OPC Foundation Cloud Initiative
The Industrial Cloud Interoperability Standard

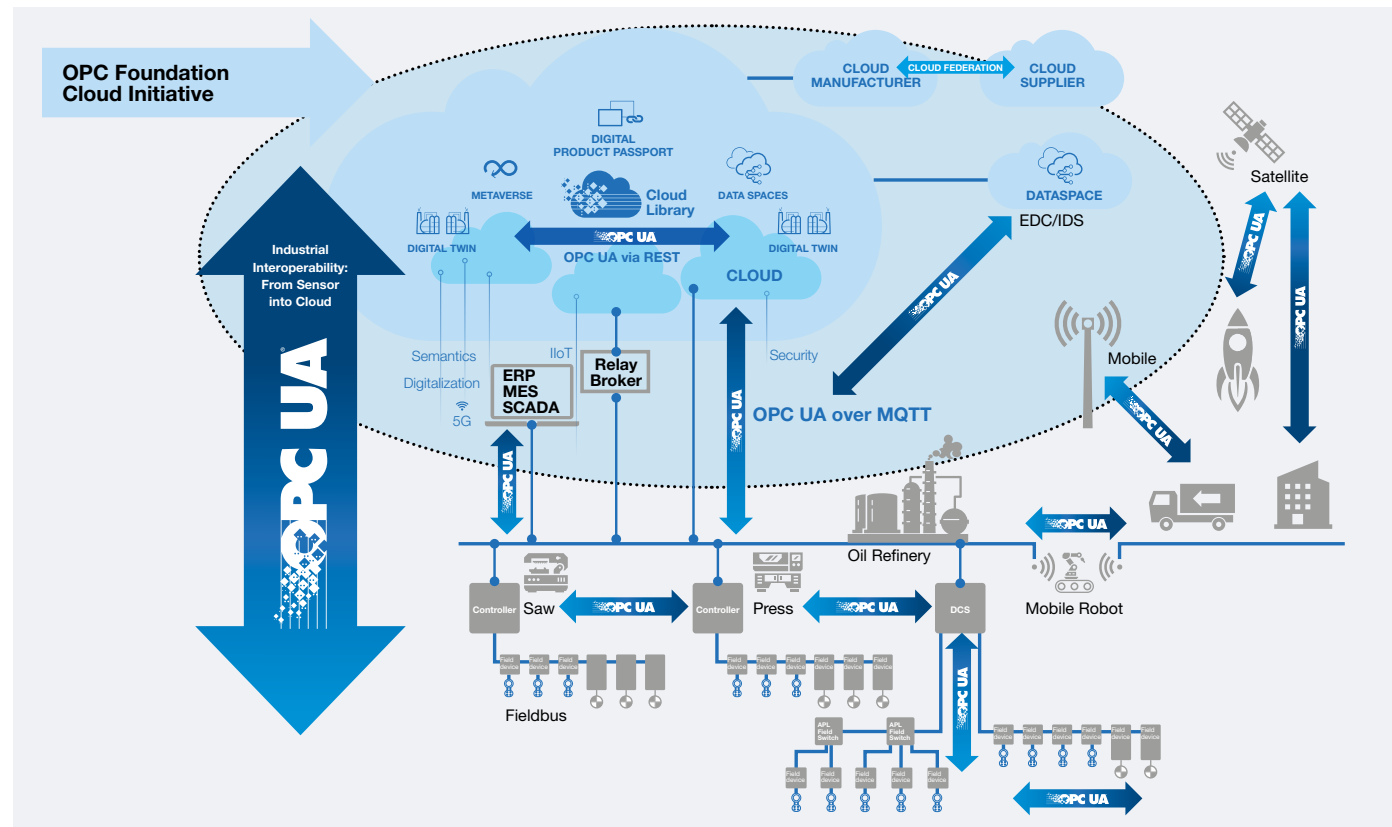**OPC Foundation Cloud Initiative**

Industrial Interoperability: From Sensor into Cloud

OPC UA

DIGITAL PRODUCT PASSPORT

METAVERSE — Cloud Library — DATA SPACES

DIGITAL TWIN — OPC UA via REST — DIGITAL TWIN

CLOUD

CLOUD MANUFACTURER — CLOUD FEDERATION — CLOUD SUPPLIER

DATASPACE — EDC/IDS

Satellite

Semantics Digitalization — IIoT — Security

5G — ERP MES SCADA — Relay Broker

OPC UA over MQTT

Mobile

Oil Refinery

Mobile Robot

Controller — Saw — OPC UA — Controller — Press — OPC UA — DCS

Field Device — Fieldbus

APL Field Switch — APL Field Switch

Supporting cloud providers

aws — Google Cloud — HUAWEI — Microsoft — SAP

The Industrial Cloud Interoperability Standard

Vision
Building the Industrial Cloud
Interoperability Standard

Goals

Digitalization in manufacturing is resulting in a world divided between those who possess and effectively utilize data and those who lack access to those resources. This is a barrier to both corporate success and macro-economic growth. Legislators (such as the EU with the upcoming Data Act) are responding to this by requiring vendors to share data among much broader eco-systems. In addition to requiring standardized data exchange in broader eco-systems, critical use-cases for traceability like the Digital Product Passport (DPP) and security aspects must be considered.

At the OPC Foundation, we believe that this creates a greater need for interoperability of end-to-end information models and standardized cloud interfaces to support these legislative demands.

OPC UA – One harmonized Solution for OT/IT

Deliverables

– Standardized interoperability:
   Accelerate **interoperability of IT and cloud applications** using OPC UA, e.g. data analytics using AI, industrial data spaces, digital product passports, industrial metaverse was well as digital twin applications.

– Semantic Data Models in the Cloud:
   Maintain OPC UA Information Models (Companion Specifications) in the cloud to utilize the context of data in cloud services.

– Best practices:
   Create a **cloud reference architecture** to provide best practices, increase standardized data sharing and cloud-optimized profiles for the OPC UA standard.

– Establish validation and certification for OPC UA Cloud Interoperability including a new **Protected Identity** for OPC UA Cloud eXchange "UACX".

Simplified Reference Architecture

On Premises (Manufacturer)   **Enterprise Cloud (Manufacturer)**
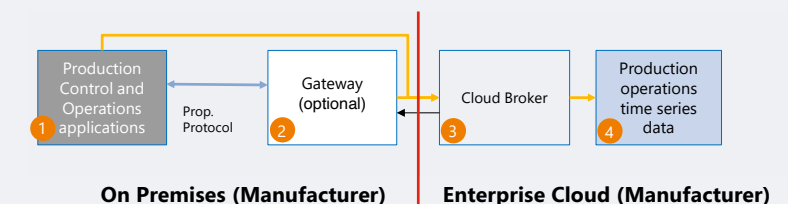
At its core, the reference architecture consists of just a view components:

A. Secure, standardized data ingestion from on premises machine data ① via a broker ③ to a time-series database in the cloud ④.

B. The time-series data is contextualized by OPC UA Information Models, adding semantic meaning

Use-cases

Depending on the supported OPC UA features and scenarios, additional components such as an on-premises gateway may be required:

U1. PLCs with support for OPC UA over MQTT can communicate directly with the cloud broker for bi-directional data exchange.

U2. On factory setups, additional firewalls can be put in place by the addition of on-premises gateways ②.

