Metadata for CIP Devices

Greg Majcher, Rockwell Automation
Michael Schaffner, RA Technologies

Metadata AND Data for CIP Devices

Greg Majcher, Rockwell Automation
Michael Schaffner, RA Technologies

What's all this Metadata stuff, Anyhow?

metadata /mĕt′ə-dā″tə, -dăt″ə, -dä″tə/

noun plural

1. Data that describes other data, as in describing the origin, structure, or characteristics of computer files, webpages, databases, or other digital resources.

noun

1. Data that describes other data, serving as an informative label.
2. Data about data.

Bob Pease R.I.P.

Fixed in Our Product Designs

```
Param100 =                          $ Parameter instance 100
        0,                           $ reserved, shall equal 0
        6,"20 28 24 01 30 1D",       $ Link Path Size, Link Path
        0x0000,                      $ Descriptor
        0xC1,                        $ Data Type
        1,                           $ Data Size in bytes
        "Thermal Protection",        $ name
        "",                          $ units
        "TRUE when motor is marked “Thermally Protected”", $ help string
        0,1,0,                       $ min, max, default data values
        ,,,,                         $ mult, div, base, offset scaling
        ,,,,                         $ mult, div, base, offset links
        ;                            $ decimal places
    Enum1 =
        0,"Not Thermally Protected",
        1,"Thermally Protected";
```

Link Path to Motor Data Object

Descriptor: RO, WO, scaling support, etc.

Data Type

Name

Help String

Min, max, defaults

Enumerations

Types of Metadata Continued

Fixed in the Specification

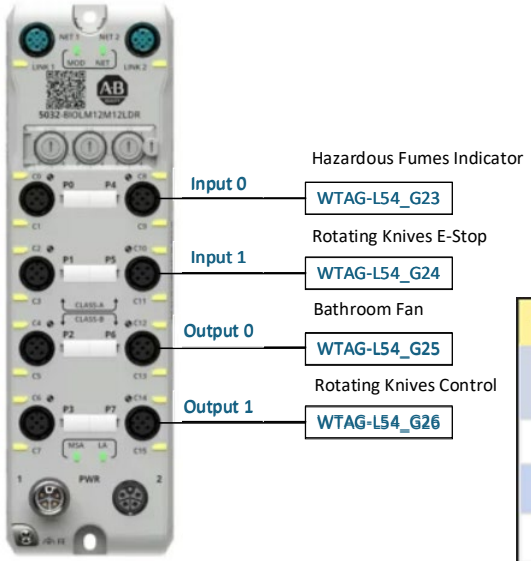
- CIP Specification-Defined
- Data-Metadata Relationships

Table 5A-9.3 Discrete Input Point Object Instance Attributes

Attribute ID	Need in Implem.	Access Rule	NV	Name	Data Type	Description of Attribute
1	Optional	Get		Number of Attributes	USINT	Number supported in this product
2	Optional	Get		Attribute List	ARRAY OF USINT	List of attributes supported in this product
3	Required	Get		Value	BOOL	Input point value
4	Optional	Get		Status	BOOL	Input point status

