ctrlX AUTOMATION Two Steps Ahead | February 2021

Let's Start!

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Inform

General information

OPC UA (short for Open Platform Communications United Architecture) is the further development of the OPC industrial standard. The service-oriented architecture (SOA) ensures platform independency, scalability and high-availability by omitting a DCOM (Microsoft's Distributed Component Object Model) basis. OPC UA ensures a complete vertical integration from the control level up to the automation component irrespective of the programming language or the operating system. OPC UA is a client/server system. Several clients can access a server simultaneously. A client can access several servers. OPC Unified Architecture was published as multi-part specification in 14 parts by the OPC foundation http://www.opcfoundation.org.

ctrlX AUTOMATION - OPC UA Client

With the OPC UA Client App, the ctrlX CORE can access each connected OPC UA server and retrieve the provided data. Together with the OPC UA Server app, a standardized machine-to-machine (M2M) communication is possible. The data which the OPC UA Client reads are made available in the ctrlX CORE data layer. Thus, these data are available to all apps on the ctrlX CORE.
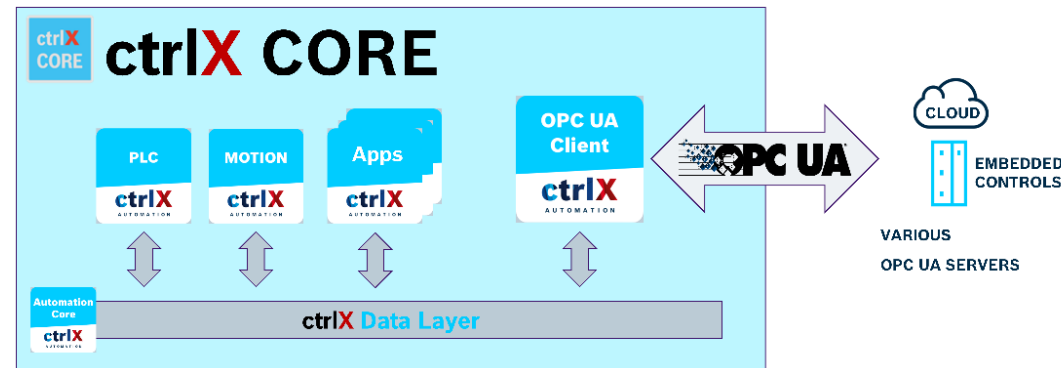
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Inform

ctrlX AUTOMATION – OPC UA Server

The OPC UA Server App offers standardized and secure communication in accordance with the OPC UA standard. As an OPC UA server, the ctrlX CORE provides all connected OPC UA clients with all device data. Typical clients are HMI, manufacturing execution (MES) or data acquisition systems. Together with the OPC UA Client App standardized machine-to-machine (M2M) communication is possible.
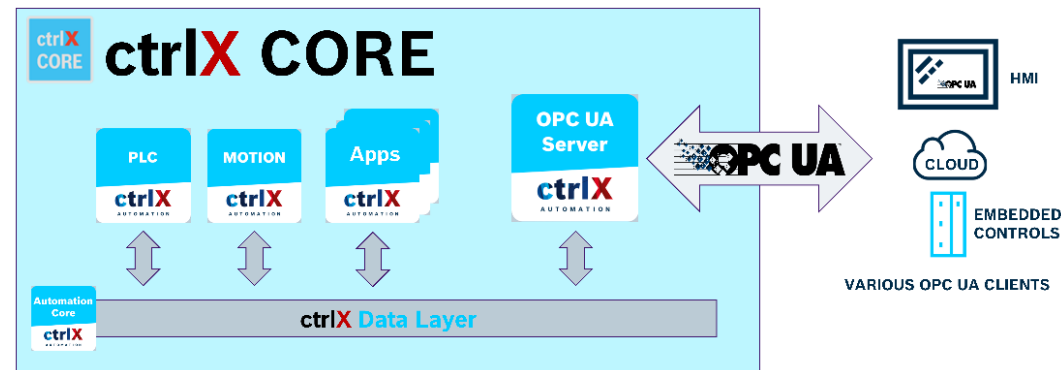
Information about the ctrlX OPC UA Apps can be found online:

