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## Software Livre: Brazil and Open Source<sup>1</sup>

*Free software does not depend on the government, but it may be implemented faster if governments use their tremendous buying power to encourage companies and the community towards free software. This will assure that the country will gain independence, more technological independence, and more capacity.*

— Sergio Amadeu, President, National Institute of Information Technology, Brazil

It was early May 2005, Marcelo Marques, strategic director of HackerTeen and Rodolfo Gobbi, CEO of 4Linux – HackerTeen’s parent company – were enjoying some of Brazil’s specialty grilled meat at a popular restaurant off Paulista Avenue, in the heart of São Paulo’s business district. After ordering some wine, they focused back on the question at hand. In its first six weeks since going live in September 2004, the HackerTeen website received over 1,600 hits. And in only a few months of operation, HackerTeen had received over 4,000 requests for applications; managing demand and growth was a pressing issue. At the other end of Paulista Avenue, Certisign CEO Sergio Kulikovsky was meeting with his company’s CTO. Several months ago Certisign had run a pilot migrating a select group of employees from proprietary software applications to Linux and OpenOffice. There had been some pain in the adjustments, but with yet another expensive license on a proprietary software application coming due, it was time to assess whether the company was ready to migrate everyone to the open source configurations in order to save money and gain better control over the company’s operations environment.

Over the past two years, Brazil had publicly espoused open source software (OSS), drawing international media attention. President Luiz Inacio (Lula) da Silva had issued several proclamations that the government should switch to open source and prioritize Linux in procurement decisions wherever possible at the federal level.<sup>2</sup> Opponents argued that migrating to OSS would not bring savings, as the hidden costs of training and maintenance on these programs outweighed their initial low cost. Advocates lobbied to give Lula’s policy more teeth by requiring OSS to replace all existing proprietary software as licenses came up for renewal, noting the government could save millions of dollars a year in fees.<sup>3</sup>

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<sup>1</sup> The authors would thank Patricio Goycoolea for his translation help, and Francisco Veloso for his generosity and time.

<sup>2</sup> In September 2003, the Brazilian government was finalizing a policy recommending that federal ministries, agencies and state enterprises install OSS instead of proprietary software in new computer equipment. The goal was for at least 80% of government computers purchased in 2004 to run on OSS; the guidelines, however, were not binding. See Jonathan Karp, “A Brazilian Challenge for Microsoft; the Government’s Preference For Open-Source Software May Tilt the Playing Field,” *The Wall Street Journal*, September 8, 2003, A14. The procurement policy of Lula’s PT (Worker’s Party) government inscribed OSS as a priority choice whenever possible. However, this policy held only at the federal level; Brazil is made of 27 independent—and some quite powerful and wealthy—states, that functioned independently from the federal government.

<sup>3</sup> Savings were estimated at \$10.5 million in 2004, according to the Committee for Free Software Implementation, or about 7% to 9.5% of spending. The government projected spending \$56 million to adopt Linux by 2005. “Brazil Government Saves \$10.5 million with Free Software 2004,” *Latin America News Digest*, March 21, 2005.

HackerTeen and Certisign were representative of the kinds of foothold OSS had gained in Brazil's diverse software industry. Both companies were proponents of open source. HackerTeen offered a highly innovative approach to network and systems administration training to teenagers using role-playing games (RPG). The company leveraged OSS at each layer of its offerings, and was currently committed to building a commercial enterprise while embracing the "free as in freedom" philosophy of OSS. Focused on issues of security, HackerTeen's open source environment made it particularly suited to training "good Hackers," the opposite of crackers;<sup>4</sup> ABIN, Brazil's federal enforcement agency wanted to hire the first ten graduates.

Certisign developed proprietary products and open source solutions, and was committed to a closed development platform for some of its authentication products. Working in an OSS environment gave Certisign certain advantages: the company could re-engineer the core of successful solutions for individual customers. Kulikovsky could also encourage activity in certain security standards by dedicating Certisign developers to relevant smart card challenges and deliver their solutions back into the Linux environment to seed further use. The company was successful, yet the cost of license fees led Kulikovsky to seriously consider the viability of running the operations of his company exclusively on OSS. The challenges Marques and Kulikovsky faced were familiar to many Brazilian technology companies.

## Brazil and Free Software

### *The Industry Context<sup>5</sup>*

In 2004, close to \$1.64 billion was spent on software in Brazil, and the IT sector as a whole employed over 847,643 people.<sup>6</sup> The industry had emerged from market reserve conditions dating to the 1972 Informatics policy.<sup>7</sup> With liberalization of the Brazilian economy in the early 1990s, hardware prices dropped, foreign competition increased and demand for software grew; double-digit growth rates were posted throughout the 1990s. The reserve had placed severe restrictions on imports, fostering the development of many small adept and flexible players who met the highly customized needs of their specialty clients across a range of sectors. Telecommunications and financial services were the largest consumers of these niche development shops; but many larger firms had their own in-house development capabilities.<sup>8</sup> In 1993, a new Informatics Law introduced tax incentives aimed at local production, encouraging

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<sup>4</sup> In Brazil, the term "hacker" was free from the negative connotations associated with this term in the other parts of the world.

<sup>5</sup> This section draws on Antonio J. Junqueira Botelho, Giancarlo Stefanuto, and Francisco Veloso, "The Brazilian Software Industry," in eds. Ashish Arora and Alfonso Gambardella, *From Underdogs To Tigers: The Rise And Growth Of The Software Industry In Brazil, China, India, Ireland, And Israel*, (Oxford: Oxford University Press, 2005) 99-107.

<sup>6</sup> International Data Corporation, 2005.

<sup>7</sup> The policy protected Brazilian manufacturers of hardware (minicomputers and microcomputers), and their peripherals, from imports.

<sup>8</sup> The leading activities in the industry were system integration, followed by processing services, and hardware and software support—these four activities represented 57% of total IT service revenues. Botelho, Stefanuto and Veloso (2005) 106.

manufacturers to invest 5% of their revenues in research and development activities.<sup>9</sup> By the late 1990s, in-house software development was increasingly replaced by stand-alone specialty software companies. (See **Exhibit 1** for industry data across time.) In 2004, the government accounted for over 30% of the Brazilian IT market; some noted, however, that the 1970s and 1980s legacy of nationalized utilities and service companies had also left a great deal of the industry in the hands of the government; as one software executive noted, “Basically, the State gives preference to buying from its own companies.”

