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

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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 central-
ized 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 communi-
ties; 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 develop-
ment of the Linux kernel, the online community
of the contributors, or the Linux Kernel devel-
oper 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 de-
veloped 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 cre-
ative 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 program-
ning and software-project management; and
we may then call this Linux kernel developer
community as a “knowledge-creating commu-
nity”. 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 commu-
nity 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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