



Helping the Software Development Community Collaborate

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Abstract. *This paper presents the RCC-Sw project, which has as its main objective exploring the hypothesis of configuring and supporting virtual communities of software professionals based on the concept of social networks dynamics, as a way of improving collaboration and knowledge exchange among them. The paper presents the project objectives, the concepts that have given ground to its development and a discussion about the social challenges that can be faced while attempting to build this community.*

Resumo. *Este artigo apresenta o projeto RCC-Sw, cujo principal objetivo é explorar a hipótese de configuração e apoio a comunidades virtuais de profissionais de software baseadas no conceito de dinâmica de redes sociais como uma alternativa para ampliar a colaboração e troca de conhecimento. O artigo apresenta os objetivos do projeto, os conceitos que deram base para seu desenvolvimento e uma discussão sobre os desafios sociais que podem ser enfrentados ao se construir estas comunidades.*

1. Introduction

Some years ago, Humphrey (Humphrey, 1999) suggested that great part of the challenges that have been faced by software engineering professionals had to do with the culture they have created and been trained on. Software engineers are technically qualified, competent and highly intellectual professionals. However, they have been struggling with unsuccessful projects and the bad quality of the products they build.

The fact is that software development became too complex to be held by the well-known project ‘heroes’ alone (Bach, 1995). The development process became an intricate set of activities, each one requiring high and specific skills to be performed. The process became collaborative. And we can say that up to now, just a few recognize the development process in this way. Professionals are still trained to be highly technical and there is a growing feeling of lack of training on management, task coordination, social aspects and collaboration.

This problem has reached the software market and at a certain moment we saw the software process improvement research area providing solutions for the bad software product quality and unsuccessful development projects - the software process quality reference models. These models, in general terms, try to organize part of the software



engineering body of knowledge and show how software organizations can use them effectively.

The software market progressively created a demand on organizations to use these models. Based on our experience in software process institutionalization and on the discussions established at SPIN-Rio meetings (SPIN-Rio) organizations are aware of the successful outcomes obtained by organizations that have already achieved higher maturity levels. However, before starting an improvement initiative, organizations feel skeptical about the advantages of defining and improving their processes based on them. They still have to ask themselves about what practices should be valuable for its specific context and feel unsure about compromising their effort and budget on process improvement initiatives.

The Brazilian market, for instance, has attempted to apply internationally-developed standards and practices, although initiatives for the development of practices and solutions applied to Brazilian software organizations (mps Br) can be pointed out as important directions toward the creation of a cultural identity. However, the adoption of any reference model or software engineering practice requires a cultural change by software professionals as well as by the management and executive levels of software organizations (Humphrey, 1999)(Araujo and Borges, 2001).

The effort for establishing organizational memories, lessons-learned repositories, experience factories, communities of practice or any other term used by the software engineering research for composing an organizational knowledge base can be considered as an attempt to provide enough experience information that helps organizations to be surer about the effectiveness and application of practices, processes and tools. However, the technological, methodological and financial obstacles for establishing internal knowledge bases are often unacceptable, especially for small and medium enterprises. Again, despite of the competition that exists among software organizations, they recognize that they need to collaborate.

This research work argues that new ways for software professionals to share and discuss their experiences by establishing communities of practice should be provided. Professionals should specially be stimulated not only to share information and knowledge but also to plan actions and to collaborate in order to perform the planned actions. In other words, it is argued that the software development community culture can change through collaboration.

The argument stated in this research work is that sharing knowledge and experiences and combining them to perform new actions towards an improvement initiative cannot be dissociated from its social and collaborative aspect. Based on the concepts of connectivity and social networks (Capra, 2004)(Borgatti and Foster, 2003) the RCC-Sw¹ project proposes the establishment of a network of software professionals for collaboration and knowledge sharing. Through this network, participants can capture, discuss and publish practices and experiences about process improvement and software engineering, configuring it as a place where they can evaluate, collaborate and conclude about practices. The network can also serve as an instrument to enlarge social connectivity among members, defining its cultural identity, needs and expectations.

¹ RCC-Sw is an acronym in Portuguese for Collaboration and Knowledge Network for Software



The paper is structured as follows: In Section 2 the concept of social networks and its main characteristics are presented. Section 3 describes the objectives of the social network that the project aims to establish and the results of survey conducted in Rio de Janeiro's software development community. Section 4 discusses the overall specification of a supporting environment. Section 5 finally concludes the paper discussing some of the challenges we believe will be faced by this community in order to effectively collaborate.

