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FEM toolkit – A Tool for Business Process Architects

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Abstract

While there are many tools that can depict a business process on any level of detail, there is lack of tools to depict and/or design process architectures - an interconnected set of business processes that exist or are to be introduced in an organization. The FEM toolkit bridges this gap by providing a tool for process architects to discover the process architecture of an organization as-is or to develop a new one. The FEM toolkit facilitates this by providing means to discover or develop a so-called Fractal Enterprise Model (FEM) for an organization. FEM depicts interconnections between the business processes in an enterprise by connecting them to the assets they use and manage. Assets considered in the model could be tangible (buildings, heavy machinery, etc.) and intangible (reputation, business process definitions, etc.). The FEM toolkit has been developed with the help of the metamodeling environment ADOxx. It was successfully used in a number of practically oriented projects and for teaching purposes.

Keywords

business process architecture, fractal enterprise model, FEM, ADOxx

1. Introduction

The field of Business Process Management has a variety of languages and notations to model, depict, design, simulate and analyze individual processes, including mainstream notations used in practice, like BPMN [1], and research-oriented ones used mainly by academics, like Petri nets. There are plenty of computerized tools that support these languages and notations, and they can simulate or execute business processes according to a model depicted in one of these languages. This level of maturity, however, has not been reached in the field of business process architecture. There is lack of modelling notations that could properly depict relationships between indirectly connected processes, like relationships between a process for hiring people and a process in which they become participants, or between a process of developing a computer system and the processes that will be using it. This makes the task of process architects more difficult than the one of individual process modelers.

A toolkit – the FEM toolkit – described in this demo paper fills the gap described above by providing both, a modeling notation and a tool for drawing architectural diagrams. As a modeling notation, it uses a so-called Fractal Enterprise Model (FEM) [2]. Initially, FEM was created with the aim of finding a procedure that helps to discover all processes that exist in an organization. However, the result – FEM – showed to be more powerful than initially thought. FEM has a form of a directed graph with two basic types of nodes *processes* and *assets*, where the arrows (edges) from assets to processes show which assets are used in which processes and arrows from processes to assets show which processes help to have specific assets in "healthy" and working order. The arrows are labeled with metatags that show in what way a given asset is used, e.g. as *workforce*, *reputation*, *infrastructure*, etc., or in what way a given process helps to have the given assets "in order", i.e. *acquire*, *maintain*, or *retire*. Besides processes and assets, the latest version of FEM includes two new types of nodes – *external pool* and

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external actor [3]. These are introduced to represent the environment outside the organization, e.g., markets or competitors, and connect it to the internal operational activities.

The three distinct features of FEM are:

1. It allows to depict indirect connections between two processes via assets that these processes share, or one process manages an asset and the other process uses it.
2. It allows to depict the context of each process, internal – related assets and processes, as well as external – related pools and external actors.
3. It includes a so-called unfolding procedure supported by archetypes (patterns) that guide the modeler when he/she is building a FEM. This is especially important for modern organizations, in which there seldom exists a person who has a holistic view on operational activities of the whole company.

The FEM toolkit is a computerized tool that supports drawing FEM diagrams. It is built on the ADOxx metamodeling environment [4], [5], and it works as a standalone application for a variety of operational environments: Windows, Mac, and Linux.

2. Main features

FEM is unique in its approach to represent connections between the processes via assets [2]. In FEM, graphically, a process is represented by an oval, an asset is represented by a rectangle (box), while a relationship between a process and an asset is represented by an arrow, see example in Fig. 1. We differentiate two types of relationships in the fractal model. One type represents a relationship of a process "using" an asset; in this case, the arrow points from the asset to the process and has a solid line. The other type represents a relationship of a process changing the asset; in this case, the arrow points from the process to the asset and has a dashed line. These two types of relationships allow tying up processes and assets in a directed graph.

In FEM, a label inside an oval names the given process, and a label inside a rectangle names the given asset. Arrows are also labeled to show the type of relationships between the processes and assets. A label on an arrow pointing from an asset to a process identifies the role the given asset plays in the process, for example, *workforce* or *infrastructure*. A label on an arrow pointing from a process to an asset identifies the way in which the process affects (i.e., changes) the asset. In FEM, an asset is considered as a pool of entities capable of playing a given role in a given process. Labels leading into assets from processes reflect the way the pool is affected, for example, the label *acquire* identifies that the process can/should increase the pool size.

Note that the same asset can be used in multiple processes playing the same or different roles in them, which is reflected by labels on the corresponding arrows. It is also possible that the same asset plays multiple roles in the same process. In this case, several labels can be placed on the arrow between the asset and the process. Similarly, a process could affect multiple assets, each in the same or in different ways, which is represented by the corresponding labels on the arrows. Moreover, it is possible that a single process affects a single asset in multiple ways, which is represented by having two or more labels on the corresponding arrow.

