

Case studies

Marcelo D'Elia Branco
Mónica León Martínez
Alejandro Novo López
Alberto Otero García

PID_00148381



Universitat Oberta
de Catalunya

www.uoc.edu

Index

Introduction.....	7
Objectives.....	9
1. Development and implementation of free software in Extremadura: a proposal with firm backing from the regional government.....	11
1.1. Context. The socio-economic characteristics of Extremadura	11
1.2. The framework of the gnuLinEx (free software) project.). The global information society project of Extremadura	12
1.2.1. The early days: the global information society project	12
1.2.2. Context and framework of development of the gnuLinEx project	14
1.3. Events, initiatives and situations	16
1.3.1. Need for a telecommunications infrastructure: the intranet of Extremadura	16
1.3.2. Educating critical citizens in the information society: the Technological Learning Network	18
1.3.3. Technological literacy for all citizens: new knowledge centres	25
1.3.4. Support to enterprisers of ICT companies: business incubators of the new era	30
1.3.5. Strategy for transforming the information society into a society of knowledge: Centro de Fomento de Nuevas Tecnologías	35
1.4. Spread and transferability of gnuLinEx (<i>free software</i>)	40
1.4.1. Actions for the spread of gnuLinEx	41
1.4.2. Collaboration, cooperation and the transferability of free software and gnuLinEx technology	42
1.4.3. Social and economic repercussions of the spread and use of gnuLinEx	44
1.5. Linex.org services website	45
1.5.1. The functions of linex.org: support, information, social aid	45
1.5.2. What does linex.org offer?	46
1.6. gnuLinEx from a technical perspective	46
1.6.1. Versions of gnuLinEx	47
1.6.2. gnuLinEx 2004 applications	49
2. Free Software in the Brazilian Government.....	56

2.1.	Preface. Tentative steps on a long road	56
2.2.	Introduction	57
2.3.	Free software in the Brazilian Government	57
2.3.1.	The Government's reasons for the implementation of free software	58
2.3.2.	Migration planning and the free software community	61
2.3.3.	Training of Government technicians	62
2.3.4.	Migration plan and strategy	62
2.3.5.	<i>Free Guide</i> . The Brazilian Government's guide for migration to free software	64
2.3.6.	<i>João de Barro</i> : Secure GNU/Linux	67
2.3.7.	Casa Brasil	70
2.3.8.	Fisherman and women discover a new "Net". The Marea programme or fishing telecentre	78
2.4.	Porto Alegre, a free thought factory	87
2.4.1.	Municipal digital inclusion policies	88
2.4.2.	Free software in schools	89
2.4.3.	Community telecentres in Porto Alegre	90
2.4.4.	Government migration plan	91
2.4.5.	Some technical details	92
2.5.	Telecentres in São Paulo	93
2.5.1.	Telecentres and the digital inclusion plan	93
2.5.2.	Structure and operation of the telecentres	94
2.5.3.	Free software used in the telecentres: SACIX	95
2.5.4.	Required investment	95
2.6.	Municipal authorities of Río das Ostras	96
2.6.1.	Sand, oil and free software	96
2.6.2.	Public & free	96
2.6.3.	Savings and technological freedom	97
2.6.4.	Tatuí, the Río das Ostras distribution	98
2.7.	The Brazilian Parliament and the information society	99
2.7.1.	Parliamentary association for free software and digital inclusion	99
2.7.2.	A story that began in the Basque Country	99
2.7.3.	A week of free software in the Brazilian Parliament	99
2.7.4.	Creation of FRENDOFT	101
2.8.	Brazil at the Summit on the Information Society	101
2.8.1.	Socialisation of knowledge at the Summit on the Information Society	101
2.8.2.	International governance of the Internet	102
2.8.3.	Digital solidarity fund	102
2.8.4.	In Tunisia, for a more inclusive information society	103
3.	Sun Microsystems	104
3.1.	Business analysis	104

3.2.	The private sector and the role of the free software community	106
3.2.1.	Feedback	109
3.2.2.	Creation of an appropriate development plan	110
3.2.3.	Software life cycle models: SBS PLC	112
3.2.4.	Process flows for the implementation of a project at Sun Microsystems	117
3.3.	Sun's free software positioning	124
3.4.	Study of free software applications implemented inside the company	124
3.4.1.	Market needs and study	125
3.4.2.	Study of the Java Desktop System (JDS) applications	127
3.4.3.	Control metrics used by the IT operations department	130
3.5.	Development and worldwide launch of the platform	133
3.5.1.	Launch management	134
3.5.2.	Distribution tools	135
3.6.	Product support	138
3.7.	Corporate training	139
4.	Cometa Technologies.....	140
4.1.	Introduction	140
4.2.	Company presentation	141
4.2.1.	Working methodology of Cometa Technologies	142
4.3.	Use of free software at Cometa Technologies	143
4.3.1.	Information technology challenges for companies	143
4.3.2.	Role of Cometa Technologies in meeting business challenges	144
4.4.	Solutions offered by Cometa Technologies	148
4.4.1.	Development of tailored projects	149
4.4.2.	Integration of tools	151
4.4.3.	Consulting	152
4.4.4.	Training	153
4.5.	Use of free software within Cometa Technologies	154
4.5.1.	Basic infrastructure	155
4.5.2.	Collaboration	156
4.5.3.	Workstations	156
4.6.	Case studies	157
4.6.1.	Tailored project	157
4.6.2.	Integration	160
4.7.	Summary	165
	Summary.....	166
	Bibliography.....	169

Introduction

In this module we will look at various public and private institutions that have chosen free software, either as the basis of their business, as in the case of private enterprises, or as an institutional policy, in the case of the public institutions. These case studies do not attempt to give a comprehensive picture of free software implementation as this would be impossible in a subject of this limited duration. The basic idea of the module is to show that is possible to put free software into practice beyond the specific aspects you may have seen over the course of these studies. This module therefore attaches special relevance to all aspects concerning the integration of diverse elements, from technological and practical to financial and management-based, ethical and social.

To summarise, the main aim of this module is to provide an overview of the practical implementations of free software that is somewhat different to the more specific approach used in the other subjects of this course and even in the first module of this material.

After explaining why it is impossible to describe every possible case of free software systems implementation, the following units will look at four specific cases of implementation: two from the private and two from the public sector. The first case looks at a relatively small government body: the Junta (regional government) of Extremadura. The second describes another, much bigger government body: the Federal Government of Brazil. The third case looks at the multinational Sun Microsystems. And lastly, we describe a small business in Barcelona: Cometa Technologies. We will then offer a brief summary of the features of the four case studies.

The Junta of Extremadura

In 1999, the Junta of Extremadura launched a global information society project that included a series of actions concerning the information society. These included the spread of the Internet, the development of e-government, web learning, support to SMEs in practices relating to the new economy and incorporation into the information society, and the support and integration of disadvantaged areas in the region and socially marginalised groups. As part of an attempt to provide a Debian-based Linux distribution tailored to the needs of the education sector, the project created LinEx. Within a few months, LinEx became one of the most successful examples of GNU/Linux use in Spain and in Europe.

The Federal Government of Brazil

Twenty-two percent of the population of Brazil lives in poverty. This, along with the fact that Brazil is such a large country, means that communication between the different parts is difficult and some communities can be isolated. This combination of factors led the Brazilian government to launch a series of parallel projects for digital inclusion in a range of areas. The projects involved setting up telecentres to reduce digital exclusion by improving professional skills, spreading the use of free software and encouraging people to take part in new technologies. Free software played a key role in the creation of these telecentres because it enabled the digital inclusion of individuals through the use of legal software.

Brazil has been pioneering in the use of free technologies around the world and is a point of reference for other countries in South America.

Sun Microsystems

Sun is a large multinational with offices in over a hundred and seventy countries on all seven continents. The company has adopted a clear stance in favour of open standards: the promotion of free competition through the publication of protocols and interfaces is an intrinsic part of Sun's philosophy, which has led it to work closely and actively with the free software community, contributing both source code and human and financial resources. Through this collaboration, the free software community improves or adapts programs so that Sun Microsystems can market the products with additional services, such as support and training. Sun's biggest contributions include the release of the office productivity package or suite, OpenOffice.org.

Cometa Technologies

Cometa Technologies is a private sector company that provides information technology solutions based on free software tools and standards. This case study will thus describe an example of an SME a significant part of whose business involves the use of free software. The activity of Cometa Technologies revolves around two main lines of business: the development and integration of technology solutions, and consulting and training.

Given the differences between the four situations, the format in which each case is described is also unique. We have not set down common guidelines for the four case studies, preferring instead to give the authors free rein to describe each example using their own criteria.

We hope that these examples will give you an idea of the subtleties involved in creating free software solutions in the real world.

Objectives

The aims of this teaching module are:

1. to explain the various organisations and free software projects set up by the Junta of Extremadura;
2. to confirm free software's potential in popularising the Internet and developing e-government and web learning;
3. to describe the diverse organisations and free software projects set up by the Government of Brazil;
4. to promote understanding of the social impact of free software and its potential in bridging the digital divide in disadvantaged regions and among marginalised social groups;
5. to describe the development methodology for projects launched by Sun Microsystems;
6. to raise awareness of the benefits of company participation in free software projects; and
7. to confirm the viability of free software business models by studying the case of Cometa Technologies.

1. Development and implementation of free software in Extremadura: a proposal with firm backing from the regional government

1.1. Context. The socio-economic characteristics of Extremadura

Figure 1.



The geographical features of Extremadura make it a predominantly peripheral region. Located in the far south-west of the countries of the EU, in the west of Spain, it borders with Portugal and is the centre of the triangle formed by Madrid, Seville and Lisbon.

Extremadura spans 41,634 km² and has a population of 1,073,904 inhabitants (663,142 in the Badajoz province and 410,762 in the Cáceres province). The population is very disperse, with a density of 25.78 inhabitants per km². Extremadura accounts for 8.3% of Spain's total surface area while its population makes up 2.6% of the country's total.

Extremadura is split into 383 population nuclei and 57% of its population live in towns with less than 10,000 inhabitants. The main centres are: Mérida, the administrative capital, with a population of roughly 52,110 inhabitants; Badajoz, with 138,415 inhabitants, and Cáceres, with 87,088 inhabitants. Between the 1950s and 1980s, Extremadura witnessed the migration of its population to the north of Spain, the legacy of which is still visible today: between 1960 and 1975, the region's population dropped by 22%, while that of Spain as a whole increased by 18%. In recent years, Extremadura has observed an upturn in this trend, actually registering a positive migratory balance.

In financial terms, Extremadura is one of the least developed regions of the European Union (Objective 1). The region's income per capita is the equivalent of 54% of the average income of the European Union and the employment rate is 42%.

The economy of Extremadura has evolved favourably over recent years and was Spain's Autonomous Community with the greatest relative EU convergence in 1985-1999. Extremadura has used the EU cohesion funds to set up diverse projects in the fields of education, society and business. These projects, designed to introduce the region to the revolution in new technologies and knowledge, are fostering its development on the basis of freedom and equality and raising it to a level where it can adapt to the changes ushered in by the revolution of knowledge.

1.2. The framework of the gnuLinEx (free software) project.).

The global information society project of Extremadura

1.2.1. The early days: the global information society project

Extremadura has been developing a strategy for the transition towards a knowledge-based economy since 1997. The strategic project is aimed at integrating the region into the revolution in information and communication technologies and has been the priority of the current regional government's political action.

In 1998, on the occasion of the debate on the region's status, the President of the Junta (or regional government) of Extremadura issued a challenge for developing a strategy that would allow the region to reach the level of



Figure 2.

development of its wealthier neighbours by focusing on information and communication technologies and the implementation of an information society strategy. The idea was thus to instigate political and technological action to position the region at the starting line for this new revolution, in contrast to what had historically been the case in the region, when it had either lagged behind or simply not formed part of the earlier revolutions of western modernity.

One year later in 1999, the global information society project was launched under the slogan *Inventors of our destiny in the new era*, set to inaugurate a whole series of actions relating to the information society. This project introduced a first generation of actions, which included: the spread of the Internet, the development of e-government, e-learning, support to SMEs in practices relating to the new economy and incorporation into the information society, and the support and integration of the most disadvantaged areas of the region and socially disadvantaged groups.

What was once a goal is now a reality in a continuous process of change and improvement, in a region that is moving towards an open, plural and egalitarian society of knowledge. In recent years, these early information society actions have evolved to shape a regional cross-sector policy in the field that embraces business, education, citizenship and government, acting equally in all sectors while adapting to their specific needs. With a marked Community focus that takes into account European trends in this field, it has positioned itself at the fore of Europe's networked regions.

Extremadura's strategic project for access to the information society was based from the outset on the fundamental principles of connectivity and technological literacy, in an attempt to improve quality of life for the people of Extremadura through equality and freedom.

Hence, the actions carried out in the region both then and now have equipped it with a powerful communications infrastructure, a regional intranet that can connect over 1,400 points in the 383 towns of the Autonomous Community by broadband; in addition, events have taken place and initiatives and programmes launched with both educational and socio-economic goals.

From the very start, it was clear that the most important pillar of the entire process would be education and that information and communication technologies could make a decisive contribution to improving teaching quality. This led to the design and introduction of the RTE (*Red Tecnológica Educativa*, Technological Learning Network) and the design of the PAT (*Plan de Alfabetización Tecnológica* or Technological Literacy Plan), which had to meet the needs of population sectors that had arrived late to the new technological revolution. Lastly, to be certain of covering all areas of society, the region launched Vivernet, a business incubator for companies of the new digital era, and set up the CFNI (*Centro de Fomento de Nuevas Iniciativas* or Centre for

the Promotion of New Initiatives), which would study and guide the region's information society strategy in line with the changing circumstances of each moment.

The cross-cutting project in this entire process is gnuLinEx (*free software*), which was launched as a response to the need to prevent success of the entire strategy from depending on external factors which, like proprietary software, elude any form of government regulation.

gnuLinEx was designed first and foremost to guarantee the connectivity of the education community, followed by that of the regional government and private business sectors, by offering an alternative to the current market.

1.2.2. Context and framework of development of the gnuLinEx project

The information and knowledge society has to be constructed as a group project, so the use of tools that were open and accessible to everybody was not merely a happy coincidence.

Transfer of competence

The competence for the information society, telecommunications and networks and research previously exercised by the Regional Department for Education, Science and Technology was transferred to the Regional Department for Infrastructures and Technological Development by Decree 2/2005 of 11 January (published in the Official Gazette of Extremadura on 18 January 2005).

The Junta of Extremadura, through its Regional Department for Education, Science and Technology (the department charged with guiding, coordinating and evaluating the Autonomous Community's actions in the information society), considered that the best way of encouraging freedom and equality among its citizens was through technological innovation, by using and putting within everybody's reach what is not owned by anybody, with particular reference to the knowledge accumulated over time by humanity.

The aim of the global information society project was to encourage citizens to use ICTs by taking advantage of their possibilities at all levels but particularly in education and business creation, which would improve quality of life for the people of Extremadura.

Consolidation of the diverse educational actions and support to the creation of new technology businesses or the fostering of an ambitious technological literacy plan led the regional government to a point where its successful maintenance depended on an external element: the computer programs and applications used. And this set the context for the creation of gnuLinEx: the need for free software programs to complete this task, which had to be fully controllable and this would only be possible with the use of free software programs.

