

Knowledge representation for an efficient re-use of project memory using ontology concept

[Sabri Allani , Hatem Ben Sta]

Abstract— This paper presents a knowledge management experiment realized in an in high technological industry. After some definitions of project memory, related works and some critiques of existing approaches of project memory we suggest an approach based on two key guidelines : representation of both the context and the design rationale of a project for an efficient access to knowledge using the technology of the ontology field . Finally, after avoiding some of the weaknesses the existing approaches we suggest our ontology approach with is based on [1] rational approach , showing how ontology technology can effectively contribute to the conceptualization of memories projects in order to allow preserving relevant information to be used later .

Keywords— Project Memory, Knowledge Management, Ontology.

I. Introduction

Nowadays, the information technology can reduce the design process. To get to design products in the best conditions of time, cost and quality must control all the factors that allow a designer to create solutions technically feasible and best meet the constraints and objectives expressed in the specifications, therefore to satisfy the desires of a client. an important question is to know how a company or partners consortium can maintain competencies generated during an engineering project until their next use, and how the technical choices validated or invalidated within a previous projects can be reused.

However, the question is: how to store design choices, justifications, working hypotheses, context and authors , these choices and how the traceability of reasoning process can ensure going faster in the design of future products, In fact, Our approach aims to representation of both context and the design rationale of a project for an efficient access to knowledge using the technology of the ontology field .In fact , the method consists of an information retrieval environment that , in the one hand can infer knowledge , models as a semantic network , and On the other hand, is based on the context and the objectives of a specific activity (the design) .The environment supporting the project memory based on ontology that is going to be defined by the to be used to gather similar project elements .

II. Definition of a project memory

Before, defines what is a project memory we need to define what a project is according to [4] a project is “a specific gait that permits to construct systematically and progressively an achievable reality” in The norm X50-105 of the AFNOR .moreover he adds that “a project is Defined and implemented to satisfy the needs of a user, a customer or a clientele and imply an aim and some actions to undertake with given resources” However, the concept of a project is often used in any industrial company witch lead us to define the project memory .

There are several authors who defined the project memory:

For [5], “A project memory is defined as a memory of knowledge and data acquired and produced during the realization of projects” .

For [2] “A project memory is generally defined as a representation of the experience acquired during projects realization “.

[6] Defines the project memory as being “lessons and descended experiences of given projects”.

[8] Defines it as “an explicit representation of knowledge acquired and produced during the project”.

Last but not least [1] defines a project memory as

“An elements of the product and his/her/its process of conception in view of an ulterior Use” However, These definitions focus on the topic of “Project Memory” rather than on its goals , these latter remain implicit. In fact The objectives of those definitions is to cover all elements manipulated during the project: traceability, product, process, actor, organization, etc. So we suggest the following definition: A project memory is a way of showing and sharing of experience in all project phases.

Sabri Allani /Hatem Ben Sta

Intelligent Information Engineering Laboratory, Higher Institute of Management of Tunis 41, Rue de la Liberté, Cité Bouchoucha 2000 Le Bardo, Tunis, Tunisia

III. Related works of project memory.

A. Yasmina Harani Proposition

Yasmina Harani defined in its work [13] with the project memory model as follows:.

- **A product model:** to describe the various aspects of product design at different levels of abstraction.
- **A process model of product design:** Describe the process of product design at different levels of detail depicting the why, how and by whom or on what each step of the design.
- **A resource model** to represent all stakeholders during the course of the design.
- **The integration between the three models** was developed from concepts as well belonging to one than the other two models. To obtain a consistent model .

The best thing in Yasmina approach is the strongest of the link established between the three concepts : Product/Process/Resource , Nevertheless , this approach does not take in consideration this three aspects: documentation, justification, argumentation.

B. Michel Labrousse Proposition

In his work, Michel Labrousse [15], was defined an approach named the FBS-PPRE model ((Function /Behavior/Structure Process/ Product/ Resource/ External effect). And basically He modeled these three concepts using UML [16],GRAI [10], and IDEF3 [11] and therefore he gives three examples : the FBS model (Function, Behavior and Structure) [12] , the MOCHA model [9] and model of Yasmina Harani [19] . However , The weakness of this model is absence of the distinction at the base between Product, Process and Resource which are generalized in "Objects" Added to that, this proposition dose not take into consideration the three objects Organization, Justification of the choices and Documentation during project realization .

