



Contents lists available at ScienceDirect

Manufacturing Letters

journal homepage: www.elsevier.com/locate/mfglet

Letters

Model-based development and application generation for the batch process industry

Wilfried Lepuschitz^{a,*}, Alvaro Lobato-Jimenez^a, Andreas Grün^b, Timon Höbert^a, Munir Merdan^a^a Practical Robotics Institute Austria, Wexstrasse 19–23, 1200 Vienna, Austria^b Ing. Punzenberger COPA-DATA GmbH, Karolingerstrasse 7B, 5020 Salzburg, Austria

ARTICLE INFO

Article history:

Received 31 October 2017

Received in revised form 22 December 2017

Accepted 22 December 2017

Available online xxxx

Keywords:

Batch process

Ontology

Model-based development

Automated generation

SCADA

ABSTRACT

In the context of required flexibility for production systems due to dynamic product life cycles and market demands, the application of semantic technologies is regarded as a beneficial approach. This paper describes the development workflow of an ontology-based model for representing concepts of the batch process domain towards the automated generation of an application in an industrial supervisory control and data acquisition (SCADA) system. The presented approach shows the feasibility of model-based development for industrial practice by integrating the ontology in an SQL database, which is accessible for the utilized industrial SCADA software.

© 2017 Society of Manufacturing Engineers (SME). Published by Elsevier Ltd. All rights reserved.

1. Introduction

The food and beverage industry represents nowadays a dynamic domain requiring flexible production systems. However, most applied software solutions acquire data from the production floor, which results in various information flows and processes limiting the system flexibility. Suitable mechanisms need to be incorporated for supporting the interoperability between software applications but also meaningful information has to be inferred from the data [1]. In this context the approach of model-driven development is regarded as a promising methodology for designing control applications for such systems [2,3]. Using such model-based engineering concepts is part of the evolution in regard to cyber-physical systems [4] or Industry 4.0 [5]. For instance semantic models in the form of an ontology can provide knowledge in machine-readable form, which allows knowledge sharing and usage of the models for advanced system integration paradigms [6]. A multitude of ontologies is reported in literature for describing concepts of production systems of various domains [7]. E.g. OntoCAPE represents a very extensive example of an ontology in the process domain meant for computer-aided process engineering [8]. A further example is BaPrOn, an ontology that encompasses ANSI/ISA-88 concepts (see Section 2) for batch process scheduling [9]. The potential benefits of such approaches have

been presented oftentimes but nevertheless their industrial adoption is still in an early stage.

This paper describes the development workflow of an ontology for representing concepts of the batch process domain towards the automated generation of an application in an industrial supervisory control and data acquisition (SCADA) system, i.e. zenon by COPA-DATA [10]. As model-based development is still not widespread in daily practice in the industry, the presented approach shall prove its feasibility by integrating the knowledge model in an SQL database that is accessible for the industrial SCADA software. An important asset of the ontology is the consideration of important industrial standards and thus its increased data integration aptitude. The following sections described the considered industrial standards, the development workflow and finally a conclusion.

2. Relevant industrial standards

The following standards are identified as significant for the ontology development in order to represent the concepts of the batch process domain:

- IEC 61512 (respectively ANSI/ISA-88) Batch Control [11]: This standard constitutes a framework encompassing a set of reference models, structures and definitions for the specification of concepts and requirements in batch automation and the corresponding control software. An XML implementation denoted as

* Corresponding author.

E-mail address: lepuschitz@pria.at (W. Lepuschitz).

BatchML [12] exists that implements the models and terminology using the XML Schema language (XSD) within a set of XML schemes.

- IEC 62264 (respectively ANSI/ISA-95) Enterprise-Control System Integration [13]: This standard constitutes an information exchange framework incorporating hierarchical models and terminology for higher levels than in IEC 61512 for the purpose of the integration and inter-operation of enterprise and control systems. An XML implementation denoted as (B2MML) [14] exists that implements the data models also using the XML Schema language (XSD).

- ISO 15926 Industrial automation systems and integration – Integration of life-cycle data for process plants including oil and gas production facilities [15]: This standard provides the classification of data and information, reference data for plants or facilities, an information exchange format as well as query and transfer protocols for the process domain.

The combination of these industrial standards provides a multitude of aspects in regard of data integration and interoperability in the domain context.