Labels inside ovals (which represent processes) and rectangles (which represent assets) are not standardized. They can be set according to the terminology accepted in the given domain, or be specific for a given organization. Labels on arrows (which represent the relationships between processes and assets) are standardized. This is done by using a relatively limited set of abstract relations, such as, *workforce* or *acquire*, which are clarified by the domain- and context-specific labels inside ovals and rectangles. Standardization improves the understandability of the models.

While there are a number of types of relationships that show how an asset is used in a process, there are only three types of relationships that describe how an asset is managed by a process – *Acquire*, *Maintain* and *Retire*.

To make the work of building a fractal model more systematic, FEM uses archetypes (or patterns) for fragments from which a particular model can be built. An archetype is a template defined as a fragment of a model where labels inside ovals (processes) and rectangles (assets) are omitted, but arrows are labelled. Instantiating an archetype means putting the fragment inside the model and labelling ovals

and rectangles; it is also possible to add elements absent in the archetype, or omit some elements that are present in the archetype.

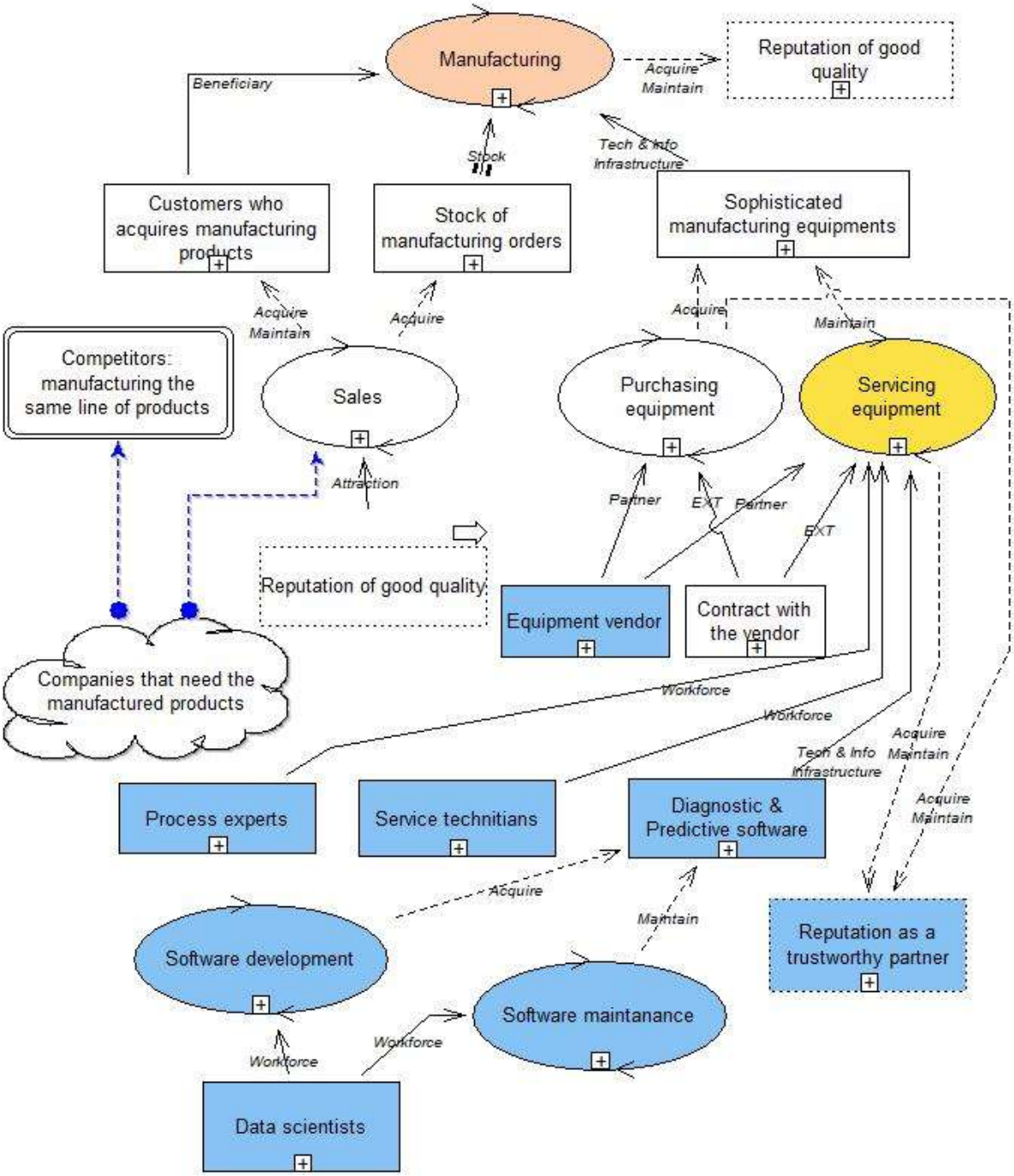

Figure 1: An example of a FEM in the FEM toolkit.

