A Framework for Modeling
Strategy, Business Processes and Information Systems

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Abstract

In order to continuously improve its knowledge and to identify problems and possible solutions, an organization requires understanding the way business is aligned with the organizational strategy and how information systems are supporting the business.

This paper presents a framework for describing and associating organizational concepts at multiple levels of detail using three separate areas of concerns: goals and strategy, business processes and information systems. The framework is presented as an extension to the Unified Modeling Language (UML) using a standard UML Profile. The framework's concepts are illustrated by modeling the purchase and sales business operations of a retail store from the strategic, process and information systems viewpoints.

1. Introduction

There is a common agreement that the landscape for business and information technology has been changing in the last decade. On the one hand, the widespread use of information technology and the connectivity granted by the Internet provide new methods for interconnecting organizations and customers, enabling transaction costs across organization boundaries to be driven down and making the traditional departmental or hierarchical structure less attractive either from a strategic or economical point of view. On the other hand, the growing competitive pressure is forcing organizations to rethink continuously the ways in which they do business and the type of business that they do, leading to a different way of managing. In this scenario, organizations are regarded in terms of business processes instead of functions, integrating activities from several organizational functions in a cross-functional value chain. An organization needs to be flexible enough so that is can cope with the complexity of its business systems while not disregarding all the opportunities created by internal or external business changes. This means that an organization requires to have knowledge of how it operates at both business and supporting information system levels and to have a precise assessment of the dependencies between these.

In order to continuously improve its business knowledge and to identify problems and possible solutions, an organization requires modeling its business processes. Business process modeling comprises the description of the structure and behavior of an organization's value adding activities. Although there is no universal accepted definition of business process, we describe it as a collection of activities that take one or more inputs and create an output that is of some value to a costumer. Business processes have goals and are triggered by events occurring either internally or externally to the organization. Goals convey an organization's strategy and allow business processes to be qualitatively or quantitatively assessed. Therefore, the combined analysis and modeling of goals and processes is of great importance to the organization, allowing the strategy to be traced down to the business processes. However, the impact of combined goal and business process modeling is seldom considered.

In this paper, we present a framework for describing, linking and tracing organizational concepts at multiple levels of detail using three separate areas of concerns: strategy and goals, business processes and information systems. This framework is expressed as an extension to the Unified Modeling Language (UML) using a standard UML Profile so that a common representation language is used not only in the business but also in the software domain.

To represent the goal model, we propose applying the Balanced Scorecard approach and extending the concept of goal, problem and contradiction. This allows increasing the expressive power of goal models, capturing more knowledge about the overall business and strategic and operational goals. Business processes are represented as a hierarchic decomposition of activities that provide added value, contributing to the achievement of a goal. Moreover, separating core and supporting

processes and providing traceability between goals and processes enables processes and strategy to be correlated. By applying the same approach to the information system level, system components supporting the business processes can be represented.

To illustrate the framework concepts, we model the purchase and sales business operations of a retail store from the strategic, business process and information systems viewpoints.

This paper is structured as follows: the next section provides the context for our approach; section 3 presents a high-level view of the framework; sections 4, 5 and 6 detail the framework's major concepts, namely the goal, business and system levels; section 7 and 8 present the framework modeling views; section 9 presents and examines the result of a case study. Finally, in section 10 we set out our conclusions and work directions.

2. Background and Context

Although business modeling has been a significant challenge for business and IS practitioners for more than one decade, relatively little has been written about how to express dependencies between business and goals and how to represent how an information system component is supporting the business. This section provides background on goal and information system modeling and on relating information systems to business processes.

2.1 Goal Modeling

Business strategy is an integrated set of actions aimed at increasing long-tem well-being and strength of the enterprise relative to its competitors [1]. Strategy can be captured into a set of business goals that regulate the company's operation and must be achieved by business processes.

Kueng identifies two major problems when capturing business goals [2]:

- Goals cannot be captured because some goals are forgotten when interviewing managers and stakeholders.
- Goals are not shared among business process participants.

We sustain the same view because the output of the goal modeling process is usually the translation of strategy into goals and not strategy itself. By capturing and representing the strategy from which each goal was derived, a goal model delivers more knowledge about the business and is a more effective tool for communication between the business participants.

According to Nilsson, the fundamental concepts when capturing goals are goals, problems and contradictions [3]. Goals are classified as qualitative or quantitative and can be further specialized depending on the business being represented.

By further structuring the way goal models are organized, it is possible to overcome most of the difficulties raised in traditional goal modeling Furthermore, if one views goal modeling from the Balanced Score Card's standpoint, it is possible to increase the representational power of goal models, capturing more knowledge about the overall business and strategic and operational goals [4]. These ideas will be further addressed in section 4, where goal modeling is presented and discussed.

Setting business goals creates the reason for the existence of business processes, which will be next addressed.

2.2 Business process modeling

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.

It is now generally accepted that business software should directly support and be aligned with the business processes of an organization.

2.3 Information system modeling

Traditionally an information system (IS) relies on a software architecture model. Software architecture describes the structure of the system components, their relationships and the guidelines governing their design and evolution [5].

The associations between the business concepts and the supporting information systems are usually embedded in the architecture's development process [6]. This implies that identifying which parts of business are supported by which parts of the system is not a straightforward task [6].