C. Smain Bekhti Proposition

➤ In 2003 :

Based on the work of [5] Smain Bekhti has defined his Owen proposition of project memory called DyPKM with is a process of definition and modeling memories projects .His project memory is decomposed into a resolution of the problems and decision making called "memory of the logic design" and a party representing the characteristics of the project called "memory context."

Fig. 1: Shows The memory of context that is the whole of elements characterizing the course and the organization of project of design

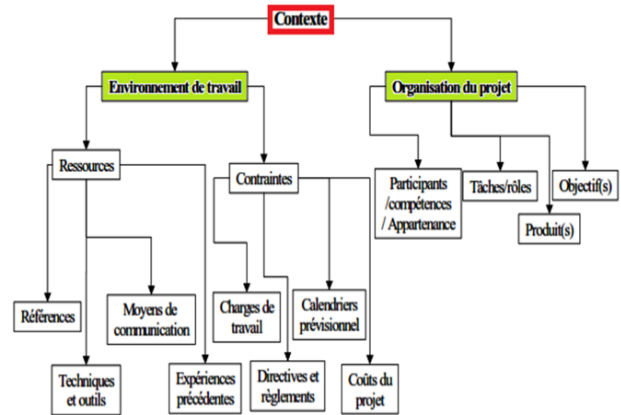


Figure 1: Elements of the context memory of [14]

The second part is Memory of the logic design this memory is the space for discussion of the problems between the team organization in order to solve them. The basic components of the design rationale are: Problems, arguments, suggestions, Selection Criteria, evaluation solutions Decision.

The strangest of Smain Bekhti [14] proposition is the Simplicity of the method , Applicability in real time. And Maturity models and representations. Moreover, the Integrating traceability process in the body of the Project implementation. Last but not least , This approach does not require specific knowledge engineering skills but simply an understanding of project objectives. Nevertheless, this model does not take into account the following aspects: Evolution, Information, Organization, Justification and Integrity constraints are not explicit. Added to that, much concentration on the logical aspect of design but some context (time, cost, quality) has not been developed.

➤ On 2011 :

Smain Bekhti, [16] redefined thé DyPKM approach using thé ontology concept and therefore many weakness have been fixed and many benefits have been added .

The new approach is still based on tow parts : project context and the design rationale and the produced project memory considered as a referential resource in an organization, This resource is structured as a domain ontology, how prove links to relevant Documents and a semantic network accurately linking up concepts constituting the project context and the design rationale. This approach is based on four elements :

The project organization: teams, members, tasks, roles, competencies, etc.

Resources and constraints: rules, methods, directives, time, budget, etc.

Project realization: problem solving (problem definition, suggestions, and decision), solution evaluation (arguments, criteria), etc.

Project goals and objectives.

Relations between the above elements are represented in figure 3

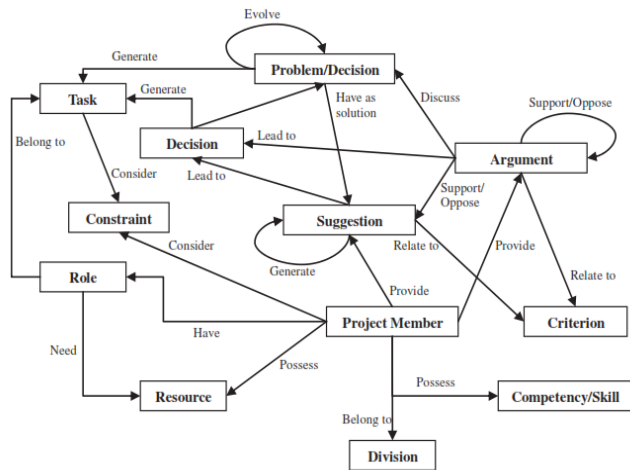


Figure 2 : Project memory structure [16].

