O'CoP, an Ontology Dedicated to Communities of Practice

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Abstract: The Palette project dedicated to learning in Communities of Practice (CoPs) aims to offer several services for CoPs, in particular Knowledge Management (KM) services based on an ontology dedicated to CoPs, the so-called O'CoP. Built from information sources about the Palette CoPs, O'CoP aims both at modelling the members of the CoP and at annotating the CoP's knowledge resources. The paper describes the structure of O'CoP, its main concepts and relations, and it reports some lessons learnt from the cooperative building of this ontology.

1   Introduction

CoPs are "groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis" [Wenger et al., 02].

The objectives of the Palette IST project (http://palette.ercim.org/) are to develop services for CoPs: information, knowledge management (KM), and mediation services. Eleven pilot CoPs are involved in the participatory design of the Palette services. These CoPs, located in various European countries (Belgium, France, Greece, Switzerland, UK), belong to three different domains: (i) teaching (e.g. @pretic, a CoP of Belgian teachers playing the role of resources-persons to support the use of Information and Communication Technologies (ICT) in schools), (ii) management (e.g. ADIRA, a French professional association gathering executives from medium to large IT companies in Rhône-Alpes region), and (iii) engineering (e.g. UX-11, a CoP composed of 150 IT engineer-students practicing GNU/Linux). The CoPs' size varies from less than ten members to more than a hundred of members.

KM services aim at supporting CoPs' management of their knowledge resources, so as to improve: (i) the access, sharing, and reuse of existing knowledge, and (ii) the creation of new knowledge. A knowledge resource can be either a *document* materialising the knowledge made explicit by CoPs' members when cooperating, or a *person* holding tacit knowledge. The KM services will be based on Semantic Web technologies: they will rely on an ontology (describing concepts useful about a CoP, its actors and their competences, its resources, its activities, etc.) and on the semantic annotation of the CoPs' knowledge resources w.r.t. this ontology. In [Vidou et al., 06], we proposed generic models useful for understanding a group activity, collaboration, competencies, learners' profiles, and lessons-learnt. A CoP being a specific kind of a group, the CoP-dedicated ontology, so-called O'CoP, is based on

these generic models. It consists of CoP-relevant concepts and relations with which the CoPs' resources can be annotated. These CoP-relevant concepts and relations are specialisations of the high-level ontology constituted by the generic concepts used to represent the generic models. The CoP-oriented KM services will rely on the O'CoP ontology.

After summarising our ontology development method and the ontology structure (section 2), we will describe its main concepts (section 3), the lessons learnt from its building (section 4), before concluding (section 5).

2   Ontology Development Method and O'CoP Ontology Structure

Our method for developing the O'CoP ontology includes the following steps:
- *Information sources collection*: selecting three main sources to be used either as *corpora* where picking out candidate terms, or as *grids* for extracting candidate terms: (i) Rough-data documents (audio records/files of CoPs' interviews, transcriptions and minutes of these interviews; the interviews were performed by Palette members that played the role of *mediators* between some specific CoP and the knowledge engineers); (ii) Analysed-data documents (e.g., syntheses of interviews, vignettes and scenarios structuring the CoPs' activities); (iii) Methodological and theoretical documents (e.g., our generic models and existing ontologies or thesaurus);
- *Contextualised lexicon construction*: selecting from the corpora and w.r.t. the grids (i) the *terms* relevant for describing the CoPs and (ii) their respective contexts (i.e. the text surrounding the terms) to help understand the terms.
- *Vocabulary identification* i.e. refining the contextualised lexicon once validated by the CoPs' mediators and producing, for each term, a definition and some examples of use.
- *Hierarchy building*: (i) identifying the terminological concepts and relations, and (ii) structuring them, and eventually adding new higher-level concepts.
- *Ontology formalisation* in RDF/S, the formal language agreed in Palette.

A tool, called ECCO, supports these iterative steps and provides the user with mechanisms enabling to keep the traceability of the sources of the candidate terms. The resulting O'CoP ontology is structured into three main layers (see Figure 1):
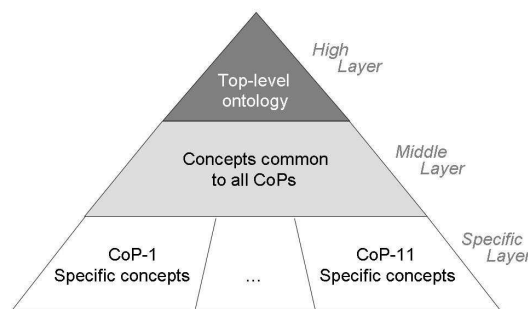

Figure 1: Structure of the O'CoP ontology

- *A high layer* (or top-level ontology) including the concepts and relations needed to represent the generic models presented in [Vidou et al., 2006]; they served as a grid for analysing the corpora and building the other layers of the ontology.
- *A middle layer* including the concepts common to all CoPs. These concepts correspond to terms confirmed by the mediators as common to all CoPs. They are specialisations of the high-level ontology concepts. Note that some concepts stemming from literature on CoPs could be included in this common layer, provided that they are attested by at least the CoP corpora.
- *A specific layer* including the concepts specific to each CoP: these concepts correspond to terms confirmed by the mediators as specific to a given CoP or to very few CoPs.

