

Quo Vadis OPC?

From Data Access to Unified Architecture

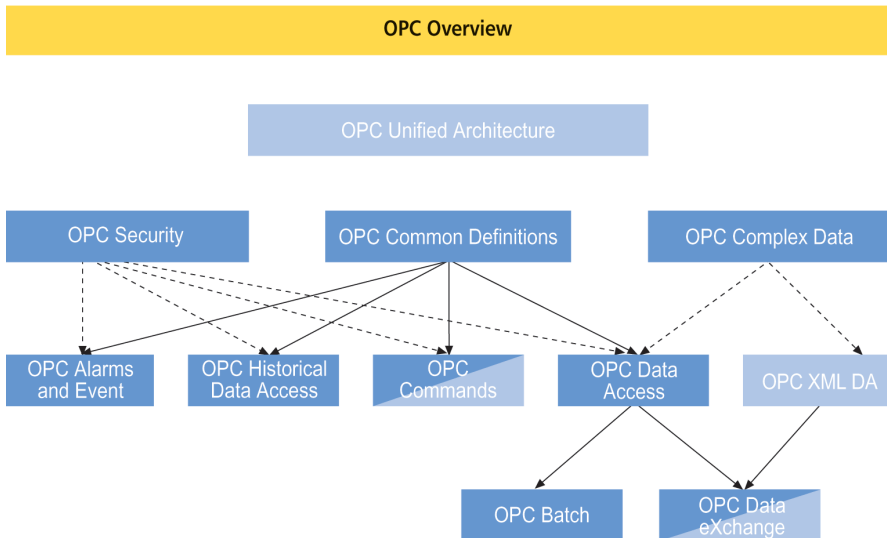


Fig. 1: OPC specifications available or in progress: The specifications shown in dark blue are based on DCOM, those in light blue are based on XML and Web services.

OPC Unified Architecture – in short, OPC UA – is far more than a new OPC architecture defined by a series of new OPC specifications. OPC UA is the vision of "global" interoperability, i.e. of making possible a standardized data exchange between software applications independently of the manufacturer they come from, the programming language they were developed in, the operating system they run on or the place they are located at. With OPC UA the OPC Foundation goes way beyond the previously existing limits for the use of OPC technology: Based on XML and Web services – and thus independent of Microsoft's COM/DCOM technology – OPC UA will allow the secure and reliable transport of data and information from the factory floor through to the production planning or ERP system.

What does the road to OPC UA look like? When will the first OPC UA products be available? Should manufacturers wait for OPC UA or would it pay to start with OPC XML-DA already today? These questions and many more will be answered in the following overview of the development of OPC technology.

Objective and Status Quo of OPC

OPC was initially defined to provide a standardized solution to the frequently recurring task of interfacing PC-based applications-primarily SCADA (Supervisory Control and Data Acquisition) and HMI (Human Machine Interface) systems-to the process peripherals. In May 1995 the newly founded OPC Task Force met for the first time to discuss this objective. In mid 1996

the OPC Foundation was founded and the first OPC Specification, Data Access 1.0, published. Today, ten years later, OPC has become a worldwide standard for data and information exchange between software components. With over 7,500 OPC products and millions of installations in a wide variety of industries, the OPC initiative has proved a sweeping success. The times have long gone when OPC was used merely to replace proprietary communication drivers for interfacing SCADA systems and visualization programs to the process peripherals. Process supervisory control systems, PC-based controls and MES systems are unthinkable today without an OPC interface. It is no longer used for transmitting only process data or individual parameters: Entire ERP documents, parameter sets, control sequences, video signals or drive programs are transported via OPC.

The OPC Data Access (DA) specification is meanwhile already available in version 3.0. Besides OPC DA a



Fig. 2: The OPC Toolbox from Softing will support the OPC Unified Architecture in future

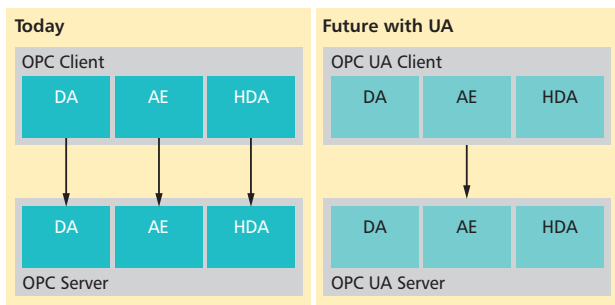


Fig. 3: The OPC Unified Architecture enhances the combinability of OPC servers of different categories

variety of other specifications exist, such as Alarms & Events (AE), Historical Data Access (HDA), Batch, Data eXchange (DX) and other specifications that address industry and task specific problems.

