OPC UA Client Library for Microsoft Excel

S7-1500 / OPC UA / .NET / C# / MS Excel VBA

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Table of Contents

1 Introduction

1.1 Overview

With the current firmware of SIMATIC S7-1500 an integrated OPC UA Server has been added to the control system. This enables an additional option of direct process data exchange of the SIMATIC S7-1500 with a wide variety of other systems that support OPC UA.

In this application example, you can find the OPC UA Client Library with which you can create your own applications, e.g. in Excel VBA.

Assumed knowledge

The following basic knowledge is required by the user:

- Basics of programming in C#/.NET and Excel VBA
- Basics of configuring in the TIA Portal
- Basics of OPC

1.2 Mode of operation

The OPC UA Client Library internally uses the C# class "UAClientHelperAPI". This class summarizes the basic functions of the .NET stack of the OPC Foundation. The OPC UA Excel Client communicates with the OPC UA server of a SIMATIC S7-1500.

The SIMATIC S7-1500 OPC UA server is planned and configured via the TIA Portal. Client and server are connected via Ethernet and communicate through OPC UA via TCP/IP.

For more information, please refer to the entry: "OPC UA .NET Client for the SIMATIC S7-1500 OPC UA Server".

Figure 1-1
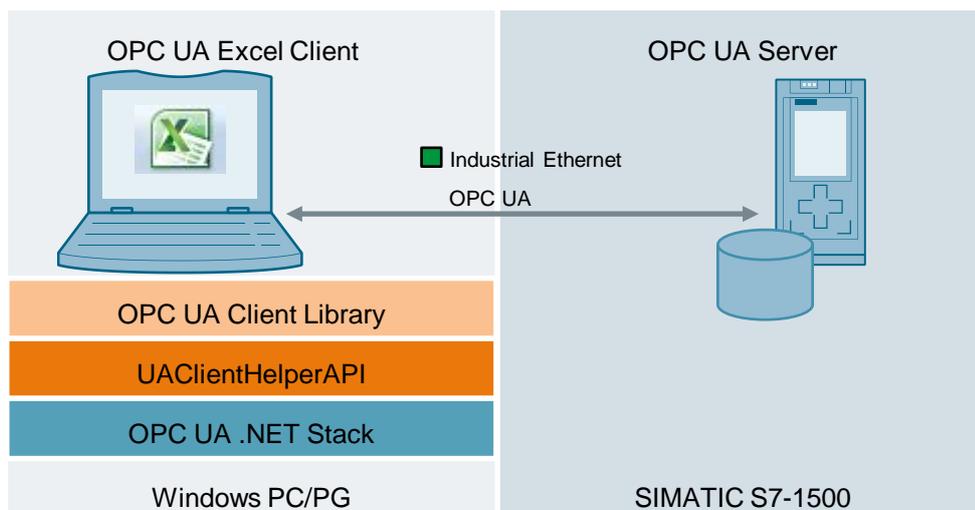
Note	OPC UA Client Library is not suited for performance-optimized applications.

1.3 Components used

This application example was created with the following components:

Table 1-1

Component	Number	Article number	Note
S7-1500 CPU 1516-3 PN/DP	1	6ES7 516-3AN01-0AB0	Firmware 2.0 or higher
TIA Portal	1	6ES7822-1..04-..	V14 or higher
Visual Studio 2012	1	-	Community version also possible.
OPC UA .Net Stack	1	-	V1.03.341.0 Download: Links & Literature in item \2\.
Microsoft Office 2010	1	-	

