

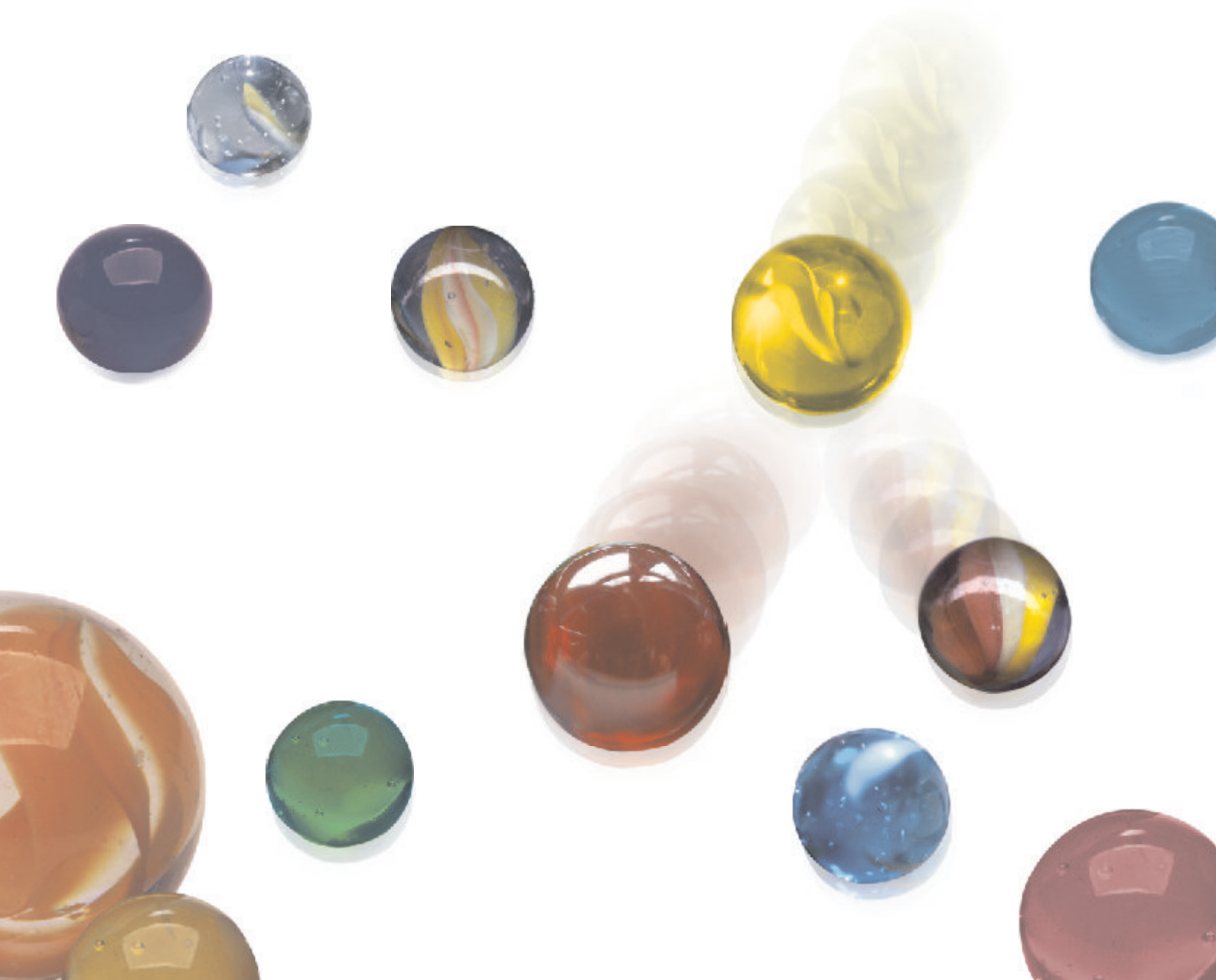
Ministério da  
Ciência e Tecnologia



UNICAMP



# Impact of the **Free Software and Open Source** on the Software Industry in Brazil







Impact of the  
**Free Software and Open Source**  
on the Software Industry in Brazil

**Impact of  
Free Software and Open Source (FS/OS)  
on the Software Industry in Brazil**

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# Presentation

The free software / open source software (FS/OS) model has drawn the interest of, and given rise to reflections from government, university, and corporate actors in Brazil and abroad. The rise of a self-organized, complex and virtual network of developers and users with varying motivations and of new forms of licensing software indicates that there are new variables in the software sector. Free software has become a strategic option for technological development that creates opportunities for social inclusion as discovered by a number of successful experiments in Brazil.

With the help of the Ministry of Science and Technology, Softex's Economic Observatory and UNICAMP's Scientific and Technological Policy Department conducted a study that sought to better understand the impact of free software in Brazil. Factors such as the scope of use, developer capability and particularly the impacts on software companies (technical capacity, business models, etc.) were studied.

The study results, which are presented here, constitute the largest study in the field of a single country conducted anywhere in the world. The main conclusions indicate that, although it is not a technological breakthrough, the FS/OS model introduces a new way of developing and licensing software, which is breaking the traditional models of appropriability and technological development.

The phenomenon of construction, interaction and generation of results within the various FS/OS communities is unprecedented in the software sector. In most of these communities, there are no formal ties in the participation and there seems to be an increasing generation of new communities and of the collective learning process.

The results of this study contradict certain myths about the FS/OS model in Brazil. The profile of Brazilian developers is similar to that of European developers. They are highly professionalized, with a predominance of qualified professionals: systems managers, network technicians, entrepreneurs, researchers, and college students. Among development companies, however, small companies prevail, but larger companies have already adopted this model as well.

The profile of users is quite different. Large organizations prevail, highlighted by the communication and information technology sectors, government, commerce, and education. Their main motivations are economic (cost reduction) and technical (development of new skills).

The market for FS/OS-based operating systems in Brazil is estimated to have a minimum volume of R\$ 77 million, considering only the sale of Linux distributions and related services, with potential to grow 2.5 to 3 times by 2008. Since the model is strongly associated with the services, there are many marketed services that could not be calculated due to the non-availability of statistics on the FS/OS model in Brazil. In addition, there is no methodology or statistics available to measure the Linux market for embedded software.

From the perspective of competitive characteristics, FS/OS is a strong threat to the package model (platforms and operating systems), software components (when the emphasis is on use as a product) and customizable products, precisely because appropriability (keeping codes closed) is an essential competitive factor for these models. In relation to the models for services and embedded software, since they have greater specificity and appropriability is less important because of closed codes, present greater investment opportunities. The study shows how FS/OS accelerates the transition of the software industry from products to services.

FS/OS is becoming professional in Brazil, and is beginning to move from the industry's periphery towards its center. Resulting from an opposition to the industry's most powerful proprietary markets (Unix, Windows, Office), FS/OS has revealed all its political, institutional, and emotional appeal. This appeal has drawn the attention of many people. They include those who had (and have) as a philosophy a free mind contrary to the restrictive appropriation of knowledge, to those who see an opportunity to knock down the biggest and best known giant of the software industry. They even include people at large corporations who saw (and see) in FS/OS an enormous opportunity to get rid of an inconvenient monopoly that restricts their business. There are a variety of often antagonistic interests in FS/OS as it is presented throughout this work, which is worthwhile reading for all who study this sector.

The free software wave is circling the world. Let's welcome it to Brazil.

**Arthur Pereira Nunes**



# Introduction

This document presents the results of the study The Impact of Free Software and Open Source (FS/OS) on Brazil's Software Industry, performed by Softex's Economic Observatory in partnership with Unicamp's Scientific and Technological Policy Department, with the support of the Ministry of Science and Technology (MCT). The purpose of this study was to carry out a preliminary survey of the technical and economic organization of the use of free software and open source (FS/OS) in Brazil. Integral to this objective was: an identification of the main markets and business models related to FS/OS; a survey of FS/OS capabilities within the country (developers, specialized companies, etc.); consumer and user survey; identification of the appropriability conditions involved in FS/OS; and other supplementary assets which are essential for FS/OS development and use.

The four principal sources of information surveyed by the study included:

- a) a panel of specialists;
- b) an electronic survey with 3,657 respondents (the largest performed in a single country);
- c) a series of interviews with people at companies developing and using free software and open source (FS/OS); and
- d) an exhaustive survey of secondary information on companies engaged in FS/OS in Brazil.

Based on these sources, the study presents the greatest accumulation of information on the FS/OS theme performed in Brazil to date. The text below has the following structure:

**Chapter 1, FS/OS The General picture:** presents an understanding of what FS/OS is all about and how it is organized, as well as the trends developing nationally and internationally, the appropriability instruments (license types and appropriability modes), the communities and their basic characteristics, in addition to the general implications for the software industry's economic organization.

**Chapter 2, Developer profile:** identifies and analyzes the social, economic, and technical profile of developers (individuals and companies), including their fields of operation and entrepreneurial profile.

**Chapter 3, User's profile:** identifies and analyzes the technical and socioeconomic profile of users, including individuals, entrepreneurs and companies.

**Chapter 4, FS/OS Economic dimensions: motivations, sectors, and business models:** presents the motivations of the different parties involved with FS/OS in Brazil; the economic sectors and the application areas where there is greater intensity in the development and use of FS/OS; and in conclusion focuses on the business models related to FS/OS, and analyzes the implications for the software industry. This chapter presents an estimate of the Linux market in Brazil in late 2004.

Finally, the **conclusion** reconsiders issues raised throughout the study and discusses the importance of policy issues and their importance in promoting FS/OS in Brazil.

# Chapter 1

## FS/OS The General picture

Free software and open source (FS/OS) are the latest and most interesting phenomenon on the computing scene (which go beyond the field's borders), generating interest like that found in the early days of the commercial Internet. The free software concept appeared in 1983<sup>1</sup> and recently has received greater publicity. Its evolution over 20 years has allowed FSOS to move forward in several aspects including: technical, political, strategic, their suitability to users' needs, quality and security. This evolution results from a heterogeneous set of events, players, and perspectives. Actually, it is an evolutionary process the paths of which are still being traced and which are closely inter-related in a collective process. Large working communities have been created, in which there is an engagement around a common domain and in some instances, a socialization of knowledge and practices<sup>2</sup> take place. These dynamics involve the development of software (and related material such as documentation), and the dissemination, encouragement, and support for the use of FS/OS, and establish an entrepreneurial vision and practice that sees FS/OS as an important growth option.

The FS/OS principles are grounded on the basic premises of freedom of expression, access to information, and an eminently collective nature of knowledge, which should be built and made available democratically and not be privatized. Software, within the FS/OS model, is just one more way of representing or organizing knowledge and is therefore, a common asset. As such, its dissemination and use should be free. In order for these principles to be actually observed, there are a few requirements, including that users have access to a program's source code and freedoms involving its use.

In short, FS/OS is understood as all software which offers the user – by means of its licensing scheme<sup>3</sup> – the ability to use, reproduce, modify and redistribute its source codes. It is also important to point out that the software development and distribution model are characteristics which distinguish free software from proprietary software. These particularities will be duly addressed throughout this document.

Two designations coexist with this basic definition: *free software* and *open source*. These designations contain similarities and differences. Both of them signify substantive changes in the software industry, from the point of view of the end user, software developer, or other related agents.

The expression **free software** and **open source** (FS/OS) is used in this study in order to define the range of nonproprietary products and services which were surveyed. According to the literature and even the practice, free software (FS) and open source software (OS) are distinct, or at least identifiable categories, even though they are an integral part of the same theme: the production and use of nonproprietary software. In fact, the most common doubt is not precisely around the meaning of these two categories, but around the gratuity or

---

<sup>1</sup> Actually, software began free and was quickly transformed into a proprietary business.

<sup>2</sup> Etienne C. Wenger in 1991 (Lave et al, 1991) coined the term "practice communities", defining them as groups of people who share an interest and get together to develop knowledge in such a way as to create a practice around this topic. These communities are not bound to hierarchic or institutional structures. The fact that they have flexible borders (affiliation is open) differentiates them from a typical functional unit of a company, and gives potential to the learning opportunities in concrete situations.

<sup>3</sup> Legally, the manner in which the user can "relate" to a software is defined by means of a use license which is written, defined, and chosen by the software producer and which should be accepted and respected by the user. The Brazilian legislation about the subject is Law No. 9609, dated 2/19/1998, articles 9 and 10, for Computer Program Registration.



not of the product or service.<sup>4</sup> Free software as well as open source software are assets which may, or may not, be given monetary value and traded in the markets, depending on the situation. Therefore, free software is not about gratuity, but about freedom. A freedom that is basically defined as the ability to modify, reproduce, and use freely, as long as this does not restrict the use and the use capacity of another person. In the words of R. Stallman, in his GNU<sup>5</sup> manifest:

*“GNU is not in the public domain. Everyone will be permitted to modify and redistribute GNU, but no distributor will be allowed to restrict its further redistribution. That is to say, proprietary modifications will not be allowed. I want to make sure that all versions of GNU remain free” (Stallman, 1985).*

The idea that FS/OS is not under public domain (because what is under public domain can be transformed and appropriated and, therefore, the author’s rights are not valid) is an important differentiation that has led to the creation of an entire category of licenses. It is necessary to ensure that the product and knowledge developed under the aegis of FS will not be appropriated. Therefore, the information is created developed freely. In sum, there are four categories of freedom to be preserved (Augusto, 2003; Barahona *et al*, 2003):

- freedom to run the program for any purpose, from anywhere and at any time;
- freedom to study how the program operates and to adapt it to the needs of whomever studies it;
- freedom to distribute copies;
- freedom to improve the program and publish the improvements.

A program is regarded to be “free” if users are granted all these freedoms<sup>6</sup>. Otherwise, it may, at most, be an open source software.

The GNU is an example of the competitiveness of software market. Without breaching rights<sup>7</sup> and without violating legislation, an institutional path of the industry organization was changed and a parallel path, similar in its technological and technical principles, but different in its organization, was instituted. The Cathedral and Bazaar forms of development, described by Eric Raymond (Raymond, 2001), are actually different organizational models: one, hierarchic, controlled inside the company or the project; the other, nonhierarchical, conducted by the FS communities. Each has its own rules and “codes” of conduct: one is based on proprietary gains, the other on collective use and work.

This is the essence of FS. Its origin has ideological motivations (Stallman’s Manifesto and various interviews and papers substantiate this), it substantially changes the conditions in which a computer program can be developed and, moreover, used.

The development of FS over the past twenty years has taken several directions, but its greatest practical expression was and still is Linux, an operating system which competes with the world’s best known proprietary operating systems such as Windows, Windows Server, Unix, Novell, and mainframe systems (FIESP / CIESP and FEA/USP, 2004). For this reason, an understanding of Linux is very important for an understanding of the economic dimension of FS. In Eric Raymond’s words, “Linux is subversive”. This is true in several ways. Linux

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<sup>4</sup> As seen in the first chapter, the movement was initially designated as Free Software, but the dubiousness of the term “free” led Eric Raymond and Bruce Perens in 1998 to found the open source software movement, which essentially incorporates the same free software license practices, but attempted to emphasize more the practical benefits of these licenses than the ideological principles in order to increase the acceptance of open source software by software companies (von Hippel and von Krogh, 2003; Hertel *et al*, 2003).

<sup>5</sup> GNU means “GNU is not Unix”, a play on the recursive characteristic of the programming.

<sup>6</sup> <http://www.gnu.org/philosophy>

<sup>7</sup> This is not exactly consensual as there are several lawsuits (Linux x Unix) and threats against Linux for supposedly having violated dozens of Microsoft’s patents.

has changed the basic technical and economic conditions of the software industry, beginning with pricing and industrial organization (the market structures and business models related to the industry).

In principle, the term **open source** is a category which only emphasizes the opening of the program codes. It would be, therefore, a concept different from the FS, because the principles of freedom would not necessarily be observed. However, there are authors who use the term OS as a synonym for FS, making no categorical distinction between them (European Commission, 2000).

An OS license granted by the Open Source Initiative – OSI<sup>8</sup>, includes the following principles are involved:

1. free distribution, without payment of royalties or similar fees;
2. the source code should always be open;
3. changes and the realization of derived projects are possible;
4. the integrity of the source code's author is guaranteed;
5. there is no discrimination against people or groups;
6. there is no discrimination of fields of knowledge, sectors, activities;
7. license rights can be redistributed without the need for additional licenses by the parties;
8. a license should be associated with a specific product;
9. a license cannot restrict other software which is jointly disclosed.

In short, one might say that there is a conceptual difference between FS and OS, even though both are dedicated to developing open source programs, collectively, and to providing free use of these programs. The OSI principles are quite similar to those recognized by the General Public License (GPL), except for the fact that they emphasize copyrights and do not restrict, in the end, the closing of the code for proprietary use. This may be the primary difference between FS and OS. In any case, there is a series of program development activities which are organized in the same way, either as FS or OS. This form is what Raymond (2001) appropriately called Bazaar: horizontal, collective and cooperative, based on the FS communities.

The only possible conclusion is that there is no consensus about the philosophy and implications as to how developers and users act. It is possible, however, to maintain (based on the literature and by the statements of those interviewed) that the notion of FS is more ideological than that of OS, and the later this encompasses a larger group of people (nearly all those who think that the working method is similar, plus those who emphasize the differences and who occasionally work for OS projects), probably because it is less radical in its propositions, and permits making profit from the open development advantages without losing some possible incentives related to copyrights and future proprietary uses.

The perception of one category or another is actually a result of the positioning by the development communities. From the users point of view, particularly those major corporations which use Linux, the distinction is perceived but is not important in the decision making process, except to be able to locate oneself within the communities.

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<sup>8</sup> <http://www.opensource.org/docs/definition.php>, cited by Arroyo et al (2004).



The terms free software and open source code, in this study, will be used indistinctively for simplification purposes, and grouped under the term FS/OS<sup>9</sup>. When necessary to distinguish between them, the required highlight will be given. The main difference between these designations, as said depends on an individual perspective. While the idea of free software is more closely related to issues concerning warranty and perpetuation of the freedoms mentioned above, those related to open source are more closely tied to issues concerning production and business practices, such as the agility of software development through open communities.

If a developer wishes to create new software using portions of software originally presented with an open source license, he may - at his sole discretion - use any other license, including one not granting any of those original rights (freedom to use, copy, modify, and redistribute). This is what is traditionally called "closing" the code.

This situation should not occur if the software has been originally presented with a free software license (such as the General Public License - GPL), since the rights originally granted to the users should, supposedly, be extended to all the new versions and derived works created from that original, theoretically preventing the code from being "closed". We say theoretically because nothing prevents the author from deciding, at some point, to place the development under another less restrictive license than that initially registered. The copyright always prevails, at least on the legal sphere, over the many types of licenses which are used today in FS/OS.

## 1.1 Development model of FS/OS and their communities

The development of (proprietary) software is traditionally performed by groups of developers in a company or companies contracted for this purpose, under agreements to prevent the disclosure and use of information related to the product under development. Everything is involved in industrial secrecy and intellectual property issues (copyright), and the information related to the software production is regarded as a very important asset of the proprietary organization.

FS/OS allows innovative **software development models** to appear, through the cooperation of a developer network. These models are substantially different from the practices established by traditional software engineering. The Internet was (and is) a key point to this change as it has provided for a huge expansion of this form of work organization, allowing simple and versatile networks to be created, with participants from all around the world and, concurrently, distributing know-how, best practices and responsibilities to all participants of these networks, whether they are developers, translators or mere users, who cooperate with suggestions for improvement and by reporting bugs. However, these networks may be more or less "free". They can be complex systems which self-organize or can be hierarchical systems, with diversified access levels and rules.

For example, the development of the Linux kernel<sup>10</sup> explored, in principle, a decentralized and collective form of development project, which is largely made feasible by the Internet. Linux's original author, Linus Torvalds, maintained control over the operating system project, but opened the process in such a way that others could follow his work and progress and, above all, could contribute to identifying and solving problems. The Linux development, by this process, became the result of a collective learning environment, in which the leader's strategic task was to pronounce the final word about any possible disputes, while encouraging, facilitating and keeping the flow of ideas, knowledge, experiences, etc. (Molina, 2003).

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<sup>9</sup> In other countries, however, the preferred term in order to join both concepts is "open source software", which is frequently abbreviated to OSS.

<sup>10</sup> The kernel is the central core of the GNU/Linux operating system, one of the most successful current examples of free software, both from the perspective of product as well as development process, which ensure a constant and coordinated evolution. We will return to this point in other chapters of this work, especially in Chapter 4.

As these practices became generalized, the implications for software development were remarkable: the Internet became the environment for project development, and all those who can and wish to cooperate could do so through a collective process with a number of ways to cooperate (programming, fault indication, suggestions for improvement, translation, documentation, advertising, or even financially). These are heterogeneous and weakly related collectives (only a common motivation joins them: the development of a specific software), usually without any formal contracts or employment links with software development companies or organizations. These collectives are traditionally called a software development **community**.<sup>11</sup>

Software development, under these conditions, requires the action of the project leader(s), in general the person(s) with most experience in the field, who decide(s) which collaborations will be incorporated into the next software version, and the project priorities and directions, by listening to the community forming around the project. Clear examples of this governance model (with specific variations) are the Apache ([www.apache.org](http://www.apache.org)), and the Linux kernel ([kernel.org](http://kernel.org)) development communities. The organization of most of the free software development projects is based on the merits of those participating in that community. The concept of merit may change from community to community, but in general involves issues such as quantity and quality of contributed code, suggestions, and active participation as well as coherence and constructive opinions at debates on the project directions. This governance manner, when prevailing, is essentially based on merit, but also has security and strategic criteria.

This development model also allows many individuals and companies to be able to cooperate in order to create a software which none of them would be able to develop individually, due to its complexity and cost. Therefore, it is a form of organization benefits from economies of scope and scale. It allows for quick fault correction and enhanced security, because the source code can be publicly inspected and this causes it to be exposed to critical evaluations because there are many people who can cooperate with the correction of detected faults. Another interesting characteristic is the possibility for making specific changes according to the individual needs of each user, generating several customized versions which perfectly meet each characteristic demanded for.

The development model also favors the possibility of splitting a project: in case there is no agreement as to the directions a given project should follow (that is, if a group of people or even one person who takes part in the development disagrees with the directions defined by the leader(s)), it is always possible to start a new project, with new priorities and directions, making use of the entire code already developed in the original project, starting from the exact point where a dispute<sup>12</sup> occurred, while the original project follows its defined guidelines.

Currently, the organizational format of the work related to the software development has attracted great interest among researchers from several areas, from law to political science and, of course, economics. The term *commons-based peer-production* has already been used in order to define this production mode. Yochai Benkler (Benkler, 2002), who coined the term, characterizes this FS/OS development model as a more visible example of a new socioeconomic phenomenon that defines a third production mode, which is more appropriate for the networked digital environment. According to the author, this new production mode differs from traditional models based on property (companies) and on agreements (markets), as its core characteristic is that of individual groups who cooperate on major projects, for various motivations and social signaling, instead of market prices and hierarchic/managerial command, which are typical of the other production modes.

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<sup>11</sup> As we will see below, there are more or less professionalized communities. For example, that for the development of the Linux kernel is now completely hierarchical, coordinated, and its closest members are software professionals.

<sup>12</sup> This situation is known as “fork” in a development program. It is a relatively common phenomenon. Forks can also occur when a group with specific needs decide to start a project using a greater part of the code from a project already in progress, but which has other objectives (for example, a group that wants to create a support system for distance education and which begins its project by working with the generic code for site content management).



