Introducing The OPC UA – MTConnect Companion Specification
Version 2 Release Candidate

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Agenda

▸ Introduction

▸ MTConnect Overview

▸ OPC UA Synergy with MTConnect

▸ Companion Specification

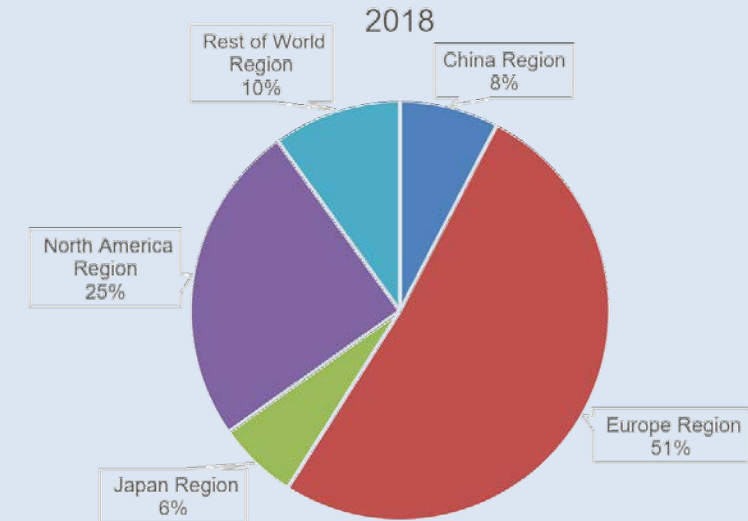▸ Next Steps

OPC Foundation

Introduction

OPC Foundation

- ▸ Vision
  Secure, reliable, vendor, platform, and domain agnostic interoperability from sensor to enterprise and beyond

- ▸ Global Profile
  - ◦ Non profit organization (founded 1995)
  - ◦ Companies from Automation & IT
  - ◦ Internationally Recognized: OPC UA is IEC62541

- ▸ Deliverables
  - ◦ Specifications: openly available
  - ◦ Tools and code examples for faster, easier adoption (AnsiC/C++, C# .NET Standard, Java)
  - ◦ Certification: OPC Labs open to everyone

GitHub

- ▸ Ecosystem with toolkits and education
  https://opcfoundation.org

Organizational Overview

Membership: 652 (Feb 19th, 2019)

2018

Rest of World Region 10%
China Region 8%
North America Region 25%
Europe Region 51%
Japan Region 6%

2019 Board of Directors

Microsoft	Honeywell	Rockwell,
SAP	Yokogawa	Schneider,
Siemens	ICONICS	ABB
Beckhoff	Ascolab	

Recognized by Industrial IoT Consortia Around the World

USA   Europe   China   South Korea   Japan

The Industrial Interoperability Standard

Delivering a framework for enabling secured, standardized data and interfaces

OPC UA — The Industrial Interoperability Standard

OPC UA: The industrial framework enabling secured, standardized data and interfaces

Interoperability

Independent of: Vendor, Platform, Market and OS agnostic

Scalable: From Sensor to Cloud

Discoverable Services Oriented Architecture (SOA) independent of the transport method

Non-Profit Owned (OPC Foundation)

Widely Adopted: growing 50M install base

Data Modeling

Powerful: preserves source context

Extendible: Vendor extendable data model (Companion Specification)

Relevant: Enables domain specific information models

- Factory: Robotics, Machine Vision, …

- Process: FDI, FDT, O-PAS, NOA, PA-DIM, MDIS, …

- Energy: IEC61850, ..

Security

Secure Design from group-up

Based on open security standards

Authentication | Encryption

Future Proof: Evolves with security technologies

Vendors/Users can choose level of security

Accepted: Aligned with IT requirements

MTConnect, … today 50 initiatives!

Collaboration: Companion Specifications

OPC Foundation delivers:

- Rules for OPC UA CS developed together with partners
- Process for joint OPC UA CS development and potential certification
- Standardized format templates and workflows
- Compliance
- Intellectual property protection

https://opcfoundation.org/markets-collaboration/

Example Markets:

- Automation
- Building Automation
- Energy
- Engineering
- Measurement
- Oil & Gas
- Transportation

Collaborations

The OPC Foundation closely cooperates with organizations and associations from various branches. Specific information models of other standardization organizations are mapped onto OPC-UA and thus become portable.

