

# A Methodological Approach for Enterprise Modelling of Small and Medium Virtual Enterprises based on UML. Application to a Tile Virtual Enterprise

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**Abstract.** Enterprise Modelling has been used successfully for years with different purposes. Nowadays, there are a lot of languages, methodologies and tools related to Enterprise Modelling, even for modelling Virtual Enterprises. However, some of the Enterprise Modelling weaknesses have not been solved yet. One of the most important is the lack of interoperability among enterprises that use different Enterprise Modelling Languages (EML). Such EML are defined in proprietary formats, and they are only implemented by proprietary and expensive tools. So that, this problem is intensified in Small and Medium Enterprises (SMEs), because they have limited resources.

In this context, this paper shows my Ph.D. thesis proposal describing the problematic situation which is the origin of this research and the objectives suggested to solve it. The thesis goal is to investigate the possibilities of using UML 2.0 and Profiles mechanism in order to provide a methodological approach for solving interoperability problems to Small and Medium Virtual Enterprises in the context of Enterprise Modelling.

## 1 Introduction

The objective of this paper is to describe the proposal for my Ph.D. thesis. This document intends to give a first idea about the thesis origin and objectives. It is structured in three sections. The first one shows background and definitions related to the thesis framework. In the second one, the problematic situation that the thesis intends to solve is described. Finally, the main research objectives are presented.

## 2 Background and definitions

Enterprise Modelling [18] is the art of 'externalizing' enterprise knowledge, which adds value to the enterprise or can be shared, i.e., representing enterprise in terms of its organisation and operations (processes, behaviour, activities, information, objects and material flows, resources and organisation units, and system infrastructure and architectures). Therefore, this art consists of obtaining enterprise

models, that are a computational representation of the structure, activities, processes, information, resources, behaviours, etc. of an enterprise, government or any another type of business. This model can be at the same time descriptive and definitional, including that what is and what should be. And its role should be to obtain a design, analysis and operation of the enterprise according to the model, i.e., driven by the model (model-driven) [11]. In conclusion, Enterprise Modelling is the set of activities or processes used to develop the different parts of an enterprise model with a definite objective.

On the other hand, Unified Modeling Language (UML) is a visual language for specifying, constructing and documenting the artifacts of systems. It is a general-purpose modelling language that can be used with all major object and component methods, and that can be applied to all application domains (e.g., health, finance, telecom, aerospace) and implementation platforms (e.g., J2EE, .NET). UML has emerged as the software industry's dominant modelling language. It has been successfully applied to a wide range of domains, ranging from health and finance to aerospace to e-commerce [16]. However, UML has been used mainly so far as a modelling language in order to produce software artifacts. Even though, some works to evaluate UML from point of view of Enterprise Modelling have been carried out by some authors [2, 9].

Moreover, the Profiles package is defined in UML 2.0 as a mechanism that allows metaclasses from existing metamodels to be extended to adapt them for different purposes. This includes the ability to tailor the UML metamodel for different platforms (such as J2EE or .NET) or domains (such as real-time or business process modeling). UML Profiles had been already defined in the previous versions of UML, but their definition has been improved in the UML 2.0, specifying better the relationships allowed among elements of the model and the use of metaclasses of a metamodel inside an UML Profile [12].

### 3 Problem description

Nowadays, there exist a lot of languages, methodologies and tools related to Enterprise Modelling, even for modelling Virtual or Extended Enterprises [10]. Enterprise Modelling Languages provide constructs to describe and model the people roles, operational processes and functional contents, as well as support information and production and management technologies. There exists great quantity of Enterprise Modelling Languages and they are overlapped. But the integration of the models generated with these languages is complicated, since tools do not exist to integrate models generated with different languages. In this sense, the objective is to achieve a common format, as UEML or POP\*, which are valid initiatives in order to enable exchange between different models and the establishment of an environment for reusing existing models [1, 13, 14, 17].

This kind of languages are defined in proprietary formats and they are only implemented by proprietary and expensive tools. Therefore, interoperability problem is intensified in Small and Medium Enterprises (SME), who have limited resources to adapt successfully innovative technologies existing in the market.

So that, SMEs carry out few enterprise models, and moreover the exchange of them among partners is very difficult.

On the other hand, SMEs set up Virtual Enterprises in order to establish flexible collaborations with other partners and to take advantage of new market opportunities. Virtual Enterprise [3] can be define as a temporary network of independent companies, often former competitors, who come together quickly to exploit fast-changing opportunities. The business partners are integrated using information and communication technology. So, interoperability problem at different levels, including enterprise modelling level, can become decisive aspects to reach business success.

Therefore, the main problem at enterprise modelling level for Small and Medium Virtual Enterprises (SMVEs) is focused on the lack of interoperability of existing Enterprise Modelling Languages, and also on the few quantity of enterprise models generated in this kind of enterprises. However, such enterprises use UML to model and generate software artifacts. The idea of this proposal is to provide a methodological approach that can help SMVEs to use successfully UML, not only to generate software models, but also to produce enterprise models that enable them to have a holistic enterprise view and better interoperate with other partners.

## 4 Research objectives

The IRIS Group of Universitat Jaume I in Castelló (Spain) has been working on several projects related to Virtual Enterprise in different sectors (transport, tile industry, textile, etc.) since 1999 [4–8]. This thesis proposal is motivated inside this framework in order to improve the interoperability of this kind of enterprises at enterprise modelling level.

Therefore, the main research goal is to provide mechanisms to reduce interoperability problems at enterprise modelling level to SMVEs. In this sense, the objective is to investigate the possibilities of UML use for Enterprise Modelling in order to solve this kind of interoperability problems. Besides, the mechanism provided by UML Profiles, redefined in UML 2.0, will be analysed in order to extend and adapt UML for the specific domain of enterprise modelling in SMVEs.

The specific objectives of the research work are the following:

- To perform the state of the art in UML and UML Profiles focused on Enterprise Modelling, and in Virtual Enterprises especially in SME; taking into account the MDA [15] framework defined by OMG and European Projects related to interoperability.
- To obtain a set of requirements for modelling whole enterprise dimensions of SMVEs, in order to define a framework for describing problematic situation.
- To define a methodological approach for enterprise modelling of SMVEs based on UML, which should include the UML Profiles defined in order to extend UML for enterprise modelling, and the guidelines to use this profiles in order to generate interoperable enterprise models.

- To validate the methodological approach defined in a real case of study, applying the methodology to a Tile Virtual Enterprise.

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