

Knowledge management system analysis using ASPECS methodology

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Abstract

In order to manage the frequent changes in customer requirements, products increasingly complex and face an extreme hard and tougher competition; organizations are always seeking to improve the use of their knowledge portfolio. Thus, it is noted that since fifteen years, many of them have begun to structure their approach to knowledge management. In this article, we propose a model of knowledge management system (KMS) based on the paradigm of Multi-Agent Systems (MAS) and the methodology ASPEC dedicated to the analysis, design and deployment of complex systems. This approach allows analysis and design to highlight the objectives of a KMS and the major mechanisms of its functioning. We use a goal-oriented approach that allows modeling of the targets of KMS and the actors involved and their dependencies.

The contribution of this article consists on the analysis of the field of knowledge management, bearing in mind the objective to develop a KMS based on an organizational approach that focuses on social and collaborative design process and manages reuse of knowledge.

Key words: Knowledge management, Organizational Approach, Project Memory, Multi-Agent Systems, ASPECS.

INTRODUCTION

In the current economic context, the competitiveness of an enterprise strongly depends on its internal productivity, performance, quality of designed products, etc. The product range must be updated permanently and production costs the lowest possible. Product leadership companies must continue to enter new markets with innovative products. These facts require the optimization of processes and methodologies used by engineering departments. The design processes have to be rationalized in capitalizing knowledge, know-how and technological patrimony.

A solution to this problem consists in using Knowledge Management techniques.

In order to support KM, many enterprises have deployed softwares known as Knowledge Management Systems (KMS). This deployment was amplified by the development of Information and Communication Technologies. However, due to the fact that they are complex systems, they are still difficult to analyze and design. Indeed:

- Technologies used for the development of these KMS are heterogeneous,
- Knowledge can take many forms,
- Knowledge is distributed on all the actors of an organisation,
- Actors involved in KM processes may use specific and heterogeneous softwares,

Most of KMS are thus heterogeneous and distributed softwares that exhibit openness.

These features lead to the acceptance of the Multi-Agent System paradigm as a good candidate for KMS. As example, one can cite the following works Gandon [1], Soto et al [2], Monticolo [3], Markus [4], etc. Even if these works bring great contribution to the field of KMS, they are very difficult to compare and analyze. The goal of this paper is to propose an approach for the analysis of a KMS using a MAS methodology that allow the definition of reusable components that allow the comparison and the precise identification of contributions to KM. In order to distinguish and differentiate the contributions to KM, we have taken as referential the knowledge management lifecycle process. The knowledge management life cycle [5] advances four main processes: identification process, conservation process (capitalization), value process (reuse) and update process. The chosen MAS methodology is named ASPECS [6] and is dedicated to the analysis, the design and the deployment of complex systems. This analysis brings light on the objectives of a KMS and the main mechanisms of its functioning. In particular, every activity, composing the analysis part of the methodology ASPECS, produces an exploitable model for the understanding and the comparison with the other existing works and should facilitate the re-use of the system in the other contexts.

This paper is structured as follows: section 2 introduces the background of the article by presenting the MAS paradigm, the ASPECS methodology and the hypothesis underlying the described approach. Section 3 details the KMS analysis through the ASPECS activities. Section 4 discusses related works and we conclude by stating the main research ideas and future research directions.

BACKGROUND

3.5 Software Agent Paradigm

Wooldridge and Jennings [25] defined an agent as a computer system with the following properties:

- **Autonomy:** it operates without the direct intervention of humans or others.
- **Social ability:** it interacts with other agents and possibly humans.
- **Reactivity:** it perceives its environment and it may respond to changes that occur in it.
- **Pro-activeness:** it does not simply act in response to its environment, it is also able to exhibit goal directed behaviors by taking initiatives.

A Multi-Agent System can therefore be defined as: "a collection of possibly heterogeneous, computational entities, having their own problem solving capabilities and which are able to interact among them in order to reach an overall goal" [7]. Agents have thus the required features that allow the deployment of a KM process in a transparent and automatic fashion.

Several methodologies have been proposed in order to engineer MAS [8]. It is not in the scope of this paper to discuss them. The choice of ASPECS is justified by the facts that this methodology is dedicated to complex systems and because the activities composing it produce several work products in the form of models that allow a fine grain understanding, comparison and reuse.

3.5 ASPECS methodology

ASPECS is a process of software engineering which describes step by step the stages to be followed for the development of software, since the analysis of needs until the production of the code and deployment of this one on a specific platform. It is based on the meta-model CRIO which defines the main concepts for the analysis, the design and the setting-up of the holonic multi agent system. The holonic approach [9] offers the possibility to the designer to model a system with entities of different granularities. It can so recursively decompose a system into sub-systems, until reach a level where it can be executed by entities considered as atomic and easy to implement. The adopted language of modeling is UML. To satisfy completely the objectives and the specific needs the directed agent approach, four main constituents are distinguished in the process of development ASPECS: the Phase, the Activity, the Task and the Stage. A Phase consists of several Activities, and each activity is itself composed of several tasks. A Task can be again decomposed into stages, considered as the atomic unit of design. ASPECS development cycle consists of four phases described below:

- **The requirement analysis:** aims at identifying requirements and model fulfilling them. It also has to collect the knowledge available on the problem domain and organize them within ontology.
- **Agent Society Design phase** that aims at designing a society of agents whose global behavior is able to provide an effective solution to the problem described in the previous phase and to satisfy associated requirements [10].

- The setting-up of the solution: describes the holons architecture involved in the solution and has to supply the code of the application.
- The deployment of the solution: constitutes the final phase in charge of the deployment of the application on the chosen platform.