Along with a vibrant software industry, Brazil was ranked amongst the top ten countries with the highest number of Internet users. Internet penetration was reported at 12.3%, on par with Russia and just under France.<sup>10</sup> Internet access costs seemed low in contrast to rates in the United States or Europe (about \$15/month versus \$35 in the United States or \$45 in Europe) [VERIFY], but for much of the Brazilian population, even this fee was out of reach. The economic disparity between the few urban wealthy and the masses of urban and rural poor in Brazil is well documented. In 2004, only 10% of Brazilian households had Internet access, and only 19% of the country’s public schools had computers.<sup>11</sup> Piracy was rampant; only 900,000 computers were sold legally every year. Add in the black (grey) market sales and International Data Corporation (IDC) estimated computer sales at closer to 4 million, still only a fraction of sales in the United States.<sup>12</sup>

### *Piracy*

“The market leader is the pirate. They have 60% of the market,” a prominent open source executive commented. Increasingly, Brazil was being forced to deal with mounting pressures from the developed world on rising instances of piracy. “In Brazil, there is a feeling that piracy – it’s not wrong, it’s not right,” he explained. “It’s just the way things are. In the North – Western Europe, the United States, Japan – people respect the idea of paying for intellectual property. They’ve been trained. So people accept that. In lesser-developed countries – China, India, Brazil – people do not understand. They think ‘If I can get something for free, and I need it, I should use it.’” Sergio Amadeu, Lula’s advisor on information technology, and head of the National Institute for Information Technology (ITI), had a slightly different viewpoint, “Without a doubt, the problem of piracy is related directly to the ridiculous prices charged for software licenses.”

The problem of enforcement and policing intellectual property, however, was not a top priority for Brazil. The executive noted, “Nobody’s dying from hunger in this country, thank God, but there are a lot of other priorities. Enforcing people to pay for copyrights is going to fall further down the priority list for now.” He continued:

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<sup>9</sup> Two percent of this was to be invested in partnership with research centers or universities. “From 1993 to 2001, this law benefited 428 firms and generated upwards of \$1 billion in R&D activities, with 63% spent on research and 33% spent on contracts with research centers and universities.” Certain regions offered more favorable environments and financial incentives as well; the industry was heavily concentrated in the southern and southeastern areas of the country. About 40% of the total software market was located in the State of São Paulo. See Botelho, Stefanuto and Veloso (2005). 99-100, 107.

<sup>10</sup> Updated on July 6, 2005; data published by Nielsen/NetRatings, ITU, Computer Industry Almanac, amongst others. See <http://www.internetworldstats.com/topusage.htm> (July 28, 2005).

<sup>11</sup> Todd Benson, “A goal of free software for all; Brazil looks to expand program, leaving Microsoft behind,” *International Herald Tribune*, March 31, 2005, 13.

<sup>12</sup> Todd Benson, “Brazil: Free Software’s Biggest and Best Friend,” *The New York Times*, March 29, 2005.

Someone has to pay for policing, but who benefits from that? Multinational proprietary software companies benefit, but they do not support paying for the police, for enforcing the law, for the legal system. OK, they have a sales office here. They sell a lot, and they make investments locally, but they do not contribute enough to the system to create the legal apparatus necessary. They do not pay for us to support their economic benefits.

Proprietary software companies in Brazil claimed that downstream revenues in fact stayed in the country.<sup>13</sup> Others were skeptical over proprietary software companies' furor over piracy. As one executive noted, "If the owners of licensed software really wanted to eliminate the pirate market, they would include something in their code that would prevent piracy – something that would not allow the pirated applications to run. People would then pay for the applications they saw had value." Amadeu and others argued that piracy worked in favor of proprietary software makers. He explained:

The license for software used by architectural students here in Brazil costs approximately R\$4,200, which clearly an overwhelming number of students in Brazil don't have, so they use pirated copies. The architectural and engineering offices buy these licenses which they pay for because they may be visited by the police. But if a student didn't have experience or practice with this software, these companies would have to spend a lot more on training. This is the relationship between piracy and the maintenance of a monopoly.

Jaques Rosenzvaig, Linux distributor Conectiva's CEO,<sup>14</sup> added, "The only way out of this trap is to tell people 'Use free software. Use open source software.'"

Many believed OSS could help Brazil bridge the digital divide amongst its urban and rural poor. OSS proponents in Brazil seized on educational initiatives and institutions as one way to attack poverty. Digital inclusion was considered a critical factor in this crusade—reducing the percentage of the population without any access to the Internet or other information technology would increase basic economic well-being. Amadeu's experience setting up telecenters for the City of São Paulo in 2000, which ran on OSS, was a leading example.<sup>15</sup>

More recently, in May 2005, the government launched its People's PC—or PC Conectado—program, aimed to provide low-cost, partially-subsidized PCs to Brazil's lower-income population, or C-class families, and facilitate access to the Internet for 7 million households.<sup>16</sup> The

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<sup>13</sup> For example, IDC estimated that in 2004, Microsoft tax-related revenue exceeded \$2.3 billion in Latin America; the Brazil IT market accounted for about half of this contribution. IDC further estimated that at least \$10 was generated for every \$1 of Microsoft-related revenue. IDC IT Economic Impact Study, 2005. Further, for every \$1 of Microsoft revenue; IDC measured \$10.02 of Microsoft-enabled revenues in Brazil generated by other companies selling hardware or software that worked on Microsoft operating systems, or serviced that software.

<sup>14</sup> In February 2005, Conectiva, Brazil's oldest Linux company, and leading South American Linux distributor, merged with France's Mandrakesoft; the new company was called Mandriva.

<sup>15</sup> In 2001, Amadeu was invited by the mayor of São Paulo to organize the electronic department of City Hall. "I had an idea that for electronic governance to reach the population, it needed to have a digital inclusion program," he said. The telecenter network was assembled with free software, using Linux for the operating system, OpenOffice, and Mozilla, along with several other free software applications.

