



OPC UA at Microsoft

How openness is accelerating Industry 4.0 adoption

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Plattform Industrie 4.0 Standards & Architecture Working Group

Plattform Industrie 4.0 International Manufacturing-X Initiative

OPC Foundation Marketing & Technical Control Board

OPC Foundation Technical Advisory Council

OPC Foundation Cloud Initiative Steering Committee Chair

OPC Foundation Working Group Chair for UA Cloud Library

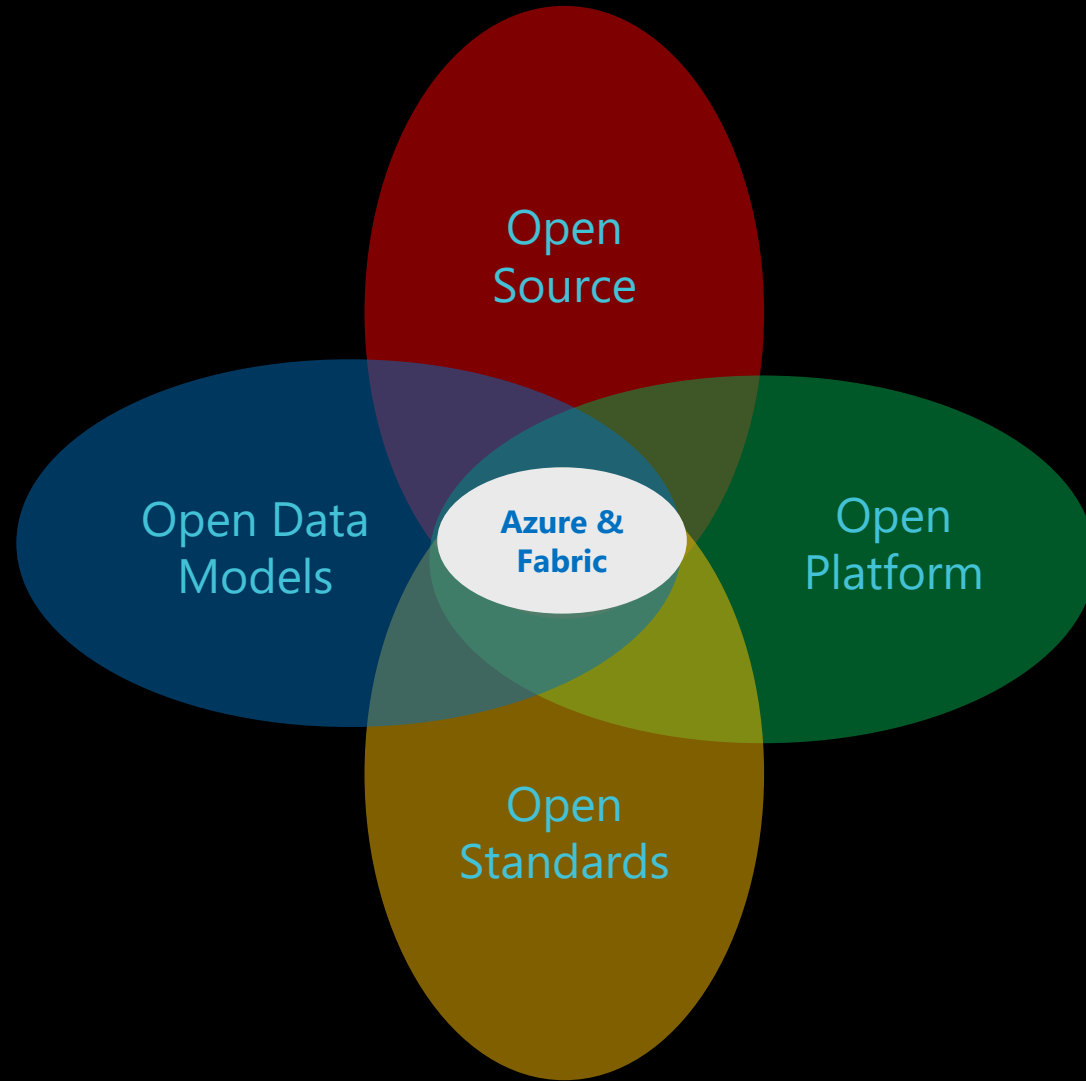
OPC Foundation Working Group Chair for Carbon Capture and Storage

OPC Foundation Working Group Chair for Web of Things Connectivity

Clean Energy & Smart Manufacturing Innovation Institute (CESMII)



Microsoft's Manufacturing Strategy – Open, Secure, Interoperable!



The Key to Reducing Costs: Data Interoperability

We need...

1. A common **Interface** (Analogy: A Book)
2. A common **Data Format** (Analogy: The Latin Alphabet)
3. A common **Data Model** (Analogy: The English Language)
4. Common **Semantics** (Analogy: The Plot and Characters of the Novel)

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





The Industrial Interoperability Standard
Since 1996

>1000 members

IEC standard since 2012 – IEC 62541

Microsoft supports OPC UA on Azure since 2016 & contributed over 6M lines of open-source code

Interoperability

to remove on-prem data silos

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

to avoid data conversion cost

Discoverable, supports complex data types

Graph support, preserves source context

Vendor extendable

Domain-specific Companion
Specifications:

- Discrete: MTConnect, Robotics, ...
- Process: NOA, OPAF, PA-DIM, MDIS, ...
- Energy: IEC61850, ...

