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ROLE ON REQUIREMENTS ENGINEERING PROCESS MODEL

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Abstract

The contribution of the requirements engineering in the success of projects is incontestable and it has been proved, through studies and statistics that succeed or fail a project depends generally on requirements engineering. This domain became the centre of interest of a big number of researchers to present the most adequate model and process to succeed the requirements engineering and so succeed the project.

Requirements engineering is done according to a process spread all along the life cycle of the system and that aims to provide methods, technologies and tools allow developing and implanting some computing systems providing the services and the information expected by their users, demanded by their acquirers, and compatible with their functioning environment.

Requirements engineering process is executed on three principals steps:

First, the requirements elicitation to identify future system needs .Then, the specification and the requirements documentation validated or modified following a discussion between the different actors of the process. The end product which is an outfit of models that allows to take into account the actors' point of view, represent not only the final specifications but also the intermediate results. This permits having coherent and well structured documents. The validation and verification of the requirement specification is the final step.

On this article, after a presentation of principal challenges that requirements engineering face and notably in specification step, we will define the fundamental notion of a role that will allow us to surround a system in all his perspectives : the organizational, the functional and even the intentional, etc.

Then, after a study of some models of requirements engineering we will propose a model of process of requirements engineering with focusing on role notation and its participation in the different process steps.

Key word: Model, specification, role, requirement engineer, profile, stakeholders, process requirement engineer

INTRODUCTION

The specification is an important step in the requirements' engineering that allows documenting analyzed to be used by the targeted users (Pohl 1993).

During 1970th and 1980th, requirements' engineers determine, in the beginning of a project, the functional demands of the different stakeholders using a method of decomposition such as the structured analysis. After, they gather all demands on a textual document use a simple word processing program. After some iteration and examinations, this document will be approved, definitively fixed and published to the concerned.

All along the cycle life of a project (the conception, the coding and the tests), the following teams work will be founded on the requirements specification to ensure conformity to identified needs. So, the specification was a manual task that used to be essentially accomplished during the initial phase of a project and that and that created a paper document without a real support.

Yet, this specification as a result of a manual process has been long, costly to produce and rarely maintained and it often induced to error because identified needs are incomplete, incoherent, ambiguous, rarely up dated and difficult to read (Firesmith, 2003).

Actually new specification tendency exist to response to permanent progress of requirements which influence the requirement engineering model so why we will focus on presenting an adequate model for such situation.

1. THE CHALLENGES OF THE SPECIFICATION:

1.1 New tendencies to the process of requirements engineering

The new system developing tendencies as well as the innovation of the life cycles project has enormously affected the requirements specification and has allowed requirement engineer to have steps forward on this domain.

We present some features of some modern life cycles:

Iterative requirements engineering: takes in consideration that a human being makes mistakes and the ignorance can easily induce to the error during the specification that must therefore be progressively identified and corrected continuously in order to improve the product.

Incremental requirements engineering: recognizes that many applications are too complex to be achieved and having hundreds of demands to analyze and specify at the same time therefore it opts to a progressive specification that identifies and adds the new needs of the current state to those of the preceding steps.

Parallel requirements engineering: recognizes that many activities must be done in order simultaneously to respect a certain delay. So, all the life cycle phases (the conception, the implementation and the tests) are rushed in parallel before the specification. In the same way in requirements engineering, the extraction of needs, the specification,... are done in parallel so that permits the implication of several teams and improves then the total productivity of the enterprise.

Of such cycle of spreading out imposes the necessity of the constant evolution of the needs and the demands that in results an evolution (for example, of the ameliorations, of the corrections, additions) of the specification.

1.2. Multiple stakeholders

Now, the big challenge of requirements specification teams consists to satisfy the stakeholders' demands that vary according the statue of each one and the activities' domain. These differences carry on the formalities, the level of abstraction, etc. For example:

- Directors use the specification as a foundation to the executive decisions concerning financing, approval and project management. They have need of the short, concise, easy and comprehensible documents.
- Administrators use habitually the specifications to manage the bearing of the project and estimate the schedule and the necessary resource. They need more detailed specification but remains to a high level of abstraction.
- Experts of the domain: they are demands source and commentators. They ensure that requirements are correctly specified. They need a specifications concentrated on their domain of expertise.
- Architects: The architects must rapidly identify the architectural demands. They need more information linked to the architecture without have a low requirements' level.
- The designers, the developers and tester need much more a complete and detailed requirements specification.

Therefore have an only requirement specification document cause often confusion and disagreement.

