

Suitable Awareness Mechanism for Sharing Knowledge

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Abstract. Communities of Practice are knowledge-intensive communities, which basically accumulate and share knowledge around a common topic of interest. As knowledge sharing is the best added value that people find in meet communities of practice, any technological approach for supporting knowledge-intensive communities must guarantee it. This paper seeks to show that any approach for supporting a collaborative community memory system (a traditional technological solution for supporting knowledge sharing) must take into account awareness feature, since awareness plays essential role at the moment of sharing knowledge. Awareness is not only a means for understanding what is going on in the shared knowledge workspace, but also it is clue to maintain the community “in action”, so sharing knowledge successfully. Awareness becomes in the source of emergent knowledge.

Keywords. Communities of Practice. Knowledge Sharing. Collaborative Community Memories. Awareness. Knowledge Awareness

1 Introduction

This paper seeks to show why awareness plays an essential role in any system-support for knowledge sharing in a knowledge-intensive community like Communities of Practice.

Recently, Communities of Practice (CoP) have gained a particular interest in Knowledge Management due to their knowledge-intensive nature. “*Communities of Practice are groups of people who share a concern, a set of problem, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis*” [1].

Brown and Gray [2] offer the following explanation, referring to CoPs at Xerox: “*What are CoPs?... At the simplest level, they are a small group of people (in this case, about 20) who’ve worked together over a period of time. Not a team, not a task force, not necessarily an authorized or identified group. People in CoPs can perform the same job (tech reps) or collaborate on a shared task (software developers) or work together on a product (engineers, marketers, and manufacturing specialists).*”

Suitable Awareness Mechanism for Sharing Knowledge

They are peers in the execution of “real work.” What holds them together is a common sense of purpose and a real need to know what each other knows. There are many communities of practice within a single company, and most people belong to more than one of them.”

People find value in meeting CoP because they typically *share* information, insight, and advice. They help each other solve problems, they discuss and explore ideas and points of view, explore ideas; or simply they develop a tacit understand that they share. Mainly, they accumulate knowledge and they become bound by the value they find in learning together. This value is not only essential for their work, since CoP can go across and beyond organizations; it also means a personal satisfaction on knowing people that understand, share and/or have same concerns, problems and passions, and of belonging to an interesting group of people. *“Overtime, community develops a unique perspective on their topic as well as a body of common knowledge, practices, and approaches”* []. Therefore, knowledge sharing is the best added values of participating in a CoP. In the future, we will refer to a community of practice just by “the community”. **If people participation in a community can profit of its knowledge for developing his work**

The nature of the shared knowledge is variety. Communities do not only accumulate knowledge about a topic of interest, they also share knowledge about who are participating in the community, who knows what, who are interested in, level of expertise, perspectives, and more. This means that all of this knowledge is integrated in the community knowledge.

Organization has a particular interest in knowledge that communities accumulate. Traditionally, organizations develop group memory system [] for capturing and sharing community knowledge. Group memory systems are knowledge repositories that store the group knowledge and are administrated by knowledge managers. Knowledge managers’ tasks are mainly o capture community knowledge and store it. But, due community’s nature, communities develop their memories themselves. It is a shared responsibility that involve a collaborative process, which aims at building the shared knowledge.

There are many community-oriented technologies for supporting community’s knowledge sharing as they are showed in [], in general they are groupware-oriented. One of the main challenges of these tools is to reproduce the dynamism that the community has around the knowledge. The community’s knowledge is constantly growing and evolving, due each community memory contribution stimulate new knowledge emergence and therefore maintains the community “in activity” sharing knowledge. It is in this context where we will analyze in this paper why *awareness* [] is a necessary tool for supporting the knowledge intensive activity that takes place around in a community. In particular, awareness supports the knowledge sharing process and becomes the source of new knowledge that emerges from the community. Awareness also facilitates the understanding of knowledge evolution.

This paper is organized as follows. Section 2 briefly presents what is the nature of the knowledge that the community shares; and in section 3 is analyzed how it is shared, in terms of a two-steps cycle process where knowledge is externalized and internalized. In section 4, we expose the reasons why we present awareness as an essential tool for sharing knowledge. Next, in section 5, the requirements of a collaborative community memory system are briefly presented in terms of:

Suitable Awareness Mechanism for Sharing Knowledge

knowledge formalization, collection, retrieving, communication and distribution are discussed. In particular, features of gathering and delivering awareness information are taking into account for improving knowledge sharing. Finally, conclusions and further works are exposed.

