Mapping CIP to OPC UA
History

2018
• The Common Industrial Cloud Infrastructure SIG was formed to enable interactions between CIP devices and Cloud applications

2019
• OPC UA was chosen as the mechanism to interface with the cloud

2020
• CICI SIG documents use cases/user stories
• OPC Foundation and ODVA form a Joint Workgroup

2021
• CICI SIG writes requirements for OPC UA Companion Specification
• JWG writes first draft of OPC UA Companion Specification
What is OPC UA

• Open set of standards designed as a universal communication protocol.
• Uses standard internet technologies (e.g., TCP/IP, HTTP, and Web Sockets).
• Defines set of core services and a basic information model framework.

• That framework allows information to be exposed in a standard way using metadata (i.e., servers expose their type system)
• OPC UA Clients can discover and use information without prior knowledge
What is an OPC UA Companion Specification

- Uses OPC UA’s information modeling framework to describe common information found in an industry vertical (e.g., Plastics and Rubber) or type of machine (e.g., Pumps and Vacuum Pumps).
- These specifications attempt to harmonize the representation of the information in that vertical or machine by defining objects, variables, data types, methods and references specific to their operation.
- Companion specifications present an information model that defines a common interface that can be supported in any instantiation of that model.
Why Write a CIP Companion Specification

Millions of existing CIP products can be exposed to new, protocol independent applications via OPC UA.
### Translation

<table>
<thead>
<tr>
<th>OPC ComponentType</th>
<th>CIP Identity Object</th>
<th>Mapping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property</td>
<td>DataType</td>
<td>Attribute</td>
</tr>
<tr>
<td>Device Revision</td>
<td>String</td>
<td>Revision</td>
</tr>
<tr>
<td>Manufacturer URI</td>
<td>String</td>
<td>Vendor URI</td>
</tr>
<tr>
<td>Product Instance URI</td>
<td>String</td>
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</table>
OPC UA Information Modeling - Graphical

- UML-like graphical representation of information

Inheritance
DrillPressType is a subtype of BaseObjectType

Indicates a type

Reference indicates relationship

Interfaces abstract functionality

Component: Object

Properties

Component: Method

Component: Variable

MotorType: DrillPressMotor

Manufacturer

DeviceRevision

StartStop

Speed

Direction

Height

Interfaces

IVendorNameplateType

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IVendorNameplateType
<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BrowseName References</td>
<td>DrillPressType</td>
</tr>
<tr>
<td>NodeClass</td>
<td>BrowseName</td>
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<tr>
<td>References</td>
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<tr>
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<td>Variable</td>
<td>Speed</td>
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<td>0:HasProperty</td>
<td>0:LocaleText</td>
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Modeling CIP Devices

1. Identity
2. Network Interface
3. Application
Network Interface Model

Newly-defined types for the CIP Companion Specification
OPC UA defines the Base type

Devices defines the ComponentType and some Interfaces containing identification information

The CIP CS defines a device type that inherits from ComponentType

- It adds the CipIdentityType
- Uses interfaces for optional ID attributes
- Makes certain properties from the Devices interfaces mandatory to align with PA-DIM.
Create GenericCipObjectType

Instances of this type can be nested to represent multiple CIP instances
Next Steps & Conclusion

• The material we have today provides good coverage for many asset management functions and will provide immediate benefit when released as a first version

• There are still many challenges that need to be addressed
  – Offline and online representation of all the data a device has to offer
  – Aggregated representation of devices by a gateway
  – Metadata that fully describes CIP objects
  – Handling of complex data and services
  – Generic handling of any CIP object
  – Security (particularly for anything other than getting data)

• These issues still need to be investigated to achieve a feature rich solution that satisfies all the use cases we envision