1.3 Permanent technical progress

Another big challenge consists indeed on the increase applications complexity. Because of the enormous technological progress, the applications followed the relay and they do not cease converting from monolithic applications to client-server applications and n -tier applications. As a consequence of this technological evolution, the requirements became huge and complex and they touched functionalities, quality, API, architecture, design, constraint trials as well as enterprises laws and disciplines.

2. THE POSITION OF ACTORS AND ROLES ON REQUIREMENTS SPECIFICATION

The previous presentation of challenges faced by the requirements engineering in general and the specification in particular and the different opted solutions by requirements engineers allow us to notice that making a successful specification requires first a good comprehension of the entities (stakeholders)for example the clients that express their needs.

In requirements engineering, the notion of role represents a fundamental notion. It defines the specific behaviour of a participating entity to a particular context (Pohl 1993).

In fact, stakeholders' goals and roles in the definition and the resolution of project problems a long term subjects of interest on requirements engineering. Several process modelling technologies and approach based on role exist for instance: Activity role diagram, network interaction role …

The concept of role in these approaches allows underlining the responsibilities of the users and reflecting the organizational structure. But the boundaries of actual approach consist in fact that the user behaviour and his role are definite statically on a previous step or the user capacities and behaviour can change according to the context, also, the dynamism of the enterprise and their continuous evolutions requires surly bringing modifications on the different process.

So in our definition of role notion that we estimate fundamental in RE modelling approach we will start by a review of this notion in different existing representation models. In fact, the accomplishment of operational targets holds on resources as well as concerned actors competences. Indeed business processes are part of the organizational environments which are very dynamic so modelling those processes must be rich and flexible taking on consideration the evolution of process and actors in strategic or a business level while passing from a step to other.

Hence, we will present the way that some requirements engineering approach represented the role and actor notions.

The **I* approach** (Yu, Mylopoulos, 1994) provides a description of the work organization in terms of dependences relation between the actors according to the intentional components as aims to reach, tasks to accomplish, resources to produce and non functional requirements to satisfy. Therefore this approach opted to an agent -oriented approach to answer to the needs focusing on agents' intentional features. The trade process is considered as relations of dependences chain rather than a sequence of activity or purposes to be achieve where the actor is considered as an active entity doing tasks to reach the aims. An actor is an agent (human or software agent) having an activity or a position that is the outfit of agents role. This approach recognizes that actors have the liberty of action, in the social context (inter-actor), named strategic dependence (Babar 2007).

An enterprise is described by these organizational, operational and informational activities as well as these changes processes. Therefore in order to have a complete vision of the enterprise we must take on consideration when modelling all the enterprise perspectives.

In this context, The **EKD** (Kavakli, Loucopoulos, 2003) approach describes an enterprise as a netting of business process that collaborates to achieve some corporate aims. This approach present several models such as aims model, concepts model of the, actors-role model and activities model.

These models are linked to ensure an exhaustive representation. Indeed, the actors can be individuals, groups, roles, organizational unities, external systems, etc. They are associated to the goals of the aims model and represented by the actor model-role.

The process and the tasks of the enterprise are represented by activities model illustrating the aims achievement and the utilization of the necessary resources with taking on consideration the decision point, the interactions between actors and roles and the activities parallelism.

The **KAOS approach** (Dardenne, Lamsweerede & Fickas, 1993) underlines explicitly the importance of the representation and the modeling of the organizational aims and precise their relations with the operational components of the system. This approach separates modeling problems of modeling solutions. This approach puts the accent on the refinement of goals to functional needs with taking on consideration the human or automated agents to whom we assign the responsibility to satisfy requirements.

The **TROPOS approach** (Castro, Kolp, Mylopoulos, 2002) take in consideration when modelling the organizational environment of the actors, their goals and also their competences and abilities. In fact, an actor is considered as a physical or software agent having aims and interests. The way to achieve them is called plane, the behaviour of actor in a precise context is called role. The outfit of the roles represents a position. The ability of an actor to achieve aims is named capacity.

Therefore modelling business process must be based on roles and context to be more reliable and believable and must take in consideration the implication of actors at requirements engineering and their competence as resource to the realization of the aims.

Effectively the **RB2PM** model (Saidani, Nurcan, 2007) is a model that represents the actors as individuals having the capacity to take decision and not only as a resource. The role notion represents the aptitude or the authority to achieve some functions and not only the execution of a sequence of activity to accomplish a set of operational goals but also the knowledge and the autonomy of the actors. A function is defined as a set of operational aims of process held by a role and achieved by executing tasks. An actor belongs to one or several unities of organizations and summoned to the appropriated roles basing on his qualification and his competences. This model is very interesting because it permits to focus on actors' competences and preferences. This increases the system flexibility especially the business process evolution thanks to actors' contributions.

