

OPC overcomes communication barriers

Convenient access from embedded platforms to S7 and S5 controllers

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OPC stands for "Openness, Productivity & Collaboration". It is a standard which bridges the communication gaps between software applications and devices from different manufacturers. Today, OPC has been adopted by practically all fields and branches of industry. Ten years after the first specification, OPC is one of the most successful industry standards, with several thousands products and millions of installations worldwide.



Figur 1: OPC can be used to conveniently access S7 and S5 controllers

All commercially available SCADA systems, process control systems and PC-based controllers now offer an open OPC client interface for access to any OPC server. Data is generally exchanged with the process environment (I/O devices, measurement devices, controllers such as the Simatic S7 and S5) via OPC servers. The great success of OPC in automation is demonstrated by the fact that there are more than ten OPC servers on the market from different manufacturers for handling a single task: accessing Simatic PLCs. With DCOM (Distributed Component Object Model) as its technological basis, however, OPC is restricted to use with the Windows operating system. But at the same time, Microsoft's DCOM has contributed to the success of OPC. On the one hand, the rapid acceptance of Windows PCs as automation components allowed OPC technology to become established around the world within just a few years. On the other hand, the increased use of OPC, the new

areas of application which are opening up and the general trend towards Web technologies are placing entirely new demands on OPC. With Microsoft's DCOM as its basis, however, it is not possible to use OPC for communication outside firewalls (for remote maintenance, for example) or on non-Windows platforms (for implementing Unix-based ERP systems or Linux-based software, for instance). This means that it has been impossible to conveniently access data in Simatic controllers from OPC applications under Linux.

### *Platform independence*

Web services, XML (Extensible Markup Language) and HTTP open up entirely new possibilities for OPC. With the OPC XML DA specification, the OPC Foundation is using Web services and XML as the new technological foundation for open OPC communication between applications from different manufacturers using various protocols (fieldbuses, serial, etc.) on different platforms. Web services can be created on any platform with any programming tools. XML is a widespread, flexible and extensible descriptive language which – like the HTTP transport protocol – is supported by practically all platforms. OPC XML DA clients and servers can therefore be used on Windows, Unix or Linux, as well as on all other platforms which allow Web services to be implemented. OPC communication can take place through the exchange of XML messages via the "Simple Object Access Protocol" within an intranet, or even beyond the bounds of firewalls on the Internet. Platform independence and the ability to access OPC components beyond firewalls have therefore become a reality. A new era has begun in which thousands of OPC DA servers will gradually migrate to OPC XML DA servers to enable cross-platform interoperability. OPC will be implemented on entirely new types of devices which do not run the Windows operating system. OPC products will soon be available for embedded devices, as well as for business software, sensors, input/output and handheld devices, controllers and ERP, MES and PPS systems.