Brief description

gnuLinEx is a GNU/Linux distribution geared towards end users of computer equipment whose needs are basically office automation and communication tools (e-mail and web browsing). It does not require extensive IT knowledge since GNU/Linux environments have now obtained excellent levels of quality and user friendliness.

gnuLinEx is based on GNU/Debian, the most secure and robust GNU/Linux distribution available, the design of which facilitates the creation of other distributions to make the most of its advantages (integration of its packages, excellent variety and quantity of software, stability, speed, security, etc.) and eliminate its disadvantages (installation and setup). gnuLinEx modifies a series of these features to adapt the distribution to the needs of the Junta of Extremadura.

It is easier to upgrade gnuLinEx than other systems because a simple command can install the software and update the entire system. Diverse packages can be installed from a range of sources: gnuLinEx portal, CD-ROMs, floppy disks, remote ftp and Internet http sites, etc.

Be legal, LinEx copy: the GNU-GPL licence

gnuLinEx uses the GNU-GPL licence (GNU public licence) held by the Free Software Foundation; this makes the source code of a program available for modification by any user; in turn, this user must then make the new sources available to all other users. The GPL licence applies to all GNU programs (among others) and hence, to all programs in the gnuLinEx distribution, which guarantees users the freedom to distribute, copy and/or modify the software.

Early approach: achieving the social and educational aims

gnuLinEx is a unique experience in software distribution and use, an action that came about as a result of the regional government's commitment to its launch and development. For the first time, a government body promoted the development and installation of software tailored to the needs of the end user, pinpointing the needs of the education community in its initial approach.

Analysis of the available software for computers installed in the education centres revealed that the aim of providing one computer for every two students would be impossible without investment from the national government, as the regional budget would be unable to cover the costs. Moreover, as future upgrades could not be guaranteed, the initial effort would be cancelled out.



Figure 3.

gnuLinEx did not therefore come about by casual coincidence or spontaneous generation. In fact, since its launch on 17 April 2002, when the first version (LinEx v. 2.0) was presented, it has covered a dual aim:

- The educational aim of contributing to the development of the Technological Learning Network with a ratio of one computer for every two students in every classroom in schools.
- The socio-economic aim of spreading free software throughout Extremadura by means of the PAT (Technological Literacy Plan), SMEs (small and medium-sized enterprises) and the regional government itself.

1.3. Events, initiatives and situations

Extremadura's strategy of access to the information society has given rise to a series of key projects allowing it to meet the aims of connectivity and technological literacy across the population, originally proposed to improve quality of life for citizens without geographical or socio-economic restrictions.

What was, four years ago, a statement of intent and future commitment is now a reality that has materialised into a series of complementary projects with a common reference: participation in the promotion, spread and use of gnuLinEx in the development of its activities.

1.3.1. Need for a telecommunications infrastructure: the intranet of Extremadura

With the deregulation of the telecommunications market in Europe, Extremadura found itself in a situation of risk because it was very unprofitable for telecommunications companies to extend broadband infrastructures to the small towns where much of the region's population live.

However, with the launch of the global information society project, Extremadura set up numerous cultural, social, educational, economic and administrative processes that could contribute to the progress of the region and its citizens, and which created the need for an advanced telecommunications network. The main aims of this were:

- To ensure the accessibility of all citizens to infrastructures and information society services.
- To promote the technological literacy of both the rural and urban population.

Firstly, the region ensured that all schools had broadband as this would ensure that it reached all Extremaduran towns (even the smallest ones have their own school). If this had not been the case and we had been entirely dependent on market interests, we would have to have waited a very long time for the infrastructure to reach these towns – indeed, it may never have arrived.

Secondly, given that the advantages of the intranet extended beyond institutions forming part of the regional government, an attempt was made to ensure that domestic users, business men and woman and other organisations could benefit from the infrastructures created, with these services being provided by the company awarded the network contract.

Spread and features of the regional intranet

As a direct result of the established aims and arising needs, the Junta of Extremadura held a call for tenders for the installation of a corporate network of advanced telecommunications services (Ruling of 24 January 2000), which was completed in December of that year (Ruling of 27 December 2000, when Retevisión I, S. A., was awarded the contract for the advanced telecommunications network service of the Junta of Extremadura, voice/data service, as published in the Official Gazette of Extremadura on 9 January 2001).

The successful bidder began to implement the network in 2001, which will include the following connection infrastructures:

- 2 Mgb/sec. data access for the 1,478 regional government buildings, spread across the 383 towns in the Autonomous Community of Extremadura, with the possibility of increasing the size of the infrastructure and equipment for greater bandwidth at points considered necessary by the regional government.
- Internet access for a high number of simultaneous users.
- Development of a numeration plan and implementation of the switchboards required for voice/data traffic consumption in government buildings, including schools and healthcare centres in the region.

All these features unify the telecommunications tariffs and services across the regional government, cutting costs and improving the services adapted to the latest technologies. Extremadura's intranet was the first in Europe to boast these attributes.

The intranet data service of Extremadura is supported by state-of-the-art equipment for connection of the existing local area networks and the possibility of supporting virtual networks between the various buildings or bodies so that independent security policies can be established for each network.

The voice service is supported by cutting-edge digital switchboards allowing digital connection between different points within the Extremadura intranet. The design of its scope and extension is open, so new organisations and bodies associated with the Junta of Extremadura can be incorporated as needs require.

A fully equipped management system is used for these services, which provides all the necessary information on the status of the network, allowing its real time management and configuration.

1.3.2. Educating critical citizens in the information society: the Technological Learning Network

The RTE (Technological Learning Network of Extremadura), regulated by Decree 177/2001 of 20 November (as published in the *Official Gazette of Extremadura* of 27 November 2001), represents the integration of the information and knowledge society into the education system of Extremadura by promoting improvements in teaching quality, which affects both the teaching/learning methodology and the training of teaching staff and management of schools themselves.



Figure 4.

The basic aims of the RTE are:

- to guarantee connectivity between all educational establishments (through the regional intranet);
- to equip secondary schools with one computer for every two students (adapting the architecture of the old schools and creating new ones);
- to facilitate access to free, quality software and applications for use in the classroom (gnuLinEx); and
- to train and advise teaching staff in computer tools and applications and to encourage teachers to create quality content (syllabus materials that can be used in class and shared with the rest of the teaching community through the website).

From the outset, development of the RTE (which affects approximately 580 schools) has been regarded as a strategy for the extension of public information society services because it guarantees a minimum of interconnectivity (2 Mb) in all Extremaduran towns.

The RTE is being developed on four different levels:

- **Communications and IT equipment infrastructure:** classrooms adapted to allow two students to share a single computer in secondary schools and five children per computer at pre-school and primary school ages, and implementation of the regional intranet, which connects all of the region's schools by broadband.
- **Creation of content and methodological experimentation:** allows progress to be made in the educational possibilities of ICTs, fostering the creation of inter-school task forces to encourage the development of joint projects.
- **Teacher training:** essential for optimising both the IT equipment in classrooms (tools and applications) and the services developed alongside the latter (web space, e-mail, etc.); training can be on-site or web-based.
- **Digital tools:** exclusive use of free software through adaptation to gnuLinEx and development of a range of programs to meet the specific needs of the education community (students, teachers and parents). These programs are constantly changing in line with the needs that arise, as determined by the education community.

Lines of action and project development strategies

Communications and equipment infrastructure

- **Development of the regional intranet.** The RTE is supported by the intranet of Extremadura, which provides all of the necessary tools for network access from all computers for education.
The intranet guarantees access by all educational establishments in the region to the Internet (2 MB/s). This connectivity also promotes the development of tasks and projects between diverse centres, encouraging them to produce and share educational materials, bridging distances.
The Extremaduran intranet connects 1,478 buildings of the regional government, including all non-university educational establishments.
- **Equipment of the centres.** Each educational establishment has its own server that can manage over 500 computers in each centre, and all classrooms have one computer for every two students in secondary schools and one for every five primary and pre-school pupils. The teacher also has a computer and printer. In total, the classroom computer equipment amounts to 66,289 computers.

This makes Extremadura an international reference for the incorporation of ICTs into the classroom, supported by recent data published by the Organization for Economic Cooperation and Development (OECD) from September 2003, which place Extremadura at the fore of Europe in the ratio of students to computers.

In Extremadura, the ratio of students to computers is 2.25 students for every computer, while the EU average is one for every 11 students. Spain brings up the rear in the European Union with a ratio of 15 students per computer, while the top places are held by Denmark with 3 students per computer, Sweden with 4, Norway with 4 and Finland with 5.

- Services optimising the Technological Learning Network.
 - All educational establishments have 100 MB of web space to host their sites and 15,000 e-mail accounts have been set up for teachers.
 - The software installed on the computers is free software (gnuLinEx) and incorporates application packages developed specifically for teaching: gnuLinEx-Edu Primaria (letter arranging, handwriting tutor, etc.); gnuLinEx-Edu Secundaria (calculation of percentages, verb conjugation, periodic table, etc.) and gnuLinEx-Edu FP (technical vector drawing, printed circuit board designer, accounting package adapted to Spain's General Accounting Plan, billing and point-of-sale package, etc).
 - Virtual Network Computing program, which establishes a communication protocol between a network of computers allowing one computer to control the monitor, keyboard and mouse of another computer. This means that an image of the teacher's display can be sent to the screens of either all students or a selected group, and vice versa, which allows the teacher to display the screens of all of the computers in the classroom on his or her own monitor.
 - Remote control for switching equipment on and off, meaning that students and teachers do not need advanced IT knowledge.
 - IT administrator. Every secondary school has an IT technician to maintain the school's server and provide technical support to teaching staff.
 - Creation and maintenance of the RTE site, which includes news, competitions, links to teaching resources (grouped by level and area of knowledge), and syllabus materials produced by teachers in Extremadura.

Content generation and methodological experimentation. The generation of contents is a priority and constitutes a significant element in the operation of the RTE, since the development of new syllabus materials and classroom resources form the basis of the support given to teaching staff in scheduling



Figure 5.

their subject for the academic year. As a result, a team of teachers is being created, distributed by level and area, and with a series of common parameters and educational principles, who will be advised and supported by IT technicians.

To aid in the generation of educational content, gnuLinEx includes packages containing an innovative new tool called Squeak that can generate multimedia content without a thorough knowledge of computers. We will discuss this tool later.

Note

We will return to this point in the "Squeak on LinEx Project" section.

- **Regional training plan**

- Teacher training. Teachers need to learn how to use ICTs in education and acquire a knowledge of new teaching roles (with the teaching tools and materials now available, we can adapt to diversity, apply more active and less theoretical methodologies, apply new continuous assessment techniques, etc).

The motivation of teachers to use these materials will no doubt increase in line with their instrumental and teacher training and as they discover good teaching practices relating to the use of these media, which they can easily reproduce in the context of their work. The introduction of computers into the classroom has been an important step forward in the use of the many multimedia teaching resources by teachers, who now have the support of a powerful teaching ally without the need to move the entire class to the IT room. Since the year 2000, there has been an intensive, coordinated effort to boost ICT training in schools in Extremadura and encourage content generation. This training has been carried out across the region, mainly by staff at the Centres for Teachers and Resources (new technology consultants), in two forms: on-site and web-based.

During the 2001-2002 and 2002-2003 academic years, 4,301 teachers attended web-based training in Extremadura.

Three web-based activities were scheduled for the 2003-2004 academic year (one per term), attended by almost 2,500 teachers. The high demand has necessitated large-scale action, both in the number of activities and in the resources required to launch these. The main aim of the courses has been to raise awareness of the free programs in gnuLinEx and the teaching applications that it includes (gnuLinEx-Edu).

Around 350 activities have been carried out through on-site training, attended by some 7,800 teachers. Web-based training has also been a great success with teachers of Extremadura because travel and timetable incompatibilities are no longer an issue with this type of training.

A web-based training platform has also been set up with the name Campus Abierto (campus.linex.org), under a GPL licence. This platform can incorporate any advances made in platforms because it can be freely modified and adapted.

In parallel to this training plan, each Centre for Teachers and Resources schedules training activities based on the needs detected at schools within its catchment area.

Obviously, training has been based on gnuLinEx since the creation and presentation of the tool, both to provide basic knowledge of the system and to explain its possibilities in teaching: image processing, multimedia, etc.

- **Training of Extra-Curricular Activity Monitors in ICTs.** The school day for pupils of pre-school and primary age involves classroom activities in the morning and extra-curricular activities in the afternoon. The twenty-eight extra-curricular activities offered are grouped into six categories, one of which is new information technologies. The monitors who teach the activities in this category are given special training in order to set down the basic contents common to all centres.

Meetings and conferences are also held to coordinate and provide support to monitors, taking advantage of the extra-curricular activities held at schools in Extremadura to integrate ICTs into all areas of the syllabus, extending them to related groups (such as parent-teacher associations) through training courses, project development, etc.

Specific and advanced training on equipment, servers, programming and web design is also given to the new technology consultants of the eighteen *Centros de Profesores y Recursos* (Centres for Teachers and Resources) in Extremadura.

Lastly, training is scheduled for students in higher education to give them sufficient knowledge of information and communication technologies to prepare them for Internet business management and to support and advise them on business creation in the new economy.

- **The decision to use free software and gnuLinEx in schools in Extremadura.** The choice of the RTE as the first step in the distribution and use of gnuLinEx was determined by the political goal of hitting the ratio of one computer for every two students in 2005, an aim reached in secondary schools in 2003 thanks to gnuLinEx and its features.

The use of completely free software among students, developed over the Internet by people who are physically distant from one another but with a collaborative spirit, is a lesson in itself. The decision to use free software in education was based on the many advantages it offers for teaching:

- It can be freely used, modified or distributed; copying is legal, which means that students and teachers can legally copy it.
- The use of a free system largely eliminates the problems of piracy. It is natural to want to share your programs with others and, with free software, this is legal.

- It is open, so the program code can be used and modified. In subjects that so require, it can be studied and improved, and we can learn from real programs with millions of users.

- It is collaborative, participative and customisable.

- It is economical.

In general, schools around the world work with virtually no budgets and obsolete computer equipment. Due to the limitations of technical and financial resources, the impossibility of purchasing up-to-date software to ensure that students do not become illiterate in the new information and communication era poses a further problem.

Free software offers a solution to this shortage of resources since its advantages include the fact that it has very few technical requirements (basic architecture) and it is free, making it a very valuable technical and teaching resource in schools. The features of gnuLinEx are:

- system with applications and an operating system in a single distribution;
- office automation package that contains the most common applications and supports the standard formats on the market;
- multimedia and imaging editing programs;
- Internet browsing, communication and network management programs; and
- application for the remote control of computers.

The total cost of this equipment would amount to over € 1,800 per computer on the market but with the installation of gnuLinEx and the subsequent software licence savings for each of the 66,000 plus computers for education, around € 1,000 has been saved. The complete development of gnuLinEx (including servers, distribution of copies and promotion) has cost approximately € 300,000.

gnuLinEx in the education system of Extremadura

The need to boost the RTE on the one hand and to obtain absolute control over the high number of existing pieces of computer equipment (the result of efforts to bring IT to all classrooms) on the other, meant that a stable and powerful system had to be found for working as a network and that software was needed that could be updated without having to depend on third parties, with minimal costs and tools that could be used by teachers, students and the parents of students.

gnuLinEx is also used to manage the e-mail accounts of teaching staff and to house the websites of the teacher and resource centres and the educational establishments.

