

Object oriented data space in OPC UA

The objective of this exercise is to familiarize with OPC UA technology including address space modelling, client and server implementation. The OPC UA project is performed under Microsoft Visual Studio 2015 environment including OPC UA SDK C++ library and prepared lesson templates. Created OPC servers and clients should be verified using OPC UA Expert software.

Assumptions: An automatic assembly station performs assembly operations. First it retrieves an element from the input of the station, then performs the assembly operations, and finally passes the assembled element to the output of the station.

The current state of the station is indicated by its status word. STATUS word consists of 7 bits that represent following situations that can appear during production:

- **b0 - RUN** - station performs its function (production running)
- **b1 - ALARM**- work stopped by failure
- **b2 - INTERVENTION** - work stopped by an operator
- **b3 - EMPTY** - station don't work for lack of parts (no input)
- **b4 - BLOCKED** – operation does not run through a closed output (station can't get rid of the machined work piece)
- **b5 - EXCLUDED**– intentionally exclusion (do not work by decision) □ **b6 - TIME OUT**- assumed cycle time exceeded

There are binary signals that indicate state of input and output buffer:

- ST_INPUT indicates that there is an element on the input to be assembled by the station
- ST_OUTPUT indicates that there is an element on the output of the station. The element should be removed before the end of next production cycle or station will go to BLOCKED state

The duration of ongoing production cycle is represented by a variable:

- CYCLE_TIME (in seconds). The average value for production cycle is 30s maximum 60 s.

Tasks to be done during the exercise

1/ Prepare an OPC UA address space: Use UaModeler software to create AssemblyStationType – the OPC UA Type should be prepared in OPC UA address space. All information related to production cycle should be reflected by AssemblyStationType. Prepare parent object type StationType for generic (abstract) station model that will be common for all stations. Consider status, inputs, outputs and measurements.

Apply type inheritance mechanism to create the children type the AssemblyStationType corresponding to automotive production station as described in assumptions.

Create OPC UA server application using “Compile” option of UaModeler. Open generated VS 2012 application and start OPC UA server.

Tip: Compare your application with SDK example
UnifiedAutomation\UaSdkNetBundleEval\examples\ServerGettingStarted\Lesson02 Test
your application (and Lesson2) using OPC UA Expert software.

2/ Create objects of AssemblyStationType on OPC UA Server:

a/create first instance UA1_gr_sec (gr is your group nb sec section) of production station using UaModeler software b/create second instance UA_2_gr_sec (gr is your group nb sec section) of production station using OPC SDK (by creation relevant C# application code).

Tip for point b/: compare your C# code with Lesson02 example in GettingStarted- Shortcut to see how to create objects on the server from OPC SDK.

Check your results using OPC UA Expert software.

3/ OPC UA client: Familiarize with OPC UA client example available in SDK environment BasicClient - Shortcut. Connect your server and try to read and write variables created on DCS server.

4/ Prepare Station_Sim_gr_sec (gr is your group nb sec section) project based on BasicClient. The client should simulate the behavior of the station and fulfil the following assumptions:

- the station starts its production cycle when previous cycle is finished, element is available on its input and station is not excluded
- the corresponding status bits should reflect the current state of the station
- the time of production cycle should be simulated by random function with average value 30s
- after the end of production cycle the ST_OUTPUT signal should be set to true
- if ST_OUTPUT has been true at the end of production cycle the station status is Blocked (until output element is removed)
- the TIME OUT status is generated when a production cycle exceeds 60 s

Report:

1. Archived source configuration files for UaModeler.
2. Archivised server project.
3. Archivised client project.
4. Preent screens from OPC UA Expert (for all steps)
5. Short report with highlighted main steps performed during the exercise