J. Bradford DeLong,<sup>13</sup> professor of economy at the University of California, Berkley, emphasizes the birth – within the heart of the FS/OS development communities - of a new mode of social organization that is different from the three conventional social engineering tools he recognizes to be used by humanity to organize the large scale division of labor: markets, hierarchies, and charisma.<sup>14</sup>

### Communities and cooperation

The term “community”, as used above, is actually applied in different contexts to different groups of people, with a greater or lesser granularity. For example, it is applicable - in a general context - to the entire collective of people who relate to FS/OS, who understand not only a project or a theme, but the participants of all communities which are somehow linked to the development, use, dissemination or support of FS/OS. These communities can, for example, be user groups, developer groups, mixed groups, technical debate groups, political debate groups, organization and articulation groups or groups which use and or develop software in common. Figure 1 helps illustrate these arrangements, and seeks to represent the involvement of various authors in a project.

This last group is what is more commonly defined as a community: those forming around a software or software development project. Typical examples are the Mozilla<sup>15</sup> community, the Mambo<sup>16</sup> community and others, which gather developers, users, and participants to debate and improve a particular tool. These communities can also be subdivided into others that are more specific, such as a developer subcommunity (which handles technical development issues and directs the problem resolution), and a support subcommunity (which offers help to users who are beginning or facing difficulties to use a given feature of a particular software). The communities are a remarkable characteristic of most FS/OS development projects. The more the projects stand out, the larger the communities that form around them. Although the developers play a core role in these projects, soon the software users are added, and they also contribute in one way or another to their evolution. In software, as is well known, learning by using is absolutely critical, either for the discovery of bugs or for the suggestion of improvements. There are also the non-active users who seldom participate in the debates about software, which places them in an isolated position in the community, but even so they are regarded as participants (they are counted in user statistics, for example).

Other collaborators also join the communities such as translators, investors, graphic artists (who contribute with icons, layouts, usability studies) and book editors.

An essential factor for the existence of these communities is the ease of communication provided by the Internet, which allows the interaction, cooperation, and even competition among members.

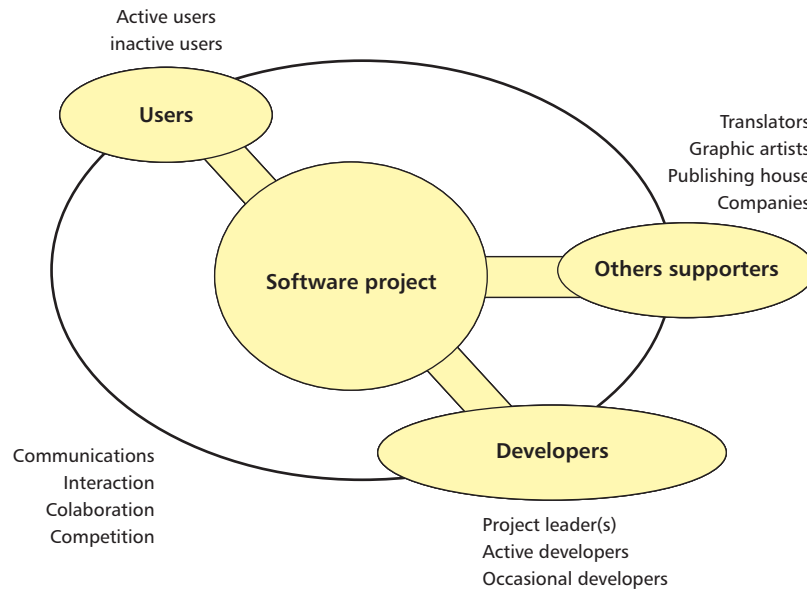
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<sup>13</sup> Cited by Imre Simon (2004) at [www.ime.usp.br/~is/Benkler/cbpp.html](http://www.ime.usp.br/~is/Benkler/cbpp.html)

<sup>14</sup> However, from an economic perspective, one may attribute “charisma to the attributes of uncertainty, opportunism, and frequency usually associated with contractual decisions (do or seek outside).

<sup>15</sup> [www.mozilla.org](http://www.mozilla.org)

<sup>16</sup> [www.mamboserver.com](http://www.mamboserver.com), [www.mamboforge.net](http://www.mamboforge.net)



**Figure 1** – Schematic representation of the communities and subcommunities relating to FS/OS

Cooperation has become increasingly rich, as appropriate tools for each activity have been created and improved: distributed systems for software version control and bug tracking and control systems are two examples of developer tools, while discussion lists, forums and chat groups, websites and others are used both by developers and users. Large communities often promote regional, national or even international on-site gatherings as well.

There are also those communities which organize themselves around debate themes related to relevant issues at the heart of the other FS/OS communities. These are heterogeneous groups involving users, developers and policy makers, who may discuss FS/OS use issues, strategic-political disclosure, dissemination, and articulation.

### Brazilian communities

Some characteristics referring to the Brazilian free software development communities were identified in a recent study (Reis, 2003). The profile of the Brazilian communities evaluated is that of small groups, with an average of five individuals who are both developers and users of the software around which they organize themselves. There are quite frequently participants with more than five years experience in these communities, which represents a strong base from which a project can progress. The following are some examples of Brazilian software development communities:

- **OpenOffice**<sup>17</sup>: A community dedicated to localizing to Brazilian Portuguese and conducting the supplementary development (dedicated to the Brazilian user) of the ensemble of office tools. OpenOffice.org
- **Mozilla**<sup>18</sup>: A community of users, developers and those interested in Mozilla for Brazil. In addition to the translation of the applications, the focus is on promotion and providing support to Brazilian users.

<sup>17</sup> <http://openoffice.org.br>

<sup>18</sup> <http://mozilla.org.br>



- **MonoBASIC**<sup>19</sup>: A development community which proposes to create a free compiler for the VisualBasic. Net language, integrated with the Mono project.
- **Care2xBrasil**<sup>20</sup>: An integrated application system for the healthcare area.

There are various other Brazilian software development projects around which communities are formed (some of users, other of developers). The best known projects, according to a study conducted by the website [br-linux.org](http://br-linux.org), in 2003<sup>21</sup>, are the **Kurumin** (distribution of easy-to-use Linux), **WindowMaker** (graphic environment), **txt2tags**, **rau-tu**, **dsearch**, **brazil**, **slackpkg** and **sarg**.

There is also a profusion of thematic communities in Brazil, the scope of which varies a great deal from small local groups to large national groups. Good examples are the various communities entitled **Free Software Project** (FSP or PSL in Portuguese), which include state FSPs (for example PSL-SC, PSL-RJ, PSL-BA) and thematic FSPs (FSP-Women, FSP-Legal, etc.), in addition to FSP-Brazil which, in theory, combines the entire Brazilian free software community interested in debating strategic issues and organizing nationwide on behalf of FS/OS.

Information communities in which there is an intense exchange of information, contents, tips, etc. are also quite common in Brazil. Good examples are the website [br-Linux.org](http://br-Linux.org) and the list **Dicas-L**<sup>22</sup>.

## 1.2 Licenses

The distribution and use of FS/OS is based on licenses in the same way as proprietary software. A software user should agree with and accept the software's license in order to use the codes contained therein. These licenses have the power of a contract, in which the user undertakes to respect the rules proposed by the software owner and can be sued in case he fails to observe them (this does not make it illegal, unless the user violates copyright laws, or a license associated with patents). The rules defined in these use licenses are those which define whether a software is regarded as free, open source or non-free (proprietary). As already mentioned, FS/OS licenses authorize any user to utilize, copy, modify, and distribute the software according to certain rules. Proprietary software licenses usually allow the user to use the software only in keeping with the rules set by the software owner (in general, the distribution or development company), its reproduction, multiple installation, alteration, assignment, resale, or redistribution is forbidden without paying an additional fee.

Some FS/OS licenses have received many comments, but the information is not always clear or precise. The most commonly used free software license is that kept by the Free Software Foundation - FSF (GNU project), called **GNU General Public License** (GNU GPL), which defines the freedoms of a software user to: unrestricted use, adapt to private use, redistribute copies, implement improvements, and disseminate the improvements. There are many other FS/OS licenses such as the **Revised BSD** (Berkeley Software Distribution) or the **MPL** (Mozilla Public License).

Enhanced with the GPL license, FSF created the **copyleft** concept, which is a way of ensuring that a free software and all software derived from the original always continues to be free<sup>23</sup>. **Copyleft** is a feature based on the legal concepts of copyright, through which an author's rights are preserved, but the commercial (copy)

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<sup>19</sup> <http://monobasic.sl.org.br>

<sup>20</sup> <http://care2xbr.codigolivre.org.br/>

<sup>21</sup> <http://brLinux.Linuxsecurity.com.br/noticias/001434.html#001434>

<sup>22</sup> <http://www.dicas-l.unicamp.br>

<sup>23</sup> <http://www.fsf.org/licenses/licenses.htm>

rights are released, provided that this rule is kept for all future users. It is worth pointing out that not all FS/OS licenses impose a **copyleft**.

The GNU GPL license has become a reference for the FS/OS movement. According to Taurion (2004), "it is a license that maintains a source code's freedom, preventing a company from taking possession of the free source and marketing it in a proprietary way". Any change made in software that was released under a GPL license should have the same license (called the contamination effect), ensuring that the new software is also made public so that the community that has already cooperated with the original version is also able to enjoy the improvements. The following are other examples of licenses:<sup>24</sup>

- **LGPL (Lesser General Public License):** Version of the GPL with a relaxed copyleft, since it allows a LGPL code to be coupled with another code that is not (as long as certain conditions are observed).
- **BSD (Berkeley System Distribution):** Is a plain license which imposes no restrictions on the use, modification, and redistribution. It does not adhere to the copyleft concept, but to that which may confer any purpose on the software, including to associate the original free source with a non-free source in order to create a proprietary software.
- **MPL (Mozilla Public License):** Is a license which imposes copyleft only for original portions of the code, differentiating the existing code licensed by the MPL from the new code, which does not necessarily need to follow the same license (and can even be proprietary).

Figure 2 represents the possible evolution in software licensing from the decision of the original developer to apply a GNU GPL license or a BSD type license. The implications of this decision are inherently associated with the adherence to the copyleft principle or not.

The choice of the license to be used is, in many cases, a decision made by the author. He may choose one of the known licenses or write the terms of a specific license. If, however, the developer resorts to the already available code, he may have to adapt to the rules defined by the licensing of the code being used. For example, if the developer uses a code on his software under the GPL, theoretically he should adopt the same license for its code. However, the developer – as the author - may subsequently give any disposition he wants to the code he developed, the copyright prevailing (situation represented by the descending vertical assets in Figure 2). If, for example, the code used is under a BSD license, the developer may decide to use any license (including GPL and BSD, or even write his own license). If, on the other hand, he uses a proprietary code he cannot release his code under a free license unless he retains the material ownership of that code (ascending vertical asset in Figure 2).

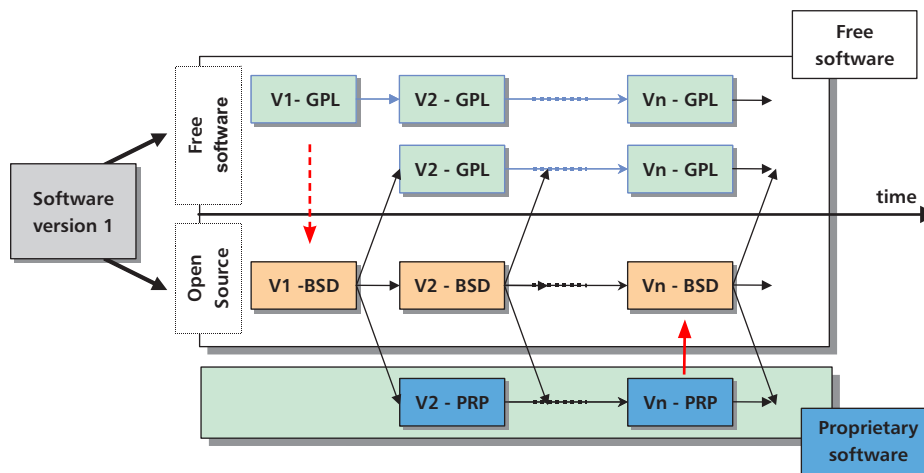
It is appropriate to also point out the possibility for dual licensing, that is, the same source code can be released by the author under two (or more) separate licenses depending on the situation and the user's interest. This is the case with the MySQL database system (from company MySQL AB), which presents a free license (compatible with GNU GPL) in order to be used on projects of other free software and license said to be commercial, which allows the product to be incorporated into non-free products. In the latter case, the licensing scheme works as that for proprietary software, with payment per product copy, and is suitable for companies wishing to develop software using MySQL, but which does not want to release its own code with a GPL or compatible license (what would be an obligation for this company since, by incorporating the code into another one which is under the GPL, the new code should also be presented under this license). Another example of dual licensing is that adopted by the Sun company for the OpenOffice.org software, which is available under a LGPL

<sup>24</sup> OSI (Open Source Initiative) registered 54 licenses recognized as compatible with the Open Source Definition (in November 2004). Check [www.opensource.org](http://www.opensource.org). The FSF also comments on dozens of software licenses, free or not, copyleft or not, and makes a comparison and evaluation of "compatibility" with the GNU GPL, at [www.fsf.org/licenses/license-list.html](http://www.fsf.org/licenses/license-list.html).



and under a **SISSL** (Sun Industry Standards Source License), which is also a free software license, but different from the GPL.

The issue related to the FS/OS licenses, specifically in Brazil, is still a subject not well known to users and even to many developers. The Creative Commons<sup>25</sup> organization, in cooperation with the Getúlio Vargas Foundation Law School, recently published the **CC-GNU GPL** license in Portuguese, as the first result of a cooperative effort to support the dissemination of the licenses defined by that organization in Brazil<sup>26</sup>. In the same spirit, the law office of Kaminski, Cerdeira, e Pessler Advogados, in cooperation with the organization Open Source Initiative (OSI<sup>27</sup>), initiated a cooperative project for the translation into Portuguese (and according to Brazilian law) of the licenses certified by the OSI as compatible with the **"Open Source Definition"**<sup>28</sup>.



**Figure 2** - Possible licensing evolutions for free software and proprietary software

Chart 1 presents some interesting facts related to companies "approaching" FS/OS. They are actions that may be an indication, on an international level, of the movements by major companies towards approaching, adapting and, if possible, appropriating the knowledge and the characteristic processes of the FS/OS dynamics, while these movements bring FS/OS closer to the business world and the largest cities.

On another scale, one can also notice a movement in this direction: the adoption of FS/OS by companies using information and communications technologies (ICTs) as a way to reduce costs. The tactic is to use and benefit from the advantages with little "retribution" to the FS/OS communities for that which is internally developed, in order to solve specific problems, eliminate faults in the software, etc. This is also how FS/OS is used by many software development companies: they use free development platforms (e.g. compilers and the operating system itself) which are useful and, in general, free, to create their own products which, however, are not free. These issues will be better analyzed in the chapter referring to the motivations and business models associated with FS/OS.

The next chapter will present the results of the research about the profile of developers and users. Both individuals and companies are analyzed in this chapter and compared with other international surveys.

<sup>25</sup> [www.creativecommons.org](http://www.creativecommons.org)

<sup>26</sup> This license is recognized and disclosed by the federal government ([www.softwarelivre.gov.br/Licencas/](http://www.softwarelivre.gov.br/Licencas/))

<sup>27</sup> [www.opensource.org](http://www.opensource.org)

<sup>28</sup> Available at [www.opensource.org/docs/definition.php](http://www.opensource.org/docs/definition.php), the Open Source Definition specifies the minimum requirements a software license should observe for the software licensed to be regarded as open source software.

**Chart 1** - Important facts in the history of the approach between FS/OS and the companies

<b>Period</b>	<b>Relevant fact</b>
1998	Investments by Intel <sup>29</sup> in Red Hat <sup>30</sup>
1999	Red Hat shares traded publicly
1999	IBM <sup>31</sup> announces the GNU/Linux adoption strategy
2000	IBM announces a US\$1 billion investment to make software and hardware compatible with Linux, and allocates 250 engineers to work with the FS/OS communities.
2000	Sun Microsystems <sup>32</sup> announces the licensing of OpenOffice LGPL (maintaining a double license with SISSL).
2000-04	The web Apache <sup>33</sup> server widely dominates the market.
2000-04	GNU/Linux starts to be widely used in consumer electronics: Sony Playstation <sup>34</sup> and TiVO <sup>35</sup>
2004	Novell <sup>36</sup> acquires Ximian <sup>37</sup> and Suse <sup>38</sup>

Source: Adapted from Molina (2003)

<sup>29</sup> [www.intel.com](http://www.intel.com)

<sup>30</sup> [www.redhat.com](http://www.redhat.com)

<sup>31</sup> [www.ibm.com](http://www.ibm.com)

<sup>32</sup> [www.sun.com](http://www.sun.com)

<sup>33</sup> [www.apache.org](http://www.apache.org)

<sup>34</sup> [www.playstation.com](http://www.playstation.com)

<sup>35</sup> [www.tivo.com](http://www.tivo.com)

<sup>36</sup> [www.novell.com](http://www.novell.com)

<sup>37</sup> [www.ximian.com](http://www.ximian.com), company developing software for GNU/Linux, which is highly successful for its quality.

<sup>38</sup> [www.suse.com](http://www.suse.com), a company which created an outstanding GNU/Linux distribution.



## Chapter 2

# Developer profile

This chapter describes FS/OS developers in Brazil. The first part presents a profile of **individual developers**. The second part, presents the **development companies**.

Generally speaking, one might say there are various myths about the people and institutions responsible for the FS/OS phenomenon, partly due to their renegade origin. So, in order to understand this phenomenon it is necessary to note that the profile of developers, both individuals and companies, has changed in the last 5 years, especially with the entry of major players as indicated by the establishment of the **Open Source Developer Labs** (OSDL), which is a nonprofit organization funded by corporations such as IBM, Intel, Hewlett-Packard and CA, specifically to develop Linux for large-scale production environments.<sup>39</sup> In the beginning of the free software movement the typical profile - in the words of **Andrew Morton** (responsible for maintaining the stable form of the Linux kernel) - was that of a PC “geek” programming in his basement ‘simply for love’. But in the last few years, Morton says, most of the Linux code has been generated by professional programmers, employees of corporations such as IBM, Red Hat and SGI, within regular working hours.

One might say that, in addition to this change, the development process in major FS/OS projects is quite hierarchical since a few developers (called the ‘**core group**’ and recognized by their peers ) are responsible for most of the code, while a much larger number of developers offer just a few contributions, most of them error and problem reports (bugs) (Lerner and Tirole, 2002, p. 2006). The concentration also takes place in geographic terms, according to Morton, since the **Linux core group** consists mainly of developers from the USA, Europe and Australia. There is an increasing involvement of countries from Eastern Europe, but the participation of Asia and Latin America remains small (Jackson, 2004).

This table is related to the emergence of the **open source** software movement as a complement to that of **free software**. As already seen, the wide dissemination of Linux attracted a high percentage of commercial investment in the OS projects, and companies dedicated to providing Linux with support were established, the pioneers being **VA Linux**, established in 1993 and **Red Hat**, established in 1995 (Lerner and Tirole, 2002). Red Hat became a large company and is considered the leading worldwide distributor of Linux. Similarly, other smaller companies working with FS/OS appeared, either in development or related services. In Brazil, the company Conectiva - which has a Linux distribution and provides services<sup>40</sup> – can be mentioned.

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<sup>39</sup> Among other activities, the OSDL is responsible for paying for the work of Linus Torvalds, the Linux creator, and the only person allowed to insert changes in the Linux kernel (Jackson, 2004). The OSDL action will be discussed again in the Chapter addressing motivations and business models.

<sup>40</sup> Recently, Conectiva was acquired by the French company Mandrake, which has distribution in Europe. Mandrake (France), Conectiva (Brazil), TurboLinux (Japan), and Progeny (USA) entered into an agreement to develop their products based on a common binary implementation based on standards existing in Linux. The initiative is called the Linux Core Consortium (LCC).

These FS/OS aspects have attracted the attention of researchers, who have sought to characterize both the development companies<sup>41</sup> and individual developers<sup>42</sup>. According to Barahona et al (2003, p.91), this helped know the people who participate in the FS/OS projects, whose work is often partly anonymous and scattered, and clarify some myths, by getting to know their origin, motivation, technical background and other factors. The electronic survey performed as part of this study helped to fill the broad information gap about Brazilian developers as did the interviews and secondary surveys.

## 2.1 Social, economic and technical profile of the Individual developer

In order to obtain information about the individual developers an **electronic survey** was carried out, and answered by a surprisingly high number of developers, and was one of the world's largest (see chart 2), especially considering that it covered only developers located in Brazil.<sup>43</sup> A total of 1,953 responses to the survey of FS/OS developers in Brazil were considered, which allows sketching a very representative profile.<sup>44</sup>

This study - made it possible for the first time in Brazil - to sketch a profile of the Brazilian developers and to locate Brazil within the global context of FS/OS. The following information refers to national developers and is organized in terms of socioeconomic characteristics and the experience and organizational characteristics of their involvement with the FS/OS. After the presentation of the most frequent characteristics based on a comparison with the international profile, the results of the groupings outlined by means of multivariate analyses will be presented.

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<sup>41</sup> On the international level we can mention the studies of Wichmann (2002) and Arroyo *et al* (2004). In Brazil, the only study already performed is that by Saleh (2004).

<sup>42</sup> On the international level the following studies outlined the socioeconomic, demographic, and technical profile of the developers worldwide: Hertel *et al* (2003), Ghosh *et al* (2002) and Robles *et al* (2001). There are also studies about the FS/OS projects - Reis, 2003; Gosh *et al*, 2002; Krogh *et al*, 2003; Hertel *et al*, 2003). On the national level, it is worth mentioning the study by Augusto (2003), who analyzed the motivations and orientation of Brazilian programmers by issuing 102 questionnaires to participants in Brazilian discussion lists, including Conectiva Linux, Debian-br, Brazilian version of the OpenOffice.org, Kurumin, in addition to users/developers from the UERJ, Unicamp, and ALERJ. In addition, Brazilian developers participated in a small scale in international studies, such as Reis (2003), Gosh *et al* (2002) and David *et al* (2003).

<sup>43</sup> The survey was widely publicized in the Brazilian FS/OS community through discussion lists and related sites, but also went beyond these frontiers with the release to the general media at a press conference at the 5th FISL (International Free Software Forum). Following the line of international studies, the sample was voluntary and remained open to response by anyone who regarded himself or herself as a developer or user. The construction of the questionnaire was inspired by the international bibliography, especially those found in similar studies such as the Free/libre and open source software: Survey and study (FLOSS) (Gosh *et al*, 2002). It was decided that it would be particularly advantageous to use questionnaires from international studies, which had already been tested by developers, and already had models to handle results. So, the questionnaire was highly similar to the FLOSS questionnaire, but with adaptations. The questionnaire was submitted to a pretest before the launch.

<sup>44</sup> Nevertheless, the statistical methods used will not make any probabilistic assumption and their purpose is not to make inferences about the population. The survey was conducted as a nonrandom sample, since this is the first one of its kind performed in the country.



