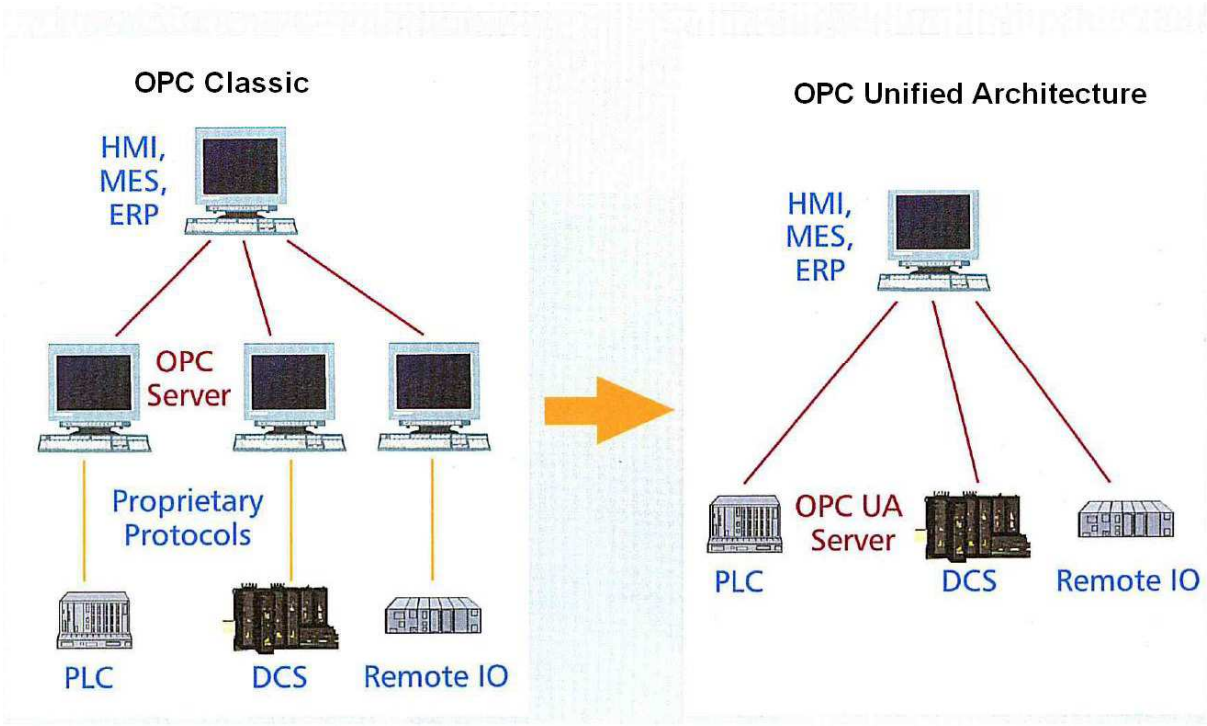

Fig. 1: OPC UA architecture: OPC UA allows the implementation of servers in embedded systems, thus opening the door to new automation concepts.

Part 1 of 8:

On the Verge of a Breakthrough

OPC Unified Architecture products open the door to new automation concepts

After the success of Classic OPC technology in the past, the OPC Foundation completed the specification of the successor standard, OPC Unified Architecture (OPC UA), about three years ago. This new standard is aimed at eliminating the weak points detected in Classic OPC while significantly expanding the use case scenarios. Since its completion, a whole number of industrial applications have been implemented based on OPC UA. Against this backdrop, this is a good time to take stock: What use cases are covered by OPC UA? What benefits does OPC UA offer? Will OPC UA be able to live up to the expectations placed in this standard?

Classic OPC technology has existed for more than 15 years. Since then OPC has grown into an industrial standard for real-time data exchange, event monitoring, and historical data access. The major advantage is the possibility to use software applications from different vendors within the same overall system. OPC is thus widely adopted today, with an installed base of many millions of installations in manufacturing and process automation applications,

in building automation and numerous other industries around the world. Time has shown, however, that Classic OPC technology has a number of limitations that stand in the way of even wider acceptance and use. One is that Classic OPC is closely tied to the Microsoft Windows operating system and its base technology, COM/DCOM ((Distributed) Component Object Model). The configuration of data exchange between PCs, in particular, requires extensive expertise and thus complicates the use of OPC in these applications. A whole range of additional wishes and demands on OPC technology also come from the industry, regarding e.g. security support, protection against data loss, redundancy capabilities, and support of complex data types. In response, the OPC Foundation developed a fully revised and expanded version of the OPC standard – the OPC Unified Architecture – which was released about three years ago. It eliminates the weak points of Classic OPC and adds essential new characteristics like platform independence, scalability, high availability and Internet capability. The new standard now allows implementing completely new, cost-saving automation concepts.