D. Hatem ben Sta Proposition

In his work, Hatem ben Sta [1], was defined a whole of generic and coherent UML models coherent intended to develop the software tool to assure the projects memory, after adaptation and taking into account the context an approach based on a multi-tiered architecture, takes advantage of the level of system data base management object-relational data, allowing to have a structure of flexible implementation that can be easily maintainable. This architecture also provides access to the memory of the project according to different points of view. The general proposition structure is shown in fig 3:

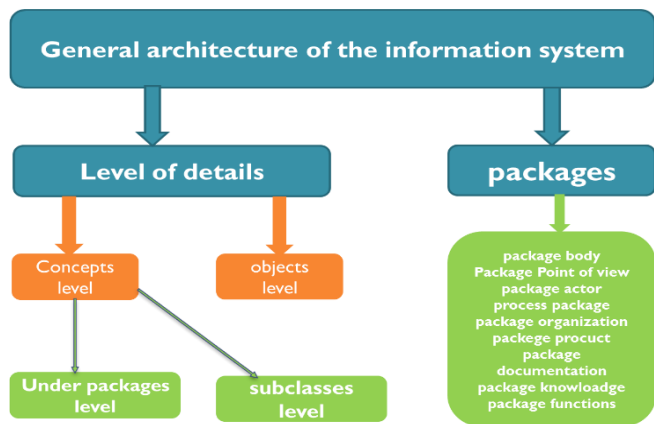


Figure 3 : Project memory structure of [1].

However , the strength of the work is great genericity developed models with is shown in fig 5 as the overall architecture of the proposed project memory packages.

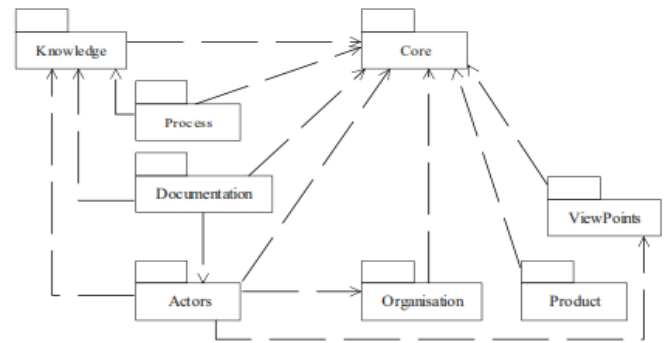


Figure 4 : Global architecture of the system. of [1] .

Despite all the prewise proposition the model of hatem ben sta [1] models were constructed on the basis of a pattern of modeling used the representation of tree structures frequently encountered in the field.

Nevertheless, the approach of [1] have some weakness:

- The mapping between packages is not very easy and the query may takes a long time to fetch results.
- Rigidity of models and the absence of flexibility.
- it not easy to add, modify and maintain elements
- last but not least , nowadays it is very importing to have process of reasoning between all project memory elements in order to make the reutilization of previous projects fast , automatic and easy .

In fact, for all those reason and especially due the big generosity of the proposed models that are bases on generic and coherent UML we choose to based our work on [1] approach . Indeed, rebuilding this approach using ontology technology can solve all the weakness and make it better for better due to the many advantages of the Ontology Engineering versus Object-Oriented Modeling.

IV. Benefits of using ontology in project memory

Firstly let's begin with the definition of an ontology, in fact, according to [27] an ontology is “ an explicit and formal shared abstract view of a part of the real world. This view is described by a whole of tools as a vocabulary formed of concepts, relations, axioms and rules of inference “ and we suggest the following definition : “we consider ontologies to be domain theories that specify a domain-specific vocabulary of entities, classes, properties, predicates, and functions in order to representing knowledge about a domain and for describing specific situations in a Domain”

Secondly , we gives some advantages of using ontology in project memory , however , the Object-Relational data-bases offer a very powerful environment for knowledge management, several insufficiencies remain under this paradigm that an ontology-based approach might help to solve . due to the Benefits of using ontology technology in project memory :

- The ability to scale a query up to the semantic web will be a powerful advantage .
- Under the Semantic Web, we benefit from another kind of flexibility due to ontology-based modelling: since concepts can be formally identified by an URI
- A Process of reasoning between all project memory elements in order to make the reutilization of previous projects fast .
- The easy way to add , modify , maintain all project memory elements .
- Contribute efficaciously to the conceptualization of the projects memories
- The ontology can contain any concepts/propositions that apply to all types of projects.

However why do we use the memory of the project in ontology form ?

For instance, designers may need a project memory that makes to reutilization of past projects fast, easy, Automatic. For this reason, we propose to represent project memory as an ontology saved in owl file that can be inferred using a semantic inference engine like (protégé, ontopia corese , NeOn toolkit, Adaptiva.ect) and this have many advantages such as:

- save the effort
- interact with the tools that use other ontologies
- use ontologies that have been validated through use in applications .
- make easy conceptualization of the projects and reasoning between all project memory elements

v. Advantages of the generic model of the [1] approach :

The strength of [1] approach consists in proposing a generic model allowing the implementation of project memories taken an advantages of the ontology technology . In reference to model levels transformation proposed as shown in figure 5 .