VDMA: Manufacturing Industry
- 17+ OPC UA CS In progress

MTConnect

Overview

Standards Vs. Frameworks

▸ OPC UA implements standards across industries
▸ MTConnect is application of OPC UA in Manufacturing Tech industry

Standards Ecosystem

"What does this standard do for me?"
"What is the business case?"

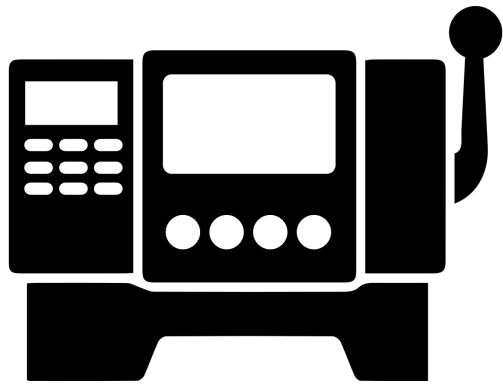# MTConnect is a domain model.

>Vocabulary
>Semantics

Vocabulary

"What is this thing?"

Semantics

"How does this thing relate to other things?"
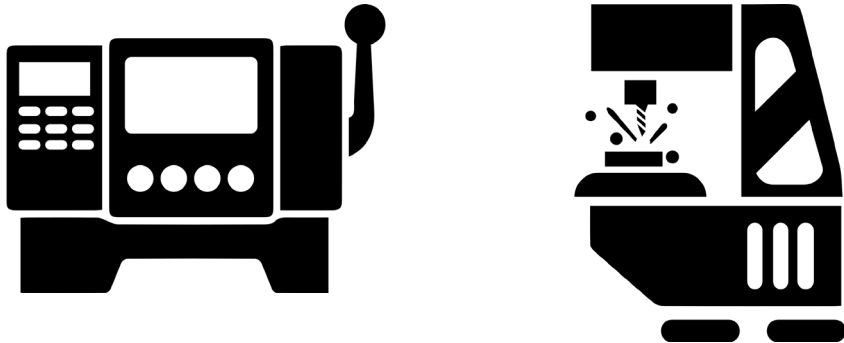
Scope

Domain models

(MTConnect)

Plastics

Packaging

Pharma

Oil and Gas

Manufacturing Technology

Building management

Electrical

OPC UA

Synergy with MTConnect

OPC UA – Open Industry Standard Data Exchange

OPC UA – Open Industry Standard Data Exchange

MES

ERP

Web & Mobile Clients

Firewall

HMI

SCADA

OPC UA added value for MTConnect:
- Access to broad software ecosystem
    (SCADA, MES, ERP, AZURE, etc.)
- Implement security from factory to cloud
    (encryption and authentication)
- Send commands
    (OPC UA methods)
- Combine Many industry information models
    (PackML, ISA-95, PLC Open, etc.)

