

# BUSINESS PROCESSES EXTENSIONS TO UML PROFILE FOR BUSINESS MODELING

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**Key words:** Business Modeling, Business Process Modeling, Process Driven Modeling, Information Systems, UML Profiles.

**Abstract:** In today's highly competitive global economy, the demand for high quality products manufactured at low costs with shorter cycle times has forced various industries to consider new product design, manufacturing and management strategies. To fulfill these requirements organizations have to become process-centered so they can maximize the efficiency of their value chain. The concept of business process is a key issue in the process-centered paradigm. In order to take the most out of the reengineering efforts and from the information technology, business processes must be documented, understood and managed. One way to do that is by efficiently modeling business processes. This paper proposes an extension to UML Profile for Business Modeling to include the concepts of business process.

be used to enable reengineering efforts and information systems development.

## 1. INTRODUCTION

Nowadays the competition on the business world has reached an incredible level. Market globalization brought by technology, and in particular by the Internet, imposes the understanding and adaptation to this new business philosophy.

It is essential to communicate, understand and manage the business domain where organizations work. Models and modeling techniques were created to simplify the complex business environment.

This paper is structured as follows: the next section provides the context for business modeling; section 3 presents the unified modeling language and its extension mechanisms; section 4 details the major concepts of business process modeling and the business process extensions; section 5 presents an example application of the extensions on a case study. Finally, section 6 sets the conclusions and future work directions.

## 2. BUSINESS MODELING

Business models serve as means to an end. They allow organizations to communicate, document and understand their activities. This understanding can

## 3. BUSINESS PROCESS MODELING

Modeling a business is one of the most complex activities in building an information system. In recent years, many different approaches to business modeling have been proposed. One that has been receiving much attention is process-driven modeling, in which the business is analyzed in terms of the main business processes.

In order to address the problems presented previously, the business processes need to be captured and modeled in a similar way that the information systems are modeled nowadays.

The object-oriented approach is a mature approach: it is supported by mature languages and technologies, it has a common standardized modeling language, UML (Unified Modeling Language), it is relatively easy to find people with some form of background in object-oriented principles and techniques, and it is possible to buy hundreds of books on the subject. It has been and for many aspects still is an approach to software development of tremendous importance (Herzum 1999, OMG 2000a).

### 3.1 Unified Modeling Language

The first step towards the definition of a common business and information system description environment is choosing the common modeling language. The obvious choice was the Unified Modeling Language (UML), since:

- UML is the modeling language (representing the evolution and maturation of several analysis and design modeling languages - as Booch, OMT and OOSE), receiving broad industry support - UML is considered to be the modeling standard language (OMG 2000a).
- UML is simple to understand and use, but preserves a necessary level of formalism (appropriated for a large target audience - from the architectural designer, to the business person, or the process modeler, among others) (OMG 2000a).
- UML is an evolutionary general purpose, tool-supported, standardized modeling language, which can be applied to different domains using a powerful extension mechanism (Alhir 1998).
- UML has its own architecture with four different layers that makes possible the definition of new concepts on the language (Alhir 1998).

As UML was initially designed to describe aspects of a software system, it had to be extended to more clearly identify and visualize the important concepts of business.

#### Extension Mechanisms

In this work it is used a UML standard extension mechanism called stereotypes. The UML extension mechanisms, as stereotypes, are the main UML feature used in this paper.

A stereotype is an extension of the vocabulary of the UML, which allows you to create new building blocks specific to your problem from existing ones (Booch 1998). Stereotypes may have their own icons.

Through stereotypes, properties, constraints and tagged values new meta-model elements are created, tailored or customized.

This stereotypes may be grouped in a UML profile which is a predefined set of Stereotypes, TaggedValues, Constraints, and notation icons that collectively specialize and tailor the UML for a specific domain or process (OMG 2000a).

#### Business Modeling Profile

This profile is located at the level M2 (OMG 1999), and although nowadays it is an end user specific profile, it's a good candidate for becoming a standard profile, or even, to be included in the EDOC profile (OMG 2000b).

