Coherent Enterprise Information
Modelling in practice

Koenraad Vandenborre  
Peter Heinckiens  
Ghislain Hoffman  
Herman Tromp

Inno.com, Heiststeenweg 131, 2580 Beerzel, Belgium,  
Koenraad.Vandenborre@inno.com
TMME, Bourgetlaan 60, 1140 Brussels, Belgium,  
Peter.Heinckiens@toyota-europe.com
Ghent University, Intec, Sint-Pietersnieuwstraat 41, 9000 Gent, Belgium,  
Ghislain.Hoffman@rug.ac.be, Herman.Tromp@rug.ac.be

Abstract
In large-scale organizations, the need for enterprise information modelling originates from new business opportunities like B2C and B2B and new cross-domain business demands. This paper sketches why enterprise information modelling is important in this context and where it should be situated in the software engineering process. We further stress the importance of coherent modelling. The content of this position paper is the result of the application of academic ideas in the real-life context of Toyota Motor Europe.

1: Introduction

Currently large-scale organizations are facing huge challenges in IT. Within the organization, newly demanded business functionality crosscuts legacy system borders. On the other hand the internet and its related technologies offer new business opportunities, forcing the organization to externalize some of its IT-systems. The newly demanded functionality and the externalization however, were both out of the scope of the design of the systems and applications currently executing company critical tasks; they are said to be monolithic, designed to execute their task and not designed to deliver services to other systems. In every-day practice this means that every one of these systems has been constructed with its own view on the business model, its own design model, and its own implementation model. The effort to filter out commonalities, model and implement them separately and make them reusable was, if not at all inexistent, too small to be useful today. The reasons for this, although mostly valuable, are for instance the scope of the project, the available technology, the complexity of the system, the deadlines and costs… The major concern at this point is to fulfill the new needs with the resources available at this moment.

We are convinced that Enterprise Information Modelling is of crucial importance to the organization and its needs, in order to be able to adequately answer the new challenges it
faces. We’re also convinced that coherence with other steps of the software engineering process is crucial in order to introduce Enterprise Information Modelling successfully. The ideas presented in this paper follow from and elaborate further on former work from some of the authors [3], on well known work from others, nowadays considered as standard works - we mention [1], [6], [7] – and on related new publications in the field (see e.g. [4], [5]).

The structure of this paper is as follows: first, we present our understanding of Enterprise Information Modelling; thereafter we situate it within other modelling efforts and within the software engineering process. This is followed by a discussion of important implementation issues that have to be tackled.

2: Enterprise Information Modelling

2.1: Information Domains

The concept of Enterprise Information Modelling, as defined in the next paragraph, followed from our work regarding Information Domains. Information Domains, in our lines of thought, are certain areas within an organization that deal with concepts that are of importance to at least that area and possibly other areas. The concepts herein must be made persistent under a certain form, mostly a database and more general a data-store. Whereas we consider the data-store to contain the raw data, we consider information to be the service-based delivery of that data through a well-defined interface into a format that is independent on the format of the underlying data and that has the correct semantics for the client(s) requesting that information. We consider a domain to be a higher structure containing a set of concepts, the higher structure often being referred to as a package. It is obvious that different approaches can be taken; we tried packaging by starting from an organizational point of view, defining different domains from the organization chart, an application / systems point of view, defining the domains from the existing logical grouping of applications within the organization and a business process point of view whereby domains are identified from looking to and organizing the concepts used within the business processes. In our experience it turned out that a new view, orthogonal to the ones formerly mentioned, gives the most natural classification of domains.

2.2: Definition

To our understanding, enterprise information modelling is that part of modelling that is situated between the modelling of business processes and the modelling of any single system or application. Its main objective is to define and model assets which are of common use to different domains within the organization. In this way, Enterprise Information Modelling presents an added value to the organization as a whole through its reusability and its common semantics to different interested parties within the organization. Where formerly the same concepts were modelled many times, often in different forms and each time for the sake of one particular application, this effort can be done once. The result of this reusability is a reduction in the overall cost. Furthermore Enterprise Information Models do augment the understanding of the concepts modelled herein.

2.3: Positioning Enterprise Information Modelling

Modelling efforts on the highest level in an organization chart the business processes of the organization. These business processes form the heart of the organization;
they are its reason of existence. Applications are built to automate tasks or activities extracted from the business processes. In that context they’re a form of specification of the task at hand: requirements are gathered, the task gets analysed, and a design and an implementation are made. A crucial part that’s often lost, while automating a task, is preserving an overview of how that task is interrelated with other tasks originating from the same business process, how this task gets influenced and influences other tasks possibly operating on the same information.

Things get even worse if another task in the business process is to be automated. More often than not, the formerly automated task is not taken into account while designing the automation of the new task, and even if it is, the conclusion is often that the former cannot be reused. This should not astonish us as the first automated task was never designed for reuse.

The conclusion to make here is that apparently an important step is overlooked; the analysis of the task under hand should consider how previous efforts can be reused and how the automation of this task can be achieved with possible reuse in mind. This exactly is what Enterprise Information Modelling aims at and leads to the generalized modelling overview in Figure 1.

![Figure 1: Interrelation between different models](image)

As we will describe further (see the section on “2.5: Coherence”), the Enterprise Information Model must be based on the Business Process Model. It is interesting to note that Figure 1 also indicates that Business Process Modelling and Enterprise Information Modelling can be looked upon as a horizontal cut through the organisation as where Application Modelling is a vertical cut.
2.4: Using Enterprise Information Modelling in the software engineering process

Whatever software engineering process is chosen, RUP, a tailored UP or extreme programming, it is important to note that a consistent build-up and use of an Enterprise Information Model will have a profound impact on the process itself. As described in the previous paragraph, mining for existing assets and mining for new assets must become part of the process.

