Open Source Software Development Model

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INTRODUCTION

The open source movement can be traced back to the hacker culture in the '60s and '70s. In the early 1980s, the tenet of free software for sharing was explicitly raised by Richard Stallman, who was working on developing software systems and invited others to share, contribute, and give back to the community of cooperative hackers. Stallman, together with other volunteers, established the Free Software Foundation to host GNU (Gnu's Not Unix, a set of UNIX-compatible software system). Eric Raymond, Stallman's collaborator, is the primary founder of the Open Source Initiative. Both communities are considered the principal drivers of open source movement.

A number of worldwide, online communities for open source development have been established since then to facilitate the development of open source software. For example, the Open Source Development Network (OSDN) is one of the largest organizations for such purpose. One of its subordinates, sourceforge.net, is hosting nearly 70,000 projects and 700,000 registered developers and users at the present time. The recent wave of sponsoring open source projects by commercial companies is another significant phenomena. Big IT players such as IBM, Sun, and HP have realized the importance and benefits to "open" their source. From other perspectives, open source applications have been expanding into various domains, including education, the Internet, office management, programming, communication, and even the medical domain. The Apache server powers half of all Web servers worldwide, far more than Microsoft and Netscape combined. Table 1 lists some typical application domains and well-known open source software.

Table 1. A list of popular open source software products

Operating system: Linux, FreeBSD
Internet: Apache Server, Mozilla
Communication: sendMail, OpenSSL
Programming: Perl, Tcl/Tk, GNU
Office: OpenOffice

BACKGROUND

With the successful delivery of many software products, the open source development model has been attracting increased interests from both practitioners and researchers. The open source development model can be characterized by its fast evolution, distributed development, and extensive user collaboration. It is a simple mean of releasing software with free source code, but one that brings a series of new social and technical challenges, including licensing, distributed development, project management, commercial adoption, and user collaboration. A number of research methods have been adopted to investigate the phenomena of open source development, including general descriptive discussion (Raymond, 1999; Hars & Ou, 2002; Cubranic & Booth, 1999; Augustin, Bressler & Smith, 2002), case studies (Mockus, Fielding & Herbsleb, 2002; Lakhani & Hippels 2003), and surveys (Zhao & Elbaum, 2003; Lakhani & Hippel, 2003). As usual, different research methods employ unique ways of investigation but have potential weaknesses. For example, case studies tend to focus on a few large open source projects such as Apache, Linux, and Mozilla, but lack of comprehensive observations on common issues for a broader spectrum of open source projects. Survey research is able to cover a large number of projects, however it may ignore details or specific issues for individual open source projects.

The open source model can dramatically affect changes in the traditional ways of software development. Table 2 lists some relevant issues that arise with open source development.

KEYS TO UNDERSTANDING THE OPEN SOURCE DEVELOPMENT MODEL

Despite the debates, critiques, and the evident enthusiasm regarding the Open Source Development Model, without any doubt, it is becoming a recognized paradigm that competes with the traditional methods of software development and is expected to grow in the future. To understand this phenomena, several essential attributes

Table 2. Issues that arise with the Open Source Development Model

- *Reliability:* Whether software developed under a model different from traditional carries same or higher reliability.
- *Licensing:* Licenses under which open source software products are distributed. How terms and conditions are phrased.
- *Release Management:* The rapid evolutionary open source model requires unique version control, release distribution, and management.
- *Quality Assurance:* What traditional QA methods and open-source-specific mechanisms (e.g., user contribution) are leveraged to insure quality.
- *Adoption:* How open source products are adopted by people and organizations outside of the open source community.
- *Documentation and Maintenance:* Due to the voluntary nature, attention should be paid on later development tasks such as documentation and maintenance offered to users.
- *Project Management:* Efforts are needed to keep the project stable and attract as many contributing users as possible to improve the software.
- *Collaboration Tools:* Without effective collaborative tools and environments, it is impossible to complete projects as a virtual team.

of the Open Source Development Model must be observed, including motivation to contribute, development process and quality assurance, communication methods, and user collaboration.

- *Motivations to Contribute*—It is sensible to understand the open source model by trying to understand the motivations of contributors who are willing to develop software and give it away for free. Zhao and Elbaum (2003) discovered that open source projects are started mainly for personal needs, community needs, and company needs. In a more focused study on this topic, Hars and Ou (2001) identified two types of motivations that account for people's participation in open source projects. These are internal factors that include intrinsic motivation, altruism, and community identity, and external factors that include future rewards (i.e., selling products), human capital, self-marketing, peer recognition, and personal need. Lakhani and Hippel (2003) also find that an opportunity to lead is also a motivation for developers to contribute. A recent survey study (Zhao & Deek, 2004), designed specifically for open source users, found that in user groups, most of the users are motivated to contribute by personal needs, followed by having fun and employer needs. Also, the same study verified that learning is a major benefit that users receive by contributing.

- *Communication Methods*—Open source development is a success story of collaborative development through computer-mediated virtual communities such as sourceforge.net. That is also a reason why open source projects attract contributors from all over the world. Web-based collaborative tools enable developers and users from different locations to coordinate and collaborate on development tasks. However, current collaboration environments are still largely facilitating technically oriented tasks (e.g., version control) instead of socially oriented ones (e.g., group decision making). Future trends of computer-mediated collaboration methodologies in open source development are likely to expand towards the socially oriented direction.

- *Development Process and Quality Assurance*—Unlike with traditional or commercial software development, open source projects are less formally organized in terms of following certain process models. Similarly, quality assurance activities are carried out in a less formal ways (Zhao & Elbaum, 2003). The rapid release and evolution of software raises some discussions on the analogous relationship with the eXtreme Programming model. Although there are a large variation in terms of how the evolutionary processes are managed in different projects, Zhao and Elbaum (2003) present many interesting findings relating to the lifecycles of a broad range of open source projects. For example,

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