One major issue that enterprises face today is ensuring that the IS architecture is business-driven, supporting the business requirements, and can be adjusted so that changing business needs are satisfied [7]. Current components technology, like Sun's EJB [8] and Microsoft's .Net [9] enables information system reusability and maintenance to be simplified.

However, in terms of IS and business modeling, there is still the lack for a universal and standard language and notation that fulfills these technological opportunities and business demands.

2.4 The Matching Problem

One of the major concerns for enterprises in today's mutable and instable business environment is the need for permanent change and innovation. However, the tuning of the business strategy usually implies business processes rethinking [3]. The successful modification of the way the enterprise works (business processes) must be pursued by an evolution in the IS that support it [3].

A complex mission, in the situation above described, is to determine the implications of the business changes in the IS (and vice-versa): the *IS / Business matching problem*, or the *matching problem* (for short). The *matching problem* can be expressed as a generalization of the common software *traceability* problem [10], since the matching concept used in this paper does not require a development process.

In the days of mainframe apogee this issue was not taking seriously, simply because the systems were monolithical and changing them (to satisfy new business needs) might determine the conception of an entirely new system (serious business process reengineer or IS architecture redesign was not feasible) [11].

As stated before, now that is technologically possible to use off-the-shelve components as plug-and-play pieces which support different parts of business and use legacy systems as other components [12], the *matching* issue becomes a fundamental successful factor for the enterprises.

With the purpose of identifying the *matching* between business and IS its important to define the key concepts of the IS structure. Buschmann extended component notion is the foundation for the IS structure definition. He states that a component is "an encapsulated part of the software system, with an interface that provides access to its services, serving as building blocks for the structure of the system" [13]. Therefore, every system can be described as a composition of components and relations among them [12].

Nevertheless, there is no common language or representation that unifies these IS concepts with strategy goal modeling and process modeling. Only through a universal language that supports all these concepts will be possible, for example, to know what components must be changed (or bought) when some portion of the business is changed, addressing the matching problem.

2.5 Choosing a Modeling Language

In order to address the problems presented previously, it was decided to develop the mechanisms that allow all the participants in the business and IS evolution to produce traceable business/IS architectures.

In other words, first of all, it is critical to define a set of concepts in a common, standard, easy to understand and learn language.

Using these concepts (inherent to the IS and business modeling), different views of the system and/or business will be defined, in such a way that it is possible to trace the business and the supporting system components.

The first step towards the definition of a common business and IS environment is choosing the modeling language, which must preserve the requirements previously explained. The obvious choice was the Unified Modeling Language (UML), since [14]:

- UML is the modeling language (representing the evolution and maturation of several analysis and design modeling languages – as Booch, OMT and OOSE [14]), receiving broad industry support – UML is considered to be the modeling standard language [14].
- UML is simple to understand and use, but preserves a necessary level of formalism [14] (appropriated for a large target audience – from the architectural designer, to the business person, or the process modeler, among others).
- UML is an evolutionary general purpose, tool-supported, standardized modeling language, which can be applied to different domains using a powerful extension mechanism [15].
- UML has its own architecture with four different layers that makes possible the definition of new concepts on the language [15].

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. 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 to join business and IS ideas in a common language.

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 [16]. Stereotypes may have their own icons.

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

3. The Framework

The major issues rose in the previous section and the solutions proposed by this paper are contemplated on the framework briefly presented in this section.

Our framework (Figure 1) aims at providing a formal way of describing business goals, processes and information systems and the dependencies between them.

It is composed of three separate levels, corresponding to each of the referred concepts, each of which provides adequate forms of representing the notions about the layer being described.
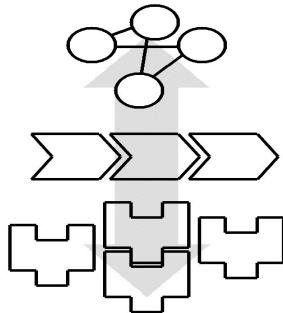

Figure 1. Goal / Process / System framework

In the first level, the aim is at describing business strategy through the goals set (which will be further explained in section 4). These goals must be achieved through one or more business process.

The business processes are described at the second level and must exist in order to satisfy one or more goals (as explained in section 5). Besides serving goals, business processes interact with resources in order to do work and may be supported by information systems.

The information systems layer (described in section 6) aims at modelling the components of the system that support the business.

Although the framework presents a clear separation of concerns (business and system), the dependencies and relationships between the different layers are easily recognized, as it will be elucidated further in this paper.

4. Goal Modeling

The approach to goal modeling taken in this paper is mostly based on the goal patterns described in [3]. This approach towards goal modeling is based on the following notions:

- *Goals* control the behavior of the business and show the desired states of some resources in the business;
- *Problems* are obstacles that hinder the achievement of goals. They are related to goals, in the way that they not only express adverse conditions to the accomplishment of business purposes but also give way to the creation of new goals that aim at eliminating problems (these goals are usually sub-goals of the one associated with the raised problem);
- *Contradictions* between goals arise when two mutually exclusive goals exist.

In this approach, two sub-goal classes are defined, the Quantitative Goal and the Qualitative Goal. A Quantitative Goal is aimed at describing goals that can easily be measured through some value that is to be

achieved. On the other hand, a Qualitative Goal requires human judgment to verify its achievement since it is difficult to describe in measurable terms. Qualitative Goals must have an associated goal description. Quantitative Goals, besides having a goal description, have also a goal value, a current value and a unit of measurement[1].