Security

to mitigate cybersecurity threats

Secure Design from group-up

Based on open security standards

Auditing, Authentication & Encryption

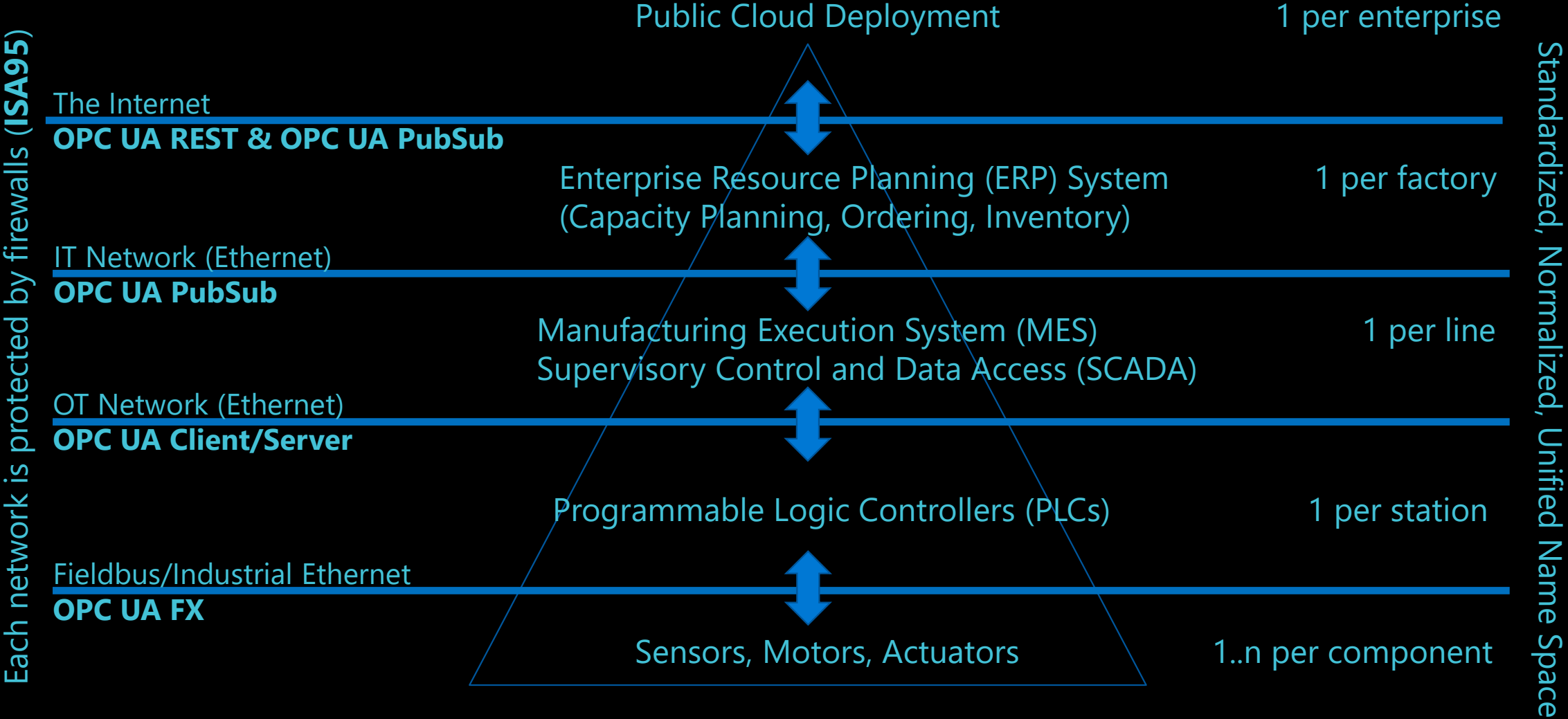
Evolves as security technologies evolve

Vendors can choose level of security

Acceptable by IT departments

Reviewed by international experts

The Industrial Automation Pyramid with OPC UA



Creating a Unified Name Space (UNS) with OPC UA for the Cloud

Each OPC UA server has a globally unique **Application URI**.

Each OPC UA server's address space is divided into namespaces, each with a globally unique **Namespace URI**.

Namespaces are made up of OPC UA nodes with a unique **Node ID**.

An Extended Node ID combines the Namespace URI with the Node ID.

To create a **Unified Name Space** to globally address every single OPC UA node (for example in the cloud), all we need do is:

Combine the Application URI with the Extended Node ID!

Then use this combination in the Name field of your OPC UA PubSub metadata messages for each dataset entry (or as your MQTT broker topic).

For additional context, it makes sense to use the ISA-95 asset hierarchy ontology (enterprise->site->area->line->work cell) for the Application URI.

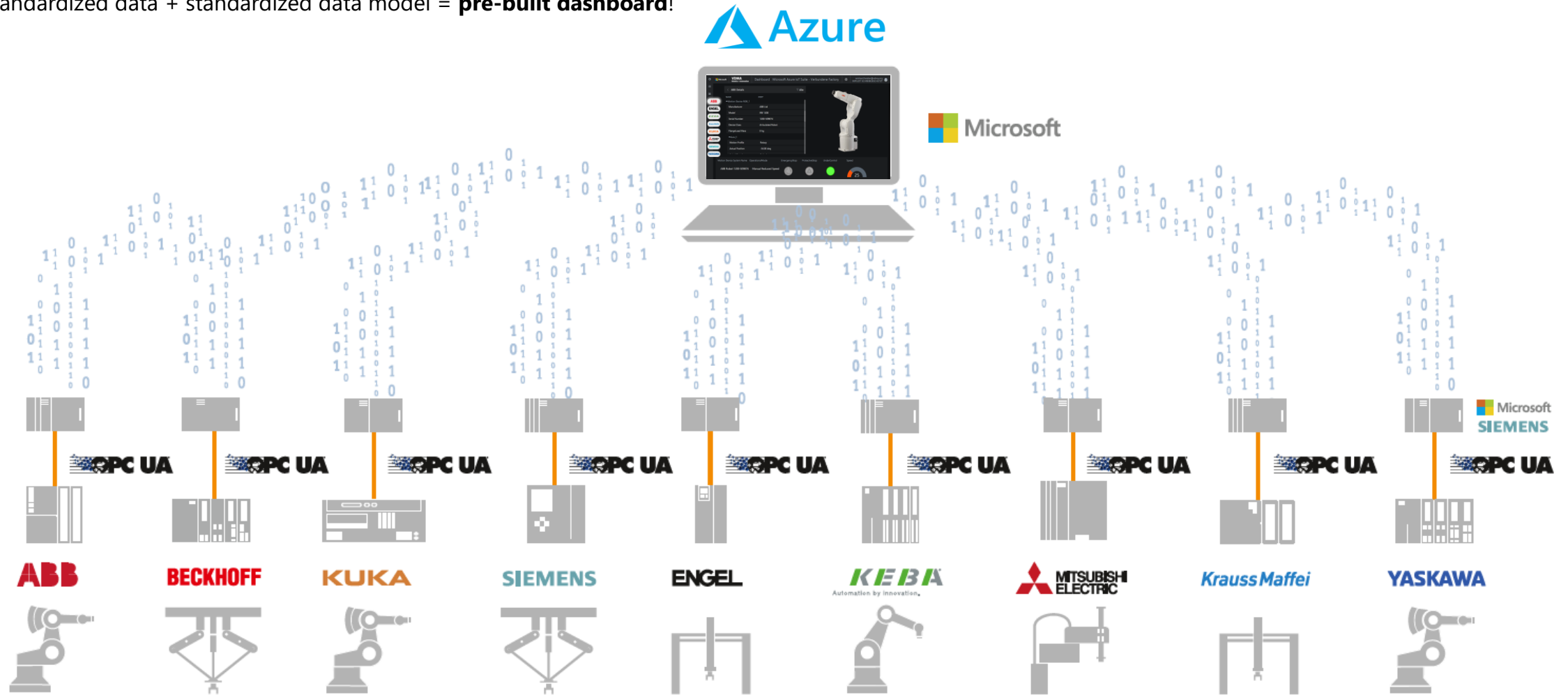
Example: "Name": "svu=http://packaging.line1.building2.munich.contoso;nsu=http://opcfoundation.org/UA/Station/;i=434"