2. Social Networks

Usually, the existing forums for discussing software practices – workshops and conferences – are still academic, although one can notice efforts in attracting the participation of industry professionals. In spite of that, the format of these forums does not let professionals to discuss in details a specific practice, issue or problem, and the information exchanged remains more informative than formative. Discussions lists/groups and communities of practice have also been established as a channel for exchanging ideas. However, although they allow easy contact and fast exchange of information, they lack the flexibility for reflection, combining ideas and most of all, helping participants to effectively take collaborative actions.

Therefore, this work looks forward the establishment of a community with a set of characteristics that can help software developers and software organizations to find a favorable place to collaborate. A place where participants have a common objective, can freely share knowledge and actions and find adequate support to collaborate. That means to establish a collaborative network.

The word 'network' has currently a variety of meanings. In spite of the many meanings it can have, the word network always brings the connotation of keeping nodes tied, or of an instrument for capturing things. From the first idea, social networks (Rezende, Santoro and Borges, 2005) have the aim of associating and tying people. These associations or ties allow participants to perform actions together by contacting and mobilizing each other. From the second idea, social networks can be viewed as an instrument for collectively capturing knowledge. Through social networks, people publish, exchange and store information and knowledge so as to collaboratively perform actions.

The main characteristics of a social network are:

Common objective: A network will only work when its participants have a common objective. It is this objective that will make them have enough commitment for sharing knowledge and acting together. Therefore, the first step for establishing a social network is to clearly define what the objective of being part of it is.

Focus on actions: A group of people that meets to study or discuss a specific theme or subject – usually called an interest group – can not be considered a network. They do not act on reality with the intention of changing it. This happens in the same way as in communities of practice. It is not enough for a group of persons to face the same problem for them to act as a network. It is important that they have conscience that they can coordinate actions in order to change and that through this coordination they will obtain better results than if each one had acted alone.



Voluntary adhesion, participation and leaving: People cannot feel dissatisfied in the network, thus, they must participate and contribute to the network whenever they want and in the way they want. The success of keeping people in the network is capturing people that identify themselves with the network objective, allocating time and effort.

Isonomy and multi-leadership: The single characteristic of social networks is isonomy. Isonomy exists when all participants are equal in face of the same set of regulations, following rules in an indistinct manner. Isonomy is the requirement for sharing power and allowing the network to continue collaborative. Isonomy does not obstruct the emergence of leaders. Members in the network alternate states of leadership, allowing any member to propose actions and to attract other members to perform them. In a specific point in time, many autonomous leaders coordinate their actions simultaneously, which explains the concept of multi-leadership.

Information exchange: Network members must have autonomy to act. As there is no centralized coordination with an overall consciousness about everything that is happening in the network, participants must be able to extensively publish actions and results. Information must circulate freely in order to provide awareness and mobilize members around suggested actions.

Self-organization and collaboration: As mentioned before, there is no centralized coordination in the network. Participants naturally configure subgroups or work groups through collaboration.

Capability of attracting new members: One of the purposes of a network is to extend its actions and ideas to an ever-growing universe of participants: sponsors, partners, volunteers and collaborators. The joining of members compensates those members who leave, guaranteeing a long-term survival to the network.

Regarding its goal to perform actions, the social network helps participants to obtain more results together than if they have to count on people outside the network. What ties them together is their common objective and commitment. The efficiency of a network depends on the ability of each member in making information arrive to other members; enrich information he already has; and make their knowledge grow. In summary, the efficiency of a network is proportional to its ability to generate action and information flows.

3. Defining a Social Network for Software Professionals

Rio de Janeiro is one of the most developed states in Brazil. Although being one of the most populated regions and one of the national economic centers, there is a growing sense that the software business in Rio has been facing continuous challenges. A great part of software clients, especially financial enterprises, have moved to other regions and software companies struggle to sign contracts with the few contractors that stayed, especially, gas, oil, telecommunications and government organizations.

A community of software professionals is already settled in Rio de Janeiro based on the model of the Software Process Improvement Networks (SPINs) proposed by the Software Engineering Institute (SEI). This community, called SPIN-Rio, was established in 1999 and has the mission of promoting and discussing software engineering practices.



The main interaction model of this group is to organize periodic events – open to any one interested in participating – where some specialist of the industry or academy comes to give a talk on a specific subject and participants are invited to discuss about it.

This model has proven to be attractive to let the local software community meet, make contact, share information, expectations and doubts about practices and improvement initiatives. However, it has not leveraged the ability of this community to establish social or interest-based ties in order to articulate collaborative actions. Participants feel more as listeners in this community than active participants on a knowledge network.

