Designing an 'Electronic Village' of Local Interest on Tourism: The eKoNES Framework

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Abstract

This paper presents the baseline of a framework for building electronic villages of local interest as communities of practice. In this context, an electronic village is considered as a multi-sector virtual organization in which electronic squads are formed as coalitions of representatives from different sectors to work together for a period of time to realize a common mission. We assume tight coupling between the virtual organization and a physical space to differentiate the electronic village of local interest from the notion of the global electronic village. In light of the above, the paper focuses on two primary issues: namely, the stimulation and organization of collaborative work by virtual teams / squads and the design of 'collective' artifacts in an exemplar case in the context of eKoNES-Tourism – a pilot electronic village on regional tourism.

Keywords: Virtual organization, virtual communities of practice, practice toolkit, electronic squad, information-based product assembly

Introduction

In recent years, virtual community fabrics have matured to the extent that allows the establishment of novel virtualities and new concepts, which characterize on-line communities by function and scope rather than technological character. Examples include the virtual classroom and the electronic city. In the majority of these cases, the distinction is drawn around functional rather than technological characteristics. A novel virtuality, which has recently received substantial attention, is the electronic village of local interest. The electronic village is a virtual organization (e.g., many on-line communities) tightly linked to a physical space and empowered with some sort of collaborative technologies to stimulate social activities. In the literature, such virtual constructions are known to act as catalysts to local community social and economic life (Carroll et al., 2001).

In the context of on-going collaborative research and development, we are developing technology and tools for building local electronic villages as unified collaborative spaces for managing electronic services of a local virtual community of practice (Wenger & Snyder, 2000). Our approach makes a sharp distinction between an electronic village of local interest and the notion of the 'global electronic village'. The distinc-

tion amounts to the fact that the former concept emphasizes a tight coupling between virtual and local physical activities and offers a wide range of opportunities to develop alternative forms of productive social relations between members. Some of the design issues confronting the construction of electronic villages of local interest are common to other types of virtual communities of practice and include community management (i.e., discovering, building, and sustaining community), information sharing, virtual assets management, collaboration, social interaction, and knowledge management. However, since electronic villages are expected to function as catalysts towards added-value products and services, there are additional issues to be addressed, pertaining to a variety of organizational and technical aspects.

To this end, eKoNES is a collaborative R&D project that seeks to extend the conventional connotation of an electronic village so as to provide an operational model of a virtual organization with strong social links between members and an explicit focus on managing distributed collective practices for constructing information-based products. In this paper, our interest is to present a functional archetype of an eKoNES village and describe how it can be used to stimulate: (a) a sense of community amongst members through a network virtual organization (Santoro, Borges, & Rezende, 2006) and (b) a type of software factory (Greenfield & Short, 2004) facilitating collaborative assembly of new information-based products and services.

The paper is structured as follows. The next section reviews current and emerging trends in virtual organizations, community-based new product development, prevailing architectural models, and the premises of communities of practice. Then, we describe eKoNES as a community of practice and its current deployment in the tourism sector. A case study is used to depict how eKoNES squads engage in the practice of negotiating and assembling vacation packages. The assessment section summarizes useful insights based on end users' experience with the current pilot application and reveals conditions for commercial uptake of the eKoNES concept. The last two sections are devoted to highlighting some of the innovative premises of eKoNES and the paper is wrapped up with a summary of key contributions and some concluding remarks.

Related Work and Research Focus

The present work links with two main thrusts of related efforts broadly focusing on virtual communities of practice and practice-oriented tools and technologies for distributed collaborative work.

Virtual Communities of Practice

Virtual communities of practice offer a powerful model for improving knowledge-based assets and organizational competence building by fostering a social view on learning and knowledge creation (Brown & Duguid, 2000; Erickson & Kellogg, 2001; Kimble & Hildreth, 2005). The underlying assumption is that knowledge is deeply embedded in the collaborative artifacts as well as the technological practices and social context of the community that creates and manages it. It turns out that this is not uniformly attained, while within a particular context, different structuring characteristics or configurations of characteristics may be more or less conducive to success (Miller & Whitney, 1999). Therefore, despite the increasing number of organizations using tools for virtual communities of practice, very little is known as to what distinguishes success from failure (Ardichvili, Page, & Wenthling, 2003).

One common feature in all recent efforts is the reliance upon social interaction, in the form of exchanging messages, expressing opinion, offering feedback, etc., to encapsulate elements of practice. This is typically the case when communities of practice are established to facilitate new and more effective marketing models (Fuller, Bartl, Ernst, & Muhlbacher, 2006). There are, however, cases where communities of practice are devised to facilitate incremental (user-driven) in-

novation management (von Hippel, 2001). Classical examples of such communities are effectively operated in the automobile industry with consumers becoming engaged in design contests and simulations to provide original knowledge and, perhaps, new design ideas. The distinctive characteristic of these communities is that online practice is not solely framed in social interactions. Rather, online practice is manifested as manipulations of virtual prototypes to codify and stimulate community reactions on creative users' innovative design concepts. The value of this model of community-based collaborative work is clearly indicated in recent studies reporting success stories with respect to the catalytic role of virtual communities of practice in domains such as free and open source software projects (Scacchi, 2005; Scacchi, Feller, Fitzgerald, Hissam, & Lakhani, 2006), new product development (Franke and Piller, 2004; Franke and Shah, 2001; von Hippel and Katz, 2002), the automobile and airspace industries (Wenger, Benninger, Greenhalgh, Ruhl, & Monette, 2002; Wenger, McDermott, & Snyder, 2002), service industries such as tourism (Cardoso & Lange, 2007; Stockdale & Borovicka, 2006), insurance (Dignum & van Eeden, 2005), and the public sector (Mitchell & Young, 2002).

Another characteristic of virtual communities of practice that stands out very prominently in the majority of existing works is the informal nature of communities of practice, which frequently makes the task of managing the community an 'unmanageable' endeavor. Recent research seems to recognize this as a shortcoming and proposes concepts such as 'best-practice' and 'business opportunity' value-creating networks (Buchel & Raub, 2002). Advocates of this perspective claim that such value creating knowledge networks extend beyond the traditional concept of communities of practice, as they directly contribute to the creation of value within firms (Enkel, Heinold, Hofel-Alfeis, & Wicki, 2000) and sustain community-based innovation (Fuller et al., 2006).

Finally, another issue worth noticing is that existing studies on communities of practice analyze community management in single organizations, either public or private (Juriado & Gustafsson, 2007). The more demanding problem of community formation through inter-organizational partnerships or external communities of practices is seldom addressed (Dewhurst & Cegarra Navarro, 2004). The complexity of this challenge in terms of organizational and technological set up is explored in a recent study by Kern and Kersten (2007) where the authors investigate technologies for internet-based inter-organizational product development and identify the problems involved in designing the partnership interaction.