The diagram shows the example string "svu=http://packaging.line1.building2.munich.contoso;nsu=http://opcfoundation.org/UA/Station/;i=434" with three brackets underneath it. The first bracket, labeled "Application URI", spans the entire string. The second bracket, labeled "Namespace URI", spans the part "nsu=http://opcfoundation.org/UA/Station/". The third bracket, labeled "Node ID", spans the part "i=434".

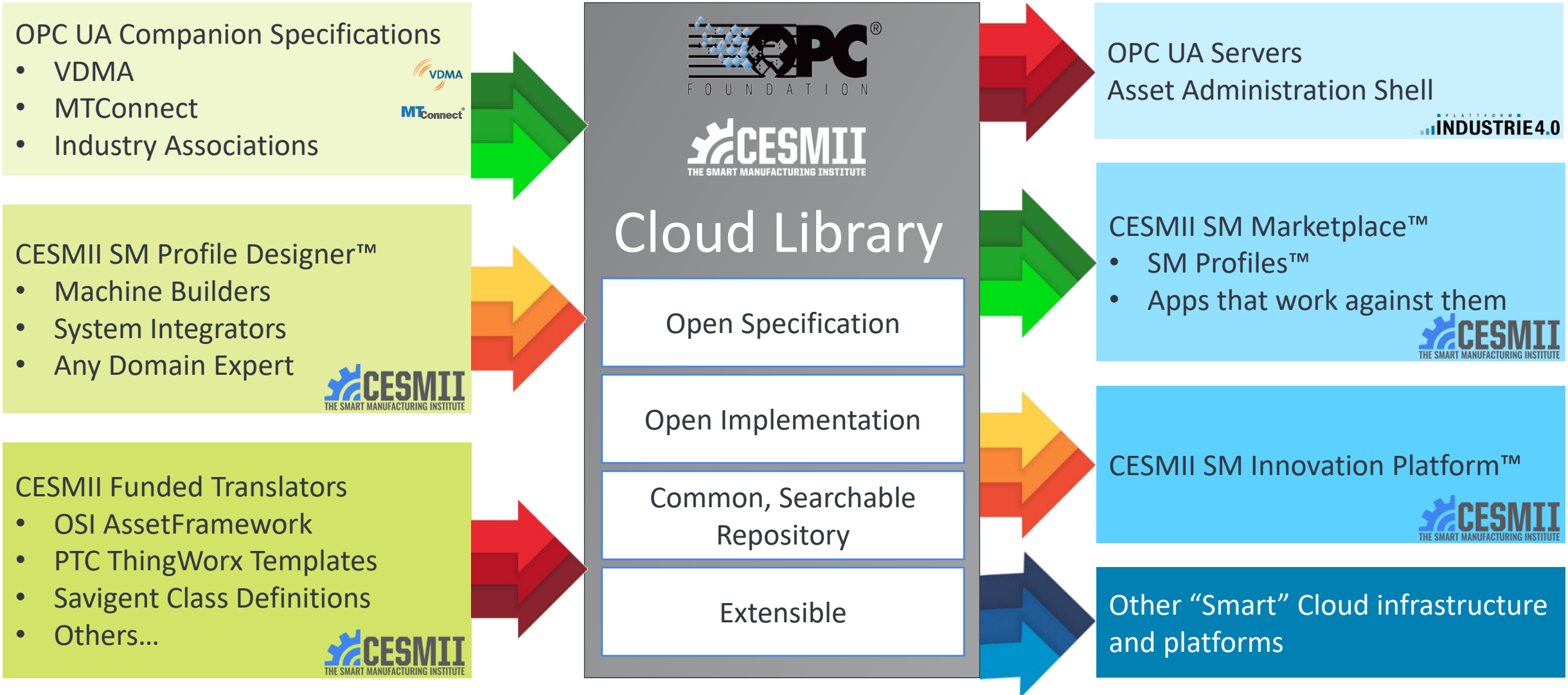
Please refer to <https://reference.opcfoundation.org/Core/Part6/v105/docs/5.1.12> for the specification of this.

