

On the Use of Actor-Network Theory for Developing Web Services Dedicated to Communities of Practice

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Abstract. Communities of practices are more and more recognized by companies, individuals and groups as valuable places to share and create knowledge. Communities of practice have to be cultivated in order to fully create the value they may bring to their environment. They need interoperable, flexible, ubiquitous, and specific collaborative tools to support their work. Developing such tools and enabling their use among communities of practice requires adopting a Participatory Design approach. Actor Network Theory (ANT) is then used to define a methodology that fosters the participation of heterogeneous stakeholders to the design process. As a case study, we show that ANT concepts are useful to analyse the design context of an European project named PALETTE that aims at developing interoperable services for helping communities of practices to better cultivate themselves

Keywords: communities of practice, participatory design, actor-network theory, European projects

1 Introduction

Our focus is on reflecting upon a design methodology that could help providing a community of practice (CoP) with enough suitable and usable tools so that it is able to cultivate itself appropriately. Wenger et al. (Wenger et al. 2002) identify seven principles for cultivating communities of practice: design for evolution, open a dialog between inside and outside perspectives, invite different levels of participation, develop both public and private community spaces, focus on value, combine familiarity and excitement, create a rhythm for the community.

We are well aware that these processes of cultivating communities of practice go far beyond the design of tools. But collaboration, communication, knowledge management, document exchange, problem solving are activities that cannot be accomplished without a strong support from technology enabled tools, all the more so because communities members are scattered in different locations and even across different organizations.

Usual communication tools like e-mail, and forums are naturally the common basis for communication. But they are not efficient enough to really support the development of the activities of a community of practice to the point where it can start create value for

itself and its environment. CoPs need tools that answer better to their specific needs and usages. They have - simply - to create, reuse, store, share, exchange, publish, represent and capitalize information. But the nature of the information, the content and the value of it are somewhat different than what a usual database or document management system can provide. The information that is manipulated in a community of practice is more often informal, declarative, textual or graphic, qualitative, practice-oriented, sometimes not well formalized or even expressed. It may deal with a lot of different subjects, the relevance and value of which are only decided by the community. Thus a community of practice needs tools that share some common features, among which:

- be available anywhere;
- allow flexible use, depending of the skills of the members regarding technology;
- cover a range of document management functions: creation, modification, publication, exchange, storage, retrieval, all on a collaborative basis;
- cover a range of information representation and modelling functions providing a mean for creating a common ground within the community;
- cover a range of knowledge management functions, related to the practice and the identity of the community, and the learning activities within the community;
- enable communication, collaboration and cooperation in the way that is useful for the community, both inside the community and between the community and its environment;
- allow to understand, represent, enrich, share members' expertise.

Such tools might be different - even radically - from the usual IT that are used in companies or for the day-to-day job. They are merely based on new technologies, open-source or "open-source minded" (the usefulness and quality of which are qualified by users, not by proprietary developers). They have to be interoperable, evolutionary, flexible *and truly* collaborative. They are likely to appear as a set (a "palette" of interoperable web services).

2 Designing web services for communities of practice: Actor-Network Theory and Participatory Design

The Participatory Design approach may be considered as a process of negotiation of usefulness to be achieved through reconciling the contrasting perspectives of various stakeholders, including users, designers and others. We argue that using ANT¹ to

¹ ANT was formerly the acronym for Actor-Network Theory. It is now used as itself, and even one of its first creators, Bruno Latour, recognises that it has become something different, and if it was created now, he would probably not have used the same words, specially the word network that he feels confusing now [Latour 1999]. We will then use ANT as a name and not as an acronym

analyse design situations where CoPs² are involved can help defining a suitable Participatory Design methodology.

There are different interpretations of the usefulness of technology. As stated by Abreu de Paula: "perception of usefulness is not statically embedded in its design, but is dynamically and constantly created and shaped by different social groups. In this respect, one important goal is to attempt to reconcile these often contrasting perspectives" (Abreu de Paula, 2004). While Participatory Design does not explicitly address the social construction of usefulness, it may be considered as framing the social interactions that eventually lead to a recognised useful system.