Types of Metadata Continued

- Created at Application Time
- Entered by the User



Program Parameters and Local Tags - MainProgram

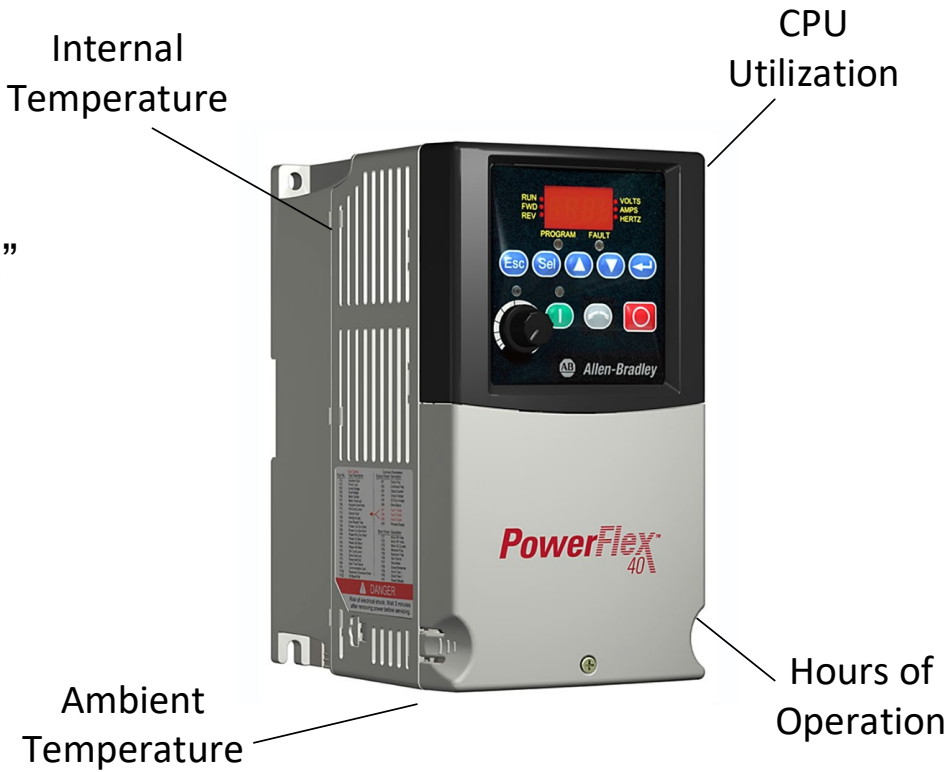
Scope: MainProgram Show: All Tags

Name	Usage	Value	Description
MSG_IO_CL3	Local	{...}	
STR_PROD_NAME	Local	''	
WTAGL54_G23	Local	0	Hazardous Fumes Indicator
WTAGL54_G24	Local	0	Rotating Knives E-Stop
WTAGL54_G25	Local	0	Bathroom Fan
WTAGL54_G26	Local	0	Rotating Knives Control

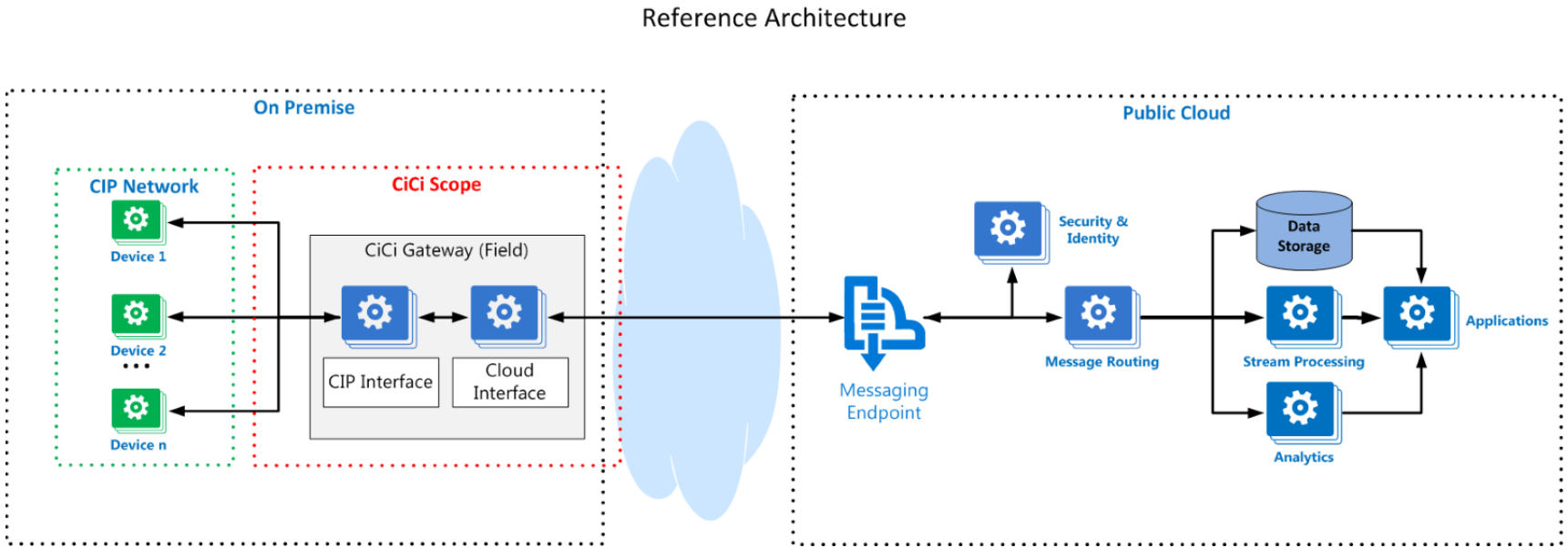
Types of Metadata Continued

Additional Data

Many products have “additional data” that is not core to their function, but may be metadata for the application or the device’s operation



What Problem are We Solving Anyway?