In our first attempt to establish a social network for software professionals, we used this whole context as the motivation factor for the network. The basic aim of a social network is to mobilize software organizations and professionals to perform actions in order to consolidate, strengthen and develop the local software industry, helping Rio de Janeiro become an important software technology, development, services and export center. Additionally, SPIN-Rio could be the preliminary source of participants to compose an initial set of network members.

3.1. Observations from a survey

Before continuing the development and establishment of the network, it was important to define what would be the interest in this initiative. A survey was conducted in order to evaluate the impact of this proposal into the software engineering community.

One of main obstacles for conducting this survey was to be aware of the real number of software professionals comprising the regional software industry. After many inquiries, it was not possible to find precise statistical data, thus not allowing for dimensioning the survey universe. This fact helped us to write down one first conclusion: how can this community collaborate if they are not able to identify itself and its members?

A questionnaire was published in the project's website and people were invited to contribute to it through mailing lists, including the SPIN-Rio mailing list. The mailing list had 5540 persons. From this universe we received 107 responses to the survey. This number was considered significant enough to allow some conclusions. The detailed results of the survey can be found in the project's website (RCC-Sw) and just the important issues for this paper are presented in the following paragraphs.

43% of the respondents work at large enterprises (more than 1000 employees), 24% work at medium-sized enterprises (up to 1000 employees); 13% at small-sized enterprises (up to 100 employees) and 20% at very small-sized enterprises (up to 20 employees). These numbers reflect the nature of the Brazilian software market that concentrates medium and small-sized enterprises.

Asked about what would be the great challenges faced by the software development market, the following answers arose: bad government support (47,66%), lack of partnership among software development service providers (47,66%), low level of software professionals' technical education (44,86%), low quality of services provided by software enterprises (37,28%), inadequate regulations and law (31,78%), training courses with bad format or with out-of-date content (30,84%), few contractor



enterprises (29,91%), others (12,15%). This data helped us imagine that software professionals consider themselves alone. They don't feel like being supported by government and don't know how to establish partnerships, although the software market is strongly competitive (there are few contractors).

Inside organizations, challenges were also identified. The majority of respondents pointed absence of software development defined processes and/or methodologies, absence of a metrics program to allow performance analysis, low adoption of process quality reference models and need for changing the existing organizational culture as the main challenges for them. These answers helped us to reinforce the idea that introducing software engineering practices are still a challenge for software organizations and professionals.

The survey then attempted to capture how these professionals should be motivated to be part of a network aiming at addressing these problems. They were asked to report to what extent and in which aspects the network would bring benefits. Most of them pointed software process improvement as the great benefit (85,98%). Other answers included: in helping organizations to export products and services (35,51%), in changing regulations and law (31,78%), and others (9,35%).

Surprisingly, one respondent was firm to point out that he/she does not expect that the network will help. We contacted this person individually, trying to understand his/her point of view. He/she explained us that the idea of a collaborative network is romantic and is a utopia. He/she is sure that the market today is too competitive and it is barely possible that professionals have the necessary feeling of sharing and collaborating.

Finally, when asked about how they think they could contribute to the network almost all participants reported that they would like to share knowledge (95,33%) and to establish contacts and opportunities (59,81%). Just a few (3,74%) answered that they could contribute through specific actions such as: elaborating training courses, creating new ideas and innovating, consulting and process improvement, testing practices or defining strategies for implementing practices.

These results helped us to conclude that this community faces challenges and is motivated to work on an initiative that can make their work better. However, one can still wonder if the community clearly understood that this network has to do with working and acting together to generate common ideas, products and to collaborative solve problems they continuously face. In order to guarantee that the network main characteristics are in place, we believe that a supporting environment would be fundamental for making RCC-Sw true.

4. Supporting the Network

Computational support for knowledge management approaches have contributed to social networks, providing basic infrastructure to allow participation, interaction and knowledge sharing. The main challenge in developing an environment to support social networks is offering functionality that does not injure the main characteristics and dynamics of the kind of network proposed in Section 2.



4.1. Supporting Requirements

A software-based environment was specified to support the RCC-Sw/Rio. The specification of this environment has been influenced by the solutions suggested in Rezende, Santoro and Borges (2005), adapted to the specific needs of the RCC-Sw/Rio. As mentioned before, the key characteristic of the proposed environment, considered as a differential from for instance, mailing lists, newsgroups etc, is that it provides features for network members not only to interact but also to easily create and manage collective actions. These characteristics need to be mapped to a set of system requirements summarized on Table 1.

