Free Choice of Platform

The Next OPC Generation

Information

OPC is undoubtedly one of the most successful de-facto standards since the invention of the computer. At a three-day conference the OPC Foundation recently presented the OPC Unified Architecture, which heralds the beginning of a new era in OPC technology. The new specification introduces a service-oriented approach not only to Data Access, but also to Alarms&Events, Historical Data Access and Commands. Among other advantages it allows communication with Linux/Unix systems and embedded controls as well as the implementation of OPC connections over the Internet.

Fit for the future: The OPC Toolbox from Softing will support the new OPC Unified Architecture specification.

Based on the proven properties of the existing OPC technology, the eleven specifications and a wide variety of code samples of the OPC Unified Architecture (UA) expand the interface standard by properties such as platform independence, scalability, high availability and Internet capability. The OPC Foundation thus goes way beyond the previously existing limits for the use of OPC technology.

From Data Access to Unified Architecture

What started ten years ago as an initiative of a handful of companies to simplify data exchange between software applications has evolved into an entire suite of specifications for the interoperable transfer of process data, alarms and events as well as historical information between software components. The OPC Foundation, which was founded in 1996, has over 400 members today. Way over 10,000 OPC products are meanwhile available in the market.

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.

Why is OPC so successful? On the one hand, it is the pragmatic and user-oriented approach to defining the OPC specifications. The focus was on the practically feasible instead of the theoretically desirable. On the other hand, the success of OPC is also due to the rapid increase in the use of Windows PCs and the choice of Microsoft's DCOM as the technological basis for OPC, as DCOM is found on every Windows PC. Exactly this point, however, at the same time raises the majority of criticism regarding OPC: That OPC technology was too focused on Microsoft, platform-dependent and not firewall-capable, and thus not suitable for use in cross-domain scenarios and for the Internet. Besides DCOM's long response times and inaccurate messages for connection interruptions, the need to disable security measures when configuring the DCOM settings is also criticized.

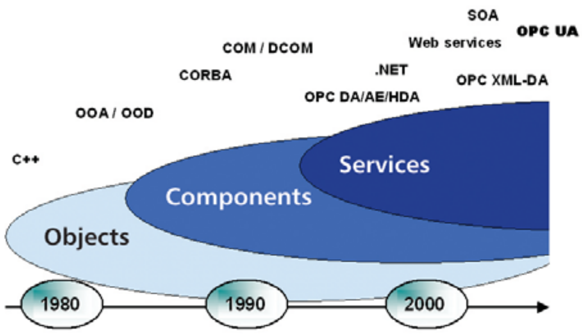
These points of criticism, however, mainly refer to shortcomings of the base technology DCOM. They have been successfully alleviated through workarounds at the OPC application level, e.g. by heartbeat monitoring between OPC client and server, OPC tunneling, etc.

Abstract

With OPC UA the OPC Foundation translates its vision of 'global' interoperability into reality. It offers a uniform, secure and reliable way of providing any authorized person with any desired information anywhere and anytime via applications. This function is independent of the manufacturer and programming language of the applications and of the operating system they run on.

From DCOM to Service Oriented Architecture

Since the standardization of XML in 1998 new Web service technologies have been developed. They include the Web Service Description Language (WSDL), SOAP, an XML protocol for exchanging messages between Web services as well as Universal Description, Discovery and Integration (UDDI) for finding services in distributed systems. In 2002 Microsoft launched its new .NET framework which consistently uses XML, SOAP and Web services. The OPC Foundation also recognized the importance of XML and Web Services early on and adopted it as an opportunity to eliminate the shortcomings of DCOM. Since 2003 the OPC XML-



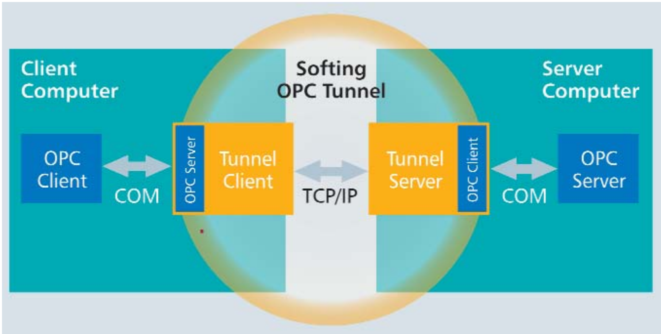
Service makes the difference: After 20 years of object-oriented programming, service-oriented architecture has entered the stage in the past few years. OPC UA now also takes advantage of this new development.

DA specification has offered a first service-oriented architectural approach besides the "classic" DCOM-based OPC technology. This Web services-based concept enables applications to communicate independently of the manufacturer and platform. Today, three years later, the OPC Unified Architecture has introduced a standard which is based on a service-oriented approach not only to Data Access, but also to Alarms&Events, Historical Data Access and Commands. By defining service-oriented and platform-independent OPC specifications, the OPC Foundation has not broken away from Microsoft. It has rather created new, easy possibilities of communicating with Linux/Unix systems or embedded controls on other platforms and for implementing OPC connections over the Internet.
The new possibilities of using OPC components on non-Windows platforms, embedding them in devices or implementing a standardized OPC communication across firewall boundaries allow speaking of a change of paradigms in OPC technology.