OPC UA advances on a broad front

Many manufacturers developed Classic OPC based products over the previous years, which are still successfully in use at end customers today. This leads to a certain reluctance to make new investments. At the same time, the competitive pressure is still low as OPC products with OPC UA support are not yet offered with market-wide coverage. Nevertheless, there are about 200 OPC UA early adopters that have already launched, or will soon launch OPC UA products. In addition, there are also many major providers of automation solutions who are working on OPC UA implementations. These companies usually take longer to launch new products and are often hesitant to make announcements. But once these products are available, the support for OPC UA technology is expected to increase. Therefore the question is not whether OPC UA will live up to the success of Classic OPC. The question is how long it will take OPC UA to achieve this success. A catalyst in this development will be the standardization by the International Electrotechnical Commission (IEC standardization), which will soon be completed. Then OPC UA will no longer be just an industrial standard, but an official IEC standard.

The Advantages of OPC Unified Architecture

- Unified data model for process data, alarms and historical data
- Simplified use across computers
- Secure communication across firewalls
- Use on non-Windows platforms
- Quick and easy engineering through embedded OPC UA
- Support of complex data structures
- Protection against data loss
- Optional redundancy capabilities

Wide range of implemented automation concepts

The following application examples describe implemented automation projects which take advantage of the benefits and extended possibilities that OPC UA offers over Classic OPC.

Embedded OPC UA server in an injection moulding machine
As one of the world leading manufacturers of injection moulding machines, Arburg is continuously on the lookout for possibilities to improve efficiency. Among the key requirements of its customers are easy installation, commissioning and maintenance. Vertical integration, configuration, visualization and diagnostics of the injection moulding machines in higher-level applications also play a major role. Based on Softing's OPC UA Toolkit, Arburg has developed an embedded OPC UA server that is integrated into the injection moulding machine, preinstalled and preconfigured, and thus eliminates the need for on-site installation at the customer's location. As the Arburg injection moulding machines are based on the VxWorks operating system, this solution would not have been possible with Classic OPC technology. The use of additional Windows PCs would have been necessary instead. Another advantage of the Arburg solution is the scalable namespace, which in OPC UA can be restricted to the required subset, according to the size of the machine. Heinrich Müller, Head of Software Development at Arburg, points out the advantages of the implemented solution: “For us, as manufacturers of injection moulding machines, the OPC Unified Architecture provides an easy and convenient way to integrate our machines into higher-level applications. OPC UA also makes it very simple for our customers to configure, monitor and analyze data in our injection moulding machines. (...) Using the Softing OPC UA Toolkit, we saved several months of development time. (...) The performance, stability and quality of Softing's OPC UA software are excellent.”

Energy monitoring and control of a residential complex via the Internet
The Austrian company nte Systems was founded in 2009 with the objective to set up a technology enterprise with an industrial character, specialized in renewable energy systems. nte Systems offers processes, methods and diagnostic systems for the use and operation of renewable energy systems, and complements the portfolio with innovative electronics and software products. In a large residential complex in Graz, Austria, nte Systems has implemented the operation and monitoring functionalities for the entire local heating grid of several buildings, for the heating system for 59 residential units, and for a 300 sq.m solar thermal system. PLCs from Beckhoff with integrated OPC UA server are used for controlling. Operation and monitoring is performed centrally through the Scady product from nte Systems, while OPC UA software from Softing is used for communication over the Internet. “After we had connected the PLC to the Internet, all the data items were visible in the Scady System Designer as soon as we entered the IP address. We could then make up the complete visualization by drag-and-drop. It couldn't be any simpler,” says Georg Stasny, Managing Director of nte Systems. As Andreas Hafellner sums up: “Only OPC UA gave us the possibility to implement for the end customer a 'no programming' remote control and monitoring platform for PLC data over the Internet. With OPC and COM or similar predecessor technologies, the secure connection across firewalls and the secure connection to several hundred OPC servers simultaneously would have been impossible or at least extremely difficult to implement. (...).”