The main difficulty of Participatory Design remains the organization and management of an efficient participation – i.e. a participation that can truly influence the design process. Each actor of the design process is an expert of her domain and this expertise influences the design process. However actors are heterogeneous in respect to their disciplines, preoccupations and interests: they don't speak the same "language". For them to interact necessitates that they construct together a "common ground". This is achieved through participative activities that mediate participation. Examples of such activities include brainstorming meetings, prototype demonstration, scenario performing, role playing, design games. Participative activities are often hampered by suspicion and even conflict.

Some of these activities may focus on creating boundary-objects (Bowker and Star, 1999; Gasson, 2006) i.e. objects "to-think-with" that facilitate mutual understanding and trust among participants with various backgrounds. A mock-up, an intermediate version of the final product, a use-case or a scenario are classical boundary-objects. This concept is closely related to what Wenger says about reification: "reification ... refer to the process of giving form to our experience by producing objects (...) In so doing we create points of focus around which the negotiation of meaning becomes organized"(Wenger, 1998).

ANT provides a conceptual framework helping formulating and building a design methodology that sustains efficient participation of heterogeneous. ANT portrays an alignment that differs from the traditional system development one along crucial dimensions: there is an open-ended array of "things" that need to be aligned including work-routines, incentive structures, system modules and organisational roles. It follows immediately that there can be no strict top-down control over such a collection of things (Monteiro, 2000). Actors' heterogeneity is one of ANT main originalities. An actor is characterized first hand by its capability to act and interact, its influence. ANT thus clearly acknowledges that a lot of "things" - humans and non-humans - do have an influence (McBride). The notion of participation is extended to take into account the

² Just as for ANT, we will use the term CoP to refer to a community of practice, following Wenger's recommendation that "community-of-practice" should be viewed as a unit (Wenger, 1998)

participation/influence of non-human actors, such as artefacts and organisations. This is obviously an interesting feature when describing a socio-technical system.

ANT concepts seem appropriate for preparing design strategies, in a Participatory Design context, that aim at "aligning the interests of the actor-network " i.e. having all their influences fit together. The alignment of the network is obtained through processes of translation: translation means both a move of some actor's interests and a translation - in the sense of change of language or representation - of those interests in order to align them with the interests of other actors. According to Callon (Callon, 1999), the translation process includes several steps, among which: *interessement* and enrolment. *Interessement* and enrolment focus on negotiating acceptable roles for the human actors.

The next ANT concept is inscription, meaning that "aligned interests [are] inscribed into durable material" (Law, 1992). A translation process supposes a medium or a material in which it is inscribed (boundary objects, for example, may support inscription). According to Akrich: "A large part of the work of innovators is that of inscribing their vision of the world in the technical content of a new object" (Akrich, 1992).

Finally, ANT introduces the concept of black-boxing. Black-boxes are "sealed actor-networks" (Stalder, 1997) whose alignment has been obtained, whose aligned interests have been inscribed in a stable association that is no longer questionable – except at a heavy cost. In this sense, a project plan is a black-box that has been sealed after a translation process has succeeded in aligning the interests of the project partners.

3. A case Study: the PALETTE European Project.

As an illustration of the concepts described above, we would like to present the context of a European Project named PALETTE³. It gathers about fifty researchers from thirteen Institutions in seven countries. The PALETTE project aims at facilitating and augmenting individual and organisational learning in communities of practice. To reach this aim, an interoperable and extensible set of innovative services as well as a set of specific scenarios of use will be designed, implemented and validated in CoPs of diverse contexts. The PALETTE services are classified into three categories: *information services*, *knowledge management services* and *mediation services*. PALETTE adopts a participative design approach, establishing a good balance between technological and pedagogical experts. Evaluation is integrated in the same process, in order to provide direct, frequent and detailed feedback.

