A Collective-Intelligence View on the Linux Kernel Developer Community

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ABSTRACT

With the rapid proliferation of all sorts of online communities, the knowledge creation and dissemination in these online communities have become a prominent social phenomenon. In this paper, one typical Open Source Software community—the online community of Linux kernel developers—is studied from the perspective of collective intelligence, to explore the social dynamics behind the success of the Linux kernel project. The Linux kernel developer community is modeled as a supernetwork of triple interwoven networks, namely a technological media network, a collaboration network of the developers, and a knowledge network. The development of the LDC is then an evolutionary process through which the supernetwork expands and the collective intelligence of the community develops. In this paper, a bottom-up approach is attempted to unravel this evolutionary process.

Keywords: Collaboration Network, Collective Intelligence, Knowledge Creation, Online Community, Open Source Software (OSS)

INTRODUCTION

In recent years, with the explosion of the Internet and the World Wide Web, online communities have become a prominent social phenomenon (Preece & Maloney-Krichmar, 2005); correspondingly, these online communities are playing an increasingly vital role in society-wide knowledge developments. Typical examples include the Wikipedia community which produces high-qualified encyclopedia (Giles 2005), the open source software (OSS) developer communities which build complex software systems like Apache and Mozilla (Mockus et al., 2002), and “Science 2.0” communities for scientific collaboration (Shneiderman, 2008). The proliferation of such knowledge-intensive online communities may raise a critical research issue, i.e. to study how knowledge is created and diffused in the online communities, and how the communities themselves grow during the collective actions of the participants. This issue is akin to the well-discussed research field of “Knowledge Management” (e.g., Nonaka & Takeuchi, 1995; Alavi & Leidner, 2001), which is usually focused on the “management” of knowledge assets and knowledge-related processes in a formal organization. Nevertheless, it can be argued that the existing theories and models for organizational knowledge...
management cannot be simply transplanted to the situation of online communities, since the processes of knowledge creation, dissemination and utilization in the online communities are fundamentally different from those in a formal organization. The creation, dissemination and utilization of knowledge in the online community are commonly accomplished by independent participants in a self-organizing and “autopoietic” (Varela et al., 1974) fashion, while in the formal organization such knowledge processes usually take place under the centralized managerial control to achieve some well-defined organizational objectives. New theories and models to explain the knowledge-related processes in online communities are required.

The Linux kernel developer community is one of the most famous online OSS communities; and this community may provide a fine case to study the knowledge processes in the online communities. The Linux kernel is the operating system kernel that underpins all distributions of Linux operating systems, which was initiated in 1991 by Finnish programmer Linus Torvalds and has thereafter been developed by thousands of part-time voluntary programmers scattered across the Internet without formal organization or centralized control. Along with the development of the Linux kernel, the online community of the contributors, or the Linux Kernel developer community, rapidly grows. In the Linux developer community, three phenomena are noticeable. First, the Linux operating system kernel, which is a software product of very-large-scale and complexity, is efficiently developed with high-quality in an unconventional way. Second, there is the self-organization of the online community of contributors throughout the development of the Linux kernel. Third, the development of the Linux kernel is a creative process. In this process, large amount of knowledge and skills are used to develop the software product; and on the other hand new knowledge about the development of the Linux operating system is also created. In this sense software development is inherently interwoven with the creation of knowledge of programming and software-project management; and we may then call this Linux kernel developer community as a “knowledge-creating community”. Facing these intriguing phenomena, it is worthwhile to examine the underlying dynamics of the evolution of the Linux kernel developer community, as well as the collective action of software development and knowledge creation in this self-organized community.

Therefore, in this paper we try to explore the knowledge-intensive online communities by giving an analysis on the actual case of the Linux-kernel developer community (DC for short). In an earlier effort, we suggested that many online communities manifest some degree of community intelligence (Xia et al., 2008; Luo et al., 2009). Based on this idea, we in this paper try to explore the underlying dynamics for the evolution of the LDC as well as the development of this community’s knowledge product, the Linux kernel.

A SHORT HISTORY OF THE LDC

To facilitate further discussion, the history of Linux is shortly introduced, with the focus being placed on the growth of the developer community in which the Linux kernel is collectively created and continually updated.

Linux was initially developed by Linus Torvalds in 1991, when he was a student in computer science at University of Helsinki. His initial motivation was to write programs in order to use some UNIX functions in his own PC with an 80386 processor; and he implemented a task-switching program, a disk driver and a small file system, which constituted Linux 0.01. On 25 August 1991, he announced this skeletal operating system in the newsgroup “comp.os.minix” and asked for suggestions for the preferable features. Then, his continuous efforts ended up to Linux 0.02, which came on October 5th. Together with the free release of the source code, he posted another message in the same newsgroup to seek feedbacks as well as possible contributors or co-developers. This was a critical event for Linux since it started the
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