Goals can be hierarchically related or merely linked to each other (such as contradictory goals). There are several alternative approaches to the subject of relations between goals. According to Kawalek [2], there are four different situations in which goals relate: (1) several goals have to be fulfilled in order to satisfy an upper-level goal; (2) alternative goals exist that are able to satisfy the upper-level goal; (3) the achievement of a goal supports the achievement of another goal; (4) the achievement of a goal hinders the achievement of another goal.

Problems, as goals, can be decomposed into sub-problems. Since a problem is always associated with a goal, the hierarchy of problems usually reflects the hierarchy of goals (as was referred in the beginning of this section, usually a sub-goal is created in order to eliminate a problem associated with it's upper goal).

4.1 New Concepts in Goal Modeling

The Balanced Scorecard is a tool for translating vision and strategy into action and measuring the effects of those actions in light of the adopted strategy [4].
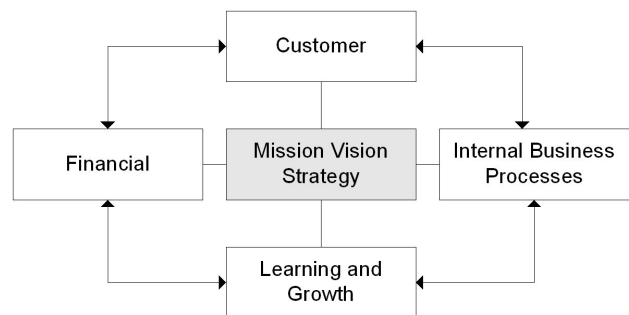

Figure 2. The Balanced Score Card

The fundamental concepts expressed in a BSC can be summarized in the following two points:

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[1] Note that there are alternative classifications of goals in the literature, such as the one presented by Kueng [2], in which goals can be classified as functional or non-functional according to their dependence from an underlying business process (functional goals are those directly dependent from a business process).

1. Distinction between operational and strategic goals and measures. The operational goals are usually associated with short-term returns the company must achieve. Strategic goals concern long term strategic purposes the company must meet.
2. Four different kinds of goals. The goals inherent to each one of the four different perspectives (financial, client, internal processes and growth and learning) express the company's vision and strategy. The fundamental concept to catch here is that these goals have different origins in different perspectives over strategy. In order to capture strategy, we must consider goals as well as their origin.

Previously, we identified goals, problems and contradictions as the fundamental concepts regarding goal modeling. Goals are classified as qualitative or quantitative and the authors state that further classification should be added in accordance with the requirements of the particular business being represented. We would like to propose a further classification for goals and relative concepts.

Following the fundamental concepts identified in the Balanced ScoreCard, we would like to propose the creation of two alternative lines of classification for goals. Besides being *qualitative* or *quantitative*, we find it necessary to classify goals as *strategic* or *operational*. Each of these kinds of goals must have as an attribute it's original *perspective* of business (inducing a second classification line) and are further classified as qualitative (*qualitative strategic goal* and *qualitative operational goal*) or quantitative (*quantitative strategic goal* and *quantitative operational goal*). Strategic goals have *time scope* as an additional attribute in order to represent information about the strategy's time scope.

Although dependent from goals, there is no need for further classification of problems. Since problems are stated in plain text and are always dependent of related goals, they have all the expressive power needed to adequately represent manager's concerns with regard to particular goals.

Contrary to problems, contradictions between goals could largely benefit from a more detailed classification. Since goals can be classified as strategic or operational, contradictions between goals can have different meanings. If a contradiction between two strategic goals is detected, a *strategic contradiction* should be created and the involved strategic options must be reviewed or properly weighted (possibly leading to further evaluation of future scenarios and strategic positioning). If a strategic goal and an operational goal are inconsistent, a *strategy implementation contradiction* is created and the measures applied to enforce the strategic path should be revised considering that it causes short-term problems. If two operational goals are inconsistent, an *operational*

contradiction is raised and both goals should be revised or reflected in the supporting process. The major purpose of making such distinctions between apparently similar conditions isn't to automatically solve contradictions but to draw attention from business intervenients to consider deeper thoughts on strategic planning when facing such situations. Rather than observing that two goals are inconsistent, managers would be alerted, for example, to the fact that strategy isn't being well formulated or implemented, or that there are conflicts between internal and client goals, by just looking at the type of the contradiction and the goals involved in the it.

4.2 Goal Stereotype

The main concept supporting goal modeling is the goal. In the next sections, the stereotype that formally defines this concept using UML is described.

4.2.1 UML meta-class extended. Class.

4.2.2 Semantics. Represents a goal that was originated by a certain perspective of the company's strategy and must be described in natural language.

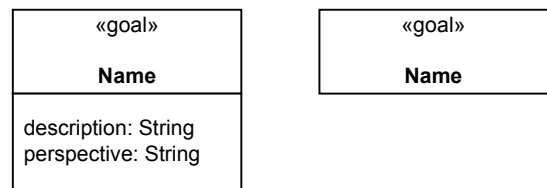**4.2.3 Diagram Notation.** The notation uses the alternative icons with the stereotype «goal».