3 Description of the Main Concepts of the Ontology

3.1 Community

The main concepts related to the community in the O'CoP ontology are:

- *Community:* it can be a *community of interest*, a *community of learners*, a *goal-oriented community* or a *community of practice*. In the interviews, interviewees acknowledged that the group of persons they are in (be it so-called a *community of teachers*, a *network of teachers*, a *resource-persons community*, an *association of companies*, etc.) is a (kind of) CoP.
- *Domain* and *Field*: as defined in [Wenger, 2004], the *Domain* is the area of knowledge that brings the community together, gives it its identity and defines the key issues that the CoP's members need to address. It is the "focus" of the CoP and evolves over its life span in response to new, emerging challenges and issues [Henri, 06]. As for the *Field*, it is the "context" of the CoP; it can be referred to as the "discipline" or the "branch of knowledge" of the CoP's members (e.g. the *Domain* of ePrep[1] is the Educative use of ICT and its *Field* can be Mathematics, Physics, etc.).
- *Objective*: related to the CoP as a whole, or to a part of it (a group, a project, a team, etc. depending on the CoP's organisation and functioning modes), an objective can be *Permanent* or *Temporary*.
- *CoP's characteristics*: the CoP's identity is characterised by (i) the *Membership*: is the CoP open to any person interested in it or are there some conditions (e.g., competency, cooptation, etc.) for entering the CoP? (ii) the *Cultural Diversity* (from homogeneity to heterogeneity) of the CoP's members w.r.t. the nationality, profile, organisational culture [Langelier and Wenger, 2005].
- *Organisational structure*: the organisation of CoPs varies from formal and structured (e.g. the CoP ADIRA[2], which is based on a "board of governors") to informal (e.g., the DL[3] which is based on "informal subgroups").
  Figure 2 shows some relations concerning communities.

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[1] A CoP gathering teachers of French "Classes préparatoires aux Grandes Ecoles" interested in ICT (cf. http://www.eprep.org/Presentation_GB.htm#CoP).
[2] http://www.adira.org/
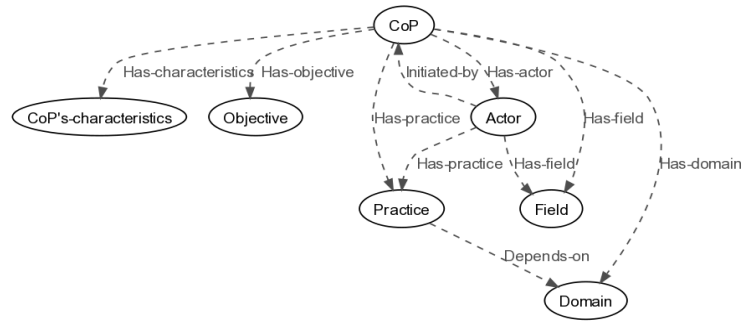[3] Doctoral Group Lancaster : http://domino.lancs.ac.uk/

Figure 2: Relations concerning a community

3.2 Actors

We define an *Actor* as "an Individual or a Legal entity intervening in the CoP". The *Actors* of a CoP are not only the CoP's members, but also the entities interacting with the CoP (also called the CoP *environment*). A *Legal entity* can be a *Professional organisation* or an *Institution* (*Companies* and *Educational institutions*). *Actors* can be involved in the CoP as *Members*, *Contributors* (*Individuals* participating in particular activities or during specific periods of the CoP's life) or *Partners* (*Legal entities* supporting the CoP).
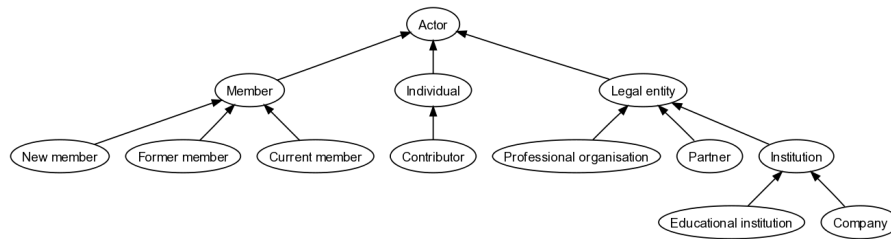