The UML Profile for Business Modeling present in UML 1.4 uses actors and introduces the stereotypes: worker, case worker, internal worker and entity (OMG 2000a).

A **worker** is a class that represents an abstraction of a human that acts within the system. A worker interacts with other workers and manipulates entities, while participating in use case realizations.

A **case worker** is a worker who interacts directly with actors outside the system.

An **internal worker** is a worker that interacts with other workers and entities inside the system.

An **entity** is a class that is passive; that is, it does not initiate interactions on its own. In business modeling, entities represent objects that workers access, inspect, manipulate and produce.

The existing model elements are not suitable for process-oriented business modeling because they can't represent the process concept.

## 4. BUSINESS PROCESS EXTENSIONS

The proposed extensions to the UML profile for business modeling consist in the introduction of the following stereotypes that represent the required concepts.

### 4.1 Process Stereotype

The business processes are the activities performed within the business during which the state of the business resources changes. Processes describe how the work is done within the business (Eriksson 2000).

At the business level the most common model that allows the analysis of the business itself is the Porter's value chain model.

The value chain model highlights specific activities, primary or support, which add a margin of value to an organization's products or services.

It's on those activities, or processes, of business that competitive strategies can be best applied (Porter 1985).

Primary or Core activities are the most directly related to the production and distribution of an enterprise's products or services.

Support activities, or processes, are the ones that make the delivery of the core activities of an enterprise possible. They consist of organization's infrastructures, human resources, technology and procurement.

#### UML Metaclass Extended Class

**Semantics** A process represents a unit of work. Its execution

**Constraints** (1) A process must correspond to one or more goals. (2) A process corresponds one to one with an ActivityState of an Activity Graph, which represents the flow graph of its containing processes.

**Diagram Notation** The notation uses the following icon with the stereotype «process».

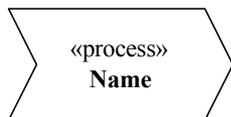


Figure 1 - Alternative process notation

**Predefined Process Classes** According to the value chain model processes can be specialized into the classes of figure 2.

There can be defined other process classes for each particular business domain where the profile is used.

## 4.2 Goals Stereotype

Goals control the behavior of the business and show desired states of some resources in the business.

Goals reveal possible solutions to problems, obstacles to the business. Goals can be divided in sub-goals, so that each sub-goal is easier to be achieved by a process.

### UML Metaclass Extended Class

**Semantics** Denote desired states, meaning that goals motivate actions leading to state changes in a desired direction.

**Constraints** (1) Must correspond to at least one process.

**Diagram Notation** The notation for class is used with the stereotype «goal».



Figure 3 - Alternative goal notation

**Predefined Goal Classes** According to the (Eriksson 2000) major organization goals can be specialized into the following classes.

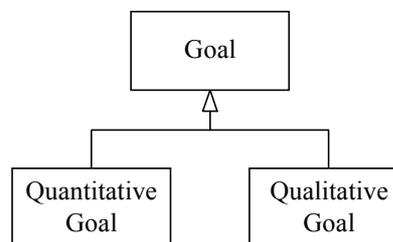


Figure 4 - Predefined goal classes

## 4.3 Resource Stereotype

Resources are objects within the business that are manipulated through processes. Resources can be arranged in structures and have relations with each other.