Integrated and Embedded Data Models

▸ Combined information models (creating a global namespace)
▸ Embedded servers reducing computing infrastructure
▸ Data access and control between equipment and to the cloud
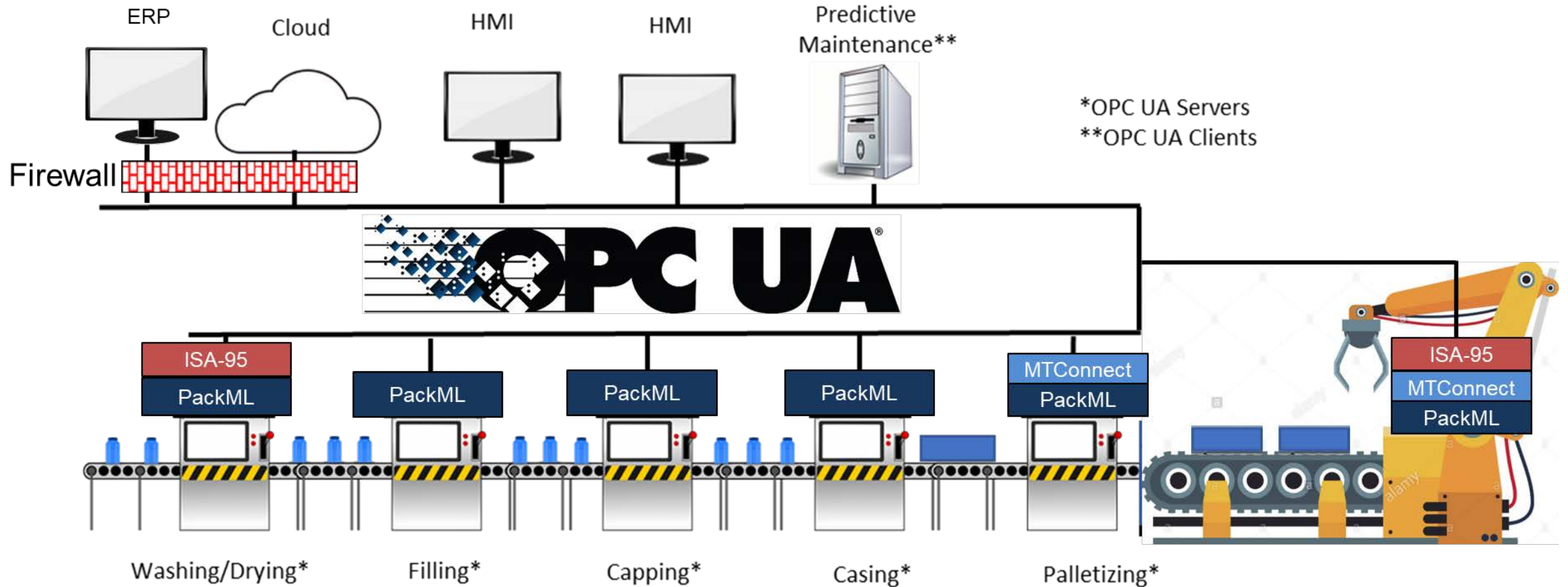
OPC UA-MTConnect Use Cases

▸ **Machine tool manufacturer with MTConnect or OPC UA**
- ◦ MTConnect to OPC UA Gateway (Agent → OPC UA Server)
- ◦ OPC UA to MTConnect Gateway (OPC UA Server → Agent)

▸ **Software Vendor with added value analysis and control supporting OPC UA and MTConnect Agent interfaces**
- ◦ Client ←→ OPC UA/MTConnect Agent ←→ Devices

▸ **Data Scientist access to other OPC UA information models for added contact (PackML, ISA-95, PLC Open)**

Cloud Analytics

▸ **Industrial system integrator integrating equipment for M2M collaboration and control**

Unload Material
Load Material
Open/Close Chuck

20
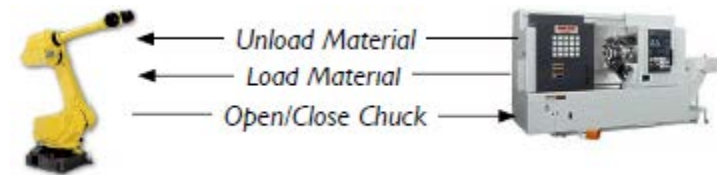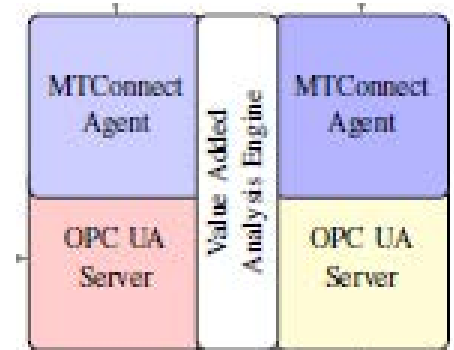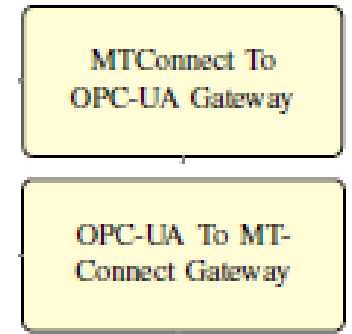
Benefit of Adopting OPC UA: Security

- OPC UA Security:
  - Designed with Security from ground-up
  - Built on security best-practices and open standards
  - END-to-END based
  - Successfully Tested by independent 3rd parties
  - Adopted as a core standard by key standards bodies globally:
    - Industrial Internet Consortium (IIC)
    - Platform Industrie 4.0
  - Designed for continuous evolution as security landscape changes