- ctrlX OPC UA Server App | ctrlX AUTOMATION Community
- ctrlX OPC UA Server App for ctrlX CORE | Application Manual
- ctrlX OPC UA Client App | ctrlX AUTOMATION Community
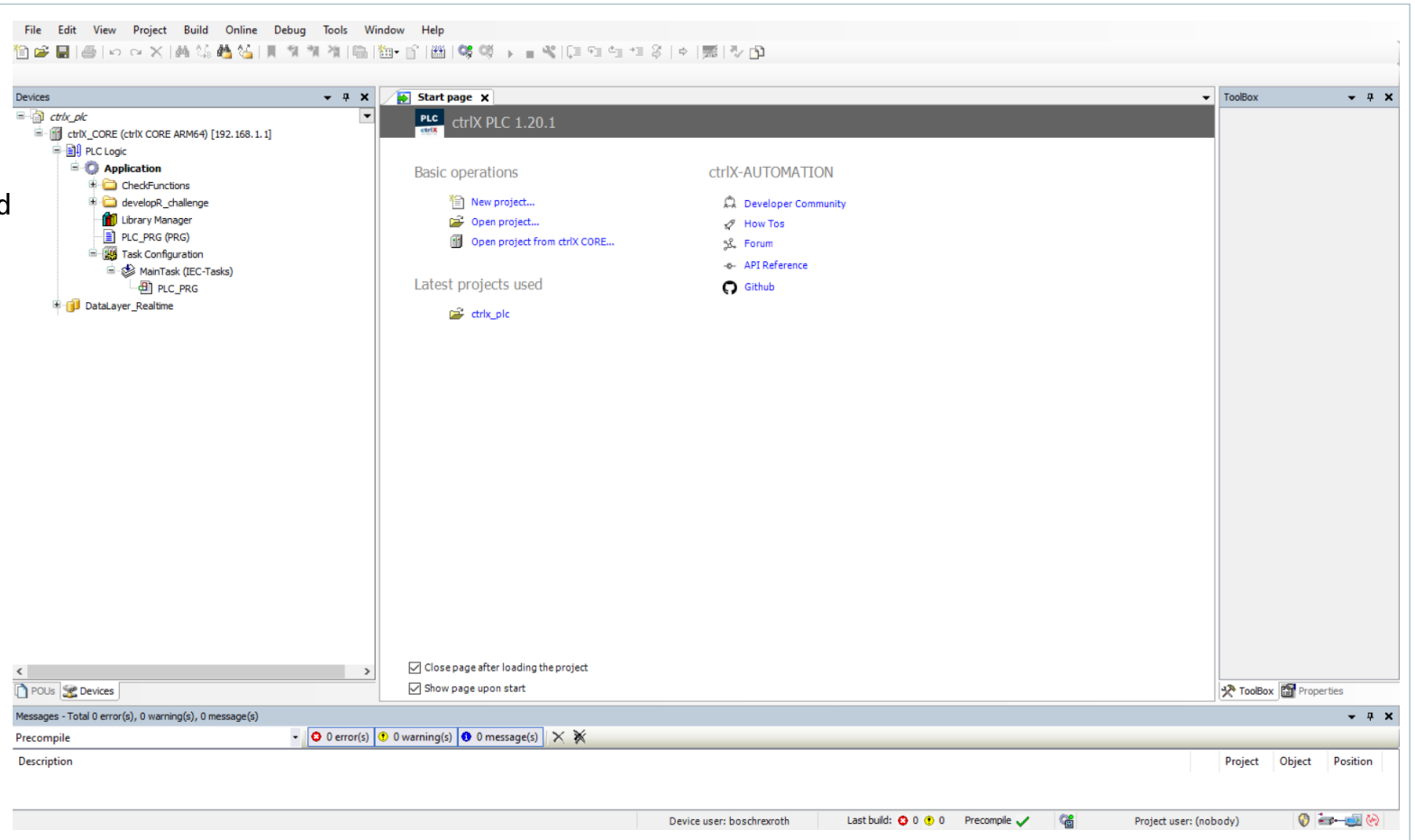- ctrlX OPC UA Client App for ctrlX CORE | Application Manual