Difficult Offline Experience

```
[Assembly]
 Assem126 =
            "Input Data 10 Points",
            "20 04 24 69 7E 03",
            ,
            0x0000,
            ,,
            10,Param7;
```

```
Param7 =
            0,              $ reserved, shall equal 0
            , ,             $ Link Path Size, Link Path
            0x0200,         $ Descriptor (do not display)
            0xC7,           $ Data Type
            2,              $ Data Size in bytes
            "10 Bits Data", $ name
            "",             $ units
            "New Help String",     $ help string
            0, 0x3FF, 0,    $ min, max, default data values
            , , , ,        $ mult, div, base, offset scaling
            , , , ,        $ mult, div, base, offset links
            ;               $ decimal places
```

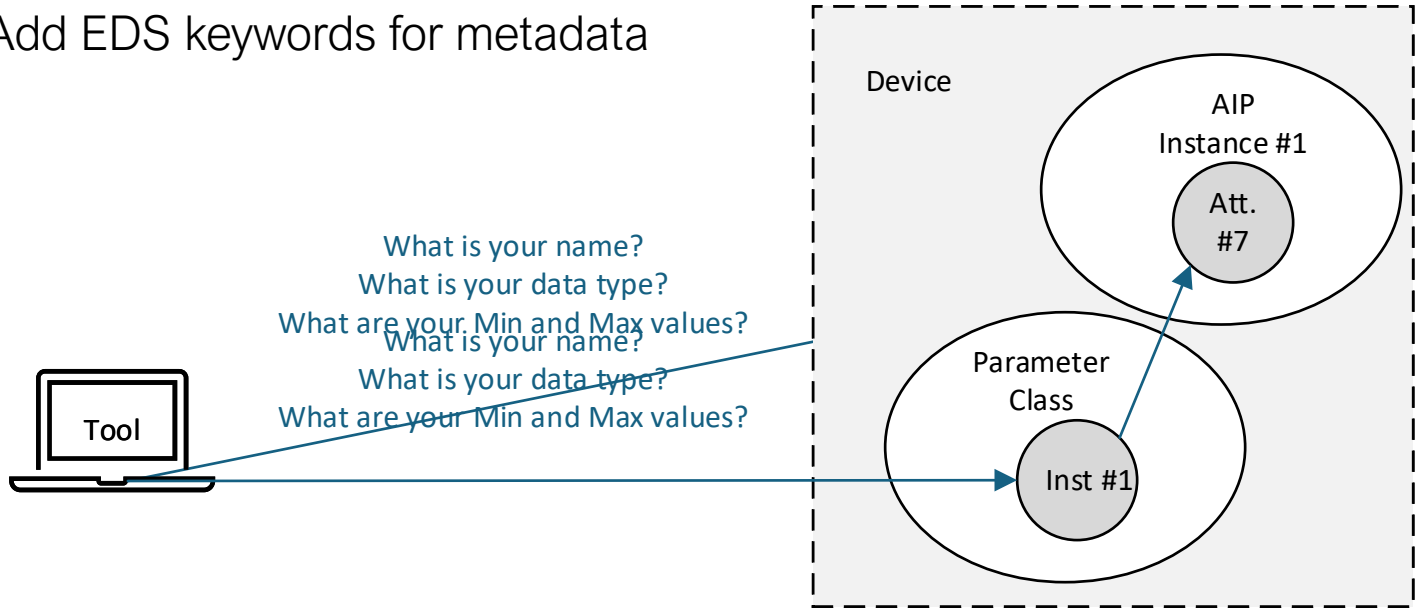
Confusing for End Users

```
Assem2 =
        "Assembly Input",
        "20 04 24 9A 30 03",    $ Logical path to data
        52,                     $ Assem Size in bytes
        0x0000,                 $ Descriptor
        ,,                      $ reserved fields
        1,Param802,             $ Diagnostic Active
              :                       :
        1,Param47,              $ Fault
        1,Param68,              $ Uncertain
              :                       :
        32,Param52,             $ Actual Speed
        32,Param51,             $ Actual Position
        32,Param53,             $ Actual Torque
```

```
Param68 =               $ Parameter instance 68
        0,              $ reserved, shall equal 0
        0,"",           $ Link Path Size, Link Path
        0x0010,         $ Descriptor
        0xC1,           $ Data Type
        1,              $ Data Size in bytes
        "Uncertain", $ name
        "",             $ units
        "Uncertain", $ help string
        0,1,0,          $ min, max, default values
        ,,,,            $ mult, div, base, offset scaling
        ,,,,            $ mult, div, base, offset links
        ;               $ decimal places
```

