The Open Source Code movement: the Linux operating system

Marc van Wegberg  
Peter Berends

INTRODUCTION

Since 1991, a world-wide group of volunteer programmers has developed an operating system for desktop computers and servers. The program is called Linux, and is derived from the Unix operating system. Since 1998, Linux is somewhat of a hype as major computer manufacturers such as IBM begin to adopt this system. On some specific types of computers, it rivals the Microsoft Windows NT operating system in stability and performance.

Linux is one of the products that came out of a co-operative movement called the Open Source Code movement. Source code is the lines of text code that programmers write. It differs from the compiled code, which is the encoded version of the program that the computer understands. The Open Source Code movement publishes and distributes for free the source code that makes up a software program. This approach differs from commercial software that keeps the source code secret, and only distributes the compiled version of the code. By publishing the source code, the programmer invites others to scrutinise the program. Other programmers can correct mistakes, but they can also copy the original programmer’s smart ideas. The movement stimulates discussions about their programs. It actively encourages user feedback and solicits ideas for improvement. This seems an important factor in the stability of the program: publishing the source code allows users to detect bugs, and helps to identify solutions. The participants use the Internet for discussions, and for the distribution of the program. The increasing popularity of the Internet is one factor that stimulated the movement. Within the Open Source Code movement, Linux is the tip of the iceberg. Many other high quality programs are available as well. If you want some links on open source, you can begin your journey here: http://www.unimaas.nl/~mwegberg/opensour.htm
WHY WE STUDY THESE NETWORKS

It has come as a great surprise that volunteer programmers have been able to challenge professional software companies like Apple or Microsoft. This new type of network is only possible because of the Internet. It breaks down the barriers between suppliers and buyers by increasing the scope of user feedback from complaints to ideas and proposals. It introduces new commercial forms, such as software as a by-product of services or hardware.

Our research addresses the questions: what motivates people in the Open Source movement? How does this movement affect dynamics in the software industry? In the Open Source movement, the intellectual property right of a piece of code lies with the programmer(s) themselves, rather than with a commercial company. This stimulates user feedback, as it adds motives such as reputation building and play. Programming is also efficient, as programmers are free to use each other’s best ideas (as long as they are candid about their quotes). Users report bugs in (public) newsgroups, where programmers or other users suggest improvements. This combination of low cost and intensive user feedback stimulates the diffusion of this software. Commercial software developers, however, have more financial clout and more people working on new versions.

NETWORKS AND MARKETS

The Open Source movement is an extreme form of a networked, distributed, joint effort. A network, like a market, is a way to co-ordinate and to co-operate in (economic) activities. Characteristic for a network is that all participants make a contribution. In contrast, a market has a sharp distinction between contributors (suppliers) and users (buyers). Participants in a network can play various roles. For example one can co-ordinate activities, contribute technological, financial inputs, or merely use others (free riders). The contribution one makes to the network will affect one’s position in the network. The reputation a participant in a network builds up reflects this position. The prospect of a reputation may motivate members of a network to participate to its activities. In a relational perspective on networks, reputation may be the main stimulus for making costly contributions to the network. In a performance-oriented perspective, people contribute because they expect the network to deliver outputs that they need.

A network can stimulate entry of new and participation by established members by improving the ability to build reputation (a social perspective), by increasing the output of the network (a performance perspective), or by reducing the costs of making a contribution. The Internet has made the important contribution of very strongly reducing the latter costs. For Open Source networks involving user feedback, the Internet is a necessary condition of existence.
If a network has ways to recognise and acknowledge a partner's contribution, it facilitates the development of reputation, and thus will elicit more contributions. Is reputation an important motivator for people? The answer may be negative, in a society where individuals have lifelong employment relations with an employer. In a networked freelance economy, however, sometimes called an e-lance economy, individuals need to develop a reputation in order to attract customers (formerly known as employers) for their work (see Malone and Laubacher, 1999, for the e-lance economy).