2 Commissioning and operation

2.1 Configuring the OPC UA server of the S7-1500

For information on how to configure the OPC UA server of the S7-1500, please refer to the entry: "OPC UA .NET Client for the SIMATIC S7-1500 OPC UA Server".
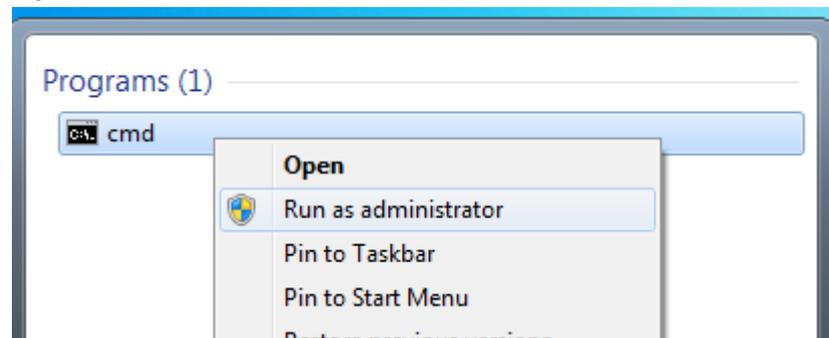
2.2 Installing the OPC UA Client Library

To use the OPC UA Client Library, you need to register the library on your system. For this, you can use the Microsoft .NET Framework Assembly Registration Utility. The Utility (regasm.exe) is contained in the Microsoft .NET Framework 4.6.1.
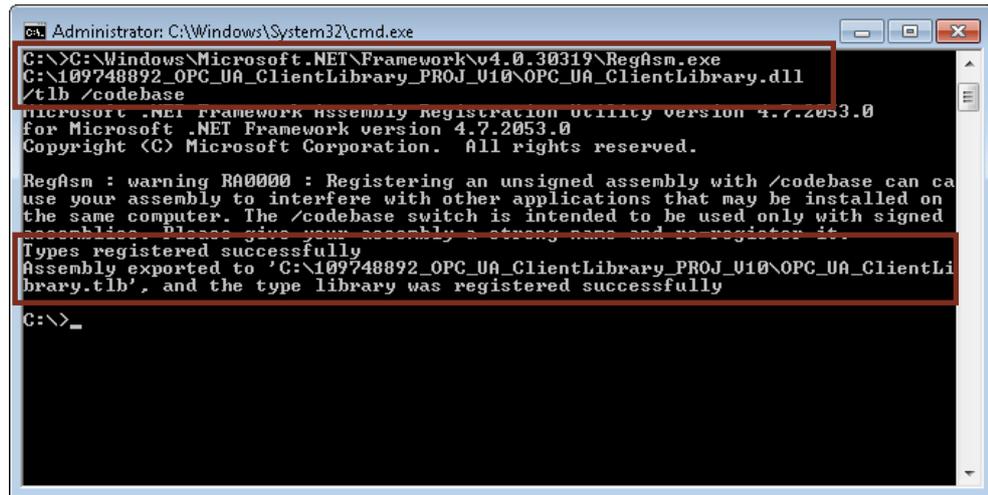
The instructions below show you the required steps:

1. Install the .NET Framework 4.6.1 (https://www.microsoft.com)

2. The path, in which the .NET Framework has been installed, is: "C:\Windows\Microsoft.NET\Framework\v4.0.30319".

3. Download the "109748892_OPC_UA_ClientLibrary_CODE_V10.zip" file.

4. Unzip this file on the same drive on which your operating system is installed. In this example, the following was chosen: "C:\109748892_OPC_UA_ClientLibrary_CODE_V10".

5. Start the command prompt as administrator.

Figure 2-1

6. Register the library on your system. For this, enter "C:\Windows\Microsoft.NET\Framework\v4.0.30319\regasm C:\109748892_OPC_UA_ClientLibrary_CODE_V10\OPC_UA_ClientLibrary\ Application\OPC_UA_ClientLibrary.dll /**tlb** /**codebase**" and confirm your entry with Return.

Figure 2-2

7. After the successful registration, you can use the library.

2.3 Operation

The following step-by-step instructions show you how you can commission the application example and how you can operate it.

Note	Requirement: OPC UA Client Library is registered on your system.

| Note	This example creates an OPC UA client certificate for the current user with the common name (CN) CN = UA Client 1500
	If you want to change the setting, you need to adjust it in the .NET SourceCode.