Approaches	Role	Actor
UML Approach	Set of task/responsibilities executed by an individual	Aperson associatedto one or more role
I star	activity or position seen under an intentional perspective of the agents	Anagentor abstractedactor (is human or software agent) having an activity
EKD	Activity taking into consideration the resources, decision point, the Interactions and the parallelism	Individuals, groups, roles, organizational unities, external systems associated to the aims
TROPOS	The behavior of an actor in a precise Context focusing on his abilities a position is a role set	A physical or software agent having aims
RB2PM	The aptitude or the authority to achieve some functions	An individual having a capacity of decision
KAOS	Actor contribution to reach aims	human or automated agents to whom we assign the responsibility To satisfy requirements

table1. The role and actor notion of the different RE approaches

Therefore from this board summarizing some definitions of RE models we propose a definition of role that we estimate the more complete: A role is the aptitude of an actor to achieve one or several tasks thanks to his abilities and taking into consideration the possibilities of changes touching both users and process. So an actor is considered as a physical entity having a position in the corporate organization and described through a profile of capacities and qualifications. We propose also defining to each business process a several features indispensable to his realization.

The figure below allows localizing role notion with reference to actors and business process. Then the role here represents the bridge that binds organizational to procedural.

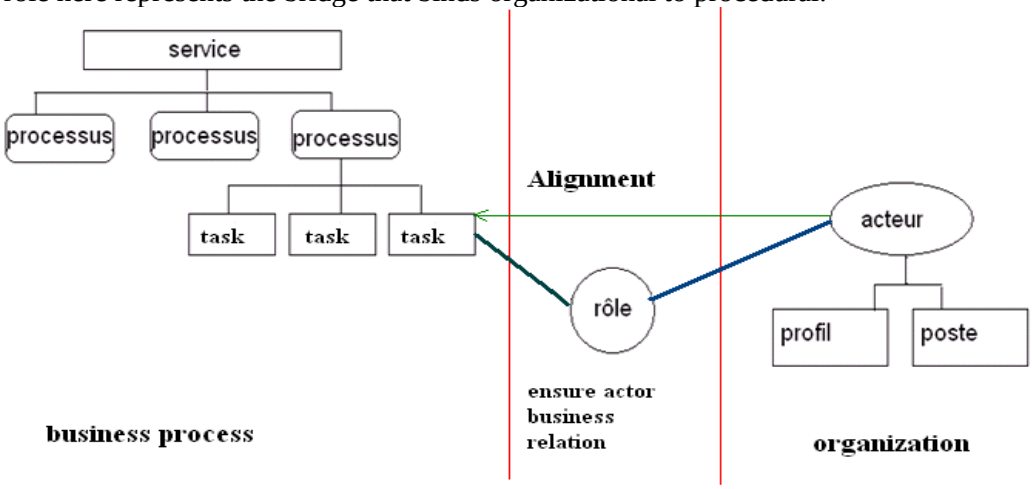

Figure1. Role position concerning the procedural and organizational view of the enterprise

3. RE PROCESSES MODELS

3.1 Model view

We present in this part three RE process models with different structures: linear, linear with iterations between the activities and iterative. In these models the common activities of RE, such as the requirements elicitation and the analysis, are maintained. Kotonya and Sommerville (1998) (Martin, Aurum, Jeffery, Paech 2002) suggest a conceptual linear model of the RE processes indicating the

iterations between the activities like present the figure 2. They state that the activities in the model overlap and are often performed iteratively.

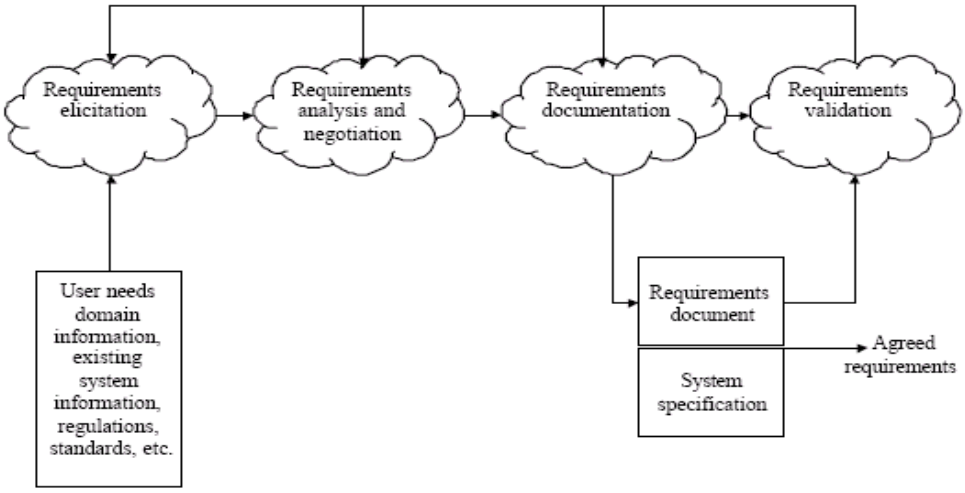

Figure2. Kotonya and Sommerville (1998) Linear Requirements Engineering Process Model