2 The Community Knowledge

CoP are knowledge-intensive because of all of their activities are related to knowledge; the most often activities consists in knowledge accumulation and sharing. Accumulated knowledge is the knowledge that the community posses, and we will name it: *the community knowledge*. Community knowledge corresponds to the community interest and competence and it also represents a common understanding on a domain of shared interest, and it is also assist community activities.

The nature of community knowledge is variety. Communities do not only accumulate knowledge about a topic of interest, they also share knowledge about who are participating in the community, who knows what, who are interested in, level of expertise, perspectives, and more. This means that all of this knowledge is integrated in the community knowledge. Following, we classify and detail community knowledge according to their nature:

- *Domain Knowledge*. This is knowledge about the domain of interest that the community has and it consists of conceptual elements and facts that conceptualize the domain of interest and competence. Community domain knowledge also represents a consensual knowledge and shared common language.
- *Social knowledge*. This is knowledge about members and their organization. Members knowledge is knowledge about who is each member. Members can be individuals or groups. In a community, people joint together following particular interests; they group themselves in smaller communities. Each member can participate in different groups. Groups can be established by some grouping criteria; groups mainly make up due to common knowledge interests, but they can also follow social interests like affinity, confidence or others. These interests are causes for shaping groups.

These two sources of knowledge are easy to recognize and are the first knowledge that can be formalized. However there is another source of knowledge that it is not so easy to capture, it is knowledge about the relationships that are established between the domain knowledge and community members. Meanwhile community develop collaboratively the shared knowledge new relationships between pieces of knowledge and people are established, for example relationship of interest (a member *is interested in* this concept); relationship of expertise (a member *is expert on* this concept); relationship of ownership (this concept *is a contribution of* this member); and relationship of privacy (this concepts *is private to* this member). This relationship are nurtured during the community activity and most of the time this knowledge is a implicit knowledge that is hard of externalized, but exist. Therefore we define a third category of community knowledge:

Suitable Awareness Mechanism for Sharing Knowledge

- *Associations between knowledge and members.* This is knowledge about the relationships that exist between the knowledge and people. Community members and domain knowledge are closely related. A community member is related with a piece of knowledge by different causes; for example because it has a certain competence level about a particular subject, or it has a responsibility with respecting a subject (plays a role), is interested in a subject, has a particular perspective, opinion or comment. This knowledge describe the interest, capabilities, expertise of the community members. These relationships define the grouping criteria i.e. the sub community that has a particular interest. More complex relationships are also held between domain knowledge and community members, i.e. knowledge of the knowledge that members have i.e. knowing of “who knows who knows what”.

Community knowledge can be seen as conceptual network made up of conceptual knowledge artifacts (domain and members knowledge) linked by associations between knowledge and people.

From community point of view, community knowledge is the shared knowledge that the community develops collaboratively. In other hand, from individual point of view, member knowledge is a “partial view” of the shared knowledge plus the personal knowledge. Personal knowledge represents the member knowledge that is not shared with the community, because it is private or out of community concerns.

3 Knowledge Sharing in a Community

Knowledge sharing in a CoP is, for its own nature, the base of a collaborative learning process. Community members are engaged in a collaborative learning process in which they are involved actively. Knowledge sharing process is a cycle process makes up of two steps:

- a) Externalization. People contribute to the community with his/her own knowledge.
- b) Internalization. Individuals get some “cue” that realizes them of a new asset and this fact goes off an individual learning process where new asset is incorporated with its own knowledge.

These two steps take turns at the community activity. Externalization can be seen as the first step toward knowledge sharing since a new asset is “shared” with every community members bringing about the possibility of individual learning take place and the internalization can occur. Externalization works as a stimulus to individuals learning process. But, internalization can also be seen as the first step toward knowledge sharing because of individual learning is the source for new knowledge emergence that can later be shared. Externalization/internalizations forms a cycle that is performed constantly.