<sup>16</sup> The state of São Paulo—Brazil's wealthiest—had 3.5 million C-class families. See "Brazil to Launch Low Cost Internet Programme by Mar 2005," *Latin America News Digest*, January 21, 2005, <[www.folha.uol.com.br](http://www.folha.uol.com.br)> (May 25, 2005). Brazil's top three fixed-line telephone companies would provide dial-up Internet connection for R\$ 7.50 per month (less than \$3),

program offered a stripped-down PC running open source software to eligible families, partially subsidized by the government through special credit lines and tax breaks. The plan also proposed lifting two social contribution taxes for PCs priced below R\$2,500, reducing costs by 9.25%.<sup>17</sup> Launching the program had been fraught with conflict and opposition. Some had argued that favoring configurations based on open source was unfair, and that the government should not interfere in the market; Congressman Julio Semeghini said, "The government shouldn't be the one who decides what hardware and software will go into these computers. That's undemocratic."<sup>18</sup> Almost all agreed however, that the program would stimulate the IT market in Brazil; president of the Brazilian Association of Software Companies, Jorge Sukarie said, "Even if the program doesn't reach its goals, it's going to end up stimulating the computer and software markets. It's not perfect, but it's certainly better than nothing."<sup>19</sup>

Analysts also believed government policies such as the PC Conectado program could decrease piracy. Proponents for an OSS-configured PC argued the use of free software on the Conectado PC would help keep total costs of ownership down over the lifetime of the machines; would be in keeping with the government's own mandate to use free software where possible; and would foster the exposure, education and training of Linux and other OSS programs and applications at the consumer level. To complement the Conectado program, the government planned several community telecenters and cybercafé programs as well, supplied with computers running free software and offering free Internet access.<sup>20</sup>

Gaining exposure and awareness early on in software use was important, as Amadeu noted, "The big battle with free software in the developing and poor countries is in the educational arena. It's obvious why some companies give away their software in schools, to be able to create a degree of understanding of their software, knowledge and familiarity with their product." "All we are saying is that it is not correct to use public money to accustom children to use software from a monopoly." Yet a legacy of procurement practices and kick-backs (or bribes) was difficult to break. He noted, "We are promoting a number of activities to use free software in Brazilian schools. Schools directed by the federal government are eligible for this, which is why there is a tremendous amount of pressure on them from the proprietary software lobby." Teenagers and university students, along with school teachers were particularly targeted for training in open source software; they were seen as a generation that could then move up the private and public professional ranks, and bring an awareness and understanding of Linux and open source software with them. HackerTeen could be an effective tool in this crusade.

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for 15 hours of access. The three telecoms were Telefonica of Spain, Tele Norte Leste Participações (Telemar) and Brasil Telecom. Benson (2005).

<sup>17</sup> This tax-exemption, also valid for R\$2,500 PCs, was an attempt to combat the grey market and Brazil's high rates of software piracy. See Patricia Duarte, "Update 1 – Brazil launches plan to raise PC use among poor," *Reuters News*, May 12, 2005, and "Government releases rules for PC Conectado," *IT Digest*, May 13, 2005.

<sup>18</sup> As cited in Benson (2005). Consumers were given the option to pay slightly more for a machine with Microsoft software; some free software advocates acknowledged that users would eventually be forced to buy more robust Microsoft software after their computer skills developed. See Duarte (2005).

<sup>19</sup> As cited in Benson (2005).

<sup>20</sup> The government pledged to invest \$74 million to open 1,000 community centers in poor neighborhoods by 2006, Benson (2005). These would supplement similar programs run by local governments and NGOs. The government also announced a plan to launch cybercafes in 1,000 cities; Casa Brasil, as the program was called, would rely on open source software. Bids were solicited in March 2005, with R\$200 million allocated by the government to acquire equipment. "Brazil: Lula releases Popular cybercafé program," *Valor Economico*, February 18, 2005.

### *Software Livre as Strategy*

Lula's open source policies were aimed to drive independence and build competitive advantage for Brazil's software industry. . Given Brazil's situation—a skilled labor force, but low costs for that labor—Rosenzvaig noted, "Our technical competence must take advantage of open source. The barriers to entry and capital investments necessary are small." Amadeu summed up the situation: "Today, Brazil is the seventh or eighth largest market of information technology on the planet. It is also a country that is behind the curve. If we improve our specialization in this IT area, we could be a reference to the world, for the implementation of these platforms of free software, which are much cheaper and safer." Entrepreneurial activity in open source software had been very active: Brazil had fostered the first Latin American distribution of Linux—Conectiva—which had become the continent's leading distribution.

Early results, however, still indicated that freedom to choose, develop, adapt, implement and use the software that best suited the needs at hand reigned; this agnosticism—as a form of self-reliance—was taken to be part and parcel of the culture itself. While it was widely rumored that Linux and other free software solutions saved money, companies like Certisign had to find the "best fit for value" for their companies—applied across many software procurement decisions. Implementation of OSS, particularly Linux, was increasing rapidly; in 2004, the growth of Linux in Brazil was almost four times the 5.7% pace of the country's overall IT growth rate.<sup>21</sup> Most were drawn by the lower costs associated with Linux for server environments, but increasingly Linux servers were used for running ERP suites and other critical tasks, moving beyond its traditional uses for Web serving, email, and file and print tasks.<sup>22</sup>

### *The Government's Software Livre*

By 2004, open source software (OSS) was often hailed as a way to leapfrog Brazil's some 183 million citizens from a transitional (or developing) economy to prominent players on the world's economic stage. When asked to assess Brazil's situation, one academic noted "'high-quality free software had proved more effective in stimulating computer use among the poor than scaled-down versions of proprietary software.'"<sup>23</sup> Amadeu argued the (hidden) upfront costs associated with OSS would pay off in the long run; he said, "Our greatest challenge is to convince the economic area of the government to invest some resources in an implementation plan for free software. That will generate an incredible savings, in the medium term. But in the short term, the investment is necessary, even with fiscal austerity, even at a time when the government is trying not to spend money."

