

Guest Editorial

Open source software: investigating the software engineering, psychosocial and economic issues

While the concept of free software is as old as software itself, there has been an explosion of academic and commercial interest in the topic since the coining of the term 'open source software' (OSS) in 1998. Opinion on OSS tends to be quite polemic. On the positive side, we see those who point to OSS as the paradigm shift needed to solve the now decades-old 'software crisis' (i.e. systems taking too long to develop, costing too much and not working very well when eventually delivered). These advocates highlight the quality and reliability of OSS products, the rapid release schedules of many OSS projects and the reduced cost of OSS development and ownership. At the extreme, technology publisher Tim O'Reilly has identified OSS as the language of the networked community, suggesting that it will be the dominant mode of work for knowledge-workers in the information society. In this vein, papers have begun to emerge that have identified OSS as a model that transfers well beyond software development into other industry spheres, for example economics, governance, law, education, medicine and even the stock market (cf. Feller and Fitzgerald, 2001; Feller *et al.*, 2001). However, countering this positive expansionist view, there are many who suggest that OSS is just the latest 'silver bullet' in the software industry, characterizing it as an over-hyped strategy employed by the weak to compete with the strong. Bob Metcalfe (inventor of Ethernet and founder of 3Com) has described OSS as 'utopian balderdash', and Roger Sessions (an influential researcher of COM, DCOM and other middle-ware technologies) has even suggested that OSS is 'a disaster waiting to happen'. Even if we narrow our scope to look at the specific case of the Linux operating system, we find the same intensity of disagreement. The original creators of the Unix operating system stand firmly on opposite sides of the fence, with Dennis Ritchie describing Linux as 'commendable', and Ken Thompson declaring that Linux 'is quite unreliable' and 'will not be very successful in the long run'.

Although OSS research is gathering momentum, to date there have been relatively few analytical studies that have investigated the OSS phenomenon in detail. Many of the earliest accounts of the phenomenon predate the use of the open source label; instead, using Richard Stallman's term 'free software' to describe systems such as Linux and Bind. Although extremely valuable and highly influential, these early accounts tended to be:

- anecdotal, e.g. the journalistic work of Moody (1997);
- ambassadorial, e.g. the early writings of Raymond (2001); or
- ideological, e.g. the work of Stallman (1992).

Likewise, the essays in one of the most widely cited canons on OSS, *Open Sources: Voices from the Open Source Revolution* (DiBona *et al.*, 1999), are generally subjective accounts of the phenomenon by the main pioneers in the free software and OSS movements, and do not represent academic research of the concept.

Our purpose in this special issue was thus to solicit papers that would represent rigorous analytical research into the complexity and multifaceted nature of OSS. In our *Call for Papers*, we identified three specific themes that we saw as requiring investigation. These were:

1. Methodological/software engineering issues: although there are undoubted success stories within OSS, the development model appears somewhat at odds with the conventional wisdom of IS development. For example, OSS often does not map to current software development life cycle models (waterfall, V, spiral – although the OSS model probably has most in common with the spiral model). OSS research therefore has potential to offer an important counterpoint to existing development theory. Likewise, the dynamics of massively parallel, modular, collaborative development could provide insights that would elaborate on existing IS development research.
2. Psychosocial issues: most reports on OSS stress the Utopian aspects of collective public good, spontaneous order, selfless behaviour, absolute democracy, etc. However, this is countered by the fact that the culture of OSS is highly individualistic and reputation based, and that the opportunities for personal gain, both financial and otherwise, are enormous. The limited literature that does exist in this area suggests that behind-the-scenes political struggles are no less widespread than in any other field of human endeavour. Thus, there is a need for detailed investigation into the dynamics of the OSS development process in practice, in order to gain fresh insights into programming as a human activity.
3. Economic/business issues: some research has been conducted in relation to identifying the different business models underpinning OSS, particularly in relation to some of the more well-known OSS projects. However, additional enquiry is required given the increasing popularity of OSS. The very future of OSS is an open question. 'Pure' OSS is likely to give way to more hybrid business models in future. This is to be expected, given that the open source term was chosen specifically to be more acceptable to commercial interests. The IPO history of OSS players has made this a multibillion dollar industry. Also, the proprietary software industry contains powerful forces that threaten the viability of OSS.