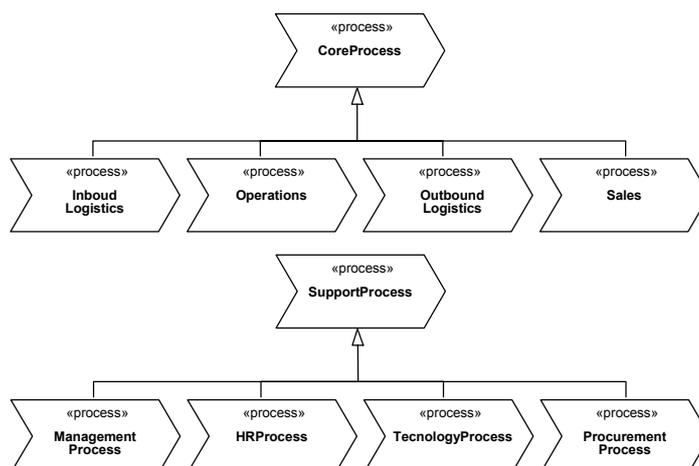


Figure 2 - Predefined Process classes

### UML Metaclass Extended Class

**Semantics** Resources can be produced, consumed, used or refined in processes.

**Constraints** (1) Must produced, consumed, used, or refined in at least one process.

**Diagram Notation** The notation for class is used with the stereotype <<resource>>.

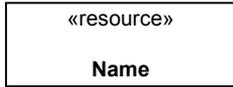


Figure 5 - Alternative resource notation

**Predefined Goal Classes** Resources can be specialized into the following classes.

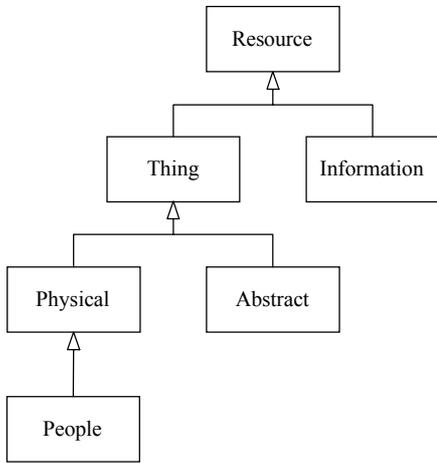


Figure 6 - Predefined resource classes

## 4.4 Metamodel

The global metamodel shows how the model elements used in these extensions relate to each other and to rest of the UML elements.

Processes, goals and resources can all be decomposed in smaller elements of the same kind.

The process stereotype is also connected one-to-one to an activity state to allow the modeler to express a set of processed as in a UML Activity Graph. With the capability it is possible to model process sequences or flows.

## 5. CASE STUDY

The case study presented is a business process common to most companies is the procurement and purchase process.

Based on the MIT's Process Handbook (Malone 1999) a typical procurement and purchase process, called **buy**, includes the following descriptions.

### 5.1 Buy Process

In 'buying' something, the exchange is based on money being given by the consumer to the producer in exchange for something of value, which can be a product, information or service.

The steps in 'buy' are the converse of the steps in 'sell'.

The **buy** process is composed of the following parts.