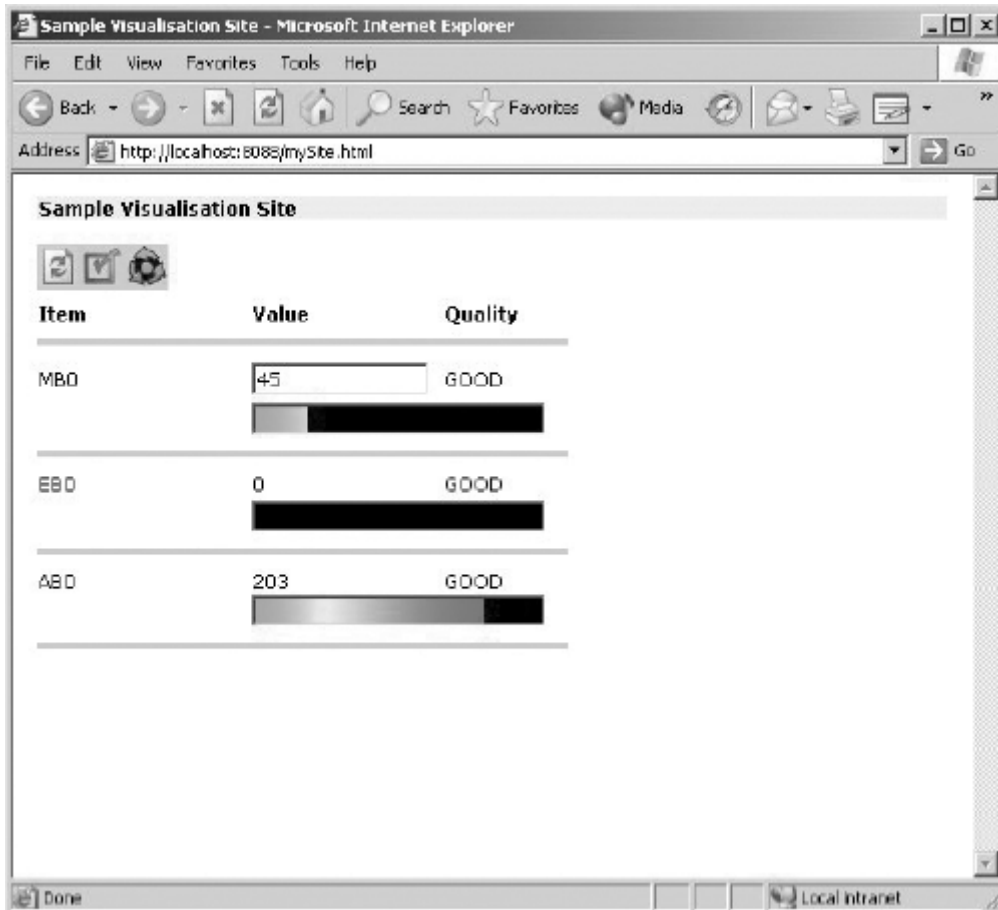
### *Convenient data access*

One example of an OPC server which supports both DCOM (Data Access) and Web services (XML DA) is the S7/S5 OPC server from Softing AG in Munich. The S7/S5 OPC server gives any OPC client applications fast and convenient access to data in controllers from the Simatic S7 and S5 series. Ethernet, Profibus or serial communication – with or without a modem – can be used for accessing the controllers. The NETLink Pro Ethernet/MPI gateway is a very practical and economical interface to S7 controllers. The OPC server can communicate with a maximum of 16 controllers at the same time via a standard PC Ethernet card. The gateway is simply connected to the controller's MPI interface and installed in a switch cabinet next to the controller using a top-hat rail. I/O data, flags, timers, counters, etc. in up to 256 controllers can be read or described at the same time by means of familiar Step7 semantics. The OPC server also offers alias functions. OPC items can be imported to the OPC DA namespace not only from Step7 projects, but also from text or Excel files. OPC items themselves can be named, copied and simply structured in this way. It takes less than 30 seconds to install the OPC server, and the computer does not need to be restarted afterwards. A convenient configurator establishes the connections in a short amount of time. This configurator also offers the option of automatically displaying all accessible S7 controllers in a network. The OPC server includes an integrated Web server for server diagnostics and for displaying the server's own Web sites with any standard browser. The Web server can also be used to activate traces, request status information or open the German

and English online help over the Internet under password protection. Process data can also be requested via placeholder variables in the HTML of the server's own Web site to create a small Web-based visualization. During operations, all communication lines are continually monitored by the system to guarantee secure data transmission. For safety-relevant projects, the OPC server supports the use of two redundant Ethernet lines. The intelligent grouping of read and write tasks optimizes data throughput. Extensive comparative tests have proven this. By implementing DCOM-based Data Access and Web-service-based XML DA in a single product, the functions mentioned here can be made available on Windows, Linux and other platforms.



*Figur 2: With the Ethernet/MPI gateway, the OPC server can access up to 16 S7 PLCs at the same time.*



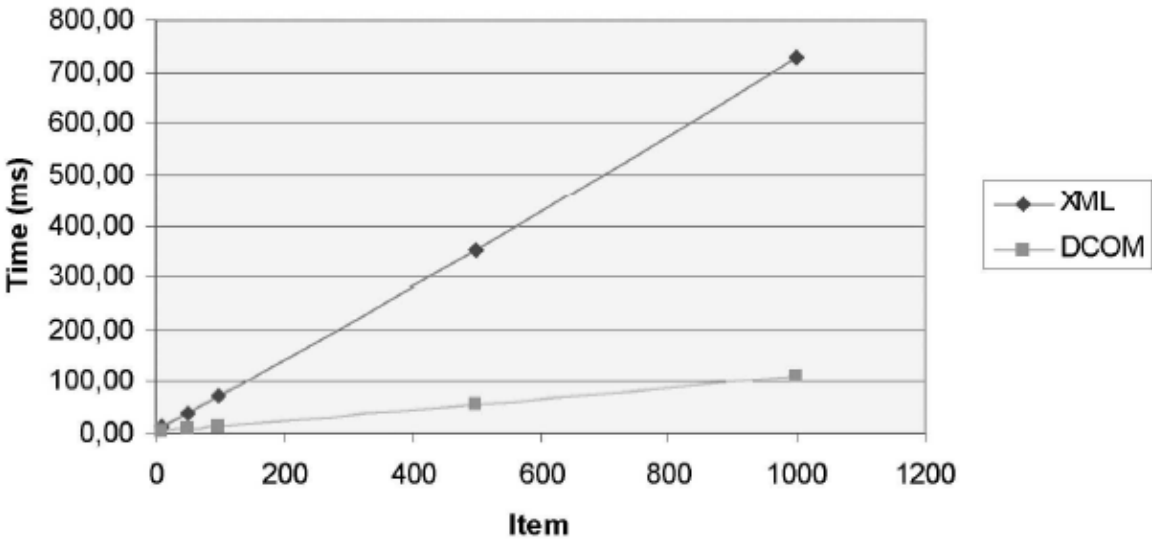
Figur 3: Visualization via integrated Web server.