Figure 3. Goal stereotype icons

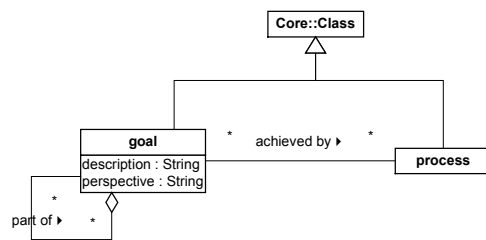**4.2.4 Meta-model.** Figure 4 describes the meta-model.

Figure 4. Goal meta-model (partial view)

4.2.5. Predefined Goal Classes. According to the new concepts introduced in section 4.1, there is the need for creating the following predefined classes (Figure 5).
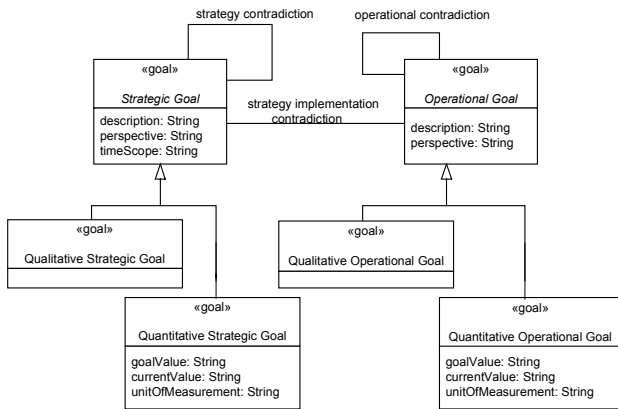
Figure 5. Predefined goal classes

Problems can be represented as instances of UML *note.*

5. Business Process Modeling

Business models serve as means to an end. They allow organizations to communicate, document and understand their activities. That understanding can be used to reengineering efforts and systems development.

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.

5.1 Business Process Concepts

The business processes are the activities performed within the business during which the stat of the business resources changes. Processes describe how the work is done within the business [17].

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 [18].

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 a enterprise possible. They consist of organization's infrastructures, human resources, technology and procurement.

5.2 Process Stereotype

The process stereotype proposed has the following description.

5.2.1. UML meta-class extended. Class.

5.2.2. Semantics. A Process represents a unit of work. Its execution may be connected to the execution of other Process(es) by Resource flow(s).

5.2.3. Constrains. (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.

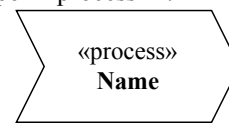**5.2.4. Diagram Notation.** The notation uses the icon in with the stereotype <<process>>.

Figure 6. Alternative Process Diagram Notations

5.2.5. Meta-model. The figure below describes the partial view of the meta-model focused on the process stereotype.
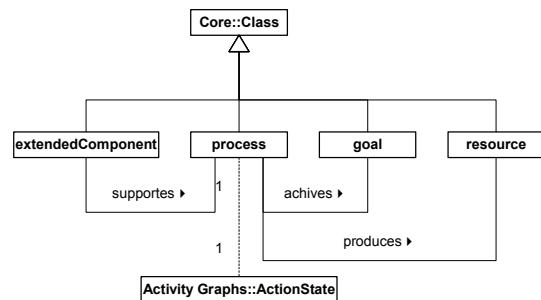

Figure 7. Business Modeling Profile (Partial View)

5.2.6. Predefined Process Classes. According to the value chain model processes can be specialized into the following classes.
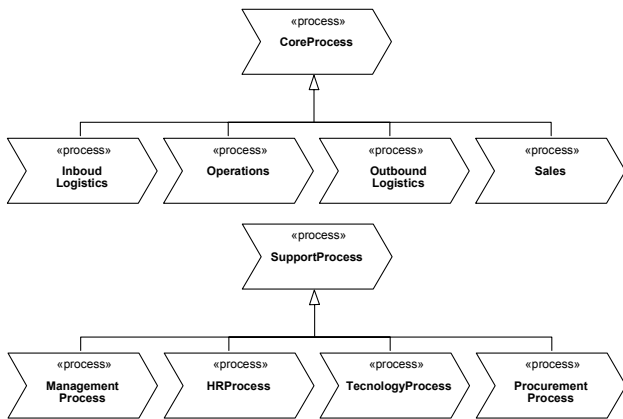
Figure 8. Predefined Process classes

The process description can be further refined by describing the resources that it interacts with.

5.3 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.

5.3.1. UML meta-class extended Class.

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

5.3.3. Constrains
1. Must produced, consumed, used, or refined in at least one process.

5.3.4. Diagram Notation. . The notation uses the icon in with the stereotype <<resource>>.
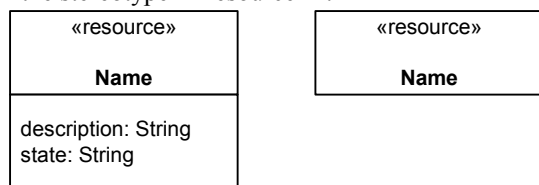
Figure 9. Alternative Resource Diagram Notations

5.3.5. Meta-model. The following figure describes the partial view of the meta-model focused on the process stereotype
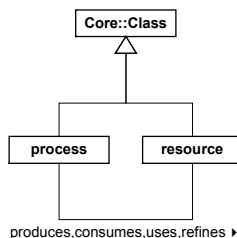

