Siemens OPC UA Modeling Editor for the implementation of OPC UA Companion specifications

Siome / OPC UA / TIA V15

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1 Introduction

1.1 Overview

The OPC UA communication protocol enables companies and organizations to create their own standards for an OPC UA information model. You can generate a standardized server interface with these functions. For communication to your system or system parts, the OPC UA clients only have to know the defined standard without taking into account detailed information on the system and its devices.

The platform-independent OPC UA protocol with the companion specifications extension greatly facilitates standardized cross-manufacturer communication and reduces implementation effort.

Many organizations and associations already have standardized OPC UA information models for your industry-specific systems and solutions. These include the following organizations, for example:

- Euromap
- AIM
- VDMA
- AutomationML
- OMAC

With the free "Siemens OPC UA Modelling Editor" (SiOME) tool, we have created an editor for defining your own OPC UA information models or mapping existing companion specifications on your SIMATIC PLC. Using this tool, you can import and edit information models as XML files or generate and export individualized models.

Figure 1-1 Function principle:
1.2 Content of the application example

In this application example, we will explain the functions of SiOME using the "Euromap77" companion specifications. These specifications define the OPC UA machine interface for injection molding machines.

SiOME is used here to generate an interface from the OPC UA NodeSets from Euromap and then to link it to the variables and methods of the SIMATIC PLC from a TIA Portal project.

In addition, we demonstrate the generation of individual OPC UA types for the definition of a user-specific machine interface.

Use SiOME to generate your own OPC UA information model. Define your own types and objects to perfectly describe your machine. This makes it possible for MES / SCADA OPC UA clients or clients for M2M communication to call up your self-defined OPC UA interface and read and write data in a targeted manner.
1.3 Components used

This application example was created with the following hardware and software components:

Table 1-1

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<th>Components</th>
<th>Quantity</th>
<th>Article number</th>
<th>Note</th>
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</thead>
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<tr>
<td>Siemens OPC UA Modelling Editor (SiOME)</td>
<td>1</td>
<td>Freeware</td>
<td>SiOME V1.7 or later</td>
</tr>
<tr>
<td>STEP 7 Professional</td>
<td>1</td>
<td>6ES7822-1AA05-0YA5</td>
<td>TIA Portal V15 or later</td>
</tr>
<tr>
<td>SIMATIC S7-1500 CPU 1516-3 PN/DP</td>
<td>1</td>
<td>6ES7516-3AN01-0AB0</td>
<td>Firmware V2.5 or later</td>
</tr>
<tr>
<td>NodeSets</td>
<td>3</td>
<td>Freeware</td>
<td>.&quot;UA.DI&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>.&quot;Euromap83&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>.&quot;Euromap77&quot;</td>
</tr>
</tbody>
</table>

Note

The following system requirements apply to SiOME:

- .NET Framework 4.5 or higher
- Windows 7 (x32/x64)
- Windows 10 (x64)

The following system requirements also apply for the use of the TIA Openness function of SiOME:

- Windows 7/10 (x64)
- TIA Portal openness installation

This application example consists of the following components:

Table 1-2

<table>
<thead>
<tr>
<th>Components</th>
<th>File name</th>
<th>Note</th>
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<tbody>
<tr>
<td>Documentation</td>
<td>109755133_SIOME_DOC_V19_de.pdf</td>
<td>This document.</td>
</tr>
<tr>
<td>SiOME</td>
<td>109755133_SIOME_CODE_V19.zip</td>
<td>Modelling Editor.</td>
</tr>
<tr>
<td>NodeSet</td>
<td>109755133_SIOME_XML_V19.zip</td>
<td>Euromap NodeSet for TIA Portal including mapping, generated with SiOME.</td>
</tr>
<tr>
<td>TIA Portal project</td>
<td>109755133_SIOME_PROJ_V19.zip</td>
<td>Example project for &quot;Euromap77&quot; with integrated NodeSet.</td>
</tr>
</tbody>
</table>
2 Configuration with SiOME

In this chapter, you will learn fundamentals on how to generate an OPC UA information model with SiOME. Two separate use cases will illustrate this:

- In chapter 2.1 "Example: Euromapspecifications" we explain how to use SiOME to generate an information model according to Euromap specifications and how to load this model to a SIMATIC PLC.
- In chapter 2.2 "Example: User-specific information model", the fundamentals for using SiOME to generate your own OPC UA information model are explained.