In this paper we are only interested by some activities of the first phase the requirement analysis which are:

- Domain Requirements Description (DRD): The global objective of the Domain Requirements Description (DRD) activity is gathering needs and expectations of application stakeholders and providing a complete description of the behaviour of the application to be developed. Many possible approaches can be used to gather and analyses requirements. For this paper, the choice is to rely on a goal oriented approach inspired by [11].
- Problem Ontology Description (POD): The global objective of the Problem Ontology Description is to provide an overview of the problem domain. In order to do so, an ontology defined in [12] is used. The problem domain is then described by an ontology that could be later refined and used by agents to communicate.
- Organization Identification (OID): The goal of the Organization Identification activity is to bind each requirement to a global behaviour, embodied by an organization. Each organization will then be in charge of the realization of one or more goals (or sub-goals) of the system
- Interactions and Role Identification (IRI): this activity aims at decomposing a global behavior embodied by an organization into smaller interacting behaviors. Each behavior defines a role that may interact with other roles.
- Scenario Description (SD): The goal of this activity is to focus on the interactions occurring inside organizations and describe the sequence of interactions occurring among roles by specifying pertinent scenarios.

3.5 Approach hypothesis

Our work is based on Monticello research works [3]. The author proposes an approach for knowledge capitalization. This work is based on an organizational approach for knowledge management of mechanical design projects. During these works, he took into account the social and cooperative aspects of the design process where professional actors work together, create, use and share their knowledge to reach the same objective: the development of a new mechanical product.

Four aspects were developed in his works:

- The elaboration of an organizational model of the design process, OrgaDesign, where are represented professional actors roles, their skills, their interactions as well as the knowledge that they use and share throughout the design activities. This model is a guide for the capitalization and the re-use of the knowledge during the design projects of conception;

- The definition of a model of organizational memory, MemoDesign, supplying a frame for the indexation of the knowledge to be archived during the design projects;
- The construction of an ontology called OntoDesign allowing the representation and manipulation of the Knowledge of the domain;
- The conception and the deployment of the multi-agent system KATRAS taking into account the social and cooperative aspects of the design process of conception and in charge of the construction of project memories of design mechanical projects. We propose a solution which is based on the professional actors activities that participate in the design projects and share and use knowledge when they interpret precise roles during the activities of the design process.

KATRAS handle knowledge which should be structured and organized in ontology. Ontology refers to an *engineering artifact*, constituted by a specific *vocabulary* used to describe a certain reality, plus a set of explicit assumptions regarding the *intended meaning* of the vocabulary words. It involved how to constrain the use of the data and it is used widely in the semantic web approach, which requires a significant degree of structure. Based on MemoDesign, we built the domain ontology which enriches OntoDesign and proposes a vocabulary and a semantic defining the concepts corresponding to the capitalized knowledge and their attributes.

We propose a KMS based on the knowledge identification from an organisational approach to model the professional processes implemented in projects. Our modelling is built with the concepts of Roles, Interactions, Organization Competence and Knowledge.

Concepts of the meta-model RIO [23] agree perfectly to model the design process: we represent a design activity by an organization. In this organization we represent the roles of the professional actors in interaction. The interaction symbolizes the collaboration between the actors which expresses itself by the realization of a deliverable (objective of the organisation/activity) and the sharing of the knowledge between the roles. So, by means of RIO, we represent a phase of the process by divisible organization in activities which are themselves represented by organizations. The meta-model RIO does not allow explicit representation of the skills and the knowledge used by the role when they interact with the other roles in the same organization.

Monticolo [3] allocates to these roles the competences which they use to achieve the activities. The competence is the capacity for an individual to implement its knowledge and to develop its know-how. Competences are also developed during the achievement of professional activities, in which the exchange of knowledge takes place. Each competence is aggregated with a set of knowledge.

Monticolo's research work aims essentially to capitalize knowledge during the design process. In this paper we analyze a KMS which reuses this knowledge.

ASPECS ACTIVITIES

3.5 Goal Oriented Analysis Of The Kms

The methodology ASPECS is managed by the description of requirements Domain requirements description (DRD). This activity treats the analysis of the system goals. Goals describe the functions that the software has to realize. The KMS has for main goal to manage the knowledge during the product design process.

The analysis of the main works on KM shows a consensus on four main processes: the repair process, the preserve process, the value process and the support process. These processes are assimilated to the global purposes that all KMS have to reach (at least partially) and are respectively: the identification, the capitalization, the re-use and the updating of the knowledge. We use goal-oriented analysis [11] to model the goals of the KMS. We use this approach to express the purpose of every stage of the knowledge management life cycle. These goals will be realized by organizations, which are going to connect each goal with a global behavior. The i^* framework [13] was chosen to support the goal-oriented analysis.

This framework provides an intuitive representation of goals, actors and their dependences. The following concepts are part of the i^* framework [11]:

- The actors (presented by circles) which represent an organization or a role.
- Hard-goals which represent a concrete objective to reach (represented by rectangles with rounded corners).
- Soft-goals having no precise definition and/or criteria to determine if they are satisfied or not (represented by clouds).
- Plans (depicted by hexagons), which represent, at an abstract level, a way/mean of realizing a task. The realization of a plan is a mean to satisfy or to contribute to a hard or a soft goal.

Moreover, one can use two forms of goals decomposition. First, the "AND" decomposition where the goal can be reached by resolving all the downward knots, presented by an arc linking son knots. Second, the "OR" decomposition where the purpose can be reached by resolving one, at least, son knots. For soft goals, we speak about positive (or negative) contributions which means that we identify goals which can contribute positively (or negatively) in the fulfillment of the goal to be realized. Five soft goals contribute positively to the realization of the upper KMS soft-goal to manage the knowledge connected by the decomposition AND (figure 1). These five sub-goals are: Context detected, realized by the detector, the identified knowledge, the capitalized knowledge, the reused knowledge and the updated knowledge. Each soft goal tally with knowledge management lifecycle and its four main processes [5].