Figure 10. Business Modeling Profile with Resource Stereotype (Partial View)

5.3.6. Predefined Resource Classes. A resource, according to Eriksson [17], may belong to one of the following classes
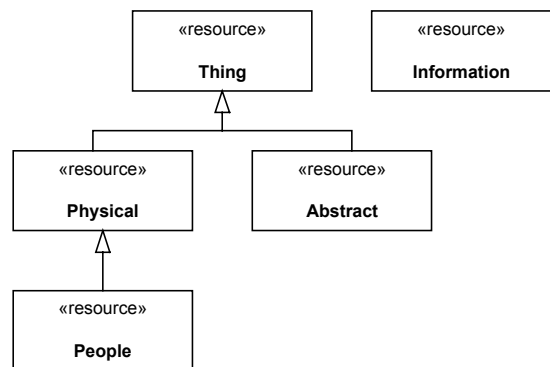

Figure 11. Predefined Resource classes

6. Information System Modeling

Aiming at the definition of a notation where one can model the IS, a UML extension, next presented, was developed: the *Extended Component* stereotype.

In this section, the process and goal concepts are assumed to be already established in the meta-model (see section 3 and 4).

At the end of this section, using the extended component stereotype, four predefined extended component classes are presented.

6.1 Extended Component Stereotype

Components are the core concept supporting IS modeling – they are the building blocks structuring the system [13].

The component notion used in this paper [13] does not require well define and network addressable run-time interfaces (cooperating out of the box with other components) [19]. Therefore, Buschmann component classification is a less restricted definition that contemplates Herzum designation and others [17], [20]. In order to accommodate these various component classifications, we use the *extended component* designation.

The component provides several services and may *use* services from other components [19].

A component may be classified at different granularity levels (for example, Herzum defines three). The lower component levels (e.g., a DCOM component) are *part of* other higher levels components (e.g., an invoice management system).

The stereotype that formally defines this concepts using UML is next described.

6.1.1 UML meta-class extended. Class.

6.1.2. Semantics. An extended component represents the functional building blocks of the system.

6.1.3. Constrains. An Extended Component corresponds univocally with an ActivityState of an Activity Graph, which represents the flow graph of its containing components.

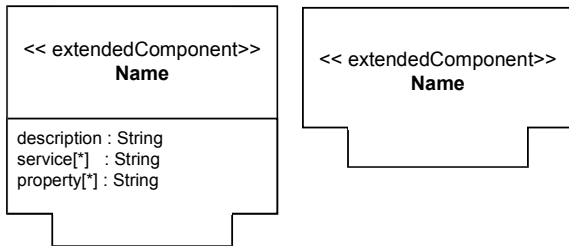**6.1.4. Diagram Notation**. The notation uses the icon with the stereotype <<Extended Component>>.

Figure 12. Alternative Extended Component Diagram Notations

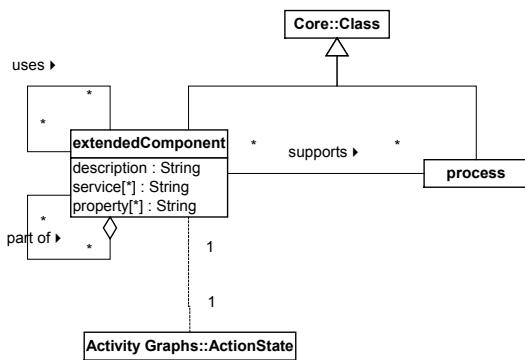**6.1.5. Meta-model**. Figure 13 describes the meta-model.

Figure 13. Extended Component meta-model (partial view)

6.1.6. Predefined Extended Component classes. A component, according to Herzum [19], may belong to three functional categories: *process*, *entity* and *utility* component. The utility component represents the supporting concepts that are broadly required across different system components. The entity component provides services that support the process component. The process component directly supports the business processes.

However, there may be components (extended components) that fit in two or three functional categories – these components cannot be classified as process, entity or utility components and are denominated *general components*.

Using UML, extended components are represented as objects. Consequently, an extended component object is an instance of an extended component class. We predefine four classes (using the Extended Component stereotype), which reflect the concepts above described: Utility Extended Component, Entity Extended Component, Process Extended Component and General Extended Component (Figure 14).
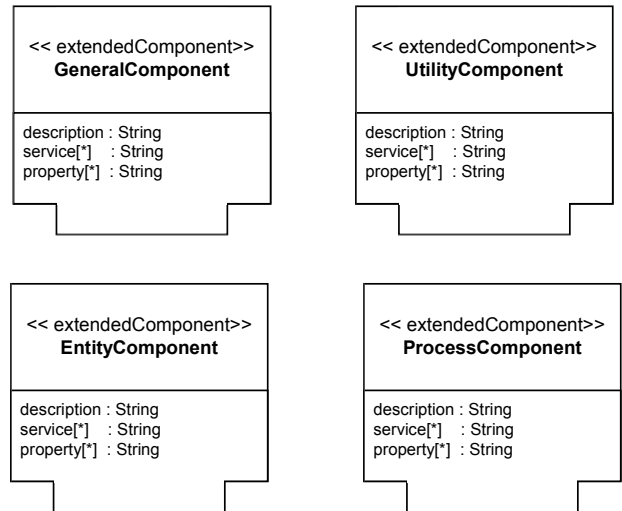