In general terms, the main functionalities of the RCC-Sw/Rio were specified based on the well-known Nonaka and Takeuchi's spiral model for knowledge management (Nonaka and Takeuchi, 1995). In this model, knowledge management is a process that must start with socialization phase (people share better if they know each other better and can exchange their tacit knowledge); next an externalization phase (turning each one's tacit knowledge into explicit knowledge); followed by a combination phase (knowledge can be combined to produce new knowledge); ending with an internalization phase (people learn and accumulate new tacit knowledge).

Table 1 – Mapping Network Characteristics to Requirements

Characteristics	Requirements
Common objective	Make the network objective explicit and clear within the environment
Focus on actions	Provide simple but adequate support to action execution
Voluntary adhesion, participation and leaving Capability of attracting new members	Make participants' roles and tasks explicit Facilitate joining of new members and easy disconnection
Isonomy and Multi-leadership	Support independent and distributed coordination Support decentralized actions
Information exchange	Support multiple views and initiatives Disseminate information among participants Support action awareness
Self-organization and collaboration	Support multiple coordination and means to achieve collective actions Foster collaboration among participants

In RCC-Sw/Rio, the socialization will be achieved by providing functionalities for establishing groups and subgroups; and the availability of communication channels such as e-mail, chat and public whiteboards. Externalization functionalities comprise organizing the overall network knowledge in terms of documents, events, news, participants' personal information etc. Combination will mainly be performed during the execution of actions. Agents in a working group bring information and tacit or explicit knowledge available in the network or external to it in order to contribute to the success of the action. Internalization is a subjective phase that will be achieved by each agent as continuously participating and acting in the network.

Regarding roles, there are three basic roles in RCC-SW/Rio: i) agents - the usual participant in the network. An agent is able to: propose and participate in actions being



supported by the network; share news, documents, material, experiences and knowledge within the network; ii) secretary: the secretary represents the network to the 'external world'. It is a group of people responsible for clarifying doubts about the network, for keeping the record of current participants and for publishing the results and knowledge obtained through the actions performed by the network; iii) support: group responsible for technical support; solving software and/or hardware problems.

4.2. The Environment

A first version of the RCC-Sw Environment was implemented using the free platform Plone (PLONE) due to its flexibility so as to implement the system. Plone runs on top of Zope (ZOEPE), a well-known open source application server written in the Python language (PYTHON).

This version comprises some of the requirements presented in Table 1, attempting to provide basic functionalities for the creation of the network: joining the network, creating and publishing actions and exchanging information. The intention is to make this first version of the environment available as soon as possible to start the observation of its impact and behavior into the software development community. A overview of the environment is presented in Figure 1.

