Embedded OPC UA Can Help Enhance Interoperability at All Automation Levels

By Craig Resnick

Keywords
ARC World Industry Forum, OPC Foundation, OPC Unified Architecture, OPC UA, OPC DA, OPC A&E, OPC HDA, PLC, PAC, IEC-61131-3

Executive Overview
Those who attended the "Transforming Manufacturing with OPC UA: From Embedded to the Enterprise" session at the recent ARC World Industry Forum in Orlando, Florida discovered that embedded OPC UA (Unified Architecture) has finally moved beyond the conceptual stage, with relatively widespread adoption and deployment. Key findings include:

- Automation and other suppliers are developing, certifying, and delivering embedded OPC UA products
- ODVA and other organizations are working with the OPC Foundation to extend the benefits of Embedded OPC UA into machine control
- Many companies are already taking advantage of the technology to improve interoperability and break down informational silos
- We’ve just begun to scratch the potential benefits that can be achieved using this technology

Embedded OPC UA as a Transformational Technology
The OPC Foundation has been working to help solve communication and connectivity problems between plant and factory floor devices and host systems and applications since 1995. Virtually every end user, OEM, and automation supplier employs OPC standards such as OPC Data Access (OPC DA), OPC Alarms and Events, (OPC A&E), and OPC Historical Data
Access (OPC HDA), to establish communications and connectivity between disparate devices.

However, no longer is connecting devices at the field, control, and operations levels sufficient; today's users also need to connect plant devices, applications, and systems up to the enterprise level. Many OPC users have also expressed concerns about the security features of OPC communications, which previously were limited with the early versions of OPC classic communications.

The OPC Foundation recognized the opportunity to enhance interoperability and provide platform interoperability by developing new specifications through participation by a new category of enterprise and embedded suppliers in OPC Foundation activities. The new specification -- OPC Unified Architecture (OPC UA) -- has been demonstrated to improve secure interoperability between all plant equipment and systems and between the plant and enterprise, helping eliminate islands of information.

The questions are: is OPC UA real? Have suppliers begun to incorporate it within their solutions? And, if so, how are users taking advantage of these solutions? This report, based on the session, "Transforming Manufacturing with OPC UA: From Embedded to the Enterprise," at the recent ARC World Industry Forum in Orlando, Florida will address these questions.

**Embedded OPC UA**

The OPC UA specifications, initially released in 2006, integrate functionality from the existing OPC specifications (OPC DA, OPC A&E, OPC HDA) into a comprehensive service-oriented architecture. OPC UA adds essential new properties, including platform independence, scalability, high availability, new security mechanisms, and web services. OPC UA has two dimensions: 1) to provide secure interoperability at the automation level by embedding the technology within plant-level devices and applications, and 2) to extend OPC communications from the device and automation levels up to enterprise applications and systems.

Embedded OPC UA is based on an attractive lightweight architecture, with the minimal embedded OPC UA implementation using an efficient binary communication protocol. As a result, embedded OPC UA can be ported to many embedded operating systems, including proprietary real-time operating systems. At the top end, embedded OPC UA supports communication
with enterprise standard XML Web Services protocols, helping to ensure connectivity and communications via a common architecture from the field level all the way up to the enterprise level.

According to the OPC Foundation, embedded OPC Unified Architecture can already be found in a variety of products, including OPC UA servers embedded in both programmable logic controllers (PLCs) and programmable automation controllers (PACs). Several PLC/PAC and IEC 61131-3 system suppliers have also tested embedded UA servers for a PLC-Open/OPC UA demo and integration into IEC 61131-3 runtime systems. Some Windows CE-based HMI suppliers are implementing embedded OPC UA HMI clients. And a handful of wireless sensor and fieldbus communication gateways are now equipped with embedded OPC UA servers. ARC believes that, with the potential to embed OPC UA "on a chip" into a multitude of devices, tremendous opportunities exist to expand OPC UA into other domains, such as into security and building automation.

**Embedding OPC UA on a Chip**

Liam Power, Technical Director at Embedded Labs, a software company based in Waterford, Ireland, presented "OPC UA on a Chip, Redefining Automation Architecture." Liam cited examples of OPC UA applications embedded on a chip being used to provide connectivity for scheduling, control, visualization, logging, reporting, and productivity applications.

Liam described how OPC UA embedded in low-cost microchips will enable seamless communication from the field device level all the way up to MES applications. He stated that OPC UA will soon be embedded throughout the automation system in everything from serial fieldbus to OPC gateways, PLCs/PACs, I/O blocks, motor drives, and sensors & actuators. Liam also predicts that, by the year 2020, less than one in 1,000 OPC UA servers sold will be as installable software for PCs and that the installed base of embedded OPC UA devices will exceed 50 million units. ARC believes these are both reasonable predictions.