To install and run gnuLinEx in educational establishments in Extremadura, the results of previous partial experiences were taken into account. The main difficulties detected then concerned the lack of full support for migrating to the new system, although we should remember that it was the first time that a government institution in Europe launched a free software distribution.

The organisational structure of the teacher and resource centres, which divides the region into eighteen sub-regions, was used. All of the new technology teaching consultants at these centres have been trained in gnuLinEx, both in technical aspects and in its possibilities for teaching. These consultants offer training support to teaching staff at the educational establishments, in collaboration with the non-teaching IT administrators at each centre.

Execution consisted of three phases:

- Training of an "avant-garde" group, composed of around a hundred teaching staff with computing experience and a number of other professionals, the purpose of which was to reflect on and experiment with the possibilities of new technologies in teaching.
- The results of the previous phase stood the project in good stead for the second, more critical phase, which took place in 2002-2003, when nineteen secondary schools from the region were fitted with the complete infrastructure. The aim of this phase was to complete the technical model (hardware and software) for each centre and the teaching model (use of the infrastructure). Initially, the greatest difficulties were to overcome the typical inertia towards the use of computer applications and certain incompatibilities with existing contents. However, in the light of previous experiences, the use of free software meant that these contents could be adapted.
- The third phase began with a costly though necessary decision: to transfer the experience to all educational establishments, extending the training programme and informative activities to all teaching staff of secondary schools, based, naturally, on the experience acquired in the previous phases.

The main problems and challenges that needed to be addressed were: the lack of a model to follow, an overwhelming infrastructure and the incompatibility of contents with gnuLinEx. In the end, however, the features of the free software guaranteed the ultimate success of the project.

Coordination has been key. The success obtained in technical aspects stemmed from the adoption of a flexible free technology model that allowed for excellent control of all resources, thus minimising maintenance requirements. In organisation and teaching, success came about in the form of teaching practices now used to provide training in use of the new classrooms to all teaching staff of educational establishments.

Squeak project on LinEx

Squeak is a free software cross-platform program (it runs on over twenty platforms) for the creation of multimedia content. On the one hand, it is a multimedia development tool that allows new users and children aged 7 and up to programme and build complex systems while, on the other, it is a tool/environment/language based on Small-talk-80 that is geared primarily to multimedia and simulation environments for IT professionals and experts.

Given this wide array of possibilities, the tool is used not only in educational contexts but also for the development of web applications and research into user interfaces and operating systems.

Its main architect, Dr Alan Kay, is regarded today as one of the fathers of modern computing: he created the windows environment for personal computers and was the first computer scientist to use the mouse as a screen cursor.

For its features and possibilities, the Regional Department for Education, Science and Technology has incorporated Squeak into the educational context of Extremadura with the support of Small-Land. For the RTE, the installation of gnuLinEx and Squeak on the region's 80,000 computers will enable teachers to generate their own active contents for subjects and transform students into key players of the construction of their knowledge. Moreover, because it is a flexible and customisable tool, any additional features required from an educational standpoint can be incorporated.

The educational community of Extremadura has welcomed the use of this tool, with working groups being formed immediately to develop Squeak projects. Beginners' courses for teaching staff are also being held (on-site classes and distance courses using the campus abierto tool) on learning with and the possibilities of everyday use of Squeak in the classroom.

1.3.3. Technological literacy for all citizens: new knowledge centres

The PAT (Technological Literacy Plan) initiative was launched by the Junta of Extremadura in collaboration with the Asociación Regional de Universidades Populares (regional association of popular universities), local governments and other collaborating organisations with the aim of providing IT training to the entire population of Extremadura and ensuring global access to the information and knowledge society. It was designed to meet the needs of



Figure 6.

sectors of the population that arrived late to the new technology era and to educate the adult population, making it one of the region's key technology actions.

The new knowledge centres

The PAT is carried out through NCCs (*Nuevos Centros del Conocimiento* or New Knowledge Centres), public spaces with an Internet connection and: an IT technician, a social catalyst, eight Internet-ready computers and the most common peripherals (scanner, printer, digicam, etc). This equipment creates an environment whereby users and social, economic and cultural institutions can discover and experiment with the opportunities arising in Extremadura as a result of information and communication technologies.

Figure 7.



The NCCs were launched as a pilot project in 1999 with six centres based in community centres. There are now thirty-four centres, located mainly in rural areas at a certain distance from big cities or in disadvantaged urban areas as a means of social and cultural integration. Local governments have launched many initiatives to introduce them into their respective areas, as is the case of the NCCs of Navalmoral de la Mata (Cáceres) and Los Santos de Maimona (Badajoz), the latter of which uses the available resources of the town's school.

The aim is to set up a centre in every town or city in Extremadura to guarantee equal access and connectivity.

The users of the centres, citizens and organisations interact on projects taking into account the interests and demand of the population of Extremadura. As a result, they act as à la carte technology training venues while also promoting social and cultural participation.

Another interesting contribution to the PAT is that made by the itinerant IntegraRed team, which has portable centres that visit rural areas with populations of 235-800 inhabitants. These centres remain in each area for one-week periods and meet the aims of the PAT by spreading and generalising the use of ICTs.

Aims of the PAT

The main aim of the PAT is to identify the attitudes and skills of the population of Extremadura, to find out which need to be maintained and which have to be changed. The specific aims of the PAT are:

- to promote free and democratic access to ICTs among the population, allowing them to take part in the structural changes taking place in the information society in Extremadura;
- to encourage the participation of social organisations and to train the population in enterprising skills;
- to promote the creation of social and virtual spaces, fostering collaboration between institutions, organisations and populations with common interests;
- to ensure the involvement of Extremaduran society in the spread of its local and regional culture and to reinforce its collective identity through the Internet;
- to transfer the knowledge generated as a catalyst, project and plan for social improvement;
- to guarantee the use and development of gnuLinEx for equality of opportunity among all citizens, social organisations, institutions, companies and local governments;
- to promote the use of IT tools as learning and communication management systems; and
- to act as a reference for the possibilities of technological literacy and free software.

Key points of the PAT

The most innovative aspect of the PAT is its teaching/learning model, which is carried out by management technicians in the different centres (IT catalyst and social catalyst) and a number of volunteers. The model

takes its inspiration from the educational participation of adult learning (motivation, skills acquisition, participation) and the activities are designed as methodological tools to encourage learning, with a particular focus on:

- Knowledge of the environment: familiarisation with the way of life and socio-economic features of the region.
- Focus on specific needs: specific needs and interests of the users.
- Technological initiation: familiarising the user with the technological environment (what computers are and how they are used).
- Development of basic technological skills to ensure the correct use of IT tools.

The use of free software for the acquisition of basic technological skills allows users to choose from the variety of available software options. Neither cost nor difficulty are obstacles to the general use of ICTs by the population.

Research and development through pilot projects geared towards sharing and improving knowledge with communities that develop free software, improved access to the Internet and communications, etc.

Technological literacy and gnuLinEx for Extremadura

gnuLinEx, designed for use in the educational environment but made available to the entire population for private or business use, is a key component of the PAT because its main aim is to ensure universal access to ICTs among the population, without discrimination for any reason.

The support for the entire technological literacy process of Extremadura to eliminate and/or bridge the digital divide is the use of gnuLinEx; hence, since its presentation, all NCCs have used and adopted it as their working philosophy. The incorporation of gnuLinEx into all computer equipment and its knowledge and use by users has had positive results and experiences in the design of innovative activities, with the aim of spreading and raising the profile of the alternatives. The numbers of elderly citizens who learn how to use a computer or surf the Internet at these centres reveals that fears about free software systems are completely unfounded.

The use of gnuLinEx has changed the vision and role of users: they are no longer mere consumers of technology, but rather participants of a community.

Actions with gnuLinEx in NCCs:

- Migration and adaptation of the previous infrastructure of all centres.

- Distribution conferences, with videoconferencing with key figures from the free software community.
- Creation of groups for learning skills in gnuLinEx.
- Creation of technological development teams among users with an interest in free software.
- Participation in promotional fairs and events.

The following conclusions can be drawn from the experience gained with gnuLinEx as a tool for everyday activity and the technological literacy of NCC users:

- For new users, free software training is as easy and affordable as training in any other software on the market.
- For advanced users who use or have used other operating systems, the transition to gnuLinEx represents no major difficulties, as has been the case when they switched from their usual system to more user-friendly or up-to-date systems.

Transferability of gnuLinEx in the PAT

gnuLinEx has emerged as a tool allowing us to create our own developments that can be shared with other organisations and institutions and vice versa. The process of continuing technological literacy continues under the "Be legal, copy LinEx Extremadura" slogan.

The participative technological methodology and gnuLinEx depend on the people who form the information society, making it easy to adapt and use in other rural communities. The governments of Autonomous Communities in Spain such as Castile-La Mancha, Valencia and Andalusia and countries such as Brazil, India, Colombia, Nicaragua, Peru, Chile and Uruguay have all visited Extremadura to learn about and study the PAT. The upshot of this is that they are using Extremadura's experience to develop similar plans in their respective regions and/or countries.

Castile-La Mancha is developing a technological literacy plan in collaboration with the Ínsula Barataria Foundation, with a hundred centres with similar features to the NCCs.

Andalusia has launched a project called Guadalinfo to set up technological literacy centres.

Colombia is developing the LinExCol (LinEx of Extremadura for Colombia) project, a distribution created by Fundehumano with the support of the Junta of Extremadura.

1.3.4. Support to enterprisers of ICT companies: business incubators of the new era

Vivernet (Centre for New Technology Businesses) is a programme of the Regional Department for Education, Science and Technology set up in collaboration with Fundación para el Desarrollo de la Ciencia y la Tecnología (FUNDECYT, the Foundation for the Development of Science and Technology). Its aims are: to aid in the generation of new businesses in the field of the information society by offering young enterprisers with creative skills the resources they need to develop their activities, to support the technological adaptation of SMEs by offering the businessmen and women of Extremadura a vision of the new opportunities for business and management of ICTs, and to promote the use of free software in the business sector.



Figure 8.

Vivernet was launched in mid-2000 and has since contributed to the consolidation of companies in the ICT sector already operating in Extremadura, offering support and encouraging collaboration and cooperation between them. As a business centre for new technology companies, Vivernet hopes to be a reference for these companies and has set up the following lines of action:

- Working with enterprisers who wish to launch projects in the ICT sector, whether in rural or urban areas.
- Offering consulting services to guide enterprisers to success in their projects and activities.
- Holding courses on technologies and business administration, including courses on tools and free software applications that specialise in business management.
- Promoting collaboration and the exchange of ideas and experiences to encourage the creation of business networks.
- Encouraging the use and development of technological tools to adapt SMEs in Extremadura, helping them to grow and increase their competitiveness.
- Supporting and spreading the use of free software in general and gnuLinEx in particular across businesses in Extremadura. This is done through training courses, either at basic level for an introduction to gnuLinEx or at a more detailed level for specific applications such as Zurbarán (Gimp), for digital image processing.

Conferences and forums are also held on the business opportunities of free software in this sector in Extremadura for businessmen and women, enterprisers and students about to complete their studies.

Business centres: Cáceres and Badajoz

Figure 9.



Vivernet has strengthened its business support structure with two business centres for enterprisers, located in Cáceres and in Badajoz, respectively, with a virtual space (<http://www.vivernet.com>) and an itinerant team that takes its work to the rural parts of Extremadura. These business incubators offer the following resources and services:

- Logistical resources and technological equipment. The centres provide offices equipped with sufficient technological infrastructure for the optimal development of business activities. These offices are offered to enterprisers who opt for a business activity related to the information and knowledge society. Candidates for this option must submit a business plan and a project feasibility study that a panel of experts will study to decide who these areas will be offered to. The business centres also have other areas and common resources (fax, copying, security, cleaning, etc.) that can be used by those in charge of business initiatives, including classrooms and meeting rooms.
- Information and documentation service. This service offers a combination of information and guidance on the diverse facets of business. They also manage the [vivernet.com](http://www.vivernet.com) virtual space, which produces specialised

informative newsletters and provides selective information services for the initiatives and companies based at the centres.

- Legal advice and consulting service. This service helps businessmen and women to draw up a business plan and study its economic viability. It also offers advice on the administrative procedures involved in setting up a business and on tax requirements and financial issues.
- IT and technology support service. This manages the IT systems of the centres and offers technology advice to enterprisers.

In order to achieve the aims of Vivernet with potential enterprisers in the rural parts of the region, an itinerant team of experts has been set up that travels across Extremadura to help with the drafting of new business plans and offer legal, business and technological advice.

Vivernet inaugurated the Cáceres business centre in April 2000 and in July of that year, another centre was opened in Badajoz. The itinerant team began its work in September of the same year. The results obtained since then have been: 148 business plans analysed and 70 companies given support; 3,370 hours of courses attended by 2,703 students; 4,327 registered Vivernet users and 68,934 visits from businessmen and women and enterprisers requiring its services; 12 companies hosted under the vivernet.net domain, 287,451 vivernet.com users and 4,115,208 visits to the Vivernet site.

Technological adaptation and promotion of free software in companies in Extremadura

gnuLinEx is stimulating the creation of new companies and businesses in the development of content and applications based on free software.

The Vivernet programme, whose main aims include the promotion of free software in the region's business sector, has led to the creation of seventy firms, of which 80% use gnuLinEx and 20% base their business on activities related directly to it.

Two companies from Extremadura (.DEV and Astron) recently created two programs based on gnuLinEx for the business community, Facturlinex and Contalinex, under the general name of Gestionlinex.

Along these lines, Vivernet has launched what it has called LinEx-Empresa, a space designed to promote actions to encourage the use of gnuLinEx in companies, which can be found at the gnulinex.net business site.

Vivernet has been working on two new activities since October 2003 that will extend the initial aims of the project and create new fields in which to apply the working methodology of the Vivernet team of experts.

The first activity involves the technological adaptation of SMEs in Extremadura while the second deals with the migration of companies in the region from proprietary software to the use of free software. This activity is carried out through the **business portal**, which offers a series of migration tools and utilities, besides spaces for collaboration, queries, news and repositories of free programs for business management.

The second activity is called **Linex-Empresa** and is a combination of actions designed to extend the use of gnuLinEx and free applications and programs in companies across Extremadura. It is funded by the Regional Department of Labour and the Economy of the Junta of Extremadura as part of its SME consolidation and competitiveness plan.

The purpose of Linex-Empresa is to establish and/or consolidate itself as a public reference of business unity, promoting synergies between companies and projects and actions undertaken in the field of free software through the exchange of information, the development of training actions and the fostering of business cooperation.

Moreover, Linex-Empresa seeks to become a tool of reference for the traditional businesses in Extremadura that wish to update their commercial and administrative processes or migrate their software licences to free software.