In 2004, a nationwide survey was contracted by the Science and Technology Ministry to develop a map of the current open source software use in Brazil: 92.9% of desktops in Brazil ran Windows platforms.<sup>24</sup> The government released free software implementation guidelines, and

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<sup>21</sup> Scott Handy, vice president of worldwide Linux strategy at IBM, cited in Robert McMillan, "IBM opens Linux centre in Brazil," *IDG News Service*, September 9, 2004, <[www.infoworld.com](http://www.infoworld.com)> (June 4, 2005). Rate of growth reported by IDC.

<sup>22</sup> This was according to Juan Carlos Perez, IDC Latin America, "Lower Costs Drive Private Sector to Linux," *Computerworld*, vol. 39, no. 29, July 18, 2005, 37.

<sup>23</sup> Walter Bender, executive director of the Massachusetts Institute of Technology's Media Lab, quoted in Benson (2005).

<sup>24</sup> International Data Corporation (IDC). For Brazil in 2004, IDC predicted increased penetration of Linux in PCs and notebooks, 7.25% up from 2.96%. "Freedows and Impacta invest R\$1.5mil in Freedows training center," *Gazeta Mercantil*,

sponsored three portals supporting migration to OSS platforms.<sup>25</sup> Several agencies began pilots to migrate to open source software. In 2004, the country's federal district judicial court (TJDF) for example, migrated all of its 16 database servers to Linux; limitations to the court's budget prompted cuts to the 4,700 workstations running proprietary software.<sup>26</sup> By 2005, 50 federal entities were reported using open source software, with six government ministries switching or switched over to Linux and other open source software, including the Ministries of Urban Planning, Mines, Culture, Science and Technology, and Information. Cost savings were estimated at several million dollars over five years.

When he joined ITI, Amadeu organized an implementation committee for free software; in 2003, 43 federal agencies participated and in 2005 that number was up to 91. "Many agencies were able to implement free software, but we are at the beginning of our work. Two years is not enough time to counter the market that has existed in proprietary software." He noted that while historically there had been heavy competition in hardware procurement within the government, there had been very little competition for software.<sup>27</sup> "This heritage—the market reserve—generates a certain imprisonment that we'll need a certain amount of time to undo." Recently, the head of Brazil's largest government IT company, SERPRO, was contracted by a major proprietary software company. Amadeu noted, "So he has left the government, with all the information about what we are doing and gone directly to work for this company. This would not be possible in the financial markets, for example, because there is would be a quarantine—a non-compete—for people who leave the industry. But in the area of IT in Brazil, this is permitted. And when you have to face a powerful lobby that has information about our plans, this makes a big difference."

## HackerTeen

In 2003, Marques began noting that his young cousin was losing interest in school and spending a great deal of time gaming; the family was concerned but thought maybe the boys "facility with computers" could get him a job. Marques soon realized that although his cousin was an expert gamer, he understood nothing about computers. Marques conducted over a month of research, going to games markets and LAN (local area network) centers in São Paulo where people, mostly teenage boys, had access to computers.<sup>28</sup> "The game industry is not worried about a teenager's education or job," Marques noted, "And the teachers did not know what to do,

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July 29, 2004. IDC estimated similar growth rates across Latin America, projecting a compound annual growth rate of 17% between 2004-2009.

<sup>25</sup> "Colaborar" aimed to coordinate migration efforts; "Interagir" encouraged individuals from the public sector to write OSS programs. The third—"Software Livre" portal—described the government's policies on open source software.

<sup>26</sup> The court was preparing a second pilot project for 2005 to test the viability of running Linux and OSS applications for workstations in Santa Maria municipality. See "TJDF budgets US\$4.4 million for IT in 2004," *Business News Americas*, December 27, 2004.

<sup>27</sup> Anecdotal reports indicated that in Brazil this was to some extent due to a legacy of favoritism, bribes and corruption in the government's buying practices of software. As Amadeu noted, "There's very strong pressure and a strong lobby from proprietary software companies. Domestic software companies, and some international ones, have supported the model of free software. The largest problem has been the intense pressure from some multinationals that has paralyzed us."

<sup>28</sup> An hour of computer use at a LAN house cost R\$5,00. Anecdotal evidence suggested that of LAN users, 80% were 14 to 25 years old; approximately 5% were women. About 90% users were there to play games, but email access and general Internet use was also popular. As Marques noted, "Games came first. They find each other there (inside the LAN) to play games."

because their students were going to the LAN houses, and not coming to school. But the students *loved* computers, the humor of the games, the challenges. That energy was positive.” Marques put together a plan to teach through gaming: specifically train young adults in security and information technology—learning about computers, configuration, networking systems, and hacking—the good kind, not “cracking,” as the illegal form of hacking was called in Brazil. Marques chose to keep the platform for the new program compatible with the rest of 4Linux’s offerings—the course delivery and training was built on open source. Thus HackerTeen was born.

HackerTeen offered a sequence of courses on computer security, entrepreneurship and ethics specifically designed for teens 14-19 years old.<sup>29</sup> HackerTeen’s design relied on challenges familiar to teens from role-playing games (RPG), chat tools and etiquette, and humor, forming integral parts of the training curriculum and designed to encourage teens to develop their entrepreneurial spirit and prevent them from becoming “Crackers” (the illegal form of hacking). Marques’ idea was to harness and direct the energy teens spent in virtual games towards learning Linux and computer security. Even before its launch, HackerTeen had caught the eye of several multinational software companies who expressed interest in hiring HackerTeen’s graduates to work on security-related matters. But the Brazilian Intelligence Agency (ABIN) announced it had first dibs on HackerTeen’s top ten graduates. With close to 80% of worldwide computer network crimes committed by adolescents, ABIN’s director noted, “These hackers could help the agency in the investigation of computer network crimes.”<sup>30</sup>

In its first six weeks since going live in September 2004, the HackerTeen website received over 860 applications from teenage boys and girls. And in only a few months of operation, HackerTeen had received over 4,000 requests for applications; managing demand and growth was a pressing issue. Marques and Gobbi had several issues to sort through, but top of their list was: How should they scale up the HackerTeen business model in order to meet such intense demand? The program was highly people-intensive in its current state. A limited number of students could enroll in the sequence of courses at a time. HackerTeen team psychologist Cynthia Lazzarotti had to meet and interview all potential candidates, along with their parents. Once enrolled, HackerTeen had only Gabriela Dias, Marques, and Mauricio de Nassau University Professor of Ethics Francisco Filho to teach the offerings. Marques had put a personal touch on almost every element of HackerTeen, now others in the international Linux community were actively encouraging him to think about how to export the program to the United States, Canada, Japan, and Europe. There were many details to be worked out.