**Embedded OPC UA Integrated into PLCs**

In his presentation, Christian Schulze, Business Development Manager for Beckhoff Automation, discussed how his company has incorporated embedded OPC UA into the architecture of its products. According to Christian, OPC UA has been embedded into its Automation Controller se-
The benefits of OPC UA include standard interfaces across all automation levels, operating system independency, and a higher degree of security compared to “classic” OPC. From Mitch’s perspective, the benefits of OPC UA include standard interfaces across all automation levels, operating system independency, and a higher degree of security compared to “classic” OPC. He also believes that OPC certification for OPC UA products will help ensure better interoperability and higher customer satisfaction and that industrial extensions will improve robustness.

ARC finds it encouraging that Siemens and other leading automation suppliers have already embedded OPC UA within products, are pursuing certification for their products, and are working actively to extend the functionality into new areas.
Embedded OPC UA Enables Operational Excellence

In his presentation, John Krajewski, Senior Product Manager HMI/Supervisory for Invensys Operations Management, discussed how embedded OPC UA will serve as a key enabler and one of the primary real-time system connectivity tools within the company’s InFusion enterprise control system, including the ArchestrA System Platform, ArchestrA Workflow, Trident safety instrumented systems, and SimSci-Esscor ROMeo plant optimization software. According to John, these encourage control excellence, people excellence, safety excellence, and asset excellence, respectively.

ARC agrees that OPC UA can help industrial organizations achieve overall operational excellence (OpX) by helping to break down existing information silos, both within plants and across an enterprise.

OPC UA Plays Key Role in ODVA’s Collaboration with OPC Foundation

Katherine Voss, Executive Director of ODVA, presented a vision shared with the OPC Foundation for machinery integration in the manufacturing sector. ODVA, a vendor member organization founded in 1995, has approximately 275 global vendor members. As a standards development organization and certification body, it manages and promotes EtherNet/IP, DeviceNet, and other ODVA technologies. In March 2011, ODVA announced a machinery initiative in partnership with OPC Foundation and Sercos International to foster cross-collaboration on topics of mutual interest for machinery applications.

Katherine explained that machine communications is a key topic of this initiative and that OPC UA will play an important role. Machine builders and end users face similar challenges when looking to integrate machines; challenges that can often be resolved when organizations collaborate. The long useful life of machine assets results in many existing installations with legacy networks. These legacy networks are often based on proprietary technologies, do not share unified integration models, and are not interoperable; making integration difficult. The OPC Foundation and ODVA aim to change this paradigm with the concept of a Unified Integration Model. This will simplify communications at the machine and supervisory layers.
and can extend the lifecycle and enhance productivity and value of legacy machines still in operation.

ARC agrees that OPC UA can help improve interoperability between these layers and ODVA technologies, especially CIP and EtherNet/IP, can help minimize the use of proprietary software implementations to turn data into information, and increase the machine’s ability to communicate critical data and information throughout the enterprise.

**Embedded OPC UA Deployed in Drilling Automation**

Clinton Chapman, Drilling Automation Program Architect for Schlumberger, presented how the company uses embedded OPC UA in a drilling automation application. Clinton explained that since so many different organizations (owner-operator, equipment suppliers, service companies, etc.) are involved in drilling automation, it makes it difficult to provide integration points. This is due primarily to security and differences in equipment.

This Society of Petroleum Engineers Drilling System Automation Technical Section (DSA-TS) was formed to “accelerate the uptake of drilling systems automation by supporting initiatives that communicate the technology, standardize its nomenclature, promote lessons learned/best practices, and help define its value proposition.”

Clinton explained that the first phase of this project was to decide on a protocol and tags for control. DSA-TS selected embedded OPC UA as the protocol and to generate a set of tags that could be used to control the systems. OPC UA was chosen because of general agreement that OPC has broad industry support, because OPC UA components are available off-the-shelf with drivers, and (freed from the limitations of COM/DCOM) OPC UA offers an attractive security model. This was particularly important because service companies and other third parties are typically involved during the drilling process. Also, both compatibility with multiple HMI/SCADA systems and the availability of OPC
DA-to-OPC UA converters strongly influenced the decision to move forward.

Embedded OPC UA provided Schlumberger with the ability to perform device discovery on existing rigs, access real-time tags for feedback from the top drive on drilling rigs, and the ability to write to setpoints by automation agents and automation consoles. Also, it was critical to be able to customize security models to allow for control selection. Finally, OPC UA provides connectivity to all address spaces for the rig, its equipment and their attributes, and all real-time values and set points.

**Recommended Actions**

- Enterprise and automation suppliers should work with the OPC Foundation to develop and certify embedded OPC UA products that enable secure interoperability between disparate devices, applications, and systems at both the plant-floor and enterprise levels.

- Owner-operators should seek out, evaluate, and implement products and solutions with embedded OPC UA connectivity and communications solutions to help maximize asset performance and break down existing information barriers within their plants and across their enterprise.

- The OPC Foundation should continue aggressively communicating real world examples of OPC UA applications in action to the marketplace, focusing on the business benefits to end users and OEMs.

*For further information or to provide feedback on this Insight, please contact your account manager or the author at cresnick@arcweb.com. ARC Insights are published and copyrighted by ARC Advisory Group. The information is proprietary to ARC and no part of it may be reproduced without prior permission from ARC.*