MTConnect OPC UA Companion Specification

Overview

Benefits of Implementing MTConnect with OPC UA

- Builds on existing systems
- Harmonizes descriptions and data models
- Streamlines system internals
- Users and vendors get:
  - Transparency
  - Consistency
  - Round-trip compatibility and no information loss
  - Security

Details of MTConnect Companion Spec

▸ Design Goals

    ◦ Full round trip compatibility from MTConnect →OPC UA → MTConnect
- No information loss
- No loss of semantics or data

    ◦ Remain idiomatically correct for OPC UA
- Use the existing data variables (part 8) and conditions (part 9) as they are defined in the OPC UA standard
- Provide equivalent capabilities and map to types without loss of content

The Information Model (in brief)

- ▸ Components have the Semantic name of the Component:
  - ◦ Linear, Rotary, Controller, Path, Pneumatic, Electric, etc…
- ▸ Data Items represented as OPC UA Data Variables

- Position
- Program
- ControllerMode
- Execution
- etc…

⟹

- AnalogUnit types for Samples
- Base Data Variable for String and extended types
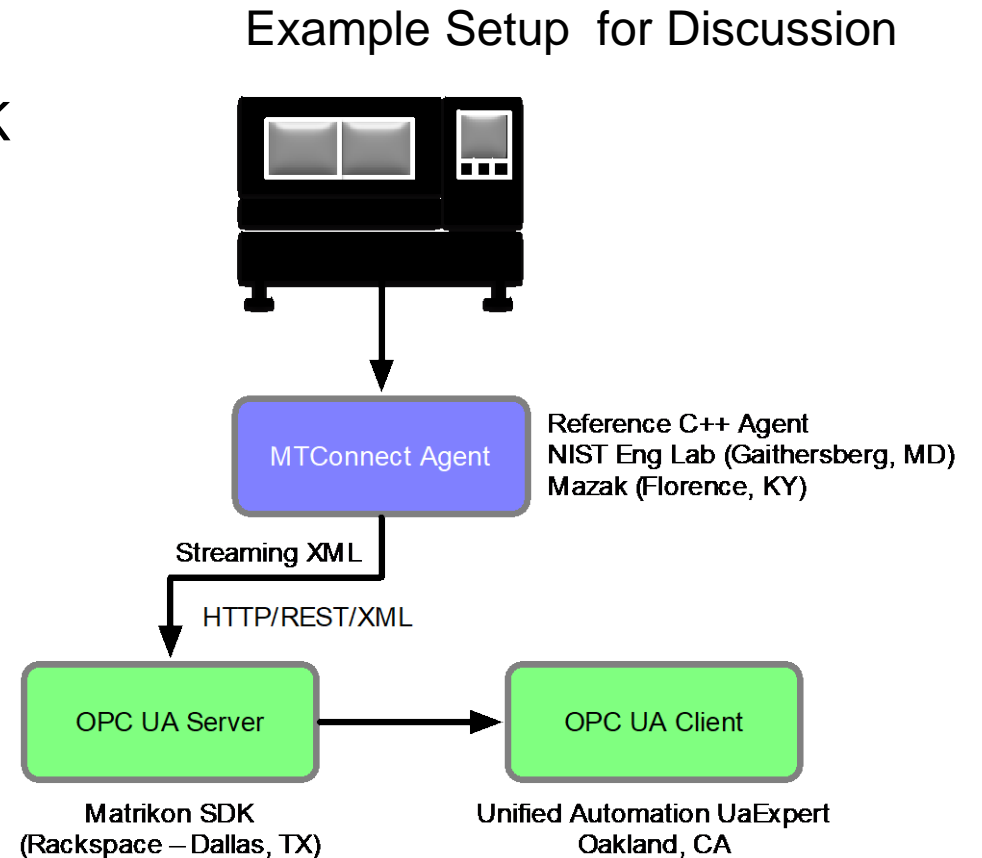- MultiStateDiscreteType for Controlled vocabularies

Conditions

- We map to the BaseCondition of OPC UA and supporting branching for multiple concurrent faults and warnings