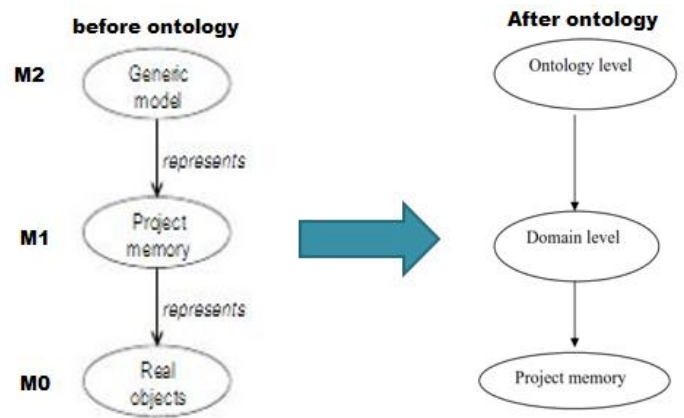


Figure 5 : the transformation from the Object-Oriented approach to the new Ontology approach

Based on [18] and [19] works we can deduce that:

Level M0 is relative to real world “objects”, such as product, human or material resources, calculation resources, CAD models, documentation, etc. with can replaced by the **Ontology level** :any concepts/propositions that apply to all types of projects should be located in the ontology level .

Level M1 corresponds to the models of the previous real objects, and constitutes a project memory; it structures the pertinent information without redundancies, with will be replaced by **Domain level**: it specifies the projects types. This is carried out by specializing the required classes corresponding abstract classes in the ontology level and by instantiating objects from industry.

Finally, **level M2** is the more abstract one; it Describes the model allowing project memories Instantiation. This level is generic and ensures the Possibility to memorize all projects’ information, Will be replaced by **Project memory level**: consists of objects that store information about particular projects according to the specification of the classes in the domain level. In our case it is about projects of conception .

vi. Proposition of a Project memory model using ontology Technology

Based on the Global architecture of the system of [1] we suggest our proposed Global architecture using ontology as shown in figure 6.

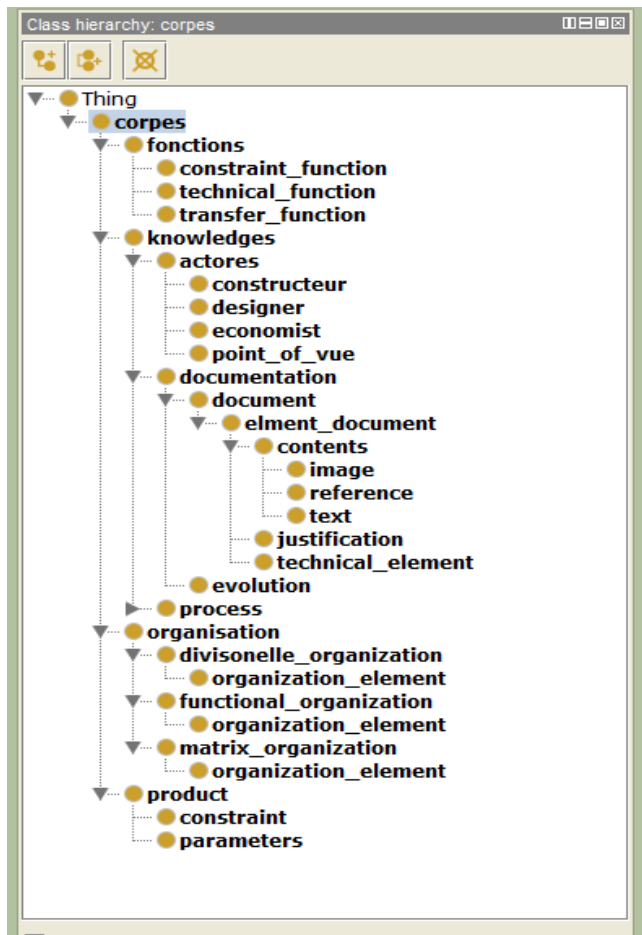


Figure 6 : Global ontology architecture of the system

Knowledge acquisition and representation in project memory is presented in this model as a generic ontology shown like blow:

Corps ontology: it is the most important ontology main class in the model since it represent the link between all other class and it is intended to manage the common attributes and the relations between all the classes, as well as the sights. It also makes it possible to follow the evolution of any element,

This main ontology makes it possible to add other dependent concepts easily to the project memory.

