Guidelines for Business Modeling Elaboration based on Views from Domain Information

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Abstract

Business modeling is an activity of the Requirements Engineering that involves a knowledge process of the organization and provides a specific business domain view. On this process, models that can approach the context in which the system domain is inserted in different views (roles, business process and business rules) are built. In spite of the importance of these models, in general, they are not part of the software documentation due to the additional cost and time to build them. One solution for this is the business modeling reuse. In this context, this paper presents a set of guidelines for elaboration of business modeling based on views starting from the documentation of a certain domain, aiming to make available such modeling for reuse on the software development, maintenance and reengineering. A case study to evaluate the applicability of these guidelines was performed and it is also presented on this paper.

1. Introduction

The globalization of the world markets, triggered by the technological progress in general and through Internet, became an even more competitive **business**, pushing the organizations to acquire and adapt to the new business logics, improving the quality of their products and the efficiency of their services [7]. The technological information is a constituent part of the whole business and this is what defines the requirements for the information system, being essential for the use of business modeling as a form to visualize the business structure on a simplified way [7].

In spite of the fact that business modeling plays a fundamental role on an application development and maintenance, a lot of companies still have not incorporated this activity on their development process.

The documentation supplied by business modeling provides a specification of the system requirements in a clearer and consistent way [7]. Besides facilitating the development of a structured system, documentation can also be used on its maintenance, being many times necessary for the system domain understanding or as artifact for reuse.

Business modeling can be approached in different views that facilitate the understanding of the business under different perspectives, capturing specific characteristics of the business.

Analyzing the business modeling under the reuse perspective it is possible highlight the importance to guide the evolution of the domain of the application [7] [11].

Reuse of business modeling favors the construction and the reconstruction of a system, because the artifacts contained in business modeling has previously been analyzed and validated. It is emphasized that the business modeling reuse is also relevant for the software reengineering, because the system many times does not have documentation that makes possible its understanding and this depends totally on the software engineer's experience on the business domain.

This work has as objective to present guidelines for the business models elaboration (from the roles, business rules and business processes point of view) of a certain domain in order to make available such

models to be reused on the software development, reengineering and maintenance. This way, allowing the team productivity increase as well as time and cost reduction on the software documentation elaboration.

This paper has been organized in the following way: on Section 2 the importance of business modeling and some existent techniques to support its construction are presented, on Section 3 related works found on the literature are reported, on Section 4 guidelines for business modeling elaboration based on views mainly from the domain class diagram domain are presented, on Section 5 the applicability of the guidelines proposed on this work by means of a case study is presented, and on Section 6 the conclusions and future works are discussed.

2. Business Modeling

Business modeling and the business analysis embrace the understanding of the organization structure, the business rules that affect its operation, the objectives, the tasks and the responsibilities of its members and the data that are needed and manipulated [9].

Business modeling objective is to develop models to describe what the system should do to reach the operational and organizational objectives [3]. Such models can be presented by means of views. Each view captures one or more specific characteristics of the business. A view is an abstraction of a specification, omitting details that are irrelevant for that point of view. The information is modeled in different diagrams and each diagram represents the particularity of each business aspect [7].

Role view presents a group of activities that describes the interaction among actors that play roles. The role carried out by each actor provides the behavioral characteristic for an activity [5].

Business process view presents the processes that correspond to the activities that should be understood to reach a certain objective. The business process involves the participation of resources (people, material, information, technology, etc) and relationships [7].

Business rules view approaches the business rules as commands that can control or have influence on the execution of a business process or on the resources structure of a business, in the form of a condition or restriction for the execution of a certain activity [7] or to explicitly define and acquire the business rules, consistent with the objectives of the organization [3].

2.1. Business Modeling Techniques

To support the development of business models, appropriate techniques have been created, intending to supply specific mechanisms: KAOS [6], ORDIT [1], EKD [3], i* framework [12], business modeling with UML [2], among others. From previously quoted techniques, the techniques EKD [3], i* framework [12] and business modeling with UML [2] are commented on this work:

- EKD (Enterprise Knowledge Development) [3]: performs the systematic and controlled analysis of a business and its components, using the concept of objectives, processes and actors of a business, formed by interrelated sub-models, in which each one represents an aspect of the domain.
- i* framework [12]: focus the representation of the actors' intentions to reach the organizational objective. The i* framework embraces the construction of two models: Strategic Dependence Model (SD) and Strategic Rational Model (SR).
- Business Modeling with UML (Unified Modeling Language) [2]: supplies a modeling graphic language for the building of software projects, extended to the business modeling area, supplying specific graphic artifacts for the modeling.