Figure 14. Predefined extendedComponent classes

7. The Framework Revisited

The concepts previously described, which define the system, business and strategic layers of our framework, are related to each other at the meta-model level. These relations are expressed in Figure 15.
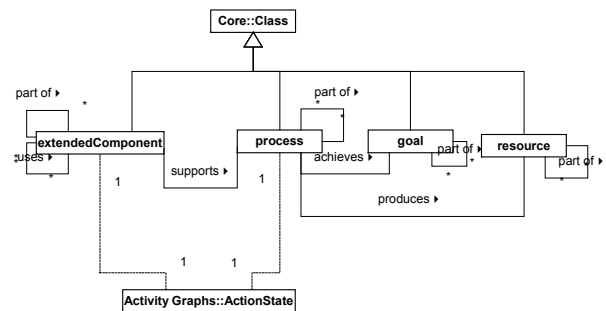

Figure 15. Global Meta-model (simplified)

8. Views

The framework introduced in this paper (see section 3), like a building's architecture, may be observed from different points of view. The different views reveal different concerns and abstraction criteria's.

In this section two major views on the framework are introduced:

- *Structure view* that describes the goal structure, the process and resources decomposition, the system building blocks and theirs dependencies.
- *Behavior view,* which shows the processes, resources and system dynamics.

The views described in this section are exemplified further in this paper (see section 9).

8.1 Structure view

The structure view shows the organization and dependencies of the three framework layers. The diagrams defined in this view address four core issues:

- Characterization of the *goal vision*, describing the goal structure of a company.
- Description of the *processes* structure and dependencies that define the company business.
- Characterization of the *system* structure (as the breakdown of extended components into sub-extended components) and the dependencies between extended components.
- Dependencies between *Goal, Process and IS*. This vision is a crucial stage in the IS and the business *matching*.

Only one diagram is defined for each topic: the *Goal diagram,* the *Process diagram,* the *Information System diagram and the Goal/Process/System diagram (GPS* diagram, for short). These are UML *object diagrams* that present the goals, processes, resources and components and theirs relationships.

Since the goals, processes and components have a hierarchical structure (they are defined as "part of" others), the diagram presents them at the selected detail level. The detail level depends on the particular diagram's purpose. Consequently, the full business and system description is only accomplished through several diagrams at different detail levels.

8.2 Behavior view

Through the behavior view it is possible to model the system and the business dynamics. The objectives of this view are:

- The description of the system behavior and the interactions among components.
- The description of the processes and resources behavior and theirs relations.

The standard UML behavior diagrams [14] are used to describe this view (sequence, collaboration and state diagrams).

9. Case Study

In this section the framework concepts are illustrated by modeling the purchase and sales business operations of a retail store from the strategic, business process and information systems viewpoints. Afterwards, we present the major changes (at the business process and information system levels) that a reformulation in the strategy of the retail store would imply.

9.1 Description

The case study chosen to demonstrate the concepts introduced previously is a typical midsize retail store. The business operations of this fictitious store are very similar to MIT's Process Handbook [21], having major processes *BuySupplies*, *SetupStore* and *SellProducts*.

Our retail store's strategy is mostly based on three fundamental goals: provide costumers a better shopping experience, have 99% percent of products available for costumers (which is fundamental to any local mid-size retail store), and reduce stock levels in order to increase cash flow.

A costumer's shopping experience is mostly conditioned by waiting times, service and a suitable exposure of products. One contradiction raised by the implementation of this strategy is the simultaneous need to lower waiting times (obtained by having more opened checkboxes) and better service level (mostly by having clerks available for helping costumers in their shopping) because, without hiring more personnel, these operational goals are very difficult to achieve.

Another problem raised by this strategy is due to simultaneously wanting to have greater product availability and less stocks. It's a great risk because, before adjusting ordering frequency and quantity for each product, stock breaks can easily occur. Another problem raised by this strategy is due to simultaneously wanting to have greater product availability and less stocks. It's a great risk because, before adjusting ordering frequency and quantity for each product, stock shortages can easily occur (Figure 16).
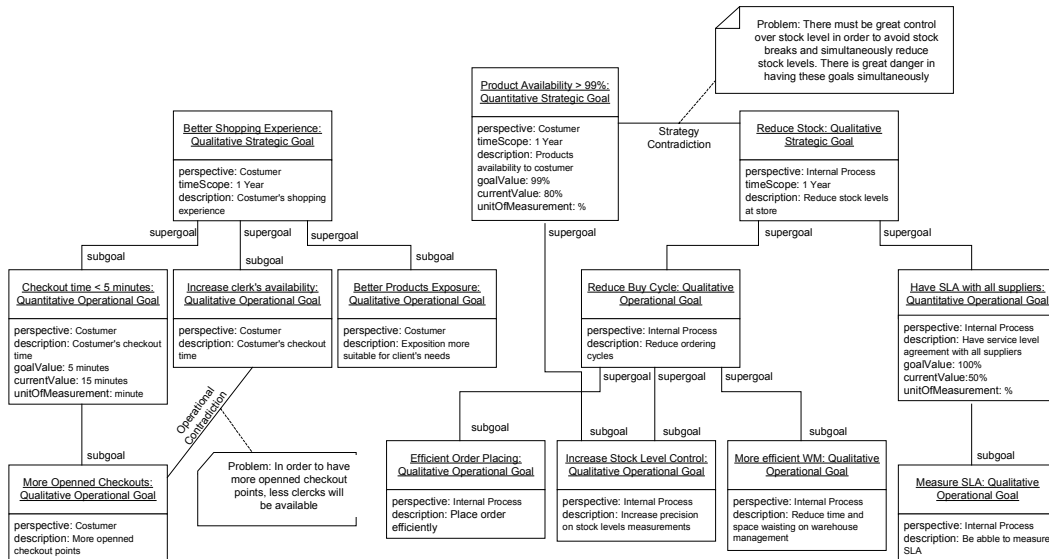
Figure 16. Retail store Goal diagram