U3. Some OPC UA enabled assets may not support OPC UA over MQTT yet, but an OPC UA server instead. In these cases, a ② gateway is needed to provide translation between OPC UA over MQTT and OPC UA client/server communication. Bi-directional communication can be achieved for this, too.

U4. For asset supporting industrial protocols such as Modbus, HART, or other non-OPC UA interfaces, the market offers a many industrial connectivity software options converting the legacy interface to OPC UA. It is highly recommended to use software supporting the integration of OPC UA Companion Specifications to enable modelling the OPC UA interface with standardized data models.

Working Groups (WG) coordinated by the OPC Foundation Cloud Initiative

- **UA Cloud Library**
  A query-able online store of OPC UA Information Models

- **OPC UA over MQTT**
  Secure transport from edge to cloud and cloud to cloud, including a prototyping and a testbed group

- **OPC UA REST Interface**
  Easy access to OPC UA information for the IT world via a standardized REST interface

- **OPC UA Industrial Metaverse**
  Connecting the virtual and real world with OPC UA

- **OPC UA AI**
  Leveraging Large Language Models for and with OPC UA

- **OPC UA Data Space (in planning)**
  Provide decentralised semantic OPC UA information to central Data Spaces but keeping Data sovereignty

- **OPC UA WoT Connectivity**
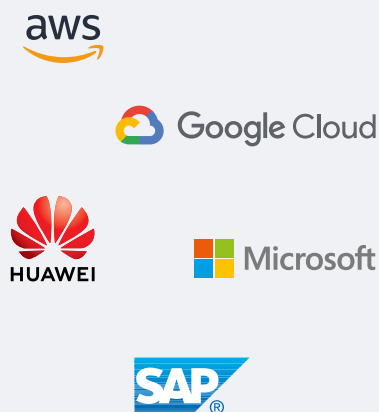 Standardized industrial connectivity software configuration

Detailed descriptions of the existing working groups, URLs for the open source reference code and further information can be found here:
www.opcfoundation.org/cloud

Milestones of the OPC Foundation Cloud Intitiative

Phase 3 – Mar 2025
End-users feedback to Cloud Reference Architecture
Present and discuss OPC UA Cloud Reference Architecture

Phase 4 – Apr 2025
Public presentation
Public presentation during Hannover Messe 2025

Phase 5
Prepare validation and certification
Define criterias for the protected identity "OPC UA CX" (Cloud eXchange). This will result in a set of mandatory profiles and facets for the OPC Foundation certification process.

Phase 1 – 2024
Ramp up
Establish OPC Foundation Cloud Initiative including cloud suppliers, end-users and automation suppliers

Phase 2 – Jan–Mar 2025
Sharing information with End-users
Inform about available standards and offerings
1. Better Together: Digital Product Passport powered by AAS, EDC and OPC UA
2. Secure, standardized connectivity to cloud systems: OPC UA over MQTT Activities in OPC Foundation Working Groups
3. Accessing OT Information with the OPC UA WebAPI
4. UA Cloud Library
5. OPC UA Metaverse
6. OPC UA WoT Connectivity/Binding
7. OPC UA AI

Supporting cloud providers
aws
Google Cloud
HUAWEI
Microsoft
SAP

Supporting end-users
Boehringer Ingelheim
Continental CONTITECH
DANONE
equinor
L'ORÉAL OPERATIONS
Miele
Mondelēz International SNACKING MADE RIGHT
Renault Group
JTI
Tetra Pak PROTECTS WHAT'S GOOD™
VOLKSWAGEN AKTIENGESELLSCHAFT

Supporting automation providers
ABB
BECKHOFF
Honeywell
MITSUBISHI ELECTRIC Changes for the Better
Rockwell Automation
Schneider Electric
SIEMENS
YOKOGAWA Co-Innovating tomorrow

Interested? Join us!

www.opcfoundation.org/cloud

UA Cloud Initiative Reference Architecture – Generic

On Premises (Manufacturer)   **Enterprise Cloud (Manufacturer)**   **Product Customer**

Legend:
- Data Space Protocol
- OPC UA PubSub
- OPC UA Client/Server
- HTTP REST Queries
- OPC UA OpenAPI REST
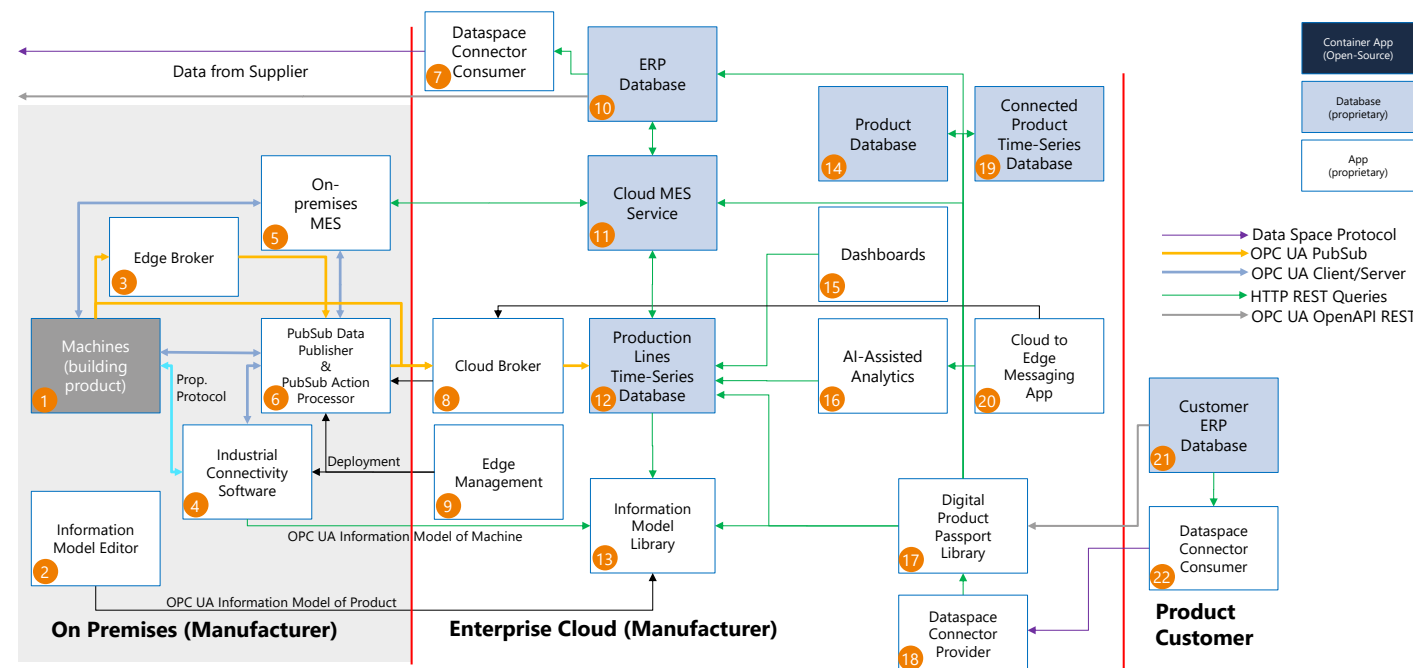
1 Machines of the Manufacturer on-premises producing the consumer good.

