

Communication Pattern Analysis in Communities of Practice

Aldo de Moor¹, Hans Weigand²

¹STARLab, Vrije Universiteit Brussels, Belgium

ademoor@vub.ac.be

²Infolab, Tilburg University, the Netherlands

weigand@uvt.nl

Abstract

Currently, it is very hard for communities of practice to select and configure appropriate communication services, since their communicative requirements are hard to specify using technology-focused web service modelling and specification approaches. We outline the communication analysis-stage of a proposed methodology for communication service specification in such communities. Communication patterns modelled with the Extended Workflow Loop (XWL) formalism can be the basis for such analysis. These patterns define the communicative workflows and norms that describe acceptable and desired communicative interactions within a community. The ideas are illustrated by applying them to ePortfolio communities.

Keywords: Communities of practice, Communication patterns, XWL, Analysis

1 Introduction

Communities of practice are important catalysts of research, economic and social processes. Such, at least partially, *virtual* communities are evolving socio-technical systems (Wenger et al., 2002). In these communities, many stakeholders collaborate on joint goals while simultaneously having partially conflicting interests. Examples are regional business networks, SME networks, innovation platforms, and R&D networks. Communities have a need for a wide range of communication services (Preece, 2000). Examples include customized workflow management systems, discussion services, and knowledge management systems. In this paper, we will illustrate our ideas with the example of ePortfolio communities:

A prominent class of communities of practice in which communication processes and services play a very important role, are the upcoming ePortfolio communities. An ePortfolio is an instrument to ensure that competencies of individuals can be matched with business needs and training capacities of educational institutes (Arnaud, 2004). ePortfolios are collections of personal information about a learner that represent accomplishments, goals, experiences, and other personalized records that a learner can present to schools, employers, or other stakeholders. ePortfolios have many possible applications, including personalized learning trajectories, job matching, and many other services still being conceived. Soon, most European citizens will have an ePortfolio. It is therefore considered a powerful way to promote lifelong learning, a strategic EU objective (EU Council, 2002).

Attention is currently shifting from just what ePortfolios are, to the *interactions* in which they are being used. In other words, what are acceptable or desired ways to govern the interactions between ePortfolio stakeholders. This is not a trivial problem, given the potentially thousands of ePortfolio communities across Europe, the many stakeholders and interests involved, and the variance of cultures, problems, and approaches in different European regions.

At the moment, it is very hard for communities to select and configure appropriate services, since their communicative requirements are difficult to specify using technology-focused web

service modelling and specification approaches such as UDDI, BPEL4WS, WSDL, and XLST. The reason is that communities are not governed hierarchically, but are complex socio-technical systems regulated by subtle, situated sets of norms (Harvard Law School, 1999; Carotenuto et al., 1999). Such communicative norms work in unexpected ways to generate trust and social support (Ridings et al., 2002; Wellman and Gulia, 1999). Technical approaches for designing communication services for communities therefore do not suffice. Instead, communicative workflow modelling techniques specifying human and organizational interaction patterns are a prerequisite of adequate communication service specification. Weigand and De Moor (2003) introduced the Extended Workflow Loop (XWL) as a model for analyzing complex networks of business communication patterns. The focus there was to analyze the communication norms governing a particular XWL. However, still lacking is a methodology to apply the XWL for solving real-world, complex organizational problems, such as service specification. The objective of this short paper is to outline the communication analysis-stage of a methodology being developed to specify tailored communication services for communities. The XWL is at the heart of this methodology. The key idea is that communication patterns of various kinds can be compared, for example actual process descriptions with normative reference models, or best communicative practices of different communities. By embedding such comparison processes in a full methodology, communication service specifications can be generated that would much better satisfy the essential requirements of communities than possible with traditional workflow modelling methods. In this paper, we outline and define a preliminary research agenda for this communication pattern-based specification methodology.

