A MODEL MULTI-AGENTS FOR SHARING AND EXCHANGING KNOWLEDGE IN COMMUNITY OF PRACTICES

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Abstract: This paper attempts to show, how CoPs evolve knowledge transfer. We are focusing on the elaboration of a frame to analyse and underlie the logics of the modalities of functioning of CoPs. We qualify this concept as an abstract regrouping knowledge creation. By adopting a processual perspective, we will try to present the mechanisms of sharing knowledge within a CoPs. CoPs is a collection of agents (human beings) who have rather strong common points such as, their level of social capacity, their competences, and the cognitive capacities. The development of the exchanges is based on abstract boundaries; the couple knowledge/community implies that an exchange of information takes place through mechanisms of co-operation, negotiation and through a specific communication language of community members. However, the legitimacy of exchanged knowledge is recognized only with interpersonal confidence association that creates for itself progressively interactions. Besides, these exchanges take place only through rules and standards established by all the members. After having pointed out the theoretical bases of CoPs and the sharing knowledge mechanisms, we will present an approach of simulation using the paradigm of the multi-agents systems, sharing knowledge's within the CoPs.

1 INTRODUCTION

The concept of community is today at the core of many organizations which are involved in the development of the open source software, CoPs and Epistemic. KM (Nonaka and Takeuchi, 1995) appears to be a highly interesting, although its human dimension, more precisely the social aspect of its transfer process of knowledge is often neglected. The ability to manage and to share knowledge could indeed fuel the competitiveness of organizations. Recent researches suggests the change of behaviour within a structure (Grant, 1996) favourable in knowledge transfer. However, in our research, by community, we mean a group of people who interact frequently in a direct way, and in a multi-face process, they weave between them more or less asymmetric connections. People who always work together evolve in the way of a community environment. This suggests that the notion of cooperation and not competition is one of the fundamental characteristics of the community. Bowles and Gintis (Bowles and Gintis, 2000) underline the importance of the notion of community, and not the emergence of special community forms which, according to him, explains the increasing interest of this concept. Our purpose concerns the concept of CoPs, which corresponds to an emergent space where the transfer of knowledge can be made away from organizational constraints (Wenger, 1998). Inside such knowledge-producing community, the members' behaviour is characterized by the respect of social standards, voluntary engagement in construction, exchange, and sharing of common repertory cognitive resources, experiments and storytelling. Through their specific practices, this community can be considered as a "core" of skills that helps the hierarchical structures in the construction of knowledge. This concept of distributed actors' organization is well studied in the field of the Artificial Intelligence (AI). More specially the Distributed Artificial Intelligence (DAI) being particularly interested in the modelling of intelligent behaviours entities distributed in an environment. Multi-agents organizations spread information on physically distributed sites, the can serve as a support for the design of distributed information systems (Yu, 1999).Our research concern implementation tool intermediation for the CoPs in

the aspect of interaction, negotiation, cooperation, knowledge share. But this short work is strictly focussing on share, exchange and capitalization of knowledge. We aim to modelize CoP's members' behaviours while exchanging, and sharing knowledge process. We then define the characteristics of the agents occurring in the process of computer adding knowledge sharing. In this step we will describe how we mean as communication as action between agent-agent.