2017: Azure IoT Connected Factory

Standardized data + standardized data model = **pre-built dashboard!**

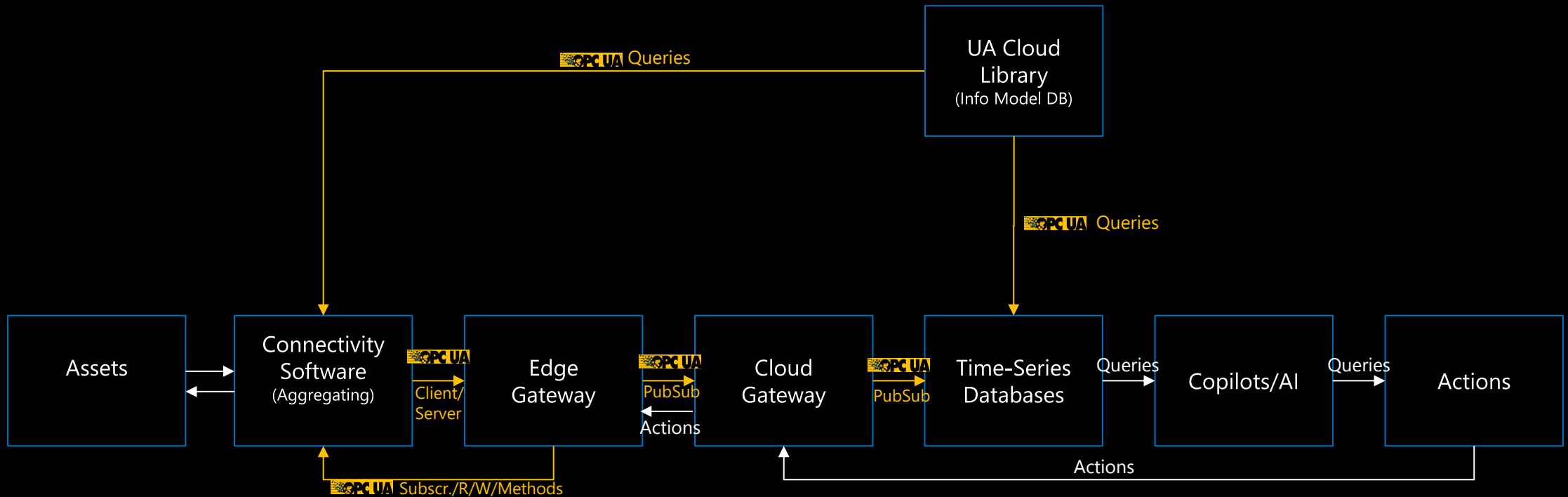


Enabling Interoperability for Smart Manufacturing

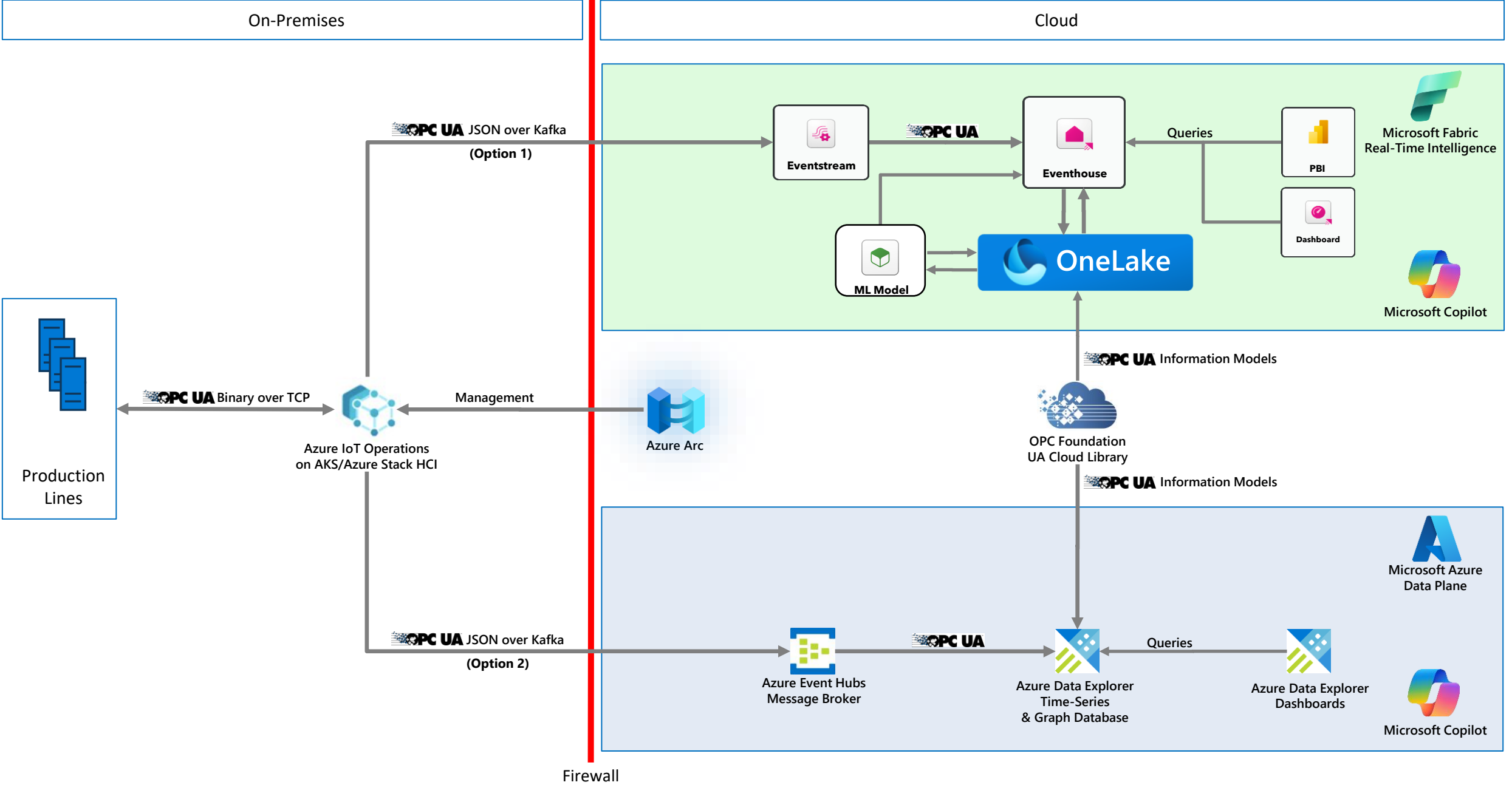


The missing piece: UA Cloud Library!

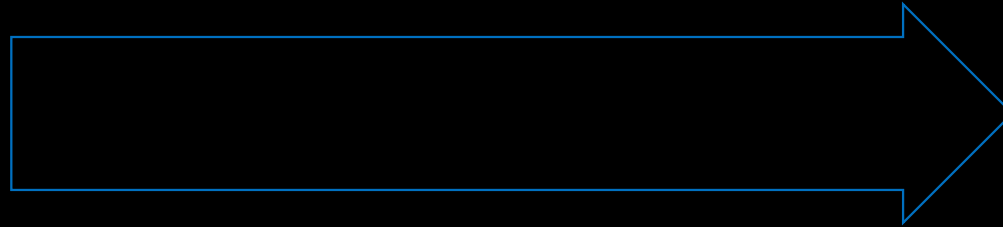
A cloud-based, scalable, OPC UA information model library, with a standardized, open interface.
A Joint Working Group (JWG) between CESSMII and the OPC Foundation.