More specifically, EKD approaches the business modeling having as focus the business objectives and the involvement of actors on the processes, on the business rules and on the organization objectives. For this, several conceptual models produced, such as: objectives model, business rules model, among others, presenting multiple views of the business. The model of business contains a number of interrelated sub-models, each one representing an aspect of the domain, favoring the understanding of the business. The capture of the business requirements supplies information for the sub-models that after validated will be used as requirements for the system. The technique is directed to the business knowledge management, to development of a system, documentation of a system and of organizational changes management.

The i* framework is a technique with the focus on the actors' intentions. These intentions are addressed to reach the organizational objectives and will depend on factors related to the business processes, such as: tasks execution, resources availability, other actors' dependence, so that the objectives can be reached. Two models are provided: the Strategic Dependence

Model (SD) and the Strategic Rational Model (SR). The SD model describes the dependence relationships among the several actors involved on the organizational context and the SR model describes the interests and the worries of the actors in this context.

UML provides a set of artifacts that produce models to represent the static and dynamic views of several business aspects. A UML allows extensibility mechanisms to be created (stereotypes, restrictions) to be adapted to the representation of the business models, as way to facilitate the understanding and to improve the graphic representation of the techniques, methodologies or processes, for example, RUP (Rational Unified Process) [8].

The UML adoption as a standard notation for the system modeling and extended to business modeling favors the development or the adaptation of existent tools to match this purpose.

Analyzing the studied techniques, EKD and UML are techniques to better describe the context of business modeling based on views, for embracing the business characteristics, artifacts multiplicity for models construction and a clearer and more comprehensive language. It is highlighted that the studied techniques will be reference for the construction of the graphic representation of business modeling, which will not be mentioned in this paper.

3. Related Work

The authors mentioned on this section point out at the guiding of some authors for business modeling development directed to a specific business view.

Yamamoto *et al* [11] developed a modeling focused on business processes, as a way to improve the system development. The approach is based on the use of a metamodel and a tool for business process modeling, making possible the reuse of business processes on the construction and reconstruction of a system.

Caetano *et al* [5] approach the business modeling embracing the concept of business objects and roles. On the business object model, the modeling presents the intrinsical properties of the object, independent of the context in which it is inserted. The role model shows the behavior or extrinsical properties of the business object inserted in a specific context of the business. According to the authors, the use of the models provides an understanding of the business process objectives and, consequently, of the business.

Vasilecas *et al* [10] approach the business modeling directed to the business rules modeling. The authors highlight that the business rules influence all the aspects of the system, being able to describe system running. The authors built a structure or metamodel for storage of the business rules modeling in a repository and a tool for model construction.

4. Guidelines for Business Modeling Elaboration based on Views

In order to the organization to reuse the business modeling, it is necessary to elaborate the business modeling from the application domain of interest.

It is highlighted that for this it is necessary to have the representation of the application domain documented in some artifact (for example, requirements document, use case diagram, class diagram, entity-relationship diagram, etc).

On this context, this work has as objective to define an approach for business modeling reuse based on views. To support the definition of this approach, it is necessary to establish guidelines for the business model elaboration (from the roles, business rules and business process point of view) of a certain domain. For that, the class diagram of application domain will be the main reference document.

It is highlighted that, the elaborated guidelines comprehend the role view and business processes, being that on the view of the business rules the guidelines, so far, have not been established. To support the guidelines elaboration some works have been taken as basis [3] [5] [10].

Following, on the Section 4.1 and 4.2, it is presented the guidelines sketch to create the business modeling on the role and business process views. It is important to highlight that some guidelines are applied directly to the class diagram and others are applied by means of questionnaire, because they depend on the software engineer's knowledge on the domain. Those last ones are applied to refine the created model.

Later on the Section 5, it is presented the applicability of the guidelines using as documentation of a certain domain the class diagrams of the GRN analysis pattern language [4] that belongs to Business Resource Management domain; that is about the renting, maintenance and commercialization of resources and/or services.