**Chart 2 - Comparison with other surveys in the world**

Research	Responsible institutions	Year	No. developers	Location of respondents
FS/OS Brazil	MCT SOFTEx GEOPI/DPCT/Unicamp	2004	1,953	Brazil
FLOSS Europe	University of Maastricht (Netherlands) European Commission IST programme	2002	2,784	71% Western Europe/Russia 13% USA 17% others
FLOSS-US	Stanford University's Stanford Institute for Economic Policy Research National Science Foundation	2003	1,588	53% Western Europe 27% North America 8% Russia and Eastern Europe 5% Eastern Asia 3% Australia and New Zealand 3% Latin America 1% Middle East and Africa
FLOSS-JP	Mitsubishi Research Ministry of Economy, Trade and Industry	2003	547	97.4% Japan 1.3% USA 1.3% others

Source: Based on the electronic survey, Gosh *et al* (2002); David *et al* (2003); Mitsubishi Research Institute (2004).

### 2.1.1 Social, economic and technical characterization of developer's

Most of the respondents were classified as systems administrators or basic network technicians (65%).<sup>45</sup> In most cases, they are "basic" developers whose activities and abilities are related to software development and programming activity, such as network and systems administration as well as support. This profile of abilities was expected. Comparing this data with that from other countries, it is found that it is around core activities that most of the abilities in FS/OS progress are found. These are support and management activities related to the systems and programs representing the largest part of the FS/OS service market (and also in software, generally speaking). In any case, the great majority of the respondents have already participated in FS/OS projects: with regard to the participation in projects, 76% of the respondents have already participated in programming projects; 35% in documentation, and 31% in translation and localization of FS/OS. However, participation as a leader is restricted: 45% have never participated in projects as leaders, 24% have participated in a project as leader, and only 27% have participated as leader in more than one project. Therefore, it is possible to note an "elite" group of developers as will be made clear in the multivariate analyses.

Other characteristics reinforce that the majority of respondents are basic developers: 58% do not deposit the developed software on repositories, and 52% are not concerned about allowing the software to be internationalized<sup>46</sup>. The fact that a high number of developers do not deposit their software should not be understood as a lack of concern by the developers with sharing. It is quite likely to mean that the sample developers do not generate codes with a complexity and integration that justify making it available for the community.

<sup>45</sup> According to the questionnaire explanation, these are professionals who manage systems and networks, and perform minor adaptations to the program code and even to shell scripts.

<sup>46</sup> Internationalized: Software able to be adapted (localized) to different languages and countries, for the use of libraries and appropriate development procedures. The internationalization and the deposit of created/changed codes are quite relevant for the project development and knowledge growth in the communities, as they allow a network to be shared and formed.

In addition, contributing to a project involves not only programming, but also testing and reporting bugs (Lerner and Tirole, 2002).

It is possible to perceive a movement toward professionalization in FS/OS. Even though 83% do not have a professional certification associated with FS/OS - most probably because this is not yet required -, there is strong concern with certification (only 29% do not consider this to be important), with documentation of the developed software (70% document the development and create manuals), and in authoring the developed portions (53% identify and consider this to be important).

It is interesting to compare the average Brazilian profile with the international profile of the developers from charts 3 and 4. There are many similar factors such as age, marital status, employment status, total income, and income from work with software (with the difference that the highest percentage, on an international level, comes from the development work), involvement with proprietary software, and participation in FS/OS projects (total projects in which they have participated). However, there are important differences with regard to:

- **educational level**, since most of the Brazilian developers are in college and only 42% of them are graduates, as opposed to the 70% already graduated on the international scene;
- **main occupation**, in Brazil there are more programming technicians and network and support managers than software and related engineers;
- although the **starting age at the FS/OS** is similar (22.0 and 22.9 years), this is a phenomenon more recent in Brazil (the median starting year is 2002) than in Europe (the median year is 1998).

Before presenting the groupings it is appropriate to stress another three points: the geographic concentration of developers, income, and transfer of responsibilities between FS/OS and proprietary software.

- **Geographic location**: The developers are mostly concentrated in the Brazilian Southeast (52%), and South region (26%).<sup>47</sup> These regions total 78% of the respondents, indicating the disparity in the progress of free software in the Country's different regions, which to a great extent – is similar to that in the software industry.
- **Personal income**: Considering that the large majority has a college degree, work at relatively sophisticated areas, and are relatively young, one may say that the respondent's have a mid-level monthly income with growth perspectives: 54% earn 5 minimum wages, and 29% earn above 10 minimum wages. In addition, the occupations help identify the income profile as they reveal that many of the respondents hold the positions of programming technician, or network administrator and provide support for computing operations. Furthermore, a substantial part of the respondents are students, supposedly with a very low income (if any). In any case, it is possible to assume that they represent a mass of professionals who are graduates or in the process of graduating, who represent a potential insertion and expansion in the corporate employment market, either formal or informal, entrepreneurial or self-employed.
- **FS/OS and proprietary software**: The start of the proprietary software development is previous to that of the FS/OS for 55% of those interviewed, however, it is interesting to point out that, for 31% of the respondents, their involvement with FS/OS started before their involvement with proprietary software. This characteristic points to two factors: first, the skills move reasonably well from the proprietary to the free software (in the sense that there are no technical hindrances to one or the other); second, there is a significant (and growing) contingent of people who began software development with FS/OS.

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<sup>47</sup> The largest number of developers is concentrated in São Paulo State (32%), followed by Rio de Janeiro (10%), and Rio Grande do Sul (10%).



**Chart 3** – Comparison of developer profiles (Brazil and Europe): socioeconomic characteristics

<b>Research</b>	<b>FS/OS Research</b>	<b>FLOSS Europe Research</b>
Median age	26	26
Marital status	39% single 38% married	41.4% single 21.1% married
Male	97%	98.9%
Higher education	42% (20% with graduate course)	70% at least graduated (37% with graduate course)
Employment status	66 % employed (13% self-employed individuals) 15% own companies	79% employed (14% self-employed individuals) 17% students
Main occupation	Programming technician, network administrator, support (34%) Software engineers, systems analysts (20%)	Software engineers (33.3%) Programmers (11.2%) Students (20.9%)
Income	44%: less than 5 minimum wages 29%: above 10 minimum wages	45%: less than 2,000 (euro/dollar) 27%: 2,000 to 4,000 18%: above 4,000
Income from work with software in general	22%: no 38%: development 25%: administration 11%: support 3%: training 1%: distribution	24.7%: no 50.9%: development 7%: support 17.3%: administration

Source: Based on the electronic survey, field research and Gosh *et al* (2002).

**Chart 4** – Comparison of developers profile (Brazil/Europe): characteristics of involvement with FS/OS

Research	FS/OS Research	FLOSS Europe Research
Income from FS/OS	40%: no	46%: no
	36%: directly	50.3%: directly
	24%: indirectly	43%: indirectly
Dedication to the development of FS/OS (hours/week)	62%: less than 10	70%: less than 10
	37%: more than 11	14%: 11 to 20
		16%: above 20
Participation in projects	71%: 1 to 5 projects	71.9%: 1 to 5 projects
Leadership in projects	45%: never	35.2%: never
	24%: 1 project	32.1%: 1 project
Belonging to the communities	26%: FS	48%: FS
	10%: OS	32.6%: OS
	53%: both	
Median age when began FS/OS development	22	22.9
Median Starting year	2002	1998
Dedication to the development of proprietary software (PS) (hours/week)	<b>51.3% also develop PS</b>	<b>52% also develop PS</b>
	39%: less than 10	29.1%: less than 10
	14%: between 11 and 20	12.8%: between 11 and 20
	43%: above 21	58.2%: above 21

Source: Based on electronic survey, field research and Gosh *et al* (2002).

### 2.1.2 Developer profiles (groupings)

From the issues regarded as the most significant an attempt was made to develop a profile of developers from groupings which emerged from the multivariate analyses used.<sup>48</sup> The following variables were used:

- **Skills in FS/OS:** Self-classification as basic developer or advanced developer; affiliation to the FS/OS communities; motivation to develop/distribute FS/OS; development place;
- **Dedication**, in weekly hours last year, to FS/OS and proprietary software projects;
- **Development of technical aspects:** Deposit of the developed and adapted software in repositories, concern with documentation; internationalization, and authoring;

<sup>48</sup> Two techniques were used: multiple correspondence analysis (MCA) and hierarchic grouping analysis. The MCA is a multivariate exploratory technique the purpose of which is to represent on a chart a large array of categorical variables by reducing their original representation space. From the contribution of the axis to the total variability, we can identify whether there are plausible associations of interpretation between the response categories, that is, the presence of a factor that indicates a discrimination of different profiles on socioeconomic or technical scopes. The factorial loads presented were appropriate for the categorical nature of the data. The grouping analysis was applied to the results of the MCA which consolidates the groups that can be interpreted as the different profiles within each scope. The number of groupings, or different profiles, is arbitrarily defined based on some numeric measures and their graphic representation in the dendrogram. What matters at this stage is the interpretability of these groups on the study level. The interpretation is aided by the discrimination measures of the answer categories in each group.



not deposit the created or modified codes in repositories, they do not worry about documenting the development and about professional certification in FS/OS. In addition, they neither consider themselves as part of any community nor part of the Open Source community. Their activity in FS/OS is probably a kind of hobby, since in addition to the low dedication, they do not develop FS/OS at their place of employment. Personal income is high (above 10 minimum wages) and they have at least graduated college and may have taken specialization courses.

### **Group 2 - Systems administrators and network technicians (36.1%)**

Group 2 is formed by respondents who work with software administration and support, working professionally as programming technicians, network administrators and in support and related occupations. Some are public servants, probably working in these same occupations, and government is one of the leading sectors. Their work with free software is paid either directly or indirectly. Some of them do not work with proprietary software. The schooling level is average, and the income varies from 2 to 20 minimum wages. So, the grouping is formed by employees with an average income (2 to 10 minimum wages), who gain their livelihood from FS/OS. However, they do focus on development, which explains why they do not deposit their codes. Although they can work with both proprietary software and FS/OS, they seem to have low decision making independence.

### **Group 3 - Students (21.56%)**

Group 3 accounts for those respondents who are students (in most cases, at a college level), who do not work, or who receive a low pay. There are also some IT professors from public universities with a master's or doctoral degree. Therefore, work with FS/OS is not a source of personal income and the development is conducted at the school or college. However, the dedication to FS/OS projects in the last few years was from 11 to 20 hours a week, although in a low number of projects (they were involved in at most 5 projects). In general, they do not develop proprietary software. Within this group are those respondents who fulfill some important technical requirements in FS/OS: they have already been involved in a project as a leader, they are interested in internationalizing the software they develop and in identifying the code portions they develop or modify, they deposit the software in their own or in an international repository. But they neither have a professional certification related to FS/OS, nor understand this issue. The software developed are mainly devoted to culture, entertainment and education. This category is the training base that will operate in the other categories in the future. Therefore, an important part of the professional training can be found here and can be divided into any of the other 3 categories, either as entrepreneur or employee.

### **Group 4 - Advanced developers of FS/OS (19.71%)**

The last group contains the most active and professionalized developers of FS/OS, as the issues more directly associated with the FS/OS were those which mostly helped discriminate the group. Advanced developers greatly experienced in FS/OS are considered to be those who: currently participate in more than 3 development projects, have already participated in various projects as leaders, and participate both in the Free Software and Open Source community. They fulfill the important requirements for FS/OS such as a concern with internationalization, documentation, and identification of portions of the developed software code. In addition, they deposit the developed software. Their activity in the field is intense and professional. They dedicate above 40 hours a week to FS/OS projects. They earn directly for their work with FS/OS, acting as software engineers/systems analysts or in related occupations or as IT consultants, and some own companies with considerable activity in FS/OS (from 30% -50% or above 80% of the activities are dedicated to FS/OS). They have professional certification in FS/OS. They develop for almost all sectors and for the application areas most mentioned in the survey, while these were not variables that helped discriminate the group. They also earn a relatively high monthly income (above 10 minimum wages) and have a high level of education (master's degree)



**Table 1** – Comparison between groupings of individual developers

<b>Variables</b>	<b>Developers of proprietary software (22.63%)</b>	<b>Systems administrators and network technicians (36.10%)</b>	<b>Students (21.56%)</b>	<b>Advanced developers of FS/OS (19.71%)</b>
Self-classification	Advanced developer	Systems administrator / network technician / basic developer	-	Advanced developer
Member of the FS/OS communities?	I regard myself as an integral part of the OPeN Source community  I do not regard myself as an integral part of the FS/OS communities	-	-	I participate in both
Average hours/week of work on FS/OS projects last year	Less 2	2 to 5	11 to 20	6 to 10 21 to 40 Above 40
FS/OS Development location	Do not develop at place of employment  Do not develop at school / college / university	Develop at place of employment  Do not develop at school / college / university  Do not develop at home as a hobby / self-employed individual	Do not develop at place of employment  Develop at school / college / university  Do not develop in other places	Develop at place of employment
If proprietary software is developed, how many hours/week on average worked on proprietary software projects last year	21 to 40 Above 40	Do not develop proprietary software	Do not develop proprietary software	-
Main source of income (software development, support or administration)	Development	Administration  Support	Not related	Development  Training / capability
Is the work with FS/OS a personal income source?	Not a personal income source	Yes, directly; I am paid to provide support for FS/OS  Yes, directly; I am paid to manage FS/OS  Yes, indirectly; among my duties, I also develop FS/OS, but this is not required	Not a personal income source	Yes, directly; I am paid to develop FS/OS
Percentage of activities of company/cooperative which is dedicated to FS/OS	5 to 25%	Owns no company	Owns no company	30 to 50% > 80%

Variables	Developers of proprietary software (22.63%)	Systems administrators and network technicians (36.10%)	Students (21.56%)	Advanced developers of FS/OS (19.71%)
FS/OS development software sectors	Trade Financial sector Do not develop for electronic and communications equipment	Government	Do not develop for the trade Develop for culture and entertainment Education electronic and communications equipment Do not develop for the government Develops for other sectors	Trade Communication and information (services) Electronic and communications equipment Government Healthcare Services Financial sector Information Technologies Transportation, logistics, and storage
FS/OS development application area	Commercial automation	Administration - others Network manager Data protection and security	Do not develop for electronic commerce e- learning Others Utilities	Commercial automation Electronic commerce Data communication e- learning Geoprocessing Database manager Web page Data protection and security
Self-classification of work on FS/OS	Not classified as training, programming, maintenance, and integration service  Is classified as a customizable product	Is classified as training, programming, maintenance, and integration service  Is not classified as service for the supply of customized development and solutions  Is not classified as a customizable product  Is not classified as a package product	Is not classified as a training, programming, maintenance, and integration service  Is not classified as service for the supply of customized development and solutions  Is not classified as a customizable product  Is classified as a package product	Are classified as a service for the supply of customized development and solutions
Participates in projects of	-	Did not answer	-	-
Quantity of FS/OS development projects participated	1 to 5	Did not answer 1 a 5	1 to 5	1
Number of FS/OS development projects participating currently	0 1	-	1	2 3 4 to 5 6 to 7



Variables	Developers of proprietary software (22.63%)	Systems administrators and network technicians (36.10%)	Students (21.56%)	Advanced developers of FS/OS (19.71%)
Number of FS/OS development projects in which involved as leader, coordinator or administrator	0	0	1	2 3 4 to 5 6 to 7
Deposit of developed software in FS/OS repositories	Do not deposit in a closed repository of the company at which they work  Do not deposit in own open repository  Do not deposit in a specialized Brazilian repository  Do not deposit	Do not deposit in a closed repository of the company at which they work  Do not deposit on own open repository  Do not deposit on a international specialized repository  Do not deposit in a specialized Brazilian repository  Do not deposit	Do not deposit in a closed repository of the company at which they work  Deposit in own open repository  Deposit in a specialized international repository	Do not deposit in a closed repository of the company at which they work  Deposit in own open repository  Deposit in an international specialized repository  Deposit in a national specialized repository  Did not answer "do not deposit"
Concern about internationalizing the developed FS/OS	-	Did not answer this question  No  I do not know / I do not care	Yes	Yes
Interested in documenting the developed FS/OS, creating manuals	No	Did not answer this question  No  I do not know / I do not care	-	Yes
Identification of the source code portions developed / altered as FS/OS	No	Did not answer this question  No	Yes, but this is not very important to me	Yes, this is very important
Professional certification currently associated with the FS/OS	Did not indicate "Yes, I think this is important"  I do not know about this	Yes, I think this is important  No, but I think this is important	No, I do not think this is important  I do not know about this	Yes, I think this is important  Yes, but I do not think this is important  No, I do not think this is important
Main current occupation	Entrepreneur	Programming technician, network administrator, support, and related services.  Public servant (IT)	Professor (IT)  Student (IT)  Student (other sectors)	Software eng.  Systems analyst and related  Consultant (IT)  Entrepreneur (IT)
Schooling level	Complete higher education  Specialization	Medium	College Incomplete  Master's degree  Doctor's degree	Master's degree

Variables	Developers of proprietary software (22.63%)	Systems administrators and network technicians (36.10%)	Students (21.56%)	Advanced developers of FS/OS (19.71%)
Monthly income (minimum wages)	10 to 20	2 to 3	No income	10 to 20
	Above 20	3 to 5	Up to 1	Above 20
		5 to 10	1 to 2	
Employment status	Member/owner of a company	Employee	Scholarship holder (student)	Member/owner of a company
			I am not employed right now	
Main current work place	Private company	Public company	Did not answer this question	Private company
	Own company/ Cooperative	Federal public administration	Not employed	Own company/ cooperative
	Others		Public university	
			Private university	

Source: Field research, electronic survey.

## 2.2 Characterization of the development companies

This section outlines the profile of companies that deal with FS/OS in development, administration, support, training, and capability activities. In broad terms, we can say there are three types of companies that deal with FS/OS in Brazil.

- Small and medium companies founded in the 1980's and 1990's, which deal particularly with proprietary software, but which began to dedicate a small part of their activities to FS/OS due to market requirements and other reasons;
- Small and medium companies founded more recently, in large part due to FS/OS, and which have a substantial part of their activities focused on the FS/OS;
- Large companies, some of them multinational, which have recently also entered the FS/OS world with specific strategies.<sup>49</sup>

Different instruments were used in order to obtain information about the three different types of companies. The electronic survey and the secondary surveys were effective in surveying data on the activity of small and some medium companies. However, the panel of specialists pointed out mainly significant cases of medium and large companies whose employees were interviewed with a structured script. Therefore, first, the small and medium companies were mapped by analyzing the data from the secondary sources and the electronic survey. Second, using the data from the interviews with employees of medium and large companies, some strategies of selected companies will be presented in order to better understand some issues revealed by other parts of the research.

<sup>49</sup> The most significant example of this is IBM, which supports Linux development by means of the OSDL and the entire Linux Technology Center (LTC). There are 5 LTCs in the world (in Brazil, China, England, Germany, and the USA). The LTC in Brazil was set up in partnership with Unicamp, and is located on its campus. It is the first LTC experience with an outside partnership. The work of the LTCs is directed by the OSDL.



## 2.2.1 Characterization of development companies (small and medium)

It was possible to gather basic information about 364 development companies,<sup>50</sup> from the secondary survey and the electronic survey. They are concentrated in Brazil's Southeast (53%) and Southern (29%) regions, a concentration that was also observed in the answers by individual users and developers. Most of the companies (40.93%) were found in the capital cities of São Paulo, Rio Grande do Sul, Rio de Janeiro, and Paraná States.<sup>51</sup>

The surveyed information indicates that these companies are Brazilian owned (98%) and are small-size companies in terms of billing and number of employees: 79% have billing of up to R\$ 500 thousand per year (only 11% have billing higher than R\$ 2.5 million/year), and 70% rely on no more than 9 employees. However, the work on FS/OS is far from a business of small-size companies alone. As stated above, work in FS/OS is also part of the strategy of major software companies. In comparison with the universe of software companies in Brazil, those engaged in FS/OS tend to be smaller and are concentrated in the Southeast.<sup>52</sup>

### Groupings of development companies (small and medium)

In order to find distinctive profiles among the software development companies, a multiple correspondence analysis (MCA) and grouping analysis were used in the same way as with the technical profile of developers. It is appropriate to point out that the analysis was restricted to the data from the electronic survey (n=421), since there were intentional responses about more variables than the information collected in the secondary survey (n=364).<sup>53</sup> From the total of 421 companies with information in the electronic survey, the multivariate analyses showed that approximately 36.8% of these records were incongruous because they had data that was incomplete or quite far from the standards indicated above, probably because they were provided by employees not authorized to speak for the companies. These records were disregarded and the following analysis addresses 266 companies.

The variables which most distinguished the companies were the **dedication to FS/OS, and work in economic sectors and application areas** as presented in Figure 4 (the ellipses indicate the groupings indicated by the sub-title).

The first axis separates the companies according to their **dedication to FS/OS** in relation to the percentage of activities, billing and professionals. It is possible to perceive the opposition between those companies that dedicate more than 80% of their activities, professionals and billing to FS/OS and those which dedicate less than 25%, and the other dedication percentages appear in a gradient between the two extremes (indicated

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<sup>50</sup> A systematic and extensive survey of a list of companies involved with FS/OS in Brazil was performed concerning use, marketing, and development. This list of companies was prepared from the collection of data from four sources: (a) companies which responded to the electronic survey; (b) companies registered with the site [softwarelivre.org](http://softwarelivre.org), whose records are regarded as among most complete in existence; (c) companies mentioned by the panel of specialists; (d) companies whose use or work on FS/OS was, somehow, reported in the media. Given the list of companies, an attempt was made to complete and check the information about each one of them via the sites and news. The companies about which it was not possible to obtain data in the location (city and state) and which had no website were excluded from the list of companies.

<sup>51</sup> Excluding the capital cities, the cities with university centers nearby, which encourage the creation of these companies (Campinas, Juiz de Fora and Americana), are highlighted.

<sup>52</sup> A comparison was made with the data from the Quality Study, performed by SEPIN/MCT in 2001 with 446 organizations, of which 372 develop package or custom-made software and 81 distribute or edit third-party software. With regard to size, the research by the SEPIN/MCT showed that "only" 41.8% of companies had billing of R\$ 720 thousand/year and 34.9% were large companies (above R\$ 2.5 million/year). In terms of location, the SEPIN/MCT study of 2001 found that 43% of the companies are concentrated in the Southeast region and 32% in the South.

<sup>53</sup> In addition to the identification and location data, the secondary survey database contained information on the capital origin, billing range, number of employees range, economic sectors and area of activity and the classification in connection with the type of work in FS/OS (if the company is an FS/OS developer, user or user/developer). The electronic survey database, which also composed the secondary survey database, contains information on the percentage of activities, billing, and professionals dedicated to FS/OS, information that was impossible to capture through secondary sources.





### **Group 1 - Companies with greater dedication to FS/OS (48%)**

This group includes companies which dedicate more than 55% of their activities and their professionals to the FS/OS, from which comes 55% of their billing which, in general, ranges between 250 thousand and 500 thousand. They are companies recently founded, probably together with the free software trend, because they believe in the opportunity it represents. They develop in particular for the following sectors: *communications and information, government, information technologies* and *services*. The most frequent application areas are infrastructure, probably for Linux-related services (data security and protection, network manager and data communication) and distance education. Their activities can be classed as all business model categories, except for package, but particularly fall into low value services. They thus work in services of low technological intensity and low profitability.