The *Call for Papers* was distributed on several IS, software engineering and OSS mailing lists and websites in September 2000. There was a great deal of interest in the topic, and we had queries and requests for further information from all over the world. In the end, a total of 17 papers was received from authors in Austria, Australia, Brazil, Denmark, Greece, Italy, Sweden, Switzerland, the UK and the US. Each paper was subjected to a double-blind review process involving three reviewers per paper. We are delighted to take this opportunity to

express our gratitude to the reviewers for the excellent reviews that have contributed enormously to the success and quality of this issue. Based on the reviews, we eventually selected seven papers overall for publication. These papers will be published in two consecutive issues of *Information Systems Journal*: three papers in this issue, and four papers in the first issue of 2002 (volume 12, number 1). The papers represent an interesting cross-section of research on OSS and are in keeping with our tripartite agenda mentioned above.

In the current issue, the first paper, by Michael J. Gallivan of Georgia State University in the US, is entitled *Striking a balance between trust and control in a virtual organization: a content analysis of open source software case studies*. This paper seeks to theorize the OSS development model, an aspect that has been sorely missing in OSS research to date, and one which must be addressed if OSS is to have applicability beyond the software industry. Thus, the paper addresses the economic/business theme mentioned above. The author samples a wide range of OSS research with a view to investigating some theoretical concepts that have in turn been derived from literature on virtual organizations, trust and the McDonaldization of society. The paper questions the view – often held as axiomatic and part of conventional wisdom – that trust is required among the agents who constitute virtual organizations. Rather, this paper, based on a rigorous analysis of existing OSS research, reveals that trust does not feature explicitly in the OSS literature; instead, various forms of control, for example social control and self-control, are often identified as the tools actually drawn upon to achieve success in OSS projects.

The authors of the second paper, *The power of gifts: organizing social relationships in open source communities*, are Magnus Bergquist and Jan Ljungberg from the University of Gothenburg, Sweden. In contrast to the third paper, which focuses on the ‘harder’ software engineering issues, this paper adopts a softer, more qualitative approach, thus addressing the psychosocial and economic themes suggested above. The authors seek to develop a theoretical understanding of OSS and focus on developing the gift economy model as proposed by Marcel Mauss. They suggest that the treatment of gift giving in the OSS literature is not sufficiently detailed. In drawing on Mauss, they argue for taking into account the essential differences between gift giving in ‘primitive’ cultures and gift giving in a digital world interconnected via global networks. The empirical data from the study are drawn from the OSS literature and from an analysis of postings to various news groups and discussion lists over 2 years. The research approach is classified as virtual ethnography. The study focuses on how newcomers or ‘newbies’ are socialized into the ethos of the OSS gift-giving community, and also analyses how power relationships are established through gift giving. Several researchers have identified parallels between processes in OSS and academe, and this is discussed in some detail in this paper.

The third paper by Niels Jørgensen of Roskilde University, Denmark, *Putting it all in the trunk: incremental software development in the FreeBSD open source project*, provides an in-depth analysis of FreeBSD, a very popular open source operating system. A detailed account of an open source software development life cycle (SDLC) is presented. This SDLC has positive implications (e.g. the significant motivation of frequent feedback and delegation of responsibility for committing changes to the wider developer base), but also negative implications

(e.g. it is difficult to design and develop complex features with an incremental approach). The findings suggest that the SDLC applies to the development process of individual developers; for larger tasks, participants create their own form of organization. This appears to be a reversion to the responsible autonomy phase that was characteristic of the early days of computing (cf. Friedman, 1989) and, again, this could be a significant motivator. Among the other very interesting findings in the paper is the fact that 43% of developers surveyed reported being paid by their employer for their open source development work – suggesting that OSS is far from an amateur, part-time phenomenon. Also, the fact that 200 developers have code commit privileges in the FreeBSD project differs significantly from other OSS projects, such as Linux and Apache, once again confirming that OSS is by no means a homogeneous phenomenon. Finally, the study reveals that simple code gets more feedback than complex code, and that it is very hard to elicit feedback on design issues. This could represent a constraining factor in any attempt to transfer the OSS model to software engineering in general.

As already mentioned, four further papers on open source software will appear in *Information Systems Journal* 12(1):

- *A framework for creating OSS-like communities in organizations*, Srinarayan Sharma, Vijayan Sugumaran, and Balaji Rajagopala, Oakland University, Rochester, MI, USA.
- *Effort, cooperation and coordination in an open source software project: GNOME*, Stefan Koch and Georg Schneider, Vienna University of Economics and Business Administration, Austria.
- *Code quality analysis in open source software development*, I. Stamelos, L. Angelis, and A. Oikonomou, Aristotle University, Thessaloniki, Greece.
- *On the security of open source software*, Christian Payne, Murdoch University, Australia.

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