Press Release

Unified Automation

Product Announcement: High Performance OPC UA SDK

With the new High Performance OPC UA SDK, Unified Automation GmbH is taking OPC UA to the next level. This gives a major push in enabling the Internet of Things and Industry 4.0.

Schwabach, February 23, 2015. As the leading supplier in OPC UA Technology we have analyzed the issues and bottlenecks of today's OPC UA implementations. We came to the conclusion that only a complete redesign can solve the issues to improve the performance, improve the scalability, and increase the security of OPC UA. This makes OPC UA usable in smallest devices and thus "IoT Ready", and furthermore guarantees improved performance for high end servers which must be able to handle thousands of connections in parallel.

With a new software architecture and new implementation from scratch we have achieved all these goals. Of course, the new implementation is still wire-compatible with the original OPC Foundation Stacks.

Key Features
• Superior Performance
• Improved Security
• Scalable
• Small Footprint
• Portable ANSI C Code
• Asynchronous Network API
• Parallelism
• High Quality

Parallelism Revisited

One problem of many network applications is bad multi-threaded design. Too many threads are created without a clear concept, which lead to enormous waste of resources, bad performance due to locking problems, and trashed CPU caches. Some implementations even create one thread per

connection, which is the worst design in a sense of scalability.

With the new SDK, we have designed a set of OPC UA components which can work in parallel, independently of each other, and thus achieve superior performance on multi-core CPUs without interference. In addition, this architecture allows to drive the components from a single threaded main loop in smallest micro controllers.
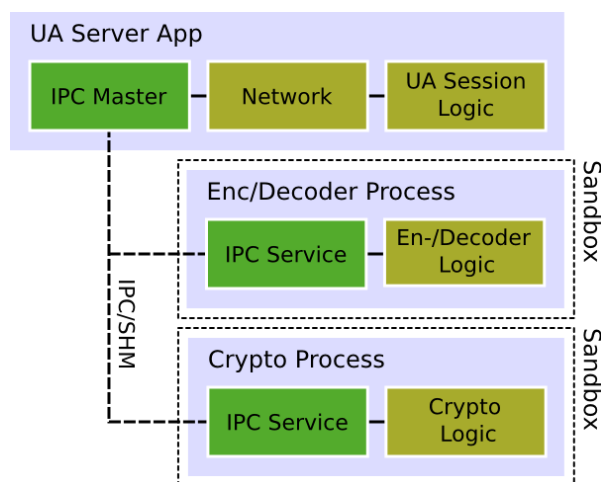
Sandboxing

The component design allows to run components like the network encoder/decoder in a separate process. This not only can improve performance, it also allows to benefit from sandboxing mechanisms like Linux Secure Computing Mode. This allows to disable any operating system calls for this process. In the case of a bug which could lead to an exploit, the process is terminated by the OS as soon as an attacker tries to access a forbidden operating system function. The master process detects this and can restart the terminated process.

Asynchronous Network API

The new OPC UA implementation is based on a completely asynchronous network API as an OS abstraction layer. The different network backends allow to benefit from modern OS specific APIs like POSIX AIO, Linux epoll, BSD kqueue or Windows Completion Port APIs. These APIs don't suffer from scalability problems like the ancient Berkeley Socket APIs and are the enabler for high performance server applications. The usage of these APIs allows to reduce the number of context switches and copy operations which improves the performance when scaling to thousands of connections.

With this new API we also have introduced solutions for non-blocking domain name resolution, which we have identified as a big design problem in today's implementations.

Asynchronous Crypto and PKI APIs

As with network APIs, today's crypto implementations suffer from synchronous blocking implementations. Our new OPC UA implementation is designed completely asynchronously to solve

this issue. Two different backends are supported out of the box: OpenSSL and PolarSSL. More backends can be added over time. This concept also allows to add hardware accelerated cryptography. The asynchronous design now allows to delegate an encryption job to a hardware chip, continue OPC UA communications and later on process the result of the hardware encryption, even in a single-threaded environment.

Improved performance
As one of the biggest performance bottle-necks we have identified the encoder/decoder component of today's ANSI C based OPC UA implementation. Even though it is faster than JAVA and C# based stacks, the whole potential was not reached. With a complete redesign of the encoding procedure we could gain a performance boost by a factor of 10 for the encoding process. This can lead to an overall performance boost of the OPC UA protocol up to a factor of 4, depending on the type of data transferred.

Small footprint
During the whole design process we kept a focus on small footprint to make the software usable for embedded devices. A modular concept, configurable memory pools, and efficient implementation make it perfectly suitable for smallest devices and for Internet of Things (IoT). On an ARM based demonstration device running Euros Real Time Operating system we were able to integrate an OPC UA server in 300K Codesize including the Operating System.
A new table based address space concept allows to integrate huge address spaces with a fraction of the memory required in other SDKs. It also supports read only address space models that completely reside in ROM.

Software Quality
To ensure the best quality from the beginning, we developed a comprehensive test environment. Using this toolset, we are already able to achieve 98% line coverage and 95% branch coverage.

Outlook
The planned release date for the SDK is September 2015.

About Unified Automation
As a leading OPC UA software provider, Unified Automation offers OPC UA products, cross platform toolkits and development frameworks in different programming languages. The targeted market of OPC UA enabled products ranges from embedded device manufacturers up to enterprise application developers. Unified Automation sees itself as technology and software provider in the field of OPC based communication. The software development kits (SDKs) form the base of OPC UA products of nearly all large and small automation vendors worldwide.

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