### **Group 2 - Companies with a low dedication to FS/OS (52%)**

The main characteristic of this group, for which FS/OS is not the company's main activity (up to 50% of the activities, professionals, and billing), is their work in the *commercial, services* and *health* sectors and the *absence of development and supply for the government*. They are companies that already existed before the free software boom, which worked on the development of solutions that were directly impacted by free software and, therefore, develop FS/OS in order to serve the market, particularly in commercial automation and Web applications. These companies already developed custom-made software and, realizing the market demand, began to provide solutions using FS/OS, but continue to have proprietary solutions in their portfolio.

Chart 5 presents a comparative summary of both groups.

In the **3-group formation**, the difference is that this third group is derived from the first one, from the extraction of companies with an average dedication to FS/OS (between 55% and 75%) and which work particularly with embedded software. These act in infrastructure areas and sectors such as *communications and information, information technologies, electrical-electronic and communication equipment, commerce, and services*. This subgroup helps explain the average value of a professional for consulting and integration (R\$61 to R\$90) which is higher than that of group 2 (up to R\$60), since these higher values are probably related to the professionals who develop embedded software, not to those professionals hired by FS/OS development companies.

**Chart 5** – Comparison of developer company groupings

<b>Variables</b>	<b>Group 1 - Companies with high dedication to FS/OS (48%)</b>	<b>Group 2 - Companies with low dedication to FS/OS (52%)</b>
Billing deriving from FS/OS	> 80%	5 to 25%
	55 to 75%	30 to 50%
Dedication of the company's activities to FS/OS	>80%	30 to 50%
	55 to 75%	5 to 5%
Professionals dedicated to FS/OS	>80%	
	55 to 75%	
Economic sector for which they develop	Communications and information (services)	Commerce
	Government	Services
	Information technologies	Health
	Services	Do not develop for government
	Education	
	Commerce	
	Electronic and communication equipment	
Business model	Training, programming, maintenance, and integration services	Service for supply of solutions and customized development
	Service for supply of solutions and customized development	Customizable product
	Customizable product	
	Component / on-board	
Application area	Data security and protection	Commercial automation
	Network manager	Service administration
	Data communication	Web page
	Distance education	
	Database manager	
	Administration - others	
Average value (in brazilian reais) per professional per hour for companies in the integration business model:	61 to 90	< 31
		31 to 60
Number of company employees:	-	0 to 9
Billing range	-	Up to R\$ 250 mil

Source: Field research, electronic survey



## 2.2.2 Strategies of selected companies

Nine interviews were conducted with FS/OS developing / supplying companies, among a group of 16 companies where interviews were realized:<sup>55</sup>

- two that develop FS/OS solutions for the retail sector, but also for other sectors;
- five public companies whose main customers are government entities, which have experience in the public health and education areas, on the local and federal level;
- two companies producing, -electronic and communication equipment, especially routers and modems with on-board FS/OS. Although this is not the core business of these companies, they internally develop and adapt FS/OS.

The following is the summarized information per groups of companies according to the economic sectors in which they work:

### Commerce (retail)

The two companies working in the retail trade have some common and differing qualities. They have different development focuses. The multinational company focuses on establishing partnerships and training centers in order to promote open source in the market. To do so, in every segment of the industry it seeks an area where the Linux is an alternative, relying on business partners that provide ready solutions for the market.

On the other hand, the Brazilian company sees this moment for Linux as a way to promote its brand name as a software developer, which can make products best adjusted to its customers. This would be an opportunity to go back to development, since it was created as a software developer, but this line of work was strangled by the presence of major players. In addition, Linux increased the competitiveness of products, particularly those related to commercial automation. In this way, Linux would have made it easy for the return of the discussions that seemed to be closed long ago.

Both companies have at least three common points. The first is that both invest in pre and postsale support for Linux. They believe that there is a lack of support in the market, that is, from companies that might provide customers with support for the decision to migrate to or install a new base, as well as to provide tranquility in terms of a continuous development. In this regard, both have set up postsale support and concept testing centers and the Brazilian company formed a partnership with a university aimed at testing solutions especially for the government and having them approved.

The second common point in the strategy of both companies is to make versions of their proprietary solutions available to run on the Linux, in particular for dedicated equipment applications in the retail (point-of-sale-POS system), or for other dedicated equipment. They believe open software will evolve, however, the proprietary products are and will continue to be more sophisticated in critical processes, since there is a commitment to a long-term investment in development. Finally, the third common point is that they both have a partnership with a university.

### Government

All government computing companies analyzed have a project to migrate from low platforms in administrative areas to FS/OS solutions, especially those using the Linux operating system. There are also initiatives oriented to end users from administrative areas involving the migration of desktops.

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<sup>55</sup> The choice of the companies to be interviewed was made from the economic sectors that most heavily use FS/OS as pointed out by the panel of specialists. Large companies were emphasized since they were not included in the other surveys (electronic questionnaire and secondary surveys). For reasons of confidentiality, the companies will not be identified here.

The use of FS/OS in one of the cases - of a municipal-owned company - began as a technical option in isolated initiatives for at least 8 years, first used in infrastructure (such as file servers and file managers), and then reaching the end user. In mid 2002, a taskforce was created to evaluate the migration process. Nearly the entire internal staff (operating, support, help desk) was trained. As of 2003 the institutionalized use of the FS/OS began en masse throughout the company, including the development and desktop tools.

In addition to the platform migration, municipal public companies are working on the migration of servers and workstations in the education and health areas: there are experiences of school computerization and setting up of laboratories and telecenters for education departments (stations with Linux or *dual boot*), and there are experiences in progress of computerization of basic healthcare units by using a logic similar to that of dedicated equipment such as POS using FS/OS. Finally, there are development experiences, particularly in digital certification and security.

The great challenge these companies face is to handle the legacy. Many companies rely on a stable platform with many years of team learning and interaction. Changing this means a risk of losing the stability. The great majority of the large-size organizations do not think of migrating the legacy, but only the low platforms. Changing the legacy requires a high investment and depends on years of work to convert all the government automation systems.

In summary, one may say that the current movement of FS/OS development companies is already professional, but with many uncertainties, particularly at the regulatory level and in terms of the development perspective of the surrounding factors, which is necessary for the growth in importance of FS/OS. The feeling is that everyone understands the importance of the investment in FS/OS (especially by what one sees internationally), but the risk level is still high, especially because these are markets being formed, and a set of rules still being institutionalized. Therefore, the professional development of FS/OS in Brazil is taking its first steps with national, multinational and public companies. The moment calls for the reduction of still high transaction costs for the professionalization of FS/OS in the country.



# Chapter 3

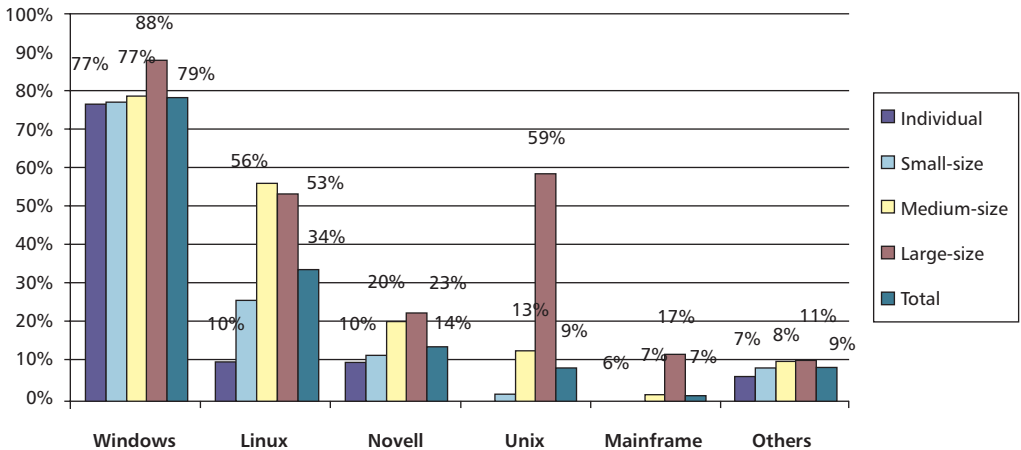
## Profile of FS/OS users

This chapter seeks to establish a profile of the FS/OS users in Brazil. Two types of users are analyzed: **individual users**, who range from end users working at companies and other institutions to home users; and **corporate users**, which are understood to be companies and other user institutions.

There are various studies available about FS/OS users. Lerner and Tirole (2002) point to the fact that quick dissemination of the software took place due to the new FS/OS organization model, which includes cooperation in development and distribution via the Internet, and also due to the large capital investment by major corporations in FS/OS projects and companies, particularly for hardware. The FS/OS “beneficiaries” range from home users from less developed countries to *Fortune* 500 companies.

The surveys conducted and articles in the specialized media in Brazil point to a growth in FS/OS use, particularly within the corporate universe, which is in keeping with the international trends pointed out by Lerner and Tirole (2002). The main entrance to the free software world has been the Linux operating system. Two recent studies demonstrate this trend.<sup>56</sup> According to a study of the 100 “most connected” companies according to *Info Exame* magazine (Fortes, 2004), 64% of these companies already use Linux.

Data from the study, *I-Digital: Profile of the digital company 2002/2003* (FIESP/CIESP and FEA/USP, 2004), published in 2004,<sup>57</sup> provide a detailed look at the use of Linux in servers by company size (graph 1) and application type (graph 2). With regard to size, despite the strong presence of Unix at large companies and of Windows at companies of all sizes, Linux appears in second place over all and is used on 53% of the servers of large companies, and 56% of medium-size companies.

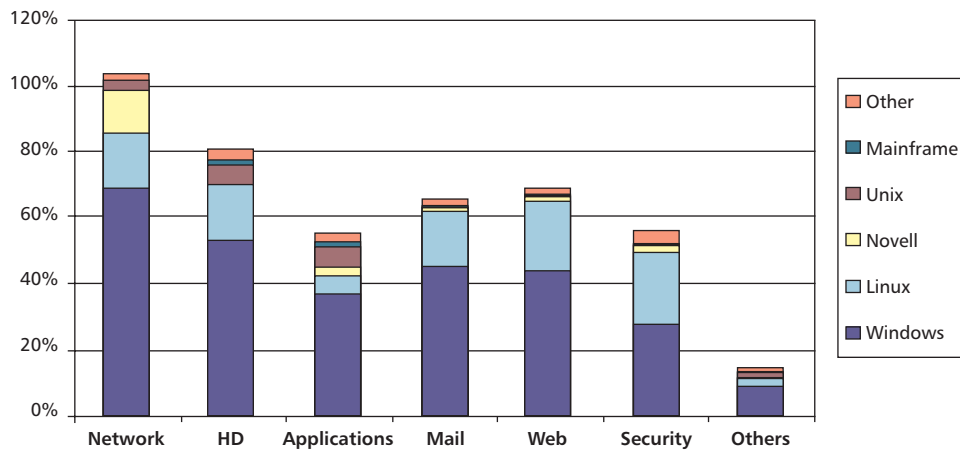


**Graph 1** - Main operating systems used on servers  
Source: I-Digital: Profile of the digital company 2002/2003 (FIESP/CIESP and FEA/USP, 2004)

<sup>56</sup> It is worth pointing out that the data from the two studies are not directly comparable, because the study by *InfoExame* magazine addresses large Brazilian companies, and that by FIESP, companies of various sizes which are more restricted to São Paulo state.

<sup>57</sup> This research was performed from a sample of 1,334 out of the 14,485 companies in FIESP’s records.

Considering the use of the operating systems on servers per type of application, one notes the clear predominance of Windows on all types of applications, particularly on the database and network management functions. Meanwhile, Linux is found in second place, highlighting applications for mail server, web, and security management.



**Graph 2** - Operating systems by type of operation  
 Source: I-Digital: Profile of the digital company 2002/2003 (FIESP/CIESP and FEA/USP, 2004)

Linux, therefore, strongly competes with Windows in the server segment. According to Meirelles (2004), 12% of the servers installed in Brazil are Linux, while 60% are Windows, as seen in table 2. This follows world trends as, according to *InfoCorporate* magazine (Vieira and Nogueira, 2003), Gartner identified that in 2002 Linux accounted for 6% of the world operating systems market and in 2003 reached 9%. The forecast for 2007 is 18%.

**Table 2** – Operating Systems on servers in Brazil

System	Penetration %
Windows	60
Unix	18
Linux	12
Novell	7
Other	3

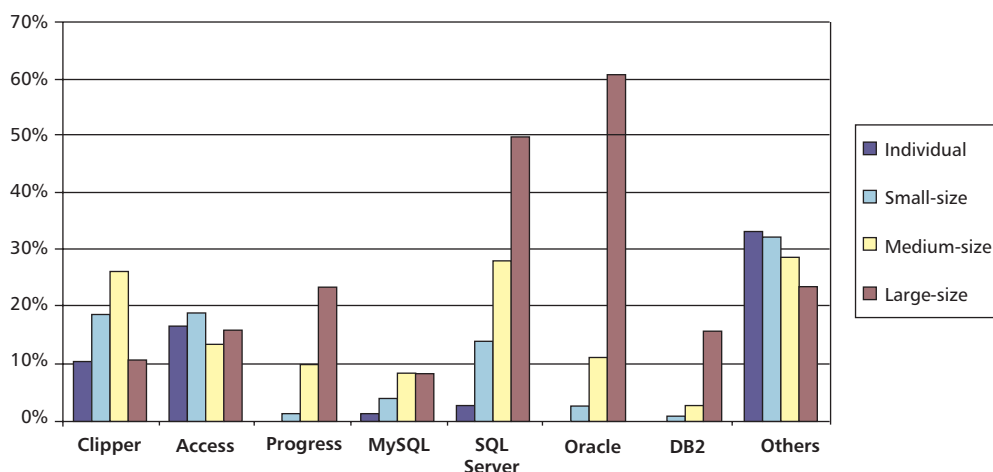
Source: Meirelles, 2004.

In other segments beyond infrastructure, FS/OS use is restricted. The data from the *I-Digital* study show that in transactional databases (graph 3), Oracle prevails for large-size companies and the Microsoft SQL Server for companies of all sizes. The use of FS/OS database (MySQL) is well behind other small-size databases such as Clipper and Access, regardless of company size.

Penetration among browsers is also low. The Mozilla browser has 7% of the market and is well behind Internet Explorer which, even having lost a 5% market share, continues to dominate the global market with 88.9%.



It may be said that the use of FS/OS on desktops is still restricted and perhaps will be the last market niche to be encompassed (ComCiência, 2004). According to a survey by the International Data Corp., Linux will have 6% of the global desktop computer market by 2007, which represents significant growth relative to the 2.7% in 2002 (ComCiência, 2004). In this way, although there are no surveys of individual users in Brazil, it can be presumed that there is a small number of individual users with a non-technical profile who spontaneously use FS/OS.



**Graph 3** – Transactional database software  
Source: I-Digital: Profile of the digital company 2002/2003 (FIESP/CIESP and FEA/USP, 2004)

A factor which can be pointed out as being responsible for such restricted use is the immaturity of the graphic interfaces. The dissemination until very recently took place mostly among sophisticated end users, such as systems administrators, due to the development model which tends to privilege developers (Lerner and Tirole, 2002). Reis (2003), in his master's degree research, shows that there is not much attention to "usability" in the software development process, which is probably one of the main factors for the widespread reputation that FS/OS is complex and difficult to operate.

Therefore, Lerner and Tirole (2002) point out that among the recent challenges is the development of more user-friendly products for end users without a computing degree, due to the lower emphasis thus far given in the development process to aspects related to documentation, support, interfaces and others (*id. ibid*, p.203). The initiatives to create interfaces more adapted and closer to the Windows standard, such as the Gnome and KDE projects, can be seen as attempts to increase FS/OS dissemination among "common" users.<sup>58</sup> Efforts to facilitate installation can also be evaluated such as that of the Brazilian distribution of Kurumin, which allows the program to be installed directly from a CD that automatically configures all of the computer devices (ComCiência, 2004).<sup>59</sup>

Now that the context for FS/OS use has been presented in broad lines, the research results will be presented. The information sources used to analyze the users in this item include the electronic survey, the information provided by the panel of specialists, the field interviews with 16 using / development companies and the List of Using Companies.

<sup>58</sup> In general, the development processes of Microsoft and Linux are compared by the type of users who would be consulted during development. While Microsoft would seek to listen to a "less technical" user, Linux developers would seek the opinion of "more technical" users. According to Lerner and Tirole (2002), the decline in GNU/GPL licensing would be influenced by more pragmatic economic interests that would attempt to consider ordinary users.

<sup>59</sup> It is important to stress that the Kurumin was built from Debian and Knoppix, a Linux distribution that runs directly on a CD, without a need to install the system in a computer's hard disk. (Sources: <http://www.guiadohardware.net/kurumin/> and [http://br-Linux.org/main/noticia-lancado\\_knoppix\\_37\\_versao\\_e.html](http://br-Linux.org/main/noticia-lancado_knoppix_37_versao_e.html)).

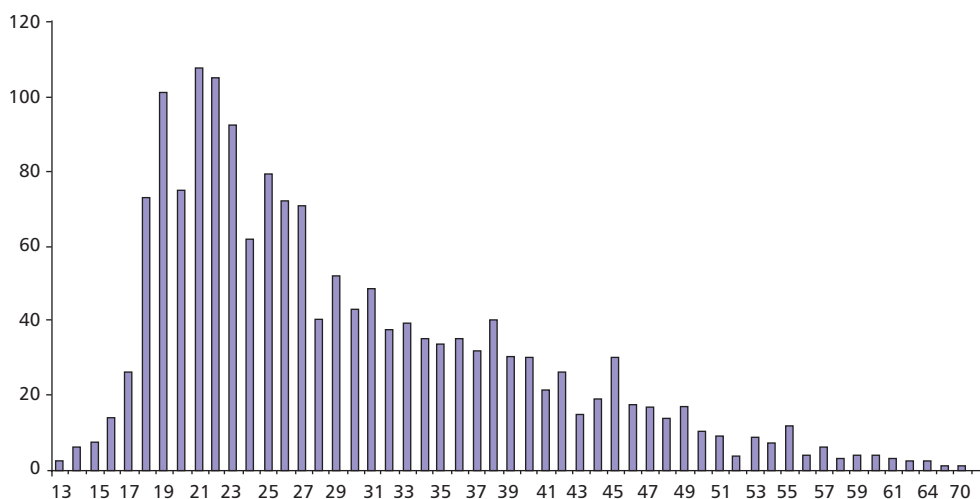
The data and analyses presented are subdivided according to the two user categories. With regard to the **individual users** the social, economic, and technical profile will be outlined from the data gathered in the electronic survey. With regard to the **corporate users**, the profile of the using companies will be outlined from secondary data and some strategies will be indicated, especially those of large, corporate users, based on the interviews conducted.

### 3.1 Individual users

#### 3.1.1 Social, economic and technical characterization of users

The information about 1,704 individual users was gathered in an electronic survey. The great majority of free software users are male (89%), and 35 or younger, while there is a higher concentration of developers between 18 and 27 (50.75%) (graph 4). Therefore, the majority is young, do not have children (68%) and live alone (43%).

These users are concentrated in the Southeast (58%) and Southern (26%) regions, a concentration which is even stronger among developers (graph 5). The highest number of users is concentrated in São Paulo State (33%), followed by Rio Grande do Sul (11%), and Rio de Janeiro States(9%).



Graph 4 - Users' age

Source: Field research, electronic survey

Sixty two percent (62%) of the users regard themselves as advanced users,<sup>60</sup> which coupled with higher education<sup>61</sup> and attendance of IT courses,<sup>62</sup> confirms the initial expectation that most users have degrees in computing or have some familiarity with their technical aspects.

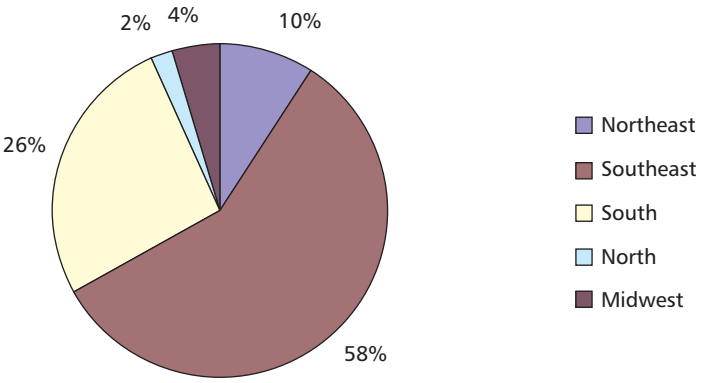
<sup>60</sup> The respondent was self-defined as a "user who installs his own software and peripherals, configures his work environment, software, and peripherals. Skillfully uses the most advanced tools of the operating system and working environment".

<sup>61</sup> Forty percent (40%) have not finished college (most of these are probably university students), 38% have graduated from college, and 20% have a graduate degree.

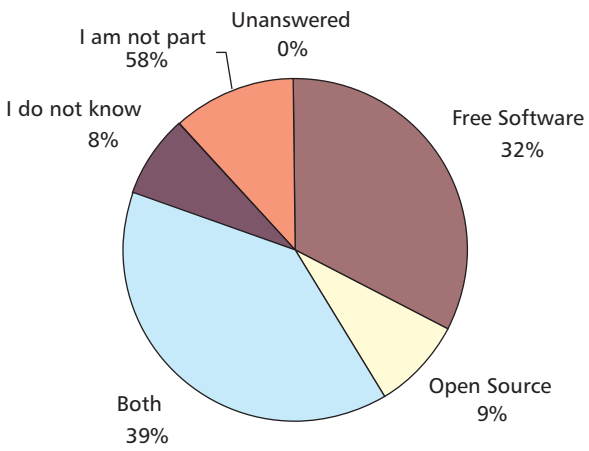
<sup>62</sup> Among users with some college education (complete or incomplete), 55% are studying or have graduated from IT related courses (computer science/information systems, or electrical engineering), which confirms the expected technical profile.



Participation in FS/OS communities is another factor that complies with initial expectations: most respondents (80%) participate in the communities, and 32% regard themselves as part of the free software community, 9% as part of the open source community, and 39% participate in both. Only 12% said they do not regard themselves as part of the communities, and 8% were unable to indicate where they belonged (graph 6). When asked if they consider the two communities to be different, most of them (77%) said they are different, but almost half the respondents (47% from the total) think that they actually work in the same way, despite indicating that they are different.



**Graph 5** – User distribution by region  
Source: Field research, electronic survey



**Graph 6** – Considers oneself to be part of a community  
Source: Field research, electronic survey

Therefore, the respondents to the electronic survey are users who participate in the communities and minimally know their principles and operational methods, which may indicate that in the near future some of these users, particularly those with an IT degree, will be able to move to the developer category.

In short, these users fall into the classification of users participating in FS/OS communities, who provide support for development by using and testing the software, as pointed out in the development schematic model of Chapter 1.





### **Group 1 - Intermediary level students (14.5%)**

This group consists of individuals less than 19 years of age, who have no income or job, who apparently use FS/OS at high schools or colleges. These users became aware of FS/OS from untargeted media vehicles and regard themselves as not very capable of using the tools. Therefore, one of the motivations of this group is to learn and develop new skills.

### **Group 2 - University students on scholarships (20%)**

Group 2 is formed mostly by university students from IT courses, who are a little bit older than those of group 1, between 18 and 24 and an income of up to 3 minimum wages, very often from scholarships. They are users who recently began using FS/OS (in 2003), and became aware of it through a university and personal network (friends and relatives). The main motivations indicate a professional interest in FS/OS, since they realize that FS/OS will improve their job opportunities and the tools are more appropriate. They, however, do not feel very capable to use the tools, and do not know the stock of software existing in repositories.