In short, Linex-Empresa is an action devised as an introduction to the use of free software in the world's business sector. It is an excellent opportunity to spread and support the regional market of software creation and development, which bases its business model on the development of applications and the provision of services, competing with the business model used by major corporations that base their profits on licence sales. Access to the source code of the applications and programs allows these to be modified and adapted to suit the specific needs of a particular company.

Through its Linex-Empresa project, Vivernet has released the full Gestionlinex management package (Facturlinex v.1.3 + integrated accounting) and the Contalinex accounting tool under a GPL licence.

Facturlinex, developed by .DEV, is a client-server application for invoicing that can be run by multiple users, which is useful for both small companies and large corporations with branches.

It can be used in shops, whose main operations are the management of information on sales, warehouses and cash registers, or in administrative offices that need to carry out invoicing, ordering, accounting or strategic management with real-time connections between all of these activities.

When used as a point-of-sale terminal, the application speeds up ordering and invoice requests, reducing waiting time and improving customer care and the competitive efficiency of the company. The application can control the movement of the entire warehouse, cash register and invoicing, all at a competitive price because of the savings made with free software licences. Version 1.3 of the application offers improved database access and modules for monitoring size and colour; it comes with an integrated accounting application the result of which is the Gestionlinex package, the ideal solution for the commercial management and daily accounting of SMEs, all under the gnuLinEx distribution.

Gestionlinex has become the alternative and ideal solution for account management and daily business management on the gnuLinEx and other Linux distributions.

ContaLinEx, developed by Astron and released under the GPL licence for gnuLinEx, is an accounting tool providing commercial and accounting management solutions for any form of company that runs on any GNU/Debian 3.0 (or higher) environment. The possibilities of this program include editing of the general ledger, journal, profit and loss accounts, balance sheets, etc.

Extremadura is home to companies that have developed and continue to develop free software or which offer services related to them. Other companies from the region have migrated their systems and adopted this type of program for their daily management and the training of their employees.

The following companies either develop free software or provide related services:

- PuntoDev GNU S.L. This company located in the city of Badajoz develops free software for SMEs.
- Ilkebenson S.L.L. A company with head offices in Cáceres and Badajoz that produces free administrative software with a customised distribution.
- Adaptia. Company located in Cáceres that specialises in free software such as GNU/Linux and gnuLinEx.
- Silex Consultores. New company based in Badajoz that offers solutions for gnuLinEx.

The following companies have adopted free applications created in Extremadura, specifically the Gestionlinex suite, for the administration/management of shops and points of sale:

- Perfumery-Drug Store (Cáceres)

- Nuovapelle (Madrid, Badajoz, Cáceres, Don Benito, etc.)
- Granja El Cruce (chain of stores selling poultry products in Extremadura)
- Cava de Puros Ángel (Badajoz)
- Sexy Cats (Badajoz)
- Alfonso, Bebé y Modas (Almendralejo)
- Amaya, Centro de Modas (Almendralejo)

1.3.5. Strategy for transforming the information society into a society of knowledge: Centro de Fomento de Nuevas Tecnologías

The early days of the strategy: the Infodex project

Infodex (Estrategia Regional de Sociedad de la Información, Regional Strategy of the Information Society) is a project launched in 1997 that formed the strategic framework and starting point in the history and development of all actions that have guided Extremadura along the way to the information society.

Infodex was an inter-regional cooperation project funded by the European Union and the Junta of Extremadura through FUNDECYT and set in the context of the RISI (Regional Information Society Initiative).

In its first phase (1997-2000), Infodex conducted a study of the situation, potential and challenges faced by the region in its use and spread of information and communication technologies.

The conditions of diverse sectors were analysed in order to learn about Extremadura's ability to deal with the impact of the information society. This diagnosis resulted in a master plan, which included the main programmes that Extremadura needed to carry out in education, telecommunications, government, health and business.

In its second phase (2000-2001), Infodex identified and performed specific actions showing that it was possible and profitable for Extremadura to form part of the ICT revolution through the proposal and development of specific pilot projects.

Its third and final phase (2001-2002) was geared towards support for consolidation of the previous phase, which included the following actions:

- The telecommunications network, materialised through its intranet.
- The extension of the intranet of Extremadura to the diverse schools of the regional government in all towns and cities of the region and the technological development of the Technological Learning Network.
- Human resources training in ICTs through the NCCs, Vivernet and the Technological Learning Network.

- The generation of contents for the network.

At the end of the Infodex project, the actions, projects, training activities, relationships and collaborations set up and built on throughout the latter required new actions if we were to reach the aims set at the project launch. This led to the creation of the CFNI (*Centro de Fomento de Nuevas Iniciativas*, Centre for the Promotion of New Initiatives).

New strategic programming: the CFNI

This programme of the Junta of Extremadura was launched as the logical evolution of the Infodex project, designed to establish and introduce a new strategic schedule and continue the activities identifying the information and knowledge society, guaranteeing coherence with the actions carried out in the framework of the Infodex project, which was important for the development and implementation of gnuLinEx.

In the first stage (2003-2003), the CFNI developed the following programmes:

- Consolidation of a regional centre for the promotion of new activities in the information society that would act as a hub for networks of information and knowledge society activities in Extremadura.
- Support to the Technological Learning Network and generation of contents for it.
- Execution of the e-Extremadura programme (a regional ERDF 2000-2006 programme for innovative actions).
- Development of gnuLinEx.

The results of the centre's activities have all been very positive:

- The e-Extremadura programme has mobilised all of the region's public and private agents (regional, local and provincial governments, universities, non-profit organisations and SMEs), which have launched more than eighty innovative projects in the field of ICTs.
- Support for the Technological Learning Network has led to its materialisation and provided schools in Extremadura with an up-to-date technological infrastructure offering the world's highest student to computer ratio. A major breakthrough has also been made in the development of educational content.



Figure 10.

- The use of free software and the creation of gnuLinEx have been crucial to the region's progress, the universalisation of connectivity and technological literacy.

The direct and active participation of the CFNI in all of these processes has encouraged its consolidation and allowed it to carry out new activities as well as improving those carried out to date. At its current stage (2003-2004), the CFNI acts in the following capacities:

- Centre for the support and development of gnuLinEx, the main aim of which is to provide technical support to the new versions of gnuLinEx and the linux.org website, besides promoting, developing and innovating through free software.
- Regional observatory of the information society, whose main purpose will be to study, document and raise the profile of the information society process taking place in Extremadura, in order to obtain a global vision of it.
- Coordinator of the e-Extremadura programme as a continuation of the previous stage and implementer of the new programme of innovative actions.

In its new role, the CFNI will obviously continue to support the Technological Learning Network and collaborate on the generation of contents. It also carries out an important task of documentation and exposure for free software and the information society, creating networks of collaboration and cooperation either in the framework of European Union programmes and initiatives or in the national and international development and implementation of gnuLinEx.

The CFNI as a centre for the support and development of free software

The boom in free software experienced in all areas and the national and international importance and repercussions of this for the creation and development of gnuLinEx have made it necessary to bolster actions for this distribution and to continue its technical and strategic improvement.

The CFNI is responsible for the technical coordination and development of the new versions of gnuLinEx, working at the core of the system and on the programming and release of the various versions. In this task, it has the support of leading national and international figures in free software and the team working on the development of the other information society programmes of the region and the regional government.

The specific tasks carried out by the CFNI for gnuLinEx development and support are:

- Technical development of gnuLinEx and the new versions of the operating system, with the creation and integration of new applications tailored to the needs of the regional government, and the promotion of the Squeak tool in the design of educational content for the Technological Learning Network.
- Management of the linex.org site and technical support to users through it.
- Promotion of free software and systems migration in government bodies. The CFNI is carrying out training actions and offering advice to the regional government of Extremadura in order to raise awareness and encourage the migration of its systems to free software.
- Free software training for all sectors of the population.
- Support and collaboration with Vivernet to support companies that offer services related to free software and incentivise the incorporation of this software into their business activities.

Since the creation of gnuLinEx and in accordance with the aims set by the regional government, the CFNI carries out a task of promotion and diffusion in collaboration with the other programmes, resulting in the following actions:

- General meetings, conferences, courses and panels of experts designed to familiarise the population with gnuLinEx, free software and ICTs, and reveal the benefits and possibilities that they offer.
- Organisation of events specialising in the demonstration of experiences and examples of good practices in free software.
- Training in the use of ICTs, free software and gnuLinEx.
- Presence and participation in events specialising in the information society and/or free software, whether locally, nationally or internationally.
- Participation in task forces, particularly those to promote free software in the government of Extremadura.
- Activities promoting the regional information society strategy of Extremadura, particularly gnuLinEx, in diverse media.

As part of its contribution to technological research, it promotes innovation, quality and competitiveness in the region in order to improve the development of free software. The CFNI supports research groups from the region through FUNDECYT and in collaboration with the public and private organisations that develop R&D programmes.

The e-Extremadura innovative programme of actions that we will discuss later has been crucial for establishing contact with research groups and for attracting and carrying out projects with gnuLinEx. The project assessment criteria include the project's use of or compatibility with free software.

To sum up, the CFNI fosters access to greater knowledge of IT systems and supports technological research and development by attempting to halt the exodus of intelligence as a guarantee for the region's technological growth and greater likelihood that problems will be solved more quickly.

The CFNI and the Regional Observatory of the Information Society

Since the launch of the Infodex project and its evolution through the CFNI, its activities have always included a crucial task: analysis and documentation of the strategies, processes and evolution of the information society in Extremadura and in Spain and the world in general. It was therefore necessary to adopt a new method to continue the tasks of observation and monitoring of the evolution and changes affecting the latter: the Observatorio Regional de Sociedad de la Información or Regional Observatory of the Information Society.

The observatory is the instrument allowing us to obtain and analyse information on the level of development and use of ICTs in Extremaduran society and to spread this information across the existing regional and European observatory networks in order to collaborate with similar bodies and set indicators and comparative studies for introducing actions to improve and reach the level of other European regions.

Obviously, the observatory plays a vital role in the study of the status and evolution of free software around the world and in collaboration with the centre for the support and development of free software.

The CFNI and the regional innovative actions programme: e-Extremadura

The activities of the CFNI include helping to coordinate the regional innovative actions programme of the ERDF 2000-2006, presented by the Regional Department for Education, Science and Technology.

The e-Extremadura programme, regulated by Decree 64/2002 of 28 May (published in the *Official Gazette of Extremadura* on 11 June 2002), has, on the one hand, ensured the collaboration of all regional government departments



Figure 11.

in the programme and, on the other, introduced a new method for defining initiatives, since it is the first time that an action has been designed with the cross-sector participation of regional agents.

As explained earlier, the e-Extremadura programme played a significant role in the promotion and use of gnuLinEx, which was fundamental for the latter as a candidate innovative project in the framework of the programme. Moreover, the design of gnuLinEx took into account the general aims of this programme as the definition and design of the two were almost parallel.

Since the launch of the two calls for projects (June 2002 and January 2003), which saw the presentation of over seven hundred projects and the co-funding of over seventy, private organisations (companies and the tertiary sector), the University of Extremadura and the local and provincial governments of the region have established the following horizontal objectives with the contribution of gnuLinEx:

- Differentiated technological literacy. With this aim, the use of gnuLinEx, which can be freely copied and distributed, can reduce the digital divide by offering the population free access to ICTs.
- Generation and adaptation of digital content. The creation and adaptation of digital content with free software means that it can be used, improved and adapted to the specific needs of individual users. Content created in applications that can be used generally without influence from the program, operating system or brand used, thus allowing the user to obtain the software free of charge.
- Promotion of a new business and labour culture. gnuLinEx contributes to the promotion and increase of new business models for the generation and adaptation of contents and applications in free software.

gnuLinEx was taken into account in the project assessment and selection criteria because many of these considered it as a development platform or for literacy and learning content.

1.4. Spread and transferability of gnuLinEx (*free software*)

Free software in general and gnuLinEx in particular represent an increasingly popular alternative, not only in Extremadura but also in other regions of Spain and other parts of the world.

The *Be legal, copy LinEx* slogan is, in effect, a declaration of principles. gnuLinEx came about as a response to a series of needs that had arisen in Extremadura at a specific time in order to solve a problem associated with

achieving a set of proposed aims. gnuLinEx was initially planned to reach the whole of Extremadura and to be extended to all those who requested at a later date.

1.4.1. Actions for the spread of gnuLinEx

With the creation of gnuLinEx, a massive promotional, profile-raising campaign was launched, which resulted firstly in collaboration offers from free software professionals and user groups, including GULEX (Extremadura's Linux user group) and HISPALINUX (the association of Linux users of Spain).

Since its official presentation, the spread and distribution of gnuLinEx has taken a number of forms:

- CD-ROM copies at diverse events and on request through the linux.org site (over 200,000 copies).
- Downloads of the program from www.linux.org, or existing *mirror sites* (over 100,000 downloads from the website).
- The regional press of Extremadura, which distributed a free gnuLinEx CD-ROM in June 2002 with each copy of the newspaper.
- Specialist national magazines, such as *TodoLinux* and *MundoLinux*, which distributed a free gnuLinEx CD-ROM with their magazines in December 2002.
- Spread of gnuLinEx through its presence at various technology fairs and conferences, congresses, etc., (approximately 87 events to date).
- Courses and workshops on gnuLinEx (around 50) held for teaching staff, IT system administrators, other government employees, businessmen and women and enterprisers through Vivernet and for the general population through the NCCs.

Around 400,000 copies of gnuLinEx have been distributed in total, including those downloaded directly from the site and those on CD-ROM. Of these, the gnuLinEx Live v. 4.0 version, first distributed in SIMO TCI-03, was widely acclaimed because it could run directly from the user's computer disc drive without the need to install the program on the hard drive while offering the same number of applications and features. The purpose of this action was to give users an introduction to free software and an invitation to test out its many possibilities.

The appearance of gnuLinEx-related news in diverse national and international media also helped to raise the profile of the distribution, affording it considerable visibility, all revealed by the growing interest of technological companies and government institutions in learning about it and in the increased demand for gnuLinEx copies.

This action attempted to reach all users regardless of their age. Hence, since the start of the year, over 25,000 copies of a paper comic about gnuLinEx have been distributed among primary-school children from the region. Its cartoons explain how and why the project was launched, drawing the reader into an adventure of knowledge about the possibilities of free software and gnuLinEx applications. Linextremix, the main character, is the link between gnuLinEx and its younger users.



Figure 12.

To complement all this promotional and profile-raising activity, not only of gnuLinEx but of free software in general, the Junta of Extremadura has also encouraged reflection on the latter. Thus, diverse personalities and groups of international repute took part in various events hosted by the regional government, including Jesús González Barahona, Richard Stallman, Miguel de Icaza, José M.^a Olmo, various free software associations, etc.

1.4.2. Collaboration, cooperation and the transferability of free software and gnuLinEx technology

As explained earlier, the diffusion of gnuLinEx has led to calls for collaboration and cooperation from prestigious associations and figures, basically for the transfer of knowledge and collaboration on the technical development of free software to avoid going over ground already covered. It has also served to establish communication with other regions and countries for sharing experiences and good practices.

The alternative represented by free software is becoming increasingly stronger and popular, which is probably due to the constitution of two associations of free software users in Extremadura: GULEX (Linux/Unix user group of Extremadura) and Sinuh (LinEx user association), and the first gnuLinEx business association in Extremadura. LinEx Debs was also set up in the same way. The members of this gnuLinEx user group are regular participants of forums on the linex.org site, who decided to form a group to detect bugs and provide solutions to improve subsequent versions of gnuLinEx.

