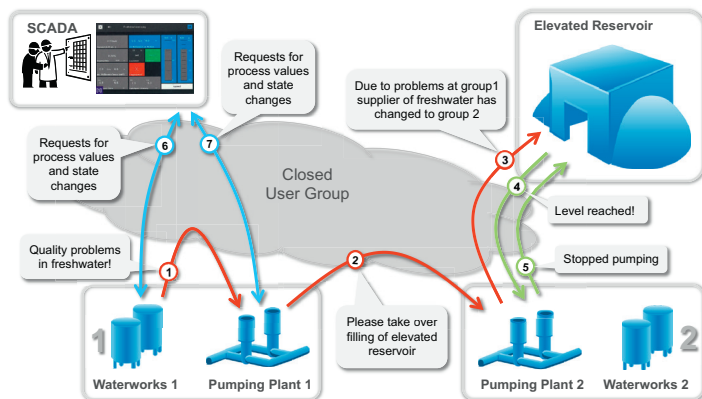


### Intelligent Water Management with OPC UA Enabled Smart Devices M2M Communication Based on PLCopen OPC UA Client Function Blocks



Decentralized, independently acting embedded controllers can form an intelligent network for the control of potable water and wastewater plants. OPC UA is the ideal technology to establish secure and standardized M2M interaction at these plants.

The movement toward the 4th industrial revolution, or Industry 4.0, is gaining momentum in a wide range of industries, and water treatment can now be counted as an application example. If we regard some of the Industry 4.0 initiative's basic concepts, such as platform and vendor-independent communication, data security, standardization, decentralized intelligence and engineering, then a technology for M2M (Machine-to-Machine) or IoT (Internet of Things) applications is already available in the OPC Unified Architecture (OPC UA).

OPC UA is used for M2M communication between plants for the intelligent networking of decentralized, independently acting, very small embedded controllers. For example, an application with the Joint Water and Wastewater Authority, Vogtland (ZWAV) has around 300 potable water plants and 300 wastewater plants (pumping plants, waterworks, elevat-

ed reservoirs, etc.) distributed over 1,400 km<sup>2</sup> and covering 40 cities with 240,000 people.

Real objects (e.g. pumps) were modeled in the TwinCAT IEC 61131-3 PLC software from Beckhoff Automation as complex objects with interactive possibilities; thanks to the OPC UA server integrated in the controller, these objects are automatically available to the outside world as complex data structures for semantic interoperability. The result is decentralized intelligence that makes decisions independently and can transmit information to neighboring systems. In addition, it can query equipment status and values for its own process in order to ensure trouble-free process cycles.

With the standardized PLCopen function blocks, the devices independently initiate communication from the PLC to other process devices such as OPC UA clients, while at the same time being able to respond to their requests or to requests from higher-level systems (SCADA, MES, ERP) as OPC UA servers.

The devices are connected by wireless routers: a physical interruption of the connection does not lead to a loss of information, since information is automatically buffered in the OPC UA server for a time and can be retrieved as soon as the connection has been restored – a very important property in which a great deal of proprietary engineering effort was invested beforehand. The authentication, signing, and encryption security mechanisms integrated in OPC UA were used in addition to a closed mobile radio group to ensure the integrity of this partly-sensitive data.

The vendor-independent interoperability standard OPC UA opens up the possibility for end users to subordinate the selection of a target platform for the required technology in order to avoid using proprietary products or devices that don't meet the needs of the application.

### Testimonial: Licensing Costs Reduced by 90%

The replacement of a proprietary solution with a combined OPC UA client/server solution in small, but powerful embedded controllers provided ZWAV with savings on the initial licensing costs of more than 90 % per device. Minimizing service assignments in the field results in significant additional savings for maintaining several hundred water facilities within an area of 1,400 km<sup>2</sup>.

For the engineering part, better standardization results in:

- Efficient engineering
- Cost reductions
- Reuse of technology/equipment
- Improved transparency
- Increased availability
- Increased choice of providers
- Higher interoperability

The considerable potential for business management optimization is more than worth putting together existing and new technologies.