2 Communication Patterns

Well-designed *communication* is essential for both the coordination of (inter)actions in the community (Malone and Crowston, 1994) and the reaching of true consensus instead of imposing decisions by force (Froomkin, 2003; Manninen 2002). *Communication patterns* are the key *design* elements that ensure that the systems supporting communities properly embody the communication norms of the community. They can be defined as a set of related communicative workflow and norm definitions describing acceptable and desired communicative interactions within a community. A *communicative workflow* is a sequence of steps to be performed to complete a communicative interaction. A *communication norm* is a set of one or more communicative actions a stakeholder may, must, or may not perform in a communicative workflow. Finally, a communication pattern may also contain *meta-norms*, which are sets of actions an actor may, must, or may not perform in defining or accessing a communication pattern. Over time, communities typically form their own, unique communication patterns that govern their interactions. Comparing these communication patterns from different communities allows for the learning about and application of best practices across communities.

An important class of communication patterns in ePortfolio communities are *scenarios*, for example describing how school-to-work transitions can be facilitated by portable ePortfolio records. Scenarios are indispensable catalysts of ePortfolio adoption, as they describe how ePortfolios could or should be used to serve particular ePortfolio objectives (Rees Jones and Vuorikari, 2004). An example of a communicative workflow would be that a job seeker sends his CV generated by an ePortfolio service to an employer, the employer requests additional information, an automated service retrieves and sends all elements the employer is entitled to see, while taking into account national privacy laws. A communication norm could be that an employer may not retrieve intermediate course grades from a job seeker ePortfolio service. An

example of a meta-norm would be that a national public employment agency may collect anonymized versions of scenario descriptions for statistical analysis purposes.

2.1 Comparing Communication Patterns

Many of the communication patterns that define communication requirements in communities are implicit, or only defined informally. In communities of practice, many *communication ambiguities* therefore arise, caused by unclear (e.g. incomplete, inconsistent, partially overlapping) definitions of communication patterns. This is not necessarily a problem when a community operates in isolation, but becomes a serious drawback when doing large-scale comparisons of patterns across communities, for example to promote the sharing of communicative best practices Europe-wide.

To better deal with large-scale comparisons of activities of communities, informal approaches no longer suffice. A *formal communication semantics*-based approach is needed to define large volumes of communication patterns; compare them on a European scale; and specify interoperable services. Formal approaches, for example, allow an automated system to find and interpret relevant context knowledge, and to detect similarities and differences between patterns. This can lead, for example, to much more detailed searches for and comparisons of best practices than would be possible by human interpretation of informal definitions alone. The key research problem we aim to address is:

How to articulate communication patterns using formal semantics? How can formalized communication patterns be reused across communities to learn from best communicative practices and specify communication services that are better matched to a community's specific requirements?

To address this problem, the 2COMPARE (Comparing Communication Patterns for Emerging Communities) consortium has been formed, with the aim to attract funding for developing such a methodology and supporting set of tools. It consists of several European research institutes, commercial software developers, a standardization organization, and two organizations that are hubs of ePortfolio development activity in the Netherlands and the UK, respectively. The methodology will include (1) a structured method to elicit high-quality informal scenarios, (2) analyze scenarios in order to articulate communication patterns and diagnose communication ambiguities, (3) contextualize the patterns using ontologies to resolve these ambiguities, and (4) specify services that best match the communication requirements of communities as defined by their patterns. In this methodology, *communication analysis* is an essential stage. In the remainder of this paper, we will explain what this crucial stage is and outline our approach to its development.

3 Communication Analysis

Communication analysis has two purposes: (1) articulating communication patterns so that their semantics become clear, and (2) diagnosing the patterns so that communication ambiguities can be identified. These ambiguities can then be resolved in a process of meaning negotiation among community members (De Moor, 2005). In this short paper we will only outline the analysis process itself. There is no space for details, but we will illustrate the process with some examples from ePortfolio practice.

Starting point for communication articulation are informal communication patterns, which are formalized to the extent necessary for the purposes of analysis. In the case of ePortfolios,

these are provided in the form of *scenarios*. The primary purpose of the scenario is to identify how a portfolio is used, by whom and for what purpose. The scenario should provide a ‘story’, told from different actor perspectives, that teachers, technologists and policy makers can understand. Scenarios are described in informal language, but these descriptions can be complemented by flowcharts, e.g. in UML, covering transitions between episodes of education and employment (Rees Jones and Vuorikari, 2004).

