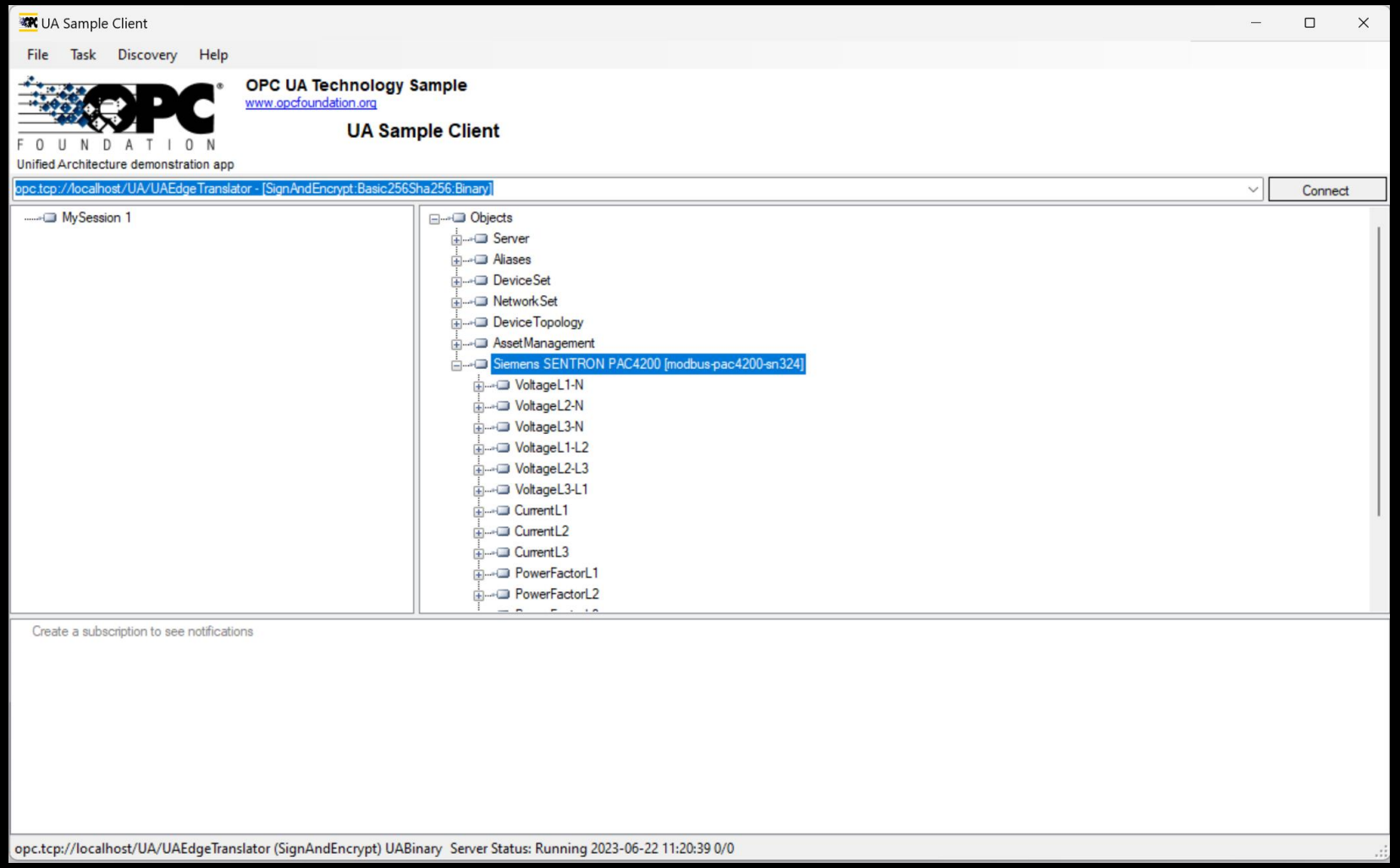
eclipse.github.io/editdor

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



github.com/barnstee/UA-CloudPublisher

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!