2 An OPC UA Information Model editor tool that can upload OPC UA Information Models to the UA Cloud Library.

3 A message broker operated by the manufacturer on-premises, usually as part of an edge infrastructure and usually supporting the MQTT protocol.

4 An industrial connectivity software reference implementation providing an aggregating OPC UA server interface and ideally supporting the OPC UA WoT-Connectivity Companion Specification.

5 The on-premises part of the Manufacturing Execution System (MES). It often includes an OPC UA server interface to read status information and manages the operation of the machines.

6 Gateways manage the bi-directional data exchange from assets the cloud services offering both, an OPC UA Client and a OPC UA Publisher supporting both the MQTT and Kafka protocol.

7 The Eclipse Dataspace Connector (EDC) consumer operated by the manufacturer which is used to establish trust between a supplier and the manufacturer by creating a digital contract. It also applies data sharing policies to the data received from the supplier.

8 The message broker operated by the manufacturer in the manufacturer's enterprise cloud. This can support either the MQTT or the Kafka protocol.

9 The industrial edge management software operated by the manufacturer in the manufacturer's enterprise cloud. It is responsible for deploying and managing edge applications on-premises.

10 The Enterprise Resource Planning (ERP) software operated by the manufacturer. It reads raw material and purchased components data from the supply chain.

11 The enterprise cloud part of the Manufacturing Execution System (MES). It often communicates directly with the ERP system and receives and processes production orders.

12 The time-series database receiving telemetry data from the production line via the cloud broker. It can also read order information from the MES system and OPC UA Information Model metadata from the UA Cloud Library.

13 The online store of OPC UA Information Models. This can either be the public instance operated by the OPC Foundation (mainly containing OPC UA Companion Specifications), or it can be a private instance operated by the manufacturer (containing OPC UA Information Models for the produced products), or both.

14 The database containing produced goods information like specifications or user manuals.

15 Visual dashboards used to monitor the operation of the production.

16 AI-assisted analytics software used to calculate equipment effectiveness, make production forecasts and predictions about required machine maintenance.

17 The Digital Product Passport Library stores Digital Product Passports modeled with OPC UA and provides an OpenAPI REST interface for upload and download.

18 The Eclipse Dataspace Connector (EDC) provider operated by the manufacturer which is used to establish trust between a customer and the manufacturer by creating a digital contract. It also applies data sharing policies to the product data provided by the manufacturer.

19 The time-series database receiving telemetry data from product usage in the field.

20 An online reference application taking the outcomes of the production data analysis and making live modifications to the production via UA Cloud Commander (completing the digital feedback loop).

21 The Enterprise Resource Planning (ERP) software operated by the customer of the manufacturer. It reads product data from the manufacturer.

22 The Eclipse Dataspace Connector (EDC) consumer operated by the customer of the manufacturer which is used to establish trust between the customer and the manufacturer by creating a digital contract. It also applies data sharing policies to the data received from the manufacturer.

Cloud architecture components are available both as
– **commercial solutions** from leading providers like AWS, ABB, Beckhoff, Google, Honeywell, Huawei, Microsoft, Mitsubishi Electric, Rockwell Automation, SAP, Schneider Electric, Siemens, Yokogawa and as
– **open-source offerings.**
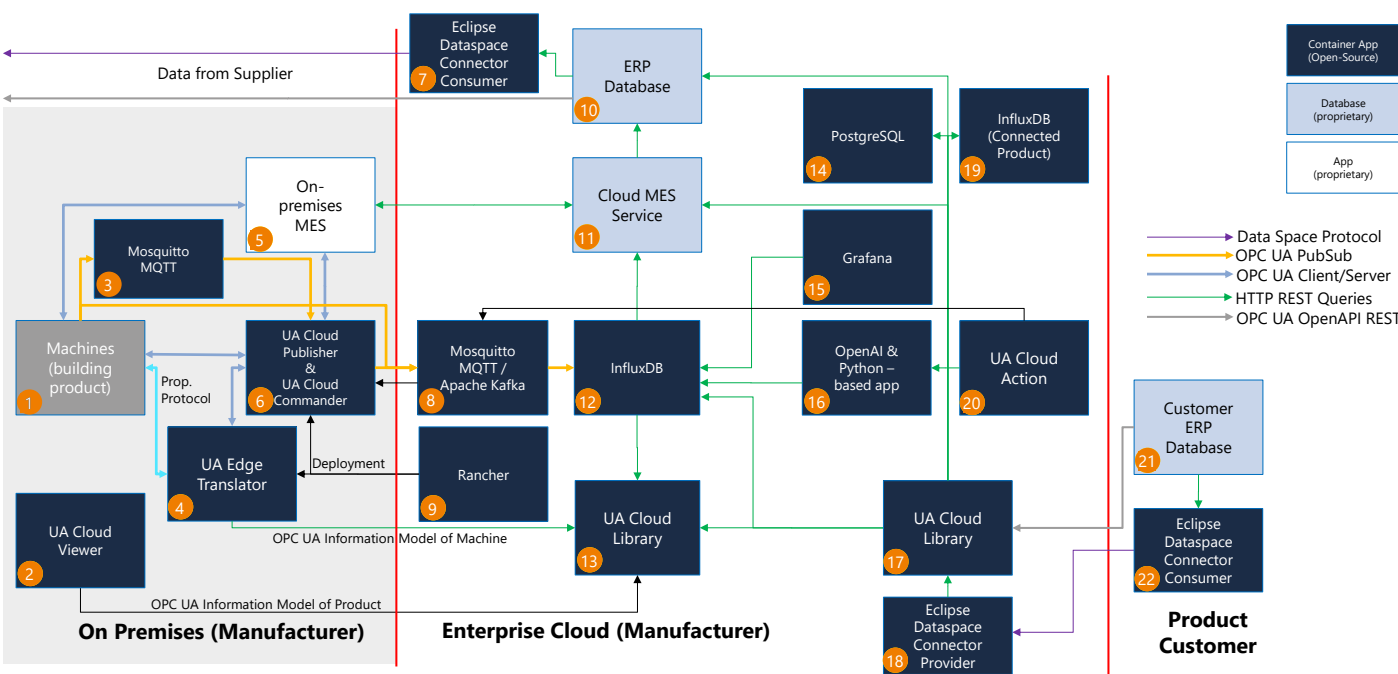
Content of the brochure:
– Detailed descriptions of the existing working groups
– a list of all commercial offerings
– URLs for the open source reference code
– Milestones and roadmap
Download here:
www.opcfoundation.org/cloud

UA Cloud Initiative Reference Architecture – Open Source Offerings

On Premises (Manufacturer) | **Enterprise Cloud (Manufacturer)** | **Product Customer**

Legend:
- Data Space Protocol
- OPC UA PubSub
- OPC UA Client/Server
- HTTP REST Queries
- OPC UA OpenAPI REST
- Container App (Open-Source)
- Database (proprietary)
- App (proprietary)

