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

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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

- **Ecosystem with toolkits and education**
  [https://opcfoundation.org](https://opcfoundation.org)

**Organizational Overview**

**Membership:** 652 (Feb 19th, 2019)

- **2019 Board of Directors**
  - Microsoft
  - SAP
  - Siemens
  - Beckhoff
  - Honeywell
  - Yokogawa
  - ICONICS
  - Ascolab
  - Rockwell, Schneider, ABB

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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

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

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)

Manufacturing Technology

Packaging

Plastics

Pharma

Oil and Gas

Building management

Electrical
OPC UA
Synergy with MTConnect
OPC UA – Open Industry Standard Data Exchange

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 \(\rightarrow\) OPC UA Server)
  - OPC UA to MTConnect Gateway (OPC UA Server \(\rightarrow\) Agent)

- Software Vendor with added value analysis and control supporting OPC UA and MTConnect Agent interfaces
  - Client \(\leftrightarrow\) OPC UA/MTConnect Agent \(\leftrightarrow\) Devices

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

- Industrial system integrator integrating equipment for M2M collaboration and control
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
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
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/

- 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:
- MTConnect Listing: https://opcfoundation.org/markets-collaboration/mtconnect
- OPC Foundation Newsletter: https://opcfoundation.org/

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