Using *i** to Represent OSS Ecosystems for Risk Assessment

Claudia Ayala[1], Xavier Franch[1], Lidia López[1], Mirko Morandini[2], Angelo Susi[2]

[1]Software Engineering for Information Systems Research Group (GESSI)
Universitat Politècnica de Catalunya (UPC)
Barcelona, Spain
{franch|cayala|llopez}@essi.upc.edu
[2]Fondazione Bruno Kessler, Center for Information Technology,
via Sommarive 18, 38123 Povo, Trento, Italy
{morandini|susi}@fbk.eu

Abstract. Open Source Software (OSS) is a strategic asset for organisations thanks to its short time-to-market, the opportunity for a reduced development effort and total cost of ownership, and its customization capabilities. OSS-based solutions include projects that are developed and co-evolve within the same organisation, OSS communities, companies, and regulatory bodies, forming an articulated strategic business ecosystem. The adoption of OSS in commercial projects leads to numerous challenges in the wide spectrum of available OSS solutions and risks emerging from the intrinsic structure of an OSS project. In this position paper we devise the use of *i** models for understanding the strategic perspective of OSS ecosystems, representing actors, intentional dependencies and responsibilities. We argue that these models can play a crucial role in the analysis of organisational risks inherent to OSS component adoption and in the definition of risk mitigation activities.

Keywords. OSS, iStar, Software adoption, risk, goal-oriented requirements engineering.

1 Introduction

The strategic importance of Open Source Software (OSS) technologies in the development of commercial software is growing steadily. Gartner recently highlighted[1]: by 2016 OSS will be included in 95% of all commercial software packages. In spite of this trend, IT companies and organizations are still facing difficulties and challenges when they decide to adopt OSS solutions. It stands that OSS is about freedom and choice, but freedom and choice introduce risks[2].

OSS components integration in the development of complex software systems has became a popular way of OSS adoption. However, despite the potential benefits of

[1] Understand the Challenge of Open-Source Software. Gartner Reports, September 2012.
[2] Critical Strategies to Manage Risk and Maximize Business Value of Open Source in the Enterprise. Gartner Reports, June 2011.

reusing OSS components, such integration involves several risks and challenges. As a result, traditional project and risk management strategies should be put forward; specially for assessing the wide, often complex, interactions of the diverse actors related with the internal and external development, maintenance and evolution of the OSS component and the context where the OSS component will be integrated. Thus, two important viewpoints should be considered and reconciled: the OSS project ecosystem and the adopting organization ecosystem. On the one hand, the OSS project ecosystem. comprises not only the developers, but the whole community, including users, regulatory bodies, and companies involved with the project (if any). It also covers technical support, marketing and possible financial aspects (including the business model(s) behind the project). On the other hand, the adopting organization ecosystem comprises the technical and business issues of the project where the OSS component will be integrated. Both ecosystems together could be considered as the OSS-based ecosystem. In this complex setting several questions emerge, e.g.:

- Which viewpoints should be considered for assessing the OSS-based ecosystem in order to ensure a smooth integration and evolution of the OSS component?
- How to secure that specific properties of an OSS do not harm business models and their underlying business strategies?
- How to implement a systematic approach towards understanding and representing dependencies that involve OSS components, for assessing possible risks?

We believe that the answer to these questions requires a clear understanding of the ***OSS-based ecosystems from a strategic perspective***, with the identification of strategic dependencies (not just related to software component dependencies) as a means to identify risks coming from the adoption of OSS components and to design risk mitigation strategies along the lifetime of a software product.

Along this line the paper introduces an approach, currently explored in the context of the European project RISCOSS (RISks and Costs in Open Source Software adoption), that promotes the use of *i** to understand the strategic perspective of OSS-based ecosystems.

2 Objectives of the research

In the RISCOSS project we envision methods and tools for supporting the analysis of risks and costs that organizations need to evaluate for deciding the integration of OSS components in the development of software products.

The processes for the adoption of commercial off-the-shelf (COTS) components are well established in many companies. Many medium and large companies follow strict guidelines for risk analysis, cost estimation, and contract agreement. Such agreements are typically based on the principles of liability and confidence, in exchange of a single or recurrent fee. However, when it comes to OSS components, the situation is different. On the one side, there is access to the source code, making possible (depending on license implications) to use and customize the component without any contract agreements and payment authorization [1]. This opens the possibility for a less bureaucratic but uncontrolled use of OSS components without a thorough anal-

ysis of risks and undesirable implications, as evidenced in industrial surveys [2]. On the other side, the own characteristics of the OSS project ecosystem are highly different from that of traditional software. The community behind the OSS component is not generally driven by a single business goal, the motivations and objectives of the contributors are manifold, the software is provided without quality of service agreements and the community cannot formally commit on the future roadmap.

