Unified Automation

Case Study March 2015

OPC UA Used in DBMAS System of DB Netz AG

Standardized Communication Structures in Detection Systems of the Deutsche Bahn

voestalpine
ONE STEP AHEAD.

Background

The system DBMAS (DB-Meldeanlagensystem) is a new standardized solution for remotely controlling and monitoring alarm systems and further operationally relevant infrastructural facilities which has been called for tenders by DB AG in 2009. Facilities to be connected include amongst others hot box detection systems in the track area, wind sensor systems on bridges and dams, and safety devices of railway tunnels.

The focus in the design of DBMAS is on the standardization of communication interfaces. Hence, the telecontrol protocol IEC 60870-101/104 has been defined to be the mandatory interface from the DBMAS control center to connected devices, the so-called field level. For all other system interfaces, a disclosure of the protocol is required.

The company SST (Signal & System Technik), which meanwhile changed its name to voestalpine SIGNALING Siershahn GmbH, has been awarded the contract for the implementation of DBMAS.

Challenges

DBMAS was supposed to be implemented based on the already existing product CMS (Central Monitoring System) of the company SST. CMS is a platform independent system which is due to its modularity very flexibly scalable and brings together information from different railway and vehicle diagnostic systems. In particular, the existing client-server communication, which was based on a proprietary protocol, had to be migrated to a standardized communication structure meeting, amongst others, the following requirements:

The communication had to be IP-based, and the protocol had to operate effectively at low bandwidths (in part less than 64 kbit/s) as well. Encrypted transmission should be principally possible. Furthermore, it should be possible to model and transfer respectively the complex information structures of the system. As the transmitted information is at least in parts relevant to security and a very prompt reaction of the operator is required, a quasi-real-time communication had to be possible. In addition to that, the protocol should preferably be standardized in the sense of a norm. For being able to integrate the protocol into existing software solutions, it should be possible to implement the interfaces in C++.

Solution

SST had already gained first, good experience with the at that time still very new standard OPC UA for standardizing the communication of train diagnostic systems. Thus, OPC UA was the prime candidate for the client-server communication in DBMAS.

DB MAS

After evaluating further options and a proof-of-concept using a test implementation, SST and DB Netz AG made a joint decision to use OPC UA for implementing the client-server communication in DBMAS, because OPC UA met all requirements. An OPC UA information model has been developed, which was able to reproduce the complex data structures of divers diagnostic information. The data are highly efficiently transmitted via UA TCP binary protocol; even in networks with lower bandwidth it is possible to achieve excellent reaction times by using the OPC UA Subscription mechanism.

Unified Automation GmbH
O'Brien Str. 2 • 91126 Schwabach • Germany
Tel: +49 911 495 25000 • Fax: +49 911 495 25009
info@unifiedautomation.com • www.unifiedautomation.com

Unified Automation

OPC UA Background

The OPC UA Specification defines a service-oriented architecture (SOA), which is platform independent and functionally combines "classic" OPC functionalities like Data Access and Alarms & Events, as well as Historical Data Access. The OPC UA communication stacks are implemented in ANSI C/C++, Java, and .NET and form the basic protocols for TCP/IP based network communication. In addition, signing and encryption of messages as well as authentication and authorization via X.509 certificates are already part of the standard.
The most characteristic feature of OPC UA is that there are extensive possibilities of information modeling. Information units (nodes) and their relations among each other (references) follow an object-oriented design paradigm. Thus, each kind of data itself, as well as its meta information, can be semantically described and generically mapped.

OPC Unified Architecture:

platform independent,
scalable, robust, secure,
flexible object-oriented modeling,
IEC 62541 standardized

Used Products of Unified Automation

Products used by voestalpine SIGNALING Siershahn:

- C++ based OPC UA SDK
- UaModeler
- UaExpert

For a simple transmission of status information inside of DBMAS, only the "Data Access" part of OPC UA has been used. Here, the client subscribes to status information which is only reported on data change. Thus, network load is reduced at low bandwidths. To generate user defined messages, the OPC UA Condition framework has been used intensively. For this, a new information model has been designed in "UaModeler" and new, own alarm types including the corresponding conditions and subconditions have been generated. The "C++ based OPC UA Client Server SDK Bundle" provides the toolkit that contains all OPC UA specific implementations and which is able to easily integrate information created using UaModeler. Thus, it is possible to develop OPC UA servers and clients in a very low expenditure of time. "UaExpert", a free of charge generic reference client, has been used as testing tool. Using its plug-in concept, UaExpert provides data and alarm views to arbitrary information models.

About DB AG and voestalpine SIGNALING Siershahn GmbH

The Deutsche Bahn AG is a transportation company with headquarters in Berlin, consisting of more than 1000 subsidiary companies. The most well-known subsidiaries in the field of railway traffic are DB Regio (short-distance traffic), DB Fernverkehr (long-distance traffic), and DB Schenker (rail freight service). DB Netz AG with headquarters in Frankfurt is the railway infrastructure company of Deutsche Bahn and operates Europe's largest rail network, which is about 33,000 km long.
Voestalpine SIGNALING Siershahn GmbH (formerly SST GmbH) is, being a system supplier and service provider, a competent partner of railway companies and specialized in operational reliability and maintenance. The core areas of expertise are in the development of railway and vehicle diagnostic systems for railway transportation as well as control rooms and linked telecommunication networks.

voestalpine
ONE STEP AHEAD.

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 operating systems). The target market of OPC UA products ranges from manufacturers of embedded devices to developers of enterprise applications.
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.

Unified Automation GmbH
O'Brien Str. 2 • 91126 Schwabach • Germany
Tel: +49 911 495 25000 • Fax: +49 911 495 25009
info@unifiedautomation.com • www.unifiedautomation.com