- Semantic relations to the class types are created to associate the condition with the meaning and relations are created to the source of the alarm as specified
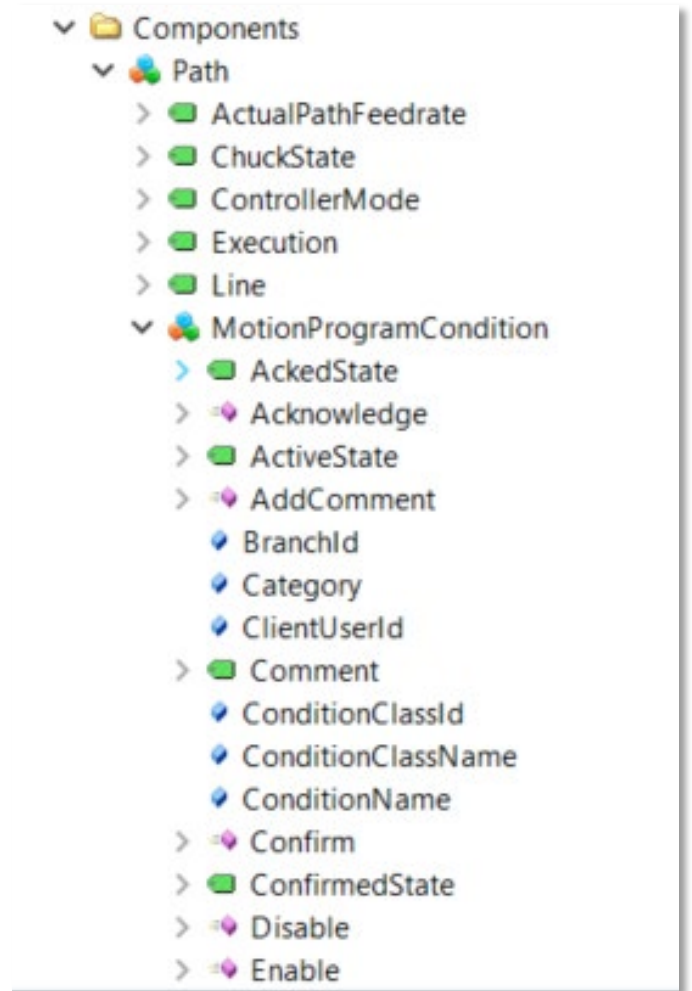
Implementation Example

▶ The Companion Specification has been implemented and is being hosted on Rackspace: opc.tcp://opc.mtconnect.org:4840

▶ Details:

   ◦ Implemented using Matrikon® FLEX OPC UA SDK

   ◦ Viewed using Unified Automation UaExpert

• OPC UA Server dynamically configures from MTConnect Agent and begins Streaming

Example Setup for Discussion

MTConnect Agent

Reference C++ Agent
NIST Eng Lab (Gaithersberg, MD)
Mazak (Florence, KY)

Streaming XML

HTTP/REST/XML

OPC UA Server

OPC UA Client

Matrikon SDK
(Rackspace – Dallas, TX)

Unified Automation UaExpert
Oakland, CA

Getting Started

- OPC UA MTConnect Companion Specification
  - Part 8 has most of the mapping details (assumes you know MTConnect and UA, if not, refer to those standards!)
- Get an OPC UA SDK
- Get the OPC MTConnect nodeset: Opc.Ua.MTConnect.Nodeset2.xml
- View/explore the implementation on: opc.tcp://opc.mtconnect.org:4840
- Compare to the two public sites with MTConnect models
  - https://smstestbed.nist.gov/vds/
  - http://mtconnect.mazakcorp.com:5610/
- **Provide Feedback**: Improvements or Corrections needed?

Next Steps

▸ Early Adopters:
  ◦ Start implementation of RC & provide feedback before CS release

▸ MTConnect Institute & OPC Foundation:
  ◦ Promote adoption
  ◦ Harmonization with VDMA Information Models

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Resources

OPC Foundation :
- **Release Candidate Specification:** https://opcfoundation.org/developer-tools/specifications-opc-ua-information-models/information-model-release-candidates-for-review/
- **MTConnect Listing:** https://opcfoundation.org/markets-collaboration/mtconnect
- **OPC Foundation Newsletter**: https://opcfoundation.org/

MTConnect:
- **Release Candidate Specification:** www.mtconnect.org