Macaulay (1996) provides a RE process model purely linear presented in the figure 3 without indicating the overlaps or the iterations of the proposed activities by the model of Kotonya and Sommerville. The RE activities are classified under different rubrics and the resultant documentation of the linear progress is common to the two models.

Macaulay (1996) recognizes that the RE processes depend on situation and discusses several different customer-supplier relationships and their corresponding RE processes.

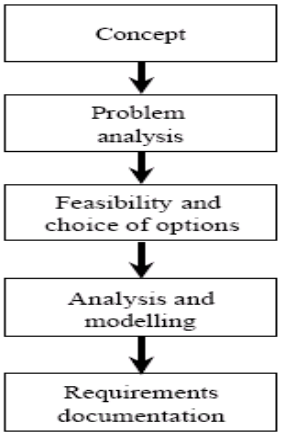

Figure3. Macaulay (1996) Linear Requirements Engineering Process Model

Although the literature tends to represent linear process of RE, non-linear models were also suggest such as the model of Loucopoulos and Karakostas (1995) present by the figure4, which represents the RE process as iterative and cyclical. This model shows the interactions between the RE activities (the elicitation, the specification and the validation) and also actors and the problems of the domain. The activities in this model are similar to the two already represented models but the order in which occur is non-linear and suggests a relation of cause to effect between them. The Loucopoulos and Karakostas model (1995) is used to represent the highly iterative process, such as the prototyping and ad hoc.

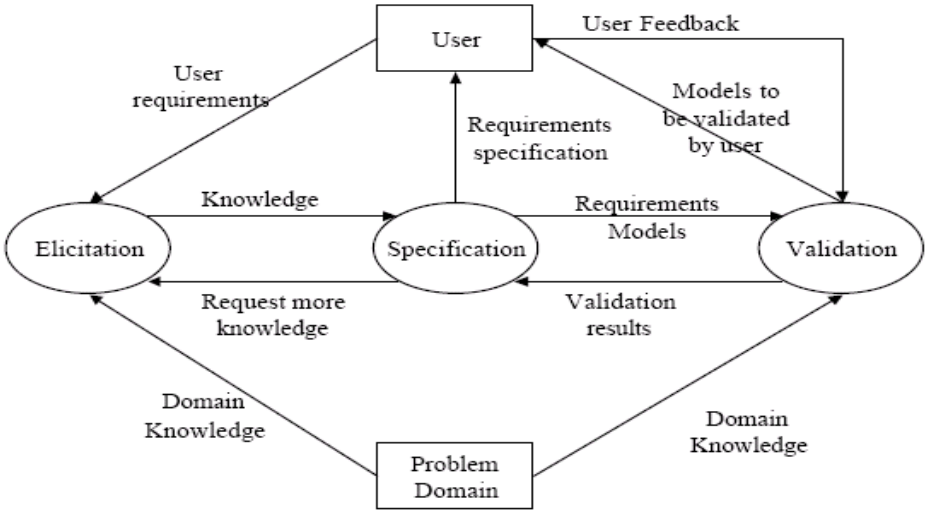

Figure4. Loucopoulos and Karakostas (1995) Iterative Requirements Engineering Process Model

3.2 Proposed model

We notice when analysing those models that stakeholders (actors) were not well considered although there influence and contribution on the achievement of RE steps is fundamental. In fact, we consider that the notion of role have to be represented on the Requirements Engineering Process Model. We estimate also that the more adequate and the more efficacious process models are the process models combining linear and iterative structure. So, we propose in this paragraph the process model of the requirements engineering of the presented needs in the figure 5 below, adding the role notion previously mentioned and putting in value the place of the actors in this process.