Consequently, to evaluate risks and opportunities of OSS components adoption, it would be crucial to further understand the strategic perspective of the OSS project ecosystem in order to evaluate its adequacy to the strategic perspective of the adopting organization (i.e., the adopting organization ecosystem).

Important risks related to the OSS project ecosystem [1] [2], could be for instance: the lack of a roadmap and/or ownership of the project, unclear liability/responsibility, and bug fixing time. From the point of view of the adopting organization, liability and support can sometimes be commissioned, to a certain degree, to specialised companies, thus de facto forcing the component to go through the COTS adoption process. However, this is not always possible and often not a favourable solution, both from the point of view of costs and additional risks. Moreover, the uncoupling of companies, developers and software gives rise to issues with which traditional risk analysis processes are not able to cope, as evidenced in various empirical studies [4].

In this context, our first objective is to support the risk assessment processes of OSS adoption by using *i** models as a basis for the analysis of the strategic perspective of the OSS-based ecosystem that involves the assessment of the OSS project ecosystem and the adopting organization ecosystem.

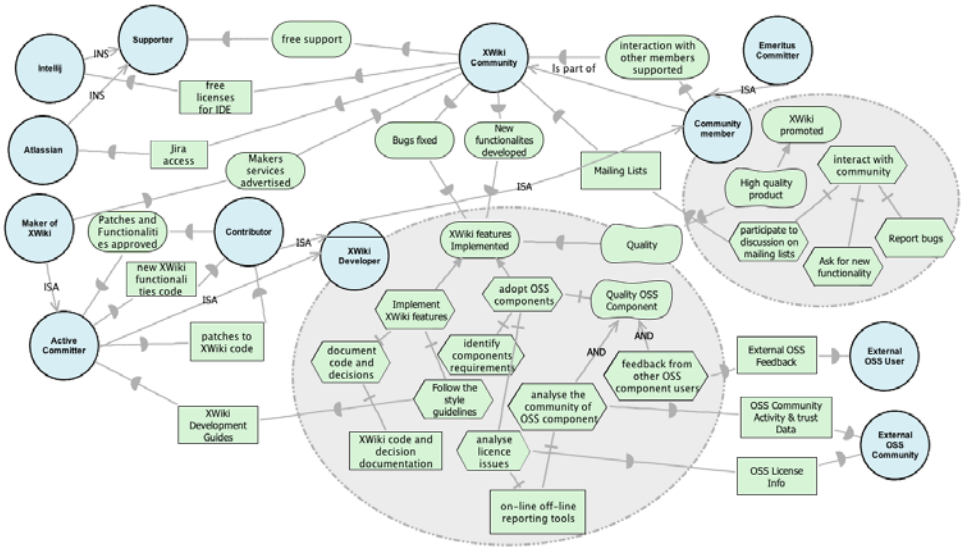

Figure 1: An excerpt of the strategic diagram representing the XWiki project.

Figure 1 displays an excerpt of the strategic diagram for an OSS project called XWiki (www.xwiki.org), which is one of the case studies of the RISCOSS project. It shows the structure and responsibilities related with the XWiki community, composed by developers (contributors and active committers) and other community members. Note that some of the roles are not "assigned", i.e. there is no formal commitment to these roles. E.g., users of XWiki become community members when they send bug reports and feature requests or discuss on forums and mailing lists. The XWiki project development is mainly driven by the company XWiki SAS (www.xwiki.com), which is also part of the model in order to explicitly show the influence of the company on the project and to understand the influence of its business strategy.

These models could be a valuable tool for the adopting organizations, for having an overview on the OSS project ecosystem and evaluating the risks implied in a potential adoption. For example, lack of ownership could be evaluated by analysing the companies and individuals that have prominent (business) dependencies and responsibilities in a project, while the lack of a roadmap could be investigated by analysing the structure of the community, identifying the amount of distributiveness, the presence of heroes, and the roles and business objectives of the companies involved.

We plan to provide specific guidelines and measures for a qualitative assessment of an OSS project ecosystem and its related risks, to support the decision process and to provide an entry point for enacting proper mitigation activities.

3 Scientific contributions

In this work we envisage several scientific contributions that are mainly related to the use of *i** for supporting the assessment of risks in OSS-based ecosystems.