4.1 Guidelines for the Role View

To build the business model of the role view, which must contain roles, resources and objectives, the following guidelines, grouped in activities, were initially defined:

1. ***Extracting roles and resources from a class diagram*:** to extract the roles and the resources from a class diagram, an analysis of the classes and of its relationships is made. The role is something that produces or consumes information and the resource is something used. To facilitate the analysis and identification of roles and resources, the following guidelines are suggested:

   - ✓ What are the important concepts related to the business domain?
   - ✓ Does the class refer to a role taking a responsibility of the business domain? Responsibility is a contract between the class and the rest of the system[1]. Is the class responsible for producing and/or consuming an information on the business domain?
   - ✓ Does the class refer to a resource (object: material, information,etc) been used on the business domain?

2. ***Extracting objectives from a class diagram:*** to extract the objectives of a class diagram, an analysis of the relationships among the classes is necessary. A relationship indicates an objective when the own verb denotes a organizational goal to be reached, when the relationship is performed.

3. ***Refining the identification from roles, resources and objectives*:** on this activity the software engineer's experience, his knowledge on the business domain and the analysis of other available documents should be considered, for example, requirements document, use case diagram, entity-relationship diagram, etc. Some questions were elaborated to help as a support. They are:

   - ✓ What are the possible roles inserted and necessary to the business domain?
   - ✓ From the classes of the class diagram that were not identified as roles or resources in the guideline 1, should one observe if they are important to the business domain and can be identified as role or resource?
   - ✓ What are the resources of the domain associated to each role?
   - ✓ What are the objectives of the domain reached by each role?

4.2 Guidelines for the Business Process View

Business model of the business process view consists of: processes, objectives and resources. It presents both the information flow and the objectives and resources involved on the business domain. To build the business model of the process view the following guidelines, contained in activities, were initially defined:

1. ***Extracting business processes from a class diagram***: to extract the business processes from a class diagram, an analysis of the methods ***defined*** in each class is performed. A process can be represented by a set of ***methods*** of distinct class. **Analyzing** the methods, one can obtain the following elements: in/out processes, used resources and reached objectives. It is highlighted, however, that these elements might not be totally or clearly identified on the methods. To facilitate the analysis and the identification of in/out processes, used resources and reached objectives the following questions are suggested:

   - ✓ What processes are identified in the business domain?
   - ✓ Does the method indicate which kind of main activity is exercised on the business domain? Kind of activity refers to the consumption (input process) or production (output process) of information.
   - ✓ What resources (objects) of the business domain are used by the methods?
   - ✓ What information and/or resources are produced on the execution of the processes?
   - ✓ What objectives are reached by each process of the business domain?

2. ***Refining the business processes*:** on this activity the software engineer's experience, his knowledge on the business domain and the analysis of another available documents should be considered, for example, requirements document, use case diagram, entity-relationship diagram, etc. Some questions are suggested for the questionnaire application:

[1] http://www.ucb.br/ucbtic/mgcti/paginapessoalprof/Nicolas/Disciplinas/UML/node3.html

- ✓ What are the possible processes inserted and necessary to the business domain?
- ✓ What are the main processes of the business domain?
- ✓ What are the necessary resources for processes execution?
- ✓ What are the information and/or resources produced in the execution of the processes? To refine this question, it is necessary that, in each process, to be confirmed with the interested ones, if only the information and/or produced resources have already been identified.
- ✓ What are the reached objectives by each process?

5. Case study

To present the applicability of the established guidelines on the Section 4, a case study was accomplished taking as basis the "Rent the Resource" pattern from the GRN pattern language [4]. This pattern aims to deal with rental of resources, which may be assets lent to a customer for a certain period or services performed by a specialist for certain time, as illustrated on Figure 1. When the business modeling approach is applied based on views in a business domain, using pattern language, it is necessary to make the instantiation of the patterns for the specific subdomain, so that it is possible to abstract the established guidelines. On this case study, it is presented the pattern "Rent the Resource" instantiated to the business subdomain "Video Rental", illustrated on the Figure 2.

5.1 Role view

On the class diagram of the Figure 2 the following roles can be identified, through established guidelines on Section 4.1:

1. ***Extracting roles and resources from a class diagram*:** using the guidelines for the analysis and identification of roles and resources:
   - ✓ What are the important concepts related to the business domain?
     The videotape rental involves the concepts: renter, customer, rental and videotape. Observing the class diagram, we can verify that each concept has an associated class, being able to originate a role or resource.