You can find detailed instructions for SiOME in the manual "109755133_SiOME_MAN_V19_en.pdf" of this article.

2.1 Example: Euromapspecifications

In this chapter, we use an information model in accordance with the Euromap specifications to generate machine instances and to link them to the variables and function blocks of a TIA Portal project.

The result of the steps to be taken in this chapter is contained in the provided TIA Portal project. Load the project on a SIMATIC S7-PLC to check the configuration, for example using the free "UaExpert" tool (6).

2.1.1 Configuring Euromap specifications with SiOME

Follow these steps to generate a Euromap information model:

1. Download the NodeSet files for "UA.DI", "Euromap77" and "Euromap83". You can find the links in the bibliography (3 and 4). Due to the dependencies of the type definitions, you need all three named Nodesets to configure the Euromap specifications.

   **Note**
   Download the most current version of the NodeSets for "Euromap77" and "Euromap83". The most recent files are indicated by the release note in the file name: "Opc_Ua.EUROMAP77.X_XX.NodeSet2.xml" or "Opc_Ua.EUROMAP83.X_XX.NodeSet2.xml"

You can find information on the NodeSets under the download links in the respective PDF files.

2. Download the archive "109755133_SiOME_CODE_V19.zip". (2). Unpack the archive and start the "SiOME 1.9.2.exe" application.

3. Click on the "Import XML" button in the "Information model" area and import the "Opc.Ua.DI.NodeSet2.xml" NodeSet.

4. Repeat this procedure for NodeSets "Opc_Ua.EUROMAP83.1_00.NodeSet2.xml" and
"Opc_Ua.EUROMAP77.1_00.NodeSet2.xml". Each imported NodeSet automatically creates its own namespace.

5. Create a new name space for your machine. To do this, right-click on "Namespaces" in the "Namespaces" area and select "Add Namespace".

6. Activate the slider "New Namespace" in the appearing dialog and assign a name. Then confirm with "Ok".

7. Create a new instance for your Euromap interface in the information model. To do this, right-click the DeviceSet object in the Information model pane, and then click "Add Instance".

8. Assign a name for the interface in accordance with the Euromap specifications ("IMM_Manufacturer_SerialNumber") in the dialog which appears. Then select the "IMM_MES_InterfaceType" data type as the "TypeDefinition" and confirm with "Ok".
9. Create a new instance for an "InjectionUnit". In the "Information model" area, right-click on "InjectionUnits" and then the "Add Instance" button.

10. Assign a name, e.g. "InjectionUnit_1" in the dialog which appears and select the "InjectionUnitType" data type as the "TypeDefinition". Then confirm with "Ok".

11. Repeat the steps 9 and 0 for "Moulds" and "PowerUnits".

12. Open the TIA project onto which the generated information model is to be transmitted. Click on the "Open TIA Portal project" button in the "TIA Portal" area.
13. Connect to an already open TIA Portal project that provides the objects for the Euromap specification. To do this, click on the check box for your project and then on "Attach to selected project". Alternatively, you can use the "Open another project" button to search for a closed project on your hard disk.

**Attach to already opened TIA Portal project**

If you receive an error message from Openness, make sure that the currently registered user has the authorization to use Openness. Further information can be found in the manual "109755133_SIOME_MAN_V19_en.pdf" in chapter "2.2.15 Creating an Information Model from a TIA Portal Project".


15. In the "TIA Portal" area, select the checkboxes of the data blocks whose variables you want to link ("map") to the OPC UA variables of the information model.

16. Activate the "Details" slider in the "TIA Portal" area to make the variables accessible in the data blocks.

17. Drag and drop the variables from the TIA Portal project to the OPC UA variables.
18. Repeat the process for all variables and methods you want to link.