These building blocks are available as open source

Nummer	Open Source
2	OPC Foundation SM Profile Designer Nodeset editor viewer and uploader.
3	Eclipse Mosquitto MQTT broker.
4	OPC Foundation UA Edge Translator supporting all leading industrial protocols south-bound and an OPC UA Server with WoT-Connectivity north-bound.
6	Umati UA Cloud Publisher OPC UA PubSub publisher and OPC Foundation UA Cloud Commander OPC UA PubSub subscriber supporting both the MQTT and Kafka protocol.
7	Eclipse Dataspace Connector (EDC), in consumer configuration.
8	Eclipse Mosquitto MQTT broker or Apache Kafka broker.
9	SUSE Rancher Kubernetes-based Edge application management.
12	InfluxData InfluxDB production data time-series database.
13	OPC Foundation UA Cloud Library online store of OPC UA Information Models.
14	PostgreSQL product database.
15	Grafana Labs Grafana visualization dashboards.
16	AI-assisted analytics software used to calculate equipment effectiveness, make production forecasts and make predictions about required machine maintenance.
17	OPC Foundation UA Cloud Library, recently extended with Nodeset viewing, uploading, downloading and editing capabilities for Digital Product Passsport scenarios. Digital Twin Consortium Asset Admin Shell Repository powered by OPC UA.
18	Eclipse Dataspace Connector (EDC), in provider configuration.
19	InfluxData InfluxDB product usage data time-series database.
20	OPC Foundation UA Cloud Action for OPC UA PubSub cloud to edge messaging.
22	Eclipse Dataspace Connector (EDC) from the customer, in consumer configuration.

OPC Foundation Cloud Referenz Architecture

| Nr.	Generic Name	AWS	Google Cloud	HUAWEI	Microsoft	SAP
1	Machines (building product)					
2	Information Model Viewer				UA Cloud Viewer	
3	Edge Broker	Shopfloor Connectivity running on AWS IoT Greengrass / Amazon EKS Hybrid Nodes Greengrass	Manufacturing Connect		UA Edge Translator	Azure IoT Operations on Azure Local	SAP APM Device Connectivity
4	Industrial Connectivity Software				UA Edge Translator		SAP Production Connector
5	On-premises MES					
6	Gateway	Shopfloor Connectivity running on AWS IoT Greengrass / Amazon EKS Hybrid Nodes	Manufacturing Connect		IoT Edge	Azure IoT Operations on Azure Local	SAP APM Device Connectivity
7	Dataspace Connector Consumer	Eclipse Dataspace Connector Consumer	Eclipse Dataspace Connector Consumer	EDS	Eclipse Dataspace Connector Consumer	SAP Integration Suite Dataspace Connector
8	Cloud Broker	AWS IoT Core / Amazon Managed Streaming for Apache Kafka	Pub Sub & Data Flow	IIoT	Azure Event Grid/Hubs	SAP Integration Suite – Advanced Event Mesh
9	Edge Management	AWS IoT Device Management / Amazon EKS	Manufacturing Connect (Cloud)	IoT Edge	Azure Arc	SAP Edge Lifecycle Managment
10	ERP Database				Dynamics 365 ERP	SAP S/4HANA
11	Cloud MES Service			Model Based Manufacturing	Dynamics 365 MES	SAP Digital Manufacturing
12	Production Lines Time-Series Database	Amazon TimeStream / Amazon Simple Storage Service (S3)	Cloud Storage & Big Table	GeminiDB	Azure Data Explorer	SAP Business Data Cloud
13	Information Model Library	UA Cloud Library	UA Cloud Library	UA Cloud Library	UA Cloud Library	
14	Product Database	Amazon RDS	Big Query	RDS for MySQL/RDS for PostgreSQL	Azure SQL	SAP BTP HANA
15	Dashboards	Amazon QuickSight	Looker	DataArts Insights/ Data Lake Visualization	Power BI	SAP Business Data Cloud
16	AI-Assisted Analytics	Amazon SageMaker Unified Studio / Amazon Q	Vertex AI	ModelArts	Copilot	SAP Joule
17	Digital Product Passport Library	UA Cloud Library	UA Cloud Library	UA Cloud Library	UA Cloud Library	
18	Dataspace Connector Provider	Eclipse Dataspace Connector Provider	Eclipse Dataspace Connector Provider	EDS	Eclipse Dataspace Connector Provider	
19	Connected Product Time-Series Database	Amazon TimeStream (Connected Product)	Big Table	GeminiDB	Azure Data Explorer (Connected Product)	SAP Analytics Cloud
20	Cloud to Edge Messaging App	UA Cloud Action	UA Cloud Action	UA Cloud Action	UA Cloud Action	
21	Customer ERP Database				Customer ERP Database	
22	Dataspace Connector Consumer	Eclipse Dataspace Connector Consumer	Eclipse Dataspace Connector Consumer	EDS	Eclipse Dataspace Connector Consumer	

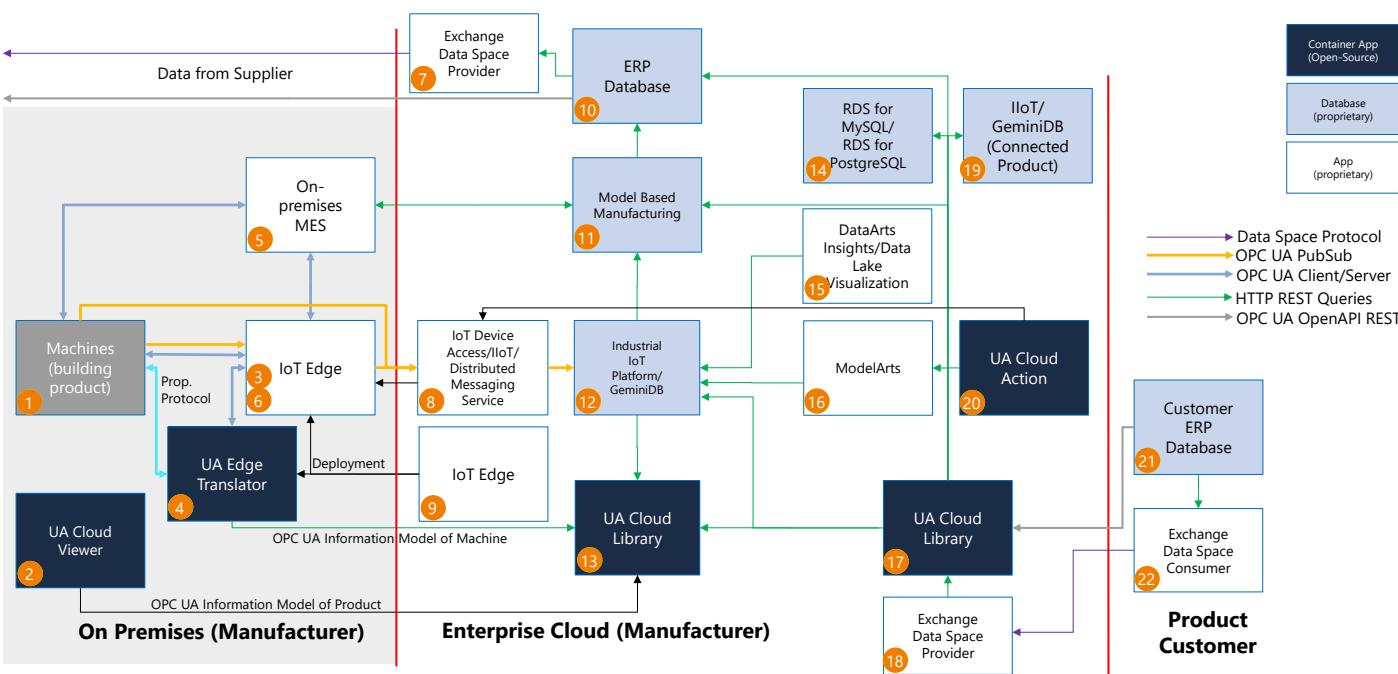## UA Cloud Initiative Reference Architecture – Commercial offerings AWS