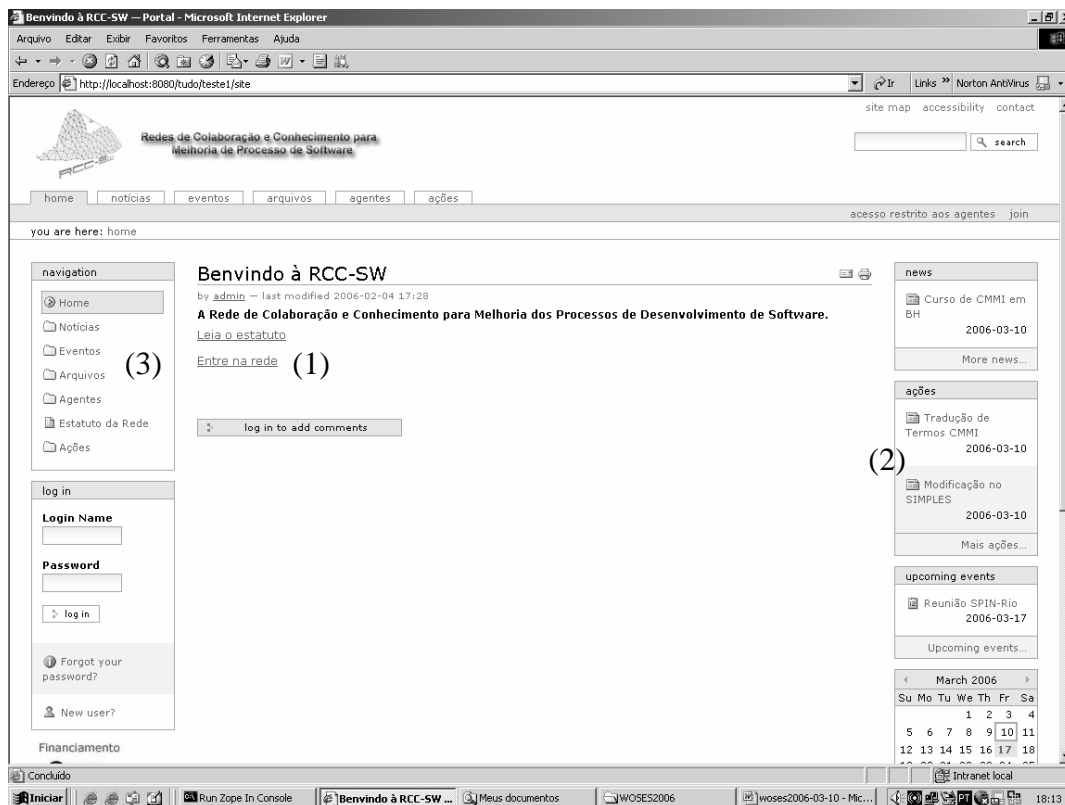


Figure 1 – RCC-Sw Main Interface

Joining the network: Anyone can subscribe to the network and become an agent by just understanding its objectives, feeling committed to it and agreeing with its internal rules (Figure 1-1). The network works in a decentralized manner; thus, the rules of the network are defined and changed by the network agents themselves. Anyway, an initial set of rules should be provided when the environment becomes available for use,



but the idea is that any agent can propose changes to those rules, which will be discussed and approved.

Creating and publishing actions: At any time, an agent can suggest an action to be performed by the network. This action can be of any kind: the proposal for translating a new reference model or documentation; the development of a new tool; the establishment of a campaign; the elaboration of a training course; or whatever an agent thinks is important to be conducted and that will attract other members to join in it. This proposal is published and participants are invited to join it, composing a working group. Actions can be planned and they generate intermediate and final products that can be shared in the network or publicized to the external environment. Figure 1-2 depicts the how actions are published to agents.

Mechanisms for starting, publishing, planning, following, completing or suspending an action will be provided by the environment as well as mechanisms for agents to join or to leave each action currently being undertaken in the network.

Exchanging information: Any agent can share information by freely creating folders and uploading files into the RCC-Sw Environment (Figure 1-3). They can also share news and events through a calendar. A classification schema or ontology will be provided in future versions in order to organize the knowledge content produced inside the network.

5. Conclusion

This paper presents a proposal for building a community of software professionals where knowledge can be exchanged, shared and, most of all, agents can collaborate to perform actions towards a common objective. The establishment of the RCC-Sw and its underlying environment will surely face challenges directly associated to social and cultural behavior of the software development community. In fact, one of the main interests of this research work is to observe how these aspects will evolve inside the community.

The concept of network has been widely applied to the organization of philanthropic institutions, focused on social, political, health or ecological issues. These networks usually have broader objectives that comprise interests of the whole society. In RCC-Sw, although the network objective has to do with improving the local software market – a common objective – we do believe that initially participants will come just to feel being part of it, to have access to knowledge that can benefit them, and to find work and business opportunities. Therefore, the great challenge and question this research work will try to answer is: can software professionals share and commit to a common objective?

However, we are working on the idea that the characteristics of a social network as mentioned before can help participants gradually feel differently and willing to collaborate. The concept and dynamics of social networks are believed to be the factors that will provide agents commitment, collaboration, effective knowledge transfer, combination and finally learning. This is the culture change we want. It is also supposed that the continuous participation in the network will help participants to establish social ties and important movements in relation to performing changes in the existing scenario



and/or environment they face, being a driven force to evaluate the effectiveness of practices, techniques and tools.

The survey results suggests that there is a motivation for the establishment of this network focused in Rio de Janeiro, but we firmly believe that the main idea can be applied to other contexts. It will be also interesting to observe different patterns of behavior in different regions or communities. Regarding observation, as RCC-Sw is in fact a community, it would be interesting to study how to apply observation approaches such as ethnography to understand, discuss and improve the network behavior.

Finally, the discussions so far pointed out some parallel work that would be important to the Brazilian software engineering community: to characterize it and its professionals' profile. This survey would be important for elaborating strategies for education, continuous training, and in performing effective actions to improve this community.

As future work, it is expected to conduct observations and analysis of the network use trying to observe different aspect, such as: centralization and leadership; its real use the impact of the network to the software market; how participants deal with establishing partnerships and actions; what is the common agent social profile and how it influences de network performance and results. It would be remarkable to study how to apply observation approaches such as ethnography (Viller and Sommerville, 1999) to understand, discuss and improve the network behavior and support.

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