Practice-oriented Tools for Distributed Collaborative Work

From a technological point of view, there are several genres of software tools that support social construction of knowledge in communities of practice. Examples include tools for information sharing (i.e., electronic mailing lists or listservs, MOOs, Wikis, Blogs, and RSS), tools for memory management (Ackerman, 1998; Ackerman & Palen, 1996), collaboratories (Olson & Olson, 2000), and tools for idea exploration (Erickson et al., 1999). Nevertheless, the generic character of these tools often constraints their ability to incorporate elements of practice framed either in workflows or artifacts of a domain of practice. The complexity arises from the fact that a domain of practice is not an objectively given entity but one that is socially constructed and one that emerges when a set of actors (individuals, groups, or organizations) become interdependent on one another because the actions that each takes with respect to the problem generate potentially unpredictable consequences for the others and vice versa.

To address this challenge, several authors have developed concepts and tools to model practice-oriented collaborative activities from a variety of perspectives. In a recent account of inter-organization collaboration, Alberto Franco (2008) reviews problem structuring methods (PSMs), a family of model-based approaches to group decision and negotiation support, and illustrates their value in the construction industry. Qureshi and Vogel (2001) review a variety of collabora-

tive models and technologies supporting social decision making and negotiation in virtual teams. Turoff, Hiltz, Cho, Li, and Wang (2002) coin the term group or social decision support systems to a new category of information management tools supporting the expression, integration, and synthesis of diverse views in a manner in which: a) all participants can come to respect and understand the differences caused by diverse values and interests of the contributing members, and b) there can be a movement towards consensus on at least some of the issues involved. In relation to software engineering practices, Greenfield and Short (2004) present the notion of software factories as an approach to assembling software from components. In a similar vein, Akoumianakis (in press) describes how practice-oriented toolkits can facilitate collaborative endeavors for mission-oriented virtual teams. A more recent trend explores the concept of e-negotiation systems to provide the grounds for participatory democracy and offering opportunities for all members of a group to contribute to the decision making process (Benyoucef & Verrons, 2008). A variation of the concept is also explored in electronic commerce to facilitate business-to-business (B2B) negotiations (Weigand & de Moor, 2003).

The above are only representative of the breadth of research efforts devoted to building tools fostering some sort of social decision support in distributed collaborative work in practice domains such as software engineering, e-democracy, and electronic commerce. However, one issue which remains relatively unexplored is the facilitation of distributed collaborative work in boundary spanning domains (Star & Griesemer, 1989). The few studies focusing on this aspect reveal conventional boundary objects, such as forms, and design artifacts, such as drawings and sketches (Carlile, 2004; Gasson, 2005), rather than workflows and processes being recognizable and making sense in different social worlds. On the other hand, it is these workflows and their online manifestation that determine the value of boundary practicing in cross-sector virtual partnerships.

Research Focus

The above review indicates that virtual communities of practice constitute a notion that is actively researched at both the theoretical and engineering levels. The existing literature is rich but the empirical findings are not always consistent and far from convincing. This makes comparisons difficult and cumbersome. In this paper, we are not concerned with the theoretical thinking behind virtual communities of practice. Instead, we aim to contribute to the debate regarding the engineering ground and the type of tools needed to facilitate cross-organization virtual communities and management of collaborative community practices. In light of the above, we will raise the issue of what constitutes 'practice' in a cross-organization virtual community of practice and how such practices can be technologically mediated. To this end, we claim that in boundary spanning virtual communities of practice, the elements of 'practice' are embodied into shared processes, tools, and artifacts, rather than mere information sharing and social exchanges. Consequently, interpersonal interaction in the form of feedback among the members is necessary but not sufficient. Feed-through becomes equally important (if not more critical) and amounts to shared responsibility and exercising influence on the work of peers. Furthermore, to support this type of feed-through requires practice-oriented tools (in the form of visual languages) which facilitate two primary objectives: namely, *locality* (i.e., the language is adopted by each member of the community of practice for speaking to another one) and *boundary* (i.e., the language is adopted by the whole community to communicate with other communities). These are considered to be necessary conditions for practice-oriented toolkits in order to (a) facilitate formation, maintenance, and sustainability of cross-organization virtual communities of practice and (b) provide the 'place' for engaging in the practice the community is about.

eKoNES as Virtual Organization

eKoNES in its basic form seeks to provide the fabrics for community problem solving by fostering tight collaboration between multi-sector virtual teams. A multi-sector collaboration is a partnership formed by representatives of at least two sectors (non-profit, private, and public organizations and community members) to solve problems that impact the whole community. It is a form of a virtual organization (Davidow & Malone, 1992) characterized by the fact that its members belong to different organizations and that they all work together during a period of time to realize a common goal. A virtual organization is defined as a geographically distributed organization whose members are bound by a long or short-term common interest or goal and who communicate and coordinate their work through information technology and tools (Dustdar & Gall, 2003). Members of virtual organizations assume well-defined roles within the context of the virtual group that are independent of their role in the organization employing them. Recent studies show that with the emergence of information technology, virtual organizations become more and more interesting in today's form of business (Jarvenpaa & Leidner, 1998) while they can follow different operational models (Lethbridge, 2001).

Community Framework and Constituents

eKoNES proposes a model for a virtual organization that is strongly biased to the management of distributed collective practices (Turner, Bowker, Gasser, & Zacklad, 2006). At present, the model's pilot application is in the area of tourism where the project has set up and operates eKoNES-Tourism – a local electronic village on regional tourism. The primary function of eKoNES-Tourism is to provide a 'place' for collaborative assembly of vacation packages to suit designated customers' needs and requirements. A vacation package is an information-based product, compiled and owned by an electronic squad. In the tourism sector an electronic squad is a coalition between members offering services such as transportation, local accommodation, food and beverage, and entertainment. Such services constitute the primitive resources of a vacation package (i.e., three-day visit to an archaeological site). Some of the distinctive characteristics of vacation packages of this sort can be summarized as follows:

- they are assembled as collaborative aggregations of primitive services;
- they encapsulate the joint offerings of a 'local' community as they are regionally bound and can be assembled and offered by locals;
- they have a collective character and they are owned by the community or the coalition;
- they have short life cycles (i.e., a few days) and they are targeted to specific customer groups (i.e., visitors of a specific destination);
- they are conceived of as being orthogonal to other services offered by established mainstream tourism actors

Consequently, assembling and packaging such information-based products and services (on-demand) yields added-value for all parties concerned, including the end user. As for the rationale for creating such 'local' vacation packages, it may be found in purely circumstantial factors depending on foreseen or unforeseen events taking place in the wider social and economic environment. It turns out that a necessary precondition for effective and efficient compilation of such information-based products and services is that they need to be dynamically created through the collaboration between members who appreciate the value of discretionary participation, collaboration, and networking in virtual community settings.