Figure 3: Concepts describing Actors in a CoP

Moreover, the *Actors* of a CoP can be defined according to their:

- *Role in the CoP*: it represents the *Actor*'s position in the CoP, which can divided in two types:
  o *Governance role*: in order to interact, learn and share knowledge effectively, the CoP's actors (e.g. the members) need a support, which can be provided by: *(i) Facilitator*: s/he encourages the participation of the members, facilitates the interactions among them. *(ii) Coordinator*: s/he organises and coordinates the activities and events of the CoP. We distinguish the *Individual coordination* (ensured by one main coordinator) and the *Collective coordination* (in the case of a CoP organised per groups or teams, where individual local coordinator belongs to a coordination group or team). *(iii) Animator*: s/he guides and manages the community, ensures its

development, relevance and effectiveness. An *Animator* thus plays both roles of *Facilitator* and *Coordinator*.

    ○ *Peripheral role*: represents knowledge providers and receivers. They are more or less involved or active in the CoP, their participation depends on the *Actors* who play these roles (personality, motivation, period, activity, etc.).

- Their *Individual profile*: identifies a CoP's *Individual* inside and outside the CoP. It comprises the concepts of *Competency* and *Occupation*.
- Their *Practice*: CoP's *members* are practitioners in an *Institution*, outside the CoP. They meet physically or virtually, through the CoP, which constitutes a channel for them to exchange about their shared Practice (e.g. teaching practice).
- Their *Behaviour*: the Attitude of the member towards the CoP gives more information about his/her degree of engagement in the CoP.

3.3 Competency

A *Competency* is defined as a set of *Resources* provided or to be acquired by an *Actor* (who plays a particular *Role* in some *Environment* or *Situation*) so that the Actor can perform, or help some other Actor to perform some *Activity*. Figure 4 gives a partial view of the Competency-Resource component and shows some relations concerning the Competency concepts.
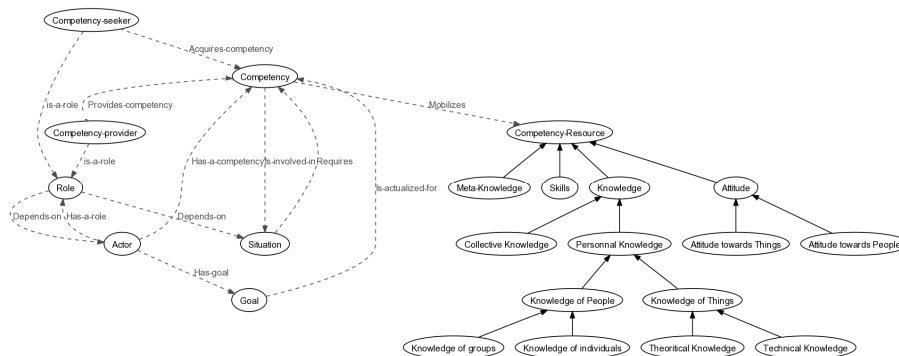

Figure 4: Excerpt of Competency concept hierarchy and some relations describing it

3.4 Resources

The *Resources* handled by a CoP are subdivided into:

- *Tools* defined according to the needs of community and their functionalities. A hierarchy describes the categorisation of these tools answering recurrent needs of a CoP including knowledge capturing (*Knowledge portal*), knowledge storage and sharing (*Repository*), collaboration (*Workspace*, *Agenda*, etc.).
- *Materialised resources* including documents, discussion. This last type of resources in the CoPs is associated to the interactions that hold within the CoP. These discussions can be *synchronous* (chat, audio and video conferences, etc.)

or *asynchronous* (mail, forum, etc.). Almost all Palette CoPs are interested in easy access to these interaction traces and in archiving them.

On the other hand, these resources can be characterized w.r.t. many dimensions, for instance, Figure 5 shows some of the concepts needed to deal with the ownership of resources in a CoP.
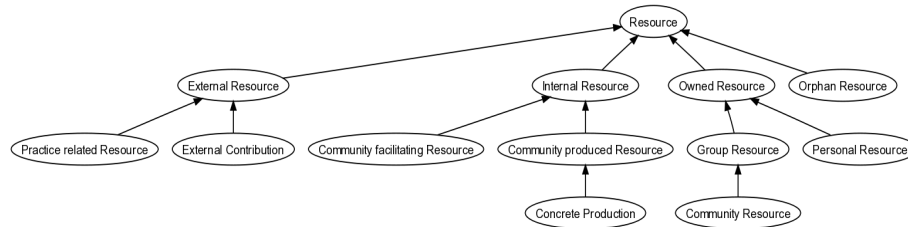

Figure 5: Categorisation of resources ownership

4   Lessons Learnt from the O'CoP Ontology Development

Concerning information sources collection, *the relevance of the terms extracted from the corpora strongly depends on the relevance of the corpora*. CoPs' mediators had focused their interviews on the organisation of CoPs, and had scarcely asked questions about CoPs' practices. As a consequence, the transcriptions of interviews contained very few terms related to practices. This leads to an ontology in which concepts related to practices are not very numerous.