HackerTeen’s training courses covered technology, entrepreneurial studies, and studies in ethics—specifically as related to information technology. Marques recruited a computer science student—Gabriela Dias—to run the technology side of the courses. Dias was a computer science major, recently graduated from the University of São Paulo. She conducted twice-weekly session over the Internet through ICQ and the 4Linux classroom tool. Professor Filho ran the ethics courses; students came into the training center on a designated Saturday. Marques taught the entrepreneurial classes, developing a curriculum that covered strategy, industry background,

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<sup>29</sup> Students advanced through six levels, each increasingly more difficult; levels were named after the belt colors in karate; see [www.hackerteen.com](http://www.hackerteen.com) and [www.4linux.com.br](http://www.4linux.com.br).

<sup>30</sup> Director Mauro M. L. Silva, as quoted in Rosana Hessel, “IBM and ABIN join 4Linux to form hackers,” *Gazeta Mercantil*, no. 5, issue 110, November 8, 2004, TI-5.

marketing, business planning and development, and various elements of entrepreneurial management. 4Linux invested R\$500,000 to build out the program, with revenues projected at R\$2 million for its first year, and predictions to recoup the investment in 12 to 18 months. At that rate, it was possible that HackerTeen would quickly outstrip 4Linux's two other business streams. Marques and Gobbi had been encouraged by several prominent open source luminaries to strategize about how to scale HackerTeen beyond the Brazilian markets; applicants from around the world were already clamoring for a local version. A launch in Canada was planned for 2007; a version for Japan was also under consideration. Amadeu was also very supportive of HackerTeen, noting that the government was interested to run the course at telecenters as a way to combat digital exclusion: "As it is based on Linux," he noted, "HackerTeen is a training program that meets all the government's strategies to promote the use of free software."

The HackerTeen application process was rigorous. Along with a written application, prospective students—accompanied by a parent or guardian—met with the HackerTeen psychologist for personal interviews; the parent was also interviewed independently. The application process included several standard personality tests and a handwriting analysis. Both admitted student and parent signed a contract on acceptance. Total tuition was about R\$11,000: R\$7,700 for the first 12 months of the program, to be paid by the parent. The last six months' cost R\$ 3,300 was to be paid by the student on the successful receipt of a job. "We are so confident that they will get a good job after HackerTeen," Gobbi noted, "that we are willing to take this risk on them."

Groups of 24-30 students formed a "class," and much of the learning—although virtual—was collaborative in nature, requiring the students to share knowledge and work together to help each other solve each level's challenges. The program ran in complement to their regular school studies. The HackerTeen teachers and psychologist were privy to each student's progress in school; this was a required element. Success in their school studies was directly tied to their ability to continue the HackerTeen program. If they did not "make the grade" in one of their school subjects they did not advance to the next level.

### *Bridging the Digital Divide*

Before the HackerTeen launch, IBM sponsored a pilot of Marques' training course through its Reinventing Education program.<sup>31</sup> IBM approached Marques and Gobbi about offering a pilot of HackerTeen in two poor regions in the states of São Paulo and Rio de Janeiro. IBM would sponsor the seats—12 in each area; the program would be run strictly as not-for-profit, as a test program for inclusion in the company's Reinventing Education initiative. Two sites were chosen: Santo Andre, a town 40 kilometers from São Paulo, and students from several communities at risk in Rio de Janeiro. The students participated in the course from telecenters since none had access to computers in their homes, but otherwise the elements of HackerTeen remained essentially the same.<sup>32</sup> As Patricia Menezes, executive of IBM Latin America's corporate social

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<sup>31</sup> IBM's Reinventing Education grant program focused on developing public school partners throughout the world to create and implement innovative technology solutions for some of education's toughest challenges. In Brazil, in addition to the HackerTeen pilot and IBM's partnership with ITI to form the CDTC program, a creative partnership was formed with Anima Mundi, an International Animation Festival, and the Institute of Pure and Applied Mathematics (Instituto de Matematica Pura e Aplicada), to implement a Linux application that transformed a ThinkPad and a video camera into an editing and animation tool, allowing public schools teachers and students to develop content to teach students at lower grade levels. All three programs relied on open source.

<sup>32</sup> Some of the admissions aspects of HackerTeen had to be adapted to these lower-income families.

responsibility programs, said, “It was a clear innovation—a way to offer access and training to promising students who might otherwise never have the chance to learn like this.”

IBM had worked with Marques and 4Linux once before, when Amadeu, ITI and IBM’s Reinventing Education program had partnered on an earlier training project in 2004, for the Center for Diffusion of Technology and Knowledge program (CDTC, or Centro do Difusão de Tecnologia e Conhecimento). CDTC, an open source technology center set up at the University of Brasilia, provided IT training for educators, a development lab and a call center for support; 4Linux had been hired to develop content according to the Minister of Education’s guidelines, and to provide the training.<sup>33</sup> Public school teachers and officials were not typically technically savvy, and some were concerned that unfamiliarity with Linux might pose a barrier. “We were curious to see if the students selected for the training would engage with Linux. We soon saw that we need not have worried,” Menezes recalled.

Training was held at an NTE in each of Brazil’s 27 state capitals. Students (teachers and educators) traveled to the capital and stayed for two weeks (80 hours) of training. Gobbi recalled:

Over a period of three months, we used eight instructors to train 785 people, divided into 35 groups. Our regular courses are focused on servers but the CDTC courses were a mix between servers and desktop. We worked with IBM and the ITI to develop specific materials and CDs for these courses, which IBM released under a Creative Commons license. During the course we showed students how to install, use and configure Linux, and introduced them to OpenOffice.