2 CoPs, KNOWLEDGE SHARING & MANAGEMENT

CoPs is a group of agents engaged in the same practice, regularly communicating through various mechanisms: Groupware, emails, forums, face-to-face discussion, and meetings. The use of information technologies and communication gives us the possibility to work in an asynchronous or synchronous mode. The literature on this concept is large, (Wenger, McDermott&Snyder, 2002; Josserand&Leger, Vaast, 2004, Soenen, 2004). We define this concept as: a group of people that communicate together, to exchange information and to enrich their knowledge and know-how through their actions to find a consensus on a subject they are confronted with. The agents engaged in such a process coordinate their activities to improve their individual competences, through the exchange and share of a common base or individual knowledge, which is built while the practice of the community is developing. The collective training and the construction of new knowledge then appears as a non-deliberated form of the common practice (Wenger&Snyder, 2000). CoPs becomes increasingly through the actions and the repeated interactions that they maintain between agents which regularly communicate their experiments and validate new forms of common practice. It plays the elementary role of core of skills that Wenger describes as "Locally negotiated mode of skills" (Wenger, 1998). The adhesion of the members is based on cooperative process; all depends on the type of community. There are communities in which, the adhesion of a new member requires a preliminary consultation with other members, through consensual agreement. The constitution of the common cognitive capital of the CoPs is made through permanent sharing of experiments between the members. The permanent comparison of individual expertise constitutes the base of the community and social standards base that guide the behaviours agents (Brousseau, 2000).As the co-operative process develops, the increase of the

common cognitive capital contributes to make stimuli increasingly easy; the frequency of the interactions while intensifying reinforces the creation of the social standards and shared routines. The implicit or explicit mechanisms of search of legitimacy exploit the behaviour of the agents belonging to the community. (Dupouët, Yildizoglu, Cohendet, 2004). Thus, the context of the CoPs refers to a range of rich behaviours of the agents which belong to the community. Satisfaction that they withdraw to exchange together makes it possible for them to develop a single comprehension (common language, and practices) in their field. The process of negotiation is made by a diffusion of the subjects discussed with the whole community. Roles can be allocated to members according both their experiments and degree of confidence. In that case, attribution of roles can be done by vote or through consensual way. Furthermore, members of the community are using technological tools which can be synchronous or asynchronous. CoPs can be invisible or institutionalised (Wenger, Mc Dermott&Snyder, 2002). The members share a substrate of common knowledge. In this fact, the concepts of the CoPs are based on three criteria's characterizing its operation (Lave&Wenger, 1991) (Brown&Duguid, Lesser&Everest 2001).To meet specific needs for a community of Knowledge practices, we propose to equip it with a knowledge base. In that regard, the panacea of Knowledge Management (KM) tools can be exploited to this end by giving the possibility to organise Knowledge credits in predetermined conceptual classes in ontology, by allowing them a more natural and intuitive access to required knowledge. The KM constitutes that an important contribution to schedule knowledge emergent of the interactions of the members of the CoPs, to show the interest to mobilize the knowledge management for the CoPs

2.1 The KM Such as the Scheduling of Knowledge Credit

The generation of knowledge within CoPs can appear by sharing means, of exchange and acquisition of knowledge. The more a person shares her knowledge with somebody, the more certain confidence grew. In addition, the knowledge acquisition implies that agent engages in a process of knowing and expertise research. The knowledge sharing corresponds to a replication of knowledge capitalized on the scale of the organization. It consists in reproducing, exchanging to compare and making evolving knowledge available to the members of an organization more specifically of a community to make a lever of value. Researchers

like (Roberts; Rolland and Chauvel, 2000; Davenport&Prusak, 1998; Kramer, 1997) see in confidence a fundamental characteristic in a process of information's exchange. The legitimacy of knowledge in an exchange process is recognized if the receiver accorded a high degree of confidence to the sender. It consists in sending messages, request or information in a store space. These spaces contain a group of knowledge or cases to be solved.

Epistemological approach: The step that we wish to adopt consists in identifying the characteristics of the context in which the knowledge share and exchange takes place, for that we shall base on an initiative of modelling / conception based on the systemic analysis (Durand 1979, Donnadieu, 2002, LeMoigne, 2002), the socio-constructivism approach, and the collective cognition and the constructivist knowledge design (Avenier, 1997), The socio-cognitive conflict (George, 2001). Finally, the approach of collective cognition allows the individuals engaged in a common practice to develop negotiation competences, confrontation and argumentation. The goal is to achieve to a group decision marker design. In such a process, agents accumulate knowledge and competence progressively with practice. These mobilized theories thus aim at highlighting us in the step of modelling of the adopted approach. What will interest modelling consist in including/understanding not only operation but also obviously the motivations of the members in the process of sharing?