During the terminological analysis, we found several terms common to some CoPs but used to evoke different concepts: e.g. the term *"platform"* was used to designate, depending on the CoP: a website, a workspace for the CoP, that may contain its documents and where the discussions of members are hosted, or yet a dedicated software e.g. e-learning platform. Some terms were also used ambiguously to designate concepts: e.g. CoPs use different terms to designate the persons in charge of particular tasks in the CoPs (*"coordinator of the project"*, *"local coordinator"*, *"manager"*, etc.), whereas these tasks are not well described and identified. Finally, some CoPs use different terms to designate the same concepts, these synonyms must be associated to the same concept in their ontologies in order to avoid redundancy. For example, the terms *Journal* and *Logbook* are used to designate the record of activities or practices of a CoP's member. More generally, the synonym terms (either in the same CoP or in several CoPs) were recognised by the validators, during the phase of vocabulary identification and term validation. In the implementation of the ontology, the synonym terms corresponding to a given concept were indicated through the RDF/S label of this concept.

The different CoPs adopted different terminologies, sometimes quite specific to the CoP and rather different from the terminology usually found in literature on CoPs. Therefore, we did not include in the common layer of the ontology the concepts offered by literature (e.g. the taxonomy of facilitation tasks for CoPs proposed by [Tarmizi and de Vreede, 2005]) if they were not attested by the Palette CoPs' information sources.

The O'CoP ontology building was a distributed, cooperative process between: (a) 6 ontologists focusing on different parts of the ontology since each one was guided by one generic model, (b) 11 CoPs' mediators validating from the CoPs' viewpoints. This led to the need of integration of different viewpoints. The different ontologists had various ways of modelling knowledge: e.g. the concept of *Activity* was needed for modelling *Competency* and *Resource*. Concepts related to *Activity* were thus modelled with various detail grains and various perspectives, requiring more integration work. Moreover, the integration between different concepts developed by different ontologists was often performed through the introduction of relations linking such concepts (e.g. relation between an *Actor* and an *Activity*, etc.). Notice that such kinds of relations were emphasised in the generic models that guided us. But they needed to be refined for more specialised concepts.

Our approach was both bottom-up (relying on a deep analysis of the information sources on the CoPs) and top-down (guided by our generic models).

5   Conclusions

This paper presented an original ontology composed of more than 800 concepts and 80 relations, dedicated to CoPs, and more precisely aimed at enabling to annotate the CoPs' members and the CoPs' resources. The link between CoPs and ontologies was studied in some recent related work. In [O'Hara et al., 02], the authors present a method based on analysis of the relationships between instances of a given ontology in order to identify potential CoPs in an organisation. In [Bettahar et al., 06], the authors develop an ontology aimed at enabling services among a civil servant CoP; [Floyd and Ulena, 05] studies the design of situated ontologies for knowledge sharing in a CoP. In comparison to this related work, the O'CoP ontology is original through: (i) the method used to build it cooperatively from analysis of several real CoPs, (ii) its objective of enabling to annotate CoPs' resources in addition to modelling the notion of CoP, and. (iii) its 3-layered structure, with a generic layer, a middle layer gathering concepts common to all CoPs and a low layer specific to a given CoP. O'CoP was for example used by the @pretic CoP, in order to annotate the mails exchanged by the members of the CoPs about their problems in the use of ICT in schools. Our work can also be partially compared to the typology of virtual CoPs (i.e. CoPs interacting through ICT) proposed by [Dubé et al., 06] or to the typology of CoPs based on their knowledge characteristics [Klein et al., 05] but these typologies are not materialised through ontologies.

More generally, the O'CoP ontology can be specialised for a new CoP. The high and middle layers are generic and can thus be reused for any CoP. If the new CoP is similar to one of the Palette CoPs, the low layer corresponding to this CoP can be reused. But if no Palette CoP is relevant, concepts more specific to the new CoP can be added in the low layer, possibly by relying on our method described in section 2.

As a further work, after achieving the current validation of the integrated O'CoP ontology by the CoPs' mediators, we will make the ontology available to all the Palette CoPs and develop several KM services based on it: knowledge creation, annotation, retrieval, presentation, evaluation, and evolution services.

Acknowledgements

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