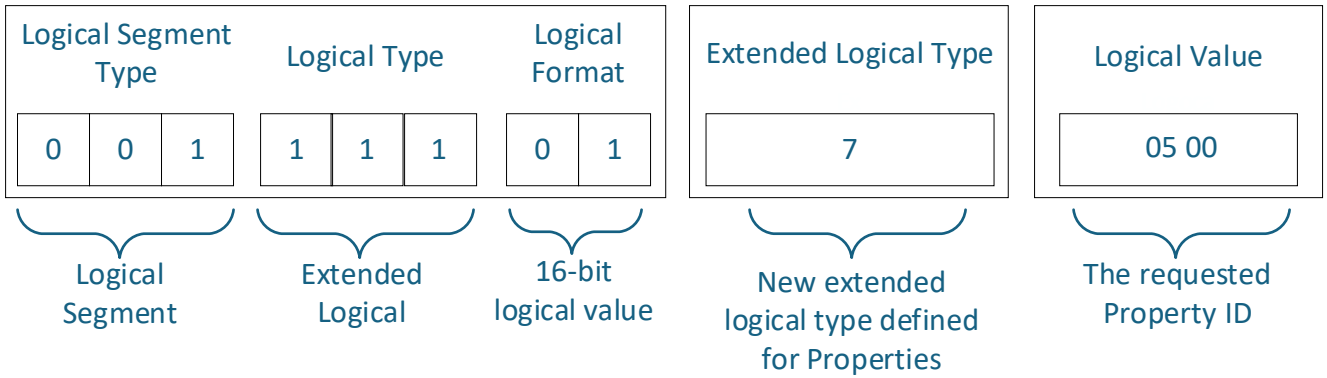
Why Do We Use Parameters Anyway?

Add EDS keywords for metadata



Extended Addressing for Metadata Properties

"Metadata" documented in the specifications is not available online, but could be



Segment Contents	Notes
[20][01][24][01][30][03][3D 07][05 00]	Segment Type = Logical Segment. 20 01 indicates Class 1 (Identity Object) 24 01 indicates Instance 1 30 03 indicates Attribute 3 (Product Code) 3D 07 05 00 indicates metadata property 5 (Name)