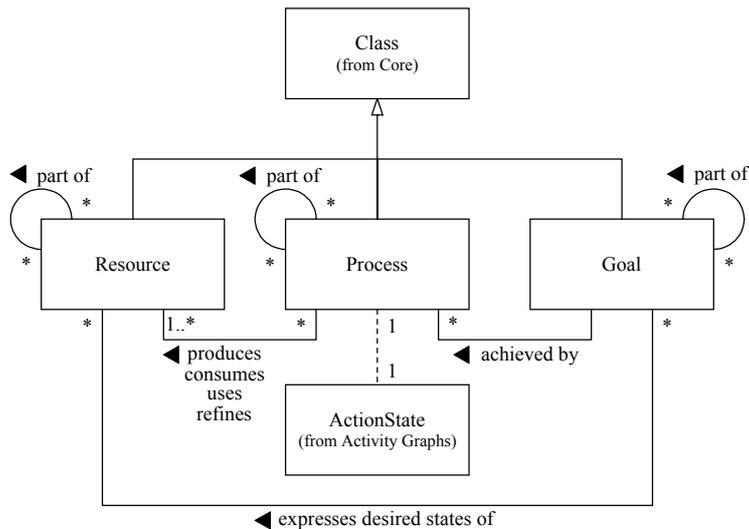


Figure 7 - Business Process Extensions Metamodel

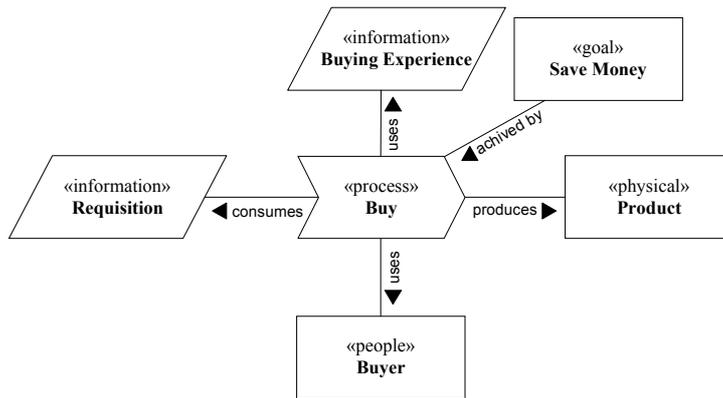


Figure 8 - Buy process

### Select supplier

In this process, buyers select which particular supplier they will use. This decision may be made in many ways. Aspects of the decision may include time, cost, quality, or other factors.

### Receive

This process involves physically receiving something, either a product or service.

### Pay

Paying for inputs is a required step when acquiring inputs via a 'buy' process. Payments may be in value other than cash. Payments may or may not involve being invoiced for the amount due. If invoices are involved, then there is an invoicing specialization.

### Manage Suppliers

This process includes managing relationships with the organization's suppliers.

In turn, the **manage suppliers** process includes the following parts.

#### Evaluate suppliers

Evaluate performance of a supplier against pre-agreed measures.

### Manage supplier policies

This entry covers the general modification of information. In the context of a business, this applies to reference files and other elements of the information infrastructure used to operate the business.

### Manage supplier relationships

This activity includes managing relationships with the organization's suppliers.

## 5.2 UML Business Process Modeling

Using the business process extensions to the UML business modeling profile the top level process would be as follows in figure 8.

Figure 9 shows the hierarchical decomposition of the above buy process.

There can be further detail in the process model. All the resources and goals can be represented in the same model.

In the case where the models are complex it is advisable to use a standard UML tool to navigate all the way through the models.

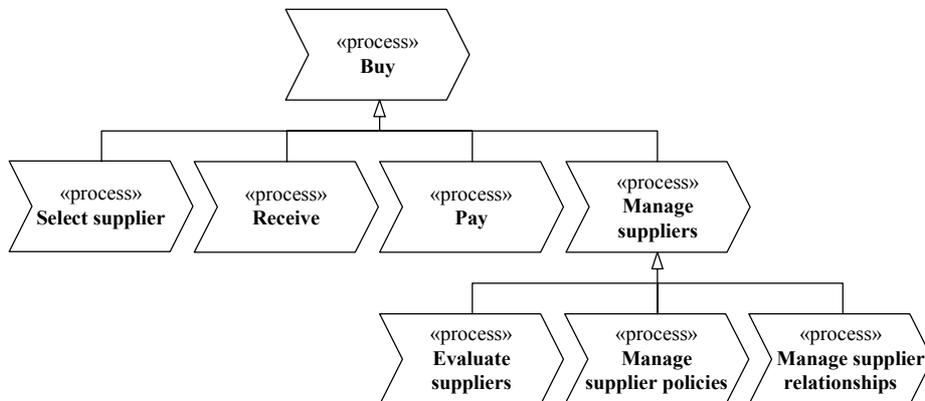


Figure 9 - Buy Process Hierarchy

## 6. CONCLUSIONS AND FUTURE WORK

As the business modeling is essential to understand, document and communicate about the business, business process models are key elements to efficiently produce, adapt and manage enterprise information systems.

The use of UML allows structuring the modeling activity in a comprehensive and visual way. UML profiles as they become more refined, and specialized to the business domain, they increase their accuracy to describe the domain.

As the profile mechanism (OMG 1999) is standardized in the UML specification, it allows models to be created and interchanged by multiple tools that support the standard. There is even a standardized way of exchanging UML models through XMI (OMG 2000c).

There is still work to be done to integrate event based modeling with this profile. A well-established event modeling language is EPC (Event Process Chains) (Scheer 1999) and it can be integrated with the profile above.

The business rules (mechanism that controls process execution) in this extended profile are not clearly identified. Although they can be represented as process restrictions, or in UML notes, they still need to be integrated formally as a separate model element.

Both goal and resource modeling can be refined from what is presented here. The former can be extended to include relations to the enterprise strategy, and the latter to model complex resources, as humans.

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