

Managing Knowledge within Communities of Practice: Analysing Needs and Developing Services

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Summary

This paper addresses the issue of knowledge management and learning within Communities of Practice (CoPs). This issue is particularly challenging at a time of global elearning and implementation and development of CoPs within public or private organisations.

Communities of Practices (CoPs) are groups of professionals who share their knowledge, ideas and practices in a common domain or topic. More and more companies and public institutions turn to the implementation of CoPs, both for capitalizing knowledge and for improving the experience and knowledge of their employees.

In this context, important questions arise about the management of collective knowledge and the human organisation, as well as the technological tools to support this process. What are the needs of (online) CoPs concerning their learning, their knowledge management and the organisation of both? What kind of needs could be satisfied by web services? What kind of services? How could they be produced to meet the very specific needs of CoPs?

According to socio-cultural theories, learning in community is facilitated by some conditions. First, people have to define personal and common objectives. Second, people have to participate in regular and rich interactions. Another condition is related to the resources produced. These resources can be considered as “common goods” or as the “wealth” of the CoP including its “memory”. These tools belong to the community and can support the learning of each member.

The technology configuration for CoPs should provide distinctive technological services to support learning, knowledge sharing and creation, as well as sociability and participation.

PALETTE, a European project (2006-2009), investigates CoPs themselves, by working closely with 10 of them, analysing their knowledge management needs and supporting them in implementing new relevant actions for this. Moreover the project studies the technological services that could support the knowledge management and learning processes.

In PALETTE these two points of view are closely interrelated through a participatory design methodology. This means that CoPs and developers of knowledge management services work together following an iterative process for identifying the CoPs' needs, developing knowledge management services based on these needs and organising activities through which the CoPs could really participate in the design of the services.

Keywords

Communities of Practice, Knowledge Management, Informal Learning, Participatory Design, Practice, Research & Development

1. Communities of Practice: Learning and Knowledge Management

Communities of Practices (CoPs) are groups of professionals who share their knowledge, ideas and practices in a common domain or topic. They meet online or face-to-face, or both. They may use Internet-based technologies for meeting, debating, sharing, collecting or building meaning about their professional practices. The learning in CoPs takes place in a peer-oriented context and involves a collaborative approach. This form of learning is effective for adults, especially when the learning goals are exceptionally complex and if it is continued over a prolonged period of time within complex professional environments (Merriam & Caffarella, 1999). We may thus consider CoPs as organisations for achieving complex learning needs. This assumption is related to the Wenger's definition of a CoP (Wenger, 2001): "...a community of practice is a group of people who share an interest in a domain of human endeavour and engage in a process of collective learning that creates bonds between them...".

Since about 15 years, more and more companies and public institutions turn to the implementation and "cultivation" of CoPs, both for capitalizing knowledge as a "key to success in a global economy" (Wenger, McDermott & Snyder, 2002) and for improving the experience and knowledge of their employees. In this context, important questions arise about the management of collective knowledge and the human organisation, as well as the technological tools to support this process. What are the needs of (online) CoPs concerning their learning, their knowledge management and the organisation of both? What kind of needs could be satisfied by web services? What kind of services? How could they be produced to meet the very specific needs of CoPs?

In the IST European Research & Development project we are currently involved in (PALETTE, <http://palette.ercim.org>, 2006-2009) we address these questions from two points of view:

- the CoPs themselves, by working closely with 10 of them, analysing their knowledge management needs and supporting them in implementing new relevant actions for this,
- technological services that could support the knowledge management and learning processes.

In PALETTE these two points of view are closely interrelated through a participatory design methodology. This means that CoPs and developers of knowledge management services work together following an iterative process for identifying the CoPs' needs, developing knowledge management services based on these needs and organising activities through which the CoPs could really participate in the design of the services.

In this paper, we present the analysis of knowledge management needs of CoPs we are working with. We then outline some relevant functions of services developed in the PALETTE framework. We finally present some participatory design principles and activities through which we are working with the CoPs.

2. Ten CoPs from three domains

The CoPs we are working with are from three professional domains. The table 1 briefly presents them with their interests and purposes.