2.3.1 Description of the user interface

The user interface of the "OPC UA Excel Client" example client is divided in three sheets: "Connect" "ReadWrite" "Subscribe"

"Connect"

The following figure shows the "Connect" interface:

Figure 2-3
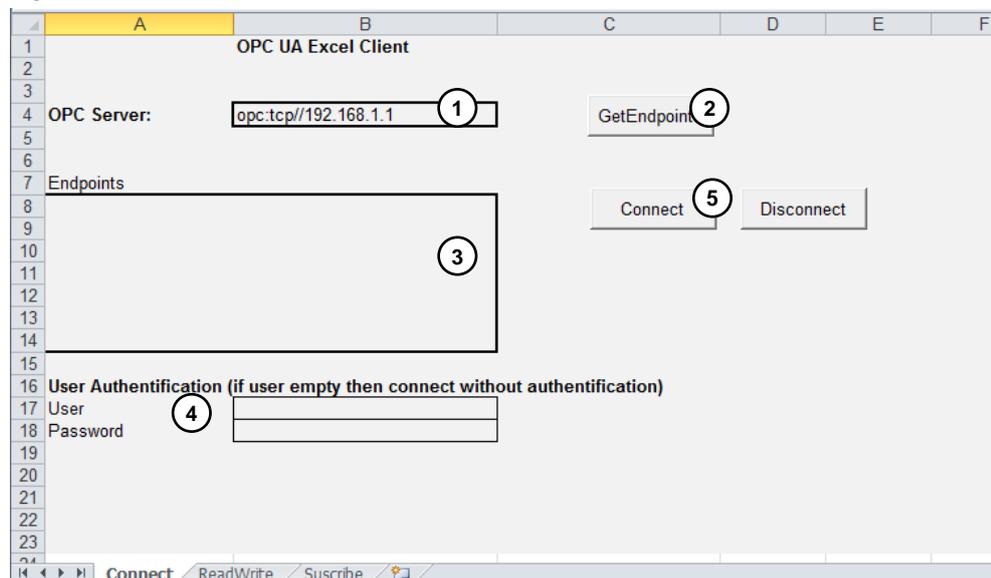
The following table describes the functions of the interface of the previous figure:
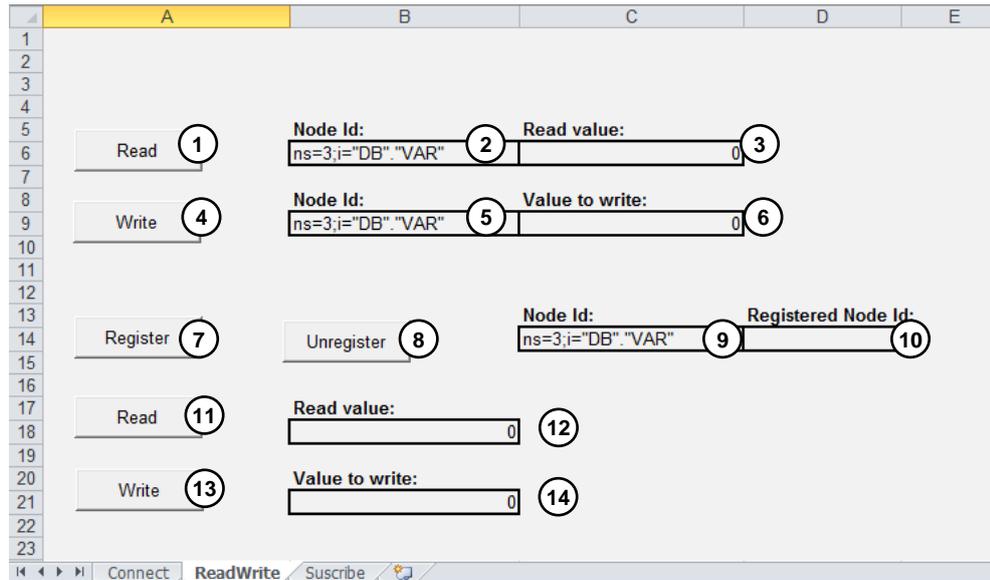
Table 2-1

No.	Description
1.	Text field to enter a OPC UA server URL.
2.	Button to search OPC UA endpoints with the URL (1).
3.	List of the OPC UA endpoints found.