**Note**

To link methods, you must link the instance data blocks of the respective TIA Portal function blocks to the methods of the information model using drag & drop.

19. Click on the "Export XML" button to save the generated information model. The generated file can be reused at a later time.

20. Select the "Include mappings" checkbox in the dialog which appears if you need the information model for an OPC UA server of a TIA Portal project. Deactivate the checkbox if you need the information model for an OPC UA client, for example. Confirm with "OK". In the dialog that appears, select a storage location for your information model and click "Save",

**Export XML**

- Select namespace
  - http://opcfoundation.org/UA/
  - http://opcfoundation.org/UA/0.1/
  - http://www.eumap.org/euromap93/
  - http://www.eumap.org/euromap77/
  - http://www.0EM.com/siemens/euromap77

- Include mappings
- Include Type Dictionary
2.1.2 Importing interface in the TIA Portal

Proceed as follows to load an OPC UA interface generated and mapped with SiOME on the OPC UA server of a SIMATIC PLC:

1. Start the TIA Portal and open the project whose functions are to be made accessible via the interface.
2. In the project tree, navigate to “CPU > OPC UA communication > Server interfaces” and double-click on “Import server interface”.

![Diagram of TIA Portal tree with selected nodes and open window](image-url)
3. In the dialog which appears, search for the directory where the XML file of the mapped interface is located and select the file. Confirm with "Import".

4. Select the CPU in the project tree and click on the "Download to device" button.

**Note** The TIA Portal project in this example already contains an imported Euromap interface.
2.2 Example: User-specific information model

With a user-specific information model, you can generate OPC UA types and objects specially for your application case or machine. These types and objects are generated in SiOME and then exported as XML files. You can either import the generated interface into the TIA Portal or use it to generate an appropriate OPC UA client.

In this chapter, we will create name spaces, individual variable and object types and instantiate these for the resulting OPC UA information model for illustration purposes.

Creating a user-specific information model

Follow these steps to generate a user-specific information model:

1. Download the archive "109755133_SiOME_CODE_V19.zip". Unpack the archive and start the "SiOME 1.9.2.exe" application.

2. Create a new name space for your machine. Right-click on "Namespaces" in the "Namespaces" area and select "Add Namespace".

3. Activate the slider "New Namespace" in the appearing dialog and assign a name. Then confirm with "Ok".

Add Namespace

- New Namespace
- Namespace URI: http://myManufacturer.org/myInterface
- Version: 1.00
- Publication Date: 2019-03-30T00:00:00Z
4. In the "Information model" area, create a new data type for your information model. Create a structure in this area. Navigate to "Types > DataTypes > BaseDataTypes", right-click on "Structure" and select "Add New Structured Data Type".

**Note**
You must assign individual types to their own name space since the "0" name space ("http://opcfoundation.org/UA/") is reserved for the specifications of the OPC Foundation.

5. Assign a name for the structure in the dialog which appears and confirm with "Ok". The active namespace is automatically selected as the namespace in which the definition of the structure is to be stored.

![Add New Structured DataType](image)

6. Fill the structure with items. Right-click on the structure you just created and select "Add New Structure Item".
7. In the tree view, select the created item with the left mouse button, assign a name in the "Structure Item Definition" area and select the desired data type.

8. Repeat steps 6 and 7 for every required item in your structure.
9. Create an object type to instantiate it later as an object. In the "Information model" area, navigate to "Types > ObjectTypes", right-click on "BaseObjectType" and select "Add New Objecttype".

10. In the dialog that appears, enter a name for the object type and confirm with "OK".

11. Select the object with variables. Right-click on the object just generated and select "Add Child".
12. Assign a name for the variable in the dialog which appears, select the "Variable" class as the "NodeClass" and then the desired data type for the variable. To do so, select the user-specific structure which you defined in advance. Confirm with "Ok".