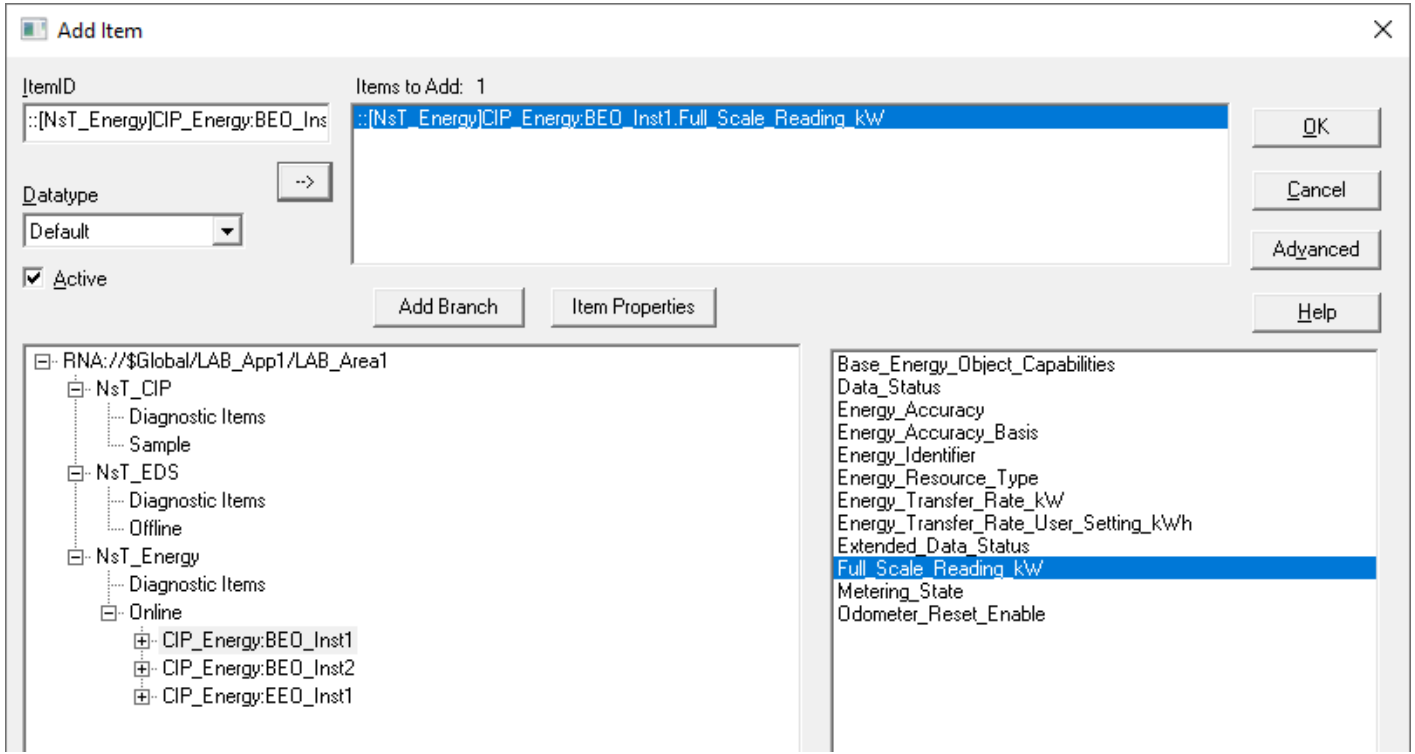
Proposed Metadata Properties

Property ID	Property Name	Need in Implementation for Attributes	Comment
1	Attribute ID	Required	Useful if the attribute was accessed symbolically or by a mechanism other than a CIP message (e.g., over a different communication channel)
2	Need in Implementation	Optional	
3	Access Rule	Required	
4	Non-Volatile	Required	
5	Name	Required	
6	Data Type	Required	
7	Description	Optional	
8	Semantics	Optional	Fantasy? Perhaps.
9	Link Path Size	Required	Useful if the attribute was accessed symbolically or by a mechanism other than a CIP message (e.g., over a different communication channel)
10	Link Path	Required	Useful if the attribute was accessed symbolically or by a mechanism other than a CIP message (e.g., over a different communication channel)
11	Descriptor	Optional	Much like its use in the Parameter Object, the Descriptor can be used to define how other Properties are used