National collaboration agreements

One example of gnuLinEx transferability and collaboration agreements for research and development in free software between the Junta of Extremadura and other regions – that is also a model demonstrating the advantages of free software in the development of e-government – is the cooperation protocol signed between the regional governments of Extremadura and Andalusia

in April 2003 for the use and diffusion of free software and gnuLinEx in particular. By this agreement, the government of Extremadura facilitates the use of gnuLinEx to the government of Andalusia and establishes mechanisms of cooperation for the development of new applications and free software support and diffusion activities. This agreement resulted in the launch of the GUADALINEX project in June 2003.

Other regional governments of Spain have also shown an interest in implementing free software in their respective Autonomous Communities, following the example of Extremadura. These include the Basque Country, Aragon, the Canary Islands, Barcelona, Madrid and Valencia.

International collaboration agreements

On an international scale, though still within Europe, the French region of Nord Pas de Calais is preparing to introduce gnuLinEx in its institutions after confirming in situ the results of a two-year experience in the region and seeing from the example of Extremadura that free software is a perfectly viable alternative.

Although gnuLinEx has become a reference for the entire world as an example of good free software implementation in a government organisation, there has been a great deal of interest in the distribution from South America, a region that is keen to collaborate with Extremadura. As a result, the Junta of Extremadura has signed diverse collaboration agreements and protocols for the diffusion of free software and gnuLinEx in particular with South-American governments and institutions, including:

- Protocol for collaboration with Porto Alegre (Rio Grande do Sul, Brazil) in December 2003.
- Collaboration agreement with ILAEDES (Latin-American Institute of Education for Development) of San Salvador (El Salvador) in December 2003, with the AUGM (Association of Universities of the Montevideo Group) joining the agreement later.
- Protocol for collaboration with the Prefecture of the Department of Santa Cruz (Bolivia) in February 2004.
- Framework collaboration agreement with FACS (Fundación Augusto C. Sandino). Managua (Nicaragua) in August 2004.
- Protocol for collaboration with the Huancavelina region of Peru in September 2004.

- Protocol for collaboration with the Rectory of the Technology Institute of Sonora (Ciudad de Obregón, Sonora, Mexico) in November 2004.

Private collaborations

Actions in the private sphere include the collaboration agreement signed in May 2003 between the Junta of Extremadura and Lambdaux, at the request of this company, which was also extended to the Juan Carlos I University and the firm Infinity System. The purpose of the agreement was to share the technology that they were integrating in order to provide technical support to leading national hardware firms. This technical solution is based on the same standards as gnuLinEx, so its progress had an immediate effect on this distribution and vice versa: gnuLinEx benefitted from the incorporations required for these firms to run their products with free software. Users can now choose from two types of free software: gnuLinEx or Lux, a free operating system that is 100% compatible with gnuLinEx, created by Lambdaux under the GPL licence and pre-installed on Airis laptops. The product costs € 15 per year, which includes support and maintenance services.

1.4.3. Social and economic repercussions of the spread and use of gnuLinEx

From a financial point of view, the existence of a full software that can be legally copied, modified and distributed without legal restrictions helps to break down economic barriers such as the high cost of software licences.

Government organisations around the world invest a substantial proportion of their budgets in the purchase of commercial software and on improving and maintaining their IT systems. These expenses do not generate profits, so free software is both an alternative and a major opportunity as it allows savings to be made on licence fees. Moreover, new lines of research and development can be generated with this technology through collaboration and participation, which means that efforts and resources are not wasted.

In the experience of Extremadura, the independence and savings generated by the gnuLinEx system in the regional government has also been significant.

It is estimated that almost € 48,000 have been saved with the migration of the systems in its various bodies to free software. This is the cost of licences for the use of the proprietary software programs that would need to be installed in a reference implementation of twenty-two computers. Hence, the use of free software for the development of e-government offers clear benefits.

This expense, applicable not only to the regional government offices but to all of the IT equipment of the Technological Learning Network, would be impossible to meet and would hinder the development and success of a project of this size in Extremadura.

Moreover, the spread of gnuLinEx, largely responsible for breaking down these barriers in the region, has already brought benefits to companies in Extremadura related to ICTs, companies that have uncovered new business opportunities in free software and are taking advantage of the opportunities offered by gnuLinEx, developing their business along two lines:

- Companies that sell IT equipment have seen their profits increase with a default installation of gnuLinEx on their computers, passing on savings in licence fees to consumers.

Megasoft System, an Extremaduran wholesale company from the IT sector is now leading the market in the sale of computers with a pre-installation of gnuLinEx instead of proprietary software. The company passed on the licence fee savings to the retail price of the product to obtain a more competitive market edge and saw its sales increase by 37.16%. The growing popularity of this type of software has recently encouraged firms such as OKI to develop it for its printer drivers.

- Companies offering traditional IT services have reoriented their business by developing improvements and adapting and migrating applications to free software.

Projects offering added value and support to diffusion and aid to companies wishing to migrate their systems to free software include the Vivernet Free Software Business Platform (LinEx-Empresa), launched by the Regional Department of Labour and Economy of the Junta of Extremadura through its funding of the PCCP (SME Competitiveness and Consolidation Plan), which also received funding from the State Ministry of Economy. The aim of this project was to facilitate migration from proprietary software in companies. The project managed to consolidate itself as a public point of reference, uniting companies and encouraging synergies between them for the launch of free software projects and actions.

1.5. Linex.org services website

1.5.1. The functions of linex.org: support, information, social aid

The chief aim of the linex.org site is to define what gnuLinEx contains in order to control its evolution. The existing free software is organised rationally because otherwise it would be virtually impossible to provide organised technical support for it all as there is so much of it. As a result, users can find technical support with what they find on the site being what they see on their computer screens.

Technical support is fast for technical queries concerning gnuLinEx, most of which concern the installation process or how to install specific devices. However, the site offers added value in one of its top features, which allows users the possibility of easily upgrading gnuLinEx through the site, an essential service. This ensures that the latest versions and/or innovations in applications of the distribution are used.

The site also has an informative function and acts as a point of reference for topical issues, not only concerning free software and gnuLinEx, but also the evolution of the information and knowledge society in Extremadura and beyond.

linex.org has an important social function in that it has become a virtual meeting space and point of reference for gnuLinEx users.

1.5.2. What does linex.org offer?

Data recorded on the evolution of interest in the implementation of free software in diverse social and economic contexts are interesting because they reveal a significant increase in users who opt to use free software or who have already migrated their systems.

This growing interest stirred by the possibilities of free software and gnuLinEx in particular can be seen in various signs obtained through the site:

- The number of downloads and requests received for the distribution. Many gnuLinEx downloads are carried out through the site: around 100,000 downloads to date of all released distributions.
- The number of users currently registered, approximately 6,976 users.
- The number of visits to the site. Since its creation, it has received more than twelve million visits, over half of these in the last year (according to data from July 2004), which works out at an average of 700,000 visits per month. Interestingly, 72% of these visits were made through free browsers.

1.6. gnuLinEx from a technical perspective

Since the creation and launch of gnuLinEx, several versions of the distribution have been released, including Live 4.0. The new versions and the revisions of these have enabled us to improve the software, allowing it to work with hardware that previous versions had difficulties with.

gnuLinEx is a GNU/Linux distribution, a series of free applications that make up a complete operating system aimed at end users, based on the GNU/Debian distribution in the GNOME graphical environment, which is a very simple user interface that offers users a whole range of common applications and programs allowing them to get to work immediately: word processor, spreadsheets, image editor, photo retouching, website editing, browser, music and video player, e-mail, etc., and the series of educational applications included in LinEx-Edu.

gnuLinEx uses a very simplified graphical installation process in which almost all tasks are carried out automatically. As regards compatibility, the files generated by gnuLinEx applications are fully compatible with typical file formats. gnuLinEx is also compatible with virtually all available devices, such as printers, scanners, digital cameras and other peripherals.

1.6.1. Versions of gnuLinEx

The first version of gnuLinEx was v.2.0, launched in April 2002. This version was developed by a company called Ándago and based on the last stable distribution of Debian Potato 2.2, GNOME 1.4 and OpenOffice 1.0. The graphical installation took six clicks and the applications icons appeared with representative names of Extremadura. This first version marked the culmination of a project that had been in preparation for over a year, studying its possible areas of application, evaluating its advantages and disadvantages and using it as a pilot project in a number of offices of the Regional Department for Education, Science and Technology.

However, it was version 3.0 of gnuLinEx that proved the most popular. In the summer of 2002, two lecturers from the University of Extremadura, José Luis Redrejo and Antonio Ullán, GNU/Linux users for more than six years and considered to be the architects of gnuLinEx, began to create an improved version of the distribution, the result of which was an excellent distribution with over 200 different applications and some specialist applications requested by users.

Version 3.0 of gnuLinEx is based on Debian Woody 3 and GNOME 2.0, with numerous backports to adapt it to the graphical environment. The installation process was improved (based on progeny) and included educational programs for primary and secondary schools and the packages containing the Squeak authoring tool. A number of revisions were made of this version: 3.0r1, 3.0r1+g2.2, 3.0r2, the latter of which was also presented at SIMO 2003 along with the Live version, developed by José Ángel Díaz, bootable from a CD-ROM, with improved visual themes and based on metadistros.

Version 3.0 of gnuLinEx also had a version called Free, with 100% free software (no Flash or Java).

The last version to appear was gnuLinEx 2004, based on Debian Sarge, GNOME 2.4, kernel 2.6 and OpenOffice 1.1.

The first revision of this last version was gnuLinEx 2004 rc2, which contains kernel 2.6.7. and GNOME 2.6. There have been many improvements both to the applications and utilities and to the graphical appearance. They include the following:

- First stable distribution using component technology, allowing the production of packet blocks with their own logic and conditioners and facilitating the mixing of versions and distributions.
- Improved installation process (based on the Anaconda port). The combination of Anaconda and component technology allows for customised installations.
- Based entirely on GNOME; the KDE configuration tools have disappeared.
- All applications have been translated, although the help for some programs is still only available in English.
- The names and icons of the applications are the same in Brazil, Andalusia and Extremadura. Their appearance can be changed back to their original status.
- Includes the series of Linex-Edu educational applications, classified by subject.

There is a second revision, gnuLinEx 2004rl, whose improvements include:

- The possibility of upgrading from Menu applications (fingerprint).
- The official repository was upgraded from gnuLinEx 2004 to gnuLinEx'2004 rl with an image of GNU/Debian SARGE, which means that the 10,000 plus applications of the latter can also be installed.
- Others, such as:
 - Genome 2.8.2
 - New Bootsplash
 - Evolution 2.0
 - Mozilla Firefox 1.0
 - K3b 0.11.17
 - Numerous bugs fixed
 - New drivers for USB modems and winmodems
 - etc.



Figure 13.

1.6.2. gnuLinEx 2004 applications

A list of the applications contained in each of the gnuLinEx utilities now follows, with the customised name of the application, the original name and a brief description of what it does.

Accessories

- Almazara (File Roller 2.6.1). Application for creating, viewing, modifying or unpacking files, folders or compressed subfolders. Offers a unique GUI and uses commands such as .tar, .gzip and .bzipg2 for filing operations.
- Diana (Gedit 2.6.0). Application for creating text files. With additional Gedit modules, diverse text editing tasks can be carried out inside the application window.
- Mapuche. Unicode character map.
- Nebrija (Online dictionary 2.6.0). Online dictionary for searching definitions of words in a database.
- San Salvador (Gcalctool 4.3.51). Powerful calculator with different modes (basic, scientific and financial) for solving a wide range of mathematical problems.

Images

- Alhambra (gthumb 2.3.2). GNOME Image viewer and browser. For browsing the hard drive displaying files with images and viewing images in a variety of formats.
- Aliseda (Sodipodi 0.33). Application for processing vector images. Works with SVG (Scalable Vector Graphics) formats but can also export illustrations to PNG (Portable Network Graphics) for editing with any retouching program such as Gimp.
- Azteca (Ghostview Gnome 2.6.1). Previews documents in PostScript and Portable Document Format (PDF) format.
- Cuzco (Gnome 0.112 PDF viewer). Viewer for PDF files based on Xpdf.
- Dehesa (XSane 0.92). Application for scanning documents.
- Hervás (Camorama 0.17). Program for viewing, editing and saving images from a web camera.

- Morales (DIA 0.93). Program for drawing structured diagrams. Application for basic diagram editing. It has a tool panel and a range of specific pre-designed and classified symbols that can be incorporated directly into the diagram at a single click.
- Picasso (Eye of Gnome 2.6.0 in the new 2.4.1). Program for viewing and cataloguing graphics files in various formats (.bmp, .gif, .ico, .jpeg, .png, .pnm, .ras, .svg, .tga, .tiff, .xbm and .xpm). It offers various levels of magnification and full-screen viewing using little memory and Bonobo technology for embedding graphics in other GNOME applications.
- Zurbarán (Gimp 2.0.1). Cross-platform graphics processing tool (drawing, composition and photo retouching).

System tools

- 112. Creates an emergency disk for rebooting the computer.
- Aljibe (system registry viewer 2.6.0). Application for monitoring and viewing system registry files. To view system registry files, it may be necessary to start the session as a primary user.
- Almenara. Displays an icon indicating when documents are being printed.
- Amizada (Gnome System Tools 0.33.0). Configuration of network devices and connections).
- Arco (floppy disk formatter 7.10.4).
- Azarías-Internet (Foomatic-gui 0.7.1). Installs printer drivers from <http://www.linuxprinting.org>.
- Boto (root terminal). Opens a terminal as an administrator using gksu to prompt for the password.
- Caipora (Samba Server Configuration Tool 1.2.2). Creates, modifies and deletes Samba partitions. Allows Microsoft and Linux networks to exist simultaneously.
- Candil (system monitor 2.6.0). Application for viewing current processes and monitoring system status.
- Cazorla (Gnome System Tools 0.33.0). Tool for configuring system start-up. Used to specify the operating systems that users can choose on start-up if the hard drive is partitioned.

- Cortázar (NFS server configuration tool). Creates, modifies and deletes NFS (Network File System) partitions.
- Hurdes (VNC viewer). Tool for connecting to another computer running VNC and controlling the latter.
- Marwan. Application for running the computer as another user. Opens a dialog window in which to enter a command to be executed as indicated by the user.
- Peropalo. Starts the session as another user without quitting the current session.
- Picota (Gnome System Tools 0.33.0). Management of system users and groups. Allows us to view the available users and to create new users.
- Potosí (Synaptic 0.48.2). Tool for installing, deleting and upgrading software packages.
- Puchero (Gconf 2.6.1). Configurations database editor. GConf is a CORBA-based system for storing configuration information, known as "key-value pairs". It forms part of the GNOME project.
- Séneca (Gnome System Tools 0.33.0). Configures the services to be run on system start-up.
- Tentudía (Gnome System Tools 0.33.0). Time and date settings.
- Terminal (GNOME terminal 2.6.1). GNOME terminal emulator application for the following actions: access to UNIX shell in the GNOME environment and/or to run any application designed to be run on the VT102, VT220 and xterm terminals.
- Trajano (GDM, Gnome Display Manager 2.4.4.4). Graphical application that configures the Gnome display manager.

gnuLinEx tools

- Upgrade gnuLinEx. Application for automatically upgrading gnuLinEx.
- Menu configuration tool. Configures certain menu tricks.
- Nautilus configuration tool. Configures certain Nautilus tricks.
- Wine configuration tool. Application that lets you configure Wine, the Windows emulator.