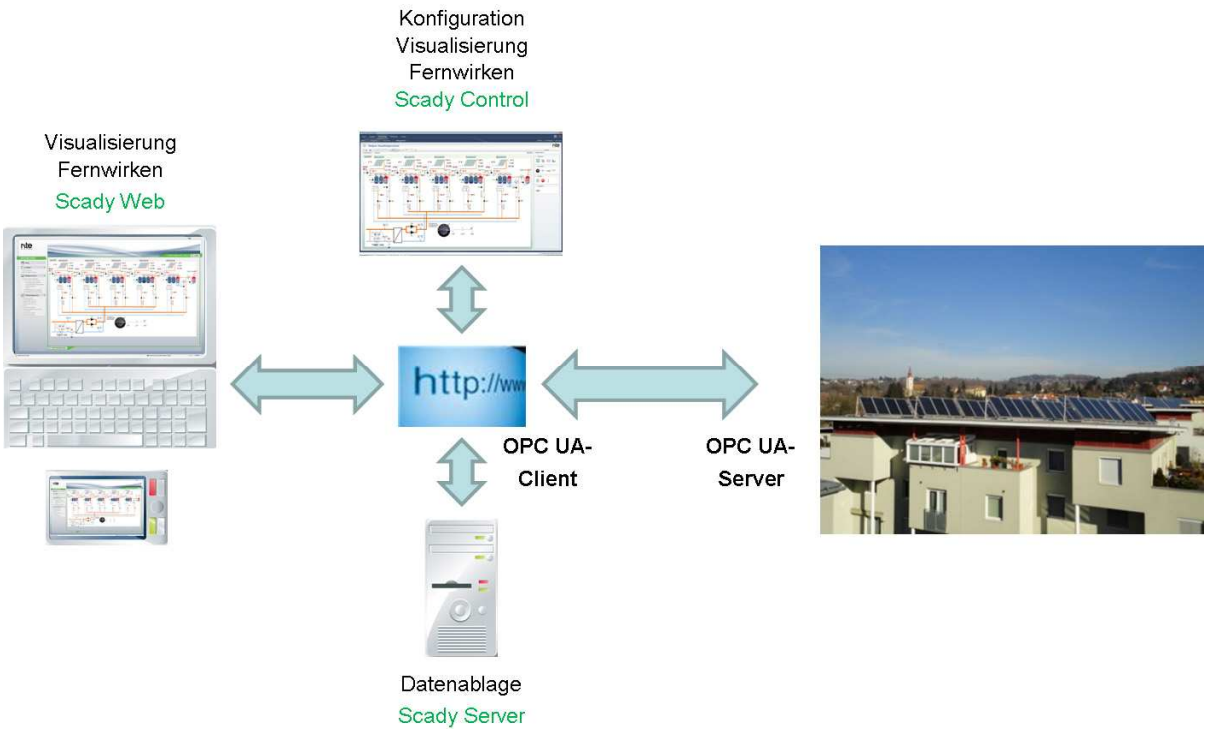

Fig. 2: In a large residential complex in Graz, Austria, the operation and monitoring functionalities have been implemented for the entire local heating grid of several buildings, for the heating system for 59 residential units, and for a 300 sq.m solar thermal system.

Monitoring of an offshore wind farm

Areva's alpha ventus test field for an offshore wind farm is located in the North Sea, about 45 km off the German coast. The wind farm uses 5MW wind turbines, which each operates autonomously and fully automatically, and monitors itself. At the same time, all the turbines are also monitored around the clock by operators on the mainland. Connecting the wind farm with the central operating station required the implementation of special security and authentication mechanisms in a complex network infrastructure consisting of different subnets and domains that are connected by routers and protected by firewalls. Under these conditions, configuration and administration are a challenging and time-consuming task. As OPC UA is based on encrypted data transmission and supports user authentication as well as the monitoring functionality at data item level, the decision to employ this technology did not take much pondering. Otherwise, a VPN network and remote operating stations would have had to be established. As the Areva wind turbines use a Beckhoff controller with Windows Embedded CE operating system, which provides an integrated OPC UA server interface, all that needed to be done was implement the OPC UA client in the Areva visualization system. The solution by now already allows communication between the offshore turbines and the enterprise information system on the mainland to perform remote control, maintenance and measurements.