Challenge 02: ctrlX OPC UA App | Setting up Motion App

Steps

1. Open ctrlX PLC Engineering programming interface.

Symbol Configuration

- To be able to publish variables to the data layer or also OPC UA, a symbol configuration have to be inserted to the project. All variables of your application can be added as symbols e.g. out of a global variable list.
- The symbol configuration is used for preparing symbols with specific access rights for project variables. With these symbols, you can access the variables from outside, for example from an OPC server.
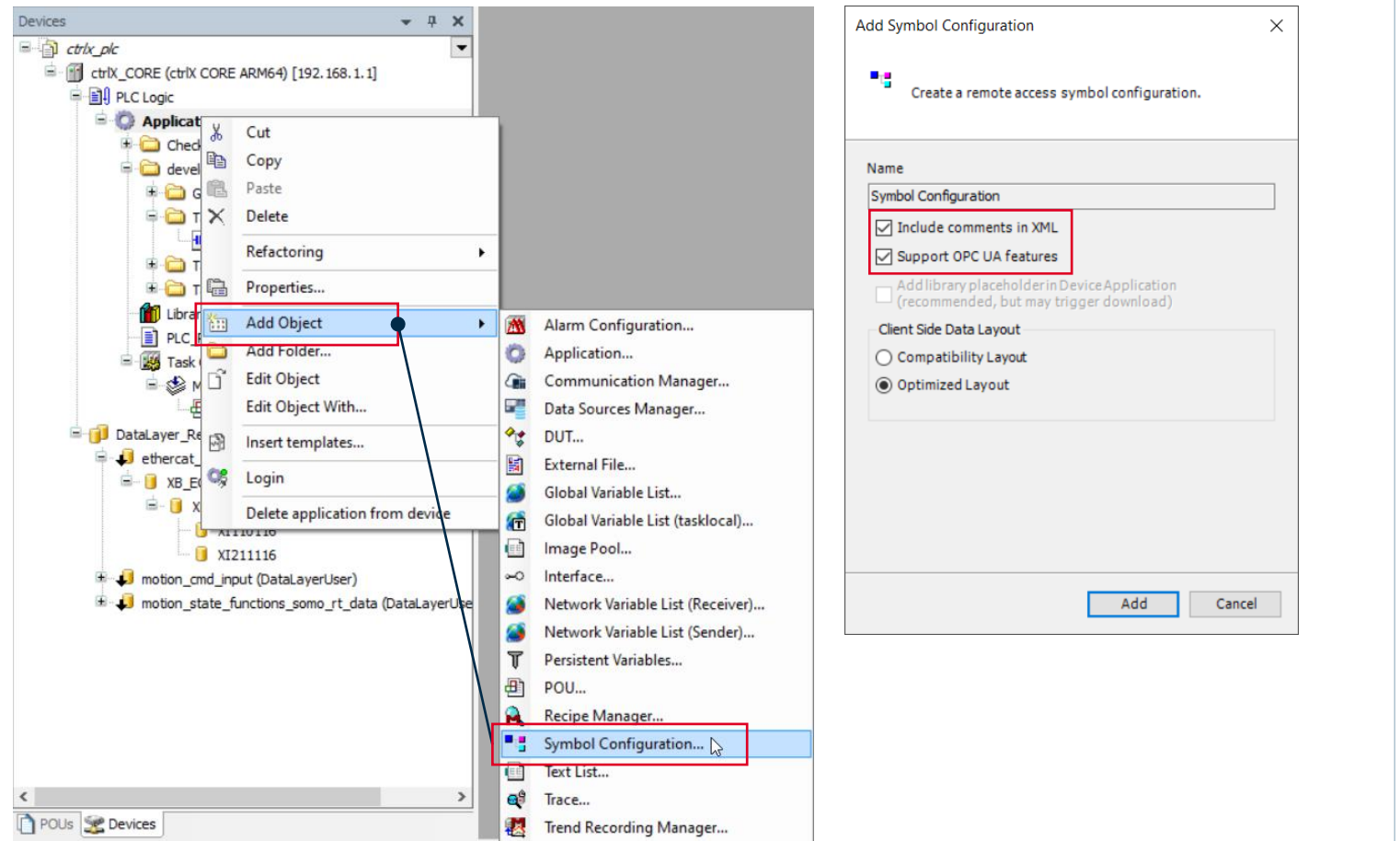- The symbol file is downloaded together with the application to the PLC.

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Steps

2. Follow the steps below to create a symbol configuration object in ctrlX PLC Engineering project.

Creating a symbol configuration

- Select and right-click the "**Application**" object in the Device tree.
- Select "**Add Object**"
- Click "**Symbol Configuration…**"
- In the popup window, tick the check boxes: "**Include comments in XML**" and "**Support OPC UA features**" and click the "**Add**" button
- The "**Symbol Configuration**" object is added to the device tree and the objects editor (Symbol configuration) opens.
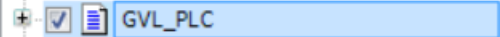

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Challenge 02: ctrlX OPC UA App | Setting up Symbol Configuration

Steps

3. Follow the steps below to add variables to the symbol configuration.

Adding variables to the symbol configuration

- In the symbol configuration object editor (right photo), click the "**Build**" icon in the symbol configuration editor.

- Select the check boxes of individual variables. In our case, tick the check box: "**GVL_PLC**"

- When you expand ( ) GVL_PLC, you will be able to view the variables that have been created and used for the PLC App challenge.

- The variables that are ticked will be added to the symbol configuration.

- PLC Engineering transmits the symbol configuration to the PLC following an application download or online change.