- Gnome session configuration tool. Configures certain Gnome tricks.
- Original icons. Application for changing the customised names and icons in gnuLinEx back to the program's original ones and vice versa.

Internet applications

- Algar (gFTP 2.0.17). Multithreaded FTP client.
- Corniche (PAN 0.14.2.91). Application for reading Usenet news and managing news groups.
- Giralda (Chestnut Dialer 0.0.6). Configuration of telephone network access.
- Grulla (Mozilla Firefox 0.8): Netscape-based web browser.
- Guaraní (GnomeMeeting 1.0.2). Audio/videoconferencing application for calls to remote users over the Internet.
- Hurdes (VNC viewer). Tool for connecting to another computer running VNC and controlling the latter.
- Iguazú (WebDownloader for X 2.5 Orc3). Application for downloading files from the Internet.
- Mágina (Firestarter 0.9.3). Tool for configuring firewalls.
- Medellín (Nvu Mozilla 0.2). Application for designing and editing web pages.
- Terrona (GAIM 0.77). Instant messaging program.

Multimedia applications

- Amazonia (Volume Control 2.6.1). Mixer for audio devices.
- Brasero (CD ECLiPt Roaster 2.2.0-0.8). Tool for burning audio and data CDs.
- Camarón (CD player 1.547.0). Application for playing audio CDs.
- Ceres (Rhythmbox 0.8.3). Application for organising and playing music files in mp3, FLAC or Ogg/Vorbis.

- Doñana (Audio Recorder 2.6.1.). Application for saving and playing sound files in .flac, .ogg and .wav format.
- Fluxus (Mplayer 0.90). Application for playing audio and video files.
- Monfragüe (X Multimedia System 1.2.10). Cross-platform multimedia player for audio files.

Office productivity applications

- Alcántara (Open Office Impress 1.1.1). Open Office presentations editor for creating slides, transparencies, etc.
- Brocense (AbiWord 2.0.1). Word processor.
- Cáparra (Gnumeric 1.2.11). GNOME spreadsheet.
- Espronceda (Open Office Writer 1.1.1). Word processor. For designing and producing text documents with graphics, tables and diagrams. It also allows documents to be saved in a variety of formats, including Microsoft Word, HTML and Adobe PDF.
- Glifo. OpenOffice.org printer administration.
- Guadalupe (Ximian Evolution 1.4.6). E-mail manager.
- Guaiba (Gnome MDB Viewer 0.6pre1). Graphical interface for MDB tools. For viewing and exporting databases created with MS Access 97/2000/XP.
- Iulipa (MySQLControlCenter 0.9.3-Beta). Professional tool for MySQL administration.
- Macondo (OpenOffice 1.1.1. HTML). HTML editor based on an OpenOffice template.
- Ovando (OpenOffice 1.1.1. templates). OpenOffice tool for creating documents from a template.
- Porto Alegre (Open Office Calc 1.1.1). OpenOffice spreadsheet application that can be used to calculate, analyse and manage data. It can also import and modify Microsoft Excel spreadsheets.
- Quipú (Openoffice.org Math 1.1.1). Application for creating mathematical formulas, with numerous operators, functions and format help.

Programming tools

- Chivato. Programming tool (Bug Buddy 2.6.1.). Graphical Gnome utility for bug reporting.

Other applications

- Desktop preferences. For the configuration of devices such as audio, keyboard, mouse, desktop background, screensaver, etc.
- Games. Comecocos, Frozen-Bubble, GCompris, etc.
- Almuzaffar (Nautilus 2.6.3). Graphical Gnome shell for viewing and administrating system files and applications and for viewing available network servers.
- Mochilero (Yelp 2.6.1). Gnome help viewer.
- Startup folder. Displays the start-up folder in the Nautilus file manager.

linex-edu: educational applications

- Astronomy: kstars (desktop planetarium).
- Geography: Kgeografía (geography learning program), Kworldclock (map of time zones), Sunclock (sun clock and time zones).
- Languages: Khangman (game based on the familiar hangman), Klettres (application for learning the alphabet in a different language and reading simple syllables), Kmessedwords (game based on letter and word puzzles).
- Children: memory game, Mr. Potato, Gcompris educational suite, Tux Paint, Tux Type.
- Language: kverbos (application for learning verb forms in Spanish).
- Maths: Kig (interactive geometry for KDE), kBruch (small program for generating fraction exercises), kmplot (application for creating mathematical functions), kpercentage (program for learning how to calculate percentages), Xabacus (simulation of the age-old calculator).
- Music: Audacity (advanced audio editor), Grip (audio track reader/ripper), Rosegarden (musical composition and MIDI sequencer), Solfege (musical note identification program).
- Chemistry: gperiodic (periodic table of the elements and information on them), kalzium (periodic table of the elements and information on them, in Spanish).

Others: FlashCard (application based on the traditional method of learning with flashcards, KEduca (application interactive tests based on forms), KTouch (application for learning to touch-type).

2. Free Software in the Brazilian Government

2.1. Preface. Tentative steps on a long road

Brazil is on its way to entering the information society. However, as in other areas of the planet, the different segments of its society are not being incorporated at the same speed. The Brazilian elites have been quick to connect to the global computer network. Virtually all leading industrial and trading companies and financial capital use computer communication as an additional way of stimulating, updating and expanding their business. The problem lies with the poorer levels of society, which make up the bulk of Brazil's population, whose inclusion in the digital era is slow and comes up against the obstacles posed by the traditional concentration of income into the hands of the few in Brazilian society.

Sergio Amadeu da Silveira

Chairman of the ITI (Information Technology Institute) and coordinator of the Technical Committee for the Implementation of Free Software of the Government of Brazil. Sociologist with a Master's Degree in Political Sciences from the University of São Paulo with the dissertation "Poder en el Ciberespacio: Estado-Nación, control y reglamentación de Internet" ("Power in Cyberspace: Nation State, Control and Internet Regulation"). A doctoral candidate at the University of São Paulo, he is studying democratic theory in the information era. He is the author of *Exclusión Digital: la miseria en la era de la Información* (Digital exclusion: destitution in the information era), published by Perseu Abramo. He supervised the *Software Libre e Inclusión Digital* (Free software and digital inclusion) selection of the publishing house Conrad and wrote one of its texts.

Marcelo Branco has attempted to show that information technology is not neutral. Here, we are presented with an important description of the efforts being made by a series of government institutions and Brazilian militants to reshape models of technology by focusing knowledge on a new paradigm that will create a more balanced information society.

In the information society, sharing knowledge is the equivalent of sharing wealth. It is the fundamental basis for the development of a more democratic information society with a less concentrated power. Hence, when we talk of free and open source software we are referring to a new technology policy. The facts, ideas and expectations detailed here by Marcelo Branco are the equivalent of a search for a government policy for the knowledge and mastery of a technology that will allow for a wider distribution of the positive options that can be guaranteed by a knowledge-based society.

Free software is moving forward both in Brazil and the rest of the world. This progress is not uniform and has its dangers. We need to be aware of the powerful interests being stirred up and pushed to one side when we adopt a stance in which we wish to share the essence of a piece of software: its

source code. We will see here that protocols and software are essential for the networked communication of society. Whether it be a language, a mediator of human intelligence or an invention or commodity of considerable financial value, software must be free. Freedom is only possible with autonomy. This is what Branco attempts to show in this text.

Sergio Amadeu da Silveira

2.2. Introduction

This text was written at the request of the Universitat Oberta de Catalunya (UOC), which required material on free software in Brazil to use as part of its International Master's Degree in Free Software.

The aim here is to describe something of what is happening in Brazil to promote free software in the government, using explanations and statements from top government officials. I am wholly responsible for the structure and content of this text, which does not necessarily coincide with the official position adopted by the governments involved.

Due to deadline constraints and the sheer size of the country, many stories about Brazil will be left untold in this first edition and there will probably be some errors or inaccuracies in the text itself.

Our aim with this text is to create a starting point for a dynamic process of construction in which new cases will continue to be added and efforts will be made to update the ones described in this first edition.

Thus, we are open to criticisms and suggestions from the free software community.

We would like to thank the Universitat Oberta de Catalunya for the opportunity to recover part of the recent history of our country in the knowledge that this could help to construct a new information society.

2.3. Free software in the Brazilian Government

"We must satiate the thirst for knowledge. We must promote digital inclusion as a matter of urgency."

"I consider the debate on the potential and challenges of new information and communication technologies to be of great importance. These technologies are opportunities for improving communication, dialogue and progress among our countries. [...] It all comes down to solidarity and our collective

will. All peoples have the right to advances in human intelligence and creativity to stimulate their own progress and well-being. [...] We will make digital inclusion a powerful weapon for social inclusion.

The Brazilian Government's dialogue with civil society is decisive. [...] We must satiate the thirst for knowledge. Access to technological progress must be a universal right – not a privilege of the few.

We must promote digital inclusion as a matter of urgency.

The speed of technological transformations can cause us to miss out on opportunities.

So I have taken the initiative of making digital inclusion a state policy [...].

Free software meets these requirements. Its main merit lies in promoting the transfer of technology among individuals and nations, helping everybody to form part of the information society."

Address of Luiz Inácio Lula da Silva, President of Brazil, in Africa
(available at: <http://www.softwarelivre.org/news/2794>).

2.3.1. The Government's reasons for the implementation of free software

During the first few months of Lula's term in office, important changes were made to the Brazilian Government's e-programme, coordinated by the Chief of Staff, José Dirceu. Two technical chambers were set up: the Technical Chamber of Free Software Implementation and the Technical Chamber of Digital Inclusion. The ITI (Information Technology Institute), an organisation reporting directly to the *Casa Civil* (Cabinet Office) of the Brazilian Government, was charged with coordinating the Federal Government's migration to free software. This operation was not delegated to a government agency but carried out by the President's Office itself, which reveals just how much of a priority the government initiative was in the plans for the information society.

The sociologist and free software activist, Sergio Amadeu da Silveira, was the administrator and coordinator of the successful telecentre programme of São Paulo, based entirely on free software. Da Silveira was chosen to chair the ITI and hence guide the implementation of free software in the government.

The Brazilian Government's main reasons for introducing a free software implementation project were macroeconomic factors, the guarantee of increased security for government information, the enhanced technological

Website

ITI: www.iti.gov.br

autonomy and capacity of the country, greater independence from suppliers and support for the socialisation of technological knowledge as an alternative for developing countries.

Macroeconomics

Each year, over € 752 million leave Brazil destined for the payment of software licences on a domestic market that moves € 2,255 million a year. This means that a third of the funds managed by the software industry in Brazil are passed on in the form of *income* to the monopolistic software giants.

Besides increasing the deficit of the balance of services, in this situation, the development of IT companies in Brazil is unfeasible. According to Sergio Amadeu, "to computerise the population, small businesses and town halls, the use of a proprietary platform would require sending more *income* abroad. And the more computerised the population (mainly with the use of basic software), the greater this sum would be. And yet, there are stable, secure and very cheap alternatives to be found in free software".

Less than 8.6% of Brazil's population is connected to the Internet and official sources state that over 53% of these users use illegal software without the authorisation of their owners. Hence, under intellectual property laws, they are considered criminals. The straightforward decriminalisation of this segment of Brazil's population with proprietary software would mean sending more than double the current amount for *income* abroad. Considering that we need to increase the number of digitally included individuals, the proprietary software option is clearly unfeasible from a macroeconomic perspective.

Secure information

Security and privacy were two other key factors in the Government's decision. The Government must guarantee the security of public information systems and the privacy of the data of its citizens. To achieve this, access to the source code of the programs used is essential. Without the source code, it is impossible to audit programs to check that they only do what the manufacturer says they do or whether there is a backdoor allowing breach of data privacy. Moreover, it is impossible to correct program errors without the source code, other than by contacting the proprietary manufacturer.

"By definition, closed software cannot be used by a government and considered to be secure software because the government does not have access to its source code. The development model of proprietary software in security terms is very outdated. The most obvious proof of this is that Microsoft partially opens its source code to governments so that it can remain on the market. However, these governments are always at the mercy of this foreign developer and when a new version is released, they must go through the new code again. In addition, the government technician allowed access

to this code is subject to draconian confidentiality agreements. As a result, governments are not interested in using software over which they do not have *full auditability*. The watchword in logical security is full auditability and this is yet another reason for our decision to opt for free software", says Sergio Amadeu.

Technological autonomy and independence

The basic capital of the digital revolution and information society is digital knowledge itself. In other words, "digital outsiders" are those who do not have access to digital knowledge.

How can we include Brazil in the knowledge society if its universities, businesses, research centres, governments and society are not fully aware of the technology spreading across the country? Hence, any programme for the digital inclusion or integration into the information society will only be consistent if it uses free software. Digital inclusion programmes that use secret, proprietary software are effectively programmes for "exclusion" from digital knowledge.

According to Sergio Amadeu, this was the Brazilian Government's main motivation: "In my opinion, the main reason is technological autonomy. The more a person uses free software, the more one can progress from user to developer. This is where the great potential of free software lies. Technicians from the Government, businesses and the country in general can master the essence of the software, and this is the main reason for using free software. "It is for mastery of the essence of the software, not simply for macroeconomic reasons."

Brazil does not want to be a mere consumer of proprietary technologies and products; it has the right to be an active subject in the information society.

Supplier independence

We know that due to the logics of public law governments must purchase with utmost transparency and make these purchases public using the public bidding model. Moreover, governments have the right to know what they are purchasing. Proprietary platforms create a technological dependence that keeps the competition in check, make understanding the purchased product impossible and create a market niche for the company that sold the product to the government. As we know, this contravenes the public principles of government.

"Free software allows greater independence from the distributor of the solution. When the Government purchases a free software solution, it has access to the source code and its four basic freedoms. Hence, because it has the source code, it is not tied to the developer, which guarantees interoperability in the future", explains Sergio Amadeu.

Think of it this way: the purchase of proprietary software by governments is like us buying medicines without the right to know their chemical formula, or buying processed food without being entitled to know what it is made of.

Socialisation of knowledge

To allow underdeveloped or developing countries to rise out of this historical era of dependence and subordination to the rest of the world, the current international treaties and laws on patents and *copyright*, trade names protected by the ideology of intellectual property, need to be changed.

Intellectual property protection was originally created to encourage freedom of creation by stimulating inventors and to generate benefits for society. Nowadays, it is a market niche for developed countries and their monopolies, as suggested by the Chairman of the ITI when he says, "Brazil has seen that the peoples of the world are interested in the socialisation of technological knowledge. And this is the clear stance taken by Brazilian diplomacy, which is consistent with the notion of free software. Brazil has come across many contentious issues similar to that of free software. The crux of the matter is knowledge and socialisation. Free software is born by saying: Can I be free software? To which the answer is: Only if you socialise", says Sergio Amadeu.

