A Historical Analysis of the Emergence of Free Cooperative Software Production

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INTRODUCTION

Whatever its name, **Free/Libre or Open Source Software** (FLOSS), diffusion represents one of the main evolutions of the Information Technology (IT) industry in recent years. Operating System Linux, or Web server Apache (more than 60% market share on its market), database MySQL or PHP languages are some examples of broadly-used FLOSS programs. One of the most original characteristics of this movement is its collective, cooperative **software development** organization in which a growing number of firms is involved (some figures in Lakhani & Wolf (2005)). Of course, programs, because they are codified information, are quite easy to exchange, and make the **cooperation** easier than in other industries. But, as pointed out by Stallman (1998), if sharing pieces of software within firms was a dominant practice in the 1950's, it declined in the 1970's, and almost disappeared in the 1980's, before regaining and booming today.

This article aims at explaining the evolution (and the comeback) of a cooperative, non-market production.

In the first part, we explain the decrease of cooperation as a consequence of the evolution of the computer users, of their demand, and of the industrial organization constructed to meet this demand. This theoretical and historical framework is used in the second part to understand the renewal of a cooperative organization, the FLOSS phenomenon, first among computer-literate users, and then within the industry.

SOFTWARE IN THE HISTORY OF THE COMPUTER INDUSTRY

Among the few works of reference existing on the evolution of the **computer industry**, we use the following as our basis: Mowery (1996), Genthon (1995), and Dréan (1996). Richardson (1997) and Horn (2004) have analyzed the specificities of the software industry.

If these authors do not agree on the number of periods that this industry has gone through since its birth at the end of World War II, they agree on two main ruptures:

- The arrival of the IBM 360 series, in the early 1960's, opening the mainframe and mini period when, thanks to the implementation of an operating system, a standard machine could be sold to different clients, but also a program could be used on a family of computers, of different power, and not abandoned when the machine was obsolete; and
- The arrival of the PC, and specifically the IBM PC, in the early 1980's, when the computer became a personal information management tool, produced by different actors.

Each of these periods is characterized by a technology which has allowed firms to propose new products to new consumers, changing the dominant producer-user relations. This has had an impact on the degree of cooperation in the **software production**.

Period 1: The Industry of Prototypes – Start: Mid-1940's

As pointed out by Langlois and Mowery (1996), there was no real differentiation between hardware and software in that period, and computers were "unique" products, built for a unique project. They were computing tools, or research tools, for research centers (often military in nature, like H-bomb research centers). Each project allowed producers and users to negotiate the characteristics of the machine to be built. Also, the software part was not seen as an independent source of revenue by firms.

Production is Research

Thus, computer and software development were a research activity, conducted by high-skilled users, or Von Hippel (VH) users, in reference to Von Hippel's (1988) user who has the competences to innovate, and being the one who knows best his needs, is the best to do so (Dréan, 1996; Genthon, 1995).

Research is Cooperation

In that non-profit, research environment, we think that cooperation was rather natural, allowing firms to decrease their research costs and better answer to users' requirements. But this cooperation was mainly bilateral cooperation, between the constructor and the user. There was no network to exchange punch cards.

Period 2: Industrialization – Start: Early 1960's

Thanks to technological progress (miniaturization of transistors, compilers, and operating systems), the scope of use extended in two directions in that period: the reduction in size and in the price of computers. This raised the number of organizations that were able to afford a computer.

According to Genthon (1996), the main evolution characterizing the period was that the same program could be implemented in different computers (from the same family), allowing the program to evolve, to grow in size, and to serve a growing number of users. The computer had become a tool for centralized processing of information for organizations (statistics, payment of salaries, etc.).

The Emergence of a Software Industry

In this period, some pieces of software became strategic for producers, especially the operating system, which was the element allowing them to control the client. In fact, as a program was developed for and worked with one single operating system, it became difficult for a client to break the commercial relation, once initiated, with a producer.

In "exchange," this client no longer even needed to understand the hardware part of the machine and could clearly (increasingly, throughout the period) evaluate the cost of its investments in the software part. This client, increasingly companies, was also more and more reluctant to publish in-house developed programs, for competitive reasons, and because most of the time these programs were so specific that few contributions could be expected.

Increased Cooperation, but for R&D Only

So we can say that the cooperative and open source development of software, and especially of innovative software was very strong in universities (it was during this period that Unix BSD, TCP/IP Internet protocol, etc., were developed), but also in some private research centers, like the Bell Labs (which actually invented the Unix operating system and licensed it very liberally). But this diffusion did not extend beyond the area which Dasgupta and David (1994) called "open science."

Period 3: Specialization – Start: Late 1970's

With the arrival of the micro-processor, the scope of use extended again in two directions: increase in power, and reduction in size and price of low-end computers. The dominant technological concept of this period was that the same program can be packaged and distributed to different persons or organizations, in the same way as for other tangible goods.

The third period was that of personal but professional information processing. As explained by Mowery (1996), this period was dominated by economy of scope thanks to the distribution of standardized computers (PC), but principally because of the development of standardized programs.

Research and Innovation are Strategic Assets to be Valorized

The willingness to close software production and to sell it as product was reinforced, in industry as well as in universities:

- In industry, thanks to the adoption of copyright protection, allowing the closure of the source code, but also because of the growing demand for standard programs, as already explained, and the decreasing skills of PC users; they were unable to develop or to modify their programs, nor to be innovators, and thus unable to cooperate with the