It is expected that the adoption of the developed services and scenarios will result in

³ (6th Framework Programme - Priority IST-2004-2.4.10 - Technology-Enhanced Learning). PALETTE stands for: Pedagogically sustained Adaptive LEarning Through the exploitation of Tacit and Explicit knowledge

- the facilitation of tasks performed by learning CoPs by removing barriers imposed by current approaches;
- the exploitation of diverse mental models, knowledge resources and competences of CoPs member through the social interaction of codified and tacit knowledge;
- the creation of new knowledge, which can lead to the evolution of the associated learning resources;
- the easy access and reuse of knowledge built by the CoPs;
- the increase of active participation of individuals in CoPs;
- the emergence of new CoPs, inside and outside organisations;
- the increase of the overall quality of learning in CoPs.

PALETTE will provide innovative models and technical solutions with regard to the following dimensions:

- efficient reuse and sharing of information among the CoPs' participants;
- user-friendly production and use of multimedia content to support the expression of practices (behaviour, rules, personal theory, etc.);
- efficient and effective support of the individual and organisational learning process, the incoming of new participants in a CoP, and the capitalization of knowledge.

PALETTE will implement the conditions for the exploitation and development of open source services by a large number of CoPs. Thus the PALETTE services and scenarios will not only address the needs of identified CoPs but also describe the conditions for their enhancement through the active participation of users in their development.

One of the first tasks of the project, which started in February 2006, was to settle a design methodology implementing the conditions for Participatory Design. It seemed that ANT was a good support for creating a common understanding of the methodological context of the project.

3.1 Using ANT to implement the participatory design methodology in Palette.

McBride (McBride) suggests a 7 steps methodology where ANT is used as an analytical tool "to identify actions which may speed the social embedding of the technology and the successful take-up of (a) system": identify stakeholders, investigate stakeholders, identify stakeholders' interactions, build actor-network models, identify irreversibility (provisional stabilities), identify inhibitors and promoters, identify actions for aligning the network (participative activities).

In PALETTE, we apply an analogous methodology to implement the Participatory Design process:

- the first steps consist in identifying the various stakeholders, their interests, the inhibitors and the promoters for the enrolment of these actors in the actor-network;

- then, by attempting to "align" these actors' interests, we will build the actor-network and an ANT-based description of the issues related to bootstrapping the participatory approach in Palette;
- finally we will propose a set of actions – mainly participative activities with boundary objects – and select a set of inscription medium with the aim to "enrol" the various actors and promote the social design and acceptance of the new technologies.

3.2 Building the actor-network: identifying and enrolling the actors, aligning their interests

There are a lot of actors gathered for the project purposes.

- CoPs, CoPs members, CoPs animators
- CoPs observers, community of CoPs observers
- Project, DoW⁴, project coordination, project management
- Research teams
- Work Packages, tasks groups, sub-tasks groups
- Pedagogical tools: social sciences methodologies, interviews, scenarios, data collection methods, data representation methods...
- Methodological tools: ANT, MOT...
- Management tools: (reports, time-sheets, deliverables)
- Technical tools: from the project (existing and potential) and existing outside the project
- Technical tools designers and developers (called "Ts" in the project)
- Pedagogical tools designers (called "Ps" in the project)
- Methodological tools providers (Ts + Ps)

Most of them already existed before the project and will continue their life after the project: researchers, institutions, currently existing tools, some CoPs, etc.. Some of these actors had already build relationship between themselves, some other not. Some actors will exist only due to the project: the newly developed tools, the Work Packages, the deliverables, for example. The PALETTE actor-network is a dynamic entity which is made of all the heterogeneous actors (meaning human and non human, but also of different granularity⁵) and of all the links that tie dynamically these actors for the purposes of the project (and also for other possible reasons).