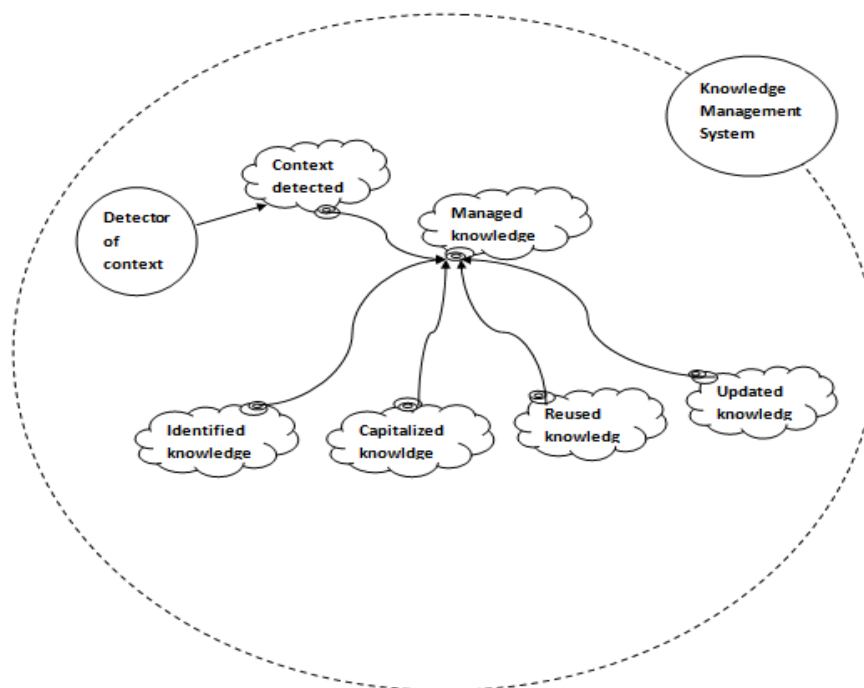


Figure 1: Strategic reasoning diagram

3.5 Problem Ontology Description (POD)

The global objective of the Problem Ontology Description is to supply an overview of the problem in the course of study. This activity deepens the understanding of the problem with a description of the concepts which compose the problem domain. The Problem ontology is modeled using a class diagram where concepts, attributes and actions are identified by specific stereotypes [14]. These stereotypes are:

- Concept to indicate an entity of the domain,
- Action to indicate a transformation of a concept,
- Predicate to indicate a predicate concerning a set of concepts.

The UML diagram presented in the Fig.2 presents our proposition of the domain ontology relative to the KMS. The life cycle of the product describes step by step the activities to be followed for the development of a mechanical product, since the phase of requirement analysis until the phase of the product industrialization. A phase is constituted of a set of activities. Every activity can be itself composed of sub-activities. At the end of an activity, a deliverable (for example a document of specification) is created. The phase delivers a state of the major work product such as a concept or a prototype. Every activities are realized by professional actors work.

The phases and the activities are modeled by organizations. These organizations are composed of roles. Every role represents the behavior of a professional actor.

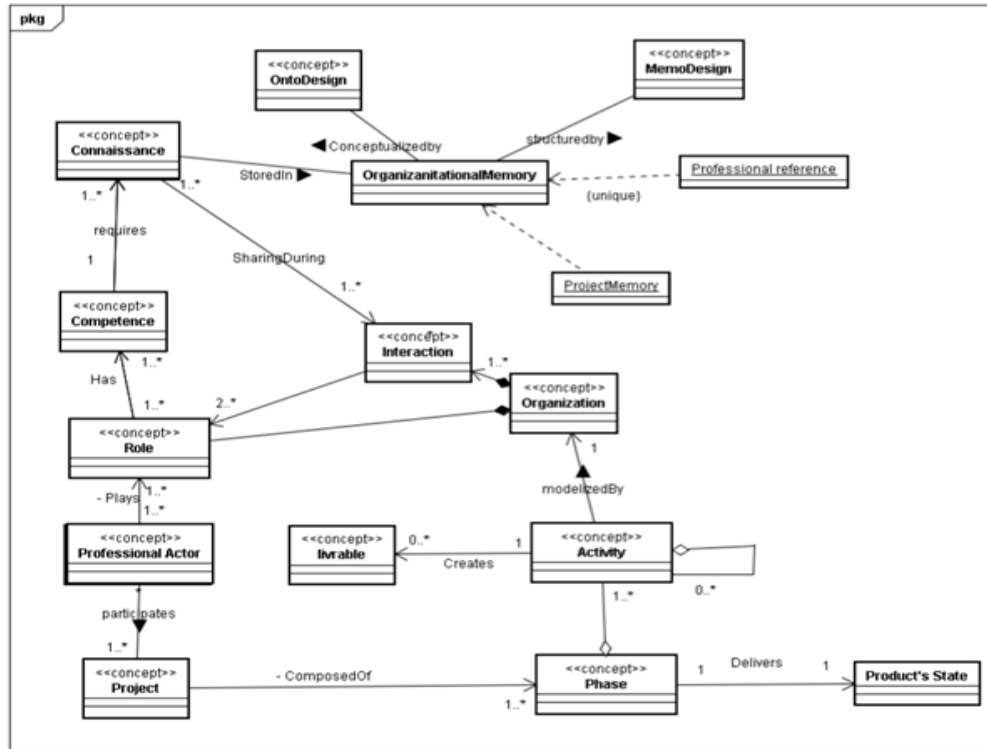


Figure 2: Domain ontology to the KMS

A role allows determining the actor's behavior during the activity through its interactions, its competences and knowledge which he uses and/or shares [3]. A competence (example: 'to formalize the customer requirements') acquired by a role (example: 'designer') requires one or several knowledge (example: 'technical requirements of the customer') to be implemented. Every competence is so associated with a series of knowledge allowing characterizing it. A role possesses one or several competences. Every competence requires one or several knowledge to be used. An actor can play several roles and a role can be played by several actors.