UA Cloud Initiative Reference Architecture – Commercial offerings Google

UA Cloud Initiative Reference Architecture – Commercial offerings aws

Nummer	Generic Name	AWS
3	Edge Broker	Shopfloor Connectivity running on AWS IoT Greengrass / Amazon EKS Hybrid Nodes Greengrass
6	Gateway	Shopfloor Connectivity running on AWS IoT Greengrass / Amazon EKS Hybrid Nodes
7	Dataspace Connector Consumer	Eclipse Dataspace Connector Consumer
8	Cloud Broker	AWS IoT Core / Amazon Managed Streaming for Apache Kafka
9	Edge Management	AWS IoT Device Management / Amazon EKS
12	Production Lines Time-Series Database	Amazon TimeStream / Amazon Simple Storage Service (S3)
13	Information Model Library	UA Cloud Library
14	Product Database	Amazon RDS
15	Dashboards	Amazon QuickSight
16	AI-Assisted Analytics	Amazon SageMaker Unified Studio / Amazon Q
17	UA Cloud Library	UA Cloud Library
18	Dataspace Connector Provider	Eclipse Dataspace Connector Provider
19	Connected Product Time-Series Database	Amazon TimeStream (Connected Product)
20	Cloud to Edge Messaging App	UA Cloud Action
22	Dataspace Connector Consumer	Eclipse Dataspace Connector Consumer
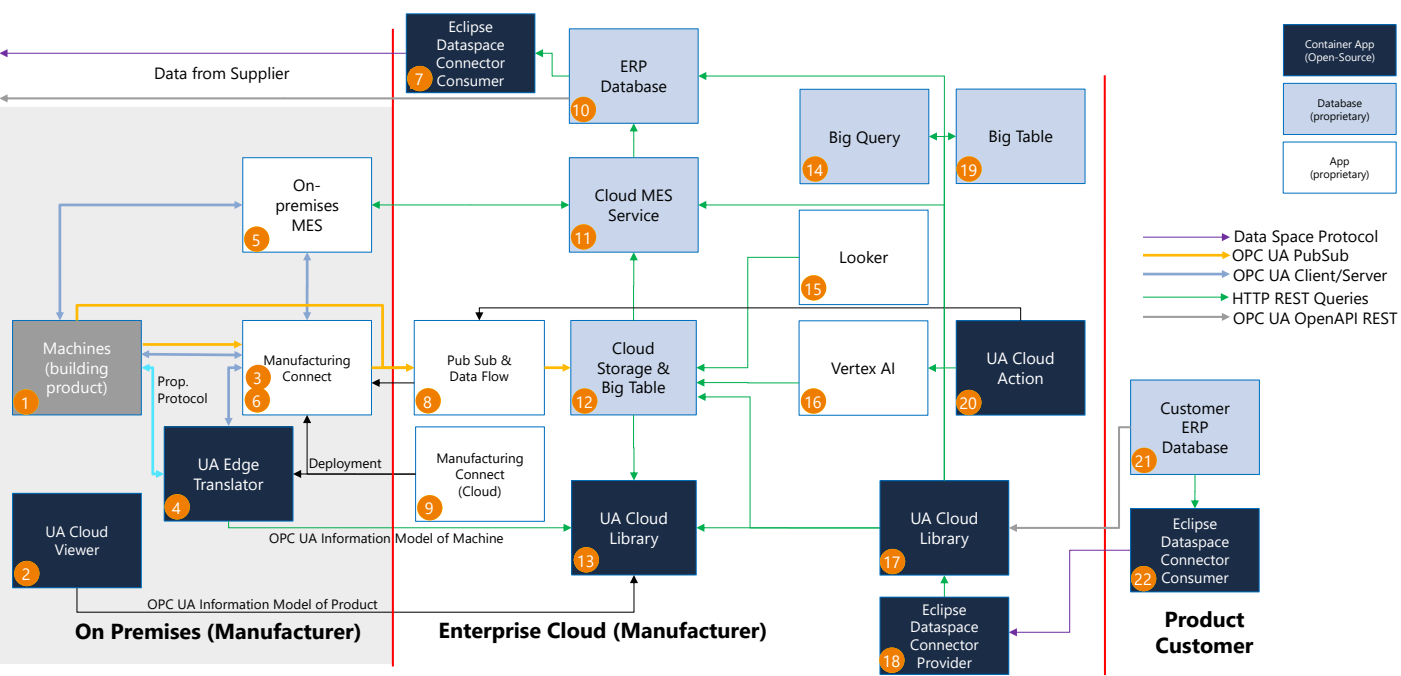
UA Cloud Initiative Reference Architecture – Commercial offerings Google

| Nummer	Generic Name	Google Cloud
3	Edge Broker	Manufacturing Connect
6	Gateway	Manufacturing Connect
7	Dataspace Connector Consumer	Eclipse Dataspace Connector Consumer
8	Cloud Broker	Pub Sub & Data Flow
9	Edge Management	Manufacturing Connect (Cloud)
12	Production Lines Time-Series Database	Cloud Storage & Big Table
13	Information Model Library	UA Cloud Library
14	Product Database	Big Query
15	Dashboards	Looker
16	AI-Assisted Analytics	Vertex AI
17	UA Cloud Library	UA Cloud Library
18	Dataspace Connector Provider	Eclipse Dataspace Connector Provider
19	Connected Product Time-Series Database	Big Table
20	Cloud to Edge Messaging App	UA Cloud Action
22	Dataspace Connector Consumer	Eclipse Dataspace Connector Consumer