OPC Goes XML and Web Services

The roots of OPC are closely linked to Microsoft's Windows operating system. The original meaning of OPC, "OLE for Process Control," is derived from Microsoft's OLE technology of the nineties. OLE was soon superseded by the Component Object Model COM and by Distributed COM. Since the standardization of XML in 1998, new Web service technologies have been developed, such as Simple Object Access Protocol (SOAP), Universal Description, Discovery and Integration (UDDI), or the Web Service Description Language (WSDL). In 2002 Microsoft launched its new .NET framework which consistently uses XML, SOAP and Web services. The OPC Foundation, too, recognized the significance of XML and Web services already early on. Since 2003 the OPC XML-DA Specification offers a second, Web services based possibility besides the "classic" DCOM based OPC technology.

OPC Toolbox

The OPC Toolbox from Softing features a range of OPC toolkits for the fast and easy development of powerful OPC clients and servers for Windows, Windows CE, .NET, Linux and other embedded operating systems. OPC products based on the OPC Toolbox are in use worldwide in several thousand installations in the manufacturing industry, in process and building automation, and in Windows CE or Linux based applications in the embedded area.

The OPC Toolbox from Softing supports not only DA, AE, HDA and DX, but also the XML and Web services based approach. Already today, Softing's OPC products allow communication via the Internet as defined by the UA specification. OPC developments based on the DCOM toolkits can be extended by Web services and XML-DA in half a day. Softing will expand its OPC Toolbox by compatible OPC UA toolkits in 2006.

It enables applications to communicate independently of the manufacturer and platform. Since this step at the latest, the original meaning "OLE for Process Control" no longer applied. OPC today stands for "Openness, Productivity and Collaboration," reflecting less the connection to a specific base technology, but rather the key factors to an open, interoperable and productive OPC interface.

DCOM-DA or XML-DA – or Both?

With the definition of platform independent OPC specifications, the OPC Foundation has not broken away from Microsoft, but created new, easy possibilities for communicating with Linux/Unix systems or embedded controls on other platforms or for implementing OPC connections via the Internet. Platform independence and Internet capability has its price, however: Comparative measurements conducted by Softing AG in Munich, Germany, showed that XML based OPC communication is slower by a factor of 3-6 than an OPC data exchange directly via DCOM (for more information, see book tip: "OPC Fundamentals, Implementation and Application", Chapter 4.5).

Today, the manufacturers of OPC clients or servers can decide between COM/DCOM or Web services as the base technology for their products, depending on whether their key focus is on platform independence, Internet capability or performance. Platform independence, for example, was the decision criterion for LOYTEC electronics GmbH in Austria when selecting OPC XML-DA for its L-OPC product. L-OPC is a LON router for LonMark networks and runs on the Linux-like RTEM operating system. Based on the Softing OPC Toolbox, an embedded XML-DA server under RTEM was developed for L-OPC. A further example of OPC on non-Windows operating systems is the OPC XML-DA server for Linux, which was developed by Ensico in Ljubljana, Slovenia. The OPC XML-DA server is now used by SNC-Lavalin as part of an energy management system and monitors 126 remote terminal units with approx. 30,000 data points. The manufacturers of OPC products today are showing a growing trend towards a "double strategy:" Previously DCOM based OPC servers are expanded by an XML-DA server interface. This approach opens up remote maintenance

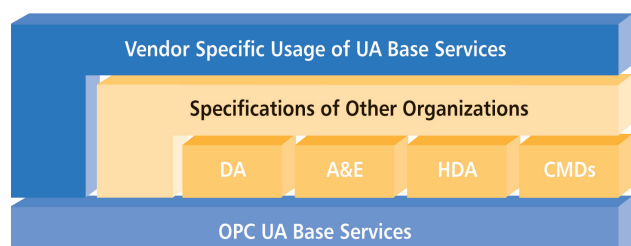


Fig. 4: The OPC UA services form the basis of the new interoperability platform

nance and remote operation possibilities over the Internet via XML-DA, while placing no restrictions on high-performance communication via COM/DCOM. This double strategy prerequisites an OPC technology that supports both DCOM and Web services at the same time, as implemented in the OPC Toolbox C++ of Softing AG in Munich.

The Next OPC Generation – Unified Architecture

The OPC Foundation has been working on the new OPC Unified Architecture (UA) specification for meanwhile two years. OPC UA defines an interoperability platform and unifies the use of different OPC servers and clients (DA, AE, HDA, etc.) for vertical and horizontal data exchange.

The OPC-UA Working Group pursues two objectives:

1. To enhance the combinability of existing OPC products of different categories (DA, AE, HDA) and
2. to extend the application possibilities and benefits of the individual OPC specifications.

An enhancement of the possibilities of combining different OPC server categories is desirable since all three servers, DA, AE and HDA servers, are to a growing extent used simultaneously in projects today.