Every deliverable is the result of an activity. In the organizational model, it corresponds to the result of the interactions. The state of the product is contained in the knowledge associated with the results of the interaction. This knowledge is shared during the interaction between the roles. They are stored in an organizational memory.

3.5 Organization identification (OID)

The purpose of this activity is to connect every requirement, for our case a set of goals or of plans, to a global behavior, embodied by an organization. Every purpose/plan is then associated with an organization responsible for its fulfillment.

An organization is defined by a set of roles, their interactions and a common context.

Components occurring during the knowledge management are illustrated in the figure 3.

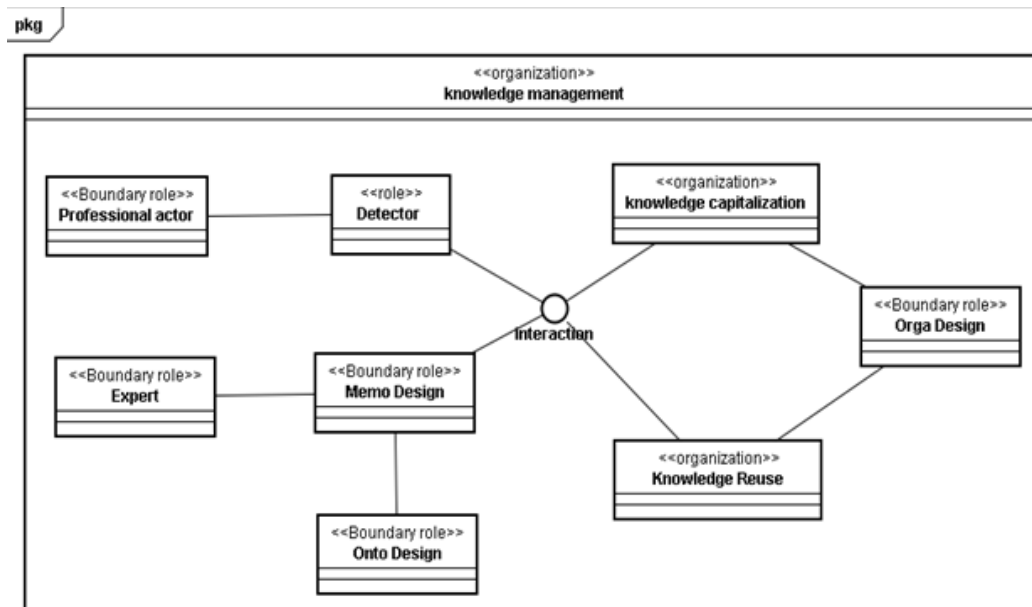


Figure 3: Knowledge management modelization

The professional actor is followed by the role of the detector. This role follows the activities of the user and detects the professional actor’s activity and role, the project name and the term in the search filed. The competence and the knowledge used during the design process are presented in the organizational model OrgaDesign which constitutes a”Boundary role”. A ” Boundary role ” Role” is a role situated on the border between the system and its outside and which is responsible for interactions arriving at this border. The”Boundary role” Expert represents the human experts in interaction with the system who take care of validating the knowledge of MemoDesign. Knowledge is represented by concepts and relations stemming from the ontology OntoDesign. These components are in interaction with organizations” knowledge capitalization” and” knowledge reuse”.

3.5 Interactions and Role Identification

This corresponds to the activity “Interactions and Role Identification (IRI)” in ASPECS which aims at decomposing a global behavior embodied by an organization in sub-organization. The finest behavior is represented by a Role. The interaction of the roles must be defined in the same organization which supplies the context of interaction. The purpose every role has to contribute to the fulfillment (of a part) of the purpose of the organization to which it belong. The resultant diagram is a diagram of class where the classes represent the roles (stereotypes are used to differentiate the roles and the boundary roles).

3.4.1. Roles dedicated to the capitalization

Figure 4 presents the Strategic Reasoning Diagram illustrating the roles occurring for the knowledge capitalization organization [3].An organization is defined by a set of

roles, their interactions and a common context. The principle for defining the organizations is to assign the goals identified in the strategic rationale diagram to roles able to fulfil them.

The detector of knowledge identifies the information 'candidates' and their contexts that is the knowledge which seem to be relevant and which could be used to build the project memory. To identify the knowledge, this role localizes them among the information created during the project (documents, schedule, calculations etc.). Having localized and identified these informations, it maps them to give them a context which will be an activity which is a stage of the design process and a given role. The mapping (cartography) allows the characterization of the knowledge.