Silvio Merz, Divisional Manager  
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Joint Water and Wastewater Authority,  
Vogtland  
[www.zwav.de](http://www.zwav.de)

## OPC UA-Enabled Smart Devices

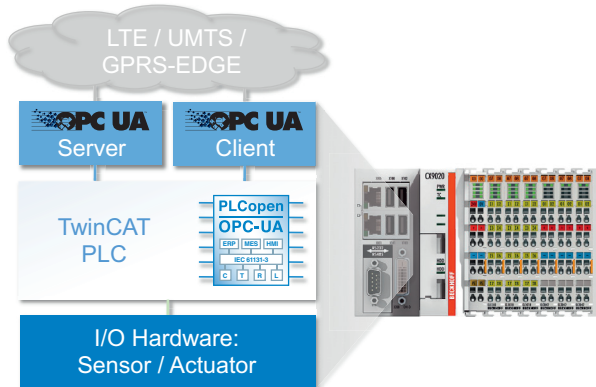


Diagram: TwinCAT OPC UA Client (PLCopen-based) and TwinCAT OPC UA Server are integrated into one of the smallest Beckhoff controllers, a CX9020 Embedded PC.

Real objects (e.g. pumps) were modeled in the IEC 61131-3 PLC as complex objects with interactive possibilities; thanks to the OPC UA server integrated in the controller, these objects are automatically available to the outside world as complex data structures for semantic interoperability.

A remarkable increase in efficiency, cost reductions and quality improvements can be observed using the IEC 61131-3 PLC in engineering. The prerequisite here is:

- an object-oriented approach
- Transplant intelligence into the PLC
- Control system or a local visualization is handled simply as an “image” on the PLC

**Advantage:** No requirements to manage multiple configurations or scaling – or the associated errors. Also, out of the cooperation of the OPC Foundation and PLCopen, a similarly high impact can be achieved on the PLC. Through structuring and modularization, data structures or their elements for Data Access, Alarms & Conditions or Historical Access, are prepared once in an object-oriented manner in the PLC source code. This can save users significant amounts of programming time.

## About ZWAV (Joint Water and Wasterwater Authority), Vogtland

The purpose of the Joint Water and Wastewater Authority, Vogtland (ZWAV) is an association of 40 cities in the Vogtland region of Germany where communities work together to fulfill the responsibilities of water supply and sanitation, which were transferred to the municipalities by law. The ZWAV is responsible for an area of 1,400 km<sup>2</sup> - covering 40 cities with 240,000 people.



## About Beckhoff

**BECKHOFF**

www.beckhoff.com

Beckhoff implements open automation systems based on PC Control technology. The product range covers Industrial PCs, Industrial Motherboards, I/O and Fieldbus Components, Drive Technology, and automation software. These innovative products can be used as separate components or integrated into a complete and seamless control system in all industries. The Beckhoff “New Automation Technology” philosophy represents universal and open control and automation solutions that are used worldwide in a wide variety of different applications, ranging from CNC-controlled machine tools to intelligent building automation.

## About PLCopen

**PLCopen**

for efficiency in automation

www.plcopen.org

PLCopen, as an organization active in industrial control, creates higher efficiency in application software development and lowers system lifecycle costs. One of the core activities of PLCopen is focused around IEC 61131-3, the only global standard for industrial controls programming. The results of the collaboration between PLCopen and OPC-Foundation include:

- mapping of IEC 61131-3 into the OPC UA namespace in order to provide semantic interoperability
- PLCopen OPC UA client function blocks which enable controllers to initiate OPC UA-based communication

## About OPC Unified Architecture (OPC UA)



OPC UA is the interoperability standard for multi-vendor, multi-platform data exchange that is secure and reliable from small sensors up to IT Enterprise level systems. This technology provides open connectivity across multiple products, regardless of hardware platform or software operating system. OPC UA (the IEC 62541 standard) includes automated discovery, security by design, data encryption, and exceptionally powerful information modeling.