Operating a retail store usually consists of buying supplies, setting up the store and selling products to clients. These are the three main processes of our retail store (Figure 17). Processes *BuySupplies* and *SellProducts* were adapted from MIT's Process Handbook [21] and process *SetupStore* was deduced from the direct observation of several retail stores.

Process *BuySupplies* focuses on connecting to the supplier side of the retail value chain (buying, receiving and paying). Process *SetupStore* concerns the in-store operations necessary to warehouse and shelf maintenance. Process *SellProducts* is responsible for attracting costumers and selling and delivering products to them – Figure 17.
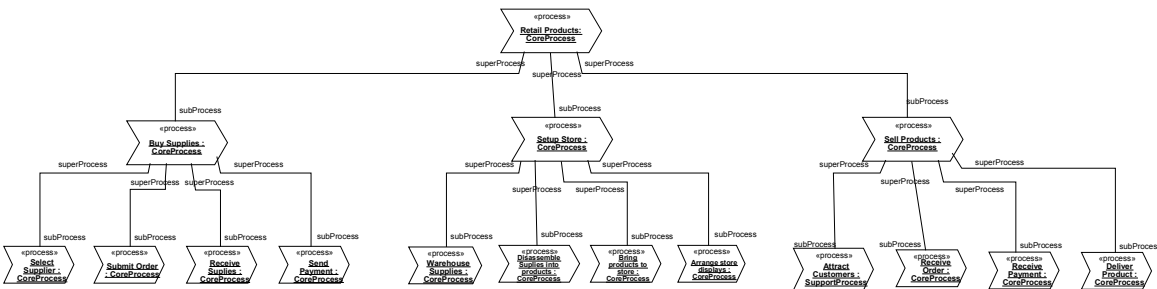

Figure 17. Retail store Process diagram

At the *information system level*, this retail store has three major components: *procurement*, *back-office* and *front-office*. These are General Components because they are constituted using other extended components – Figure 18.
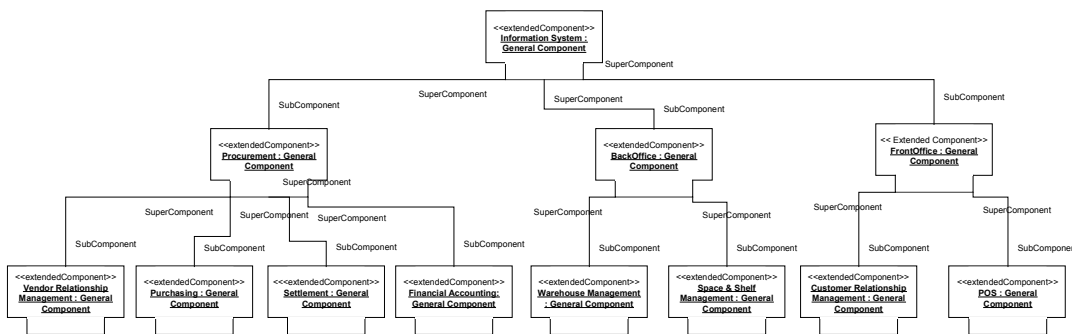

Figure 18. Retail store Information system diagram

Note that the previous IS diagram may be further detailed. For example, the *Purchasing* component (Figure 18) is defined by another *general extendedComponent* (Purchase Order Manager) and a *Process extendedComponent* (Invoice Manager). The last uses two *entity extendedComponents*, which use four *utility extendedComponents* – Figure 19.

Putting it all together using the *GPS (Goal/Process/System) diagram*, we can get the big picture of this retail store – Figure 20.

The diagram in Figure 20 represents a crucial stage in the matching problem solving. Using this diagram, for example, we can easily visualize that if there is some problem in the *Purchasing component* the *Submit Order process* will be in trouble and the *product availability goal* might not be accomplished. Next we will describe a scenario where this GPS diagram is highly important.
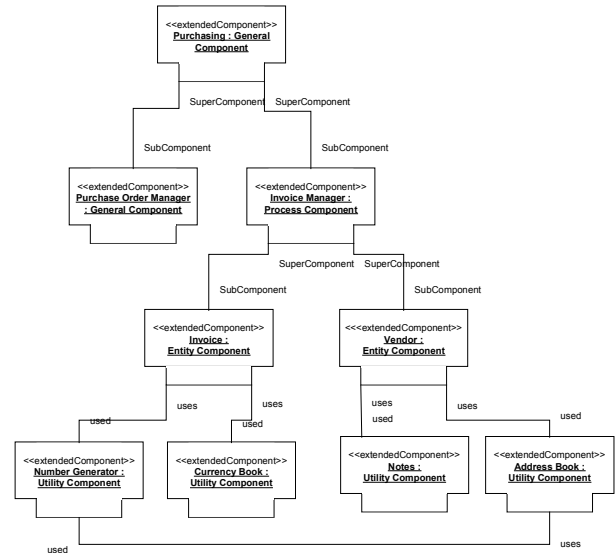