Patterns of ecosystems and organisations. A first research challenge is the possibility to extract and represent OSS-based ecosystem patterns (at different levels of abstraction). These patterns would allow abstracting the roles, goals and dependencies in the OSS project ecosystem and in the adopting organization ecosystem; and identifying schemas that have the property to be more prone to risks or to be particularly useful to implement organisational risk mitigation strategies. They should identify and highlight properties of an ecosystem, such as ownership and leadership in the structure of the community, its stability (distributiveness, centralism, presence of heroes), the role and involvement of companies in the project (e.g., technical support, financial promotion, developer contribution, community support and influence), as well as their business model.

To do so, we have identified several dimensions to classify the entities involved in such ecosystems:

- Role: producer, consumer, community.
- Setting: industrial (large, medium, small), academia, public administration.
- Business strategy: from full OSS collaboration to OSS exploitation.
- Business process: adoption, migration, consolidation, and improvement.

Each data point determined by these dimensions provides a scenario that may be analyzed and characterised by different patterns. In RISCOSS we are currently ap-

proaching several of these scenarios by analysing 5 use cases that cover situations from very limited OSS implication in the business strategy to a full collaborative approach. Such real cases will help to establish a solid evidence for the design of our patterns. For instance, we have a large industrial company that produces highly reliable software products and aims to integrate an OSS component in its software product line. Its business strategy regarding OSS is to just exploit the component functionality (without involvement in the OSS project) and does not have interest to change processes. On the other hand, we have also the case of a medium-sized company, whose business strategy relies entirely on OSS adoption and development and therefore adapted its processes and the whole organization to such an approach.

Level of abstraction in the models. Another important issue is related to the need of representing the ecosystems at several levels of detail, at both class and instance level, to facilitate the reasoning about the model, focusing on the high level structure of the ecosystem or going into further details, with a particular focus on OSS-specific actors such as individuals, community groups, etc. In line with previous experiences in other settings [3], in order to use *i** models as a communication means, we need to keep the models as simple as possible, so they could be understood by all the industrial partners of the RISCOSS project. So far, we are using general actors without classifying them except for those that clearly are agents. Also we limit the use of soft goals to the most fundamental ones. The number and relationships of actors has driven us to adopt a third kind of model, the Strategic Actor Diagram as proposed by Leite et al. [4], which gives a useful perspective on the system.

Guidelines for the specification of the models and repositories. To support the specification of the OSS-based ecosystems, a clear process is needed to specify a set of *i** diagrams. We have taken as a starting point the R*i*SD methodology for SD diagrams [5], and we plan to refine it and to create similar versions for the other types of *i** diagrams. A shared or company-internal repository of such models could be implemented to allow the evaluation of the structure of the OSS-based ecosystem, based on organisational patterns. Thanks to this repository, analysts could get an overview of the OSS project ecosystem and adopt analysis guidelines to identify risks and to manage them for getting pursuable criteria for OSS adoption decisions.

New modelling concepts. We are also considering the need of enriching the set of *i** modelling concepts on the basis of specific characteristics of the ecosystems and of domain risks [6]. Concerning the ecosystems, there could be a need for concepts able to express aggregation between actors for a direct representation of teams or communities. Also, some specification relationships between actors may be expected to emerge. Moreover, in a community-driven environment, central *i** concepts such as *delegation* and *responsibility* need to be re-discussed. In OSS, the strict concept of *delegation* changes to a more relaxed concept of *expectation* and *observance* of *norms*. Responsibility is scattered and can often not be clearly identified, and must thus often be taken over by the companies adopting the software for their products. Moreover, in this context many roles are defined by access rights and by own interest and can dynamically change. Concerning risks, we plan to follow a strategy similar to the one used in Nomos [7], namely incorporating new concepts for the representation of risk, of the impact that the risk has on the structure of the organisation and of pos-

sible mitigation activities. Available *i** risk modelling approaches such as [8], defining risks, events, affected assets and treatments, will be taken into account for this as well.

4 Conclusions, ongoing and future work

In this paper we described one of the main objectives of the European project RISCOSS that is to support decision making related to the assessment of risks in the integration of OSS components. We envision the use of *i** models to capture the intentional aspects that drive the OSS project ecosystem as well as the adopting organization ecosystem, in order to analyse both points of view and their potential risks.

Based on the analysis of five adopting organizations represented by the industrial partners of the RISCOSS project, we are currently: applying existing guidelines for the specification of *i** models, identifying elements and relationships that may represent potential patterns or new modelling concepts. Furthermore, we are performing systematic literature reviews on OSS ontologies, OSS ecosystems and OSS risk management with the purpose of developing an ontology to be linked to the *i** core. We plan to use some foundational ontology (e.g., UFO, DOLCE) to connect these two worlds, aligning with ongoing research on the semantic meaning of *i** constructs [9].

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