The XWL distinguishes between two communication loops: a *service loop* between customer and performing organization, and a *control loop*, between principal and agent of the performing organization. This approach is very useful to articulate communication patterns in communities of practice. To illustrate our approach, we will use some material from a scenario describing the use of an e-portfolio in supporting the application of a learner to a university¹. The example (small part) of a scenario is the following:

A learner is considering changing colleges. She contacts the Partner Colleges Entry Programme (PCEP) which provides a version of the e-portfolio to support entry to Higher Education and gives her access to a trained student mentor. The mentor describes what life at university is like. The learner likes what she hears and contacts her college lecturer about whether she should move to another college. The lecturer has access to selected parts of her ePortfolio to prepare the conversation. After the talk, she decides to change colleges.

3.1 Articulating Communication Patterns

The informal scenario is first formalized into a sequence of XWLs (Fig.1). In this case, there are two. First, there is a full XWL, describing how a learner requests PCEP information about life at university (see Weigand and De Moor, 2003 for an in-depth explanation of the semantics of the XWL). The PCEP delegates this task to a student mentor. In contacting PCEP, the learner makes available the part of her ePortfolio in which she describes her ambitions, as well as her personal data, like her address. The PCEP uses this information to select student mentors with similar ambitions, so that there will be a good match between learner and mentor. For privacy reasons, the student mentor does not get access to the address data. Once WF1 has finished, the learner is allowed to contact her college lecturer, and discuss her wishes to switch colleges. This dependency is expressed as a meta-norm that says that WF2 may not be initiated by the beneficiary, before that beneficiary has finished WF1. WF2 is a reduced version of the full XWL, since the college lecturer is not allowed to delegate the career discussion to somebody else.

Summarizing, an extension we need in the XWL approach is an ability to involve the object of communication (i.e. ePortfolio elements) in the communication norms. Furthermore, meta-norms are needed that allow control flow elements between XWLs to be defined (cf. van der Aalst et al., 2003).

3.2 Diagnosing Communication Patterns

In XWL, we distinguish communication norms. These regulate which actors may, must, or may not initiate, execute, or evaluate certain service or control workflows. However, norms need to be used in a diagnostic process to be useful. De Moor and Weigand (2004) present a method for the legitimacy checking of communicative workflows. Workflow situations are described in workflow loop schemas, which are then matched with the normative patterns. The results of this match are interpreted: if the workflow situation has all patterns required

¹ http://www.eun.org/eun.org2/eun/en/Celebrate_LearningObjects/content.cfm?lang=en&ov=33719&CFID=1964299&CFTOKEN=87658991

according to the norms, and it does not match with forbidden patterns, it is legitimate. However, not only communication norms and meta-norms require extension, but also the legitimacy checking process itself. So far, the checking process only says whether a workflow situation is legitimate or not. True diagnosis, however, also makes a suggestion about what exactly is wrong, and possibly also gives a direction of resolution. The idea of *communication ambiguities* therefore needs to be worked out. For instance, one XWL-communication norm could say that schools may delegate learner requests for information. Now, WF2 almost matches with this norm, since there is a learner and a delegation of information request. However, is PCEP a school? To resolve this communication ambiguity (i.e. partial definition), ontologies can be used, for instance.