Adjusting the content for the CDTC courses took about a month, but opened a range of further opportunities for the company; 4Linux’ offerings had been primarily server-based, but the CDTC program required desktop training as well. 4Linux took advantage of developing this specific content; released under Creative Commons meant the materials could be reused to create a range of new offerings that found additional outlets.<sup>34</sup> As Gobbi noted, “A lot of things that were produced for CDTC we now use at our Linux Academics, but mainly the expertise to teach Linux for non-Linux-users.” The program worked to seed knowledge through educational leaders in each region. “These trainers returned to their local community and trained school teachers at the local level,” Menezes noted. “We were training the trainers; they then have a multiplier effect.” The CDTC model had been a success and the team was in the process of scaling up the program, translating the materials for transfer to other Latin American countries.

While programs such as these increased access to technology, they served as much to set up a virtuous circle for the technology companies involved as well. They seeded expertise and learning for open source—and software generally—at the local level, and seeded OSS adoption and training in terms of software and skills.<sup>35</sup>

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<sup>33</sup> IBM supplied computer equipment, a grant of \$1 million, and contributed five IBM employees to the staff of 14. In its first four months, CDTC trained almost 800 public school teachers and technology personnel from Brazil’s 27 states.

<sup>34</sup> These included a manual, an event called “Linux Show” which presented Linux to university students through film, a theater comedy, and a book used to motivate people to study Linux.

<sup>35</sup> IBM also released portions of its proprietary code, in order to foster and encourage the open source community to develop it further, and increase awareness and adoption. See Cynthia L. Webb, “IBM’s Open-Source Lovefest,” [washingtonpost.com](http://washingtonpost.com), September 13, 2004.

As entrepreneurs, Marques and Gobbi leveraged open source to create a sustainable business model that could take advantage of the Brazils growing technical capabilities to compete on the global stage. This activity at times was burdened by the government's bureaucracy. Marques explained: "The government needs to make it easier to work outside Brazil. At one point we tried to export some programmers' code. You cannot believe how hard it was to talk to the government, to explain, fill out a lot of forms. We worked six months trying to make it happen. We gave up."

## Certisign

Certisign, an online security company, started in 1996 as a digital authentication provider; it soon modeled itself after VeriSign, selling certificates to the public in the form of public key infrastructures (PKI). Digital authentication providers, like Verisign and Certisign, enabled the secure transaction and exchange of digital information over networks. In 2004, CertiSign had about 90% of the Brazilian market for digital certificates, of which half were banks.<sup>36</sup> The domestic digital certification market moved between R\$15million and R\$20 million per year, although it had the potential to move R\$400 million per year. CertiSign had an estimated 80% market share in 2004. The company had issued 200,000 certifications since 1997.<sup>37</sup>

Early on, Certisign developed PKIs, but as Kulikovsky noted, "Given that Brazil has a very high cost of capital, the cost of a certificate here has to be higher than the United States. And as the purchasing power of people in Brazil is lower, you get the certificate, but you cannot experiment that much." Kulikovsky recalled, "We quickly learned we can't sell PKIs, we need to sell solutions. So we sold PKIs as a service, rather than the software. The software is ours, I give you only the certificate in the end. If the software that I use to produce the PKI is open source, closed software, Windows, Linux, SUN, it doesn't make a difference to the end user because all he receives is the product, the certificate."

At the outset the company was 100% open source; the digital authentication platform was UNIX-based, and could be downloaded from the Internet. By 1999, the company began to rethink its model, as it came under the wing of a supplier and adopted that company's proprietary platform. Kulikovsky – who had not yet joined the company as CEO but was a shareholder – explained:

We thought, "Is this a technology company or are we a service company?" Our whole objective was to service the clients and give them better service. When we became an affiliate of our supplier, we just purchased their platform, which was exactly the opposite of the open-source we had; it was 100% closed. We don't even know what's inside their code. But we bought that and we used it. And what we found was that it was very good, the factory works really well. The software is really stable. It's really scalable. Works really well. Although it has a cost.

The supplier license costs were worth it "given this was a specialty software," although the license relationship could be fluid, and if the cost increased too much, negotiations were possible.

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<sup>36</sup> Including the Central Bank, Banco do Brasil, Banestes, Banespa, Bank Boston, Banco ABN Amro, HSBC, Bradesco, Nossa Caixa and Unibanco. According to Brazil's banking federation Febraban, 41% of banks use digital signatures and 50% certify their documents. See "Certisign aims to double revenues in 2004," *Business News Americas*, June 1, 2004.

<sup>37</sup> "Brazil. Digital Certification Increases," *Gazeta Mercantil*, November 17, 2004, [www.factiva.com](http://www.factiva.com) (July 27, 2005)

As Kulikovsky explained, “You can only pay what you can afford for software, and that price is determined by the utility obtained not necessarily the fee charged. You can’t pay more, or else you go under.”

Kulikovsky joined Certisign as CEO in 2002. By then the company’s software environment had shifted and was completely closed. The company’s main activities shifted to developing applications, because, as Kulikovsky said, the clients no longer wanted to buy PKI. He explained, “PKI by itself has no value, it’s just a file on your hard drive. It doesn’t add value. We needed to create things that would add value.

### *The Freedom to Give Customers What They Want*

As Certisign built more robust open-source products and services, their developers worked in C or Java in order to assure cross-platform functionality. Kulikovsky noted, “We don’t make one version open source and one version closed. We do the same development and just configure it twice. It makes it a lot easier for us to do maintenance that way too; for the developer, it doesn’t make a difference. Our developers are good in Windows or in Linux, to them it’s exactly the same.”

In terms of products developed for clients, Certisign delivered both closed and open custom solutions. One example was a commission to develop a product for a client that wanted a document signing application, with specific license terms that were to be unlimited. Kulikovsky said, “They wanted to do whatever they wanted with this code, and they wanted it open source. Turns out they want it open source because they want to be able to audit it themselves, and maybe because they are afraid we may disappear from the market tomorrow for some reason.” Certisign priced the product at the cost to develop, plus implementation and time for one week of training. They were able to re-customize the code of an internal product, and deliver what the client wanted.