This is the stance that Brazilian diplomacy and the President of the country have adopted in their dealings with the rest of the world.

2.3.2. Migration planning and the free software community

One of the earliest initiatives of the ITI was to establish relations between the Brazilian Government and the free software community. This initiative began to take shape during the first "strategic planning" of the Technical Chamber of Free Software Implementation in 2003, in which activists from Brazil's free software community were invited to take part alongside government technicians.

More than a hundred and forty people were involved in this strategic planning process, which laid down recommendations, objectives and actions for the implementation of free programs in the Government. In all, eighteen recommendations, twelve objectives and twenty-nine priority actions make up the set of guidelines for migration. At an official ceremony at the Palácio do Planalto, Minister Dirceu presented the *Projeto Software livre Brasil* (Free Software Project of Brazil) with a copy of the strategic planning, which indicated the first steps taken by the Government in its adoption of free software and its relationship with the community.

Website

The strategic planning document is available at the following address:

<http://www.softwarelivre.gov.br/>

The Projeto Software livre Brasil is available at the following address:

<http://www.softwarelivre.org>

2.3.3. Training of Government technicians

The free software community was called on for a second time by the Brazilian Government. Over one week in April 2004, more than 2,000 government technicians began a free software training programme. Hackers, members of the community, were responsible for training the government employees on the 150 courses held.

In his inaugural address, Minister Dirceu stressed the importance of training civil servants in free software programs and the impact that this would have on society: "This event is the result of a group effort whose origins lie in the Executive e-Government Committee, which I am proud to chair. Its aim is to train technical staff of the Federal Government, thus spreading the free software culture across the country, specifically in the civil service, in order to make it more efficient and inclusive. We believe that the Federal Government's decision to opt for a system allowing the free modification and redistribution of software programs will enable us to eventually cast off the technological shackles imposed by the monopoly of a handful of companies and develop our own software that will meet our needs more adequately", added the Minister.[5]

Website

Minister Dirceu's address at the inauguration of the civil servant training week. Available at:

<http://portal.softwarelivre.org/news/2047>

"What was meant to be a straightforward training exercise turned out to be a huge event that brought together numerous professionals from across the country, giving us all the opportunity to share knowledge with the civil servants", pointed out Marlon Dutra, hacker and activist of the Free Software of Brazil project. "I am here to teach the 'Comprehensive Open LDAP Training' course. The whole community is very happy to be taking part in this event, which will no doubt go down in the history of Brazil, and we hope that the experience will be repeated. We know that this is helping the government to finally change the future of free software for all of us. It is a great honour for us all to be a part of this history", concluded Dutra.

2.3.4. Migration plan and strategy

The aim of the migration strategy of the Brazilian Government was to "free" workstations. Instead of starting with the big information systems and migration of the large databases which, as one can imagine, would take years

to produce a visible result, the ITI chose to migrate the personal computers of the ministerial employees. Migration of the larger systems would require a consistent, long-term plan that would take years to complete and which would not alter the logics of the technological dependence of government purchases.

Sergio Amadeu explains: "In the migration plan of a private sector company under the total control of a group of shareholders, migration begins with the company's structural systems and works its way down to the workstations. If the Federal Government of Brazil had done this, we would have been as surprised as the German troops were at the Battle of Stalingrad. We use extremely complex structuring systems that would take a long time to migrate and re-write. But while we are writing the new system, the legacy is growing, whether it be in a databank or as basic software for workstations".

The Government's plan turns the logic on its head by defining a strategy with three basic guidelines:

- Release of all workstations.
- New system developments use free software.
- Migration is initially only carried out with systems for which the above two operations are not possible.

The alternative to using applications that cannot run on stations with GNU/Linux is to build a web interface through which the user can obtain browser access to them to avoid having to rewrite the application initially. "We are working with cultural change so it is important to have a very clear vision of who is going to be migrated, given that we are dealing with technological difficulties and the constraints of the proprietary model. At the same time, there are cultural changes taking place for thousands of government employees who are the system users", explains Sergio Amadeu. "We found migration to be slow because there is a daily battle to break with the proprietary software culture and the lobby of proprietary companies, which is no mean feat", he adds.

The ITI decided to concentrate its efforts on five ministries that had already begun to migrate their workstations. The aim was to create a network effect that debunked certain myths about free software. In addition to the ITI, all of whose workstations run free software, the ministries of Energy and Mines, Cities, Culture, Science and Technology and Education, are already working with free desktops and full migration of these ministries is planned for the end of the Government's term.

This does not mean that the migration plan only extends to these ministries. For instance, Radiobrás (Brazil's public broadcasting company) already has more than eighty desktops running free software. There are also several government bodies and public undertakings such as SERPRO (the state company for Federal Government data)[6] and DATAPREV (social security data company)[7], that are introducing their own migration strategies.

Website

SERPRO:
<http://www.serpro.gov.br>
DATAPREV:
<http://www.dataprev.gov.br>

We know that we are only just getting started and that there is a lot of ground to be covered to guarantee the success of our current programmes. Many battles, inside and outside the Government, have yet to be fought and they will be decisive in the spread and consolidation of this alternative. However, we can say for certain that never before has a national government made this such a public issue, helping to step up the debate and increase the understanding of free software.

The Government's stance is also helping on an international level to construct a new information society and to defend free software in the context of the United Nations, as occurred at the World Summit on the Information Society. These initiatives took on a perspective of solidarity in the official speech by President Lula on a visit to Africa in defence of a new information society and free software as a basic option for developing countries. There can be no doubt as to the information technology label defining President Lula's Government: free software.

2.3.5. *Free Guide. The Brazilian Government's guide for migration to free software*

In the migration of the Brazilian Government's proprietary platforms to free software, we have possibly one of the most experience-packed processes in the free software movement. The difficulties encountered, the mistakes made, the search for alternatives and the results obtained will contribute greatly to stimulating and consolidating free software around the world. The record of these experiences and the sharing of this knowledge with other governments and the international free software community is proving essential for the construction and fine-tuning of the "collective memory".

Website

Guia Livre. Referência de Migração para Software Livre do Governo Federal (The Free Guide. Federal Government Reference for Free Software Migration). Available at:

<http://www.softwarelivre.gov.br/publicacoes/guia-livre-referencia-de-migracao-para-software-livre/?searchterm=guia%20livre>

With this aim in mind, through its e-Government technical committees for the implementation of free software and legacy systems and software licences, the Brazilian Government drew up its *Free Guide*, a reference work on

Website

The IDA guide is available at:
<http://ec.europa.eu/idabc/>

migration available to all government agencies and to the general public. This important tool took its initial inspiration from the *IDA guide* (Interchange of Data between Administrations) guide of the European Community.

However, the work was restructured and received significant contributions from Brazil's free software community and the technicians of the governments involved in the various migration tasks. "At the end of December, while we were debating the actions to introduce in 2004, we agreed that it was important to create a migration guide to help with the migration of free software", explains Corinto Meffe, project manager of technological innovations of the Ministry of Planning and coordinator of the Free Guide project.

The contribution of the Free Guide and the difference between it and the EC's IDA Guide is that we added the Brazilian experience of the community and governments. We changed some things, such as the fact that they use the term 'open-source software' while we preferred to use 'free software', which is clearer for the aims of Brazil. This indicates a change in conceptual focus.

The main focus of the EC's guide is costs, which contradicts a survey conducted by the IDA in 2002, which indicated that the cost factor of the use of free software in the evaluation of public administrations of the EC was sixth in importance. The Brazilian guide, however, focuses on the four freedoms of free software. We highlight the advantages of technological independence, access to the code and collaboration with development. This marked an unusual difference in aim.

Another point is that the European guide focused on the analysis of successful cases in private companies, because there were very few cases of government authorities. We removed this and introduced the successful cases of the Brazilian Government, which are "much more important", adds Maffe.

However, as you can see, the most important change is that the EC guide says that 'the views expressed in this document are purely those of the authors and may not, in any circumstances, be interpreted as stating an official position of the European Commission'. In its *Guia livre*, the Brazilian Government accepts liability and subscribes to the collective work, attaching institutional significance to it and validating an important technical reference for migrations within and beyond the country's borders. Brazil is the first country to have an institutional document in this framework.

Collective construction and launch of the *Migration Guide*

The beta version of the guide was launched at the 5th International Free Software Forum of Porto Alegre in June 2004. The Brazilian Government presented the guide to the 4,800 plus visitors to the event and publicised it in the media and Brazilian free software community channels (websites

and lists). It underwent a process of collective creation at this event, in which the community was encouraged to contribute to the improvement, validation and creation of new topics relating to free software migration. Contributions were subsequently incorporated based on the experiences of the Federal Government and on public meetings held in various Brazilian cities. On 7 September, Brazil's Day of Independence, launch of the "Ipiranga" version was made public.

Following the incorporation of hundreds of new contributions, the initial 151-page version increased to 221 pages, freely licensed under the CC-GNU GPL (Creative Commons-GNU General Public License) and was given the official approval of the Brazilian Government.

New topics and chapters were incorporated, such as the government's institutional political relationship with free software topics and the legal reasons for migration, besides the inclusion of free tools for geoprocessing, webmail, GNOME/ KDE graphical interfaces, fax servers, *groupware*. Brazilian distributions such as Conectiva and Kurumim were also included.

Aims of the *Free Guide*

The aims of the Free Guide are:

- 1) To help administrators to define a strategy for a planned and managed migration process.
- 2) To describe how this migration can be carried out, using general technical terms.

The guidelines were drawn up to have a practical use for administrators and should therefore be relevant and precise as well as accessible and understandable. This is not a handbook of detailed technical references. The structure attempts to encourage and allow changes to be made as administrators gain in experience and confidence and as the products become available to meet their needs.

- 3) To focus the guidelines and definitions in this guide on the models of interoperability of the Brazilian Government.
- 4) To create the conditions to allow these migrations to be explained in greater technical detail on the free software site of the Federal Government.

Tropicalisation and internationalisation

This wonderful process of the "tropicalisation" of free software migration experiences must continue by introducing the international community to this Brazilian contribution. Breaking down language barriers, particularly that

Website

3Creative Commons - GNU General Public License:
<http://creativecommons.org/licenses/cc-gpl?lang=en>

Website

For more information on the Brazilian Government's relationship with free software, visit:
<http://www.softwarelivre.gov.br>

of the hegemonic language of the Internet, English, will be crucial to the fine-tuning of this collective and continuous effort. And Brazil is waiting for the contribution of our international community.

2.3.6. *João de Barro*: Secure GNU/Linux

The João de Barro programme is a Brazilian Government initiative to provide greater security and to guarantee the authenticity of transactions made over the Internet, as part of its quest to popularise digital certification and stimulate the growth of e-commerce. The current platform electronically certifies all clearing system operations for national financial system transactions, amounting to € 19,770 million per day. The ultimate aim of this ITI project is to guarantee the technological independence of the entire digital certification process by the end of 2005 and to replace the entire proprietary encryption platform of the Root Certification Authority with free national hard and software by the end of 2006.

Note

João de Barro is the popular name of the Red Ovenbird (*Furnarius Rufus*).

The government's chief collaborator on this programme is CASNAV (the Shipping Systems Analysis Centre of the Brazilian Navy). CASNAV is the specifier for the entire solution, since it has been using free software for encrypting solutions for over ten years.

The project, developed through a network of collaborators from government security agencies, research centres and universities, is stimulating the production and exchange of national knowledge in the field. Besides being a strategic project for the technological development and future of the Internet in Brazil, João de Barro collaborates on enhancing the security of international free software projects.

In parallel to this, the MERCOSUR countries are working to come up with a common regulation for the recognition of certificates between member countries to speed up e-commerce in the region.

Digital certification

The ICP-Brasil (*Infra Estrutura de Chaves Públicas Brasileira*, Infrastructure of Government Keys of Brazil) was set up in 2001 by the Brazilian President's Office to guarantee the technical means (hardware and software) and regulations for enabling government institutions and private sector organisations to act on the basis of the legal validation of documents produced, transmitted or obtained electronically. Digital certification guarantees the security and authenticity of these transactions.

Through its infrastructure, ICP Brasil is the only legally valid and recognised certifying authority in Brazil. In other words, only electronic transactions and documents validated by this authority are legally recognised.

Most of the messages we exchange over the Internet are not encrypted, which means that the security and privacy of these messages can be easily breached. As they are not digitally signed, it is not possible to confirm their authenticity – and whether the person sending the message really is the sender or whether the contents sent really are the ones we see.

The ICP-Brasil identification and security process uses an asymmetric key with two passwords. A private password for encrypting and signing messages, used only by the sender of the message or document, and the root, a password that will be in the public domain. With full knowledge of the root construction, it is possible to "breach" or improve the security and privacy of information.

The proprietary technology currently used by ICP-Brasil does not allow the certifying authorities full auditing or knowledge of this technology. At most, this absolute knowledge is in the hands of employees of foreign companies. Building and sharing knowledge on this subject, from hardware to web-based business strategies is essential for any nation that does not want to be left on the sidelines of the world stage.

The hierarchy of this complex structure, coordinated by a Management Committee, consists at the top level of a policy management authority called a "Root Certification Authority" or "Root CA", which reports to the ITI and is responsible for signing the certificates from the certification authorities (CA).

At the next level, we have the chain of Certification Authorities (CAs), such as Serasa, Certsing, Caixa Econômica Federal, Receita Federal (tax agency), Serpro and the Brazilian President's Office, which issues the certificate for services authorities, called Registry Authorities (RAs) found at the far end of the next level.

RAs act as digital registries, dealing with clients, individuals or companies who wish to obtain legal recognition of their digital signature. The clients visit the registry unit and request digital certification for their company. The RA completes the registration and the clients receive digital certificates with digital signatures that can be used with all electronic transactions they wish to make with these certificates, which will guarantee the authenticity of the operation.

The quest for a more secure GNU/Linux

The João de Barro programme carries out a series of parallel projects and has created a number of different products that can be integrated into the free Root CA encryption platform. One of these involves the customisation and improvement of the security of the GNU/Linux operating system, which will be specifically applied to the João de Barro programme and other sensitive government areas.

This task is coordinated by ABIN – the Brazilian Information Agency – and will involve several Brazilian universities who will work on auditing, *bug* detection, security holes and customisation of the GNU/Linux operating system. "ABIN is locating and identifying competent individuals from academia to collaborate on the secure GNU/Linux project. Individuals with the right profile discovered in universities are being invited to take part in the programme. Around forty-two people are estimated to be working on the auditing of the operating system code", says Ricardo Valle, coordinator of the João de Barro programme.

"The universities taking part in the agreement will audit the kernel and other features of the operating system to pinpoint vulnerabilities and validate the system so that the institutions can produce a distribution of the operating system for sensitive areas of the Federal Government, such as the *Receita Federal* (Brazil's tax agency) and the federal police force.

These collaborators will attempt to locate vulnerabilities and contact the individuals who maintain the various packages in order to obtain fixes or improvements. I believe that these collaborators will very often be able to find a solution to fix a bug that has been found or come up with something else that could improve functionality", adds Ricardo Valle.

This project will have two by-products: the first is a finely-tuned and debugged operating system that will only contain the functionalities required for the HSM (*hardware security module*), which is the cryptographic security hardware. "This version will be able to fit on a floppy disk, because anything superfluous will be cut out. The software will only contain what is needed for the hardware", says Ricardo Valle.