3 THE EMERGENCE OF ANALYSIS MODEL

Adhesion within a community, presupposes certain recognition by its pairs and by the organization. Wenger argues that one of the fundamental characteristics to belong to a community of practice relates to a certain mutual confidence between the members of the community. From that point, we see the importance of analysing here the role of confidence in knowledge sharing to a community. We will talk about the interpersonal confidence that exists naturally between two individuals and whose determinants are competence and reputation.

Organizational Model: There is a type of community in which the control is strongly distributed and whose members have the same skills, and pursue multiple goals. Nowadays, after the presentation of the theoretical and practical bases of the communities of practices, we aboard now this part to approach the knowledge management. Our

work consists in to trying to show how communities of practice are managing their substrate of knowledge by a multi-agents approach.

A multi-agents approach for Knowledge sharing in a community of practices: The MAS uses the social metaphor of the insects, reactive agents (reactive SMA) or of the human organizations cognitive agents (AI-like). According to this paradigm, agents interact in order to accurately, carry out actions ordered by an external agent. In most cases, the agents were expected to coordinate their actions and sometimes to cooperate in order to achieve their goal although having different motivations. The negotiation by the agents consists to coordinate, to share limited resources or to solve a conflict while agreeing on a solution in which their respective interests are as well as possible satisfied. The models of negotiation implemented generally a language of communication and a protocol of negotiation to conceive a diagram of the interactions between agents, like the agents reasoning capacities, to modelling their work procedure to carry out their strategies. The languages of communication define some rules to carry out the information exchange between agents. These rules relate to aspects located at the low level of the communication between agents and can, for example, specify the structure of the messages or the actions of communication (Com, 2002a). The Agent Oriented Abstraction (AOA) paradigm was introduced into Multi-agents systems (MAS) with an aim, to propose an agent abstraction, i.e. not founded on extensions of the principles of the paradigm Oriented Object. In this approach, an agent is an autonomous entity with annotated knowledge and a mechanism of decision based on this knowledge. It makes it possible to approach the KM by considering the entities of the organization, their knowledge and their capacities of exchanges. The exploitation of this paradigm can be considered in a uniform way for any organization's entity. From a generic point of view, knowledge is a variable, simple or complex, which can as well represent, a collection of data, a document, an authorization, a competence. Coordination remains as much a significant concept because we can use them to exploit individual interactions. Indeed, the interest to aboard knowledge management within a CoPs based on multi-agents approach lies in compatibility and convergences between these two fields. If it is considered that an agent represents an entity in the community carrying information or knowledge, then we can approach basic concepts characterizing knowledge within the community: knowledge and data distribution, autonomy of the entities and simultaneously complex interactions between them (negotiation, share information, coordination),

dynamic behaviours, heterogeneity from points of view.

Interest of an agent for capitalization of tacit knowledge: Usually capitalization of knowledge implies the constitution of a capital that may produce benefits in time. Knowledge capitalization techniques have been already developed in distributed artificial intelligence (DAI) directly applicable to handling knowledge. Indeed, some agents have competencies, which may vary from simple operations to various reasoning. Those agents may be have in various way procedural behaviours and contain much knowledge. Cognitive agent seems to be an interesting support to realize the social system that we mobilize. Those cognitive agents can be specialised by insufflating new knowledge for a restricted field. He can also be associated with other specific agents which purposes are ranging from keeping knowledge to memorising the tasks. The developed agent is able to manage knowledge, according to its expertise field. This gives the possibility to agents to control the development of its knowledge base. Instead, to have only one KM, we allocated to each agent her own knowledge base. This can be cooperating if faced with a complex problem solving. For a specific domain, it will be necessary to create concept models to represent this field. Such systems of concepts are called ontology. We showed, the knowledge or exchanges within a community are done through roles, which are allocated to each member. This section describes initially how roles are formed, and in the second place, how roles can be configured and be allocated in terms of actions.