He soon discovered that customers like this client were unlikely to maintain their customized products once implemented. “When we closed the code, I told them, ‘If you don’t touch the software, we’ll give you maintenance. If you touch one single line, then I can not maintain it anymore, because then it’s a problem.’ Two years later, they hadn’t touched the software, instead they’ve hired us to do other improvements, to add features to the software for which we continue charge. And the same version, the same core of the application—because it’s open—I’ve been able to resell it to a lot of other clients that want similar features. There is a solid business here.”

Kulikovsky recently turned some of his developers’ attention to a smart card problem in the Linux community. The components for the reader that made up the middleware between the smart cards and application, or user, level were poorly developed; as he described, “They were not user-friendly. Whoever developed them had just tried to solve the problem. They hadn’t worried too much about making a formal development framework.” Certisign dedicated three developers—“expensive resources for me,” Kulikovsky noted—to work on creating a more formal development framework, and a middleware that can communicate with any reader. As the component was GPL software, taken from the community, anything Certisign did to it would go back into the community under a GPL as well. Kulikovsky noted, “We’ll develop it into a common framework, do correct procedures development-wise, and then return it back to the community. Because it’s no good if that original solution got further embedded as a product. And our code compliments my other solutions too.”

### *Internal Migrations*

The company started integrating the four aspects of PKI, putting them together with smart cards, readers, tokens, and consulting, training and applications. Behind these proprietary-based products, Kulikovsky was slowly shifting his own company's operations back to open source. He noted, "On my process center platform, my factory of certificates is a closed software environment, but all running on Linux servers. We now use Nokia hardware with Nokia Linux, which is a secure Linux with Checkpoint on top, which is expensive. We have expensive hardware, expensive software, and expensive maintenance. This is why we're going to a fully-Linux box with open-source firewall. It helps me keep my costs down. And I know all my expensive software and hardware is secure."

Kulikovsky, his CTO and several engineers worked together to assess all of Certisign's systems and configurations. "What can we migrate?" Kulikovsky asked. "We have to take our time. When we choose, we select application by application. And we always prefer open-source, if you look at the total cost first. And you always look at the total cost." Contrary to many skeptic's concerns over TCO, Kulikovsky found the total costs of ownership made open source a good fit for his company's needs. "It really depends on what you trying to do. There are of course costs of the non-financial sort, my time, my engineers' time, the employees' time, as they adjust to something new." He continued:

My desktop is partly Linux. It takes me a lot of work. My individual TCO is very high right now. We use a lot of cryptography. So I have to figure out the crypto libraries in Linux, which is a hassle. It's complicated. And to get the specific drivers for our smart cards, these are difficult to find. I need to get the Wi-Fi to work. These things are not easy to do, but my individual total cost of ownership is very high as compared to most people in the company. But it's one time, it's for me. And I become part of the research cost to implement the full solution when we go company-wide. We are trying now to migrate everyone 100% into Linux. We were a fully Windows company and we are trying to become fully Linux-based.

The substitutions within the company happened gradually, first with barely perceptible changes at the operating system level: first the web servers were migrated, then the user applications. A few users spread around the company tested various distributions and different applications. Last was the migration of his office employees to the Linux desktop and OpenOffice. Some people adjusted to the changes with little problem, especially when there was no fanfare about how difficult the change might be. Kulikovsky explained, "It's all a matter of what you tell people. If you install OpenOffice but say, 'Hey look, it's a new version of Office, it's just a little different.' You come back three days later and they say, 'Oh, this version is really nice.'" He acknowledged there were some trade-offs in application features:

There are some things, obviously, that the regular Microsoft Office is a lot better at. It's a little faster on the loading side. The applications themselves are better integrated, but OpenOffice has some things that are good too, for example you can output any document as Acrobat. So you already save the fee off the Acrobat and fee off Office. For a company like us, we are 90 people, that's a fair amount per person. Obviously we don't have Acrobat for everyone, and we use an older version of Office. But the license cost is a lot of money to us.

## Brazil and Open Source

From Amadeu's perspective, the government had the obligation to lead the way in the use of open source software and it was why he saw great promise in companies like Certisign and HackerTeen using open source. He commented:

When the government defines clearly that they want to use free software internally, they will be an example for the entire society. NGOs are increasingly using free software, this will also pressure the State and municipal governments and even the City Halls to use free software. The growth of free software companies in Brazil will encourage the use of free software at the residential level. There is a synergy involved. One element will encourage the other.

Despite the increasing media hype focused on Brazil and OSS, the country's digital economy rankings on the Networked Readiness Index (NRI) fell in 2004, slipping from 39 to 46.<sup>38</sup> Meanwhile, IDC reported that PC sales in Brazil jumped from 3 million to 4 million units in the same year; desktop and notebooks combined, this represented the biggest increase since 2000. And in that same time, the "grey market"—representing 64% of sales in 2002—reached 74% of sales in 2004.<sup>39</sup> Despite its outspoken support for OSS, and the government's full support, there was still a general feeling that "there's a lot of talk about open source software, without a lot of action." Some agencies had even halted (or reversed) their migrations to open source and gone back to proprietary solutions. An executive of a prominent open source software firm said, "They go for a big bang and a big splash, but in the end—nothing. There are too many things that cause confusion instead of really helping the deployment of open source."

Marques acknowledged that in the end, the software itself, whether open source or proprietary, was becoming further and further commoditized, "You have to be very creative to put things together to make it different. The client needs to see a value. If you broke HackerTeen into pieces all it is is Manga, Linux training, role-playing games, and challenges that you can find anywhere. And if you put it together, you just put together a different way to teach—that's all."

Incentives to exporters and software manufacturers were announced in late May 2005 under the Medida Provisória (MP); these aimed to enhance the environment for foreign-investment commitments. The five-year exemption from taxes was designed to help boost commitments from abroad, up from the current \$18.2 billion a year to \$20 billion a year.<sup>40</sup> Software and other IT firms were specifically targeted by the MP benefits; the government hoped the sector could expand its annual exports to \$2 billion by 2007, up from \$400 million in 2004.<sup>41</sup> These were specifically directed to streamline the kinds of bureaucracy Marques and his peers encountered.

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<sup>38</sup> Brazil's "worst grades" were in bureaucracy and education; it ranked 53<sup>rd</sup> in number of Internet users per 100 inhabitants. Its quality of public schools was very low (rank 81 in 104 countries), with its mathematics and science teaching scores at only 79. Reported by the World Economic Forum, see "Brazil: Brazil fall in IT ranking," *O Estado de São Paulo*, March 10, 2005.