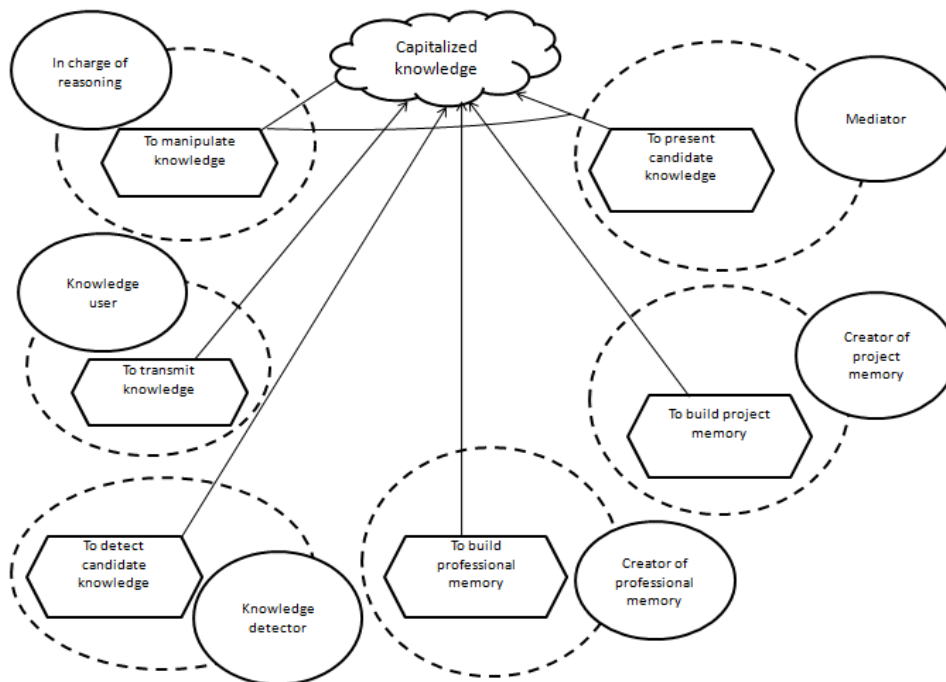


Figure 4: Strategic Reasoning Diagram for knowledge capitalization

The mediator role presents the candidate knowledge to the members of the project team identified 'as Project referents'. These are so subjected to a process of validation. The project referents can modify, delete or accept the candidate knowledge.

To do so, the mediator role allows to estimate, to standardize, to enrich and to update the capitalized knowledge. The creator of the project memory builds it from the knowledge annotated by the detector of knowledge and validated by the mediator. The knowledge are modeled and formalized according to the structure of the project memory. This role manages the filing of the knowledge in the project memory. The creator of the professional memory builds it from the knowledge annotated by the detector of knowledge and validated by the mediator.

The user of the knowledge perceives the organizational context of the professional actor (activity, role). It builds then a request to know if similar knowledge were already archived for the same organizational context. The in charge of reasoning exploits the knowledge, it manipulates them by means of the ontology Onto Design to be able to reuse them. It answers the requests formulated by the user of the knowledge and extracts the knowledge which are relevant. We modified the behavior of the role “Detector of knowledge” used for the capitalization to adapt it also to the re-use of the knowledge. This role is henceforth called “Detector of Context”.

3.4.2. Roles dedicated to knowledge reuse

Figure 5 represents the strategic reasoning diagram for soft goal “proposed relevant knowledge”. To realize it, at least one of three plans, namely, to realize the automatic assistance, to realize the PULL or to realize the Transfer must be realized. The automatic assistance is automatically started by the system, the PULL is activated by the user, the transfer comes true only once for a project and concerns a precise number of professional actors.

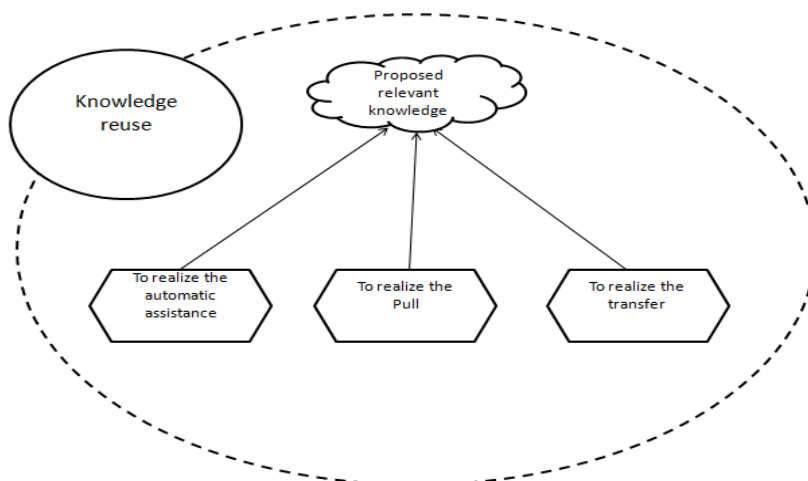


Figure 5: Strategic Reasoning Diagram for soft goal” Proposed relevant knowledge”

In the context of our work, we present the PUSH, which is defined by the proposition of the knowledge partner in a role to realize its activity by leaning on the model of project memory. The system follows the activities of the user, detects its role, the name of the product as well as its activity and proposes him automatically the knowledge according to the model RIOCK (Role, Interaction, Organization, Competence, Knowledge) (OrgaDesign). Example: if the actor plays the role of the designer and realizes the activity “to realize the analysis of requirements” it has for knowledge according to the model RIOCK the list of requirements.

The system proposes him the list of requirements of all capitalized project. He also proposes him the knowledge connected to the result of the interaction.

Four roles intervene for the realization of the PUSH (figure 6):

- Identifier (Identifier OrgaDesign)
- Reuser
- In charge of professional reasoning
- In charge of project reasoning