Roles, agent, and attribution of the roles: Several roles can be defined within the community, in a general way these roles are allocated by a regulator jointly indicated agreement with the whole of the members see Agent-group-role model and role attribution (Parunak, Odell, Fleischer, 2003). A role is a class, which defines a normative behavioural repertory of an agent (human or artificial). It provides modules for the social systems of agent and the conditions by which the agents act together. Each agent communicated to other agents according to functional conditions of the system. Several methodologies of design agents were proposed, we studied two of them: the proposal of (Ferber, 1999), and (Jennings and Wooldridge, 2000). A role in Aalaadin (Ferber, 1999) is an abstract representation of the function, service or quite simply the identifier of an agent within a group. Each agent can hold several roles, but each role is local with a group. The communication between the agents is not possible through the roles, which they assume, and consequently, the group carries out control on the communications. Roles can be defined independently of the groups and played within these same groups. Moreover, the roles can have associations of knowledge with other roles, indicating this interaction. Our proposal is mainly limited to two major aspects. The first one is what we called Role formation and the second one is called Role configuration

Role formation: in this case roles can be assigned to the agents in a multi-agents system in two manners: endogenous (by self-organization emergent like system), and exogenic (by the originator of the system when the system is built or modified). The endogenous self-organization is a phenomenon spread in the normal systems. While agents act together, structures and models on the emergent level system can adapt and be robust to the changes of the environment system. At the beginning, the behaviour could have been the actions of a simple individual. With time, however, the actions of the individual could be identified as together useful behaviour which can be used by other individuals to produce similar results.

Role configuration: can be considered according to two dimensions: Horizontal specialization that addresses the number and horizontal complexity of the actions supported by a role. Contrary to the vertical specialization, which separates the execution from the actions of the administration, in another word, it takes place according to the degree of command, which an agent can have above its actions and the actions of other agents. Specifically, horizontal roles specialization requires an end, a role for agent can require handling any kind of request, and for vertical specialization it relates to managing the action of the agent, more precisely deals with the degree of control of the actions of the system.

3.1 The CoPs like Support of Knowledge Creative

We define a community of practices as a creative community of knowledge formed of a grouping of agents carrying a common interest for a specific subject and exchanging knowledge in bond with this subject. This definition is well situated in the knowledge management of an organization through the AOA approach. Gathering agents implies existing dynamic capacities of adhesion and participation in the communities (Calmet & Maret, 2000). At least, an agent must have dynamic capacities to create communities. The idea of a common interest for a specific subject implies the evaluation of this subject by each agent, taking into

consideration its objective. In the same way, the concept of knowledge bonds with the subject of the community requires the evaluation of a distance between knowledge and a subject. The knowledge exchange (consists in sending messages in a store space, a request or information, these spaces contain a group of knowledge or cases to be solved), imply that agents can acquire and transmit knowledge. They must only have the capacity to interiorise received knowledge and to exteriorise/diffuse own knowledge: from where the idea to equip each agent with a knowledge base. The primitives that we can associate to the members of our community can be: created/finished a community (creates, delete) if the need for creating a under-community is made feel (in the case of the reorientation of the objectives of the community), to join/leave a community (Join, Leave), to send a knowledge or to require a knowledge (inform, request).We consider several models and process of operation of the CoPs. The principal constraints that we wish to impose are to ensure that the knowledge obtained by the agents during their interactions is not centralized, the autonomy of the agents, and the safeguarding of the opening of the system of agents, i.e. the possibility of entry and exit of agents without damaging the system. We wish to use an approach of "one to several" to implement the knowledge sharing. Each agent would have, in addition its own knowledge base, a list of agents if it wants to transmit knowledge or requests. Agents can everytime join communities (which he knows). We wish to develop prototypes (Java, Jade platform or others) of the simulation programs as well as applications with user interface: agent responsible for the knowledge management, agent responsible for the diffusion of information or the allocation of the functions, system of information's exchange. In term of knowledge we propose: Creation and enrichment knowledge, research centres and pro-active dissemination of knowledge service, presentation or visualization knowledge service, evaluation knowledge service, maintenance knowledge service, Administration -knowledge service.