UA Cloud Initiative Reference Architecture – Commercial offerings Huawei

UA Cloud Initiative Reference Architecture – Commercial offerings Huawei

| Nummer	Generic name	HUAWEI
1	Machines (building product)	Machines of the Manufacturer on-premises building the product.
3	Edge Broker	IoT Edge – At the edge, in close proximity to data sources or physical assets, an open platform integrating network, compute, storage, and application core capabilities, provides computing and intelligent services nearby.
4	Industrial Connectivity Software	UA Edge Translator – Open-Source
5	On-premises MES	On-premises MES
6	Gateway	IoT Edge – At the edge, in close proximity to data sources or physical assets, an open platform integrating network, compute, storage, and application core capabilities, provides computing and intelligent services nearby.
7	Dataspace Connector Consumer	EDS – The data space exchange instance is a platform for exchange and sharing that is based on protecting enterprise data sovereignty, promoting efficient data circulation within enterprises, and maximizing data value.
8	Cloud Broker	IoT Device Access (IoTDA) – The industrial IoT platform serves as a unified digital foundation for enterprises' production data, targeting the key challenges faced by manufacturing companies during the digital upgrade of their production processes. IoTDA – Provides massive device connectivity to the cloud, bidirectional messaging between devices and the cloud, batch device management, remote control and monitoring, OTA upgrades, and device linkage rules.
9	Edge Management	IoT Edge – At the edge, in close proximity to data sources or physical assets, an open platform integrating network, compute, storage, and application core capabilities, provides computing and intelligent services nearby.
10	ERP Database	ERP Database
11	Cloud MES Service	Model Based Manufacturing
12	Production Lines – Time-Series Database	GeminiDB – A multi-model NoSQL database based on Huawei's independently developed decoupled computing and storage architecture, compatible with various protocols such as Redis, DynamoDB, Cassandra, HBase, and InfluxDB.
13	Information Model Library	UA Cloud Library – Open source
14	Product Database	RDS for MySQL/RDS for PostgreSQL
15	Dashboards	DataArts Insights/ Data Lake Visualization – The new generation of BI services provides visual, real-time, user-friendly, and secure business intelligence analysis services, enabling businesses to gain insights in the most natural and efficient way, supporting real-time and efficient decision-making.
16	AI-Assisted Analytics	ModelArts – A one-stop AI development platform for developers, enabling rapid creation and deployment of models, managing the entire AI workflow cycle, and supporting intelligent upgrades across various industries.
17	UA Cloud Library	UA Cloud Library
18	Dataspace Connector Provider	EDS – The data space exchange instance is a platform for exchange and sharing that is based on protecting enterprise data sovereignty, promoting efficient data circulation within enterprises, and maximizing data value.
19	Connected Product – Time-Series Database	GeminiDB – A multi-model NoSQL database based on Huawei's independently developed decoupled computing and storage architecture, compatible with various protocols such as Redis, DynamoDB, Cassandra, HBase, and InfluxDB.
20	Cloud to Edge Messaging App	UA Cloud Action – Opensource
21	Customer ERP Database	Customer ERP Database
22	Dataspace Connector Consumer	EDS – The data space exchange instance is a platform for exchange and sharing that is based on protecting enterprise data sovereignty, promoting efficient data circulation within enterprises, and maximizing data value.

UA Cloud Initiative Reference Architecture – Commercial offerings Microsoft

UA Cloud Initiative Reference Architecture – Commercial offerings SAP
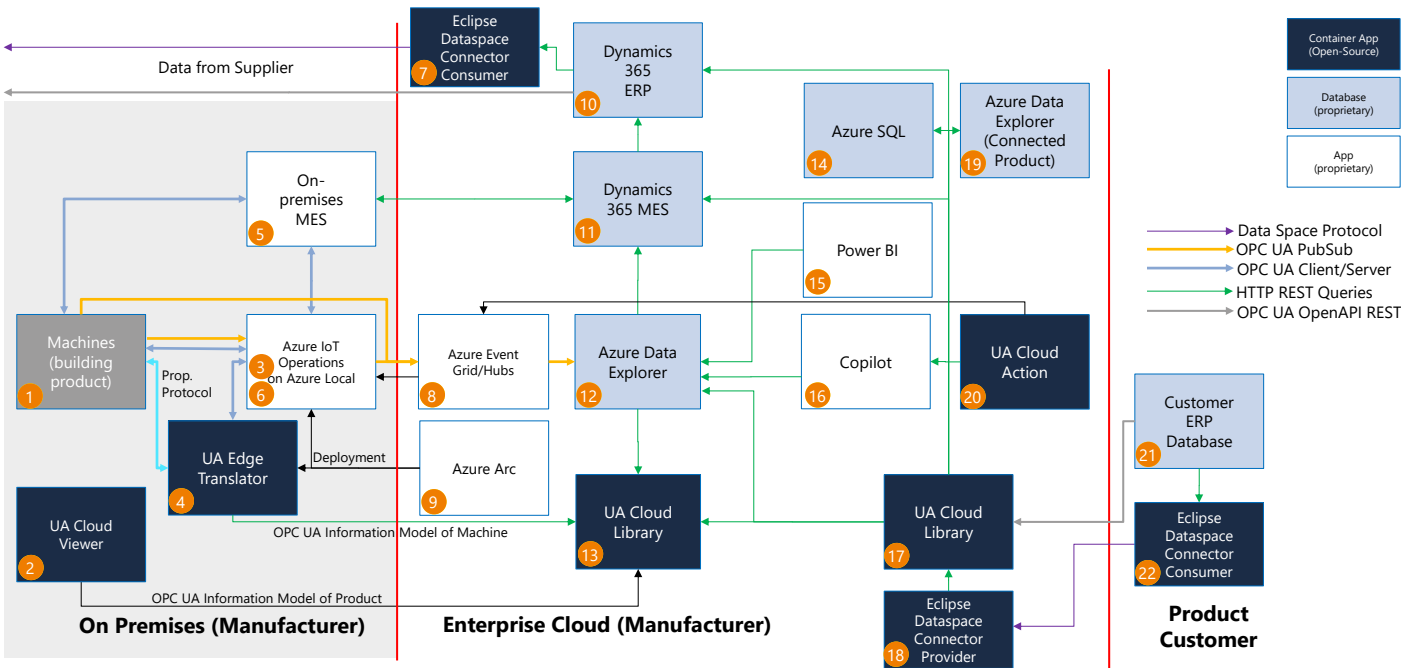
These building blocks are available as Microsoft offerings

Nummer	Generic name	Microsoft
3	Edge Broker	Azure IoT Operations with native OPC UA client and OPC UA PubSub support as well as an MQTTv5 broker, on Azure Local operating system.
6	Gateway	Azure IoT Operations with native OPC UA client and OPC UA PubSub support as well as an MQTTv5 broker, on Azure Local operating system.
7	Dataspace Connector Consumer	Eclipse Dataspace Connector Consumer
8	Cloud Broker	Azure Event Grid (MQTT) and Azure Event Hubs (Kafka).
9	Edge Management	Azure Arc edge infrastructure and application management.
10	ERP Database	Dynamics 365 ERP.
11	Cloud MES Service	Dynamics 365 MES.
12	Production Lines Time-Series Database	Azure Data Explorer time-series, graph and data analytics production data database.
13	Information Model Library	UA Cloud Library
14	Product Database	Azure SQL relational database.
15	Dashboards	Power BI visualization and insights platform.
16	AI-Assisted Analytics	Copilot Studio for creating Agents for your data.
17	UA Cloud Library	UA Cloud Library
18	Dataspace Connector Provider	Eclipse Dataspace Connector Provider
19	Connected Product Time-Series Database	Azure Data Explorer time-series, graph, and data analytics product usage data database.
20	Cloud to Edge Messaging App	UA Cloud Action
22	Dataspace Connector Consumer	Eclipse Dataspace Connector Consumer
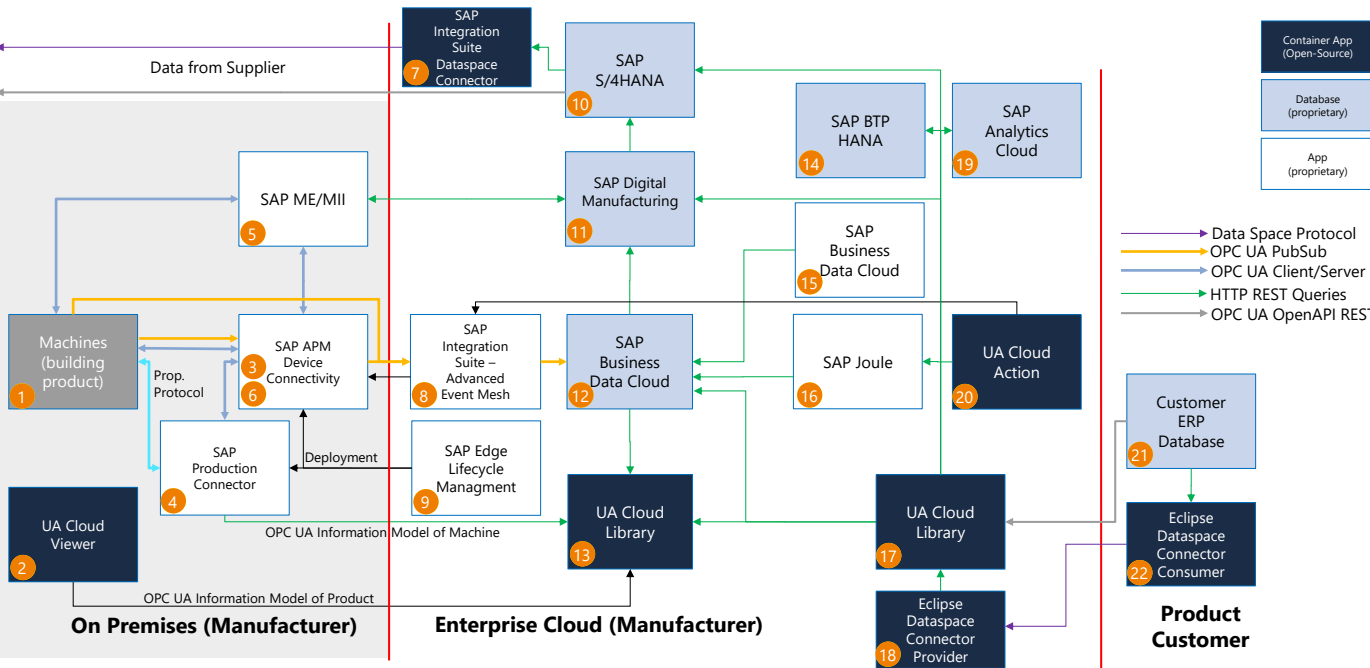
UA Cloud Initiative Reference Architecture – Commercial offerings SAP

