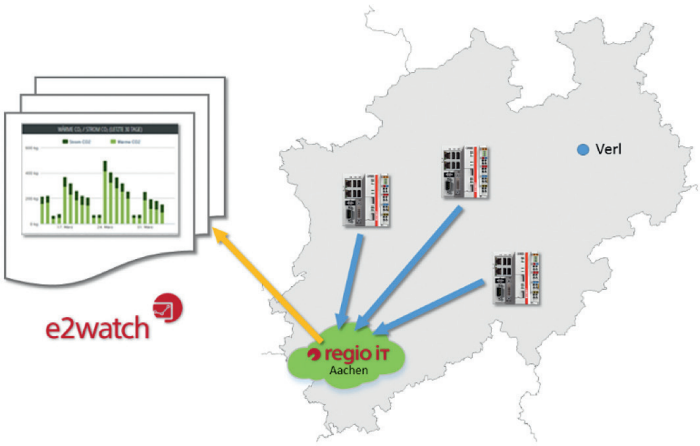
Smart Metering with OPC UA Enabled Intelligent Devices

Embedded Controller with Integrated PLCopen OPC UA Client Collects and Pushes Data to the Cloud

For optimal energy management of municipal buildings, it is necessary to be as informed as possible via rapid-response energy monitoring systems to report consumption of water, electricity, and heat. The region around the city of Aachen, Germany, together with their premises management and the IT service provider, regio iT, has therefore introduced e2watch®, which is based on advanced data logging technology from Beckhoff.



The data logger collects measurement data, which is first buffered locally, and then the information is synchronized on configurable time points with a cloud-based Microsoft SQL database from which they flow into a Big Data Management (BDM) system. There it is evaluated, and various post-processings are applied. Detailed energy consumption reports are available via a convenient web portal.

Operators, owners, and even residents of those real estate properties have access to the dedicated statistical analysis results. In particular, the building users can be kept better informed in this way for more economical and environmentally-friendly use of energy resources. The building manager can also use an internal work area for detailed analysis and alarm messages and, as a result, correct errors or adjust for additional consumption faster than before. The system can also track the compliance of energy conservation requirements. With this feature-filled technology, regio iT customers are also able to recognize and respond to emergency conditions like water pipe breaks much faster.

regio iT's customer, the city of Aachen (Germany) connected as of today around 170 facilities to e2watch®. This includes schools, day care centers, office buildings, sports halls, swimming pools, sports facilities, museums and commercial spaces, and the monitoring of 11 million kWh of electricity, 237 Tm³ water and 53 million kWh of heat. The connected buildings represent a total of approximately 1,030 data points that are collected in (configurable) 15-minute intervals. This means the immense amount of information of about 100,000 records per day.

The customer potential for BDM solutions like e2watch from regio iT is obvious and can be applied for a wide variety of markets: The collection, buffering, and forwarding of data are everyday tasks, required in countless applications. The data logger uses the standard PLCopen OPC UA client function blocks. This enables the intelligent device to actively initiate secure communications and push collected information into the cloud as well as retrieve configuration data, i.e. the transmission of the collected information to the cloud occurs after a configurable time: OPC UA with its standardized access and integrated security mechanisms is the perfect data transport layer for these types of applications.

More efficiency, security, and flexibility through standards

This kind of application strongly requires standardized and secure communication because data is being transmitted through the Internet. The obvious choice was to create the application based on the international standard IEC 62541 – OPC UA. Each data logger initiates the data communication itself, so the data logger needs to act as an OPC UA client.

As the underlying programming language, IEC 61131-3 provides an approved international programming standard, enabling the development of object-oriented programs for more efficient and maintainable program code.

TwinCAT 3 software and PC-based control from Beckhoff offer not only substantial benefits during application development via object-oriented programming, but they also provide a ready-to-use OPC UA server and client which is based on the standardized PLCopen OPC UA client function blocks.

Each data logger configuration is preset in the web portal of e2watch. This configuration is retrieved from the data loggers for self-configuration.

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Embedded PC as a distributed data logger with OPC UA connection to the cloud

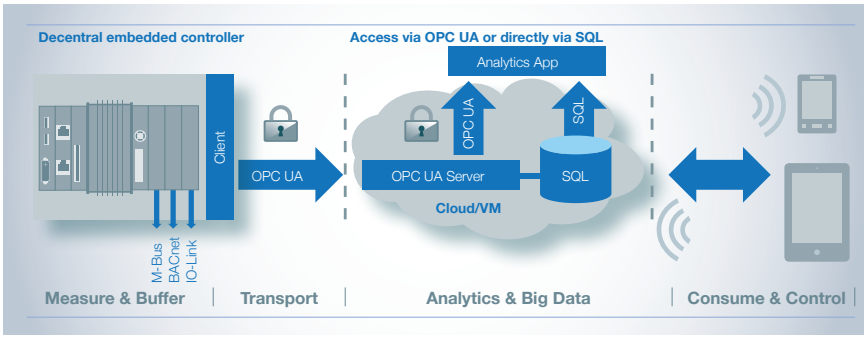

Diagram: Smart metering – Measurement of physical data

The information collection, storage, and dissemination happen in a de-centralized data logger in the facility. The e2watch® system utilizes a compact Beckhoff controller as a de-central control unit for data acquisition and buffering. The core of the data logger is a CX series Embedded PC running TwinCAT 3 automation software. A KL6781 M-Bus master terminal is used for convenient integration of the meter into the controls platform. In general, the flexible Beckhoff system supports a vast range of protocols and sensors.

The data logger can simply be taken in operation from the e2watch® portal, not requiring any programming or manual configuration effort. The data logger is delivered with "generic" default IEC 61131-3 logic to retrieve its final environment configuration from the cloud: All sensor parameters, like number of data points, data collection, and transmission time, are synchronized with the regio-iT cloud.

The system uses the secured (X.509 certificates for encryption/signing) communication on transport level defined by OPC UA. Certificate Authorities are defined per customer and delivered pre-configured by Beckhoff Automation. Using OPC UA security here means that there is no additional VPN / tunnel infrastructure required, which would typically be one of the standing charges. On the server side in the regio iT Cloud, TwinCAT 3 runs with its integrated OPC UA and database server.

About regio iT

www.regioit.de

regio iT GmbH is an IT service provider for local authorities, schools, utilities and waste management companies as well as non-profit organizations. With headquarter in Aachen, Germany and an office in Gütersloh, regio iT offers strategic and project-based IT consulting, integration, IT infrastructure and full service in four areas: IT Service & Operations, Administration & Finance, Energy & Waste Disposal, Education & Development. Currently it serves over 27.000 clients and more than 160 schools with 380 skilled employees. The company generated revenue of € 50.4 million in 2013. Today the volume of data is about 230 TB data are hosted on 1750 servers which are 70% virtualized.

About 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

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 collaboation 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.