Figure 1 summarizes the constituents of an eKoNES village following the online community framework proposed in de Souza and Preece (2004). The basic assumption is that an eKoNES village is a virtual community of practice made up from thematic neighborhoods. It is these

neighborhoods which characterize the village's local character. Each neighborhood supports specific goals depending on the needs of its members or the expectations of the wider market / economic environment. Goals are pursued by members undertaking distinct roles (i.e., villagers, neighbors, moderators) and providing contributions governed by policies and rules of engagement. Policies are embedded into processes covering *registration and access*, *acceptance of new members*, *rules of acceptable behavior*, *security*, *privacy*, *freedom of speech/act,* and *moderation*. On the other hand, community roles, such as villagers, neighbors, and moderators, designate member responsibilities in the undertaking of individual and / or social tasks towards the implementation of collective artifacts (i.e., the construction of a new vacation package).
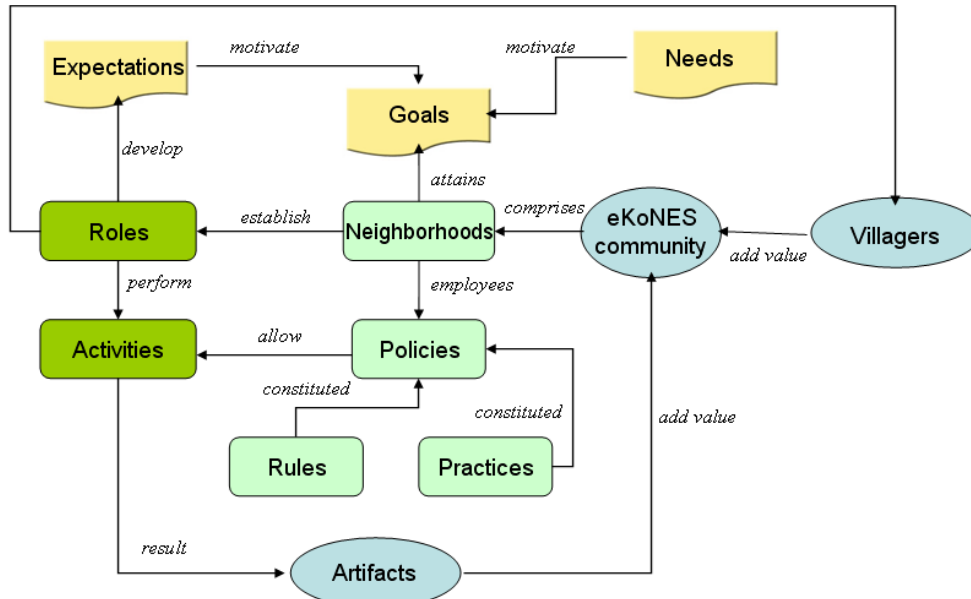

Figure 1: Constituents of the eKoNES local village

Collective artifacts are assembled by an eKoNES squad as it progressively attains distinct lifecycle stages from formation to work plan execution so as to meet an articulated or anticipated demand for the package. In order to assemble such collective artifacts virtually, through integrating and customizing generic components and negotiating their details, eKoNES-Tourism implements a kind of domain specific 'software factory' (Aaen, Bøtcher, & Mathiassen, 1997) where dedicated tools (e.g., domain-specific design languages, authoring tools, product-line specifications, etc) are embedded in a collaborative platform that is downloadable upon successful registration to a neighborhood and geared towards coordinating and performing tasks, rather than simply exchanging information. This platform constitutes the only medium for creating new virtual assets in eKoNES-Tourism.

Architectural Set Up and Technologies Used

The design of eKoNES exhibits several novel characteristics, which differentiate an eKoNES local village from other forms of on-line communities and virtual organizations. First of all, eKoNES is not just concerned with computer-mediated communication, but instead, it seeks to provide an environment for harnessing shared knowledge in collaborative settings. Its primary focus is to enable virtual teams to reach high stabilization through performing tasks. To achieve this, eKoNES builds on a range of technologies, including semantic web technologies (with emphasis on ontology construction and web services using XML and SOAP for sharing and exchanging information), groupware (with emphasis on collaborative session management, object replication across multiple platforms, and activity awareness), and advanced Human Computer

Interaction (with emphasis on toolkit-level enhancements for visualizing communities and collaborative outcomes and device-independent mark-up languages). Secondly, eKoNES adopts a knowledge-based and reuse-oriented model to facilitate continuous improvement and to attain high quality during the performance of collaborative tasks. This model is stimulated from the notion of software factories (Aaen et al., 1997) and, in particular, the concept of an experience factory (Basili, 1993) extended to facilitate social and collaborative workflows biased towards information exchange, learning, and experience sharing in new product development. Consequently, the choice of technologies used or developed and their integration is explicitly focused on these aspects of virtual collaborative work.
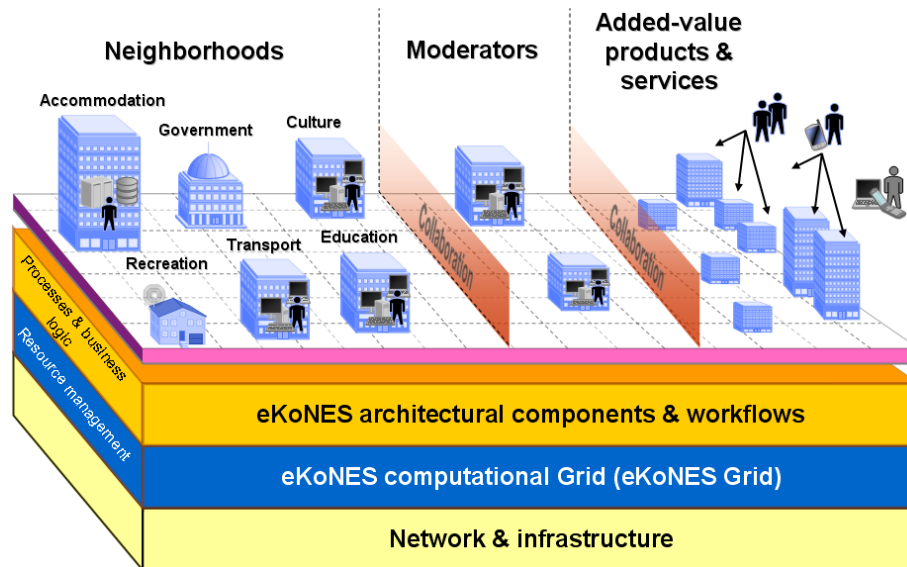
Figure 2: Architectural setup of an eKoNES local village

Figure 2 summarizes the architecture of an eKoNES village and provides an overview of the technologies involved. Our focus in this paper is on the layers above the network and infrastructure. Specifically, the eKoNES grid provides the primary means for resource sharing. The next level accommodates the workflow engine, the processes and business logic of the local village. This level designates the distinct stages involved in creating a product family, the resources supported by a neighborhood, and the process of registering to electronic neighborhoods, as well as neighborhood policies and rules of engagement. At the top level, an eKoNES village is inhabited by neighbors (registered members) and moderators who jointly create concrete information-based offerings. At this level, the eKoNES village is hosted by an augmented instance of the LifeRay (http://www.liferay.com) content management system, suitably enhanced to interoperate with middle- and low-level components.