- Save the project with (Ctrl + S)
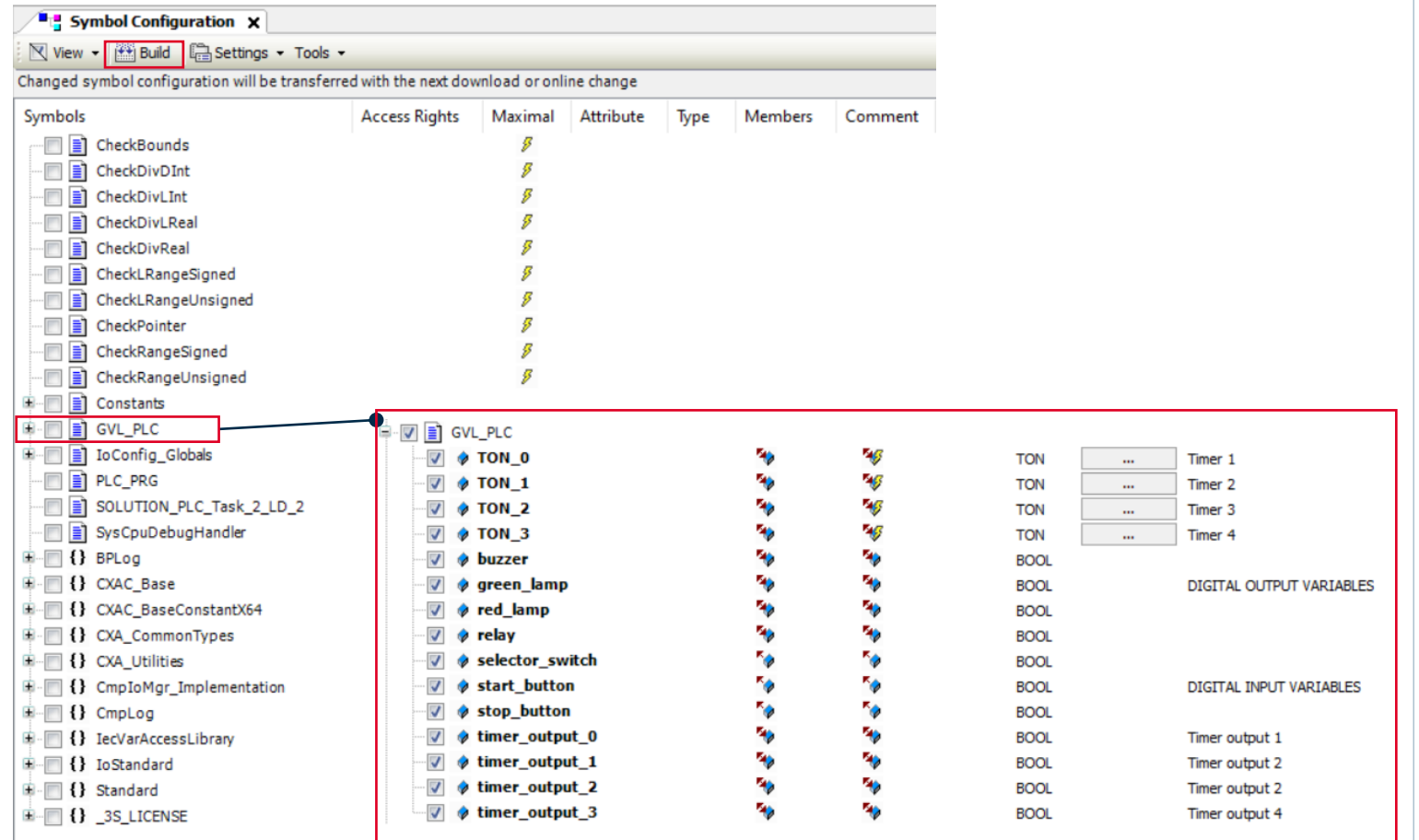
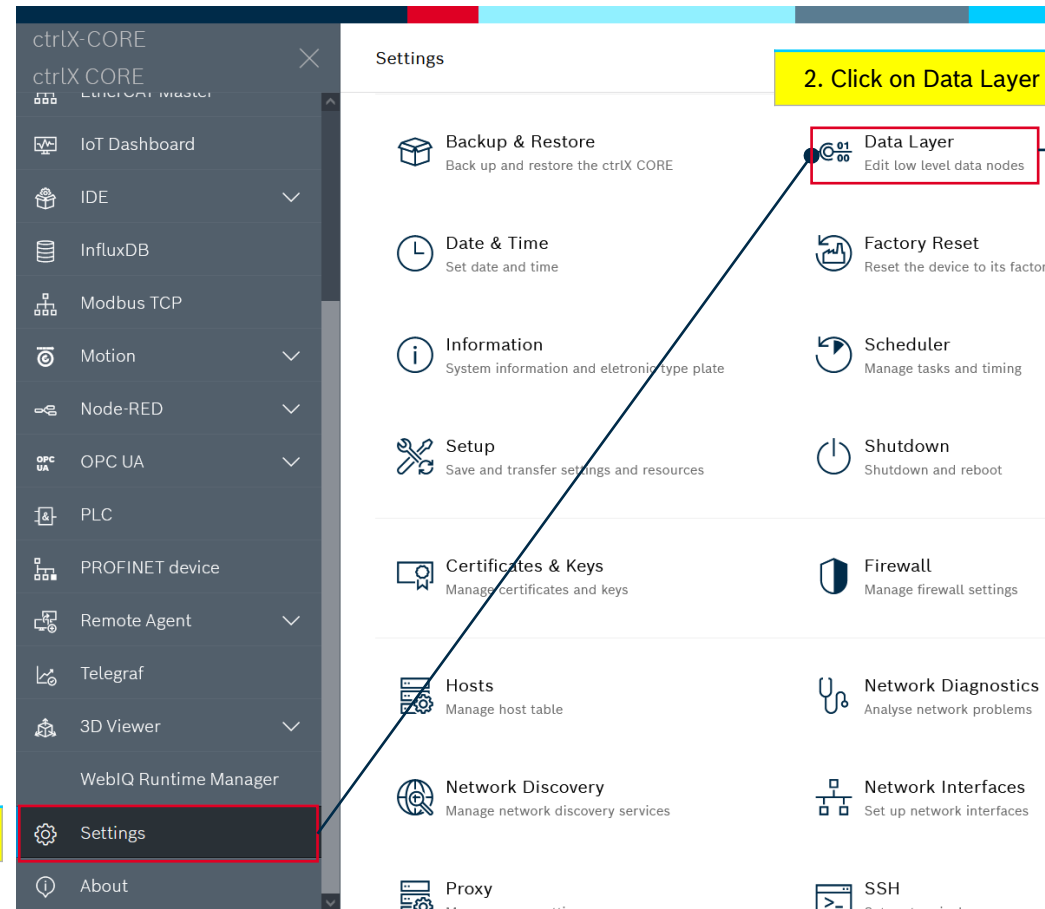# Challenge 02: ctrlX OPC UA App | Monitor Variables in the ctrlX Data Layer