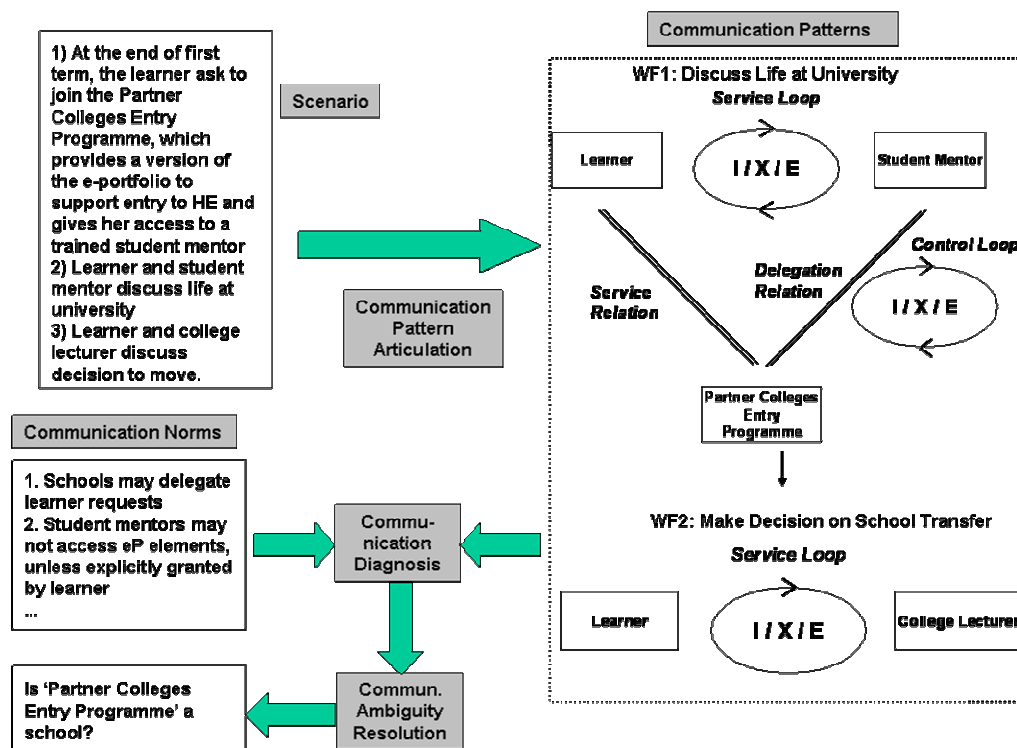


Figure 1: A Communication Pattern Analysis of an ePortfolio Community

4 Discussion

Many systems analysis approaches underestimate the complexity of requirements articulation. However, to be able to perform useful diagnosis of the communicative practices of communities with techniques like XWL, the preceding process of requirements articulation needs special attention. Spinosa et al. (1997) describe how individuals and communities engage in historical actions by “disclosing new worlds”. Historical disclosing typically starts with the recognition of disharmonies in current practices. The authors mention three possible ways one can change one’s disclosive space in response to the realization that one’s practices are not in harmony: articulation, reconfiguration and cross-appropriation, of which especially articulation and cross-appropriation are interesting for our purpose.

Articulation, also described by the authors as “gathering from dispersion”, occurs when a style is brought into sharper focus, and involves making explicit what is implicit. In this

paper, we have described an approach towards articulation that includes formalization of communication patterns. It is important to stress that the formalization is an instrument only: articulation is first of all a meaningful process, a human activity. The same should be said about the resolution of ambiguities: it can include ontologies as an instrument, but ontologies should always be recognized as commitments within communities, so the resolution of ambiguities includes discussions and negotiations about meanings based on commitments as well as the reshaping and reestablishing of commitments. The purpose of the formal techniques is not to take over the articulation processes, but to support them by making clear where choices have to be made and who should be involved in the choice making.

Cross-appropriation takes place when one disclosive space takes over from another disclosive space a practice that it could not generate on its own but that it finds useful. Cross-appropriation between communities can occur because communities typically overlap or are *imbricated* (Taylor,2002). For example, when schools and business organizations meet each other in an ePortfolio community, the business organizations may bring in certain professional patterns that via this community also find their way into the schools. A major objective of a communication analysis process therefore should be to find out how cross-appropriation can be stimulated and supported, for example, by letting communities articulate their communication patterns on a level that abstracts away from the peculiarities of one community. The hypothesis is that the essential level such as defined in LAP offers precisely this required abstraction. It should be noted, however, that the abstraction is only the first step of the cross-appropriation process, which should be followed by a process of adoption. In this adoption process, the abstraction is reversed again, and the pattern should be grounded in the community practice.

5 Conclusion

The formal semantics of communication patterns in communities of practice needs to be well-understood for practices to be comparable and so that better communication services can be specified. Communication analysis is a crucial stage in this process, where informal communication patterns are articulated and diagnosed in order to detect communication ambiguities. The Extended Workflow Loop paradigm provides a sufficiently rich analytical framework for this purpose. Using XWL, communicative workflow and norm definitions can be defined, and with a legitimacy checking approach be diagnosed for communication ambiguities. However, the current XWL-paradigm still requires extension, for example in modelling sequences of communication loops, distinguishing the notion of an explicit object of the communication, which in the case of this paper are ePortfolio elements, and developing a methodology that embeds the formalism in subtle community processes such as articulation. By using XWL as one of the cornerstones of a specification methodology that could be developed in a realistic, European-scale case, the theoretical-empirical cycle can be closed and LAP research may get a considerable boost.

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