Independence of COM/DCOM

OPC UA will not take the place of the OPC specifications that exist today, but supplement them! The installed base of (DCOM) OPC products will continue to exist and the investments made will remain protected. However, OPC UA expands the current OPC technology by significant functional aspects. Based on XML and Web services—and thus independent of Microsoft's COM/DCOM technology—OPC UA allows the secure and reliable transport of raw data and preprocessed information from the factory floor through to the production planning or ERP system. The new specification defines an interoperability platform and unifies the use of different Data Access (DA), Alarms&Events (AE) and Historical Data Access (HDA) servers and clients for vertical and horizontal data exchange. OPC UA servers provide access to current and historical data as well as events, such as alarms, value changes or the result of a program call.

Where previously up to three different OPC servers – DA, AE and HDA – with different semantics used to be necessary to acquire the current value of a temperature sensor, the event of excess temperature and the historical average temperature, only one OPC server, the UA server, will be needed in future.



Alleviating DCOM problems: OPC Tunneling is a proven strategy to avoid DCOM shortcomings in inter-PC OPC communication.

Scalable Security

UA servers can be varied and scaled in their scope of functions, size, performance and the platforms they support. The server properties are specified in a profile and can be queried by the client. For embedded systems with limited memory capacities, slim UA servers with a small set of UA services can be implemented. At the company level, in contrast, where memory resources are not that important, very powerful UA servers can be used with the full functionality.
The data of a UA server can be published in different formats. These can be a binary or XML format, but also the standard format of an organization or manufacturer. A key feature of the OPC UA specification is the definition of the UA security model. The UA Security governs the authentication of clients and servers and ensures data integrity, trustworthiness and authorization within OPC communication relationships. For this purpose, the OPC UA specification uses various Web service standards such as WS-Security, WS-Trust or WS-SecureConversation. Like the scope of functions and the size, the scope of security measures that is to be supported by a UA server is scalable within the UA Security and can be queried by the client via the UA profile. Security rules range from password authentication and the exchange of digital signatures through to full encryption of the OPC messages exchanged.
OPC messages are by default transmitted as SOAP messages, i.e. as XML text, between the UA services. As coding and decoding into the text format takes time and the overhead of textual representation is considerable, the UA specification alternatively

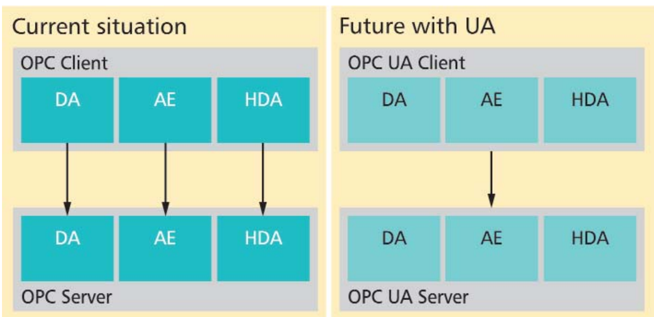
defines a UA binary format for data transfer via TCP/IP. This will enable OPC UA applications to achieve a DCOM-like throughput performance.

DCOM	XML/Web services
Microsoft proprietary	W3C standards
Object orientation/OOA	Service orientation/SOA
Methods and interfaces	Exchange of messages
Tightly coupled applications	Loosely coupled services
Procedure calls	Exchange of documents
Synchronous communication	Asynchronous communication
OPC interfaces	UA services
Platform independence	Cross-platform interoperability
Only within firewall boundaries	Across firewall boundaries

The change from DCOM to XML/Web services as the technological basis opens up a wide range of new application possibilities for OPC.

Easy Introduction and Changeover

To protect the DCOM OPC products developed until today (and yet to be developed in future), the OPC Foundation pursues a migration strategy using UA 'wrappers.' A UA wrapper is a kind of shell around an existing DCOM OPC product, permitting communication with the future OPC UA products. It will allow DCOM OPC clients to access OPC UA servers, and OPC UA clients to work with DCOM OPC servers. The existing OPC products thus do not have to be modified. The 'classical' DCOM concept is expected to keep dominating the installed base for the next two to three years, however. DCOM OPC products will continue to be developed for areas near the factory floor also in future, but will be increasingly supplemented (not replaced) by OPC UA implementations for the embedded area and for the MES and ERP levels. OPC companies like Softing develop UA wrapper components that allow a smooth and easy combination of the new OPC UA clients and servers with the still growing installed base of DCOM OPC products.



One address space is sufficient: OPC UA unifies and simplifies access to process data, events and historical data.

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. The OPC Toolbox from Softing, for example, 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 servers developed on the basis of the OPC Toolbox and running under Linux and other embedded operating systems demonstrate that Web services-based OPC technology is Windows-independent. OPC developments based on the Softing DCOM Toolkits today can be extended by XML-DA and, from 2007, by OPC UA within half a day. From January 2007, Softing will offer training courses dedicated to OPC UA. In addition OPC product developers can consult with Softing experts about how to expand an existing DCOM OPC product to an OPC UA client or server and how to create a completely new OPC UA component.

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www.iee-online.de
- Link to the OPC Competence Center at Softing
- Link to Softing OPC UA Roadmap
- Link to Softing OPC Toolbox