Meanwhile a community is sharing knowledge, its knowledge is constantly in evolution. Knowledge evolution occurs each time that the previous knowledge sharing process takes place. Each new contribution to the community knowledge is a step forward a new community knowledge state. Community’s members are the

Suitable Awareness Mechanism for Sharing Knowledge

participants of knowledge evolution, in short term, they provoke the knowledge evolution with each of their intervention; and in long term, they can perceive the knowledge evolution.

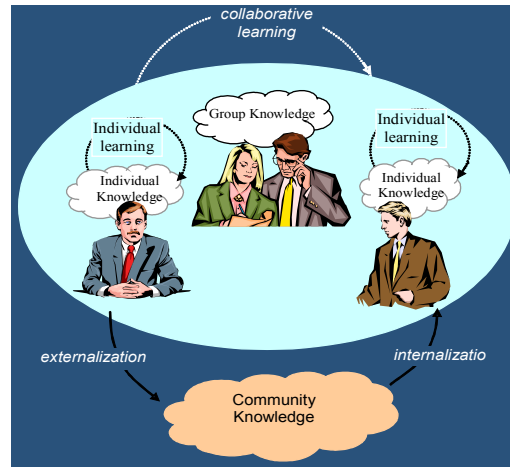


Fig. 1.

In conclusion, knowledge sharing can be seen as a spiral process where knowledge goes emerging in each cycle. Knowledge sharing involves from community point of view, individual and collaborative learning and from the knowledge point of view, knowledge evolution.

4 Awareness: a Means for Sharing Knowledge

Community's members understand that:

- if they share their own know-how, interest, concerns or passions in the community, they can profit of other members comments, ideas and point of view, and thus they enrich they own knowledge.
- if they pay attention to what is going on in the community, they also can profit of new interest, concerns and passions that others have.

These two features are the clue for maintaining the community engaged, but it is possible if the community remains active continuously, this means that the knowledge sharing process constantly happens. Low active communities lacks interest, since the decrease or absence of new knowledge or interaction means the lost of their most added value; otherwise, in higher active communities, new knowledge emerges constantly. To maintain the community in activity is the main challenge.

Community knowledge is constantly growing and evolving meanwhile the community is sharing knowledge. Therefore, one of the main challenges of a CSCW support for knowledge-intensive communities is to support and stimulate the

Suitable Awareness Mechanism for Sharing Knowledge

dynamism that they have around the knowledge. Thus, any technological approach for supporting knowledge sharing must consider internalization and externalization steps in a suitable fashion and even stimulate them.

In this paper, we advocate that a suitable awareness mechanism is a advantageous approach for improving knowledge sharing, because awareness is probably one of the best tools for maintaining the community in activity –learning collaboratively. It becomes an evident requirement for knowledge sharing:

- because community members need to be aware of “what is going on” in the knowledge workspace. This means that they need information about the existence of a new concern, problem, comment, conclusion, discussion, or even new members, groups, etc.
- because the possibility of being aware of what is going on with the shared knowledge acts as a stimulus for knowledge internalization, the base for creating new knowledge. This means that awareness becomes then a source for new emerging knowledge.

Although in short term, awareness is a good way of “knowing about what is going on in the community memory workspace”, this means given workspace awareness [] in terms of knowledge repository updates; in long term, awareness plays a essential role in the sharing knowledge process, since it is information about “what is going on with the knowledge” – *knowledge awareness*. Knowledge awareness means knowing what is going on with the domain knowledge, members’ knowledge and the associations between domain knowledge and members. This entails that knowledge awareness is the needed awareness for knowledge-intensive communities because:

- it allows a better understanding of the shared knowledge, since it gives information about the knowledge;
- it induces community participants curiosity. Curiosity is well known as the key for learning process takes place, and it becomes the seed of knowledge internalization: knowledge awareness is the medium between the externalization and internalization steps in the knowledge sharing process.
- it promotes emergent knowledge occurrence, because members are constantly articulating received awareness information with her/his private knowledge altogether (internalization takes place) and it is the source for the generation of new individual knowledge (that can be externalized in the future); and
- it helps knowledge evolution understanding. To be kept up to date becomes knowing about the knowledge along time, so understanding knowledge evolution.