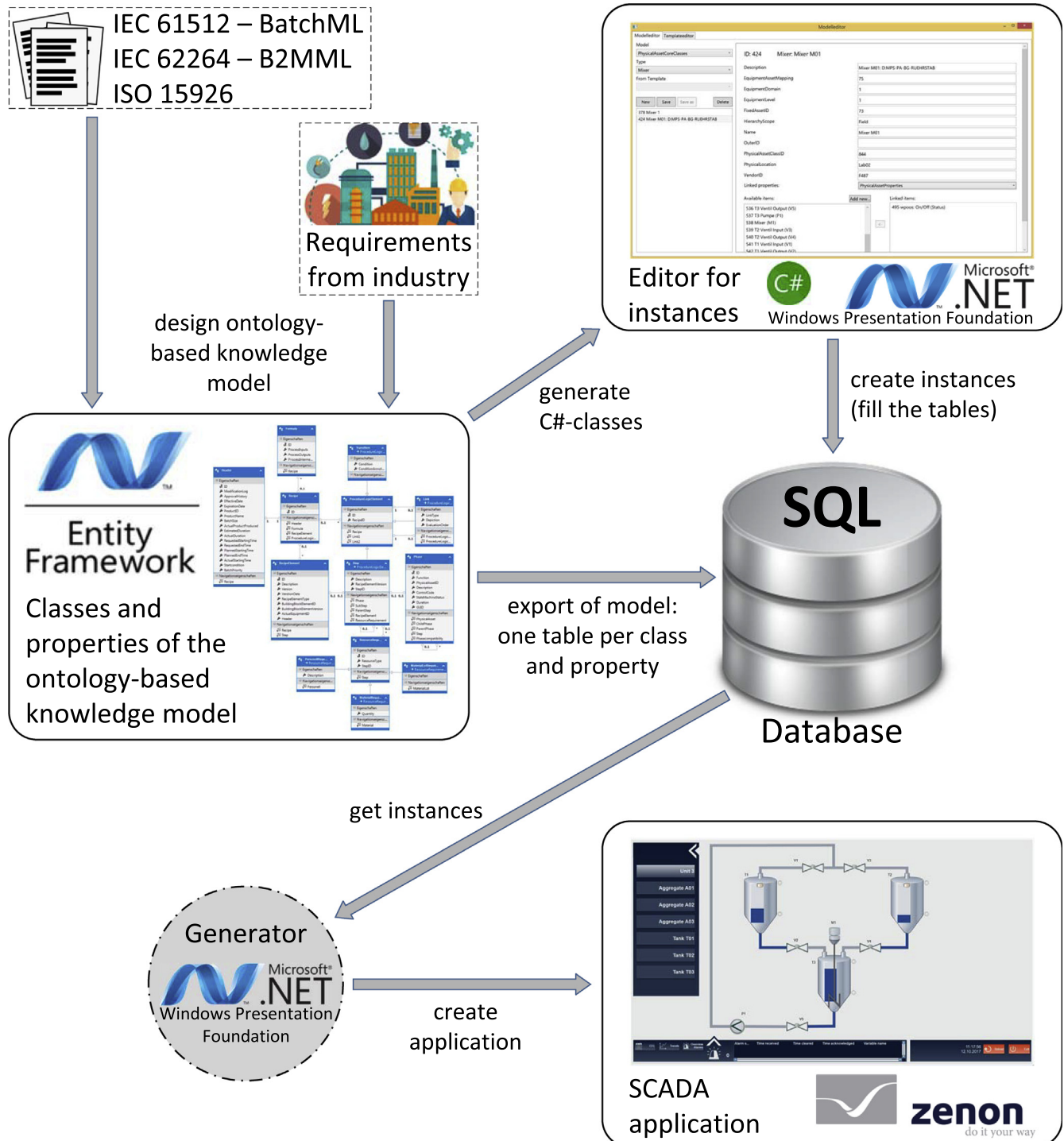


Fig. 1. Workflow of the development process for the ontology and the application depicting also the employed software technologies.

Download English Version:

<https://daneshyari.com/en/article/8048628>

Download Persian Version:

<https://daneshyari.com/article/8048628>

[Daneshyari.com](https://daneshyari.com)