Chapter 12

OPTIMAL FIRM CONTRIBUTIONS TO OPEN SOURCE SOFTWARE

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Abstract This paper examines open source software development in a competitive environment. The quality of open source software improves over time based upon contributions by firms and users. A firm's decision to contribute is interesting because it also augments competitors' software quality in future periods subject to compatibility considerations with their existing software. A differential game model is developed to understand why firms are increasingly involved in open source software development by determining the optimal contributions and software quality over time. We obtain a closed-loop Nash equilibrium solution. Examples are given to derive insights from this model.

C. Deissenberg and R.F. Hartl (eds.), Optimal Control and Dynamic Games, 197–212.

1. Introduction

Open source (OS) software is software that is licensed for free use, modification and redistribution (Raymond (2001)). Together with the compiled software, the source code is made available to users, so that they can examine and modify the code if they should choose to do so. In particular, a volunteer group may be set up to oversee the collection of code modifications and improvements, and to bring out new versions of the software that incorporate these changes. The users thus become partners in the development of the software.

While OS software development in the past has been characterized as unstructured and temporary collaborations by individual hackers, the new reality is that successful open source development has become structured, and oftentimes funded by interested commercial firms. Some commercial firms have kept open source programmers on their payroll, while others have contributed source code. A case in point is the billion dollars that IBM, HP, Novell, Intel and others have invested in Linux and OS Development Labs. [1]

One of the benefits obtained from revealing the source code is that many programmers are able to examine it for defects, or bugs. Even highly internally tested software is prone to bugs that might trigger under particular settings that have not been tested. In a method akin to the peer review system and open publications of academic research, OS software tends to be more reliable and less buggy. Thus, user testing and contributions explains why firms might consider opening their code in monopoly markets.

What is surprising, however, is that even in competitive markets, firms should contribute to open source. For example, Red Hat and Novell compete for the same business clients, and IBM and HP both offer servers running Linux software. In such a context, the competitors are also able to examine and incorporate the contributed software into their own bundle of software programs. The contributing firm thus helps its

[1] Thus, IBM hosts, coordinates, and provides support for several open source projects. It has several dedicated teams of in-house developers in charge of major projects. For example, IBM's journaled file system technology, currently used in IBM enterprise servers, is an in-house development project managed by a small, core group of contributors known as the JFS core team. HP is hosting a number of open source software projects that run on various HP systems, including Handhelds.org, HP OfficeJet Linux Driver, and OpenSSI Clusters for Linux. Motorola's Metrowerks subsidiary acquired the assets of Linux tools and solutions vendor Embedix. Metrowerks draws on the Embedix assets to provide Linux-based app development tools and platforms for PDAs, smart handheld devices, residential gateways, and digital TVs. Nokia recently released the Nokia Developers Suite for J2ME which runs over Linux. Open Office is the best known open source project of Sun Microsystems. Darwin is the best known open source project by Apple Computer.