Nummer	Generic Name	SAP
3	Edge Broker	SAP APM Device Connectivity
4	Industrial Connectivity Software	SAP Production Connector
6	Gateway	SAP APM Device Connectivity
7	Dataspace Connector Consumer	SAP Integration Suite Dataspace Connector
8	Cloud Broker	SAP Integration Suite – Advanced Event Mesh
9	Edge Management	SAP Edge Lifecycle Managment
10	ERP Database	SAP S/4HANA
11	Cloud MES Service	SAP Digital Manufacturing
12	Production Lines Time-Series Database	SAP Business Data Cloud
14	Product Database	SAP BTP HANA
15	Dashboards	SAP Business Data Cloud
16	AI-Assisted Analytics	SAP Joule
19	Connected Product Time-Series Database	SAP Analytics Cloud

UA Cloud Initiative Reference Architecture – Commercial offerings ABB

Nummer	Generic name	ABB
1	Machines (building product)	ABB Industrial Equipments, Drives and Systems Machines support connectivity with standard protocols. Both ABB systems and Non-ABB systems are supported through Genix Industrial IoT and AI Platform Suite
2	Information Model Viewer	ABB Ability Information Model & Genix Model Viewer are com-ponents of Genix Industrial DataOps Express
3	Edge Broker	ABB Edgenius Broker is a component of Genix EdgeAI
4	Industrial Connectivity Software	ABB Genix Omni Source Integration Hub provides 200+ pre-built adapters for industrial systems ABB Edgenius Field Information Manager provides Fieldbus level connectivity to hundred plus protocols
5	On-premises MES	ABB Ability MOM
6	PubSub Data Publisher & PubSub Action Processor	Genix Data Publisher & Genix EdgeAI Orchestrator are part of Genix EdgeAI
7	Dataspace Connector Consumer	Genix Industrial DataOps Message Sync brings the functionality of Dataspace Connector Consumer and is a component of Genix Industrial DataOps Express
8	Cloud Broker	Genix IIoT Gateway is a component of Genix IIoT Hub
9	Edge Management	Genix Edge Management Portal is a component of Genix IIoT Hub
11	Cloud MES Service	Genix MES Integration Service
12	Production Lines – Time-Series Database	ABB Ability History. Also, pre integrated and supporting Azure Data Explorer, Timescale and CrateDB out of the box
13	Information Model Library	Genix Information Model Repository is a component of Genix Industrial DataOps Express
14	Product Database	Genix Industry Cognitive Model on any RDBMS
15	Dashboards	Genix Dashboard Manager is a component of Genix Analytics App Studio
16	AI-Assisted Analytics	Genix AI Express for Analytical Genix CoPilot for Generative AI
17	Asset Admin Shell Library	Genix Digital Twin Hub provides asset templates and digital twin modeler and runtime. DTC AAS Repository used for asset information registry
18	Dataspace Connector Provider	Genix Knowledge Services Hub
19	Connected Product Time-Series Database	ABB Ability History. Also, pre integrated and supporting Azure Data Explorer, Timescale and CrateDB out of the box
20	Cloud to Edge Messaging App	Genix Industrial DataOps Message Sync is a component of Ge-nix Industrial DataOps Express

UA Cloud Initiative Reference Architecture – Commercial offerings BECKHOFF

Nummer	Generic name	BECKHOFF
1	Machines	TF6100 TwinCAT 3 OPC UA offers Client/Server and OPC UA PubSub
6	PubSub Data Publisher & PubSub Action Processor	TF6720 TwinCAT 3 IoT Data Agent offer OPC UA Client to OPC UA over MQTT

UA Cloud Initiative Reference Architecture – Commercial offerings Mitsubishi-Electric

Nummer	Generic name	MITSUBISHI ELECTRIC
1	Machines (building product)	GENESIS64 RD81OPC96 MELSEC iQ-R Series OPC UA server module FX5-OPC MELSEC iQ-F Series OPC UA server module

UA Cloud Initiative Reference Architecture – Commercial offerings Honeywell

Nummer	Generic name	Honeywell
1	Machines (building product)	ControlEdge PLC ControlEdge UOC
6	PubSub Data Publisher & PubSub Action Processor	Honeywell Enabled Services Matrikon Data Broker (MQTT Publisher)

UA Cloud Initiative Reference Architecture – Commercial offerings Rockwell Automation

Nummer	Generic name	Rockwell Automation
1	Machines (building product)	PLC Programmable Controllers	Allen-Bradley	US
4	Industrial Connectivity Software	FactoryTalk Linx Gateway Software	FactoryTalk	US
5	On-premises MES	MES Automation and Orchestration	Plex FactoryTalk ProductionCentre	FactoryTalk	US
6	Gateway	FactoryTalk Optix	FactoryTalk	US
9	Edge Management	Margo - Edge interoperability for industrial automation ecosystems
11	Cloud MES Service	MES Systems: Manufacturing Execution System Software	Plex
12	Production Lines Time-Series Database	FactoryTalk DataMosaix: Industrial DataOps Solution	FactoryTalk	US
15	Dashboards	FactoryTalk DataMosaix: Industrial DataOps Solution	FactoryTalk	US