The situation of an actor within an actor network is not fully defined by the existence of the actor. Some links have to be knitted with other actors to materialize the presence of the actor in the network, through enrolment. Enrolling an actor within an actor-network means that there are some agreed common interests between this specific actor and the actor-network at some moment. Building the partnership between institutions

⁴ Description of Work, the reference document for the project

⁵ A workpackage, or an institution, or a project is made of a lot of persons and other elements; thus a person and a group of person are actors of a different level of granularity

(in fact groups within institutions) to submit a proposal to the European Call for Projects was a first kind of enrolment

Enrolling actors in an actor-network requires going through some participative activities where actors can discover and share their common interests. The CoPs are not members of the project, but it is really important that they become actors of the project. Thus, They have to be enrolled, by identifying some common interest between CoPs, and/or CoPs' members, and other actors of the PALETTE actor-network. The Participative Interview process that is used to gather data about the CoPs is the main step toward enrolling them.

Currently existing collaborative tools (like Lotus Notes or e-Rooms, or Moodle, etc.) are not partners of the project as well. But they are used by a lot of people and by CoPs outside the project. They have to be taken into account in the project, from a technical point of view - which is a matter of interoperability and standards - and from a user interface point of view as well. This is done through the Tool Inventory/Categorization process, which is the main participative activity through which tools are enrolled in the PALETTE actor-network. For "inside" tools (those developed by partners), the categorization is not the only enrolment process; another enrolment process is that they are used within the project (for example, a document management software is used to collaboratively publish project documents)

3.3 Inscribing aligned interest in scenarios of use

Translation and inscription are dual processes. In PALETTE, a successive number of translations are undertaken from CoPs to CoPs observers, then to interviews transcriptions, then to data condensation; the data are finally inscribed in data representation supports available as boundary objects for other actors. Different media are used for inscribing, like documents, story telling, vignettes, and MOT schemas (Paquette et al., 2006). Another example of the translation-inscription process is the activity aiming at clarifying the notion of scenario: what is a scenario, its content, its form, etc., according to the different PALETTE actors. Several participative activities are designed to make explicit the representations/interests of the actors and progressively "inscribe" a definition and typical contents/forms of scenarios useful for all the actors, according to [Iacucci & Kuutti].

3.4 PALETTE incremental project life cycle.

The organisation (structure and stages) of a project life-cycle is a key factor for the success of a Participative Design approach. Let say it in ANT terms: the building of the actor-network, its evolution throughout the project, the nature of the translation-inscription processes, as well as the nature and number of boundary objects depend on the type of project life-cycle. The project methodology used in PALETTE is based on an agile perspective (Schwaber, 2004, Highsmith, 2004): go for a "first design round",

with some "sample" CoPs, a few data from interviews, a few tools, and try to build from this the first scenarios. This would allow us:

- to validate the methodology
- to validate the feasibility of the whole process;
- to understand better what the different steps are (especially the data representing and the scenario building);
- to explicit the processes of enrolment, translation and inscription and see if it fits really well and if everybody agrees with;
- to go further into inscribing communities practices and web services into scenarios of use.

From these scenarios, some adjustments (including possibly incremental or full new developments) could be done in the partners' tools to better suit CoPs users' practical situations. Then we will be able to re-loop the loop with other CoPs and other tools (to keep it simple, though there are all other actors involved). Step by step we will build, in a constructive perspective, our scenarios and use-cases.

The multi-rounds project life cycle allows going on rather quickly in the validation of the whole project system and enables actors working more collaboratively from the beginning.

4 Conclusion and further research

PALETTE has just started in February 2006. We are still in the process of looping the first design round. What we were able to agree upon so far is that descriptions of design situations based on ANT concepts have helped launching an efficient Participatory Design methodology. The inscriptions as MOT schemas, for example, were agreed a "good" boundary objects by both the Pedagogical and Technical partners. A lot has still to be achieved before the end of the project in January 2009. Nevertheless, we think that PALETTE is a good example of a complex socio-technical project, and that this experience of using ANT could benefit other kinds of complex socio-technical projects.

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