Industrial IoT Reference Architecture leveraging Open Standards – 2 Options



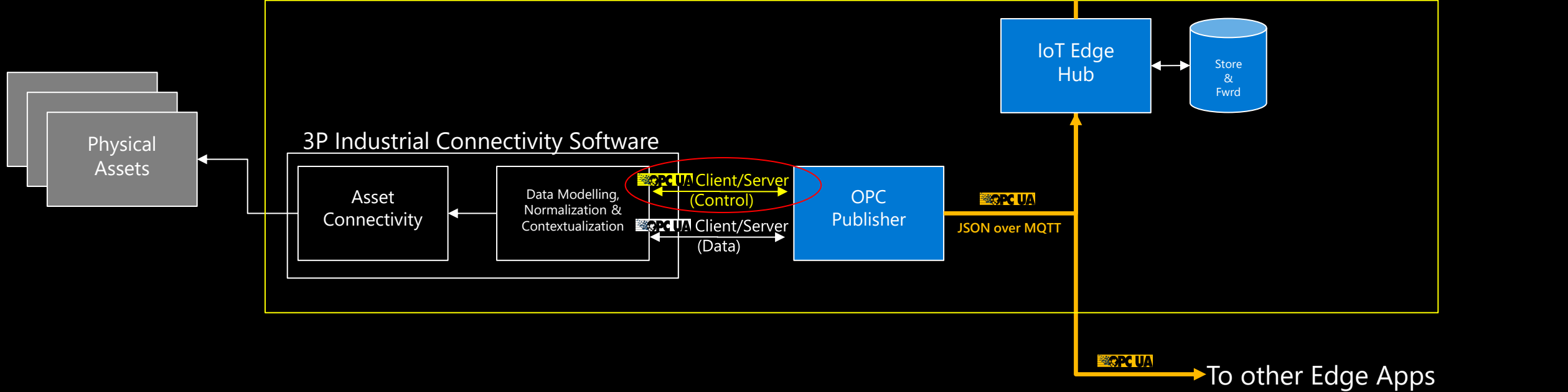
Industrial Asset Onboarding



Normalized, standardized,
open data model & interface for
all assets, including security!

Azure IoT Edge

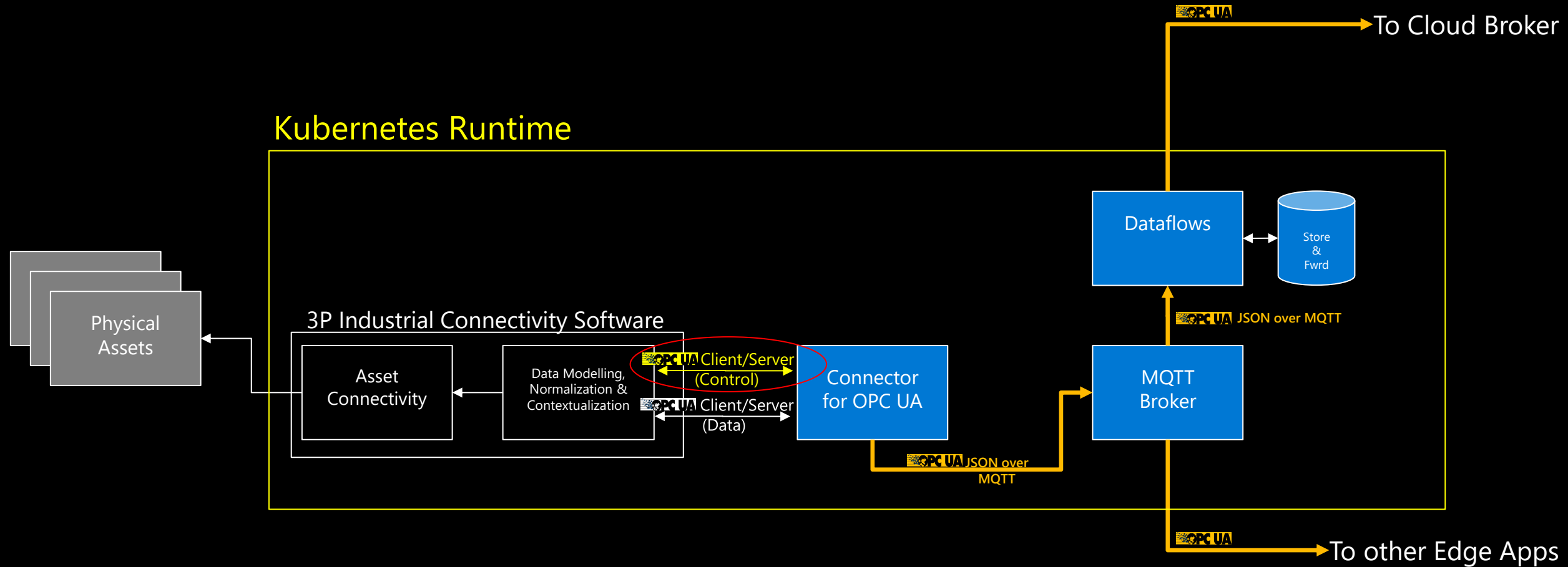
Docker Runtime (Moby) + IoT Edge Agent



For all modules:

- Observability (health monitoring, diagnostics, perf statistics)