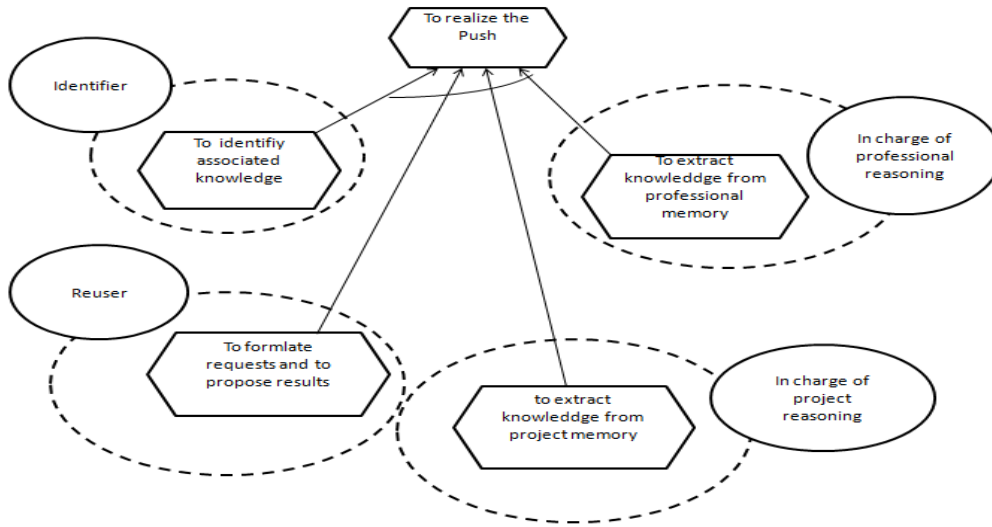


Figure 6: Dependence Strategic Diagram for Push

The second plan described in this paper is the plan "To Realize the knowledge transfer". The knowledge transfer contributes to the cooperation of the professional actors sharing the same knowledge. This type of knowledge reuse occurs only once at the beginning of every project. It consists in sending, for example by e-mail, to the actors sharing the same knowledge, relevant capitalized knowledge.

This knowledge results from the professional referent. For it, the identification of the shared knowledge and the roles which acquires them according to the organizational model is mandatory. Four roles intervene for the realization of the transfer (figure 7)

- Reuser
- Transferor
- In charge of professional reasoning
- In charge of project reasoning

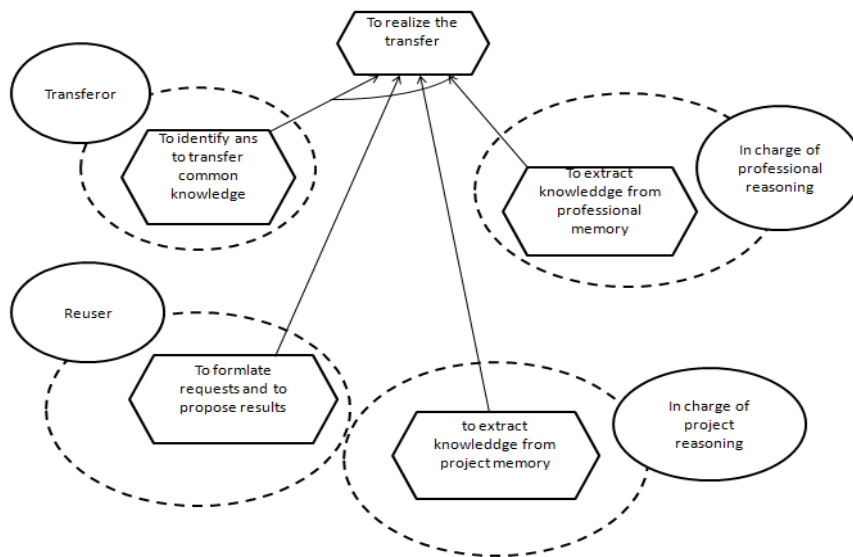


Figure 7: Dependence Strategic Diagram for knowledge transfer

Example: if two roles share the same knowledge " list of requirements ", the system sending by e-mail, at the beginning of the project, to the concerned actors (playing these roles) the list of the requirements of all the capitalized projects.

Figure 8 illustrates the interactions between the various roles for the realization of the various forms of knowledge re-use.

Several roles intervene for the realization of one or several forms of re-use. The forms of re-use constitute a help to the user according to the organizational context and according to its needs.

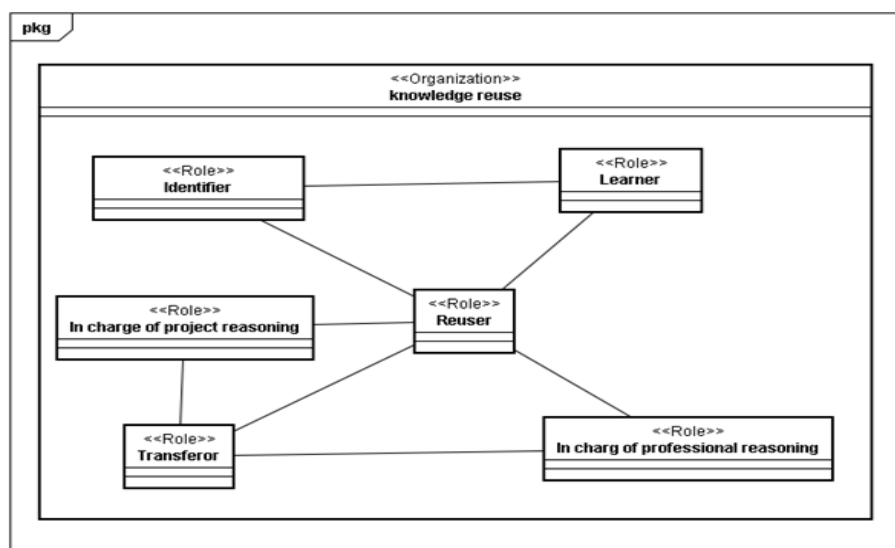


Figure 8: Model describing the re-use of the knowledge

These roles are:

The identifier deduces the knowledge connected to the role and to the detected activity. The mapping of knowledge established from the organizational model allows to identify the knowledge used by the roles of the professional actors during the design activities; The transferor: deduces, thanks to the organizational model, the roles which share the same knowledge and takes care to send by e-mail those who are relevant. This process comes true only once at the beginning of every project. The Learner manages the requests (knowledge, terms to be looked) established by the professional actors during their searches for the knowledge as well as the number of their request. Thanks to this management, it acquires the capacity to learn the most sought requests. The reuser takes care to propose to the professional actor the relevant knowledge. This proposition depends on user needs. In this objective, the role of reuser takes care to formulate the request and allows to specify the type of assistant brought to the professional actor. The in charge of project reasoning project exploits the knowledge of the current project, it manipulates them by means of the ontology *OntoDesign* so that these knowledge can be reused. The in charge of professional reasoning exploits and reuses, by means of the ontology *OntoDesign*, the knowledge of the professional reference.