Documentation ontology: manage the structure, the contents, the justification of the technical choices, to indicate the references to any data carrier (image, text, hypertext link...).

Organization ontology: structure of project team structure of a company.

Point of view ontology: definition from the various points of view

Actors: management of the actors intervening on the project, access authorizations.

Knowledge ontology: structuring of various levels of knowledge.

VII. Conclusion

To conclude, Knowledge sharing and contextual access to it in particular, still the main key of challenges in knowledge management framework.

However, Researchers on semantic web and human machine interface study techniques to Enhance this access. For instance, human machine interface, keeping track of user's activity Provides some elements of the context that can guide the access to information. However, after taken a look on previous related works and proposed approaches with their weakness points and there strongest points, the originality of this paper is: the idea of rebuilding the approach of [1] with ontology technology and take the large advantages gained from the its generic models . We also plan to implement the whole model using protégé semantic search engine and make it available online in web protégé cloud , thus it can be used in any semantic Platform.

References

- [1] Ben Sta Hatem Contribution de la modélisation Conceptuelle a l'Ingénierie du Knowledge Management : Application dans le cadre de la mémoire de Projet, Thèse, Ecole Centrale de Lille, Lille, 2006.
- [2] Degre, Y. (2001) « Intégration des données de la mécanique aux données de l'automatique: une contribution au poste de travail du génie automatique », Thèse de Doctorat de l'ENSAM.
- [5] Matta N. et al. (1999a), Ribière R., Corby O. Définition d'un modèle de mémoire de projet, Rapport de Recherche INRIA N. 3720, Juin 1999.
- [6] Pomian J. (1996): Mémoire d'entreprise : techniques et outils de la gestion du savoir, Sapienta.
- [8] Longueville B., Le Cardinal J.S, Bocquet. J.C, Daneau. P. "Toward a project memory for Innovative Product Design, A Decision-Making Model ,August 1ç-21, 2003.
- [9] Daimler Chrysler (2000).methodology and tools Oriented to Knowledge-based engineering Applications, MOKA project ESPRIT 25418, deliverable D4.3, finalversion, 26 juin.
- [10] Doumeings, G. (1984), méthode GRAI, méthode deconception des systèmes en productique, Thèse de doctorat d'état, Université Bordeaux .
- [11] Mayer, R. J. Menzel, C. P., Painter, M.K., deWitte, P.S.,Blinn, T., Perakath, B., Information Integration forConcurrent Engineering (IICE) IDEF3 process descriptioncapture method report ,September1995.
- [12]Hu, X., (2000), a survey on design rationale :representation, capture and retrieval,Conferences, Septem 10 Balmore, Maryland,DETC2000/DFM
- [13] Harani Y. (1997) "Une Approche Multi-modèles pour la Capitalisation des Connaissances dans le Domaine de la Conception",.
- [14] Bekhti S. (2003), « DYPKM : Un Processus Dynamique de Définition et de Réutilisation de Mémoire de Projets », Thèse de l'UTT, spécialité Réseaux, Connaissances et organisations, 17 Décembre 2003.
- [15] Labrousse M., (2004), « proposition d'un Modèle Conceptuel unifié pour la Gestion Dynamique des Connaissances d'Entreprise », Thèse de l'Ecole Centrale de Nantes, spécialité Génie Mécanique, 13 Juillet 2004.
- [16] Omg, (2003) Object Management Group Unified modelling language Specification,Version 1.5 formal/03-03-012003, March 2003.
- [17] Smain Bekhti, Nada Matta, Chaker Djaiz ,Knowledge representation for an efficient re-use ,College of Computer Science and Information Systems, Imam University, Riyadh 11681,P.O. Box 84880, Saudi Arabia , 27 May 2011
- [18] Hatem Ben Sta , P2M2 – A Project Memory Management System LI3 – labo Isg soie ,2010 .
- [19] Hatem Ben Sta Contribution of ontology and diagram of conception for the conception and deployment of project memory LI3,Isg soie 2010.