The agents that we can elaborate in our Proposition are:

Safety agent: dynamically, he manages to control access to the database of the system. This knowledge is imported from consensual decisions made by the agents.

Moderator agent: ensure the coordination and the diffusion of the tasks, the follow-up the realization of these tasks, as well as the integration of knowledge in the database of the community. Lay down the objectives of the group, the topics of discussion and definite a scenario of collaboration of

the agents. It has moreover a list of the agents of the system.

Community initiator agent: dedicated to the agent chosen as leader, initiation consists in creating a subject of debate, sending messages and making known the community. This action is done within a space dedicated for this purpose. All the agents of the system are members of the community. These messages consist of inform (transmission of knowledge) and request (request for knowledge). The evaluation of the contents of the messages is specific to each agent. No agent centralizes the exchanges.

Evaluator agent: ensures the evaluation of knowledge likely to be stored in the knowledge base dedicated to the community, and then transmits it to the regulator. Supports the self- evaluation and the motivation to be shared, evaluates if the objectives were achieved. The agent, which wishes to insert new knowledge, can require the authorization to the regulator of the community.

Interface agent: are agents who belonging to several communities can transfer knowledge from a practice to another, we can consider them as experts playing an advisory role.

Profiles agent: in charge to manage user profiles (name, firstname, competences, experiments....), works in close cooperation with the moderator agent. In order, without neglecting the problems of the interoperability of information systems, the model presented positions in the context defined by the CoPs (Wenger, 1998). Those diffuse knowledge while integrating environments supporting training intention. And, they can be a group of individual authors and users of knowledge, an industry of conceptual tools, a consortium of diffuser of formalisms or a community of free software developing the components of a system of remote formation. While referring to the fundamental characteristics of the communities of practices we could say that a community is defined by a triplet $< C, D, P >$, where C is the community of the actors, D is the field of competences, and P contains the questions raised or prone to discussions of the community from which new practices emerges from. For the agents, a CoPs bases itself on the structure of communication which exists between the agents, we can advance that the behaviours of the agents can consist of two large shutters: an engagement in a practice and an engagement in social exchanges. However, these two shutters are dependent insofar as the communication informs the practice and the practice feeds the exchanges.

The communication as action: Following upon the works of Austin and Searle (Austin 1962, Searle 1969), we lean on a pragmatic frame, where a

statement is considered as an action - due to the change which it entails in the world -and where its meaning bases on the knowledge shared by the interlocutors and on the intention which each has and gives. At the conclusion of a phase of negotiation, a consensus is found; the negotiated concepts belong to the knowledge shared by the interlocutors. It is thus clear that the communication, which bases on the shared knowledge, also contributes to spread this knowledge, via the mechanisms of negotiation.

4 CONCLUSION

We have presented the methodological and technological choices to conceive and implement the concepts relating to our study. The multi-agents systems through their models and technologies offer a support that we can use to conceive and establish in relevant manner the social system of which we showed the characteristics previously. Readings concerning CoPs are showing interests of such practice, but also difficulties faced by then members. A CoPs is a social system as well as agents in MAS paradigm. MAS's models and technologies fulfilled in relevant manners, CoPs characteristics.

The idea is, then, to propose a platform intermediation tool, based on MAS, which reproduce a social system in order to facilitate Cops functioning. From this step, we ha to implement the intermediation tool, on for example JADE or MADKIT platform. This system will help member of community to communicate together or with members of another community. The communication system which we will used is based on the act of language developed by Searle and Austin (Searle 1969, Austin, 1962).

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