No.	Description
4.	Settings for user authentication.
5.	Button to establish a connection to a selected endpoint of the list (3) and disconnection...

"ReadWrite"

The following figure shows the "Read/Write" interface:

Figure 2-4

The following table describes the functions of the interface of the previous figure:
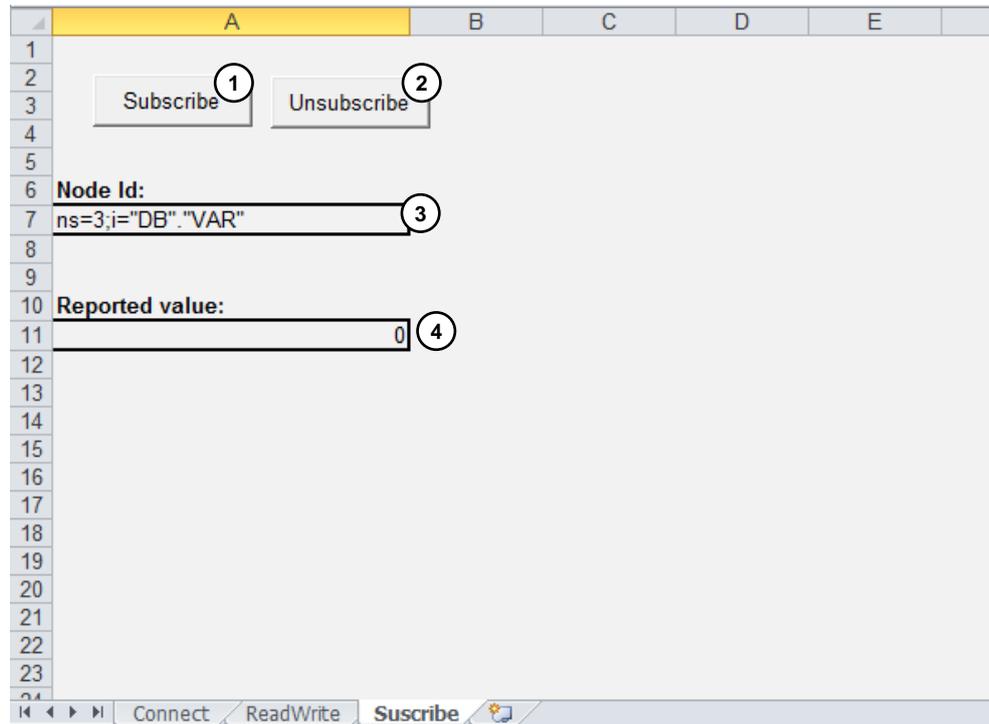
Table 2-2

No.	Description
1.	Button to read an entered node ID from (2).
2.	Text field to enter a node ID to be read.
3.	Text field to output the value of the read node ID from (2).
4.	Button to write an entered node ID from (5).
5.	Text field to enter a node ID to be written.
6.	Text field to enter the value of the node ID to be written from (5).
7.	Button to register an entered node ID from (9).
8.	Button to cancel a registration of an entered node ID from (9).
9.	Text field to enter a node ID to be registered.
10.	Text field to output a registered node ID.
11.	Button to read a registered node ID.
12.	Text field to output the value of the read, registered node ID from text field.
13.	Button to write a registered node ID.
14.	Text field to enter the value of the registered node ID to be written.

"Subscribe"

The following figure shows the "Subscribe" interface:

Figure 2-5

The following table describes the functions of the interface of the previous figure:

Table 2-3

No.	Description
1.	Button to start a subscription on an OPC UA server and to create a MonitoredItem via the node ID from text field (3).
2.	Button to end a subscription and to delete the MonitoredItem.
3.	Text field to enter a node ID that is added to the subscription as MonitoredItem.
4.	Text field to output the value of the MonitoredItem of the subscription with time stamp and status.