### *Performance is reduced*

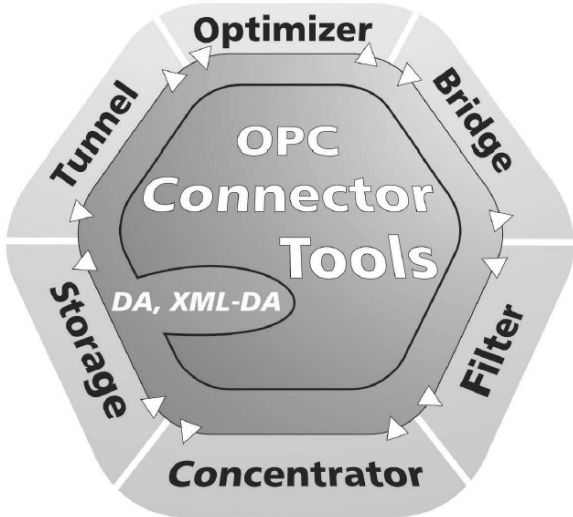
The main advantage offered by the OPC interface is independence from specific manufacturers, products and hardware. The technology enables a clear distinction between client and server applications, encapsulates manufacturer-specific product features and makes it possible to easily upgrade to a new version or switch to a different product. Platform independence is yet another advantage. This opens up the possibility of open OPC communication between components on different operating systems and over the Internet. However, the description of OPC data and methods in XML and the loose connection between the XML DA server and XML DA client leads to a fairly considerable reduction in performance. A performance test provided a rough depiction of the difference between a DCOM DA and an XML DA communication connection (Figur 4). Computers with Intel processors and the Windows and Linux operating systems were used for the test. A computer with a PowerPC 855T (Motorola), 50 MHz and Linux was also used. The client and server computers were on the intranet for most measurements. For one measurement, the computers were connected over the Internet. Items with the VT\_UI4 data type were read. The server and client ran on different computers with the Windows operating system. The client was implemented in .NET. The server was programmed in C++ using an OPC toolkit. Exchanging data via OPC XML DA was six times slower than exchanging data with OPC DCOM DA. The values, however – for example, 730 ms for reading 1000 pieces of UI\_4 data – are certainly acceptable for many applications, such as displaying trends or connecting to an ERP system. The great advantage of platform independence is therefore countered by the disadvantage of a loss in performance. The dual implementation of DCOM DA and XML DA in a single

OPC server can give the user the flexibility to choose the appropriate form of OPC communication for the respective scenario. DCOM DA to XML DA converters – so-called OPC connector tools – are available for projects in which standard DCOM clients (e.g. SCADA systems) must access Linux-based XML DA servers. These tools connect OPC products which have implemented different specifications (OPC DA, XML DA, Unified Architecture), but they also make it possible to filter OPC data and optimize OPC communication. OPC Unified Architecture is a new concept from the OPC Foundation which defines a set of Web services known as UA services. The goal of OPC UA is to create an interoperability framework which adopts the existing OPC object models of DA, AE and HDA and provides a uniform UA namespace.

### XML vs. DCOM



Figur 4: Results of the measurement with the OPC XML DA server on Windows and Linux platforms.



Figur 5: OPC connector tools allow DCOM DA and XML DA components to be connected.

## *Summary*

OPC already offers tremendous advantages for automation projects. OPC XML DA has given rise to entirely new areas of application. Specifically, XML DA offers the advantage of cross-platform OPC communication. The dual implementation of DCOM DA and XML DA in a single OPC server gives the user additional freedom in planning automation tasks. OPC made the leap to Web technologies long ago. Now it is making inroads into new applications and branches of industry.