Success Story

Branch
Infrastructure

V1.0-en

OPC
FOUNDATION
®

WWW.OPCFOUNDATION.ORG

OPC-UA Used in DBMAS System of DB Netz AG

Standardized Communication Structures in Detection Systems of Deutsche Bahn

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.

Requirements

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++.

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.

Solution

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.

Products used by voestalpine SIGNALING Siershahn

Unified Automation

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

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.

Used Products of Unified Automation

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.
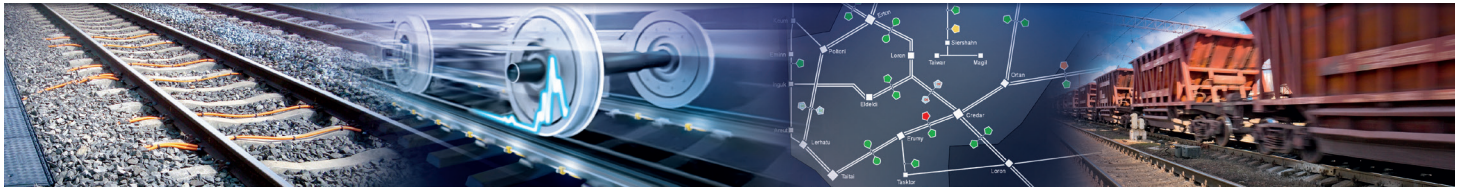
About Unified Automation

www.unifiedautomation.com

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.

About voestalpine SIGNALING Siershahn

www.sst.ag

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.

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. (fahrweg.dbnetze.com)

About OPC Unified Architecture (OPC UA)

OPC UA is the interoperability standard for multi-vendor, multi-platform data exchange that is secure and reliable from small sensors up to IT Enterprise level systems. This technology provides open connectivity across multiple products, regardless of hardware platform or software operating system. OPC UA (the IEC 62541 standard) includes automated discovery, security by design, data encryption, and exceptionally powerful information modeling.