### **Group 3 – Technical area professionals (35%)**

This group includes both employed and self-employed users, whose income ranges between 2 and 10 minimum wages, from 25 -34 with a moderate level of education. They are professionals from IT related areas as well as from other areas. They use FS/OS at home since 2002, probably as self-employed individuals, as well as at their work. The use of FS/OS tools, for these professionals, is motivated by the ease of customization and because they are more suitable, and well as because they represent a possibility to improve job opportunities.

In spite of these motivations, the users from this group pointed to a series of difficulties in using FS/OS, which were not present in the initial list of categories related to this issue. The following were the main difficulties pointed out:

- Established culture of proprietary software: Companies or customers compel the use of proprietary software and quite often there is no compatibility with the files generated by a commercial software;
- Installation problems such as the non-standardization of systems to make it easy to install and configure devices and tools, since the user interfaces are not intuitive and are poorly designed;
- Difficulties in obtaining drivers compatible with the hardware manufacturers;
- Lack of FS/OS versions of specialized tools such as AutoCAD, Photoshop; for many people, some proprietary software is still superior;
- Lack of documentation, help files and few bibliographies in Portuguese;
- Lack of technical support for the end user (help desk).

From this list it is possible, to assume that these are professionals who feel compelled to use FS/OS tools at work, or who want to use them in their professions but who still run into many limitations.

### **Group 4 – Professors and professionals from the IT management area (31%)**

This group is formed by IT professionals (software engineer/analyst, IT professor and public servant in IT) from other fields, whose income is higher than 5 minimum wages. In addition to a higher income, they are the oldest users with the highest schooling (older than 30) among the groups, as well as the most experienced in FS/OS which they have used since 1995 - 1997. They use FS/OS at work and one of the main motivations is reduced costs, in addition to a more ideological issue ("limit the power of major corporations").

Many of them have no use difficulties and no capability problems. The problems they face are related to technical issues related to the tools and to the poor adequacy of the tools available for solving their problems. They also pointed out difficulties related to cultural issues of the users they work with and the difficulty of finding qualified personnel and companies that provide support for FS/OS.

**Table 3** - Socioeconomic characterization of individual user groupings

<b>Variables</b>	<b>Group 1 Intermediate level students (14.5%)</b>	<b>Group 2 University students on scholarships (20%)</b>	<b>Group 3 Professionals from the technical area (35%)</b>	<b>Group 4 Professors and professionals from the IT management area (31%)</b>
Current principal occupation	Student	Student (IT) and others	Programming Technician / Network Admn. / Support IT Consultant Other (IT and others)	Software engineer/analyst Engineering (other) IT Professor Professor Public servant (IT) Public servant (other)
Educational level	High School Incomplete higher education	Incomplete higher education	Medium level	College graduates Master's degree Doctor's degree
Monthly income (minimum wages)	No income	Up to 1 1 to 2 2 to 3	2 to 3 2 to 4 3 to 5 5 to 10	5 to 10 10 to 20 Above 20
Employment status	Not currently employed	Scholarship holder	Self-employed Employed	Employed Member/owner
Place of work	Not applicable	Universities (public and private)	Private company Multinational company Own company / cooperative Self-employed	Private company Federal public administration

Source: Field research, electronic survey



**Table 4 -** Characterization of FS/OS use by individual user groupings

<b>Variables</b>	<b>Group 1 Intermediary level students (14.5%)</b>	<b>Group 2 University students on scholarships (20%)</b>	<b>Group 3 Professionals from the technical area (35%)</b>	<b>Group 4 Professors and professionals from the IT management area (31%)</b>
Place of use	School / university / college	School / university / college	At home At work	At work
Where they became aware of FS/OS	Newspapers and Magazines Telecenters	School /university / college Friends / relatives	On the Internet / discussion groups Friends / relatives Newspapers / Magazines / TV	At work
Reasons to use FS/OS	Participate in the community Learn and develop new skills	Improve job opportunities Tools more appropriate for my use	Due to the ease of customization Improve job opportunities Tools more appropriate for my use	Reduce costs Limit the power of major corporations
Difficulties found	Lack of capability	Lack of capability Unaware of software on repositories	Proprietary software culture Limitations of the interface with users Lack of drivers compatible with hardware manufacturers Lack of specialized tools Lack of support and maintenance	Inadequacy of software available for problem resolution Technical problems Users' cultural issues Difficulties with HR / support companies No difficulties

Source: Field research, electronic survey

### 3.2 Company users

This section analyzes the use of FS/OS at companies and other institutions in Brazil. It uses the data obtained from the panel of specialists, the electronic survey, and the secondary surveys. The media has regularly presented examples of successful use of FS/OS, especially within the banking and retailer commerce sectors. The most common, in terms of layers, is the migration to or implementation of FS/OS in IT infrastructure areas. Chart 6 shows a summary of illustrative cases obtained from media reporting.

## Chart 6 - Summary box with illustrative cases of FS/OS use by companies in Brazil

**Varig (commercial aviation).** In 2001, Varig had sharp growth in the number of e-mail users, from 3,000 to 6,000. This would involve an expense - for exchange licenses alone - of US\$ 240 thousand plus US\$ 3 per user for monthly maintenance. The company decided for an open solution (Courier + Qmail). The company now has 13 thousand e-mail accounts with free software. In addition to the e-mail, Varig intends that 100% of its Internet area have free software within 3 years. It currently has at least 30 systems running on the open model. The company estimates annual savings of 12 million Brazilian reais from the use of free software. (*Info Exame - February 2004, "O Fenômeno do Software Livre" (The Free Software Phenomenon), mentioned in Fortes, 2004.*)

**Extracta.** Extracta is a biotechnology company located in Rio de Janeiro. Free software dominates the company's technology area, which includes complete processing of chemical and biological tests. Windows remains on just a few desktops. The savings are estimated to be US\$ 160 thousand per year. (*Info Exame - February 2004, "O Fenômeno do Software Livre" (The Free Software Phenomenon), mentioned in Fortes, 2004.*)

**Sucos Mais.** Sucos Mais is a company located in Linhares, Espírito Santo State, which produces 4.5 million liters of juice per month. One hundred per cent of the company's servers run on Linux. It saved US\$ 100 thousand on licenses alone. (*Info Exame - February 2004, "O Fenômeno do Software Livre" (The Free Software Phenomenon), mentioned in Fortes, 2004.*)

**Carrefour.** Will use Linux to run Calypso (a Unisys system) on its 7,220 terminals, migrating from 30 to 40 stores a year. (*Info Exame - February 2004, "O Fenômeno do Software Livre" (The Free Software Phenomenon), mentioned in Fortes, 2004.*)

**Pão de Açúcar Group (supermarket).** Will use Linux at its Points-of-Sale (POS) to run the Itautec Commercial Automation System (SIAC) at the chain's 500 stores (Pão de Açúcar, Extra, and Compre Bem) totaling 8,500 POSs. The migration time is expected to be 3 years. (*Info Exame - February 2004, "O Fenômeno do Software Livre" (The Free Software Phenomenon), mentioned in Fortes, 2004.*)

**Wall-Mart.** Intends to migrate its 1,000 terminals at 25 Brazilian stores, but did not inform the timeframe stipulated for this migration. (*Info Exame - February 2004, "O Fenômeno do Software Livre" (The Free Software Phenomenon), mentioned in Fortes, 2004.*)

**Sonae Group (supermarket).** This group, which has 5 thousand POSs distributed at the Big, Candia, Mercadorama, Nacional, and Maxi Atacado supermarkets, uses a pilot at 3 of its 174 stores on Linux. All critical mission servers use the Linux operating system, equivalent to 10% of the group's total servers. (*Info Corporate - May 2003, "Pronto para encarar o Linux?" (Ready to face Linux?), mentioned in Vieira and Nogueira, 2003.*)

**Embrapa Informática (Brazilian Agricultural Research Corporation - Information Technology).** Uses Linux on part of its desktops and has 30% of these desktops on a dual boot system. In addition, the company is setting up a free software repository where it will make available some of its programs. (*Info Exame - February 2004, "O Fenômeno do Software Livre" (The Free Software Phenomenon), mentioned in Fortes, 2004.*)

**Petrobrás (gas and petroleum).** Petrobrás uses the Linux on cluster applications for analysis of prospecting data. There are more than 1,000 CPUs from various suppliers in cluster with Linux. (*Info Exame - February 2004, "O Fenômeno do Software Livre" (The Free Software Phenomenon), mentioned in Fortes, 2004.*)

**Banrisul (bank).** The migration began in 2004 and has been performed gradually. Part of the services from each local network of the bank agencies work with Linux, such as self-service, proxy, network servers, and DHCP server (distribution of IP address to the stations). However, several platforms should continue to coexist. (*Info Corporate - May 2003, "Pronto para encarar o Linux?" (Ready to face Linux?), mentioned in Vieira and Nogueira, 2003.*)

**UOL (content portal and paid internet service provider).** Universo Online is replacing its SOLARIS servers with Linux. (*Info Corporate - May 2003, "Pronto para encarar o Linux?" (Ready to face Linux?), mentioned in Vieira and Nogueira, 2003.*)

**Telemar (telephone operating company).** Telemar uses Linux for its pulse collection and handling system. (*Info Corporate - May 2003, "Pronto para encarar o Linux?" (Ready to face Linux?), mentioned in Vieira and Nogueira, 2003.*)

**Infoglobo.** This company publishes the O Globo, Diário de São Paulo, and Extra newspapers. Due to the specific needs of the news business they needed versatility, since its products have deadlines and any delay means a loss of money. The company chose Linux and had costs 60% lower than forecast. Infoglobo has invested approximately US\$200 thousand in the migration, compared to initial expected expenditures of US\$ 650 thousand.

**Itaú (bank).** Will use Linux on its desktops with a closed configuration. They are doing this because they want their employees to get used to the system, so that they do not pay a very high price at the time of the migration. They also intend the software to be used in the Automatic teller machines (ATMs). (*Info Corporate - May 2003. "Pronto para encarar o Linux?" (Ready to face the Linux?), mentioned in Vieira and Nogueira, 2003.*)

**GVT (telephone operating company).** GVT has already replaced some RISC servers with others having an Intel-Linux platform. With this, they obtained savings above R\$1 million. They intend to replace the entire set of Unix servers. (*Info Corporate - May 2003. "Pronto para encarar o Linux?" (Ready to face the Linux?), mentioned in Vieira and Nogueira, 2003.*)

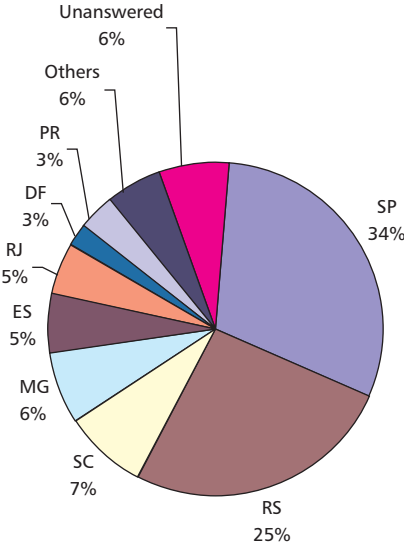
**Colombo Stores (home appliances).** The Linux Platform is deployed on the entire network operating system. The migration took 2 years and used equipment which would have to be replaced such as PCs with a Pentium 100 MHz configuration, which was a decisive factor in the company's decision. All PCs at the stores use Conectiva Linux. Linux runs on 3,200 POSs and 290 servers. The CIO of Lojas Colombo (Colombo Stores) estimated that they saved 80% in comparison with Microsoft products. (*Info Corporate - May 2003. "Pronto para encarar o Linux?" (Ready to face the Linux?), mentioned in Vieira and Nogueira, 2003.*)

**São Paulo Metro.** The first calculations by the municipal subway system for the implementation of employee e-mail services demonstrated that the price of the proprietary e-mail software license was around US\$ 100 per user, which could drop to US\$ 30 with a large purchase. Even so, that would be a heavy investment since the Metro had approximately 3 thousand e-mail users. In addition, the deployment of Notes would require the installation of various servers and the replacement of nearly all the company's PCs. This cost was avoided by using a free solution. In addition, with the use of office free packages, annual savings have reached R\$ 700 thousand for the 1,600 PCs now used by Metro s (<http://www.metro.sp.gov.br>).



### 3.2.1 Characterization of company users

By means of secondary surveys and the responses from customers in developing countries to the electronic survey it was possible to identify 154 companies using FS/OS.<sup>63</sup> The **geographic distribution** of these companies demonstrates a large concentration in the Southern and Southeastern regions, in part because this is where the Brazil's major software producers and consumers are located. Rio Grande do Sul stands out in the Southern states and concentrates 25% of the companies identified as free software users (graph 7). By city, São Paulo and Porto Alegre alone account for 43% and 20% of the total companies respectively.<sup>64</sup> The emphasis on the use in Rio Grande do Sul and, particularly, in the city of Porto Alegre, was strongly influenced by the state government, because a state law was enacted during the administration of Gov. Olívio Dutra that gave preference to free software in government purchases. This was revoked by the following government. As a result, Porto Alegre became one of the main supporters of this model on an international level and has been the seat of the International Free Software Forum.



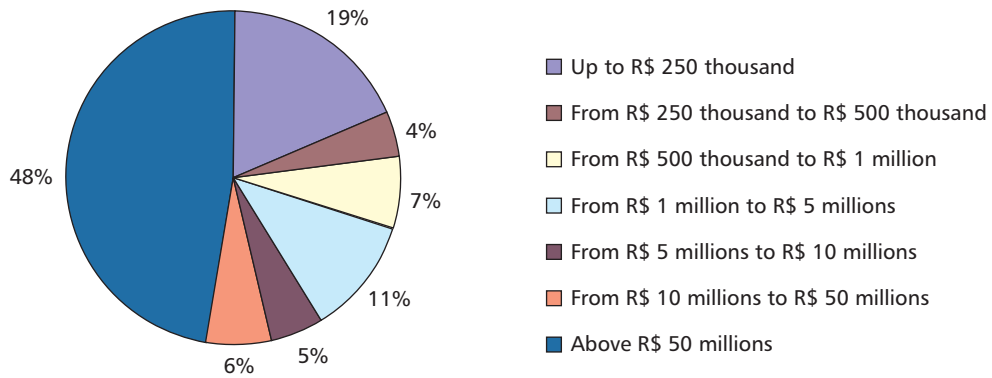
**Graph 7** - Localization of using companies  
Source: Field survey, electronic survey

A substantial number of the using companies are medium or large, since 64% of them have billing above R\$ 1 billion/year (48% above R\$ 50 million) (graph 8), and 65% of the companies employ more than 99 people (graph 9). This may indicate that the use of FS/OS is currently a characteristic of large companies. The predominance of large companies among the users - as pointed out below - derives, among other factors, from greater savings from licenses provided by adopting the FS/OS.

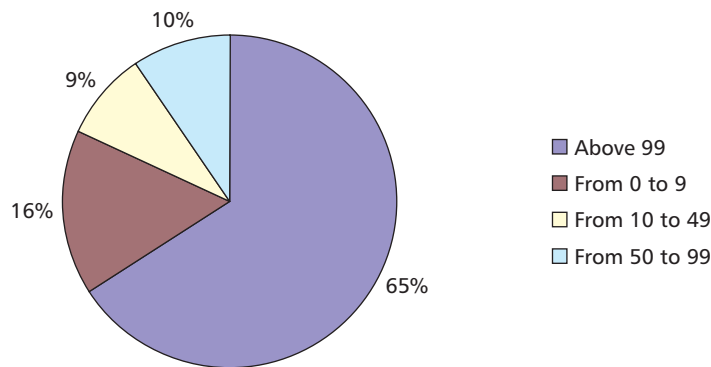
The use takes place mostly in Brazilian companies (87%), although there is a larger number of multinational companies that use FS/OS (13%) than develop it in Brazil.

<sup>63</sup> This list is thought to be larger because it is more difficult to survey user than developer companies, since users are not found in catalogs and do not always provide information on their websites about the software they use.

<sup>64</sup> Other cities standing out are: Rio de Janeiro (18%), Curitiba (15%), Brasília (12%), Belo Horizonte (11%), and Campinas (8%).



**Graph 8** - Billing by companies that use FS/OS  
 Source: Field research, electronic survey (note: n=140)



**Graph 9** - Number of employees in corporate users  
 Source: Field survey, electronic survey (note: n=105)

### 3.2.2 Strategies

In order to further detail how FS/OS is being used, some strategies observed at the major using companies which were interviewed are presented, and an attempt was made to organize the strategies by economic sector.

#### Financial sector

The financial sector presented a trend toward the use of FS/OS on the operating systems of servers and on dedicated equipment (ATM). The sector’s ICT operations require great stability and maturity of the adopted technologies, which seems to be achieved by these Linux applications. However, there are few cases of applications other than this operating system, since the solutions in effect are mature and stable.

Savings from the use of the Linux may, in one of the cases, reach R\$ 17 million in 4 years, and 90% of this is due to savings from the payment of licenses and the other 10% from the reuse of hardware, since the use of FS/OS in several instances avoided the need for new acquisitions. Although the gains have by far exceeded the investments, the cost reduction was not the strongest motivation. The adherence to standards and greater stability were the main motivations. While one of the reasons for the migration was discontinuity in DOS support, the option for Linux was certainly a bold decision. The development, support, and maintenance were internally



performed with some outside specialized help<sup>65</sup>. Although migration has already occurred on the workstations, almost no movement is perceived with regard to vertical applications for the financial system.

### **Retail trade**

A trend to the use of FS/OS on the operating systems of servers and on dedicated POS equipment was observed in this sector. These migrations were performed by in-house staff and with support and consulting from the main IT companies acting in this sector and which are also involved with supply and support of FS/OS.

A great sensitivity to hardware and license costs exists within the retail and commercial sector, since large-size retailer chains usually have thousands of computers. Consequently, cost reduction was the main motivation particularly in connection with equipment since - in all the instances of POS migration observed - this occurs from DOS to Linux (not from Windows to Linux, except for a small portion of the office equipment where a migration occurred from the Microsoft system). However, some technical aspects such as stability,<sup>66</sup> security and transparency are also significant reasons. In addition, migration is particularly highlighted among large retailers because of DOS's limits in memory management, since new applications - especially for debit/credit cards - require much more memory than the limited 640 KB provided by DOS. The fact that the sector's hardware suppliers assume responsibility for supporting Linux has also permitted a greater ease in the decision of these major users.

### **Healthcare**

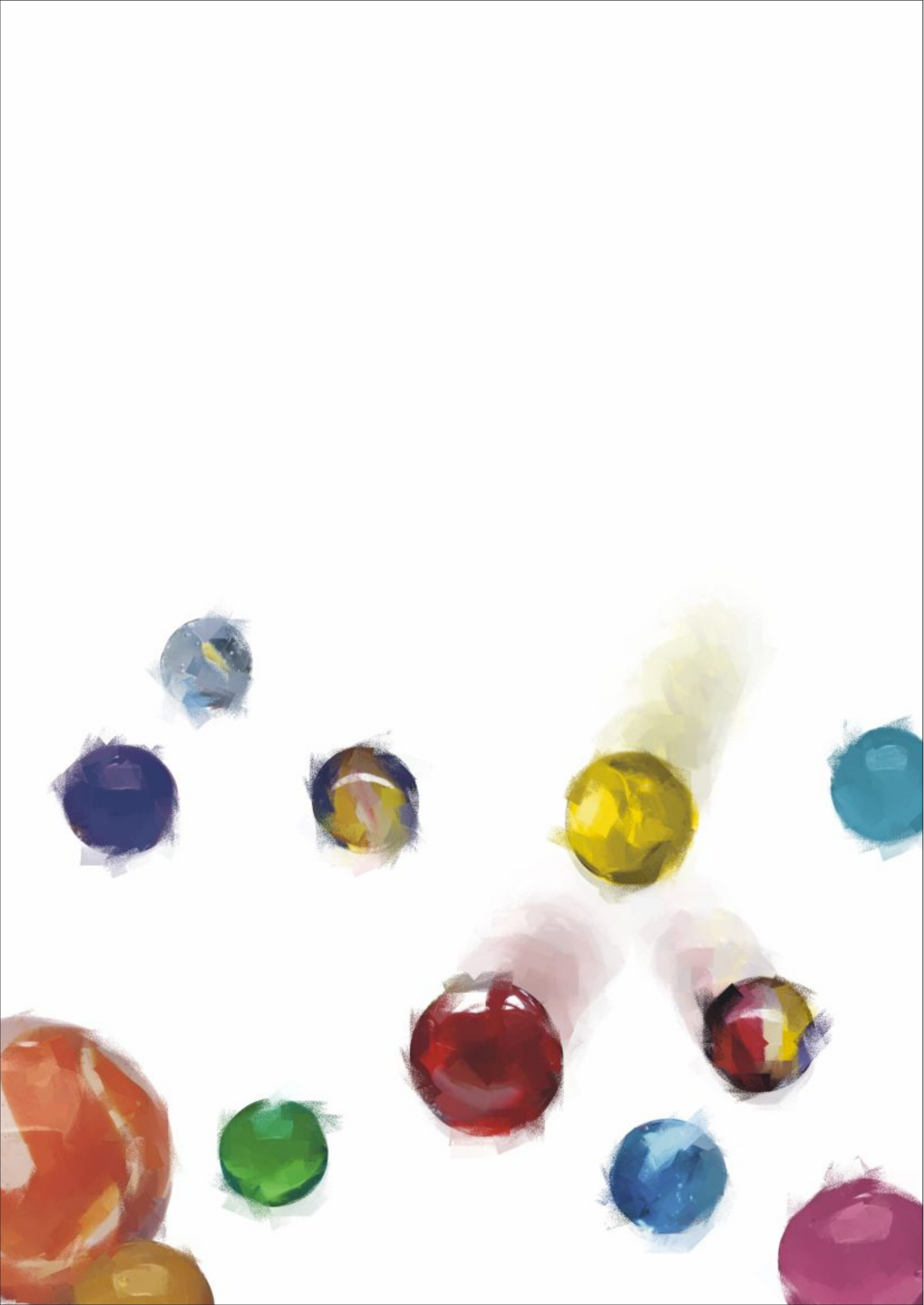
In the healthcare sector a migration of server operating systems is noted, as well as a migration on workstations to a lesser degree. There is also specific development for the field created on a free platform, particularly in the public sector. The greatest motivation is cost reduction and independent supply, which have a direct impact on the institution's financial performance. There is a huge market to be exploited.

The next chapter will define some economic factors that explain the dynamics and logic in inserting FS/OS in the software industry, particularly the Brazilian software industry. The intention is to point to the business models opportunities and threats posed by free software.

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<sup>65</sup> The success factors were the legacy of knowledge in Unix and the maintenance of standards and rules during the history.

<sup>66</sup> One of the listed advantages is system stability, which is quite valued in these companies where any downtime is responsible for savings of thousands of Brazilian reals.





## Chapter 4

# FS/OS Economic factors: motivations, sectors, and business models

Three main themes are presented and discussed in this chapter: (a) the motivations for FS/OS development and use; (b) the main sectors and use areas of FS/OS; and (c) the business models involved in FS/OS. These themes have been an integral part of many studies abroad and more recently in Brazil, although the discussion about the business models has not been deeper here. Almost all surveys of FS/OS paths attempt to understand the reasons and interests involved, particularly because it is necessary to identify the FS/OS specificities in relation to the proprietary software industry. In fact, the method employed here to understand the business models begins from the principle that FS/OS is part of the software industry and, therefore, its analysis should be made from within the industry.