Steps

1. Follow the steps below to view the variables that have been added to the symbol configuration via the ctrlX Data Layer.
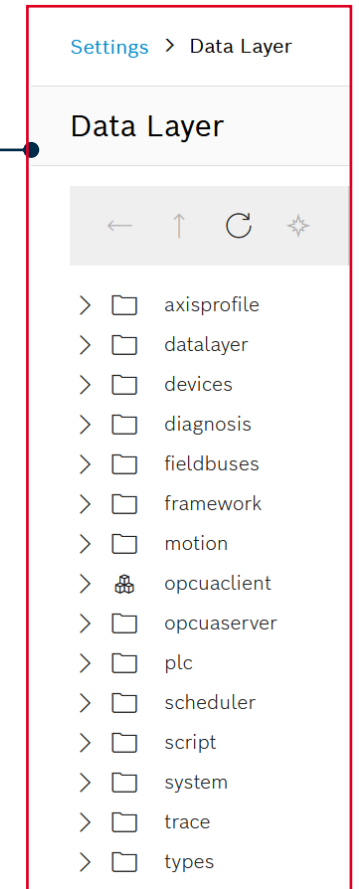
View variables in ctrlX Data Layer

- Open the ctrlX web-based user interface (described in PLC App Challenge) in the web browser.
- From the side menu, click on "**Settings**".
- In the "**Settings**" workspace, click on "**Data Layer**"
- The "Data Layer" will be displayed in the workspace.

3. Data Layer window

2. Click on Data Layer

1. Click on Settings

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Challenge 02: ctrlX OPC UA App | Monitor Variables in the ctrlX Data Layer

Steps

2. Follow the steps below to view the variables that have been added to the symbol configuration via the ctrlX Data Layer.

View variables in ctrlX Data Layer

- In the Data Layer, process data of all components can be accessed if registered at the Data Layer. Process data can be of any data type, e.g. drive parameters, PLC symbol variables or commands.
- The Data Layer window visualizes all information on a node and allows to modify the values of writable nodes.
- To view the variables from GVL_PLC, we need to navigate to the target path:

plc/app/Application/sym/GVL_PLC

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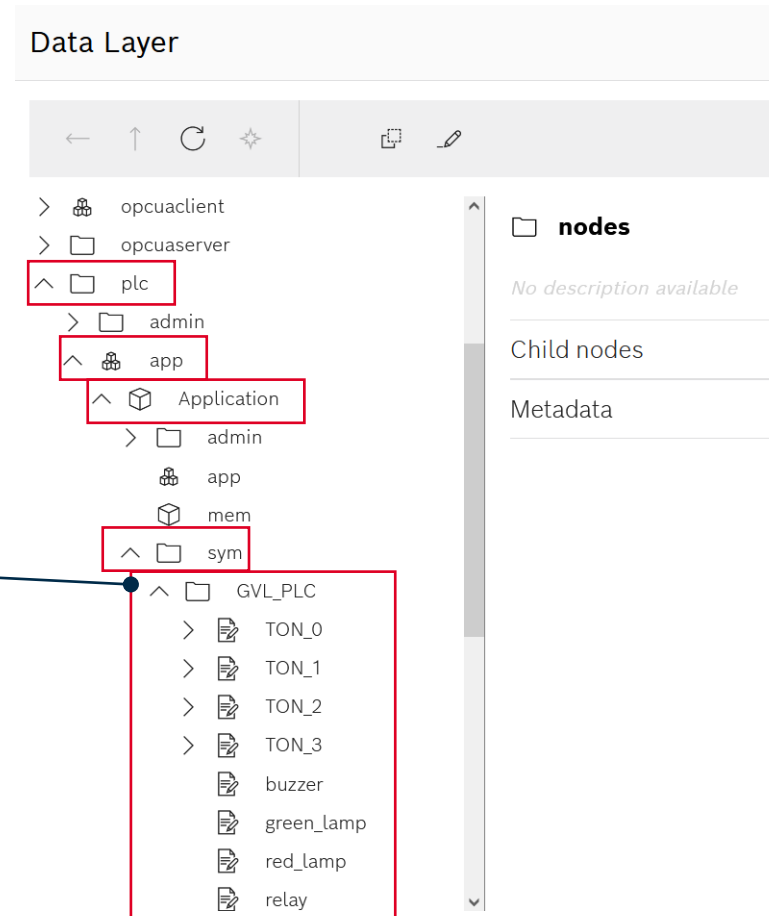
Challenge 02: ctrlX OPC UA App | Monitor Variables in the ctrlX Data Layer
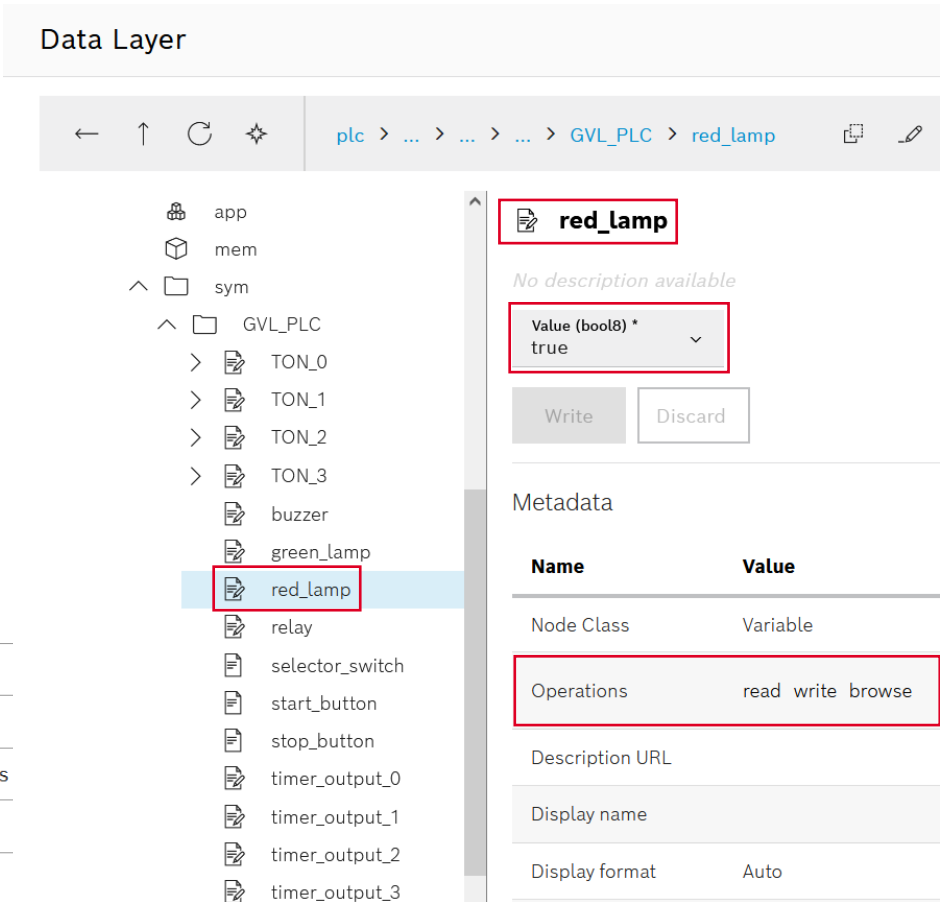
Steps

3. The status of variables can be monitored in the ctrlX Data Layer as shown below.

Monitor status of variables in ctrlX Data Layer

- As an example, select the "**red_lamp**" variable from GVL_PLC from the ctrlX Data Layer window

- We can observe that the "**Value**" is "**true**" indicating that the red lamp is ON (verify by looking at the red lamp)

- This variable is assigned to address %QX0.1 (Digital Output channel 2) from the previous PLC program that was downloaded to the controller

- We can also see in the "**Operations**" attribute in the **Metadata** area, the value is "read write browse"

- Description of the value as per below table:

"Operations"	read	Node contains a value
	write	The value can be written to the node
	create	Node has a "create" function used to create child nodes
	delete	Node can be deleted
	browse	Node has child node

Challenge 02: ctrlX OPC UA App | Monitor and Modify Variables in the ctrlX Data Layer