Figure 3 provides an instance of the eKoNES-Tourism portal outlining neighborhoods currently available and the portlet organization of each neighborhood (i.e., neighborhood news portlet, neighborhood services portlet, and neighborhood directory portlet). The currently selected neighborhood is 'Entertainment' while, for the purposes of this discussion, we have modified the content. It is worth noticing the different organization of portlets within the same page context. Prospective customers of the village's offerings are either passive Web visitors or villagers (i.e., members registered through the standard LifeRay electronic registration system). The latter type maintain their own eKoNES account and can carry out transactions as well as pose requests for adapting existing or developing new packages.

Figure 4 illustrates typical stages involved in the electronic registration to a neighborhood. eKoNES villagers may register to one or more neighborhoods provided that they offer services

owned by the neighborhood. This need not be a one-step process. Indeed, candidate neighbors may create their profile in stages and update it as required using the electronic neighborhood registration system. Upon successful registration, neighbors are presented in the neighborhood's directory (see dedicated portlet in Figure 3) and obtain access to downloadable software components and dedicated tools which are needed for their effective participation in the collaborative exchanges of eKoNES squads. These tools constitute the practice-oriented toolkit for vacation package assembly which is briefly described through a case study in the following section.

Figure 3: The eKoNES portal and neighbourhood organization
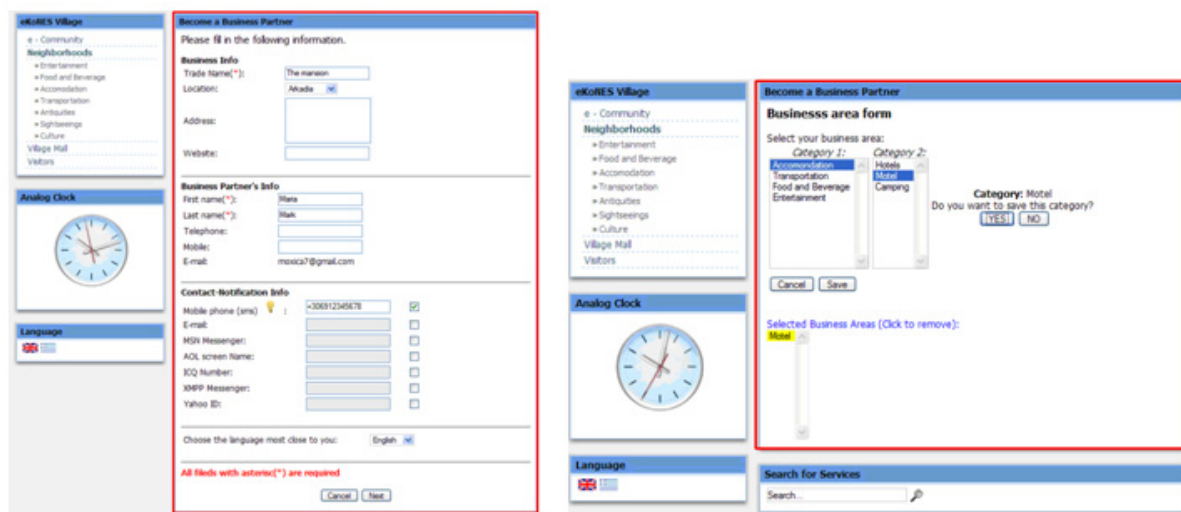
(a) Profile management   (b) Declaring competences and resources

Figure 4: Stages in electronic neighborhood registration

Case Study: Assembling Vacation Packages

To illustrate some of the practice-specific concepts of eKoNES-Tourism and to provide representative insights into the technical features of the supporting tools, we will briefly present a reference scenario (see Exhibit 1) emphasizing incremental development of a vacation package and the collaborative exchanges undertaken by the corresponding eKoNES squad.

> **Exhibit 1**: Fred has just purchased a package for a two-week vacation in a popular resort in Greece, through a local travel agent. However, as he is interested in history and culture he would like to spend a few days visiting archaeological sites nearby his vacation destination. By surfing on the Web he comes across eKoNES-Tourism and reviews the eKoNES offerings during the period of his vacation. He is also informed that by registering as an eKoNES villager he can pose a request to eKoNES-Tourism to articulate a demand for a new package. Indeed, he proceeds and creates an account with eKoNES and subsequently registers his request in the eKoNES message board. In a few seconds, the system returns a message confirming the registration of the request and the initiation of a process to fulfill the request.

The scenario's focus is on a customer's intent to plan his/her vacation period at a designated destination. Intentionally, the scenario is indifferent to how the customer reaches the selected destination or the details of the pre-packaged solution (i.e., choice of accommodation, supplementary services, etc). Instead, it concentrates on articulating demand for 'local' packages independently of the customer's prepackaged service. Moreover, the scenario could easily be extended so that it serves the cause of determining / influencing the ultimate choice of destination, but for the purposes of this discussion this option will not be explicitly addressed. The remaining of the section concentrates on the collaborative tasks of an eKoNES squad as it negotiates details, populates contents, assembles, and publishes a package to fulfill the demand articulated in Exhibit 1.

The Squad's Virtual Workroom

Once a request such as that described in Exhibit 1 is registered, eKoNES-Tourism triggers several parallel activities to create an eKoNES resource to fulfill the demand. Some of these activities reuse previously acquired knowledge and available experience while others require eKoNES members to engage in a variety of collaborative exchanges through the eKoNES squad's virtual workspace. As already indicated earlier, the tools for accessing the workspace are downloadable applications made available only to eKoNES neighbors (i.e., eKoNES villagers who have successfully registered through the eKoNES electronic neighborhood registration system).