Azure IoT Operations

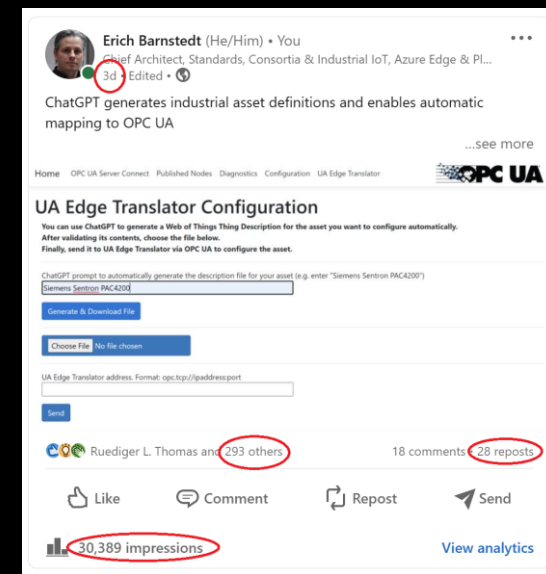
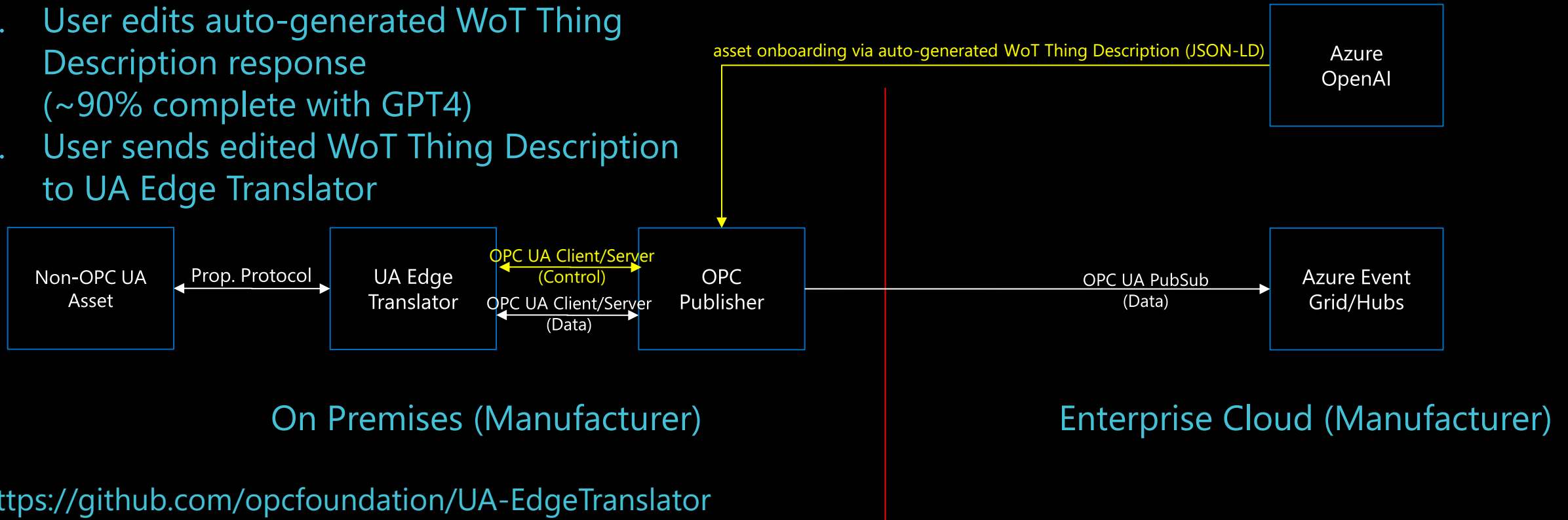


For all modules:

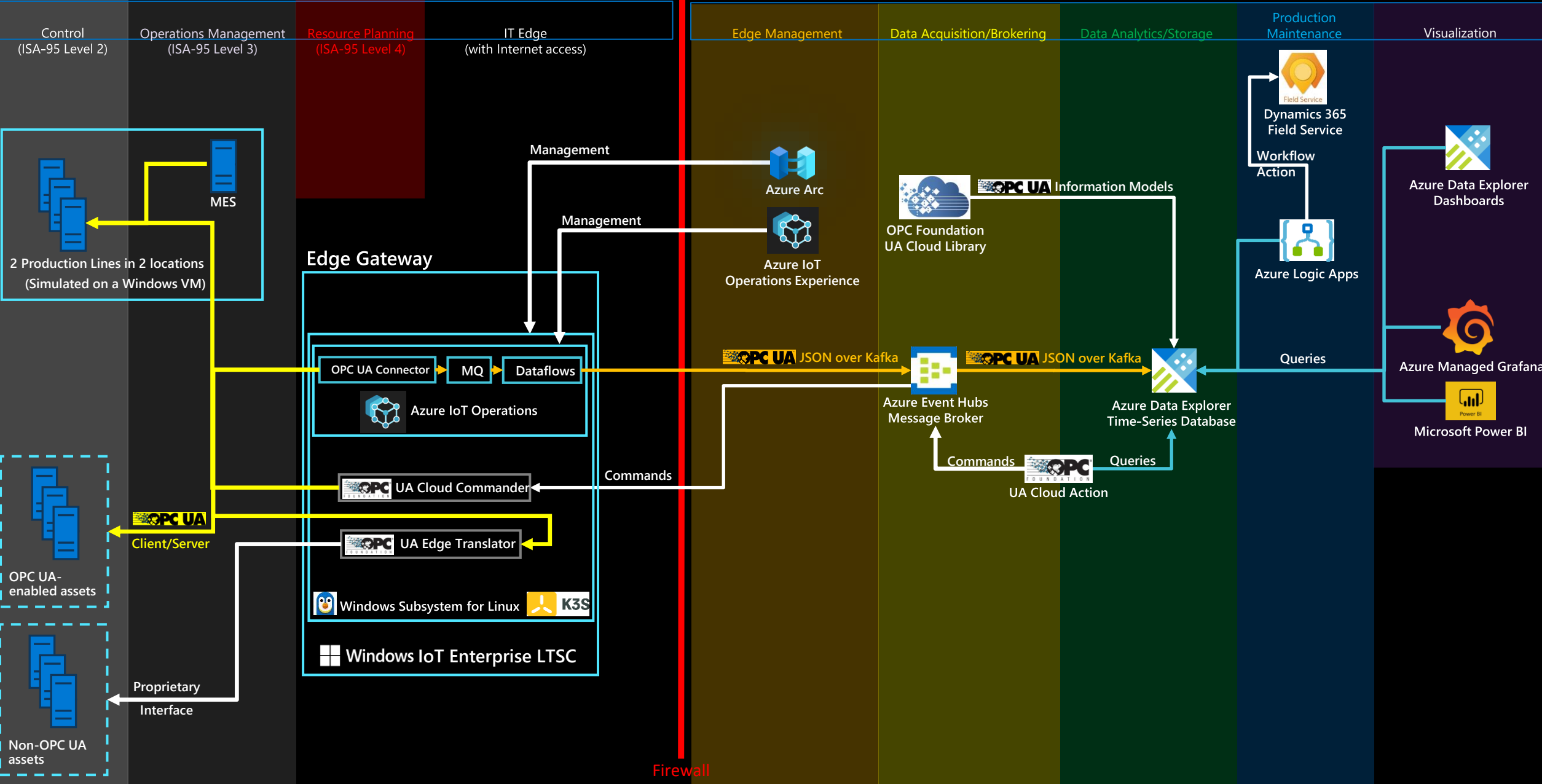
- **New:** High Availability
- Observability (health monitoring, diagnostics, perf statistics)