Steps

1. The status of writable variables can be modified in the ctrlX Data Layer as shown below

Modify writable variables in ctrlX Data Layer

- In this example, select the "**relay**" variable from GVL_PLC from the ctrlX Data Layer window
- We can observe that the "**Value**" is "**false**" and in the "**Operations**" attribute in the Metadata area, the value is "read write browse"
- This variable is not assigned to any physical digital input address (%I) thus making it modifiable/ writable
- Variables associated with an input point such as **start_button AT %IX0.0: BOOL;** has a direct relationship with the physical world, as its value reflects the state of a specific input point in the PLC
- The variable **relay: BOOL;** is more flexible and can be used for various purpose within your PLC logic, without a direct connection to physical I/O

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Challenge 02: ctrlX OPC UA App | Monitor and Modify Variables in the ctrlX Data Layer

Steps

2. The status of writable variables can be modified in the ctrlX Data Layer as shown below

Modify writable variables in ctrlX Data Layer

- To modify the value of writable variables such as "**relay**" in the Data Layer, click on the "**Value (bool8)**" field, select the value "**true**" and click the "**Write**" button

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Steps

3. The status of writable variables can be modified in the ctrlX Data Layer as shown below

Modify writable variables in ctrlX Data Layer

- After you clicked the **"Write"** button, a pop-up message will indicate that the data has been changed
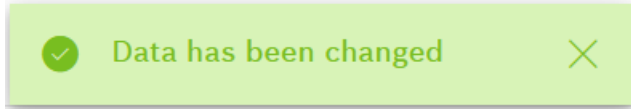
- This is reflected in the **Value(bool8)** field

Challenge 02: OPC UA App

Task 01

Challenge 02: ctrlX OPC UA App | Task 01

Description

From PLC App Challenge Task 2, you have completed the control task with latching circuits and timer functions. Now you are given the task to monitor the status of the system remotely. When the system is either on or off, you should be able to monitor the status of the inputs and outputs of the PLC but not directly from ctrlX PLC Engineering interface or the ctrlX Data Layer.

Task

This task will test your ability and understanding on Machine-to-Machine (M2M) communication using OPC UA to perform remote monitoring.

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Challenge 02: ctrlX OPC UA App | Task 01

Safety instructions for the project exercise

In order to ensure the operational capability and to identify the possible hazards of machines and systems, the safety regulations must be observed before and during the order execution.

The ctrlX CORE may only be operated in technically perfect condition. The intended use, performance data and operating conditions may not be changed. No protective devices/components may be deactivated.

In case of emergency, failure or other irregularities:

- Before connecting or disconnecting any electrical components, ensure that the power to the ctrlX CORE unit and associated equipment is turned off.

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Challenge 02: ctrlX OPC UA App | Task 01

Steps

1. The steps below only acts as a guide to complete the task. Your challenge is to make this work. Good luck!

Monitor variables remotely with OPC UA

Step 1: Install OPC UA Test Client

- Download and install an OPC UA test client. There are various options available online; one choice is <u>here</u>

Step 2: Launch the Test Client

- Open the OPC UA test client software

Step 3: Connect to the ctrlX CORE OPC UA Server

- In the test client, look for an option to connect or add a server.
- You'll need to provide the endpoint information for the OPC UA server you want to monitor remotely. This includes the server's URL or IP address and endpoint URL.
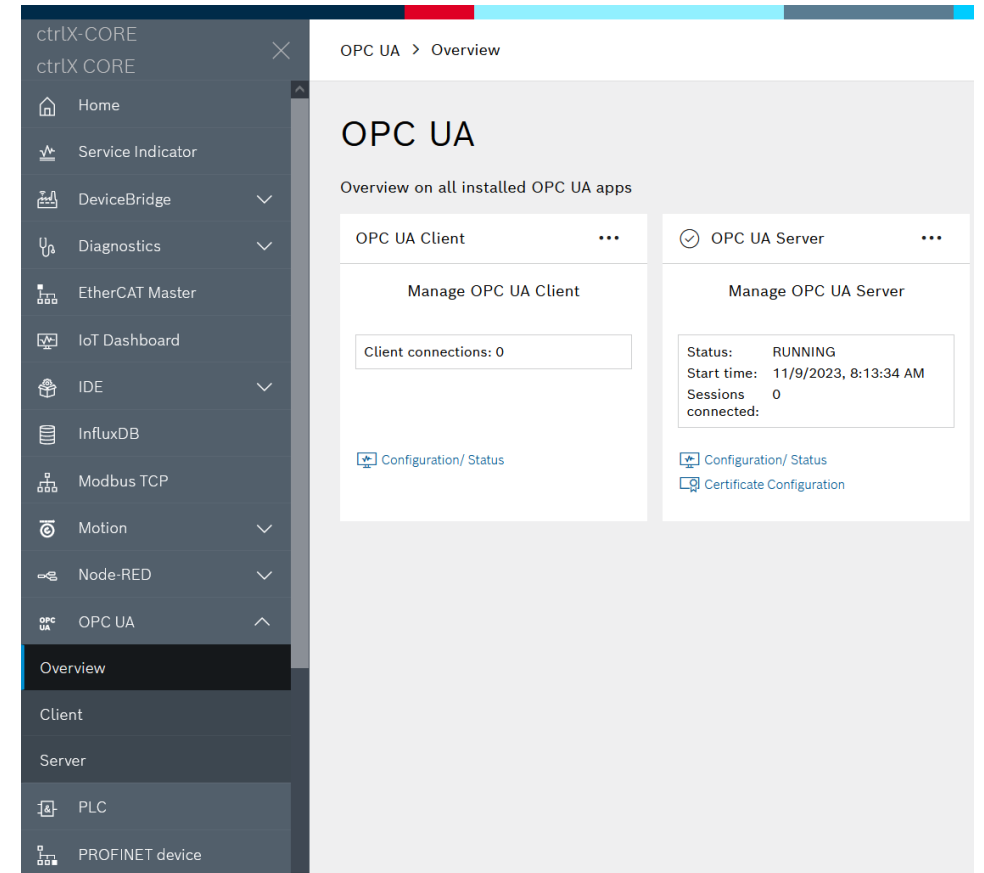
Hint: Look for the UA Test Client on Desktop directory on your PC!