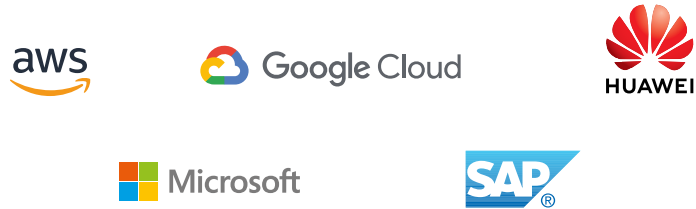## UA Cloud Initiative Reference Architecture – Commercial offerings Schneider Electric

Nummer	Generic name	Schneider Electric
1	Machines (building product)	OPC UA compatible modules: Modicon series controllers/EcoStruxure Machines/Foxboro DCS: 1. ModiconM580 PAC with BMENUA0100 2. Modicon M580 dPAC 3. Modicon M262 Logic/Motion controller 4. PacDrive LMC Pro motion controllers 5. Modicon M241 & M251 Micro Controller 6. Modicon Edge IO NTS 7. BMEECN0100H (Edge Compute Node module for M580 PLCs) 8. HMI solution (Harmony P6 Industrial PC and EcoStruxure Operator Terminal Expert) 9. Foxboro DCS solution 10. Ecostruxure Triconex Safety Systems
2	Information Model Viewer	Prosyst by Schneider OPC UA Modeler (based on UML modelers) to create and export information models
3	Edge Broker	AVEVA Edge through 3rd party
4	Industrial Connectivity	1. EcoStruxure OPC UA Server Expert – Aggregates OPC UA data 2. AVEVA System Platform: Offers native OPC UA server and client capabilities 3. uDC Server (Unified Data Collector) by Prosyst by Schneider: OPC UA server exposing OT Data regardless of the OT Controller protocol in OPC UA 4. uDC aggregation server used to collect OT Data from several OPC UA servers.
5	On-premises MES	AVEVA MES integrates with OPC UA and provides real-time production management and machine status monitoring.
6	Gateway	1. EcoStruxure IIoT Gateway – Supports OPC UA Client, PubSub, MQTT, and Kafka 2. AVEVA Edge 3. uDC Data Provider supporting OPC UA PubSub over MQTT and MQTTS communication – Prosyst by Schneider
8	Cloud Broker	1. EcoStruxure Platform – Edge to Cloud communication 2. AVEVA CONNECT – open, vendor-neutral and cloud-based platform
9	Edge Management	1. EcoStruxure Platform – device and app management capabilities 2. EcoStruxure Edge Apps-Manager 3. AVEVA Edge Management for provisioning and monitoring edge devices 4. uDC Plant Manager and Enterprise Monitor for remote monitoring, diagnosis and management of uDC servers deployed on premise – Prosyst by Schneider.
12	Production Lines Time-Series Database	1. EcoStruxure Platform – supporting the EcoStruxure portfolio storing the time-series data 2. AVEVA CONNECT Data Services – Cloud-based scalable, secure industrial data management service
14	Product Database	1. EcoStruxure Platform 2. AVEVA CONNECT Data Services – Cloud-based scalable, secure industrial data management service
15	Dashboards	AVEVA Insight – Self-service dashboards and customizable alerts for optimizing operations
16	AI-Assisted Analytics	AVEVA Predictive Analytics – AI-driven insights for maintenance and performance.
18	Dataspace Connector Provider	EcoStruxure Platform – Eclipse Tractus-X Dataspace Connector for secure data sharing
19	Connected Product Time-Series Database	1. EcoStruxure Platform – supporting the EcoStruxure portoflio storing the time-series data 2. AVEVA CONNECT Data Services – Cloud-based scalable, secure industrial data management service
20	Cloud to Edge Messaging App	EcoStruxure Platform – supporting the EcoStruxure portfolio for their Cloud-to-Edge MQTT or HTTP communication
21	Customer ERP Database	Integration with customer ERP systems is supported via EcoStruxure Integration Services.

UA Cloud Initiative Reference Architecture – Commercial offerings Siemens

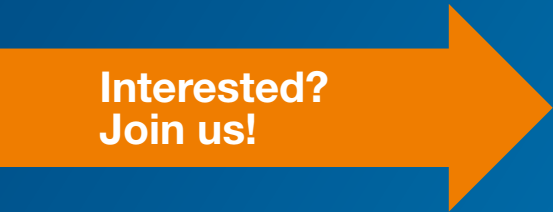| Nummer	Generic name	SIEMENS
1	Machines (building product)	SIMATIC S7-1500 and ET 200SP CPU with integrated OPC UA Client/Server and OPC UA PubSub via library. SINUMERIK OPC UA Server for tool machine controllers
2	Information Model Viewer	Siemens OPC UA Modeling Editor (SiOME) – free of charge
3	Edge Broker	Siemens Industrial Edge
4	Industrial Connectivity Software	Connectivity Software for brown-/greenfield data integration – integrated into multiple products for different industries & applications – SIMATIC WinCC SCADA Systems – Industrial Information Hub: Edge-based Shopfloor integration platform – MindConnect: Insights Hub Gateway – Opcenter Connect: MES/ERP Gateway – CMS1200
5	On-premises MES	Opcenter
6	Gateway	Hardware and Software Gateways tailored to different industries and application scenarios: SIMATIC WinCC SCADA Systems, Industrial Information Hub, Opcenter Connect, IoT Gateways, SIMATIC CloudConnect 7, SIMATIC CN 4100
7	Dataspace Connector Consumer	Insights Hubs' Cross-Tenancy, Policy Based Access Control
8	Cloud Broker	Insights Hub with MindConnect MQTT and full PubSub support, Opcenter X NATS Broker with Pub/Sub and Request/Response support
9	Edge Management	Siemens Industrial Edge Management System
11	Cloud MES Service	Opcenter X
12	Production Lines – Time-Series Database	SIMATIC WinCC SCADA Systems, Insights Hub TimeSeries Services, SIMATIC Process Historian
13	Information Model Library	Asset Library in Asset Manager in sync with on-prem located Industrial Information Hub and compliant to the OPC UA PubSub model
14	Product Database	Teamcenter X
15	Dashboards	Dashboard Designer, Business Intelligence. Turn key apps for Energy-, Performance- and DriveTrain Analytics available.
16	AI-Assisted Analytics	Range from Production Copilot, custom Agents and their Skills to out of the box AI industry solutions like Quality Prediction, Senseye for maintenance, Energy Optimizer to custom AI model development and management in Predictive Learning (via Python), SiePA, gPROMS, SIMATIC easSie, Drivetrain Analyzer (DTA) X-Tools
17	Asset Admin Shell Library	Translation Service from Asset Management to AAS
18	Dataspace Connector Provider	Policy Based Access Control and cross-tenancy sharing via contracts allows to share data
19	Connected Product – Time-Series Database	Insights Hub – Timeseries Services (raw & aggregated) and Event Services based on machine data model. Including Remote Service option to securely connect to the machine for updates
20	Cloud to Edge Messaging App	MindConnect MQTT and OPC UA for messaging from the cloud to the edge via MQTT or RestAPI Opcenter Connect supports bi-direction cloud to edge communication
22	Dataspace Connector Consumer	via provided RestAPI Services Opcenter Connect, Active integration Gateway

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