The economic dimensions involved in FS/OS and how they have been developing are the issues analyzed by the studies. Then, the results of the survey performed by this project are presented, which included individual, small, and medium-size companies, developers, major corporate users, generic users, universities and others. As in the other parts of this study three main sources are used: a panel of specialists, the electronic survey with developers and users and interviews at companies.

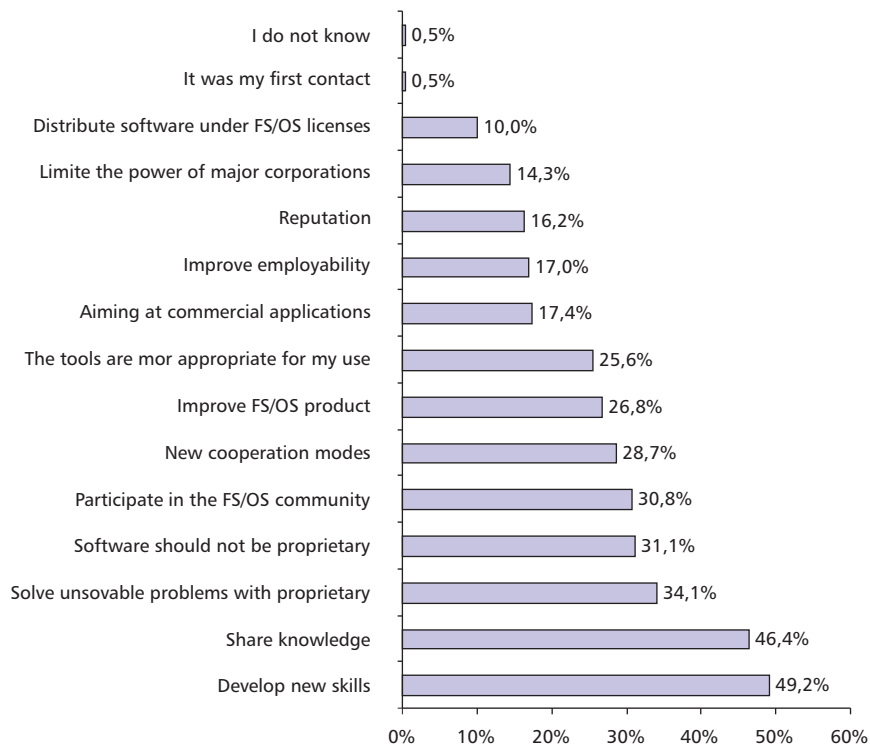
### 4.1 Motivations to use and develop FS/OS

There is a vast literature about the theme, “motivations of FS/OS developers and users”. The motivation to be involved with FS/OS options presented by the people interviewed in general involve technical, ideological, sociological, and economic factors. The motivations were investigated among the three main sources of information for this study: the panel of experts, the survey of developers and users and interviews at companies.

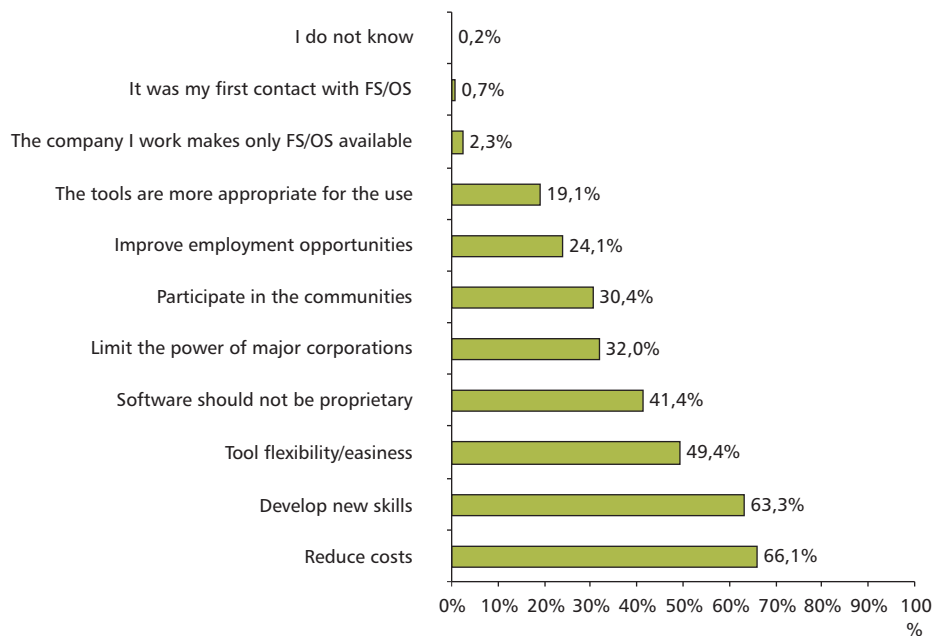
In the survey with developers, specific issues concerning motivations were raised, as seen in graph 10.

The great majority of the respondents highlighted options related to capability, such as how “to develop new skills” and “share knowledge”. Then, a motivation of a technical nature appeared: “solve problem unsolvable problem with proprietary software”. An ideological motivation followed: “software should not be proprietary”. It is also worth commenting on two economic motivations: “better employability” and “commercial applications”, both had a low placement within the survey ranking.

The results were a little bit different among the users (graph 11). “Reduce costs” and “develop new skills (capability)” were the reasons with the highest frequency. The other motivations are a mixture of technical (“tool facility”) and ideological (“software should be proprietary” and “to limit the power of major corporations”) reasons. It is interesting to note that the ideological reasons are stronger among users than among developers, probably because the financial support of the latter comes from program development. Even though the ideological component is important, practical issues make this group more pragmatic.



**Graph 10** – Reasons for FS/OS development and/or distribution, given by developers  
 Source: Field survey, electronic survey



**Graph 11** – Reasons for using FS/OS, given by users  
 Source: Field survey, electronic survey



Differentiated criteria were used to identify the motivations found by the survey among developers and users, due to the differences between these players. However, these criteria were standardized by the Panel of experts and in the interviews at companies. Table 5 displays the results of the consolidated interviews at the companies and then the results of the panel of specialists are discussed.

**Table 5** – Reasons for FS/OS development and use

Reasons	Average	Standard deviation
Cost reduction (hardware and software)	4.36	0.84
Greater flexibility/adaptation freedom	3.71	1.44
Improved quality (stability, reliability, availability)	3.64	1.34
Greater independence of supplier	3.64	1.69
Greater security/privacy/transparency	3.57	1.34
Greater scalability	3.50	1.29
Greater adherence to standards/inter-operability	3.43	1.65
Philosophy/principles	3.29	1.73
Digital/social inclusion	2.64	1.95
Greater legality (licenses)	2.57	2.28
Availability of qualified human resources	2.14	1.03
Less time for development	2.29	1.45

Source: Field survey, interviews with companies

Note: 15 Companies, Likert scale from 1 to 5, in ascending importance

The results of the interviews at the companies show the main motivation reason for using FS/OS to be “cost reduction”, followed by “greater flexibility”, “improved quality (stability, reliability, availability)”, “greater supply independence”, and “greater security”. Thus, the main motivations are economic (costs and suppliers) and technical (flexibility and quality). Motivations of an ideological nature remained in the background.

The availability of qualified human resources is of lesser importance to the companies, because apparently this neither constitutes a motivation nor an obstacle to FS/OS growth in the country. The issue of shorter development time could not be fully evaluated because two companies did not give a score for this criterion. However, it is known that for those developers whose core business is software, this criterion has great importance.

Actually, except for the reason “cost reduction”, which was almost unanimous among the respondents, the answers were greatly dispersed, with high standard deviations, which shows that the motivations vary according to a vast set of criteria (especially between developers and users, economic sector, company size and others).

With regard to the motivations identified by panel, the results only differ from those of the company interviews and the users survey, in terms of the importance given to cost reduction. Unlike what was seen in the interviews at companies and the user survey, the “cost reduction” motivation was in sixth place on the panel. The first three motivations were of a technical nature: “flexibility and freedom to adapt”, “security / privacy / transparency”, and “inter-operability”. Supplier independence and product quality were still ahead of cost reduction.

On the other hand - as in the case of the results at the companies where interviews were conducted and contrary to the results of the survey of developers - ideological factors were in the background. Again - and corroborating what was seen at the companies - the availability of human resources was not regarded as a motivation to develop and use FS/OS.

In short, the methods used by this study to survey the motivations for FS/OS development and use led to the following conclusions:

- There is no motivation standard representative of all players involved in FS/OS. The reasons are quite heterogeneous and vary among technical, economical, financial, capability, and ideological factors.
- Technical factors are more associated with flexibility, security, adaptation potential and inter-operability of programs.
- The reasons of an economical and financial nature refer to the reduction of operating and capital costs (nonpayment of licenses, lower hardware renewal fee, cheaper upgrades),<sup>67</sup> and the possible reduction of transaction costs (economies of networking in the development),<sup>68</sup> and a greater independence from suppliers).
- The gains from transaction cost in FS/OS are more associated with the economies of networking than with other events. These costs may increase if there is any difficulty in finding support services and a risk of discontinuing program development. Actually, a reduction of transaction costs only occurs when there is stability in the market of a given product or service.
- This is one of the reasons why FS/OS's success lies more in operating systems than in applications. Generally speaking, and at this time, FS/OS seems to be more a transaction cost amplifier, precisely due to uncertainty, risks, and high specificity of the assets. Less specific products (operating systems) are more easily standardized, allow for greater and quicker market acceptance, and are capable of offering a transaction cost reduction.
- The cost reduction factor evidently has strong importance for major users. The large scale FS/OS adoption by a financial institution with tens of thousands of worksites scattered throughout the country, or by a large retail company, create incentives related to the nonpayment of license fees and because there is no annual equipment upgrades as with to proprietary software. Generally speaking, on large systems (for use and development) the cost reduction factor is the main motivation for involvement with FS/OS. Another motivation pointed out particularly by the large-size retail trade companies was the virtual adoption of FS/OS as a bargain weapon to negotiate significant reductions in traditional software licenses.
- The motives related to training refer to the possibilities for shared learning (and, therefore expanded learning), and an array of skills because of the relatively large universe of observers (showcase effect). They still make it possible to enlarge the developer's employability conditions, exactly due to this permanent (networked) exposure of skills.<sup>69</sup> The altruistic behavior in FS/OS completes itself with reciprocity and considerations regarding the employment market (Lerner and Tirole, 2002).
- The ideological motives are strong and express themselves in principles contrary to the use restrictions, the advancement of knowledge and to economic concentration (oligopolies and monopolies) and by principles in favor of social inclusion.

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<sup>67</sup> At companies which use commercial automation cost reduction was a consensus, particularly because of the POSs.

<sup>68</sup> The economies of networking imply changes both in production costs (because they can lead to a reduction in expenses for manpower and capital), and in transaction costs (due to the derived externalities).

<sup>69</sup> As Raymond (2001) says: "Considering a large enough base of testers and co-developers, almost all problems will be quickly characterized and the adjustment will be obvious to someone".



- Thus, the motivations should be seen as a reflection of the players' different perspectives:
  - Developers associated with the FS/OS communities point to reasons of a technical and ideological nature as their main stimulants (flexibility, security, inter-operability, principles contrary to proprietary software and large oligopolies). Also, there are very strong capability reasons (employability, in the sense of finding a job and having an income).<sup>70</sup> The FLOSS – Free/Libre Open Source Software study and the developer profile component of the survey and study (Ghosh *et al*, 2002) confirm this profile.
  - Generic users have a combination of motivations including training, economic and ideological factors.
  - Corporate users and using/development companies clearly have a sense of cost reduction (economic/financial nature) as the main reason, which is supplemented by more supplier options (possible reduction of transaction costs)<sup>71</sup> and by technical characteristics such as flexibility and security.
  - FS/OS developing and supplying companies were expected to first observe the economic gains associated with the economic gains of networking, which allow a new product to be developed with the collaboration of a great number of developers and, therefore, in a quite shorter time. However, nobody mentioned this fact, but if someone did, it would be developing companies, not users (which “buy” the free software in the same way as they do other software, seeking guaranties and lower price). If somebody benefits from the “economies of networking” it would be the suppliers, not the users (corporate users), since they do not enter the community and have no reason to do so. Their contact is only with their software supplier which may have contact with the community and economies of networking. The argument that they “use reputable Linux distributions” is not applicable here. The technical criteria take second place and those of an ideological nature are in general of lower importance. This is in keeping with the findings of international surveys. The FLOSS Study of companies (Wichmann, 2002) points out four motivations for the companies:
    - Standardization;
    - Cost reduction;
    - Market strategies;
    - Compatibility expansion.

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<sup>70</sup> In a recent dissertation, Augusto (2003), analyzing the profile of 102 developers, found as main motivations “increase the knowledge in computing”, “reputation gain”, and “better employability”.

<sup>71</sup> The possibility of a greater independence from suppliers varies according to the type of software. One of the employees interviewed at a retail trade company said they did not receive proposed solutions for FS/OS desktop, which it understood as an indication that this area is not yet mature.

- All player categories, combined, in an interactive process as was the panel, demonstrated a preference for technical motivations, which makes one believe that among the four main motivation categories (**technical, economic, training, and ideological**) the technical reason appears to be the common factor, which facilitates dialog and interaction between the different perspectives.
- In other words, the technical advantages related to the FS/OS are a common attraction for the different (and very different) perspectives which populate the free software world. Major national and multinational corporations from various sectors, individual, small and medium-size software companies, hackers, government agents, large consulting firms, universities, research organizations, and others, work with different preferences (and motivations) for FS/OS development.
- The strong assumption one may draw from this analysis is that the development of the “free software world” depends on all these players. Even though the conflicts are visible, there are economic, technical, skill-related and ideological reasons moving FS/OS forward. It is difficult, if not impossible, to quantify the contribution of each to this movement which is essentially progressive.

## 4.2 Intensity of FS/OS use in application areas and sectors

This item seeks to analyze the FS/OS use areas and sectors (domains) which currently have greater importance. The difficulty in finding an appropriate classification to study the market and sectorial importance of FS/OS, in this study, caused the adoption of a 29-sector classification used by Unesco for software in general and which already has been applied in several other surveys. This list served as a reference for this project. Concerning the FS/OS application/use areas, the classification used in the Quality Research (SEPIN, MCT, 2001) was used. Subsets of these areas will be occasionally used in this chapter.

In all of the surveys performed there was quite a convincing convergence toward the intensity of FS/OS use within the economic sectors, with a clear predominance in four sectors: information and communication technologies, government, commerce and education (see chart 7).

A coincidence was also verified among the data sources in the other five most outstanding segments. Although with a less coinciding order than in the four most important sectors highlighted above, there was a strong convergence in the following sectors: services in general (except for commerce), health, finance, culture and entertainment and electrical-electronic and communications equipment.

The survey of the current importance was supplemented by asking the panel of specialists for their forecasts for the future importance of FS/OS use in these sectors (over a 5-year horizon). The results of this exercise showed a picture very close to that described for the current moment, with a greater intensity in use in healthcare and services in general, and a drop in the relative importance of the commercial and financial sectors. It is important to point out that government and education continue with a high perspective of intense use, both in search of ICTs.



**Chart 7** - Intensity of FS/OS use by economic sectors - current status

Sector	Sum of scores given by the groups
Communications and Information	46
Government	44
Commerce	43
Education	41
Financial Sector	27
Services	20
Electrical-Electronic and Communications Equipment	20
Healthcare	15
Culture and Entertainment	11
Energy	10
Transportation, Logistics, and Storage	3
Agriculture, Vegetal Extraction, Forestry, Hunting	2
Weapons Industry	1

Source: Field research, panel of specialists

Now, using the multivariate analyses presented in the preceding chapters (based on the survey results), one observes that - for developers for whom FS/OS is their main expertise and main business - the acting sectors coincide with those observed by the ensemble of surveys performed, with a strong emphasis on government. For companies for which FS/OS is not their main business and which work both on proprietary and free software, markets are more restricted and concentrated, especially in commerce and services in general. Curiously, these companies do not develop for the government. This gives the impression that most of the FS/OS developed for government (except for that made by the government itself) come from small companies dedicated to free software. On the other hand, it is understandable that companies more specialized in FS/OS act on a broader array of market segments than those companies for which free software is not their main niche (see Chapter 2).

In short, there is currently an intense concentration of FS/OS use in ICT markets, government, commerce, education, and other services, thus characterizing three main types of markets:

- **ICT**, natural incubator for FS/OS and, therefore, a systematic target for developments of operating systems, infrastructure, middleware and applications;
- **Government**, because of the strong directed demand based on philosophical reasons and supposed cost reduction, and especially including operating systems, but also the other layers (infrastructure, middleware, and applications); and
- **Services**, particularly in commerce and education, but also in healthcare, with a strong presence of operating systems and, secondly, other infrastructure items, but not much presence of applications.

As to the future, Brazil should - within the next five years - follow the path inaugurated in the early 2000's, with a growing role of FS/OS for in ICT, government and large-scale services, such as education, healthcare, and commerce.

This composition of sectorial importance raises some questions about the business models related to free software in Brazil. However, before going into this subject, it is worth verifying the main FS/OS application areas identified in this study. In a way, the developer application areas supplement the information on the economic sectors.

It is noted, for example, that Web page, data communication, network management and data protection and security account for most of the FS/OS applications, justifying the importance to the ICT sector (although for other sectors as well; but these applications are typical of ICT). Moreover, business automation, electronic commerce (trade), distance education, school administration (education), service administration (services), among others, demonstrate that the application areas are concentrated on business models based on low and high value services (this point will be discussed below).

There is FS/OS development in a wide variety of fields. The most frequent performance is related to services related to the Linux operating system. These services involve network configuration, operating system installation and applications, configuration for greater security, and others.

Considering the results of the secondary data survey regarding corporate developers and users, a profile is noted that coincides with the findings of the survey performed by questionnaire. The area of activity of development companies was identified based on the description of their services in their respective sites. Some of them served easily identifiable specific niches. Others were developers of nonspecific solutions for a segment (custom-made software). In these instances, the area of activity was classified as "utility development", since the systems vary considerably according to the customers' needs.

A strong convergence occurred between the survey results (primary data) and that of the list of companies (secondary data), with minor changes. It should also be stated that most free software development companies are IT companies (of the 364 companies on the list, 355 are IT's).

The corporate users, in turn, are located in a wide variety of economic sectors. Services and commerce have the highest rates. In commerce, the use of Linux on direct points-of-sale (POS) equipment can be highlighted. This equipment runs only the POS system responsible for making the sale, and the machine operating system is completely transparent to the user. This transparency is important since it eliminates training costs for the store cashiers, who will continue to access the same POS application as before. The savings on licenses are reasonable, considering that each store has dozens of such computers, and it would be necessary to pay an operating system license for each POS.

The information technology companies can also be important users of free software, since there are a number of free tools to help in development (such as Eclipse, Net Beans, Jboss, and free databases).

### **4.3 Business models in FS/OS**

Free software is an integral part of the software industry. However obvious this might seem, it is important to highlight the fact that FS/OS belongs to an industry, your industry, the software industry. Considering the revolutionary potential of FS/OS, it is necessary to clearly identify the structures it is revolutionizing. As a business model FS/OS incorporates new ways of making money in the software industry. In this way, it changes competitive standards in the industry which created it. Therefore, in order to identify FS/OS business models it is first necessary to see how it changes the software industry business models.

It is also worth answering the following questions: Will FS/OS do away with the industry's proprietary regimes? Which ones? Does it engender new technological systems and new markets? Which ones? What should change in the software market organization with growth of FS/OS?



The answers to these questions provided here are basically as follows: FS/OS does not do away the proprietary regime, but with some types of proprietary regimes, specifically those combining **low application specificity** (more generic programs, usually marketed as packages) with a **high interest in reproduction** (desirable copy). Concurrently, FS/OS does not on its own engender new technological systems, not in the meaning given to the term by Nelson & Winter (1982), but it actually engenders new directions for old paths and new paths within a given technological system. The software industry in this reorganization of paths has been taking on new contours and certain proprietary standards tend to disappear, particularly those used on operating systems.

#### 4.3.1 Businesses with FS/OS

The specialized bibliography points to several business models which actually are more diversified ways of making money with FS/OS (Hecker, 2000):

- Full service: Business based on the sale of physical packages (CD, booklets) and the sale of all kinds of software support (training, consulting, presale, customized development, post-sale, etc.).
- Clientele development (*Loss leader*): Business is not based specifically on FS/OS, but serves to create habits and preferences which will then be useful for introducing FS/OS-based proprietary commercial software.
- Enabling hardware (*widget frosting*): Use of free software for drivers, interfaces or even operating systems, to reduce costs and prices of equipment to be marketed.
- Accessories: Sale of physical items related to FS/OS (compatible hardware, books, cups, images, etc.).
- Online offer: Development and offer of FS/OS on an online system whose access is authorized by paying a membership fee. This model also presents gains from advertising.
- Brand licensing: Brands associated with FS/OS are created and licensed.
- First sell, then release: Code opening after investments are paid off, creating a clientele for new developments associated with the open program.

Two important issues are noted in these categories: The focuses of these business modes on services and on-embedded software.

Let us now see how FS/OS can be viewed from the perspective of the software industry business models. Reconsidering the survey undertaken in this project, let us look at the issues related to FS/OS business models from the categories pointed out by SOFTEX (2003).<sup>72</sup>

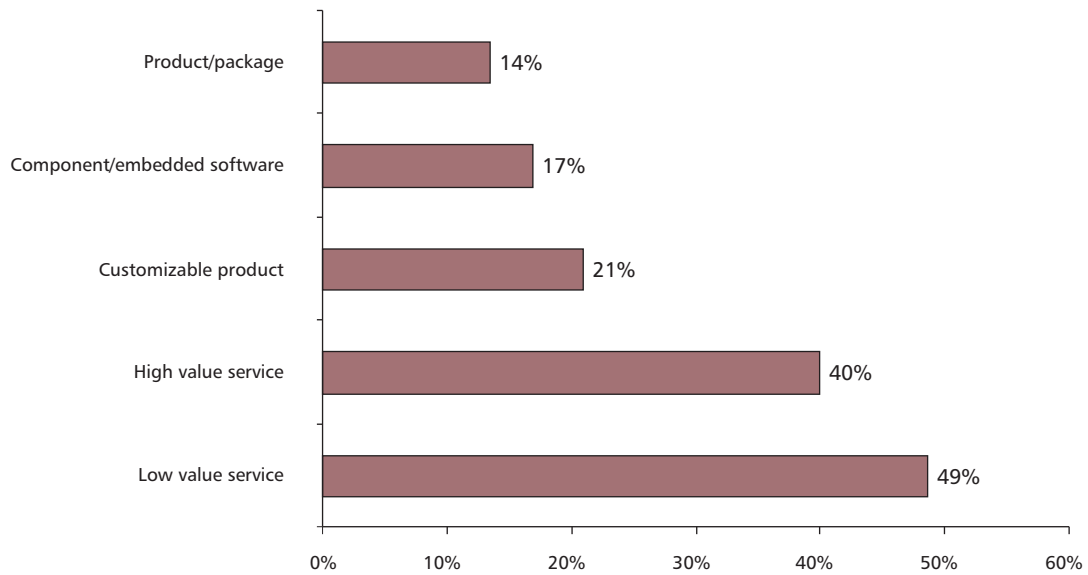
Generally speaking, developers and development entrepreneurs in particular classify their markets in three main models: high and low value services and customizable product. Actually, these preferences are more noticeable in the entrepreneurial segment than that of developers in general. Graphs 12 and 13 illustrate this point.