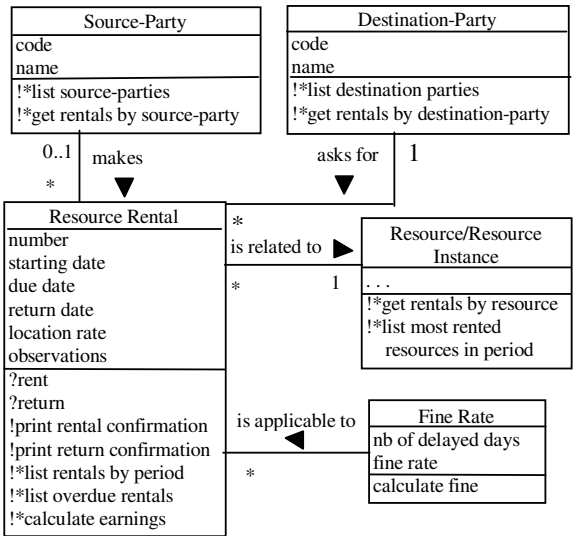

Figure 1. "Rent the Resource" pattern (Braga, 1999)

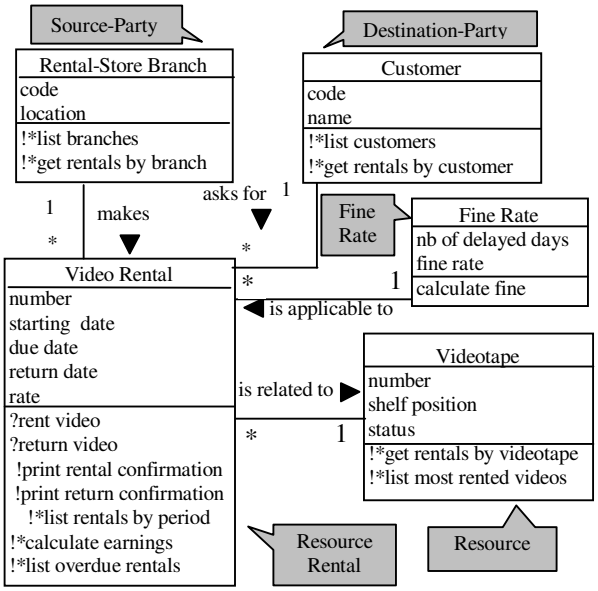

Figure 2. Instantiation of the "Rent the Resource" pattern (Braga, 1999)

- ✓ What are the classes that take responsibility for the business domain?
  Analyzing the relationship of each class one can determine if a responsibility was attributed to it. Observing the `Rental-Store Branch` class related to the `Video Rental` class by means of the relationship `makes` and of the `Customer` class related the `Video Rental` class by means of the relationship `asks for`, `Renter` and `Customer` roles can be identified, respectively.

- ✓ Does the class refers to a resource (object: material, information, etc) using the business domain?
  On the videotape rental, the used object corresponds to the videotape represented by the class `Videotape`, thus identifying a resource.

2. ***Extracting objectives from a class diagram*****:** observing the existent relationships among the classes, can obtain the relationships `makes` and `asks for`, indicating the objectives: perform the videotape rental related to the `Renter` role and requests the videotape rental related to the `Customer` role.

3. ***Refining the identification of the roles, resources and objectives:***

- ✓ What are the possible roles inserted and necessary to the business domain?
  On the videotape rental the necessary roles to the business domain have already been identified on the guideline 1. They are: `Rental-Store Branch` and `Customer`.

- ✓ Do the classes of the class diagram that have not been identified as roles or resources on the guideline 1, should observe if they are important for the business domain and if they can be identified as role or resource?
  The `Fine Rate` class has not been identified on the guideline 1. This class refers to an applicable resource when fine is charged based on videotape late return.

- ✓ What are the domain resources associated to each role?
  So much for the role of `Renter` as for the `Customer` the used resource is the `video tape`. The resource `Fine Rate` is used by the `Renter` role.

- ✓ What are the domain objectives reached by each role?
  On this case study the objectives were identified on the guideline 2.

5.2 Business process view

On the class diagram shown on Figure 2 the following business processes can be identified, by applying the guidelines established on the Section 4.2:

1. ***Extracting business processes from a class diagram*****:**

- ✓ What processes are identified on the business domain?
  The identified processes are mentioned on the Table 1. It is possible observe that a process can be represented by a set of methods. For example, methods `rent video` and `print rental confirmation` represent the "to rent video" process.