These features are essential for maintaining the community engaged in the knowledge sharing process, because they are the basic stimulus that a knowledge-intensive community needs for generating new knowledge, therefore to preserve the community “in action”. In this context, awareness becomes the source of community knowledge emergence.

Awareness will be really effective for maintaining the community in action if the delivered awareness information is necessary and enough to promote knowledge emergence. Internalization takes place when awareness is delivered. Delivered awareness information is broadcasted to each community members but it must not

Suitable Awareness Mechanism for Sharing Knowledge

exceed groups and individual needs. Next two features have to be taken into account for delivering the just right amount of awareness information: *interests* and *expertise*. Interests define group or individual concerns and they are even community knowledge. Interests may be an action itself, a topic of interest, a type of topic, to know who has performed an action, and may be a combination of more primitive interests. Interests allow us to calculate the appropriate awareness information according to the receiver needs. Expertise means the level of competence that members have and it determines the quality of knowledge that the receiver needs. Interests and expertise may even be used to adapt and personalize the given awareness information with the objective of being more effective in promoting individual activity, and in consequence community activity.

5 A Collaborative Community Memory System

The main motivation of developing a community memory system (CMS) is the creation of a shared knowledge space that acts as a communication medium between community members and a knowledge repository. In contrast to traditional approaches, we have adopted a collaborative approach for the CMS in order to respect community nature. Taken into account previous discussion, a special care must be taken at the moment of considering CMS functionalities in order to improve knowledge sharing. In particular, we found that next functionalities are critical to support a community knowledge sharing:

- Formal knowledge representation
- Knowledge collection
- Knowledge retrieving mechanisms
- Communication support, Private and public workspaces, and
- knowledge distribution

Next we will detail these functionalities and add some considerations that we have already taken into account.

Formal knowledge representation. Community knowledge must be represented in a formal way. We have chosen ontologies for representing formally the knowledge. Ontologies are a good option for formalizing community knowledge since “ontology is an explicit specification of a conceptualization” [1, 2]. The knowledge repository is a set of ontologies that represents the community knowledge. These ontologies are *knowledge domain ontology*, *community structure ontology* and *association ontology*. They are partially showed in Fig. 1 and reflect the kinds of knowledge exposed in section 2. *Conceptual ontology* represents the vocabulary of the knowledge meta-model. We see the ontologies as a semantic network, where nodes are classes and relationships or association among classes are represented as arcs.

Semiformal and informal knowledge representation. Most of community information can be represented formally but due many times community knowledge is hard coded in some kind of documents (emails, notes, chatting extracts, text documents), ontological concepts have associated a *reference document*; allowing to handle different types of information and related levels of information representation [

Suitable Awareness Mechanism for Sharing Knowledge

,]. *Conceptual ontology* is also used to integrate non-formal knowledge throughout the *reference document* concept.

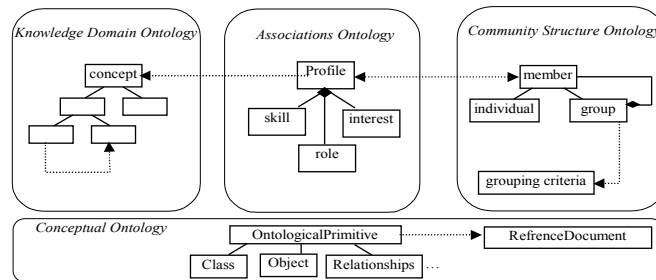


Fig. 2. Set of ontologies that shape the knowledge repository of the Collaborative Community Memory System.

Collaboratively knowledge collection. By the nature of communities, knowledge collection mainly relies on community members or at least in a group of members, but it never is an individual task since it is the community who recognize itself the value of specific information and if it interesting to store in the community memory. Knowledge collection covers knowledge externalization steps in the learning process. Contributing with new knowledge should be easy and rewarding for a community member. Even updating any ontology, community members externalize knowledge. Knowledge collection implies to make up with an edition tools for updating ontologies; it must be an easy manipulation tool, for example a Protégé-like tool with collaboration features (Protégé is a tool to construct and enter domain ontologies []).

Knowledge retrieving mechanisms. A community memory should provide easy access, navigation, and querying of the stored knowledge. These mechanisms manipulate directly the ontologies. The topology of the ontology network is a good structure to browse the ontology; since it is just a hypertext []. Retrieving knowledge is also a first step for knowledge internalization.