Whether we now really witness the dawn of an e-lance economy remains to be seen. What is clearly true is that individuals own the means of production needed to participate in an e-lance economy. Unlike in manufacturing industries, information services need a production tool (a networked PC) that almost anyone can afford. The Internet serves as input in this system, as well as a low cost distribution and transport (of information products) system. The falling costs of hardware, software, content and networking underpin the ability of individuals to team up and create joint services. That the same instrument (a networked PC system) serves both in consumption and in production activities, may break down the traditional distinction in a market economy between supply and demand, or between production and consumption.

Networked e-lancers change the competitive environment for integrated organisations. One reason for an interest in the software market, is to see how the interaction between integrated organisations and groups of e-lancers plays out. On the one hand we have here the most advanced and experienced group of e-lancers, the Open Source movement. On the other hand, we have one of the best managed, wealthiest corporations in the world, Microsoft.

That in the Open Source movement users make contributions, has an interesting parallel with distributors such as supermarkets (Wal-Mart) and some retailers, such as Ikea. These companies sell cheap products and they expect buyers to do part of the work: bring the goods to the counter, transport them home, install the furniture themselves. The secret of this formula is that a little bit of self-help by a huge amount of users adds up to a massive cost saving by the supplier. What is new about the Open Source movement, is that it involves this self-help into the production process of the software.

In the early stage of our research, we are developing a model to simulate the dynamics of the Open Source movement and how it interacts with commercial programs.
A SIMULATION

We developed a simulation model to study the dynamic process that occurs if some characteristics of the Open Source movement are in place. The basic assumptions in our model are threefold:

- Users give feedback, which is so valuable, that it increases the quality of the software.
- The more experienced and talented the user is, the higher the quality of his feedback.
- Giving feedback provides a user with reputation. The need for reputation drives people to generate feedback. The better the Open Source movement or a commercial software supplier are in recognising feedback, to build up reputation, the more users have an incentive to give feedback.

In a brief setting as in this paper, it is difficult to explain the model in all details and results. We simulated the model using various parameter constellations. We look at two parameters in particular. One represents the extent to which a user of Open Source software is able to develop a reputation for high quality feedback. The other is the initial condition: which users pioneer the Open Source movement? We simulate with five users. Their only difference is in the talent for programming. In all simulations reported, user nr. 1 (with the lowest talent) starts with commercial software. There is also one initial user of Open Source software, who ranks second, third, etc., up to fifth (with increasing talent). The other three potential users, start without using a computer. This allows us to simulate market growth. We capture the initial condition by measuring the talent of the one pioneer user of Open Source software.

We find that an increase in pioneering talent tends to increase the long-term number of users of Open Source. In other words, the number of pioneers weighted with their talent determines diffusion. This illustrates the meritocratic approach of the open source. It is not the market share of Open Source software that determines its future viability, but its share among the talented users, that counts. We also find that the better the Open Source movement succeeds in building a reputation for talented users, the higher its long term diffusion tends to be. The Open Source movement harnesses the selfish motive of creating a reputation within a group to the task of developing software.

The model exhibits a kind of natural monopoly: after the initial rounds of the simulation, only one program survives. In one simulation, we focus on the effect of initial conditions. We look at the talent of the pioneer user of the Open Source software and at the initial investment in quality by the commercial rival. The Open Source approach tends to either fail completely or to dominate entirely (close to five users, where it covers the market completely). Why would the Open Source program benefit from users with a low talent? The reason is twofold. First, a large number of users with low talent and little relevant feedback can add up to significant overall
feedback. And, these low talented users have an indirect effect: they enlarge the network, which increases the reputation incentives for giving feedback. Hence the most talented users give more feedback, when they know that more people use the program. This feature of the model raises the question whether a niche approach, as for example sought by Apple for its Macintosh operating system, can be viable if user feedback is an important feature of the competition.

CONCLUSIONS

This simple model is an attempt to come to terms with the unexpected development of the Open Source movement. It highlights some features of this movement, in particular, that it is based on activities undertaken by the users themselves. Our model highlights one motive for these activities: to build up a reputation in a network of users. It seems relevant to explore other motives, such as political views, altruism, or gift exchange, where programmers help each other in a quid pro quo, etc. Another simplification in the model is that it is about competition between the Open Source movement and a commercial supplier of software. Recent events show that many companies try to co-operate with the Open Source movement. These companies want to find out the reason for the success of this movement, in order to integrate some parts of that in their business model.

REFERENCES