Table 1: brief presentation of the CoPs

Domain	Name of CoPs	People involved	Interests and purposes
Teaching	ePrep	Teachers in French Grandes Ecoles (France - http://www.eprep.org)	Uses of Information and Communication Technologies for teaching and learning in the "Classes préparatoires aux grandes écoles" (CPGEs) preparing students for the entrance exams to the Grandes Ecoles
	Doctoral Prog.	PhD students (UK)	Support for achieving a thesis
	Did@cTIC	Teachers and assistant professors in a University (Switzerland - http://www.unifr.ch/didactic)	Teaching in Higher Education (evaluation, technologies, teaching methods, etc.)
	LEARN-NETT	Teachers and tutors supporting collaborative groups of students at a distance (Belgium, France, Switzerland, DR Congo - http://ute2.umh.ac.be/learn-nett)	Collaborative learning and tutoring at a distance
	@PRETIC	Teachers in secondary schools (Belgium - http://www.apretic.be)	Uses of Information and Communication Technologies for teaching and learning in secondary schools
	Form@HETICE	Teachers in Higher Education (Belgium - http://www.stecrifa.ulg.ac.be/formahetice/)	Uses of Information and Communication Technologies for teaching and learning in Higher Education
Management	ADIRA	Managers of Information Systems in companies, consultants, project managers, etc. (France - http://www.adira.org)	Keeping Information Technology and System professionals at the leading edge in terms of knowledge, competencies and know-how.
	ARADEL	People involved in the local economic development of the Rhône-Alpes region: local authorities, managers, consultants, etc. (France - http://www.aradel.asso.fr)	The jobs of local economic development, the evaluation of local economic policies, the strategies of local development, etc.
Engineering	UX11	Engineer students (France - http://www-inf.int-evry.fr/cours/UNIX)	Computer science, setup and use of GNU/Linux
	BADGE	Engineers involved in continuing training (France)	Telecom Networks and Services, and support for achieving the training objectives

Other CoPs from different domains (nurses and professionals involved in non governmental organisations) have been contacted and are just about to participate in the project. Even though all these CoPs are not from the same field we have observed similarities in their approach of learning and knowledge management and in the issues they encounter.

3. What are the knowledge management needs of CoPs?

Taking into account socio-cultural theories (Lave & Wenger, 1991), learning in community is facilitated by some conditions. First, people have to define personal and common objectives: What do I want to learn? What do we want to learn together? Second, people have to participate in regular and rich interactions. The more richer and well supported are the interactions, more efficient will be the learning. The first two conditions are related to the commitment of CoPs' members: if people clarify their own objectives of learning in relation with the project of the CoP, and if the participation in the CoP leads them to achieve their personal objectives, they will be willing to get involved in the activities of the CoP.

Another condition is related to the resources produced. For supporting learning through social interactions people in the community produce and reuse resources. These resources can be considered as "common goods" or as the "wealth" of the CoP including its "memory". These resources may be for instance technological tools for supporting the formalisation of "tacit knowledge" of members or organisational tools for implementing activities that lead the members to share and capitalise their knowledge and competencies. These tools belong to the community and can support the learning of each member.

These conditions cover the needs expressed by the CoPs involved in PALETTE project. Their needs could be summarised in one phrase: to formalize tacit knowledge, to archive mutual resources and to make them retrievable and reusable. Of course, these needs are not always addressed by the CoPs' members at the same level or in the same measure. But this corresponds to practical questions and issues they encounter every day, for example:

- to agree on the meaning of technical terms;
- to explicit different practical ways to carry out specific tasks such as to use a software, to teach specific concepts, or to prepare a business project;
- to archive and annotate numbers of documents produced by numbers of contributors;
- to organise these documents in significant categories;
- to search for specific information through wide archives;
- to reuse old documents or parts of them to produce new ones.

4. What kind of technological services?

According to Preece (2000), the technology configuration for CoPs should provide distinctive technological services to support learning, knowledge sharing and creation, as well as sociability and participation.

The PALETTE project aims at developing three kinds of technological services for CoPs:

1. **Services for producing, reusing and sharing information.** In order to support the activities of CoPs' members, the PALETTE project provides tools for data production, exchange and reuse between autonomous and heterogeneous applications.
2. **Services for reification of knowledge about practices.** The PALETTE project develops tools aiming at reification of the fundamental process that takes into account the fact that the knowledge acquired and shared in a CoP can consist not only of the domain knowledge, but also of more tacit knowledge such as lessons learnt from past individual or collective experiments in the community, knowledge created through cooperation between the members, knowledge on the community itself, on its organization, etc.