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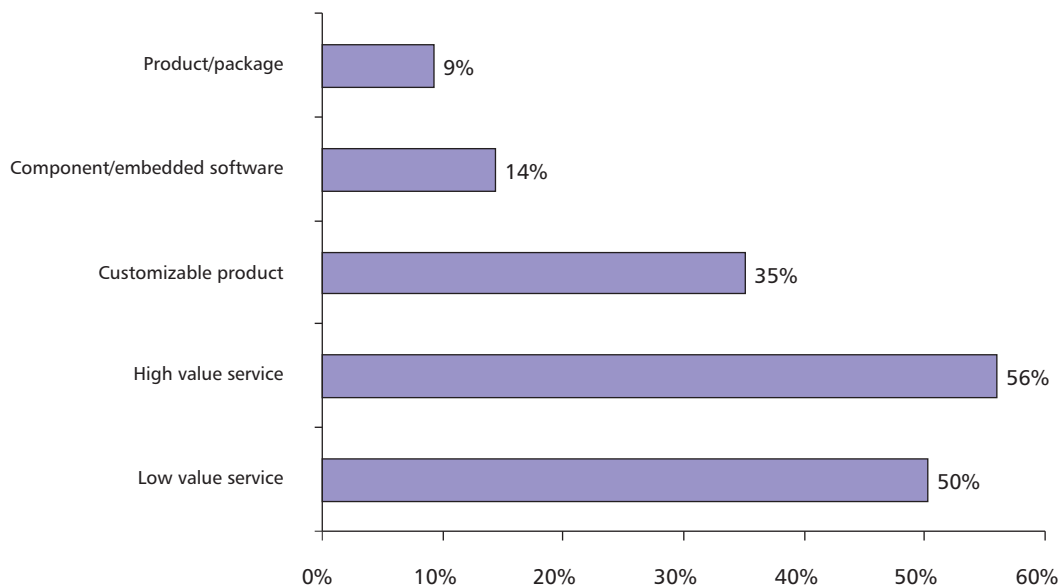
<sup>72</sup> As a reminder, the categories pointed out by SOFTEX (2003) are as follows: low-value services, high-value services, customizable products, components/embedded and packages. It is a gradient which goes from service to product, and very well represents the competitive standards of the software industry in Brazil and worldwide.

If we now cross-reference the ways of making money specific to FS/OS with the software industry business models, we will see that the greatest impacts take place especially in the “full service” and “enabling hardware” models. Although “sell and release” (which complements the “Clientele creation” model) does have impact on the industry, the main impacts are located in the first two models. The impact of the “full service” model on nearly all of the industry competition standards in general is significant (examples include Conectiva, Red Hat, and IBM).

Likewise, but more specifically, the “enabling hardware” model opens opportunities for embedded software, precisely because it reduces costs and increases hardware marketing possibilities. Chart 8 cross-references the industry’s business models with the ways of making money from FS/OS.



**Graph 12** – FS/OS Business models according to developers  
Source: Field research, electronic survey



**Graph 13** – FS/OS Business models according to development entrepreneurs  
Source: Field research, electronic survey



**Chart 8 - Relationships between business models specific to FS/OS and the software industry**

<b>Businesses with FS/OS</b>	<b>Income source*</b>	<b>Software industry business models</b>
<u>Full Service***</u>	<u>Direct, indirect</u>	<u>SBV; SAV; CUST; PAC**</u>
Clientele creation	Indirect	PAC
<u>Enabling hw</u>	<u>Indirect</u>	EMB
<u>Accessories</u>	<u>Indirect</u>	
Online offer	Direct, indirect	
Brand licensing	Indirect	
Sell and release	Indirect	PAC; CUST

Source: Field research, electronic survey

Notes

- \* Direct income source: Income from the sale of FS/OS; indirect income source: income from the sale of services or products related to FS/OS
- \*\* SBV – low-value service; SAV – high-value service; CUST - customizable product; PAC - package; EMB - Embedded Software
- \*\*\* The underlined models are those most developed in Brazil.

Except for **full service** and **online offer**, all the other ways of making money are indirect. Furthermore, **full service** is the most comprehensive form of business in FS/OS, impacting almost all of the software industry business models.

#### 4.3.2 FS/OS Threats and opportunities for the Brazilian software industry

Going a little deeper into the discussions of the paths shaped by FS/OS, it is fitting to ask what is the importance of the appropriability regime for the different software industry business models. This is an essential question because it helps understand the threats that FS/OS poses to the industry today. As a result, it permits seeing who are those most affected and, in contrast, where the main opportunities are for the Brazilian software industry.

To do so, a reflection was made on the relative importance of guaranteeing the appropriability of the different software industry business models. That is, the software industry business models most impacted by the free software were identified according to the relative importance of the appropriability regime in software.

As seen in chart 9, FS/OS’s entry in the market takes place exactly in those models where the appropriability guaranty for the business success is most important. Additionally, the impact of FS/OS will be greater if the product/service specificity is lower. In other words, business models for which proprietary code is crucial and which have low use specificity (horizontal products in the industry) are the most threatened.

Along this line, products with a broad market such as operating systems, databases, and generic components are precisely those whose business models are most affected.

The most threatened models are precisely the packages, which present a high appropriability importance and a low market specificity. Models with a low appropriability importance are not threatened and, to the contrary, see business opportunities in the FS/OS. Figures 6 and 7 help illustrate the different situations of the software industry business models in relation to FS/OS.

**Chart 9** – Relative importance of software appropriability for the industry business models and principal free software program developed per business model

Business models*					
Low value service	High value service	Customizable product	Embedded Software	Components	Packages
0	1	3	1	3	3
Main FS/OS involved**					
?	?	MySQL	?	Components in general for FS/OS (Bind, fetchmail, emacs, etc)	Linux
		PostgreS			OpenOficce
		Compiere			Apache
					Mozilla
					Gnome

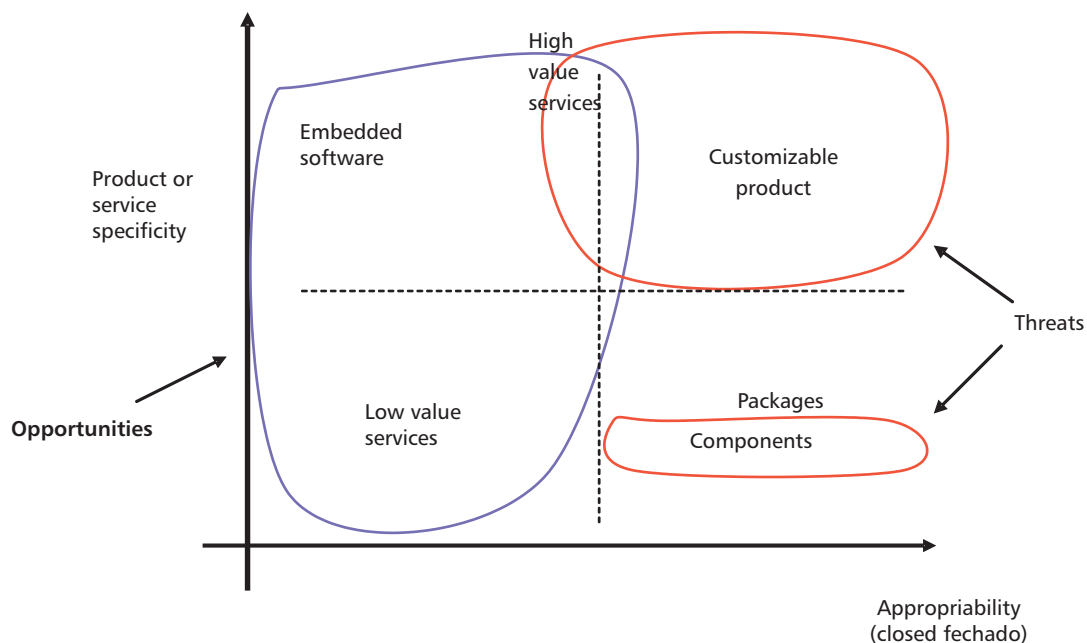
Source: By the author

Notes

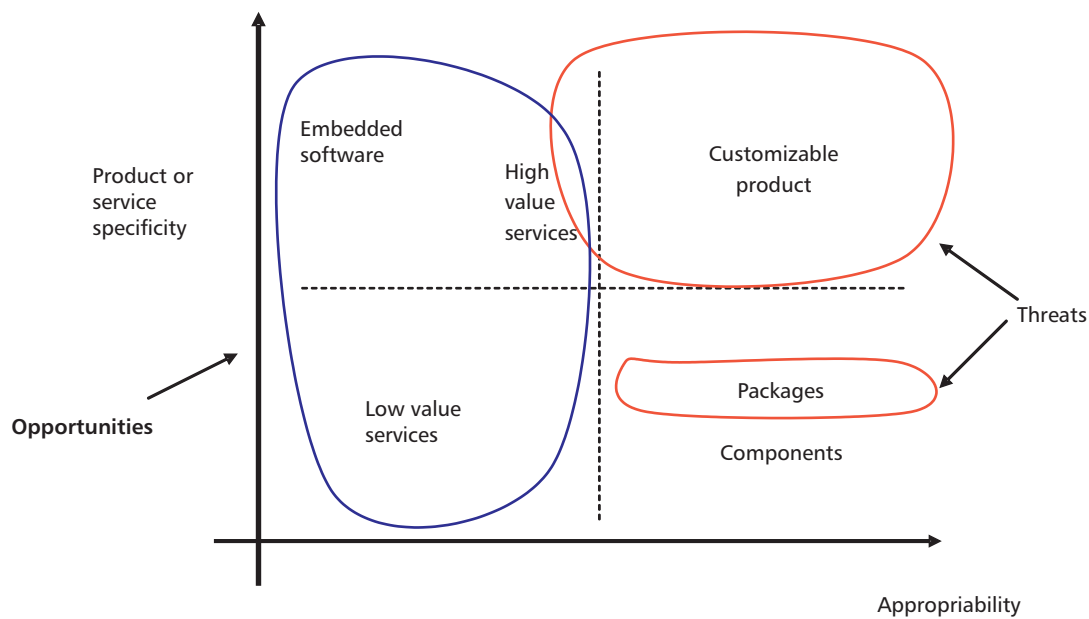
\* 0 – no importance; 1 – low importance; 2 – medium importance; 3 – high importance

\*\* ?: no examples of FS/OS developed

Figures 6 and 7 show that the main threats to Brazilian companies are in component development, precisely because this is a market vulnerable to competition from the emergence of a free access component bank. Even though this threat does not yet exist in Brazil, the companies that have components as their core business need to monitor the evolution of the free access component bank supply. Customizable products are threatened to a lesser degree, because they always involve a specific portion of development, which is not threatened by FS/OS. The generic portion is that which can be threatened. As seen in figures 6 and 7, generic packages are a greater concern for multinational companies for obvious reasons.



**Figure 6** – Opportunities and threats related to FS/OS business models, Brazilian case, from the perspective of Brazilian companies  
Source: The authors



**Figure 7** – Opportunities and threats related to FS/OS business models, Brazilian case, from the perspective of foreign companies

Source: The authors

On the other hand, the opportunities created by FS/OS apply to those dealing with services (low or high value) and embedded software. Actually, due to their high specificity and low appropriability requirements (since the software embedded in the equipment can forego legal systems with stronger propriety), embedded software is one of the best opportunities for Brazilian companies (as well as foreign ones). Meanwhile, high value services present both signs of threats and opportunities, but greater opportunity exactly because they are in the zone of high specificity and medium appropriability.

In summary:

- The main business models for national software companies are the low value and high value services and customizable products.
- The most important threats posed by FS/OS to the Brazilian software industry are from customizable products and component development, and to a lesser degree, from high value services.
- The most important opportunities in FS/OS are for embedded software, low value services, and to some degree for high value services (which use free components).
- The principal ways to earn money from FS/OS are “full service” and “enabling HW” (counterpoints to low and high value services and embedded software).
- There are opportunities presented to businesses based on “clientele creation” (loss leader), “on-line offer”, “brand licensing” and “sell and release”.

#### 4.3.3 FS/OS market size - general

The analysis of FS/OS market size on a global level is marked by isolated initiatives and by more or less reliable information. As discussed below, when the size of the Brazilian FS/OS market will be discussed, it is difficult to find reliable data generated from duly explained methodologies. In other instances, the figures are provided and their credibility depends on the information source. Data surveyed by the IDC international consultant ([www.idc.com](http://www.idc.com)) show the evolution of the Linux global market. Corroborating what could already be felt about

three or four years ago, the FS/OS market is growing and is no longer regarded as a niche or, much less, as an idealistic action. It became a billion dollar business. As already discussed, the adjective “free” does not mean without costs.

For example, the Linux market is now one of the greatest software industry renovations worldwide. This is represented by the creation of the Open Source Development Labs (OSDL) ([www.osdl.org](http://www.osdl.org)) by major corporations in 2000. The interest in Linux is illustrated by the fact that OSDL was founded by a group of companies whose names require no presentation: IBM, HP, NEC, CA, and Intel. Today, OSDL relies on 75 companies, including Alcatel, Bull, Ericsson, Mitsubishi, Nokia, Novell, Unilever, and Fujitsu. This undertaking has had a decisive impact on Linux development (which in fact, as we will see next, is already fully professionalized and hierarchized), and on other programs said to be free. The purpose of the OSDL initiative is to speed up the development and use of the Linux on the part of the companies and, as appears on its Webpage, the OSDL “is the home of Linus Torvalds, the Linux creator”.

The professionalization of the Linux development became hierarchical, which deviates completely from the format of the first moments of FS/OS. The development today operates with a structure of concentric circles. At the center is Linus Torvalds and, on the periphery, anyone who wants to participate. From the periphery to the center there are several intermediate circles which filter the contributions up to their incorporation into the program. Of the 1,000 closer contributors, 100 of them are paid and contribute to more than 95% of the changes which are incorporated into Linux. Of these 100, twenty from the developers’ core are paid by their employers (OSDL, Red Hat, IBM, among others).

The development and implementation of LSB 2.0 (Linux Standard Base) generated another collective initiative among companies, the Linux Core Consortium (LCC). Among the companies supporting this initiative is Connectiva, along with Madrakesoft, Progeny and Turbolinux. These initiatives clearly show the trajectory of Linux development: the establishment of professionalization to achieve the broadest and fastest replacement of the prevailing operating systems (Windows and Unix).

The logic for this is clear: The Windows proprietary standard became a nuisance to some and a hindrance to others. Never in the history of capitalism has the market accepted for such a long time and in such a broad way the payment of a (virtual) monopoly fee to a single company (Microsoft) in order for all the others, literally, to simply function. The current proprietary standard of the operating systems market, as it has been structured in the last twenty years, is an aberration from the perspective of capital and the trend is for it to disappear.

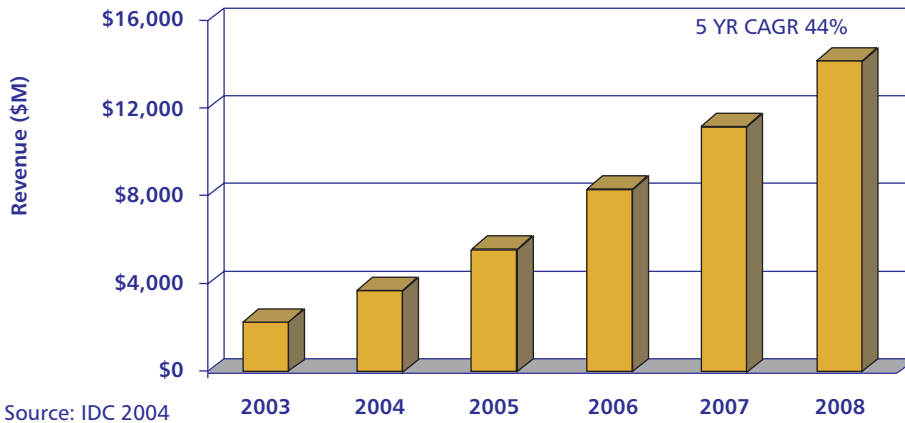
Growth in the Linux market is significant. According to IDC, the server market driven by Linux products and services today is approximately US\$ 3.5 billion (IDC, 2004) and is expected to quadruple by 2008 (graph 14). In the global market (for servers, PCs, and services) it should reach approximately US\$ 36 billion by 2008.

The interesting thing about this standard is that most of the Linux incorporation has been taking place in new hardware. That is, the natural process of equipment renewal and increase has taken place with the incorporation of Linux and at growing rates. This has not excluded the conversion of existing equipment to Linux, however, at a lower rate than that observed for new hardware. Graph 15 illustrates this characteristic. According to this same study, **Linux is now mainstream.**

According to the Gartner Consultancy ([www.gartner.com](http://www.gartner.com)), in 2002 Linux accounted for 6% of the operating systems market worldwide, and in 2003 reached 9%. In 2007, it is estimated that it will account for 18%. That is, there is a clear trend toward product replacement together with a proprietary standard which is somewhat inconvenient for many users (and even for the development companies).



### WW Linux Software Revenue

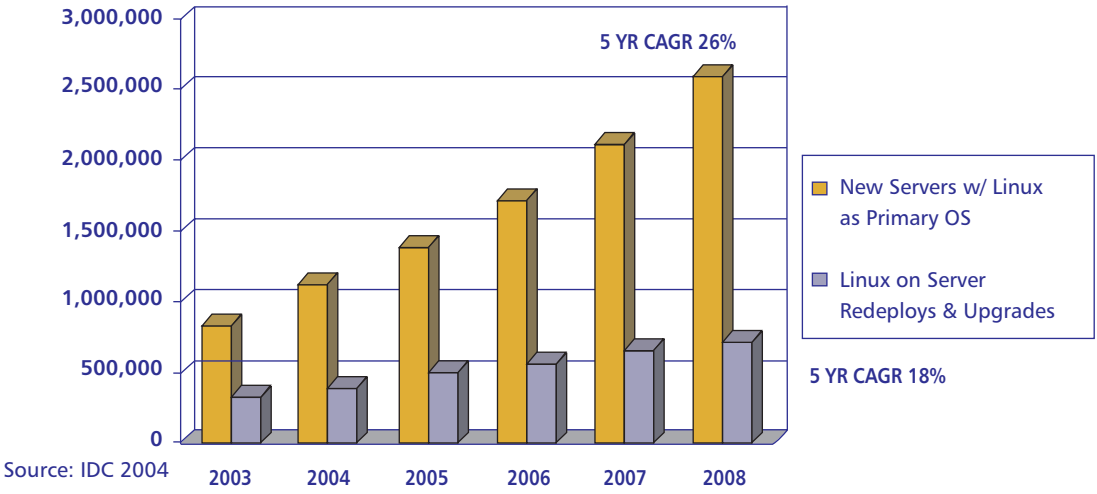


Source: IDC 2004

**Graph 14** – Expected evolution of the Linux product market

Source: IDC (2004)<sup>73</sup>

While it is reasonably clear that operating systems are adopting the free software trajectory, one cannot say the same for middleware programs and applications in general. Considering the analysis presented above about the business models and the relative importance of FS/OS, the most visible trend for FS/OS is precisely the replacement of general purpose proprietary programs (Office, Web server and database). In this regard, the penetration by Web servers, particularly Apache, which today runs on over 70% of dotcom servers, far exceeding the 20% of Microsoft (table 6), has been significant. While FS/OS plays a significant role in the operating system and Web server markets, in other markets it is still marginal.



Source: IDC 2004

**Graph 15** – Linux adoption rates in new and used equipment

Source: IDC (2004)<sup>74</sup>

<sup>73, 74</sup> The Linux Marketplace - Moving From Niche to Mainstream. IDC Software Consulting, www.idc.com, 2004.

**Table 6** - Number of Web servers and respective programs worldwide (2004)

Server	Figures in November	% in November	Figures in October	% in October	Difference
Apache	14,131,338	74.64%	13,107,363	73.96%	+0.68%
Microsoft	3,631,236	19.18%	3,542,151	19.99%	-0.81%
Netscape	141,636	0.75%	140,934	0.80%	-0.05%
Zeus	109,496	0.58%	111,427	0.63%	-0.05%
WebSTAR	101,479	0.54%	46,740	0.26%	+0.28%
WebSite	20,098	0.11%	20,374	0.11%	+0.00%
Other	796,764	4.21%	754,272	4.26%	-0.05%

Source: www.securityspace.com (December 2004)

If it is not easy to quantify the extent of FS/OS markets on a global level, the difficulties in Brazil are still greater. There is not much data available and the existing information is fragmented and, in general, not very reliable (most comes from interviews with specialists and articles published in major newspapers and magazines, without an explicit calculation method). The data are often contradictory and spontaneous figures a person feels compelled to provide when requested. Neither the government nor the private sector has good accounting of their use of FS/OS. However, (although it is not properly a task to approach in this work), we will address the problem here and point to some figures which may be useful for gauging the size of FS/OS markets.

The first issue to consider (which was already pointed out at other points in this study) is that of how the FS/OS related business models are more strongly based on services than on products. For example, the most important Brazilian company in the free software business (business model of the "full service" type) earns approximately 9% of its total billing from product sales. Of the remaining 91%, sixty-eight percent is from services in general and 23% from training.<sup>75</sup> As mentioned in the discussion of business models, the great majority of entrepreneurs who responded to the survey identify their business as high and low value services and as customizable products, in which the specialized services component is fundamental. It seems a company cannot survive from a FS/OS package, although the product (e.g. operating system, Office) is the carrying element that will generate billing from services.

According to a survey carried out by Meirelles (2004) with more than 1,500 medium and large-size companies in the country, the use of Linux has been increasing since 1999, reaching approximately 15% of the sample in 2003 (12% in 2002). Meanwhile, the study *I-Digital: Profile of the digital company 2002/2003* (FIESP/CIESP and FEA/USP 2004), demonstrated (as presented in Chapter 3 of this paper) that approximately 34% of companies (from a sample of 1,334 companies) have already adopted Linux in their servers.<sup>76</sup>

Despite the differences in the results of the two studies (probably due to the methodologies used, which could not be checked), the highest use of the Linux is on servers, replacing Unix more than Windows (graph 16).