The general metaphor used to design the user interface of the squad members' application environment is the work room within a floor of a building. Articulating this metaphor entails an analysis of the source domain model (i.e., physical village) and the mapping of its constituents to a target domain model (i.e., eKoNES village). Figure 5 depicts this mapping and summarizes the correspondence between concepts of the physical village (right class model) and an eKoNES village (middle class model). As shown, each eKoNES squad has its own work room, while the containment hierarchy to be observed is [floor] → [room] → [wall] → [object]. For the purposes of our work, the floor-level analysis is obsolete. Objects of type room and wall are both container type objects possessing additional attributes such as accessPolicy, navigationPolicy, topologyPolicy, and feedback types (onEntry, onExit, interim). For example, room access policy determines how a user can access a room, while room topology policy and navigation policy determine the organization of objects within the room and the transitions from one object to another within the room. Additionally, the room metaphor embodies social indicators to convey status (e.g., a room with the door closed is either occupied in a private context or temporarily not accessible), activity awareness (e.g., on-going activities in a room are grouped in the wall containing the room's entry point), notification (e.g., room's post-it notes), etc.
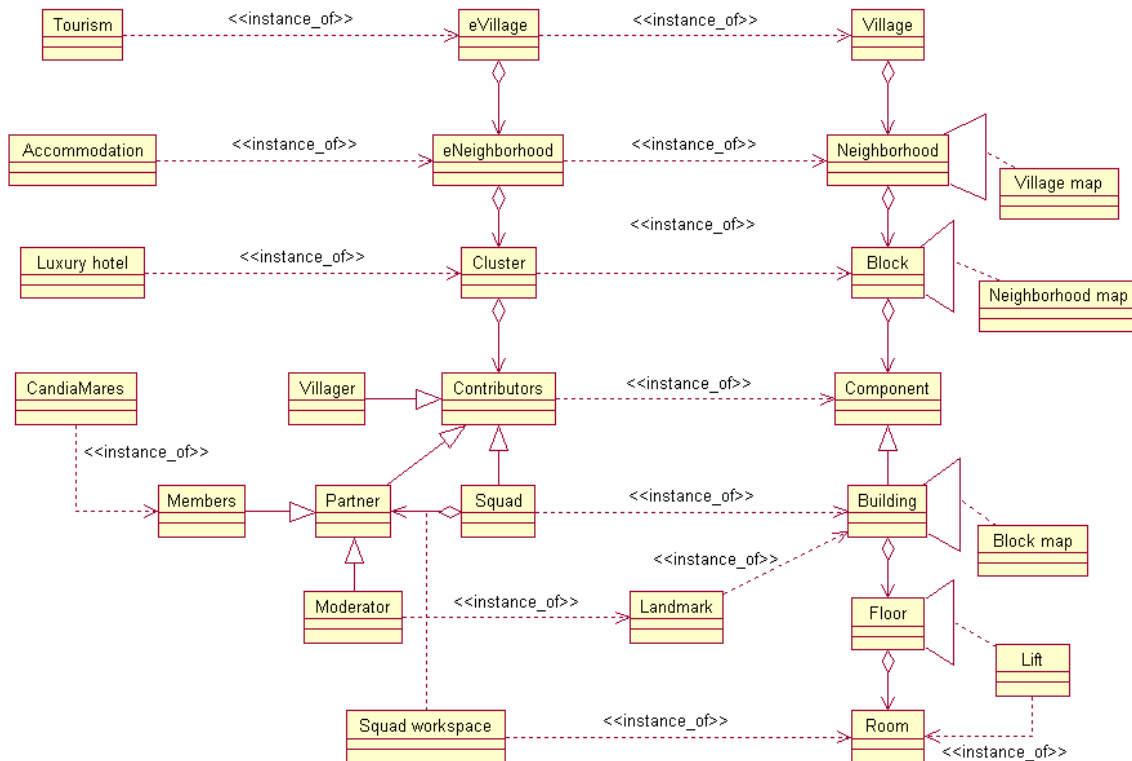
Figure 5: Conceptual model of eKoNES village
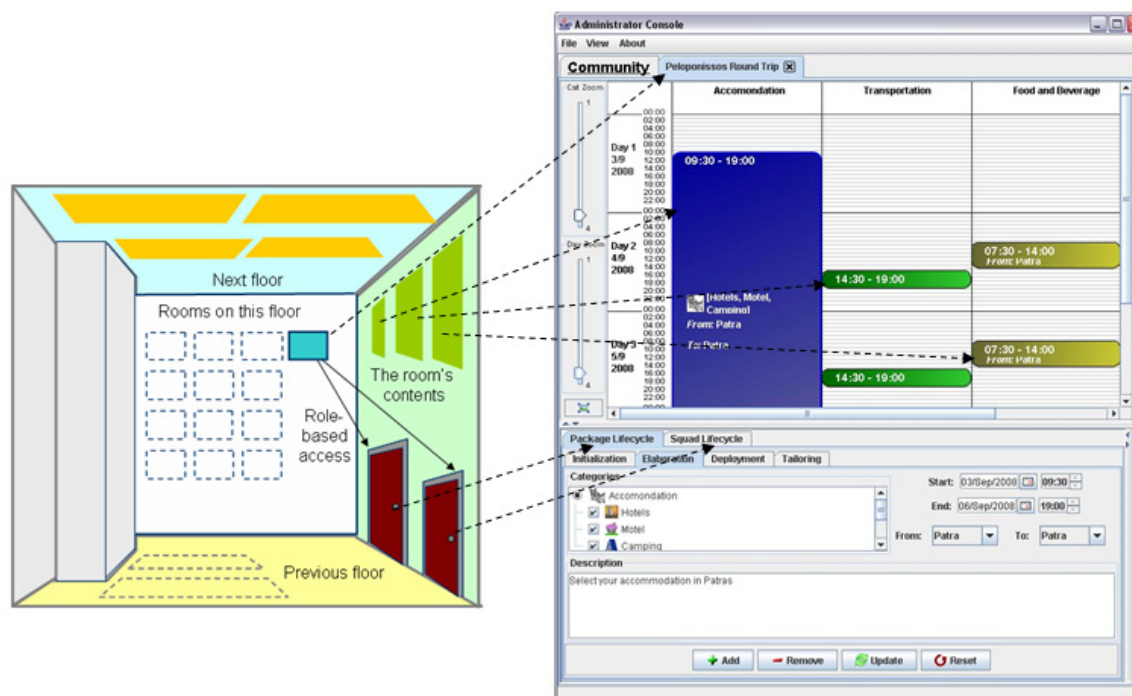
Figure 6: The moderator's view of the workroom