The mining for new assets must be done as soon as possible in the software engineering process and the outcome of this effort will clearly affect the overall cost for building the application. An application that is responsible for the construction of a company-wide reusable information asset clearly will have a higher price than the same application solely built to serve its own purposes. The ROI for building this asset will only be achieved through reuse, the initial cost is higher, see [2]. Furthermore, the actual construction of the asset must be closely followed and guarded, to preserve its integrity and future reuse. When using RUP e.g. this clearly has an impact on the inception, elaboration and construction phase.

A possibly reusable information asset must be assessed for its reuse for the application to be built in the first phase of the software engineering process.

2.5: Coherence

Whatever the correctness and the validity of every separate model in the modelling chain may be, if there is no coherence between the different models, much of their intrinsic value will be lost. Non-coherent models don’t lead to a common understanding of the business and the problem at hand; they even cause more misunderstandings and misinterpretations. This in turn causes a decreased reusability and an increased resistance to use the models.

Furthermore, it’s not only important to guard coherence between different models, but it’s as important to keep coherence between the models and the implementations made. The ultimate goal is always to build a running system that not only meets the business requirements but also the requirements imposed by the ideas behind Enterprise Information Modelling. If this cannot be achieved, the reusability of the system will decrease to a level comparable with the reusability of the older systems and the effort put in the modelling will be lost.

An important feature to achieve coherence between different models is traceability between different models. Traceability is necessary to be able to point out the repercussion of a change in one model on other related models. Traceability as an extra requirement for coherence allows for instance to check if all requirements are met and, in its ultimate form, a traceable change in implementation shows the repercussion on the business process model which offers an opportunity to formulate a business case and perform a cost-benefit analysis.

Achieving coherence between models and the implementation is not only a technical matter; organizational structures also play an important role. When looking at the path from the business process model up to the actual information delivering service, build upon a data-source, different profiles of people are involved. We mention for instance business analysts, business modellers, project managers, application architects, implementers… Ideally, every effort should be streamlined but every-day experience learns that, for a plethora of possible reasons, involvement in other projects, deadlines, and
available resources… focus gets lost. It therefore is important to have a mediator role within the organization. Within the Toyota Motor Europe context this role is, amongst others, performed by the Information Systems Architecture team.

3: Work in progress

Enterprise Information Modelling can be considered as a centralization effort within an organization. Centralization efforts are always somehow squeezed between their intrinsic long-time character and the needed quick-wins to maintain sponsorship from management and business users. Applying lessons learned from the past, as well within Toyota Motor Europe as outside, we set for an incremental strategy, wherein we mined for small, rapid and easy to implement company assets. The mining and the development of the basic strategy started as a small Architecture-internal project, preparing us to jump in at the moment a new project needed the asset. This bought us visibility and credibility. We now are on the verge of mining for more elaborate company assets stimulated by our business users.

The mining for other assets, modelling them and implementing them from within the context of a business-driven project, is a technical matter we will have to deal with in the future. From an organizational viewpoint it’s important that, building on the first success, awareness and buy-in is further created for the way of working described in this paper throughout the organization. The matrix-based organization model of Toyota Motor Europe is very helpful at this point. The awareness creation and buy-in is not only essential to get the needed sponsorship but is a seed in the brains of those involved to look at IT from a company-wide perspective instead of a one-application perspective.

In trying to preserve inter-model and model-implementation coherence, certainly in a start-up phase, it is important to maintain an overview of what is going on at all different levels, the business process modelling, the enterprise information modelling, the application modelling and to support and motivate every participant in the process.

One of the most interesting challenges we met was the concern about information-ownership. The question who is the owner of certain information has to be answered. The main problem in this area is to define who has the right to create, update or delete information. Again the answer was found by looking at the business process and by determining where the information entered this process. Starting from there, a conceptual owner can be defined and a set of guidelines on information ownership was created. This now serves as a working document that gets fine-tuned from experiences with and feedback from projects under construction.

4: Conclusions

Our conclusions so far are the following:

1. There is a need for a central team to keep a view on the complete process, from Business Process Modeling over Enterprise Information Modeling to Application Modeling and the actual implementation in the systems. This requires highly skilled people with different competences and specializations but who are able to keep an eye on the overall effort.

2. It is not sufficient to create a technical sound solution; the organizational structure at hand must be taken into account and must be used to set out a strategy for realization.
3. Every effort made must be related to a business context or a business case, the models under construction must adhere to the business and the actual implementations must follow from projects realizing business needs.
4. Buy-in from management and from business users is a crucial factor. This long term buy-in can only be achieved through successfully delivering projects.

5: Future work

To preserve the usability of the Enterprise Information Model it is of the uttermost importance to have a structure to consult the information base. This must be done as well on the modeling level as on the implementation level. On the modeling level we have a first realization of a “city map”, showing the different assets, their packaging and their interrelation. It will be very important to keep this “city map” synchronized with new realizations from projects under construction. On the implementation level, standards and guidelines have to be set for component and data-store development and maintenance. This for instance must include guidelines for replication of information and guidelines for coupling between different information assets.

The academic partners follow closely the efforts around modeling undertaken in the Aspect Oriented Software Development community. By its very nature of describing crosscutting concerns, this new paradigm may bring a tremendous advantage to Enterprise Information Modeling once it becomes mature.

While modeling and implementing more and more company assets, the importance of traceability will become greater and greater. How this can be achieved must be part of future investigations and / or product selection.

How Enterprise Information Modeling and other modeling efforts within the organization relate to the Model Driven Architecture proposed by the OMG – at whose core is the gradually refinement of models - is also a topic which must be addressed by future research.

Acknowledgements

This research would not have been possible without the co-operation and support of Inno.com and Toyota Motor Europe.

References