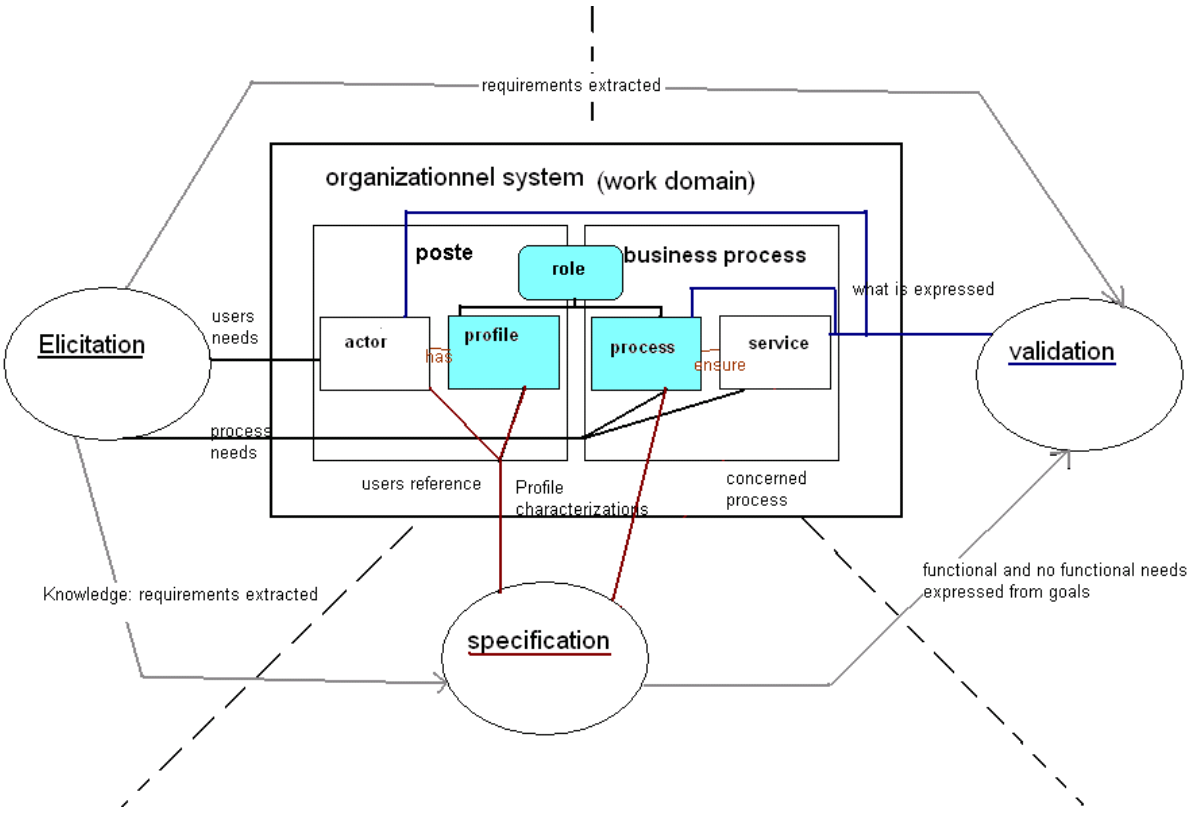

Figure5. Requirements engineering Process Model

In this model we expressed the links between the various steps of RE and the interaction between them and organizational system. For Requirements elicitation actor and processes are the source of requirements: Actors traditionally express their needs also improving processes impose new requirements. So the requirements imposed by business processes will be considered regardless if they were taken into consideration by the actors or not. The specification in RE is very difficult because several personal visions of the system are generally proposed and each stakeholders try to opt for his perspective and his way to model the system. So we will Face here many contradictions and conflicts due to the fact that each stakeholders has a different tasks, skills and knowledge (Pohl 1993). So the specification, as reference all along the life cycle of software system, must be complete, obvious and has the stakeholders' agreement.

Thanks to the notion of a role a profile can be attached to each actor: it is a kind of description collecting his skills and qualifications. Thus it is much easier to categorize the needs and extracts Reference to the stakeholders and also allows linking the appropriate actors to the adequate process in order to ensure for maximum the desired service. To validate, it is sufficient to guarantee alignment between the needs for change and the needs expressed by the specification: what should be expressed is what we really want. This will be much easier thanks to an exhaustive specification.

CONCLUSION

In conclusion, we can say that evolution is the big issue on requirements engineer, the evolution of companies to deal with permanent concurrence, of technologies to satisfy requirements or even process model to ensure the efficient use of resources and achieve goals. Evolution represents so a major factor of renewal and researches to propose the most effective models and processes to present a project in all these levels. But it is clear that each model has his advantages and his inconveniences. So the dynamism of models and concepts is essential because no models actually identify all levels of a company and no process can take into consideration all the factors and circumstances.

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