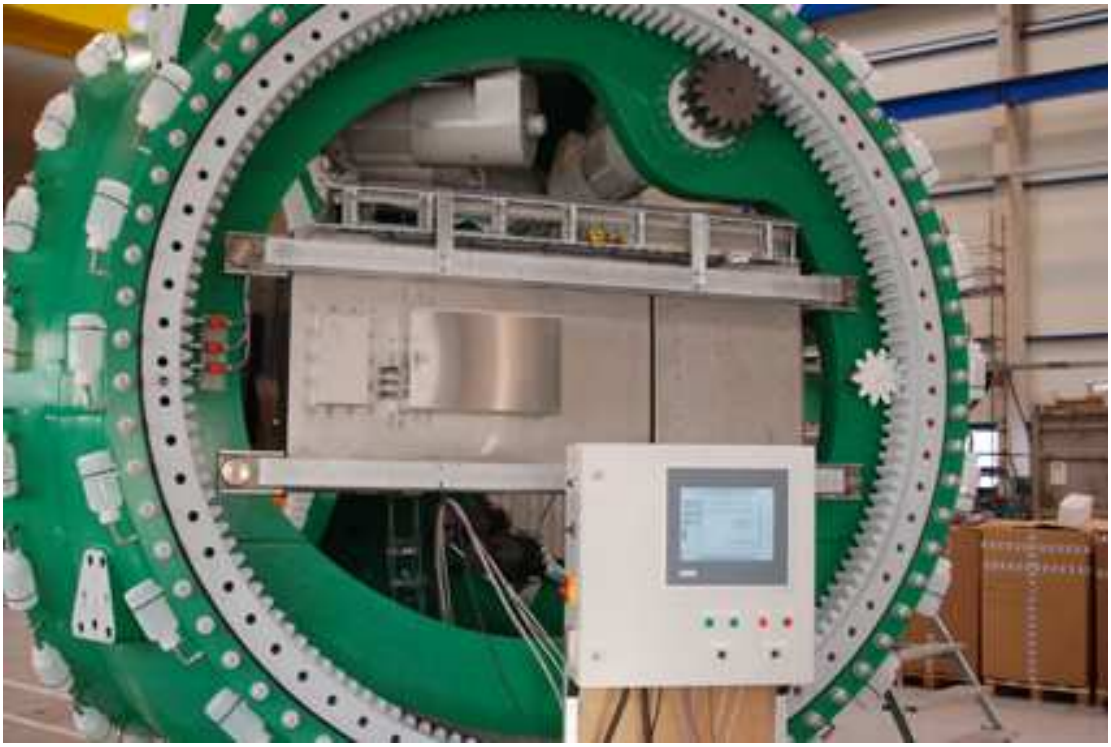

Fig. 3: Areva: The rotor of the AREVA wind turbine features a controller with an OPC UA server. This provides the basis for communication between the turbine and the central operating station on the mainland.

Collection of measurement results and decentralized display

At Miele, individual measurement results from controllers and visualization systems were to be collected centrally and displayed in thirty decentralized test stations. Among the key requirements were the ability to interface control and visualization systems from different manufacturers and to exchange data without a need for wrappers or additional interfaces, in order to achieve a high performance. To meet these demands, an OPC UA architecture has been implemented that is based on an OPC UA server as part of the Siemens WinCC process visualization software and the corresponding OPC UA clients, which are connected via Ethernet TCP/IP. As a result, Miele now has a stable high-performance system that fulfills all the requirements.

The above application examples show that OPC UA by now is more than a specification. The OPC UA technology with its versatile possibilities and high performance are successfully used in industrial environments already today. Manufacturers looking to offer an OPC UA solution for their automation components are well advised to prepare a project plan as soon as possible.

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OPC Day Europe 2012
The OPC Foundation will be holding this year's OPC Day Europe on May 16, 2012. The event will take place at Endress+Hauser in Reinach, Switzerland, and focus on the use of OPC UA in process automation.

Series of Articles in SPS-MAGAZIN

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3	24.02.2012	OPC UA Status
4	16.03.2012	OPC UA: Origin, Development and Objectives
HMI Special	13.04.2012	Ten Reasons for OPC UA
5	10.05.2012	OPC UA Specifications
6	01.06.2012	OPC UA Companion Standards
7	30.06.2012	OPC UA Compliance Test
8	27.07.2012	OPC UA Toolkits
9	31.08.2012	OPC UA Outlook