FEM has two types of archetypes, process-assets archetypes and an asset-processes archetype. A process-assets archetype represents the kinds of assets that can be used in a given category of processes, see an example in Fig. 2. The asset-processes archetype shows the kinds of processes that are aimed at changing the given category of assets. The whole FEM graph can be built by alternative application of these two archetypes in a recursive manner representing self-similar patterns on different scales, fractals. The term *fractal* in the name of our modelling technique points to the *recursive* nature of the model.

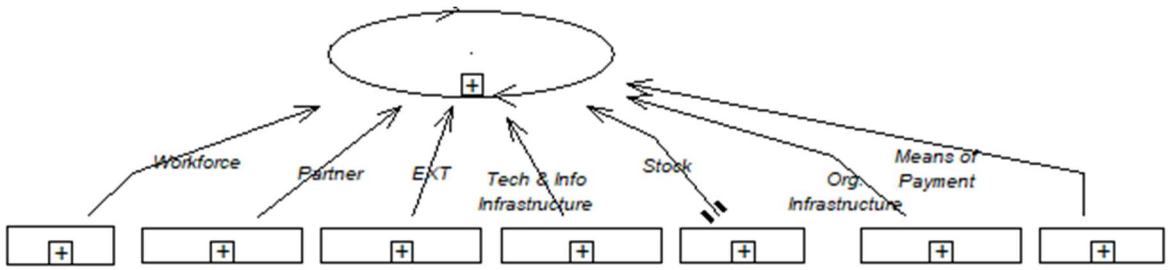

Figure 2: A generic process-assets archetype.

The unfolding procedure supported by archetypes has proven to be useful when gathering information to depict the process architecture of an organization. As soon as a process that exists in the organization has been discovered, a set of questions, which are derived from an archetype, can be asked, e.g., who participates in the process, or which software systems are used. Also, as soon as an asset is discovered, another set of question arises, e.g., which processes add new elements to the asset. This way of gathering information is especially useful for novice modelers and in a situation when a modeler investigates an organization unknown to him/her.

Besides the processes and assets, FEM has two, recently added elements – external pools and external actors – to represent the external context of internal processes, see Fig. 1, which has one pool – a cloud shape, and one external actor – a rectangle with round corners; the double line in the external actor shape indicates that there is more than one competitor.

The FEM toolkit was developed with the goal to support drawing of FEM diagrams. Besides ensuring syntactic correctness when drawing a diagram, the FEM toolkit also implements a number of useful features, which make the task of the process architect easier, namely the toolkit:

1. Supports *archetypes* that can automatically expand a FEM diagram. An archetype is invoked by pressing on the "+" sign at the bottom of the element of the model to which that archetype is to be applied to (see Fig.1).
2. Supports *ghosting* to solve the problem of multiple instances of the same model element appearing in the same or different diagrams. A ghost is a copy of an already existing model element, which has an arrow on the upper-left side of the shape (see Fig. 1). Ghosting is accompanied with a navigation mechanism that allows to find all occurrences in the same or different diagrams (e.g., via clicking on the arrow).
3. Supports *decomposing* processes and assets.
4. Supports flexible *subclassing* defined by a modeler at "runtime", which are expressed by dedicated background colors of FEM elements. This is demonstrated in Fig. 1, which is related to a business model transformation example from [6]. The light brown color of the top process indicates that it is a main process – a process that delivers value to the customers. The yellow color indicates a process that potentially can become a new main process. The blue color indicates the elements that can be reused in a new business model.

Some of these features (1 and 2) where implemented directly in the first version of the tool, others (3 and 4) "emerged" in the subsequent versions based on the experience of using the tool in practice. A more detailed introduction to these features is given in [7].

3. Maturity

FEM as a language and notation is relatively mature, and it was used in a number of projects through the years, see, for example, [8]. Also, FEM is constantly revised and extended. The FEM toolkit is a relatively new tool created one and a half years ago, and currently, it is in a stable version 0.7, while version 0.8 is in preparation. Nevertheless, the toolkit has already been used in practical projects; the results from one of them have already been published [9], while the results from another are accepted for publication and will be published shortly.

Besides the usage of the toolkit in practical projects by professionals, it was successfully used by master students in their thesis projects. One such project was finding areas of improvements in a sourcing (purchasing) process in an international concern. The toolkit was also used for teaching in two master-level courses – one course was hold at Stockholm University, the other one at the University of Tartu.

More resources related to FEM and the FEM toolkit, including bibliography, video recording of presentations, and the latest version of the FEM toolkit for download are freely available from [10].

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