Add Child

<table>
<thead>
<tr>
<th>Name</th>
<th>MyObjectChild</th>
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<tbody>
<tr>
<td>NodeClass</td>
<td>Variable</td>
</tr>
<tr>
<td>Namespace</td>
<td><a href="http://myManufacturer.org/myinterface">http://myManufacturer.org/myinterface</a>...</td>
</tr>
<tr>
<td>ReferenceType</td>
<td>Organizes</td>
</tr>
<tr>
<td>TypeDefinition</td>
<td>BaseDataVariableType</td>
</tr>
<tr>
<td>DataType</td>
<td>MyStructType</td>
</tr>
</tbody>
</table>

13. Repeat the process for all variables, methods and objects which should be located in the object type.

14. Generate an instance which should be derived from the object type create in advance. In the Information model area, right-click Objects and select Add Instance.

Note

We recommend creating a new name space so that the type definitions and the instances derived from them can be filed in a structured manner separated from one another.
15. Assign a name for the object instance in the dialog which appears and select the desired object type. Select the object type defined in advance. Confirm with "OK".

Add Instance

<table>
<thead>
<tr>
<th>Name</th>
<th>MyObjectInstance</th>
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<tr>
<td>NodeClass</td>
<td>Object</td>
</tr>
<tr>
<td>Namespace</td>
<td><a href="http://myManufacturer.org/myInterface">http://myManufacturer.org/myInterface</a></td>
</tr>
<tr>
<td>ReferenceType</td>
<td>Organizes</td>
</tr>
<tr>
<td>TypeDefinition</td>
<td>MyObjectType</td>
</tr>
</tbody>
</table>

16. Optionally, you can map the instance just generated with a TIA Portal project. Proceed as described in chapter 2.1.1 "Configuring Euromap specifications with SIOME" in steps 12 to 18.

17. Click on the "Export XML" button to save the information model. The generated file can be reused at a later time.

18. Select the "Include mappings" checkbox in the dialog which appears if you need the information model for a OPC UA server of a TIA Portal project. Deactivate the checkbox if you need the information model for a OPC UA client.

Export XML

Select namespace
- http://opcfoundation.org/UA/
- http://opcfoundation.org/UA/DI/
- http://www.euomap.org/euomap83/
- http://www.euomap.org/euomap77/
- http://www.OEM.com/siemens/euomap77demo

Include mappings
Include Type Dictionary

Cancel Ok
3 Explanations for TIA Portal project

The following explanations describe the TIA Portal project provided in this application example. All functions and data blocks do not contain specific functions and are only used for illustration purposes.

S7 program

The following figure shows the structure of the S7 application program in which the information model with SiOME is depicted in this example. The function and data block and calls in OB-Main only fulfill the requirements that it must be possible to call up the OPC UA methods and that the variables must be read- and writable in accordance with "Euromap77". There is no specific programming logic within the function blocks.

Figure 3-1
4 Appendix

4.1 Service and support

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Do you have any questions or need assistance?
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- Repair services
- On-site and maintenance services
- Retrofitting and modernization services
- Service programs and contracts
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https://support.industry.siemens.com/cs/sc

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You will receive optimum support wherever you are with the "Siemens Industry Online Support" app. The app is available for Apple iOS, Android and Windows Phone:
https://support.industry.siemens.com/cs/ww/en/sc/2067
5  Links and literature

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</tr>
<tr>
<td>Download page of this entry</td>
<td><a href="https://support.industry.siemens.com/cs/ww/en/view/109755133">https://support.industry.siemens.com/cs/ww/en/view/109755133</a></td>
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<tr>
<td>Download of the NodeSet files for &quot;Euromap77&quot; and &quot;Euromap88&quot;</td>
<td><a href="http://www.euromap.org/euromap77">http://www.euromap.org/euromap77</a></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.euromap.org/euromap83">http://www.euromap.org/euromap83</a></td>
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<tr>
<td>Link to OPC Foundation</td>
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6  Change documentation

### Table 6-1

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<th>Modifications</th>
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<tr>
<td>V1.0</td>
<td>02/2018</td>
<td>First version</td>
</tr>
<tr>
<td>V1.1</td>
<td>07/2018</td>
<td>Expansion with manual</td>
</tr>
<tr>
<td>V1.9</td>
<td>03/2019</td>
<td>Update to SIOME V1.9</td>
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</tbody>
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