The OPC-UA Working Group decided to define a model that combines the various facets of the existing OPC specifications, and to specify a set of services that are executed on a single coherent data model.

These services offer very similar capabilities to the existing OPC DA, AE and HDA interfaces, but in a unified way. The single coherent data model is to allow combining many hierarchical name spaces into a complete information or data pool. In addition, a uniform mechanism is defined to find and connect all data sources, i.e. servers. OPC UA employs the latest Web services (WS) technology, including some of the most

Book Tip: OPC Book – Third Edition

After two editions and having sold over 7,500 copies, OPC - Fundamentals, Implementation and Application, the reference book for developers, students and automation specialists, has become established worldwide as the standard work on OPC. The third, revised edition has been extended by an introduction to Web services and describes the new OPC XML-DA, OPC Complex Data, OPC Command Execution and OPC Unified Architecture specifications. New user reports on the use of OPC in the automotive industry, in building management systems, in the paper industry or in plant control as well as performance examinations of OPC XML-DA applications will motivate even those who have a previous edition to get this revised one.

recent WS standards. Some of these standards, such as the WS-Policy, enable OPC UA clients and servers to negotiate at runtime which protocols and coding are to be supported. This ensures the best possible communication while allowing highest interoperability. OPC UA also uses WS-Eventing to support real call-back functions, as used in COM interfaces, as well as polled refresh, as introduced with XML-DA. To eliminate the performance disadvantage of Web services based communication compared to DCOM, the OPC-UA Working Group defines a binary XML protocol. The protocol will enable OPC UA applications to achieve a DCOM-like throughput performance. Fig. 4 illustrates how the OPC DA, AE, HDA and OPC Commands functionality uses the base services of the OPC Unified Architecture and how these base services at the same time form the foundation for additional functionality required for specific use cases.

OPC UA Specification and Roadmap

The OPC UA Specification comprises 13 parts. Parts 1 to 7 constitute the core specification which defines the address space and the UA services. Parts 8 to 13 define the individual OPC specifications equivalent to the way in which they exist for DCOM. Fig. 5 provides an overview of the contents of the 13 parts of the specification.

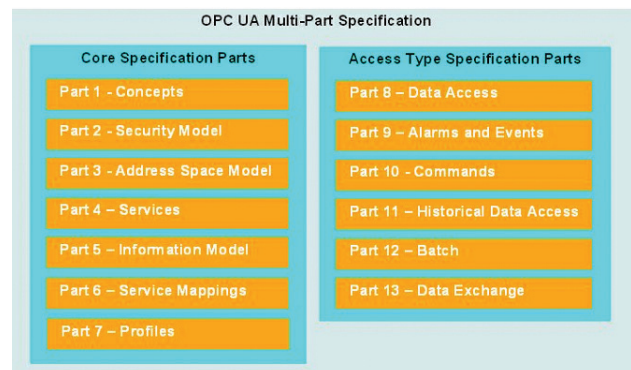


Fig. 5: The OPC UA Specification comprising 13 parts

Part 1 "Concepts" and part 4 "Services" are already available as Release Candidates. The specifications are expected to be completed by the middle of this year. Sample implementations are scheduled for the end of 2006. The first OPC UA products are expected to be available in 2007.

The Road to OPC UA

The success of OPC UA will depend substantially on how the enormous investments in the OPC products that are available today will be protected in future. From the very beginning, the OPC Foundation therefore pursued a migration strategy in the form of UA Wrappers. A UA Wrapper is a kind of shell around an existing DCOM OPC product, permitting communica-

tion with the future OPC UA products. In future, UA Wrappers will allow DCOM OPC clients to access OPC UA servers, and OPC UA clients to work with DCOM OPC servers. The existing OPC products installed in the field today do not require any modifications. Should the manufacturers of OPC products wait until OPC UA has been fully released? OPC's "component" based approach will remain in effect for an indefinite time. Over 7,500 OPC products and many millions of installed systems will continue to be used. To integrate a product in the automation environment via OPC, manufacturers can – or rather will still need to – implement the "classical" DCOM approach during the next two to three years. DCOM based OPC products and Web services based OPC UA products will coexist for the next few years. DCOM based OPC products will continue to be developed for areas near the factory floor. They will be increasingly supplemented (not superseded!) by OPC UA implementations for the embedded area and for the MES and ERP levels. OPC UA Wrappers will allow a smooth and easy combination of the new OPC UA components with the still grow-

ing base of DCOM based OPC products. In this way, the raw data of existing products that have previously been used only within the intranet can be converted into information and made available across firewall boundaries.

Manufacturing companies will continue to use toolkits for implementing OPC components. A decisive criterion for these toolkits will be that their architecture and implementation will have to allow a smooth migration of the developed components to the future Web services based OPC UA world.



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