3 Creating the OPC UA Excel Client

| Note	Obtain some information on the respective license models, depending on their affiliation to the OPC foundation, before you start with the development of your own application.

3.1 Integrating the OPC UA Client Library

Note	Requirement: OPC UA Client Library is registered on your system.

The following step-by-step instructions show you how to create your own OPC UA Excel Client.

a. Start Excel with a new file

b. In the "Developer" menu, select the Microsoft Basic Editor.

Figure 3-1
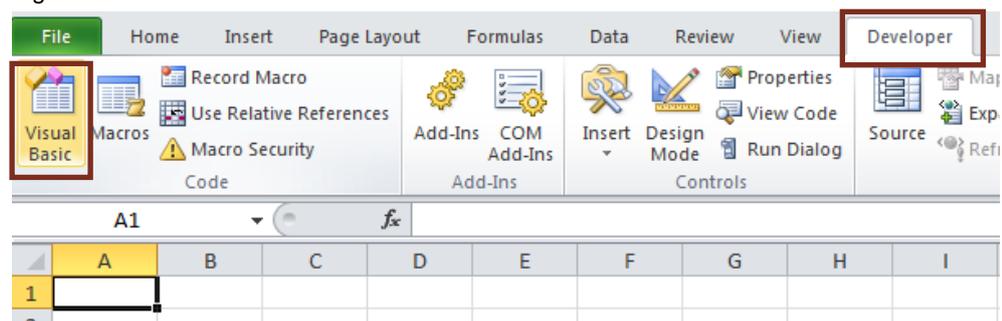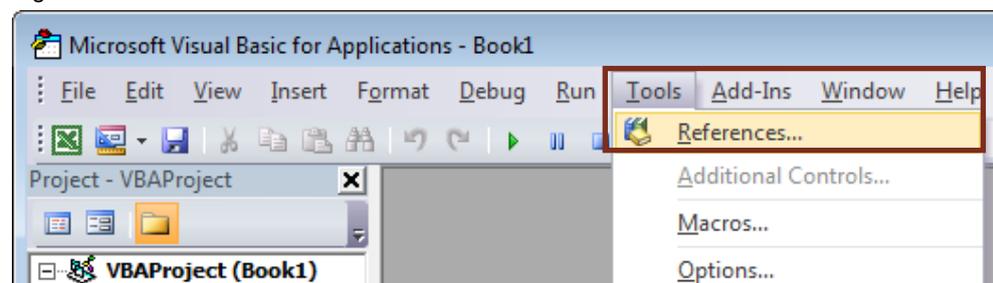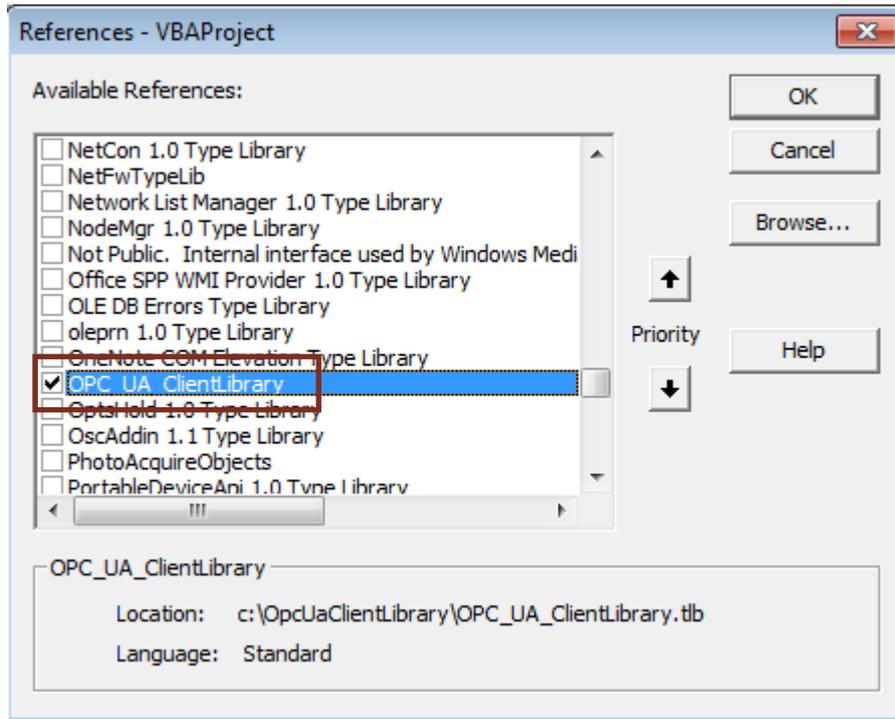