- ✓ Does the method indicate what kind of main activity is performed on the business domain?
  Exemplifying, on the `Video Rental` class, the method `?rent video` and `?return video` correspond to input processes of business domain and the remaining classes methods correspond to output processes.

- ✓ What business domain resources (objects) are used by the methods?
  The used resources are: `videotape` and `fine rate` identified by relationships `is applicable to` and `is related to`.

- ✓ What information and/or resources are produced on the processes execution?
  The information and/or produced resources are identified on the Table 2.

- ✓ What are the reached objectives by each process on the business domain?
  Exemplifying, on the `return video` process the objective is to `register the videotape return`.

Table 1. Processes identified on the business domain

Class	Method	Description	Process
Rental-Store Branch	!* list branches	to list Rental_Store Branches	to list branches
	!* get rentals by branch	to check rentals of the branch	to get rentals by branch
Customer	!* list customers	to list customer records	to list customers
	!* get rentals by customer	to check rentals by branch	to get rentals by customer
Video Rental	? rent video	to rent the video	to rent video
	! print rental confirmation	to print confirmation after renting the videotape	
	? return video	to return the video	to return video
	! print return confirmation	to print confirmation after returning the videotape	
	!* list rentals by period	to list rentals by period	to list rentals by period
	!* calculate earnings	to calculate earnings	to calculate earnings
	!* list overdue rentals	to list overdue rentals	to list overdue rentals
Fine Rate	calculate fine	to calculate the fine due to late return	to return video

Table 2. Elements produced on the business domain processes

Process	Description	Information (I) and/or Resource (R)
to list branches	to list the Rental_Store Branches	(I) registered Rental_Store Branches
to get rentals by branch	to check all of the rentals by branch	(I) rentals executed by branch
to list customers	to list customer records	(I) customers registered by branch
to get rentals by customer	to check rentals per branch	(I) executed rentals by customer
to rent video	to rent the video	(I) video rental inclusion and video situation updating (R) rental confirmation
to return video	to return the video	(I) returning and releasing video data updating (R) returning confirmation (R) the fine due to late return
to list rentals by period	to list rentals of a selected period	(I) rentals executed in a certain period
to list overdue rentals	to list overdue rentals	(I) overdue rentals
to calculate earnings	to calculate received value in a certain period	(I) received value in a certain period
to get rentals by videotape	to check executed rentals by videotape	(I) executed rentals by videotape
to list most rented videos	to list the most rented tapes at the Video Rental Store	(I) most rented videotapes

2. *Refining the business process*:

- ✓ What are the possible business processes inserted and necessary to the business domain?
  On this case study the processes were already identified by the guideline 1.

- ✓ What are the main processes of the business domain?
  The main processes are: `rent video`, `return video`, previously identified.

- ✓ What are the necessary resources for the processes execution?
  The necessary resources are: `videotape` and `fine rate`, previously identified.

- ✓ What information and/or resources are produced on the processes execution?
  On this case study, the information and/or resources have been previously identified.

- ✓ What are the objectives reached by each process?
  The objectives of each process are identified on the Table 1, on the "Description" column, previously identified.

6. Conclusion

As already mentioned, in spite of the importance of business modeling, in general, it is not used by the organizations due to the additional cost and time to build it.

On this context, this paper has presented guidelines for the business model elaboration (from the roles and business processes point of view) of a certain domain mainly from class diagrams. Such models can be refined starting from the software engineer's knowledge, as well as from other available documents, as requirements document, use case diagram, entity-relationship diagram, etc.

The performed case study has allowed to observe the guidelines applicability to elucidate elements to compose the business models on the roles and business processes views. However, it is necessary to improve such guidelines applying them in other domains and using other available documents. Besides, guidelines will be elaborated for the construction of business models based on business rules view in order to show the strategic objectives of the organization.

To represent the business modeling appropriately on the different views, existent techniques will be taken as reference, for example, business modeling with UML.

The use of the guidelines for business modeling elaboration based on views to make possible the approach of business modeling reuse.

Starting from the available business models in a certain application domain, future works will be developed to establish criteria for business modeling cataloguing and recovery, as well as, to define other guidelines to allow business model reuse on the development, maintenance and reengineering, aiming at reducing time and cost and increasing the team productivity, as well as to be an mechanism of the Organizational Knowledge Management.

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