Challenge 02: ctrl**X** OPC UA App | Task 01

Steps

1. The steps below only acts as a guide to complete the task. Your challenge is to make this work. Good luck!

Monitor variables remotely with OPC UA

Step 4: Browse the Address Space

- After connecting, you can typically browse the address space of the OPC UA server. This is like navigating through the available data points and variables.

Step 5: Monitor Variables

- Once connected, you can monitor specific variables or nodes within the OPC UA server.

Step 6: Perform Remote Monitoring

- As you navigate through the address space and monitor variables, you are essentially remotely monitoring the state of the OPC UA server.
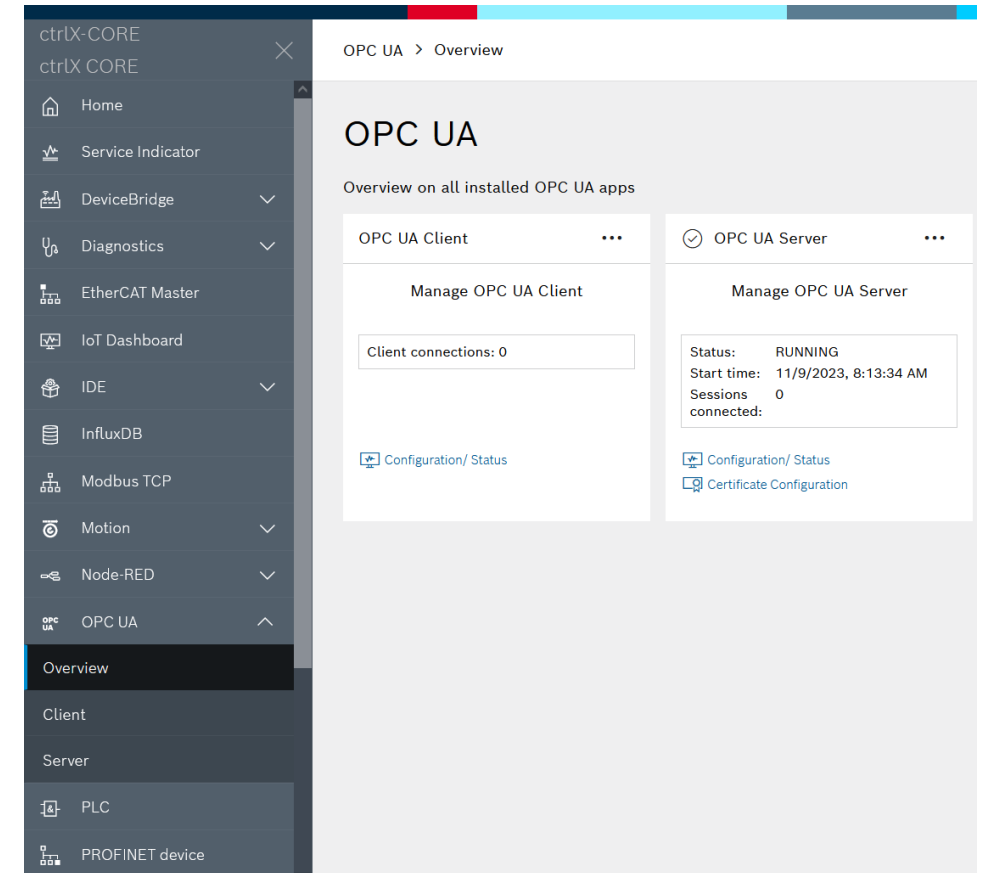
Challenge 02: ctrl**X** OPC UA App | Task 01

Steps

2. Once you have completed Task 1, follow the steps below.

How to complete Task 1 OPC UA App

- You can test your solution against the Task description
- Once it satisfies the task requirements, confirm that you have completed the task by informing the available instructor for verification
- In the ctrlX developR challenge website, under the OPC UA App challenge section, tick [✓] the Task 1 checkbox

Congratulations on completing Task 1!

Proceed to Task 2!