3. **Services for supporting collaborative learning.** Collaborative learning is inherent to CoPs; members learn from each other by making their knowledge explicit, sharing it with their peers, and reflect on it. In a learning context (in the workplace or outside it), many problems have to be collaboratively solved through debates and negotiations among a group of people. In such settings, support for achieving consensus and compromise is required as well as for argumentation and awareness about the general activity of the CoPs.

These three categories of tools aim at being interoperable within an Open Source development framework.

From a more specific knowledge management point of view, current tools aimed at supporting elearning are often based on the building of a learning memory (i.e. an organizational memory of the organization constituted by the actors of the learning process - generally teachers or learners). Such a learning memory can rely on elearning ontologies (in general constituted of pedagogical ontologies and domain ontologies) and on metadata about learning objects. The Learning Object paradigm is currently the major approach towards exchange and reusability of knowledge (Wiley, 2000).

However, learning objects do not solve the problem of providing on-demand, customised, contextual or social learning, as we observed in our CoPs' knowledge management needs. Such knowledge management approaches do not take into account the three dimensions of CoPs: mutual commitment, joint enterprise, and shared repertoire of actors, discourses and tools (Wenger, 1998). More flexible solutions could rely on semantic annotations that refer to ontologies capturing common knowledge of the CoPs (Vidou *et al.*, 2006).

The Semantic Web, Web Services and Semantic Web Services (Berners-Lee *et al.*, 2001), as well as new semantic languages and standards like XML or RDF (Becker *et al.*, 2000), seem to improve the development of tools for the automated or semi-automated capturing, sharing, and retrieval of information. The current focus of Semantic Web research is more and more directed towards supporting intelligent data exchange. In this case the information that is being annotated is not unstructured text but rather (semi)-structured information available from databases or exchanged between web services.

5. Which needs could be satisfied by Web-based services? Which by other services?

From a general point of view, a service is one or a set of software components or facilities or activities that a third-party offers (temporarily) to whoever is interested in meeting a specific need. In the PALETTE context, target users are CoPs' members, and the services have to meet one or multiple CoPs' needs. Finally, such services can be materialized by one or a composition of functions offered by IT tools.

We consider two types of PALETTE services, technological and learning ones, both for supporting the development and learning of the CoPs. The needs expressed by the CoPs in PALETTE (representing some conditions of learning) could be supported or met both by technological and learning services. Besides the technological services, learning services can be used too: pedagogical scenarios for technical and social training, strategies to capitalise, retrieve and reuse information, questions to assist members of the CoPs in the choice, appropriation and adaptation of technological services, etc.

In the table 2 below, we summarise some PALETTE CoPs' needs for knowledge management and the services that could support the CoPs for meeting them. These examples more specifically concern the teaching domain CoPs.