We detail in the following section the various protocols of interaction for the realization of the various forms of re-use described previously.

3.5 Description of scenarios

This corresponds to the activity "Scenario Description" in ASPECS. The purpose of this activity is to describe the protocols of interaction of the roles (a scenario describes the sequences of interaction of the roles realizing one (a part of) goal. The defined scenarios describe real examples of program execution. We choose to describe two scenarios which are represented in the form of stereotyped UML sequence diagrams.

3.5.2 Protocol of interaction for the Push / pull

To illustrate the interactions between the roles, the figure 9 describes the various sequences of communication between the roles dedicated to the Pull and to the Push.

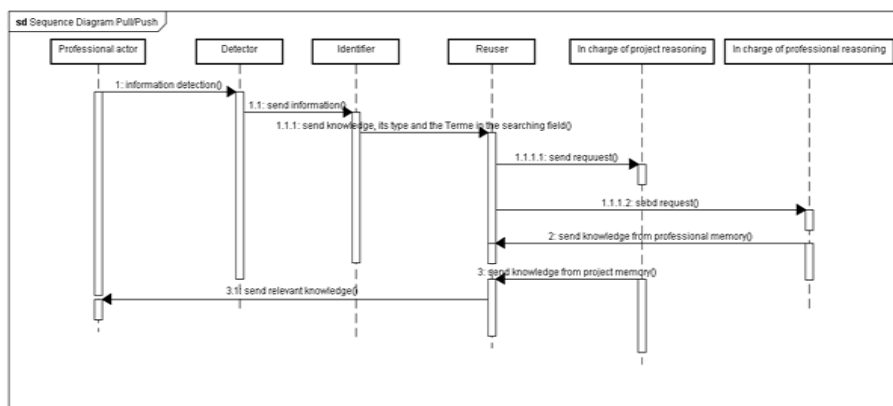


Figure 9: Sequence diagram (PUSH / PULL)

During the sequence, the Detector role detects the current activity, the role of the professional actor (mandatory to trigger the PUSH) and possibly the term in the research field (mandatory to trigger the PULL) it sends them to the identifier which determines the knowledge connected to the role and to the activity following the model OrgaDesign (knowledge associated with the role and the knowledge connected to the result of the interaction). The Identifier sends them (accompanied possibly by the looked term) to the re-user. The re-user takes care of building a request with the acquired information. Once formulated, the request is sent to the in charge of project reasoning and In Charge of professional reasoning which consult the project memory to look for the knowledge answering the composed request. The results are sent to the re-user which proposes them to the professional actor.

3.5.2 Protocol of interaction for the transfer

To illustrate the interactions between roles, we present figure 10 with the various sequences between the roles dedicated to the Transfer.

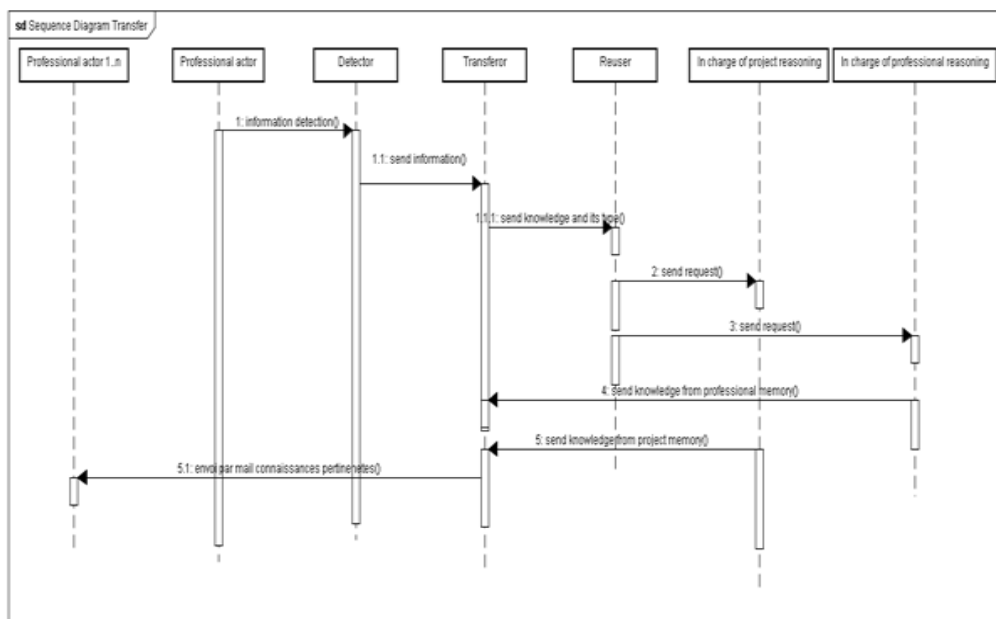


Figure 10: Diagram of sequence (Transfer)

During the sequence, the Detector role detects the name of the project. It then sends it to the transferor which verifies its existence in the memory project. If the project name is not capitalized, the transferor determines, thanks to the model OrgaDesign, the knowledge shared by two or several users. This one sends the knowledge shared to the re-user which builds the requests with the acquired information. The formulated request is sent to the "In charge of project reasoning" and "In Charge of professional reasoning" which looks for an answer in the base of the knowledge. The relevant knowledge are so sent to the transferor which takes care to send them by e-mail to the concerned professional actors.