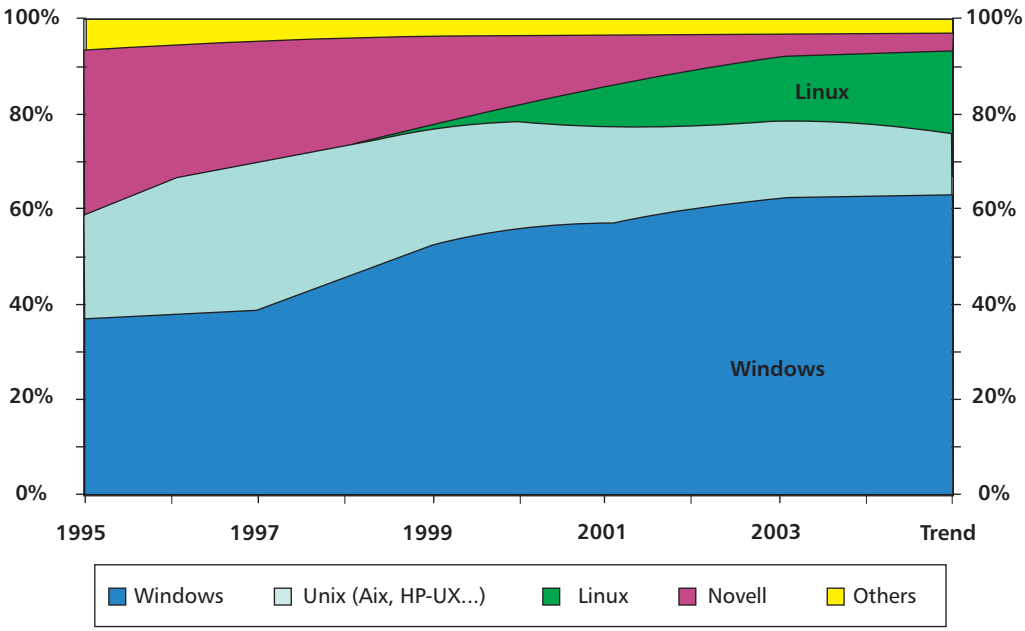
On graph 17 it is interesting to note how the electronic spreadsheet market has, in just a few years, been completely dominated by Excel (MS Office). On the other hand, this same chart shows the emergence of StarOffice, which already occupies approximately 8% of the spreadsheet market. The situation can be extrapolated to two other components of the Office market: the text editor and presentation package.

<sup>75</sup> Information obtained from the interviews at the companies referred to.

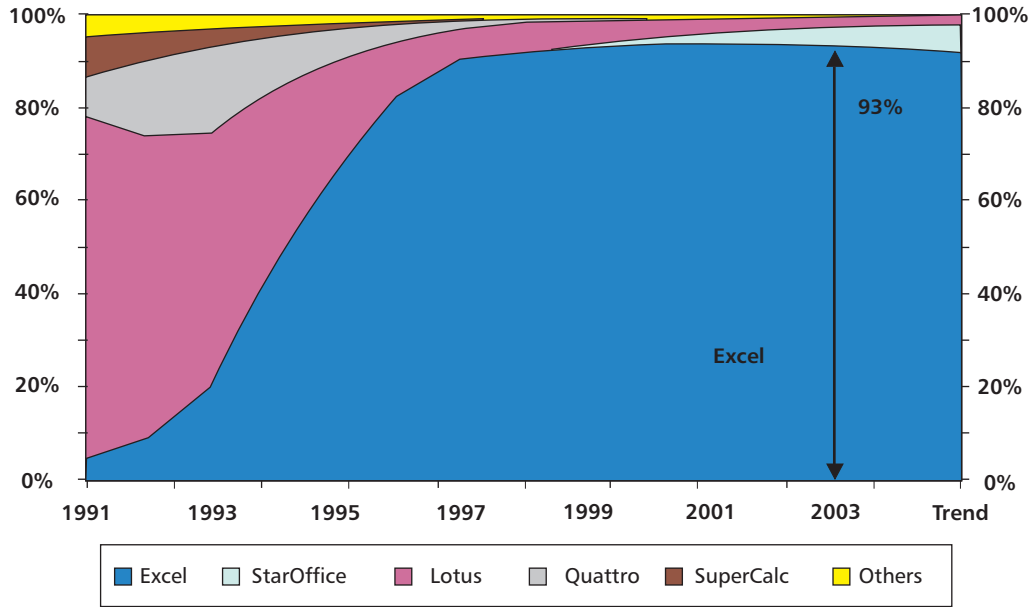
<sup>76</sup> There is double counting in the Fiesp study. That is, it records who uses both Linux and other systems.



With regard to Web servers, Brazil follows the international standard although with a lower usage rate of Apache than that found in the countries surveyed by Security Space. Table 7 illustrates this situation.



**Graph 16** – Evolution of the server market  
Source: Meirelles (2004)



**Graph 17** – Evolution of the spreadsheet market  
Source: Meirelles (2004)

**Table 7** - Number of Web servers and respective programs – Brazil (2004)

Server	Figures in November	% in November	Figures in October	% in October	Difference
Apache	113,151	53.97%	106,721	66.97%	-13.00%
Microsoft	50,661	24.16%	49,407	31.00%	-6.84%
Netscape	231	0.11%	225	0.14%	-0.03%
Zeus	10	0.00%	10	0.01%	-0.01%
WebSTAR	21	0.01%	19	0.01%	+0.00%
WebSite	43	0.02%	43	0.03%	-0.01%
Other	45,532	21.72%	2,935	1.84%	+19.88%

Source: www.securityspace.com (December 2004)

#### 4.3.4 How big is the Linux market in Brazil today?

The Brazilian software market according to SOFTEX (2003) reaches approximately 20 billion (US\$ 7 billion).<sup>77</sup> According to the Annual Service Research by IBGE (the Brazilian census institute), the net operating revenue of computing companies in Brazil with more than twenty workers reached approximately R\$ 17.1 billion in 2002. The market for “development and production of ready-to-use software, including customization” (a category which includes operating systems), reached approximately R\$ 1.13 billion in the same year.

In order to gauge the size of the Linux market, if we consider that this R\$ 1.13 billion represents, roughly speaking, the operating systems market in Brazil, and conceding that this value should be increased by approximately 30% in order to reach the sales revenue (gross operating revenue), and another 30% to represent the total Brazilian market (considering that the IBGE study identified only 70% of the national market), then we would have an approximate market size for the “operating system product” of R\$ 1.9 billion per year in Brazil.

Now considering that the country has approximately 20 million computers, and accepting an average ratio of 15:1 between the number of desktops and the number of servers,<sup>78</sup> we would have approximately 1.3 million servers<sup>79</sup> and 18.7 million desktops in Brazil. Recent data from IDC shows that the Linux market in Brazil already reaches 3% of desktops. As for servers, a study by Meirelles (2004)<sup>80</sup> points to a Linux penetration of approximately 15% of machines. So, we would have around 195 thousand servers and 561 thousand desktops operating with Linux.

Assuming now that the average price of the Linux desktop package is, according to information obtained with the main company marketing Linux packages in the country, R\$ 100.00, and that the price for servers is R\$ 300.00, then we would have an estimated Linux market of R\$ 56.1 million and R\$ 59.4 million, respectively, totaling R\$ 115.5 million in Linux product. To this figure, however, it would be necessary to apply a reducer corresponding to the number of licenses, quite lower than the number of computers running on Linux in Brazil.

<sup>77</sup> Based on the exchange rate in December 2004 US\$1 = R\$2.8.

<sup>78</sup> Information obtained from specialists in Brazil.

<sup>79</sup> This number of servers is consistent with the number of pointcom.br domains found in Brazil today (approximately 650 thousand domains; see www.nic.br).

<sup>80</sup> The option here was for the most conservative figures available.



If we consider, in this regard, that for each Linux package purchased, 15 computers<sup>81</sup> on average are installed, that value is reduced to approximately R\$ 7.7 million. Now considering that the "Linux product" corresponds to approximately 10% of the revenues of those who market it, this value would be increased to R\$ 77 million.<sup>82</sup> This would be the estimated Linux market in Brazil today.<sup>83</sup> Its growth potential - if we consider annual global rates, and the estimates of IDC itself - would be 2.5 to 3 times by 2008, when it would reach between R\$ 192 and R\$ 231 million.

Additionally, it can also be mentioned how much this market would reduce license payments for proprietary operating systems. This is another value difficult to measure. However, assuming that proprietary and non-proprietary software have similar operating costs,<sup>84</sup> the nonpayment of licenses may represent a savings of approximately R\$ 800.00 per desktop, and approximately R\$2,000.00 on average per server, which would lead to savings of approximately R\$ 85 million per year. If we consider that some Linux packages marketed today still carry MS-Office and an array of other software, this amount tends to multiply by approximately 10 times. However, as seen throughout this study, the pace of replacement of desktop applications such as the Office is still very slow.

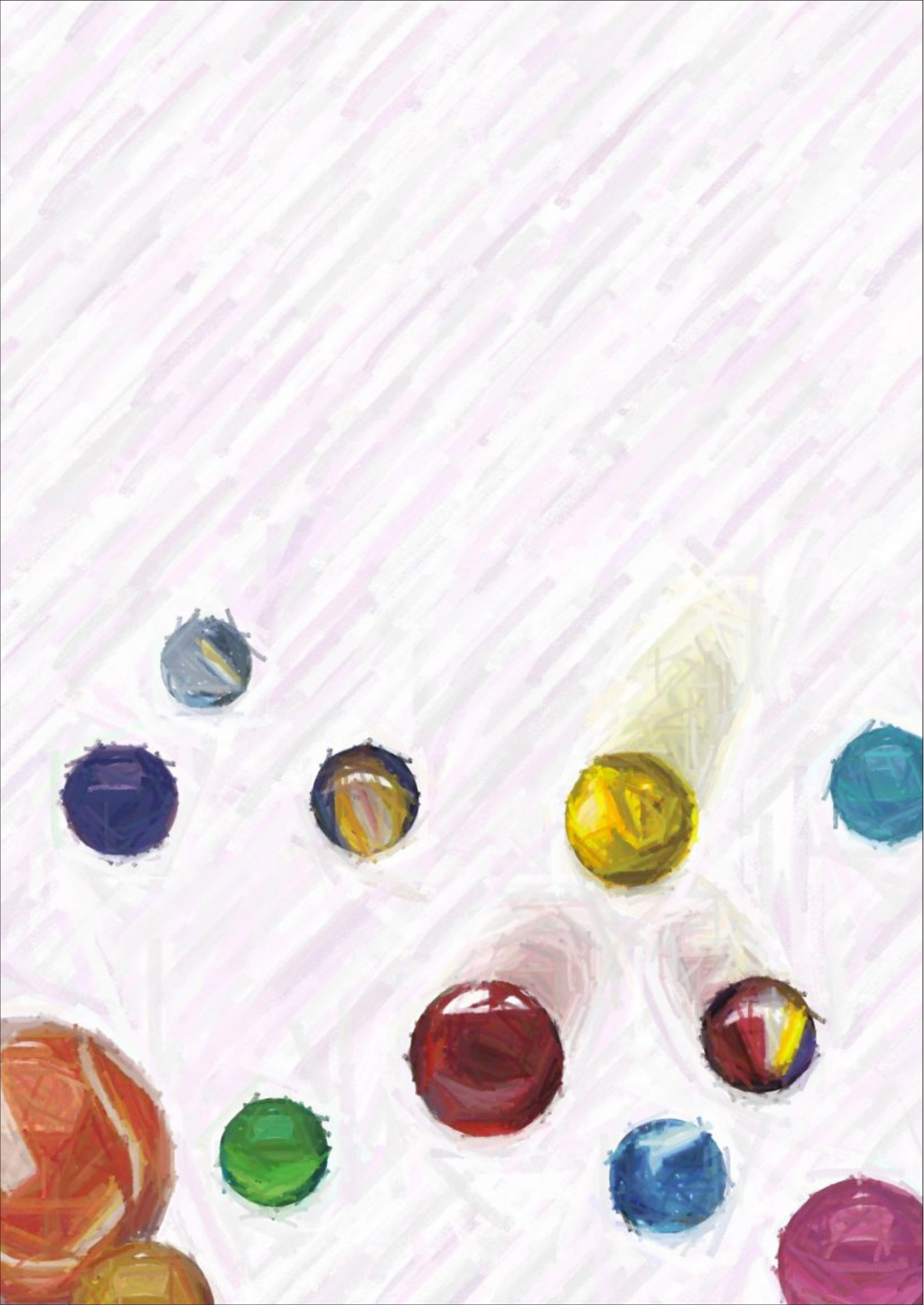
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<sup>81</sup> It is utterly unrealistic to assume that all of the 3% and all of the 15% of desktops and servers, respectively, which today use Linux in Brazil have acquired a license. The truth is that most individuals can freely download Linux from the Internet and, furthermore, the Linux packages have no restricted number of licenses. Thus, the need for a reducer is imperative. In order to calculate it, the same proportion used to calculate the desktop/server ratio (15:1) was used. It began from the principle that individuals and companies have the same maximizing behavior. So, we would have an average of 15 computers installed for each purchased package, in both the corporate market and the PC market. The reducer is arbitrary, but brings the market closer to the reality.

<sup>82</sup> This market value is consistent with the data and the market share of the main companies marketing Linux in Brazil. For example, Conectiva has an estimated market share of 35% in the Brazilian market (approximately R\$ 25 million, according to a 2003 study by the IDC), which would total approximately R\$ 71 million of the overall market. As the market share data refer to 2002, the above estimated figure of R\$ 77 million for 2003 is quite plausible.

<sup>83</sup> To this figure we should add the values referring to embedded Linux and applications the markets for which have developed in the wake of the interest for the Linux.

<sup>84</sup> This is another controversial issue. Microsoft has claims that the total cost of ownership (TCO) of Windows in four years is lower than that of Linux. Other studies show the opposite (see, for example, <http://linux.slashdot.org/article.pl?sid=04/12/13/042223&from=rss>). In relation to this dispute, we prefer to assume that there are no substantive differences between them.





## Conclusions

This project reviewed a number of factors related to the development and use of free software and open source software (FS/OS) in Brazil. It surveyed and analyzed the profiles of developers and users, their motivations, the economic opportunities, FS/OS-related business models and the opportunities and threats that FS/OS poses for the software industry.

Many reflections have been made about whether the free software and open source model represents a new pattern, or even a new paradigm in the global software industry. Actually, it is important to understand the impacts that the FS/OS movements have on the software industry. Since this is an ongoing process we cannot say with certainty whether or not FS/OS represents a new paradigm. All indications are that it is not. At this time it is a set of trajectories that represent the more or less normal paths in the industry's growth and development process. The emergence of Linux as an alternative platform to Unix and, particularly, to Windows is nothing more than the disruption of monopolies which have for years been imposing profitability and opportunity restrictions on nearly all economic activities. As already discussed in this study, never in history has a market monopoly been as comprehensive and for such a long time as that imposed by the single solution for operating systems. Therefore, it is no surprise that this would be opposed by capital itself.

Here are some of the main conclusions of this study.

- FS/OS actually brings new variables to the software industry. Although it is not a technological breakthrough, it brings a new way of developing and licensing software, breaking some structural appropriability models in this industry.
- The communication channels provided by the Internet have led to the emergence of opportunities to exploit economies of scope and scale for the software industry. Within this context many organizational modes appeared for software development, some more open and horizontal (what the literature calls the Bazaar model), others more vertical and hierarchical (known as the Cathedral model). Between one and the other model, there is now a relatively large range of situations. Thus, the FS/OS organization modes are varied and satisfy differentiated interests.
- The phenomenon of construction, interaction and generation of results by the communities is something unprecedented in the history of the Software Industry. In most of these communities there are no formal links for participation and there seems to be an increasing flow in the generation of new communities and in the collective learning process. However, there are more and more communities organized under formal contracts as is the case with the OSDL. Since its core characteristics directly touch issues that are sensitive to the accumulation of capital (collective appropriability), the FS/OS model still presents difficulties for equating business models. On the other hand, it seems to offer very promising results for both public and private users.
- The various surveys performed as part of this study, in addition to being unprecedented in Brazil, helped bridge important information gaps. The research, helped clarify some myths, both about the people and companies who work with FS/OS (by means of the skill profile) and the uses found (by means of the users' profile). The study also helped to show the movement towards professionalization, since individual developers are neither simply young hackers challenging the monopoly of large multinationals, nor are these corporations foreign to the business models being created along with FS/OS.

- Studies show that the worldwide FS/OS movement is highly geographically concentrated, in Europe, the United States and Japan. This study has helped show that peripheral countries have inserted themselves in the main activities, especially in support and management activities relating to systems and programs management. Geographic concentration is also found on a countrywide basis: 78% of individual developers, 81% of development companies, 84% of individual users and 85% of using companies are located in Brazil's Southern and Southeastern regions. Rio Grande do Sul and São Paulo States are the two main focuses of FS/OS development and use.
- The individual developers who responded en masse to the electronic survey have a socioeconomic and demographic profile similar to that found in Europe, except for those characteristics which go beyond the FS/OS movement. The FS/OS phenomenon is more recent in Brazil than in Europe and Brazil has fewer professionals with a college degree (engineering and IT courses), and more technicians, which explains the fact that most of the survey respondents classify themselves as basic developers.
- However, it is important to bear in mind that the FS/OS projects involve not only development, but also test procedures and error reports. These procedures may represent one of FS/OS's greatest distinctions in comparison with proprietary software, and is regularly mentioned as one of the factors for its technical success because of the stability of solutions and problem resolutions.
- The statistical analyses performed in this study include professionals who have worked with proprietary software and are moving to FS/OS, partly due to market requirements, as well as a highly qualified and active elite group working in FS/OS development projects. In addition, there is a large number of students among the developers, which shows that there is a group of professionals who now are or soon will be college graduates who may enter the growing FS/OS market. We can thus see that abilities to work with proprietary software transfer readily towards FS/OS and that there is a considerable and increasing number of people who have begun software development with FS/OS.
- In regards to companies involved in development, three types working in FS/OS were detected: (a) small and medium-size companies founded in the 1980's and 1990's, which are dedicated particularly to proprietary software, but which entered FS/OS, some because of market requirements; (b) small and medium-size companies founded more recently, which have a large part of their activities in FS/OS; and (c) large companies, some of them multinationals, which have also entered the FS/OS realm. The latter rely on at least two specific strategies: to provide pre- and post-sale support for Linux and to make their proprietary products available to run on this platform.
- We can then observe that the professional development of FS/OS in Brazil began to strengthen, with Brazilian and multinational companies as well as government owned companies. But the current moment calls for a reduction of the still high transaction costs to allow the professionalization of FS/OS in Brazil. In addition, the companies which have developed using FS/OS business models now face problems similar to those as do the small companies based in the proprietary model. Although they may have easier access to technological skills and technology, which lowers production costs, they face greater competition, since entry barriers are lower, (for given business models such as low and high value services and even customizable products).
- One of the ways for these companies to create opportunities is to invest in the formation of a new entrepreneurial class. This transition moment in the development of a new model seems also to indicate the appearance of a new company model, which is more suited to FS/OS's main innovative elements: network structure, virtual cooperation and knowledge sharing. These elements are not very common in traditional entrepreneurial structures, even in the software industry.



- The time required by companies developing proprietary platforms to adapt to this new model should also be considered, as well as the time needed by end users. The successful cases of FS/OS deployment in companies, particularly on levels higher than that of infrastructure (middleware, applications, etc.), only occur with simultaneous strategies for the sensitization and capability of the end user.
- Most of the individual users who answered the survey participate in FS/OS communities and also contribute by using and testing the software. They are users with a more technical profile, which is similar to the profile of the developers. This can be partly explained by the fact that the end user (desktop layer) is probably one of the last potential niches to be exploited. The groupings from the multivariate analysis appear orderly in terms of age, schooling, income, and experience in FS/OS: from the younger with less schooling and income to the older with more schooling and experience in FS/OS. The analysis pointed to the existence of two groups of students – including those who feel that they still lack training, but seek through FS/OS an opportunity to improve their employment and learning opportunities. It also found two groups of professionals, one from the IT field (many of them professionals who must use FS/OS tools at work or who want to use them in their professions, but who are submitted to their limitations), and another group from the managerial area (which mainly seeks to reduce costs, sometimes associated with a more ideological concern).
- The company users are much larger than the companies involved in development in terms of billing and number of employees. Many of them also have thousands of computers and seek in FS/OS robust solutions to help both in the reuse of obsolete equipment and in savings in operating systems license fees. The migration decision partly takes place by the security offered by the hardware suppliers, especially in the retail trade sector.
- This study has demonstrated that there are four interrelated motivations for using FS/OS: technical, economic/financial, skill related and ideological. The motivations evidently differ according to the player's category.
- The main motivation of the corporate users for adopting FS/OS is "cost reduction", followed by reasons of a technical nature such as "greater flexibility to adapt", "improved quality (stability, reliability, availability)", "greater independence of suppliers", and "greater security". There are motivations of an ideological or philosophical nature, but they are secondary. Even when surveying a wider group of players (individual developers, individual users, academics, etc.), the ideological issues do not appear as primary determining factors.
- Within the group of players who answered the survey and participated in the panel, the issues of a technical nature, and those associated with the development and use of software, are upon which the different perspectives converge. While individual companies and users are motivated by technical and economic issues, individual developers are motivated by skill acquisition (learning) and employability (showcase effect) and some (though few) solely for ideological reasons.
- The study found a current preference for the adoption and dissemination of FS/OS in four economic sectors: communication and information technologies, government, commerce, and education. A second level of interest was found in: services in general (except commerce), healthcare, finance, culture and entertainment and electrical-electronic and communications equipment. In the near future (2010), growth within the healthcare and general services sectors is expected, with government and education following and with considerable importance.
- Commercial automation, electronic commerce (trade), distance education, school administration (education), and service administration (services) constitute the main FS/OS application areas in Brazil today. As noted, these are business models based on high and low value services and, in some instances, on customizable and embedded software.

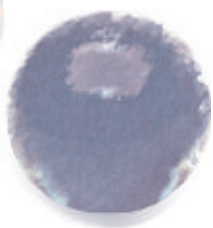
- Free software belongs to the software industry. It develops and transforms itself within the industry. Free software business models are software industry business models. Thus, FS/OS has the power to change competitive standards within the industry itself and this is exactly what it has been doing. Its main impact is on segments in which the importance of appropriability (keeping codes closed) is a critical competitive factor and application specificity is lower (more or less specific products).
- Given this combination of competitive characteristics, FS/OS strongly threatens the package model (platforms and operating systems), software components and customizable products, exactly because appropriability is an essential competitive factor for these models. Since the embedded and service models have greater specificity and lower appropriability importance because of closed codes, they are actually models that present the greatest investment opportunities. FS/OS, by definition, speeds up the transition of the software industry from products to services.
- Small software companies (the large majority of companies in the IT sector) as well as the entire IT production sector in Brazil need to address this subject. Likewise, the government - a key player in the free software field - needs to examine more carefully the implications that an open encouragement of FS/OS might cause in the industry and for Brazilian companies. There are opportunities, but also threats. The government actions and policies associated with them need to be more grounded on information and analysis than on voluntary adherence. Free software may be good for Brazilian society for a number of reasons and it is good to explain them in a convincing way. This study - which is far from conclusive, in part because it is the first survey of its kind - suggests a need for caution for permanent and better monitoring of the developments.
- FS/OS is becoming professionalized in Brazil, following in the footsteps already taken in developing countries. This is starting to move FS/OS from the industrial periphery to its core. As it rose in opposition to the industry's most powerful proprietary markets (Unix, Windows, Office), the FS/OS revealed its political, institutional, and emotional appeal. This appeal drew the attention of many people, from those who (and have) place value on independent thinking and who are contrary to the restrictive appropriation of knowledge, to those who saw an opportunity to knock down the largest and best known giant of the software industry, to those major corporations which saw (and see) in FS/OS an enormous opportunity to undo a cumbersome monopoly which restricts business. The interests in FS/OS are diverse and often antagonistic as we saw in this study.
- FS/OS is not, a priori, good or bad. So, it would be naive to imagine that the original principles guiding free software are a guarantee that it will provide social benefits. Once again, this should be viewed with due care. Whether its initial creators sought this or not, free software is now a multi-billion dollar business, with fast growing perspectives for coming years. Even organizations which grew with the libertarian wave provoked by Linux, have become large global companies. Others are willing to tread the same path.



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