Table 2: examples of CoPs' needs and related services

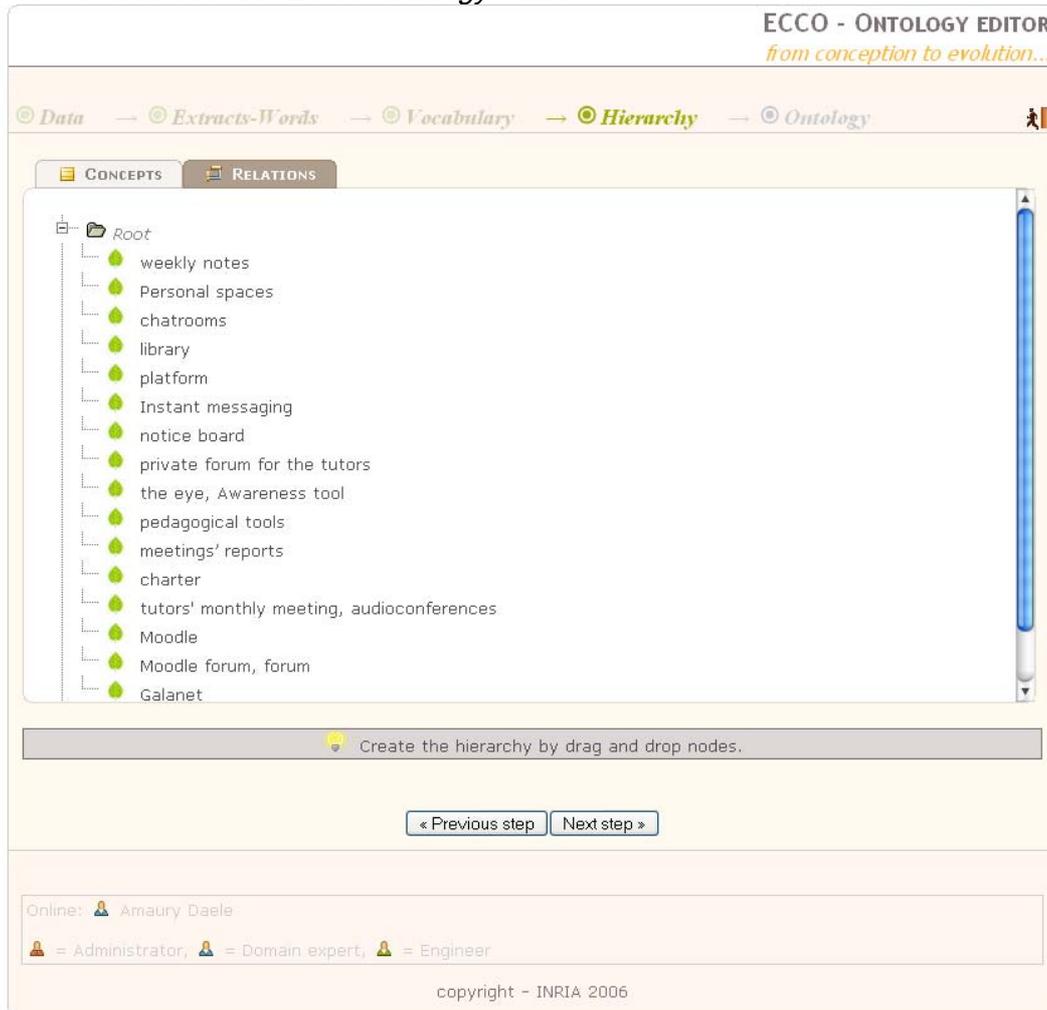
Examples of CoPs	CoPs' knowledge management needs	Proposed technological services
@PRETIC: Group of ICT resource people in secondary schools sharing about the use of ICTs for teaching and learning	<ul style="list-style-type: none"> - to share information - to retrieve archive contents 	<ul style="list-style-type: none"> - ontology management - annotation of resources according to ontologies - semantic wiki engine: to create and develop a wiki gathering definitions useful for students and teachers and to share concrete definitions
Did@cTIC: Groups of university teachers involved in a diploma of continuous training in Higher Education and Educational Technology	<ul style="list-style-type: none"> - to capitalize discussions and documents shared during face-to-face meetings about teaching practices - to produce a collection of illustrations of teaching practices - to reuse illustrations of teaching practices for elaborating documents for new teachers 	<ul style="list-style-type: none"> - ontology management - annotation of resources according to ontologies - production and reusing of structured document
LEARN-NETT: Group of teachers and tutors involved in a common course for teachers training in the field of educational technology	<ul style="list-style-type: none"> - to support participation - debate, confrontation - to capitalize produced resources (new and old ones) : various documents, discussions, teaching practices, etc. 	<ul style="list-style-type: none"> - ontology management - annotation of resources according to ontologies - semantic wiki engine for sharing teaching practices - search engine for collected resources and discussions

The proposed services are available on the PALETTE website (<http://palette.ercim.org>). Here are two examples:

ECCO (<http://argentera.inria.fr/ecco/index.jsp>) is a web service that allows creating ontologies on the basis of existing documents (text format) and managing them by defining the concepts, organising them into a hierarchy, and creating relations between them. The ontologies generation happens in several stages:

1. Creation of a base of textual documents that describe a domain or a particular context (interviews or conversations with experts for example);
2. In these documents, choose of relevant terms or expressions related to the studied domain or context that will constitute the contextualised lexicon of the domain or context;
3. Definition of the relevant terms or expressions, by either searching for definitions into the documents, or directly writing them; the choose of the terms or of the definitions may be changed at any time;
4. Organisation of the terms and their relations into a hierarchy.