4 RELATED WORKS

In this section, we try to make an overview about knowledge management system analysis by studying different research works which tackle this research area. Concerning organizational memories, several works were realized in this domain: the authors of [15] propose a meta-model to model the design process which is a graphic representation of the key concepts (situation, entity and specific roles) and proposes a method of knowledge capitalization by basing itself on this model. The proposed method integrates the various present aspects into a design project context. It consists in representing a design situation in the form of a set of interactions of various natures by clarifying the participation of every element in each of the interactions and consequently in the global progress of the project. In this sense, the passage of a given situation (at the moment t) to another situation (moment $t + 1$) is the result of this set of interactions. . This result can be observed by the creation of new elements, the deletion or the modification of some or still on the evolution of the existing links between the various elements. It is what Bekhti and Matta [25] defines as the mutual influences of the elements of the project. Some adopted the organizational approach during the modelling of design process and knowledge management. By presenting the concept of the learner company Nonaka [16], takes into account the knowledge in the company, and brings to light the mechanisms of transmission and evolution of the knowledge in organizations. Organizational approach takes into account the social character in the knowledge management which has as aim, rather than to try to formalize, to model knowledge and know how, allowing the various holders and the experts to share them and to pass on them. The authors of [17] propose a modeling of the collaboration frame which integrates the various modes of collaboration, the various modes of organization of the design process, the intermediate objects and their maturity. These various models describe all the elements existing in the context, but they do not take into account the competences and the knowledge of professional actor's roles. Concerning MAS based KMS, Dignum [18] proposed a framework for agent societies called OperA. OperA uses the agent paradigm to analyze and model organizations and their knowledge needs, and to provide a reusable architecture to build KM systems.

All those research works contributes essentially to knowledge capitalization. Our research work contributes to knowledge reuse.

Authors adopted the organizational model and used links and multimedia as type of knowledge. Soto and al [2] proposes a generic model for developing KMS which aims to capitalize and reuse knowledge. GUIZZARDI and al [19] focused on organizational reengineering to favor KM. they adopted an organizational model and used links and multimedia as type of knowledge. He proposed an approach named ARKnowD to support the analysis and design of KM solutions in organizational settings. We have been inspired by these research works to develop the KMS in particular by some roles dedicated to knowledge identification but they don't explain in details knowledge reuse. Barthes's research [20] focuses on how he intends to automatically capture the operations performed on a desktop computer by using personal assistant agents, and how he intends to organize them as Lesson Learned.

Van Elst and al [21] have proposed the Mymory workbench approach. Mymory is based on a semantic wiki system and supports manual as well as automated annotations of wiki documents. It consists of three main elements which are realized on top of a light-weight service framework: i) Document Work Services support core activities like document production (writing, annotating, etc.) and document consumption (reading). ii) Context Services realize the acquisition of user context and attention information. iii) Information Services comprise tools which aim at supporting a user's current task with relevant information (e. g., search) and which contributes to knowledge value process. The vocabulary which is used by these services is provided by ontologies (modeling context and annotation types) and a Personal Information Model (PIMO) which represents the mental concepts used by the knowledge worker to get his work done. Markus [4] has introduced an agent-oriented modeling approach for analyzing knowledge transfer effectiveness in the light of stakeholders' goals and has used different type of knowledge (documents, links etc). He has developed the Knowledge Transfer Agent KTA modeling method which contributes essentially to analyzing effectiveness of knowledge transfer instruments in the light of (potentially conflicting) stakeholders' goals. We have been inspired by these research works to support the goal-oriented analysis used in this paper.

Gandon [1] has developed a multi-agents system for the management of a corporate semantic web based on an ontology. He adopted a user's preference model and used different types of knowledge. Three aspects were essentially developed in this work:

- The design of a multi-agents architecture supporting the organizational topdown approach followed to identify the societies, the roles and the interactions of agents
- The construction of the ontology O'CoMMA and the structuring of a corporate memory exploiting semantic Web technologies
- the design and implementation of the sub-societies of agents dedicated to the management of the annotations and the ontology and of the protocols underlying these groups of agents, in particular techniques for distributing annotations and queries between the agents

The authors of [22] present a model in which concepts in ontologies are extended with organizational information to explicitly express the situation in which they were learned and used. It is discussed how autonomous agents are allowed to reason about concept usage and privacy in terms of organizational constructs, paving the way to reason about social roles in open Web communities.

Even if these research works introduce some forms of knowledge reuse, they don't detail these forms and they don't propose a methodology to analyze the KMS. In this paper, we propose a methodology dedicated to the analyze of KMS and we detail some forms of knowledge reuse.

CONCLUSION

In this article, we proposed an analysis of KMS which leans on the methodology ASPECS and which allows to bring to light the objectives and the main mechanisms of functioning of the system and to enable their understanding and comparison with other approaches. We have used a goal oriented analysis to model KMS goals as well as the involved actors and their dependences for the realization of every goal. Our work is based on [3]. The author proposes an approach of capitalization of knowledge following an organizational approach. Our contribution, towards this work, is twofold. On the one hand, the goal oriented analysis allows to bring to light the different component and their links with the aim of the realization of system objectives. On the other hand, on the basis of this analysis we proposed mechanisms of assistants to the user by knowledge re-use. Indeed, this system allows to assist the professional actor during the design process of products by proposing him mainly three types of assistant; the automatic assistance, the alarm system and the knowledge transfer. This analysis resulted in the design and implementation of a KMS based upon MAS that has been used in several design projects. Future works will consist in enriching the knowledge reuse mechanisms and evaluate the existing mechanisms through experiments during design projects.

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