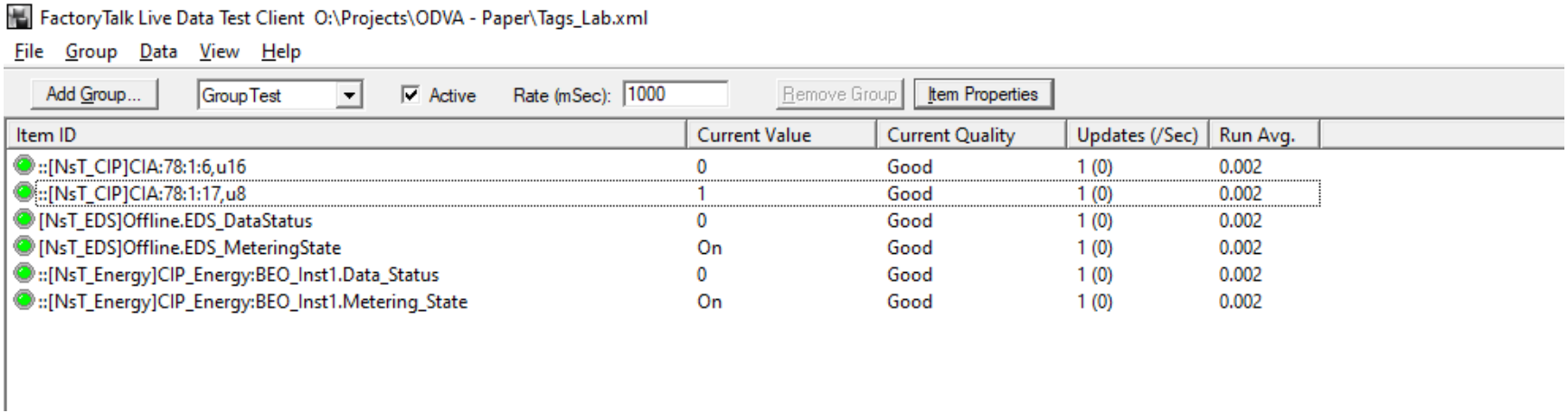
Proposed Metadata Properties

24	Time Domain	Optional	How often this attribute is expected to change value
25	Raw Value	Optional	
26	Enumerated Value	Optional	
27	Synonym	Optional	Could be an array of strings with synonyms for the Name property
28	User Entered Name	Optional	The user-entered name for this attribute. Provides linkage between the user's program and the device.
29	Data Tags	Optional	An array of "#tags" that would enable sorting and filtering data items
30	Pending Value	Optional	Report the pending value of an attribute prior to execution of an Apply Attributes service

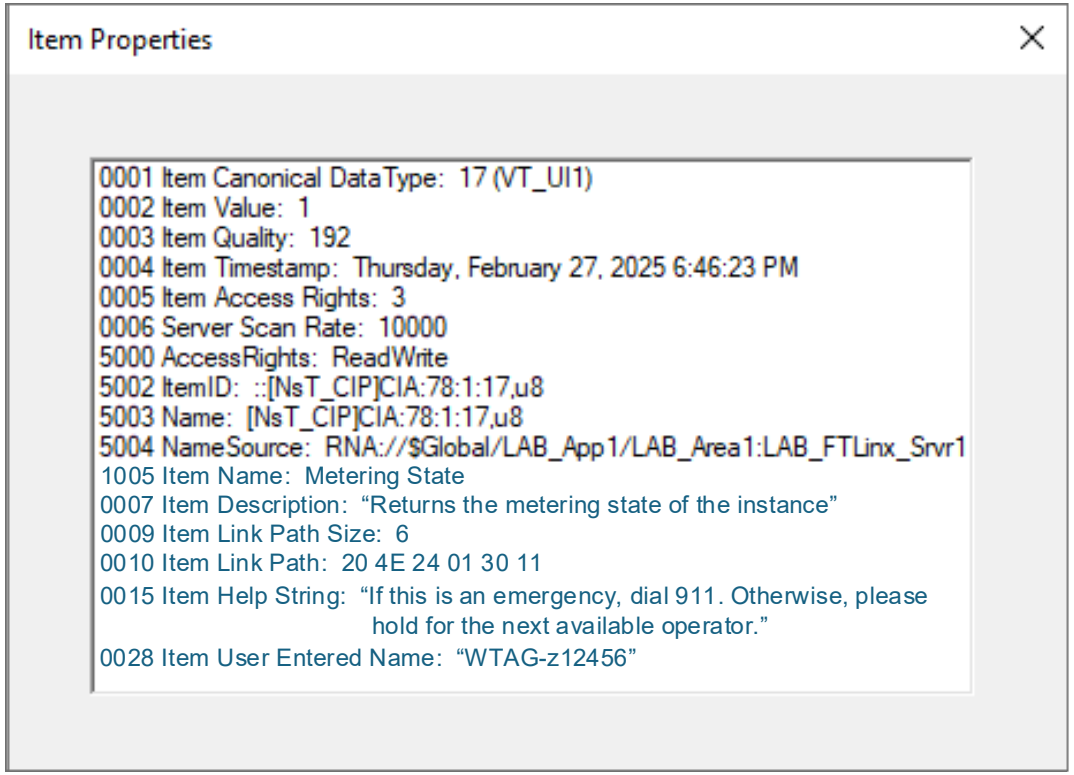
Example Software Use of Metadata



Example Software Use of Metadata



Example Software Use of Metadata



The Way Forward

- Expose More Data in EDS Files
  - More examples in the specifications
  - Specification Enhancement to add metadata to EDS
  - Extensions to EZ-EDS
  - Additional/expanded conformance tests for EDS
- Expose Metadata in Firmware
  - Specification Enhancement forthcoming for addressing extensions targeting metadata properties
  - Bulk representation of entire information model
- Application Profile for Information Discovery
- Central EDS Repository
  - Discussions are already underway within ODVA

Summary

- High level goal to make information discoverable and self-describing
- This will enhance the value of our products and enable new workflows
  - Discovery and Searchability
  - Enables better integration between vendors
  - Better diagnostics
  - Better Asset Management / Lifecycle tracking
  - Enables data science use cases we cannot foresee


30
YEARS!
2025
ODVA
Industry Conference and 23rd Annual Meeting