Figure 6 illustrates a symbolic 2D manifestation for some of the concepts introduced above. As shown, certain features of the physical room can not be afforded in the graphical embodiment of the user interface. Specifically, the notion of partially opened door can not be directly supported as the corresponding Tab component of Swing is a two-state object. Moreover, a work room has

two distinct entry points representing the moderator's view and the squad members' view of the room. Figure 6 presents the Swing version of the moderator's room, which offers management tools (i.e., package and squad lifecycle views) for manipulating work room contents. The squad members' version of the user interface is similar but does not include the package and squad life-cycle views (see Figure 7b).
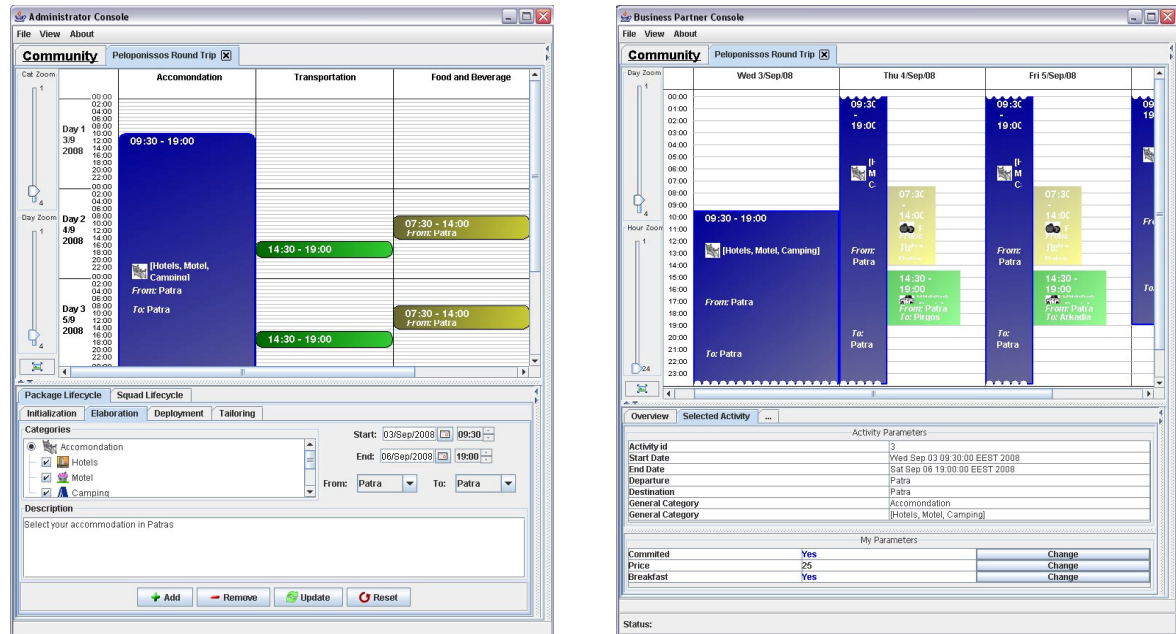
(a) The moderator's view of the package   (b) The squad members' view of the package

Figure 7: Package elaboration stage

Populating a Workroom with Content

Package initiation (i.e., the first workflow in the package lifecycle) is always carried out by an eKoNES administrator / moderator and proceeds all other activities or views. Specifically, once a demand for a new package is posed to the eKoNES-Tourism, an eKoNES moderator acting as a filtering mechanism constructs an abstract package description in XML and assigns to it a col-laboration space where members can work to fulfill the package details. The package is defined as an instance of `PackageFamily` and comprises mandatory fields such as name, creation date, duration, and identification of the domain-specific neighborhoods or categories of interest (cul-ture, residence, feeding) as defined by the end user during the process of registering interest with eKoNES-Tourism. Additional details are filled-in as the package proceeds through designated workflows from initiation to elaboration, deployment, and tailoring.

Once a package is initiated, the corresponding squad is formed dynamically by the system, com-prising all registered neighbors in the package's neighborhoods. An asynchronous notification service, supporting email, group SMS, and instant messaging, undertakes to notify all squad members and request their commitment. While in the forming stage, squad members may engage in electronic exchanges to assess requirements of the new package against their own available resources and accordingly to declare either commitment or withdrawal using their version of the work room user interface. Squad members committed to a package form the ultimate squad.

Package elaboration proceeds immediately after a package is initiated. In this stage only commit-ted squad members are allowed to contribute. In the elaboration stage, the objective is to populate a package in terms of specific activities (neighborhood services). The package is manifested as a panel of neighborhood-specific activities representing the shared model of the product being de-

veloped. Typically, the squad's moderator will propose an initial elaboration for a package and invite contributions by squad members. Figure 7 depicts the interactive instances of the package elaboration scenario for the moderator (left) and the squad members (right).

It is worth mentioning that both these views of the same package are automatically compiled and assembled from the package's XML-based model. It is also interesting to note some of the changes in the two templates. Specifically, Figure 7a presents the moderator's view of the package in construction mode. Activities are defined using the tools at the lower part of the screen and inserted into the activity panel, which occupies the package workroom (upper part of the screen). For each day of the package, the moderator assigns the activities to take place. The package activities are aligned horizontally, per day (vertical alignment), allowing the moderator to obtain a quick overview as to how activities of specified category / neighborhood are assigned to the package's duration timeline. These activities may overlap depicting package alternatives to be specified later on or selected by an end user during the stage of tailoring and personalizing the package. All activities in a designated day are represented as selectable objects differentiated by color depending on their type. The toolkit developed to allow such visual representations has been described elsewhere (Akoumianakis, Vidakis, Vellis, Milolidakis, & Kotsalis, 2008).

In the squad members' view (see Figure 7b) the package layout is different. The same shared model of the package is presented in a TV-program-like metaphor with each column representing activities of a single day. The selectable objects are those representing resources owned by the squad members. These are the only elements of the model that can be manipulated by the squad member. Upon selecting an activity various semantic actions are available allowing squad members to express opinion, request clarification, accept or decline proposals, etc. These actions are realized as asynchronous posts of XML messages to the squad's message board.