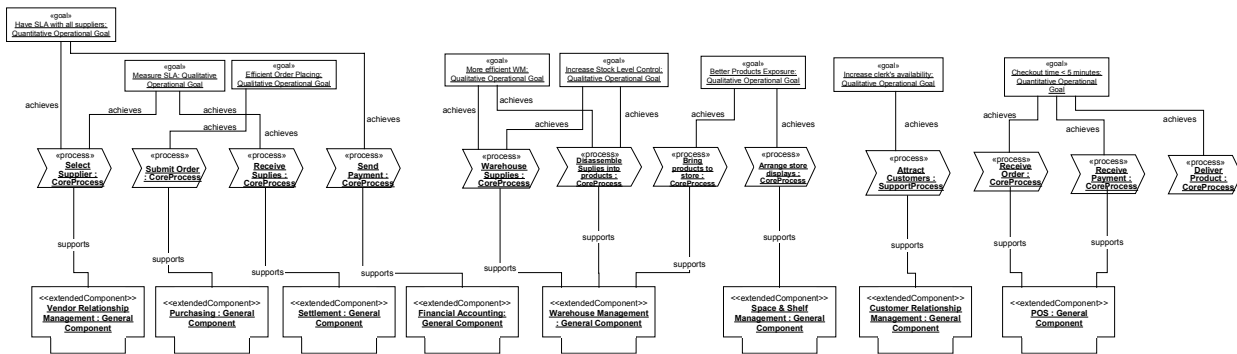**Figure 19. IS diagram (Purchasing Component in detail)**

Figure 20. Goal/Process/System diagram

9.2 A strategic redefinition

Aiming at reaching a larger market share, the retail store previously described, decided to start selling via Internet. This new business strategy (expressed through goals) has impact in several processes and information systems. However, it is not trivial to state which processes and systems must be redesign. Next we will describe how this dependencies identification task is simplified, using the GPS diagram previously presented.

The new strategy is based on two additional goals: having consistency in each point of contact with the costumer (physical or virtual) and having 99% on time deliveries. Extra goals must be set in order to achieve a good shopping experience since the virtual store must flexible and suitable for each client's needs.

At the core business processes level no changes should occur because the main process remains the same. Nevertheless, changes might be necessary at the supporting processes level in order to embrace the new goals.

In order to support the new business needs the system components that support the Sell Products process must be changed. On the one hand, the POS and the Customer Relationship Management Components must be redesigned in order to accommodate the new Internet paradigms. On the other hand, a new component that supports the product deliver process ("last mile") must be introduced.

All these dependencies between the strategy, business processes and information systems were deducted through the interpretation of the GPS diagram (Figure 20). A new GPS diagram that reflects these changes is presented in Figure 21.
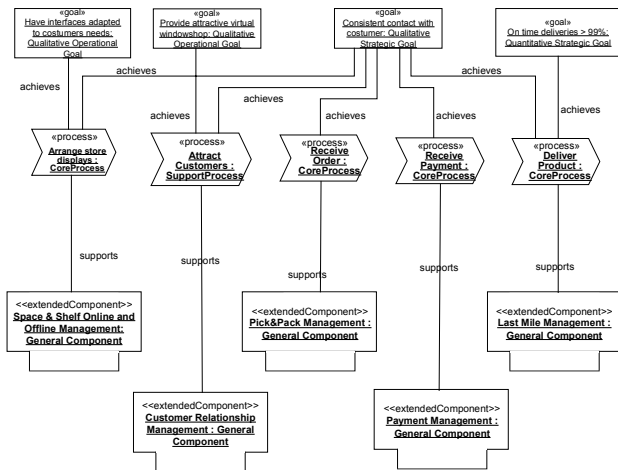
Figure 21. GPS diagram illustrating the B2C strategy (incomplete)

10. Conclusions and Future Work

The framework proposed in this paper aims at solving some of the problems haunting business modeling. Having a unique and standard language to describe different aspects of business is fundamental in order to create a common ground for discussing both business and the supporting systems. The emphasis of this framework is on providing the basis for creating such a common representation and simultaneously providing a way for addressing the matching between the different levels.

At the first level of the framework, and by considering the concepts introduced in the Balanced ScoreCard, goal modeling gains additional representation power and gets closer to manager's reality. Business processes appear as a middle tier between goals and systems, providing an expressive form of representing the work done. The relations between the process and system layers allow the representation of how information systems support business, which is one of the main issues in today's companies. System modeling is addressed through the notion of component, which is the cornerstone of today's systems architecture.

Future lines of work are planned to include a methodology for capturing reality into business models (that addresses the three levels of the framework) and a development process that leads from business to systems (of which the matching between different layers is a starting point). Present research work addressing real companies in different business sectors is being done and is the basis for the creation of patterns concerning strategy, process and systems. Thus, this framework sets the ground for a formalized representation of these patterns.

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