OPC UA and AutomationML – collaboration partners for one common goal: Industry 4.0

Miriam Schleipen
Fraunhofer IOSB
Fraunhoferstr. 1,
76131 Karlsruhe, Germany
miriam.schleipen@iosb.fraunhofer.de

Robert Henßen
Fraunhofer IOSB
Fraunhoferstr. 1,
76131 Karlsruhe, Germany
robert.henssen@iosb.fraunhofer.de

Matthias Damm
ascolab GmbH
Am Weichselgarten 7,
91058 Erlangen, Germany
matthias.damm@ascolab.com

Arndt Lüder
Otto-von-Guericke-Universität
Universitätsplatz 2,
39106 Magdeburg, Germany
arndt.lueder@ovgu.de

Nicole Schmidt
Otto-von-Guericke-Universität
Universitätsplatz 2,
39106 Magdeburg, Germany
nicole.Schmidt@ovgu.de

Olaf Sauer
Fraunhofer IOSB
Fraunhoferstr. 1,
76131 Karlsruhe, Germany
olaf.sauer@iosb.fraunhofer.de

Stefan Hoppe
OPC Foundation
Eiserstrasse 5,
33415 Verl, Germany
stefan.hoppe@opcfoundation.org

Abstract

OPC UA (OPC Unified Architecture) is a platform-independent standard series (IEC 62541) [1] for communication of industrial automation devices and systems. AutomationML (Automation Markup Language) is an upcoming open standard series (IEC 62714) [2] for describing production plants or plant components. The usage of both standards in combination and collaboration can create synergy and will lead to a wider acceptance and usability of both standards. Especially for Industry 4.0 both are enabling technologies and a combination of them is very promising. A joint working group of the AutomationML e.V. and the OPC Foundation deals with this topic since the beginning of 2014.

1. Introduction

The OPC Unified Architecture is an advanced communication technology for process control. It is a standard for industrial communication and data exchange in the production. It is used for machine-to-machine communication and is based on a service-oriented architecture (SOA). OPC-UA is successor of the classic OPC which today is often used today in the production. It provides the possibility to define information models on which the implementation of OPC UA servers could then be based. Certainly the launching costs for an initial sometimes proprietary information model are quite high. Therefore OPC UA allows defining common information models – so called companion specification. These models are available to the public and allow the reuse of the concepts predefined within. Examples for existing information models are Device Integration (DI), PLCOpen, or ISA 95. OPC UA can be compared to a worker (see Figure 1) dealing with the tools from the toolbox, e.g. AutomationML (see Figure 2).

AutomationML aims at being an integrated solution for a user-independent data exchange. The goal of the standard is an open data format which bridges the gap between planning tools of the Digital Factory and automation engineering [3]. AutomationML can be the base for a consistent data and information usage during all planning phases.

Figure 1. OPC UA as worker [IOSB].

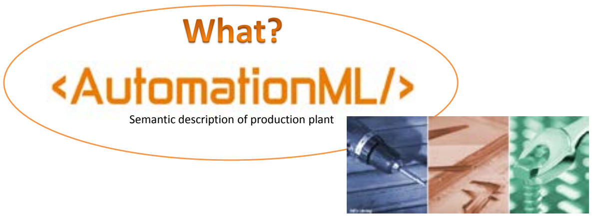

Figure2. AutomationML as toolbox [IOSB].

The joint working group tries to bring the engineering format AutomationML in contact to online production data and extends the application domain of OPC UA. Current members are coming from the industrial as well as the research domain (see Figure 3).

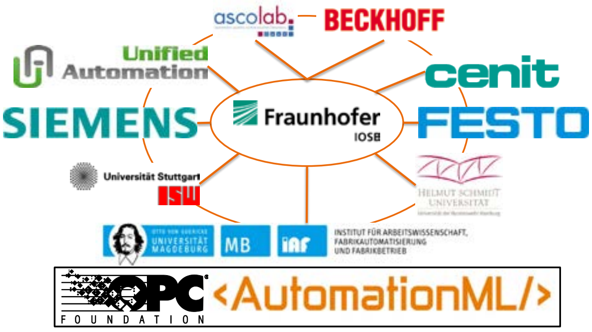

Figure 3. Current partners of the work group [IOSB].

Different use cases which will be possible by the combination of both standards were identified and are in work right now by the joint working group.

One opportunity by combining AutomationML and OPC UA is to communicate and operationalize AutomationML by means of OPC UA. OPC UA server includes an information model that allows users to organize data and their semantics in a structured manner. The information model constitutes the address spaces of OPC UA servers. It is a full-mesh network of nodes with their properties and relations. It is possible to simplify the creation of OPC UA information models based on existing AutomationML data. This can be realized by a so called OPC UA companion specification due to analogies between AutomationML and the OPC UA information model. The companion specification for AutomationML consists of an object model including many specific semantics which can be used online with multiple involved parties/disciplines/tools by OPC UA. This makes an online version of the AutomationML model possible - AutomationML models can be exchanged via OPC UA – and includes OPC UA data management, online communication functionality, multi-user support, access methods, security, etc. This is especially important for re-engineering and maintenance use cases were the AutomationML model evolves over time. The present AutomationML model can be managed by OPC UA and makes an up-to-date description of the system as-is possible.

One other opportunity is the lossless exchange of OPC UA system configuration within AutomationML models. The manual exchange of OPC UA server configuration data will be replaced by standardized/specified description in AutomationML. Parameters to set up OPC UA communication between tools can be exchange using AutomationML. This realizes consistent data, produces less errors and results in an easier and faster configuration of UA servers and clients. OPC UA can benefit from the description of complete communication network configuration and structure including communication components of sensors and actuators with respect to communication system parameters, network structure and wiring, quality of service, etc.

2. Companion specification

The companion specification defines in detail which elements (nodes) are necessary provide entry points to the model which are feasible for both AutomationML and OPC UA users. It explains the different ‘nodesets’ necessary to organize the OPC UA information model (e.g. standard types, AML organizational elements, AML standard libraries, and the actual AML example/file). Furthermore it describes how AutomationML models are transformed to OPC UA information models (for details see [4]). This includes the handling of elements, attributes, constraints, attribute types, etc.

3. Summary and Outlook

The transformation of AutomationML models coming from research brought up promising results. At present the formulated transformation rules are evaluated against examples from industry. Furthermore, effort is done to write the textual companion specification. The actual status of the working group's results can be found via the AutomationML web site or on http://www.iosb.fraunhofer.de/?opcuaaml.

Acknowledgments

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