Conflicts are usually handled in synchronous collaborative sessions (virtual meetings) where all squad members can take part and express opinion. To this end a Java-based collaboration toolkit has been developed supporting role-based access to collaborative artifacts, object replication, and floor control for manipulating shared objects. A synchronous session is announced and launched by the squad moderator, who also defines the collaboration agenda (i.e., what part of the package is to be shared and replicated during the session). This is achieved by designating the components (or neighborhoods) of a package and the package stage (i.e., elaboration). The package components indicate the parts of the model to be extracted and replicated during a synchronous session, while the choice of package stage defines the view in which the replicated object is to be presented. As each package stage emphasizes different aspects of a package, the corresponding views follow different interaction metaphors.
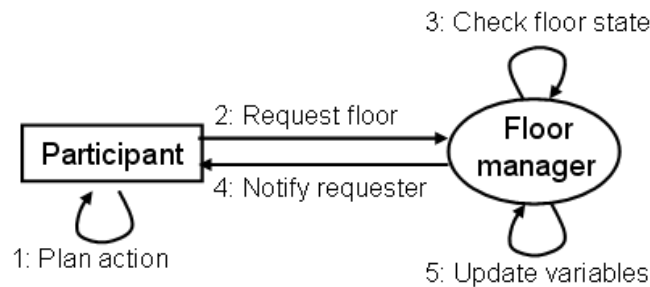
Figure 8: Floor control & management

During synchronous collaborative sessions contributions to the shared model are managed by the floor manager. The role of the floor manager is runtime permission assignments and participant notification of changes in the state of the model. Runtime permission assignment entails assessment of who has permission to act in the collaborative workspace at any time (see in Figure 8).

Thus modifying or adding new content in a synchronous collaborative context follows some rules that clarify and assure that there is a logical coherence in the actions of the participants. Every time a new collaborative session is issued, a new instance of a session floor manager class is assigned to apply the desired policy. Once floor access is granted to a participant, all replicas of the shared model at the registered clients are locked so that the model remains visible but not accessible. Manipulation of the shared object by the floor owner is transparent. In other words all participants are concurrently notified of the changes introduced to the shared object by the floor owner. This allows a kind of feed-through whereby actions in the shared object are always performed on the latest version of the model. Figure 9 summarizes this feed-through mechanism.
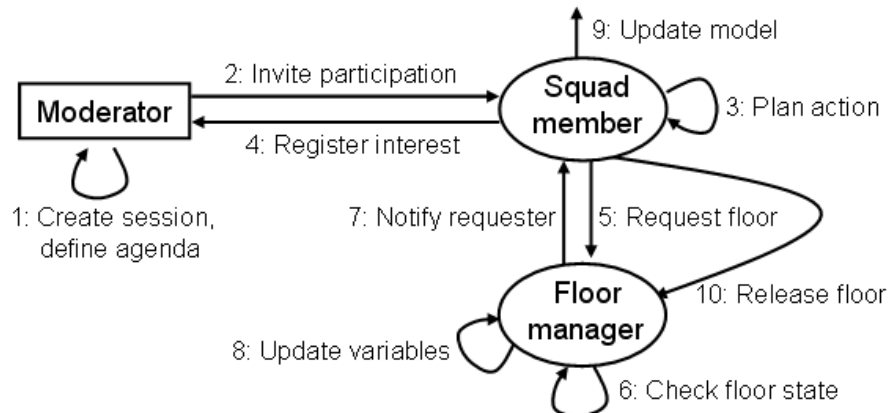
Figure 9: Feed-through

In the deployment stage the package is transformed into a concrete offering with clear illustration of package options, alternatives, and offers per activity. Package publication entails selection and authoring of a designated template layout and input of the required information, which updates the package's XML file. There may be more than one template layout assigned to a package so as to facilitate package multi-platform presentation (e.g., desktop using Java or HTML, PDA or a cellular phone). In case an existing template layout does not suffice, then a new one can be created by developing a suitable XSLT. Once the details of the package are agreed and finalized, all its components are assembled and published as a new resource in a portlet context (see upper left component in Figure 10) through the eKoNES portal. Moreover, all registered villagers having expressed an interest in the package are notified through the eKoNES notification service.

The ultimate assignment of the package's options is to be finalized during the tailoring phase to reflect a customer's detailed requirements and preferences. During tailoring, prospective users, informed of the package's availability, are prompted to consider making a personalized reservation (see Figure 10). Since the package is fully populated, end users can access it through a variety of devices including desktop computers, mobile devices, or other network attachable terminals using the suitable templates. The example in Figure 10 illustrates a typical scenario using the portal. As shown, the dedicated portlet on the left hand side assembles all currently available offerings including the new vacation package 'Peloponissos Round Trip'. Users can choose this package and explore its contents in a portlet context. This requires that the package assembly toolkit extracts and builds all elements of the package from the corresponding XML model.

It is also worth mentioning that the user may request further modifications to the package by submitting a request through the message board and asking the eKoNES moderator and the package squad to consider specific issues. In such a case the package enters the deployment phase where it is adapted to the user's request. Squad members' contributions during this stage may range from placing bids or making discounts to depositing new resources, etc. All these are manifested either as action prompts in the lower part of the squad members' user interface (see Figure 7b), which is

adapted according to stage of the package, or as announcements through the shared message board. Accordingly, they result in updates in the package description or declaration of pending issues requiring agreement. Such information is persistent and can be retrieved. This process may be iterated until a personalized package is created to suit specific user needs and preferences.

Figure 10: Package articulation in the tailoring phase

Assessment

eKoNES-Tourism is now a fully operational pilot with various evaluation scenarios being undertaken to study structural and social aspects of the electronic squads formed to facilitate vacation package assembly. To this end, over a two-year period (2006-2008), we have built the essential relationships with key actors in the field and gained their commitment to a comprehensive evaluation methodology covering both formative assessments aiming to improve early prototypes and summative evaluations with expert end users and business partners. Formative assessments of early prototypes was planned and executed using standard techniques such as prototype walkthroughs, laboratory testing, and analysis of break downs in the execution of hypothetical scenarios. Despite the fact that the results of these evaluations have been very positive, it is strongly believed that the actual value is to be found from observing operating squads over longer periods of time. This will give sufficient data to answer critical questions about eKoNES, such as understanding the knowledge management that takes place, the way such communities are cultivated, as well as behavioral patterns which emerge as a result of the members' social interactions and / or the customers' purchasing behavior and its impact on individual and community levels.

While preparing for such long-terms assessments, we have also organized three virtual ethnographies of operating squads and corresponding follow-up thematic workshops in an attempt to feed subjective opinions of participants into the research team. Each virtual ethnography entailed the assembly of a distinct vacation package, while the role of the researcher was to moderate the electronic squad. Thematic workshops followed shortly after a virtual ethnography. Each workshop was organized in two stages. In the first stage the researcher reported the consolidated experience of each exercise and then workshop members could respond and justify their online behavior, express comments, and discuss issues. At the end of the workshop each member should complete a questionnaire and return it back.