Figure 1: Screenshot of the ECCO ontology editor



SweetWiki (<http://argentera.inria.fr:8080/wiki/>) is a semantic wiki, developed with semantic web technologies, that is based on the concept of “social tagging” (or social annotation): by using a WYSIWYG editor the user of the wiki can tag (allocate keywords to) pages or images. The semantic research module CORESE is then automatically and transparently used on these tags. If a user types a tag in the research form, she/he will receive all the objects tagged with this tag or its sub-tags. The user will then receive all the related tags that are linked with relevant documents.

SweetWiki also offers an editor of “folksonomy” (a set of interrelated tags is a folksonomy). Each user can organise the tags.

Figure 2: Screenshot of SweetWiki for LEARN-NETT

The screenshot shows the SweetWiki interface. At the top, there is a navigation bar with the SweetWiki logo, a user login status ('Logged as AmauryDaele'), and links for 'Edit this page', 'Print view', and 'Semantic WEB Enabled Technology Wiki'. Below the navigation bar, the page is divided into several sections:

- Search:** Includes 'Keyword search' and 'Tag search' input fields, along with links for 'Recent changes', 'Advanced search', 'All users', and 'My Home Page'.
- Webs:** Contains links for 'Main' and 'Sand Box'.
- Administration:** Includes links for 'Manage Ontologies', 'Reload Corese', and a 'New Page:' section with a 'Create' button.
- Main Content:** A large section titled 'Welcome to the Learn-Nett SweetWiki' with a welcome message and three numbered instructions for creating and editing pages. It also includes a 'Page contents' section.
- Tags:** A sidebar on the right listing tags such as 'sweetwiki(3)', 'learn-nett(4)', 'mini-activite(1)', 'charte(2)', 'partenaires(4)', and 'PALETTE(2)'.

In order to propose concrete activities to the CoPs, by taking into account their needs, we elaborated in collaboration with them scenarios of use of the technological services. The elaboration of such scenarios, their validation by CoPs' members, and the improvement of the services functional specifications take place within a participatory design framework (PALETTE, 2006).

6. How are the services produced so that they meet the needs?

In summary, the PALETTE project aims at facilitating exchanges and learning in CoPs by developing online and "learning" services and scenarios of use which will be implemented and validated with living communities. The ten CoPs (and a few more in the future) are actively involved in the project through participative activities: interviews, trials of services, discussions about scenarios of uses, etc.

In practical terms, PALETTE services are produced through an incremental and participative process that:

- specifies and categorizes CoPs' needs (this includes the analysis of CoPs' practices, resources and environments),
- refines PALETTE services functional specifications in order to identify specific functions that meet CoPs' needs.

The design of the scenarios is a cycling process. First scenarios are developed jointly by a PALETTE researcher and the CoPs. They are discussed, or even "played", with the CoPs' members. For some CoPs, a meeting with the developers of the services that are expected to be interesting is organised. This meeting enables all the parties (CoP's members and PALETTE researchers and developers) to better understand the concerns of others, to gain knowledge about each other preoccupations, needs, desires, requirements, etc. Thus, such meetings are truly participatory activities, in the sense that each party is able to learn about all the others, and to develop a common ground of understanding (Béguin, 2003).

Then a first validation occurs, which enables developers to inscribe a first version of the functional specifications of the services and of their possible interaction. The process then

encompasses further loops, the possible use of services being able to evolve with the enrichment of each service and also with the development of the interoperation between them.

The interaction of the developers with the process of designing and validating scenarios of use may be slightly different from one CoP to another. For some CoPs, PALETTE researchers are well aware of the possible uses and services interesting for them. Demos, small tests and/or comparison with other applications already known by the CoPs are sufficient to have a good idea of a possible adequacy between the needs, the services offered and the uses. For some other CoPs, the test may take the form of a more thorough use of the tools as they already are.

The whole process is implemented according to the participatory design methodology. A whole process is designed and supported with methodological principles (participatory design, validation principles), documents templates (scenario of use, scenario of validation, specification files, etc.), scheduling of activities, definition of different roles and activities, and expected outputs.

So far, the scenarios and the technological and learning tools are under way towards new versions that will be more and more generic, i.e. adaptable to a wide range of CoPs in different domains. The first results of the project can be found at <http://palette.ercim.org>. The Open Source, interoperability and participatory design philosophy of PALETTE lets us be confident about the real use of these new services by CoPs.

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