Communication support. Knowledge sharing is also accomplished in interaction; therefore, it is essential to have communication tools through out the community supports synchronous and asynchronous communication (i.e. ICQ-like tools and posting message tools). Communication tools improve community and groups consolidation; for example, for establishing discussions around a topic of interest and it is also essential for deciding knowledge collection and for discovering tacit knowledge. Shared knowledge workspace must integrate different groupware tools for supporting community communication, even the shared knowledge repository.

People move between private and shared workspace. There are group and private spaces. Each community member has its private knowledge space. *Private spaces* allow maintaining personal preference and private knowledge. Personal preference determines a partial view of the community memory. There are private spaces for individuals and even for groups. Room metaphor [] is a way to support group and private spaces. Externalization moves knowledge from private spaces to shared spaces.

Suitable Awareness Mechanism for Sharing Knowledge

Knowledge distribution. Although internalization can take place when community members retrieve information from the community memory, an effective proactive and context-sensitive dissemination [,] is necessary to really guarantee a more realistic feeling of what is going on in the community. Knowledge awareness mechanisms are the responsible of allowing achieving knowledge sharing in the terms as were exposed in section 4. At a basic level, an awareness mechanism focuses on the *gathering* and *delivering* of awareness information. Gathering awareness information involves implicit knowledge collection. Implicit knowledge implies a component that observes the community for collecting knowledge about members' activities in the shared knowledge workspace (awareness gathering component). This component reacts when an observable event occurs in the context of the workspace. Observable events are those events that give information that can imply a change of knowledge at level of the ontologies. There are events of a wide variety; they are those derived from edition activities and also from querying and communication activities. When an event occurs information about *who* performs it, *what* it means and *where* it occurs can be capture. This is basically workspace awareness []. Implicit collection implies to have a component capable of interpreting and deducing what is the real meaning of an event occurrence in the context of the community, whether in private spaces as group spaces. Delivering awareness information implies a component able of adapting delivered awareness information according to members' interests and expertise (awareness delivering component). This component works with a member user model, which is partially represented in the knowledge repository throughout the skill and interest aspects of the member *profile* that it is represented in the *association ontology*. Components, awareness gathering and delivering components are responsible of implementing knowledge awareness mechanism.

Personal casting, broadcasting, and subscription are typical mechanisms to distribute knowledge within the community and they also apply.

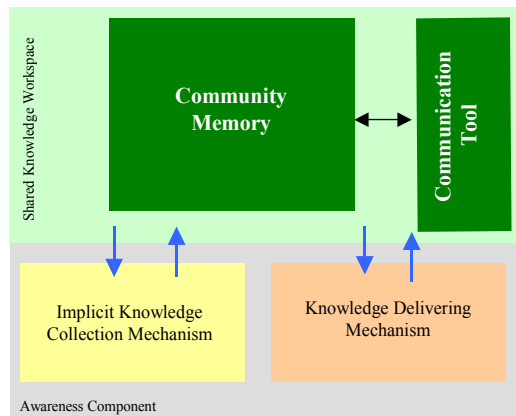


Fig. 3..

6 Conclusions and Further Work

As knowledge sharing is the best added value that people find in meet communities of practice, any technological approach for supporting knowledge-intensive communities must propose a mechanism for facilitate knowledge sharing. For achieving this goal it is important to have a complete understanding of what is the knowledge that the community shares and significant attention must be paid to issues of process and people that allow communities to capture, share, and apply what they know in a coherent fashion across their activity.

In order to develop a group memory system for supporting knowledge sharing in a knowledge-intensive community, we have noticed that awareness plays an essential role at the moment of sharing knowledge, since it is not only a means for understanding what is going on in the shared knowledge workspace, but also it becomes in a source of emergent knowledge because delivered awareness information is the clue needed for promoting knowledge internalization, one of the essential steps in the knowledge sharing process.

Currently, the Collaborative Community Memory System is under development. We are paying special attention on how to represent the knowledge, so that we follow Protégé approach adding collaborative features. Awareness mechanism is developed on the top of previous tool following the guidelines for gathering and delivering components that were briefly described in this paper.

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Suitable Awareness Mechanism for Sharing Knowledge

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