These workshops provided useful insight to refining technological components of eKoNES-Tourism, but their most important contribution was the catalytic influence of non-technological factors in the uptake of the eKoNES concept as an operational business model. It turns out that end users (i.e., potential customers) are highly motivated and very willing to use such tools so as to plan their effective time on vacation and minimize unforeseen or unexpected events. They appreciate the added value of the assembled products, the options offered, and the interaction with one moderator rather than the individual partners, as well as the feedback loop established between them and other users as well as the virtual community of practice. Some users addressed the issue of using systems such as eKoNES not only for planning their time on vacation but also for deciding on candidate destinations. However, this scenario could not be practically tested. In terms of shortcomings, end users expressed a concern regarding the lack of guarantee that their request will be processed and responded in due time as well as fear that the actual experience may deviate from the virtual good presented through the community portal. To this end, they would value highly the availability of tools for expressing opinions about a package and assessing other people's experience prior to deciding. Thus far, the end users' input, although valuable, has not revealed something which would radically change or influence the components or the operation of the eKoNES-Tourism.

In contrast, the experience and feedback of the business partners (i.e., members of electronic squads), as codified in their responses in the questionnaires but also as expressed openly in the course of the thematic workshops, were much more interesting. Our initial hypothesis that they would appreciate eKoNES as a complementary line of business to what they are already doing and a medium for building cross-organizational virtual alliances for appropriating the benefits of virtual networking was only partially supported. It turned out that this view is only appreciated by non-market institutions (i.e., chamber of commerce, local government agencies, and some union representatives) and very small and medium sized enterprises offering specific type of services, such as accommodation or food and beverage. Representatives of these sectors considered that eKoNES is ideal as a regional information service provided that it is actively supported and maintained. The vast majority of respondents representing tour operators, transportation unions, and multi-function vacation establishments, such as luxury hotels, expressed the opinion that they would like eKoNES as their own model of operation, empowering liaisons and links with their own existing partners in various sectors of the industry. This opinion was largely attributed to the negative connotation assigned to 'collective artifacts' and 'collective ownership of virtual assets'. Participants in this category considered that such artifacts are associated with high risks and cannot be operationally controlled and managed. Considering whether they would be willing to introduce an eKoNES-like operational model in their own organization all of them responded positively and rated highly both the technical approach adopted and the new opportunities it offers.

Discussion

In the previous section we have described an approach for new product development in collaborative virtual community settings which is grounded on the assumption that community management is a distinct and separate activity from the product engineering process and the toolkit used to enact this process and assemble a product. Such a premise, although not common in the communities of practice literature, has recently received substantial attention by researchers investigating community-based innovation (Fuller et al., 2006) and user-driven, incremental innovation (Franke & Piller, 2004; Franke & Shah, 2001; von Hippel, 2001; von Hippel & Katz, 2002).

In all these efforts, the essence is in the belief that community management (i.e., discovering, building, maintaining the community), although necessary, is not sufficient to facilitate distributed collective practicing (Turner et al., 2006) by virtual teams. Instead, a practice-oriented toolkit is needed to provide a 'place' for engaging in the practice the community is about. Moreover, this approach is particularly relevant in cross-organization virtual communities of practice as the practice-oriented toolkit serves as part of the community medium (or infrastructure). In other words, it allows different organizations to actively contribute to the community irrespective of its own practices and tools used.

Contrasting this view with recent writings and empirical findings in the literature on communities of practice reveals several interesting points. First of all, the vast majority of research on communities of practice focuses on discovering, building, and maintaining community, dismissing or under-servicing the elements of practice. Indeed, very few from the existing pool of studies claim and/or provide convincing evidence that the systems built/studied provided a 'place' for members to actually engage in the practice that the community is about. Secondly, the vast majority of the studies on communities of practice offer empirical evidence and insight into community management in a single organization. Virtual communities of practice formed across organizational boundaries are seldom addressed. As already pointed out, this is challenging on a number of levels, both organizational and technological, as it entails designing the virtual partnership (Kern & Kersten, 2007). Thirdly, research on practicing in virtual community settings tends to frame practice in the social interactions between members, promoting a view of virtual community as facilitator rather than as change enabler. Although this is both valid and valuable, it turns out to be insufficient in cross-organization virtual communities of practice. A more appropriate model is to complement social interaction with practice framed into workflows, tools, and artifacts through which members of a virtual alliance become engaged in the designated practice.

eKoNES strives to tackle the issue of building and sustaining boundary-spanning virtual partnerships using practice-oriented toolkits. Its normative perspective is that in cultivated cross-organization communities of practice there is a compelling need for *technologies for practice* in addition to the community medium (i.e., the WWW, computational grids, or other mainstream technologies). Furthermore, such technologies need to be designed so as to encapsulate requirements of the practice-domain, the community itself and its shared values and workflows. To this end, eKoNES distinguishes community management from practice-specific tasks and tools. Specifically, community management tasks are supported by augmenting the capabilities of an open-source portal to allow for community registration, role undertaking, and declaration of virtual assets. Practice-oriented tasks are embedded in a domain-specific software platform that is made available to authorized users. Tools of this platform constitute the only means through which members of a virtual partnership can actively contribute (i.e., define, negotiate and collaborate) towards the accomplishment of the partnership's mission.

Summary and Conclusions

In this paper we have attempted to sketch the underpinnings of the eKoNES model for virtual organizations and demonstrate how this model has influenced the design of eKoNES-Tourism – a pilot effort aiming to build an electronic village of local interest on regional tourism. Our primary design target is to set up an operational model for carrying out mission-specific social and collaborative activities and to support this model with appropriate software platform and tools. From the results presented in this paper, several conclusions can be drawn regarding the design of technologies for practice in community settings. Firstly, their design should be focused on an acceptable practice-oriented vocabulary (i.e., models, guidelines, tools). In eKoNES-Tourism this has necessitated the development of a suitable domain-specific visual design language which comprises graphical artifacts for manipulating elements of a package family and an assembly engine for executing statements of the designated vocabulary. In this context, the term execution implies a mapping of abstract features of the language to concrete packages.

An immediate consequence of the above is that technologies for practice should encapsulate workflows to unify members' view upon what is to be done, to allow incremental refinement, evolution and reuse of codified knowledge as well as to facilitate generation of new knowledge. This new knowledge is typically embedded in new products and services. In eKoNES-Tourism, we have provided a collaborative workflow engine which accommodates distinct stages for new product development and milestones to signify transition from one stage to another. Moreover, this workflow engine is designed using a model-based approach so as to allow community members to practice with models (of the designated design language) and manipulate their elements.

Finally, technologies for practice should act as media for social interaction coordinated by rules of participation and engagement. These rules should be explicit, wherever possible designed into the software, visible and transparent to all members of the community. Such rules are also prerequisites for creating and sustaining trust and an environment of mutual benefit and appreciation. In eKoNES, social interaction amounts to interactively manifesting social actions which take into account the actions and reactions of other individuals in a squad. The shared message board and the collaboration toolkit are designed precisely for this purpose. Moreover, the increased functions assumed by the squad moderator are also intended to provide a mechanism for coordinated actions among members of a squad.

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