Unified Automation

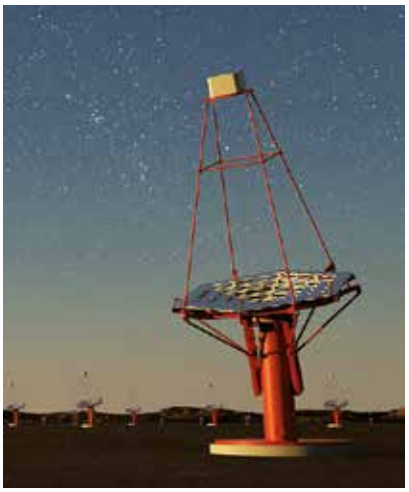
Case Study March 2013

OPC UA controls the Window to the Universe

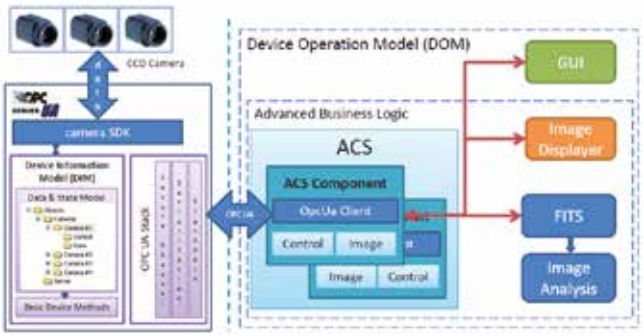
German Electron Synchrotron DESY intends using OPC UA for worldwide control of telescopes

Background

Various kinds of particle from the cosmos constantly reach the Earth – particles that can provide insights into events happening in the depths of the universe. Amongst others therefore high-energy gamma rays are used to uncover the secrets of stellar explosions, cosmic particle accelerators – such as the surroundings of black holes – or dark matter. The telescopes consist of huge systems of mirrors that focus the atmospheric light from these air showers onto fast cameras capable of resolving events on the scale of billionths of a second. Telescopes of this type are built on high mountains, as far as possible from sources of light that would interfere with the results, for example on La Palma in the Atlantic Ocean (MAGIC) or in Namibia (H.E.S.S.). To achieve a tenfold increase in gamma-ray sensitivity over a wide energy range requires more than 50 telescopes with diameters of between 4 and 23 meters arranged over an area of at least one square kilometer. The gamma-ray telescope CTA (Cherenkov Telescope Array) is to be constructed by an international consortium in order to look for cosmic high-energy accelerators with previously unavailable sensitivity. DESY physicists are participating in optimization calculations, the design of the gigantic reflecting telescopes and the conception of an operations and data center as part of the prototype study for CTA.



Challenge



The operations and data center coordinates the use of the telescope array. Research teams form different countries can request data recording of a certain sky sector in a predefined time period. These requests are sorted, scheduled and executed and the data is recorded, analyzed and compressed. The control, the synchronous positioning and movement, of all telescopes within the array is essential for the quality of the recorded data.

Each telescope has a local control and motion system in order to shift in vertical and horizontal direction; depending on the size up to 60 tons need to be moved.

Various control and operating systems of different manufacturers are used and special requirements for the communication between controller software and coordination operation center were defined.

When searching for a flexible, extendable solution that can be integrated in existing systems and that is available in upcoming equipment, DESY evaluated available bus systems and protocols.

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Solution

The communication solution should be Ethernet based and must follow an international, vendor neutral, available standard. Data transfer must be secured, authenticated and encrypted because control of telescopes on other locations and long distances should be possible. With OPC Unified Architecture the new industry standard was chosen which met all requirements for a platform independent, multi-vendor, secure communication infrastructure. The software in the operation and control center is running on Linux operating system. Here the OPC UA Clients were integrated to send the control signals to the telescopes and to get feedback and display position and status information. On the server side hardware is preferred that already comes with integrated OPC UA functionality. But if not available in the device, the SDK from Unified Automation is used to develop and integrate an OPC UA Server interface into the equipment.

OPC Unified Architecture

- IEC 62541
- platform independent
- scalable
- secure
- robust
- redundant

Used Products of Unified Automation

OPC UA Software Development Kit

- Java based Client/Server
- C++ based Client/Server

DESY developers have used the **JAVA based** as well as the **C++ based OPC UA SDK/Toolkit** to implement portable OPC UA Server and Clients. Both editions contain common base library that encapsulates the respective OPC UA Stack behind a comfortable interface. Therefore it provides a heavily simplified implementation and efficient integration into existing applications. Besides the simplification of the UA Stack API, the SDK implements common UA functionality, that is required in all UA applications, utility and helper classes, implementation of the security handling and the SDK shows with example code the most common use cases.

The SDK is completed by a tool for graphical modeling of address space and which can directly generate the related source code.

About DESY

The research center's first outing on the international stage came in 1966, with precision measurements carried out using the first particle accelerator in Hamburg: the "Deutsches Elektronen-Synchrotron", or DESY for short, the facility after which the research center is named. DESY is a cornerstone of theoretical particle physics in Europe and worldwide. The DESY theory groups in Hamburg and Zeuthen study the underlying principles that explain the world of elementary particles and its physical laws.Major focus of research at the Zeuthen location is the field of astroparticle physics. Therefore the DESY scientists are participating in IceCube, a neutrino telescope at the South Pole and the gamma-ray telescopes Fermi, H.E.S.S., MAGIC and VERITAS, as well as in development work associated with the planned CTA.

About Unified Automation

As a leading supplier of OPC UA software Unified Automation provides UA-enabled products, cross- platform toolkits and development-frameworks in different programming languages (ANSI C, C++, JAVA and C# .NET) and for different platforms (Windows, Linux, VxWorks, QNX, RTOS, and many embedded OS).
The target market of OPC UA products starts from manufacturers of embedded devices up to developers of enterprise applications. Unified Automation sees itself as technology and software provider in the field if OPC based communication.
The software development kits (SDK) form the base of OPC UA products of nearly all large and small automation vendors world wide.

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