<sup>39</sup> One-third of total sales were in the consumer market, the balance went to corporate and government sales. See "Brazil: Boom in PC sales over 2004," *Valor Economico*, February 24, 2005.

<sup>40</sup> The Medida Provisória (MP), still to be approved by Congress before becoming law, was intended to improve Brazil's standing as an export base, given the recent interest rate hikes, and the strength of the Reas against the dollar. See "Lula offers exporters tax breaks," *Economist Intelligence Unit*, May 30, 2005.

<sup>41</sup> "Lula offers exporters tax breaks," *Economist Intelligence Unit*, May 30, 2005.

Whereas previously, an entrepreneur had to complete a set of 15 complex procedures to launch a business, taking almost six months, the government intended to “cut these requirements to eight administrative tasks that can be completed in little more than two weeks.”<sup>42</sup>

Along with stiff taxes, however, the language barrier continued to be a problem; many Brazilians did not speak passable English and/or were not comfortable conversing in the language. But recent numbers showed things shifting; as one entrepreneur noted, call centers in Brazil were growing, with close to 3,000-4,000 people employed in support in 2005. Amadeu stayed focused on the advantages Brazil offered in the arena of open source development. He said:

Exporting software entails four different things. First, you can export usage licenses of a certain algorithm. Second, you can export development of software, for some code. This export model is the one that India uses for proprietary software. Brazil can be an important country for open source software. Third, you can sell training and education around the world. And four, you can, in association with companies from other countries, sell what we call support. This is why the free software model is extremely beneficial to countries like Brazil. In changing this technological paradigm, we can take advantage of the capacity and the quantity of technicians we have in this area.

By July 2005, the software debates in Brazil were increasingly overshadowed by a corruption scandal threatening Lula’s administration, some feared its taint would impact the implementation of open source software. One observer noted, “These problems with Lula mean that people can now say that anything associated with Lula is corrupt. They will use it as an excuse, and they won’t consider the questions fairly.” In terms of the competitive advantage open source software could offer, however, perhaps the debates were becoming more moot. Many Brazilian software companies already competed on the world stage; others felt the barely tapped domestic market provided ample opportunity. Conectiva had joined forces with Mandrakesoft to become a leading player on the global Linux distribution stage. Certisign had captured 80% of the Brazilian digital authentication market, and was making inroads in other Latin American markets. Marques and Gobbi were focused on how to manage HackerTeen’s potential growth, and were concerned to get their programs and materials appropriately translated; export issues were secondary at this stage. For them the constraints were at the capacity level, “The hardest thing is getting good people,” Marques said.

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<sup>42</sup> As described by Brazil’s Minister of Development, Industry and Foreign Trade Luiz Fernando Furlan in “Lula offers exporters tax breaks,” *Economist Intelligence Unit*, May 30, 2005.

**Exhibit 1** Information Technology Indices for Brazil (2000-2004)

|  | 2000           | 2001           | 2002           | 2003           | 2004           |
|--|----------------|----------------|----------------|----------------|----------------|
| <b>Spending (US\$ M Constant)</b>              |                |                |                |                |                |
| IT Hardware                                    | 6,851          | 6,063          | 4,720          | 4,296          | 4,640          |
| Software                                       | 1,576          | 1,603          | 1,563          | 1,638          | 1,752          |
| IT Services                                    | 3,876          | 3,411          | 3,063          | 3,366          | 3,953          |
| <b>Total IT</b>                                | <b>12,303</b>  | <b>11,077</b>  | <b>9,346</b>   | <b>9,299</b>   | <b>10,345</b>  |
| <br>   |                |                |                |                |                |
| GDP (US\$ B)                                   | 352            | 388            | 438            | 492            | 520            |
| IT/GDP (%)                                     | 3.49%          | 2.86%          | 2.13%          | 1.89%          | 1.99%          |
| IT Tax Revenues (US\$ M)                       | 2,513          | 2,485          | 2,635          | 2,901          | 3,172          |
| IT Tax Revenues % of GDP                       | 0.71%          | 0.64%          | 0.60%          | 0.59%          | 0.61%          |
| Software-related Tax Revenues (local currency) | 3,485          | 3,450          | 4,342          | 5,324          | 5,788          |
| <br>   |                |                |                |                |                |
| <b>No. of companies</b>                        |                |                |                |                |                |
| IT Hardware                                    | 302            | 303            | 302            | 294            | 298            |
| Software                                       | 867            | 874            | 893            | 906            | 925            |
| IT Services                                    | 2,123          | 2,019          | 2,088          | 2,150          | 2,208          |
| Channels                                       | 17,672         | 17,407         | 17,632         | 17,734         | 18,081         |
| <b>Total IT Companies</b>                      | <b>20,964</b>  | <b>20,603</b>  | <b>20,915</b>  | <b>21,084</b>  | <b>21,512</b>  |
| <br>   |                |                |                |                |                |
| <b>No. of Employees</b>                        |                |                |                |                |                |
| IT Hardware                                    | 22,352         | 20,909         | 20,815         | 19,882         | 20,396         |
| Software Vendors                               | 7,556          | 7,734          | 7,898          | 8,126          | 8,470          |
| Software-related Services and Channels         | 94,274         | 88,955         | 109,069        | 121,992        | 126,038        |
| Other Services and Channels                    | 170,749        | 161,114        | 147,882        | 135,130        | 141,062        |
| Software-related IT Professionals              | 278,942        | 263,203        | 319,580        | 364,479        | 377,994        |
| Other IT Professionals                         | 254,670        | 240,300        | 194,346        | 163,639        | 173,683        |
| <b>Total Software Employees</b>                | <b>380,772</b> | <b>359,792</b> | <b>436,547</b> | <b>494,598</b> | <b>512,501</b> |
| <br>   |                |                |                |                |                |
| <b>Total No. of IT Employees</b>               | <b>828,542</b> | <b>782,115</b> | <b>799,590</b> | <b>813,238</b> | <b>847,643</b> |

Source: IDC, 2005.