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

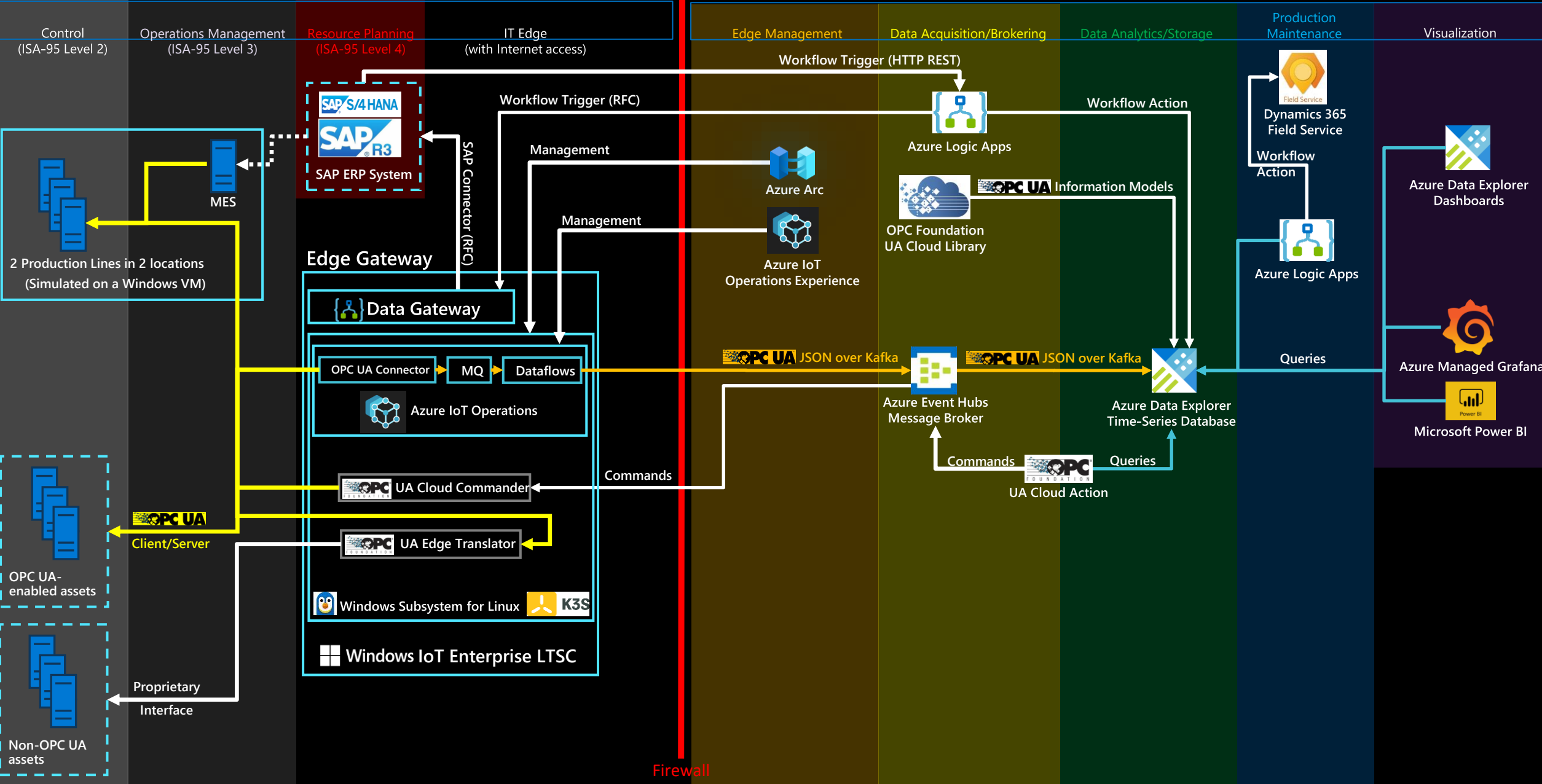
1. User enters make and model of asset in Chat prompt
2. User edits auto-generated WoT Thing Description response (~90% complete with GPT4)
3. User sends edited WoT Thing Description to UA Edge Translator