c. Refer to the OPC UA Client Library.

Figure 3-2

Figure 3-3

You can now use the OPC UA Client Library in your client.

4 OPC UA Client Library

The library internally uses the OPCClientHelperAPI which is described in the entry:
"OPC UA .NET Client for the SIMATIC S7-1500 OPC UA Server".

The following classes are contained in the library:

OpcUaClient

This class represents an OPC UA client.

Table 4-1

Method	Description
OpcUaEndpoint[] GetEndpoints(String strURL);	Determines the available endpoints on a server via which a connection can be established.
bool Connect(OpcUaEndpoint opcUaEndpoint, bool bUserAuth, String strUserName, String strUserPassword);	Establishes a connection to a server and creates a secure channel and a session to the server.
void Disconnect();	Ends an existing session and disconnects the connection to the server.
String[] ReadValues(ref String[] nodeIdStrings);	Reads the values of a tag node.
void WriteValues(ref String[] values, ref String[] nodeIdStrings);	Writes values to tag nodes.
String[] RegisterNodeIds(ref String[] nodeIdStrings);	Registers node IDs at the server for an optimized access to the nodes.
void UnregisterNodeIds(ref String[] nodeIdStrings);	Deletes the registration of already registered node IDs.
OpcUaSubscription Subscribe(int publishingInterval);	Creates a subscription on the server.
void RemoveSubscription(OpcUaSubscription subscription);	Deletes a specific subscription from the server.
OpcUaMonitoredItem AddMonitoredItem(OpcUaSubscription sub, String nodeIdString, String itemName, int samplingInterval);	Adds a MonitoredItem for monitoring an existing subscription.
void RemoveMonitoredItem(OpcUaSubscription subscription, OpcUaMonitoredItem monitoredItem);	Deletes an existing MonitoredItem of a subscription.

OpcUaSubscription

This class represents a subscription. The subscription is created and returned by the OpcUaClient in the Subscribe(...) method. The subscription is needed in the AddMonitoredItem(…) method and in the RemoveSubscription(…) method.

OpcUaMonitoredItem

This class represents a MonitoredItem. The MonitoredItem is created and returned by the OpcUaClient in the AddMonitoredItem(...) method. The MonitoredItem is needed in the RemoveMonitoredItem(...) for its removal.

OpcUaEndpoint

This class represents an endpoint of an OPC UA server. In the GetEndpoints method, the OpcUaClient provides all endpoints for the supplied URL of the OPC UA server. The endpoint is required in the Connect(...) method to establish a connection.

5 Appendix

5.1 Service & support

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https://support.industry.siemens.com/cs/ww/en/sc/2067

5.2 **Links and literature**

Table 5-1

No.	Topic
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	Link to the entry page of the application example https://support.industry.siemens.com/cs/ww/en/view/109748892
\3\	OPC UA .NET Client for the SIMATIC S7-1500 OPC UA Server https://support.industry.siemens.com/cs/ww/en/view/109737901

5.3 **Change documentation**

Table 5-2

Version	Date	Modifications
V1.0	09/2017	First version