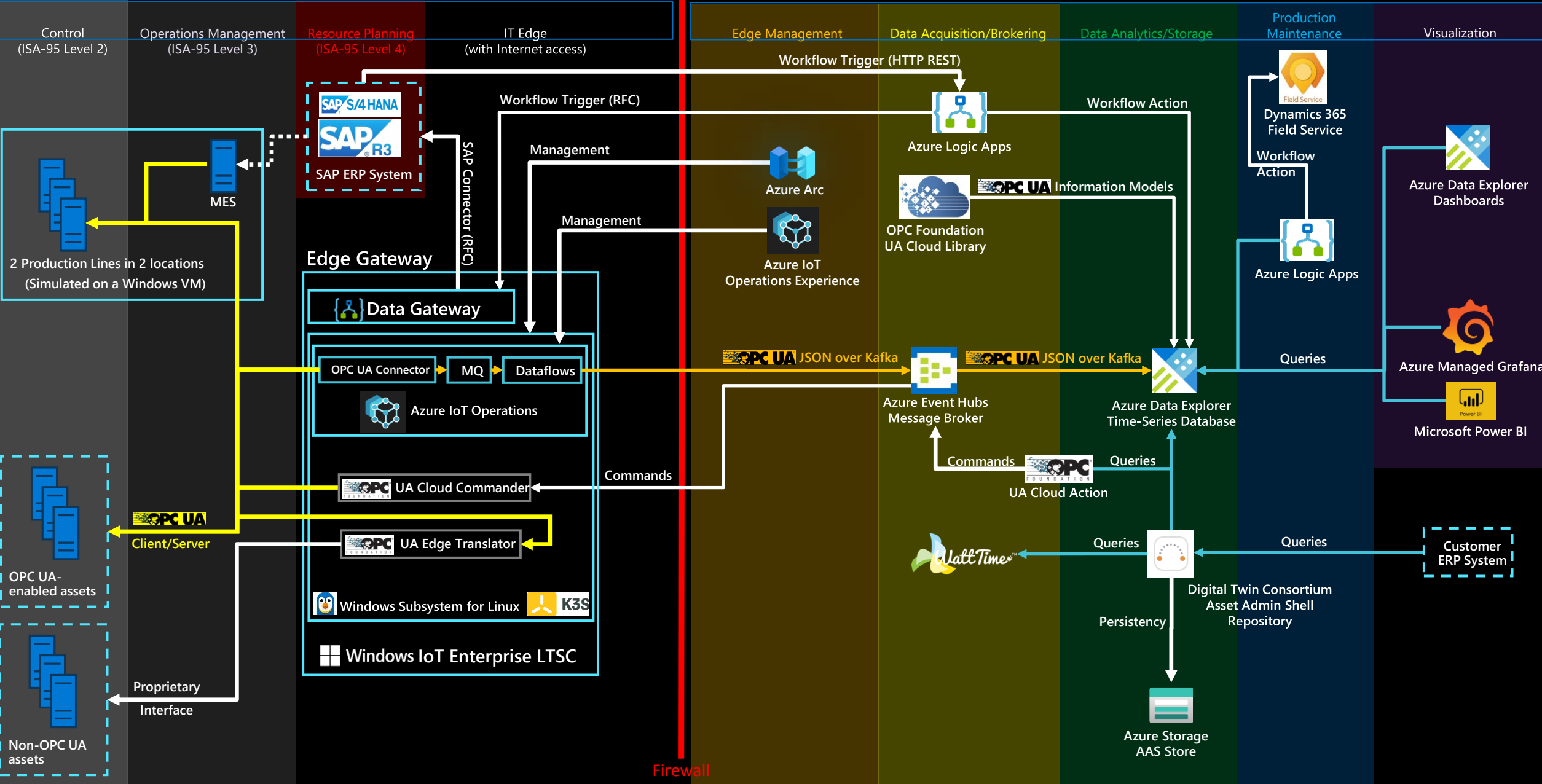
Industrial IoT Reference Architecture leveraging Open Standards



Industrial IoT Reference Architecture leveraging Open Standards – SAP Integration



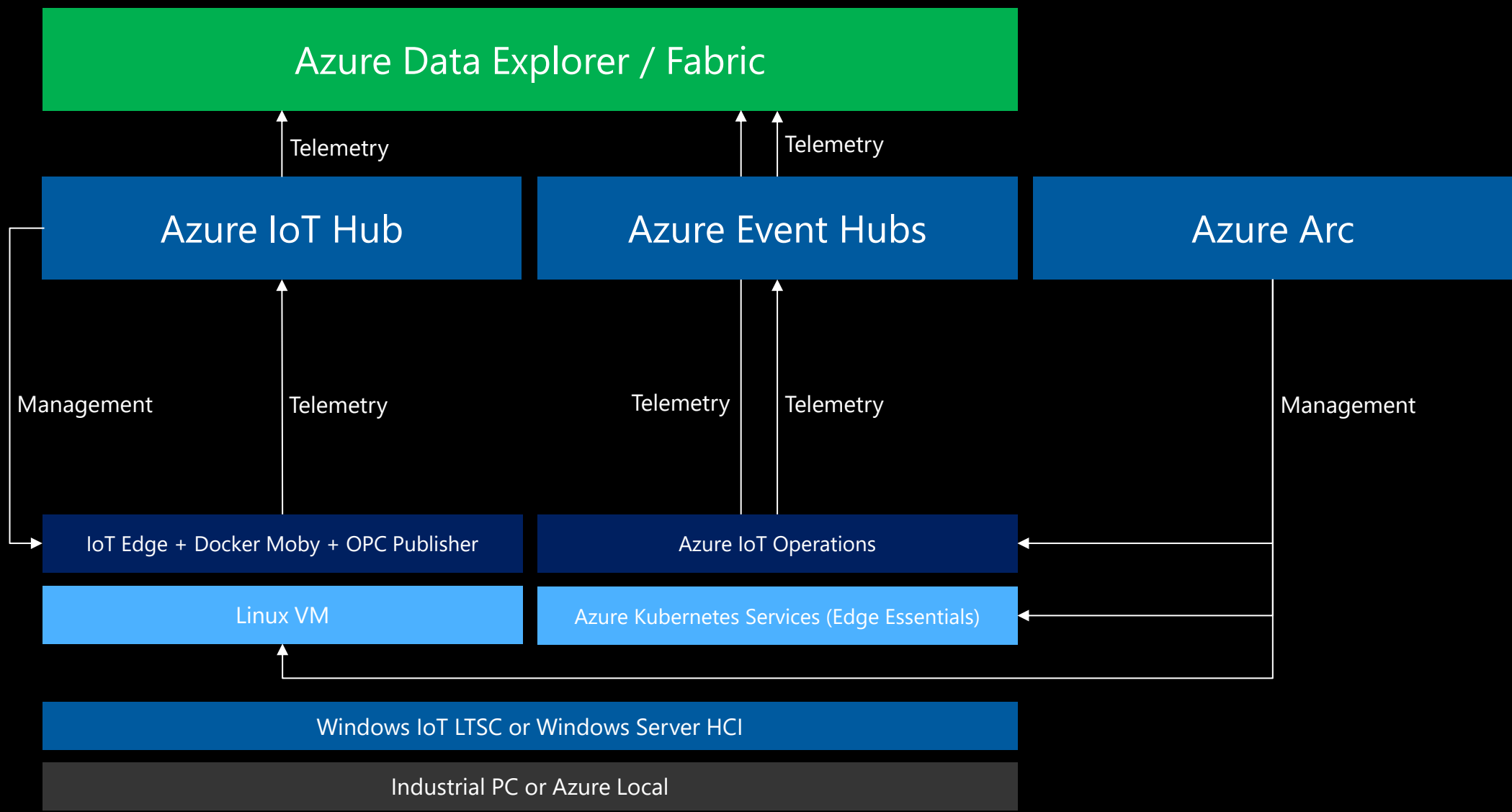
Industrial IoT Reference Architecture leveraging Open Standards – AAS Integration



Tutorial & 1-click deployment:

learn.microsoft.com/en-us/azure/iot/tutorial-iot-industrial-solution-architecture

Easy Migration: Azure IoT Operations & Azure IoT Edge Deployment



Thank you.

Peace in Europe!