The other by-product is the operating system that will be run on the workstation that controls and contains the Root CA applications. This version of GNU/Linux will be more complete and have more features than the HSM system.

The secure GNU/Linux project will thus help to improve the operating system overall and be able to offer its results to the development community. The project involves a specific form of collaboration between the government, universities and the free software community. It has also enabled performance of a scientific and technological development project in strategic areas of interest for the State, namely security and the use of free software, and it has extended the command of technology to diverse parts of Brazil and to academia.

The secure GNU/Linux project and the João de Barro programme as a whole have been designed to promote knowledge of cryptography and digital certification in Brazil. The budget for this project amounts to € 750,000.

A new cryptographic hardware

The heart of the structure is housed in a server cabinet in the Palácio do Planalto, where it deals with an infinite number of national security requirements. Besides the HSM (*hardware security module*), this cabinet houses an off-line workstation with the Root CA applications and the secret private key.

The HSM (*hardware security module*) that safeguards the private key of the Root CA – the starting key for the entire public key infrastructure of Brazil – is imported and proprietary. As a result, the Brazilian Government has neither the autonomy nor the knowledge to improve or maintain this equipment, which form the core of Brazil's digital certification system. This introduces an element of insecurity to the country's certification model because it depends on the supplier even for access to this private key.

The private key may be vulnerable to attack and the Brazilian Government can do nothing to improve this. In the light of this, a strategy is being adopted to develop a nationalised hardware solution. As part of a joint collaboration, the ITA (Technological Aeronautical Institute), with its vast experience and skills in hardware and electronics, will develop the cryptographic hardware to house the private Root CA key.

Free software for the Root CA

Another product under development is the free software application for the Root CA. This application is being designed for the signing of new certificates from a certifying authority (CA) enabled as part of the infrastructure and for issuing lists of revoked certificates.

The collaborator will be LABESC (Security Laboratory of the Federal University of Santa Catarina), which will lead a security task force from the RNP (National Research Network), which also includes the UNICAMP (University of Campinas) and the UFMG (Federal University of Minas Gerais). Both the ITA and the University of Santa Catarina will receive funding from the Ministry of Science and Technology. The three universities are working together on this project.

2.3.7. Casa Brasil

Digital technology to promote the integration of governmental action and create a point of reference and introduction for citizens with their government.

Like many governments have experienced, when Brazil's current government came to power, the country was suffering from fragmented actions and its traditional affliction of the separation of policies into "fiefs" in each ministry.

Social programmes and public services are often badly implemented with very little dialogue between the diverse ministries; there is little cross-cutting between programmes, which is often negative for much of the population. Moreover, in many parts of the country, the population find it hard to imagine where the government actually is. This fragmentation and the problems with connecting government programmes tends to superpose policies and action programmes, which are simply repeated instead of being complemented. The government also seeks to create synergies so that actions from different government agencies complement rather than compete with one another.

On the initiative of the Minister of the Department for Government Communication and Strategic Management, Luiz Gushiken, the Brazilian Government is beginning to take important steps to change this picture. The Casa Brasil project is a reference for the Brazilian population aimed at unifying the defining label, the presence of the government and improving the deployment of ministerial programmes by integrating state policies into a single physical space.

The gauntlet thrown down by Minister Gushiken, the architect of Casa Brasil, is to give a more consistent visibility to the Federal Government's action across the country. The unifying core of this space was information technology and the digital inclusion programmes of the Federal Government, which, though numerous, were disjointed and disconnected.

Although Casa Brasil is not just a telecentre or digital inclusion programme, all of these spaces, whether public or set up in conjunction with the general population, will be prepared for an intensive use of digital technology, particularly free software.

According to Antonio Lasance, Minister Gushiken's Cabinet Chief, the forecast is for a thousand centres to be up and running by June 2005 and for this number to increase to six thousand by the end of 2007, all with free software.

The Casa Brasil project is a sort of Lego construction that the Government is getting ready to create a series of government services with separate distributions, separate labels, etc. around a basic telecentre structure. Another of the aims of Casa Brasil is to act as an adhesion project, encouraging ministries to share these spaces. It is a point of reference that will have its own defining label and be implemented in conjunction with the community, local authorities and regional governments. Casa Brasil will use only free software and could have a major impact, particularly on poorer classes in the outer limits and remote areas of the country", says Rogerio Santanna, National Secretary for Logistics and Information Technology of the Ministry of Planning.

The Ministry of Communications GESAC satellite

One of the foundations of Casa Brasil is the GESAC (e-Government and Citizen Support) programme, which is connecting 3,200 satellite points of presence with VSAT antennas and modems. This provides high-speed Internet connections in some poor, remote communities (such as inland indigenous regions in very poor parts of the country, located at long distances from towns or cities), some of which do not even have electricity (in which case solar cells are used) or premises that are absolutely impossible to reach through the traditional corporate networks of Brazil.

The Ministry of Communications estimates that over four million individuals are currently being served by GESAC satellite antennas. "We now have more than four million people using GESAC and 800 computers running free software implementation, mainly used as servers and printers in these spaces, a free call centre (0800) for the whole of Brazil (for providing information and receiving requests for support and complaints) and a total of twelve services, entirely in free software, running at the programme's *data centre*", says Antonio Albuquerque, coordinator of the Communications Ministry's digital inclusion programme.

The free software community is taking part in the GESAC programme through CIPSGA (Committee for Incentivising GNU and Alternative Programmes), whose main tasks are providing the *call centre* service and training multipliers. "Multiplier training covers the GNU/Linux operating system and explains how to use all network applications, share bandwidth, support people at the various points in their region and state and, in short, to make the most out of the programme. The free software community also helped to prepare the GNU/Linux version with the GESAC satellite connection and completed the entire technical demarcation of the programme with the help of the Federal University of Minas Gerais", adds Albuquerque.

Topawa Ka'a: digital inclusion with free software in the Amazon Basin

In the heart of the Amazon Rainforest of Brazil, we have witnessed one of the most wonderful experiences of contact between remote villages and state-of-the-art technologies: Topawa Ka'a, the Rainforest Digital Inclusion Network.

Over the last 500 years, the first inhabitants of South America, the indigenous people, have seen their rights denied, their culture stifled and they have been virtually eradicated from the land that they ruled with freedom and sovereignty. In the administrative region of the Amazon Basin, which covers 58% of Brazil's surface, we find the richest and most valuable part of the

Website

For more information on the GESAC programme, visit:
www.idbrasil.gov.br

Website

CIPSGA: www.cipsga.org.br

original culture of this continent and many of the survivors of the massacre. We owe it to humanity to preserve this culture, restore harmonious relations with nature and guarantee the continuity of these ethnic groups.

As part of the aim of rescuing and restoring the prestige of the peoples of the Amazon Basin, the name of Topawa Ka'a was chosen, which comes from the Akawawa language, a dialect of Parakanã, from the Tupí-Guaraní family, from the linguistic branch of Tupí, which includes the Asurini and Surui languages. In Parakanã, "Topawa" simply means "network" and Ka'á means "wood, forest".

ELETRONORTE is a state company that supplies electricity to the Amazon Basin and has been charged with the project. It is now accepting social responsibility for its past liabilities of serious environmental and social damage caused by large hydroelectric works and an uncoordinated occupation of the land. The Director of Planning and Engineering and architect of the programme, Ismael Bayma, affirms that this sort of attitude is now considered unacceptable right across the world. For him, "the civilisation of Brazilians affected by these works, which did not always benefit them, deserved respect now and then. As does the environment, which belongs to us all".

Bayma explains that this was the background to creating the Forest Digital Inclusion Network. "Beneath the high-voltage cables that often pass over their heads without their benefiting from the electricity they carry, these citizens must have had their own ideas about the purpose of progress: How could the white men from the city build such works and confine the great rivers of the Amazon Basin while they, the native inhabitants or heroic forerunners, obtained no benefits from them? All these problems and all of this potential were there within arm's reach. So we decided to prioritise their social inclusion and, as a part of this, their digital inclusion", he adds.

The Director explains that, in view of the nature of the project with its vast geographical scope and technological implications, thought was immediately given to collaboration between government bodies and the necessary synergies. Bayma reveals that the first ELETRONORTE collaborator was ITI, which is linked to the Cabinet Office of the Government and had its own experience with the highly successful implementation of telecentres in São Paulo, a winning model with extensive network spread and popular support that was quickly assimilated by users in the poorest regions of the capital of São Paulo.

"Other government bodies quickly enlisted their help. We decided on a corporate optical fibre network that travels along the high-voltage lines and capitalises on this method; we also used satellite data transfer systems made available free of charge by GESAC, as well as other solutions", enthuses the leader of the Brazilian state company.

Social data

The social indicators and HDI (Human Development Index) of the Amazon Basin region are the worst in the country. The literacy rate is 9.7%, also one of the country's worst, and this is directly reflected in the level of digital inclusion. Less than 6.7% of the population have computers in their homes and only 4% are connected to the Internet. In Maranhão, for example, less than 2% of the population have access to the global computer network, making it the Brazilian state with the least digital inclusion. Another example is Pará, which is the fourth most excluded.

"The social issue of the Amazon Basin is one of the commitments of the Federal Government. When President Luiz Inácio Lula da Silva came to power, he decreed that state companies would incorporate social responsibility into the regions in which they operate", recalls Evandro Nonato de Souza Filho, coordinator of the project. This caused a change in the understanding of electricity distribution, which ceased to be simply a "business", as it was previously seen, to be considered a public service that had been turned on its head to provide a service to the citizens of the country. In the areas in which it operates, ELETRONORTE has set up regional integration programmes, classified into educational and technological development, and which include digital inclusion.

Performance of the programme

The initial idea of ELETRONORTE with this programme was to make use of the existing technological structure, with thousands of kilometres of optical fibre installed beneath electricity lines. The company's network and knowledge in the Amazon region also helped to shape the initiative.

It would be wrong of us to assume that technology is the main challenge to the implementation of a digital inclusion programme in the north of Brazil. The logistics for maintaining the operational context and set up socio-educational programmes is a difficult task. The equipment for some of the parts covered by the programme takes two weeks to arrive at its destination by boat. Awareness of these special features is proving vital to the success of a wide-ranging and bold project such as this.

Technical teams

In all states of the Amazon Basin, ELETRONORTE has teams of staff that manage the company's internal network and are being trained in free software. The Rainforest Digital Inclusion Network uses the logistics structure and knowledge of the company technicians who already know what a computer network is and have the skills to carry out maintenance. These telecentres are manned by the staff who cover the region.

Website

For more information about the HDI, see:

<http://pt.wikipedia.org/wiki/IDH>

Implementation of the telecentres

The Topawa Ka'a project already has three telecentres up and running: Tupiranga, Vitória del Xingú and Altamira, and ten more units are planned for the end of 2004. The initial investment for the programme is € 263,000 and the goal is to set up twenty telecentres in the northern region and in the administrative region of the Amazon Basin. Each unit has a start-up cost of approximately € 30,000, which is used to purchase computers, servers, furniture, air conditioning and to fund refurbishment of the centre. It also includes a monthly maintenance cost of € 2,650, carried out by ELETRONORTE technicians.

The project is coordinated in such a way as to optimise costs and it is seeking to increase its list of original collaborators, which are: the ITI, Ministry of Communications (which set up the satellite link), the Bank of Brazil (which has donated used computers) and the municipal authorities, which generally provide the premises with the refurbishment already complete. In these cases, ELETRONORTE's calculations indicate a 50% reduction in the sum of investments made for the programme. The project also has a private collaborator, the Internet provider IG (www.ig.com.br), which maintains the domains and e-mail accounts provided for users of the telecentres.

Infrastructure

Each Topawa Ka'a telecentre has 10-20 computers (depending on available space and number of inhabitants), all of which have free software installed on them. "The free software decision was made on the basis of the four freedoms it offers; distribution, copying, modification and distribution of the modified version", says Ana Carina Gomes de Andrade, Head of the Topawa Ka'a's Social Programmes. "We can modify programs to suit our specific needs and characteristics. It would be impossible to carry out this project with proprietary software because we would have to pay licence fees for each computer and we would not have the freedom to alter, modify and distribute the programs", she explains.

The decision for free software

The decision to use free software is in line with the guidelines of the Federal Government, a decisive factor in making the project feasible, since it needed to spread and hence the costs had to be as low as possible. This decision was also based on other concepts, such as freedom of knowledge, the ability to expand the contents of the programs – currently only available in Portuguese – "but we are studying the possibility of building a version in an indigenous dialect", says Carina.

"The possibility of creating an interface in an indigenous dialect is only possible with free software, which is easy to use and allows us to develop the distribution in the community now that many experiences have already been customised in our language, using expressions rather than letters. If we don't strengthen this relationship with our end users – the traditional communities of indigenous ethnic groups – we will fail in our aim of making technology an everyday object. If we can move forward – and this is the idea behind the project – we can create distributions that these communities can control and know what they are working with", she tells us. ELETRONORTE also took the experiences of the São Paulo telecentres and adapted them to the situation of the indigenous communities of the north.

Management council

The Topawa Ka'a telecentres have a Management Council made up of individuals from the local community, social movements, representatives of the municipal parliament (which debates their priorities) and the municipal authority of the region (which implements the actions on the premises where the telecentres have been set up). The Management Council draws up proposals for digital inclusion workshops for the community and for regional development activities, in order to provide state policies with a way in. An example of this is a request from the Ministry of the Environment to host a workshop on *quemadas* (fires lit by Brazilians to "clean" the land for growing crops), because of the number of accidents that occur in the northern region.

Strategy

The project adopts the strategy of training monitors and technical agents in all telecentres so that they can act as multipliers of the action. Training is given to a wide number of individuals and then, following an assessment, three candidates are chosen to perform paid professional tasks for the project – an administrator and two monitors – who are relieved of their positions during the centre's operation. These multipliers are inhabitants of the community, which means that Topawa Ka'a is also stimulating job creation and generating income.

Target

Each telecentre is set the initial target of benefiting four thousand people a month in the region through basic courses in computing and free computer use. The target public is the general community (indigenous and rural), whose lives are generally unstable. The interest of the region's inhabitants in the project has been overwhelming. Less than a week after the inauguration of the Altamira telecentre, for example, over three thousand people had signed up for the IT training courses and the timetables for free computer and Internet use

were fully booked up. On 13 August, the region's first 1.6 thousand inhabitants from the first four groups of the Altamira and Vitória del Xingú telecentres received their basic computing diploma.

The training includes basic computing courses (basic GNU/Linux commands), OpenOffice classes, web browsing and e-mail communication. The project also offers e-mail to all those who drop by at the telecentres.

Social concern

A new social concern that is beginning to rear its head now needs to be tackled. The arrival of technology, the participation of communities in the global computer network and their inclusion in the information society are not solving the problem of job creation. Where can we place the young people who have already been trained on the programme? There are no vacancies for office work or other typical city jobs in the region. The main purpose of a telecentre is to become a useful tool for the everyday activities of the population. They cannot create "functional digital illiterates", people who were trained to use computer tools but cannot find a way for these resources to improve their quality of life and that of the region in which they live.

Telecentres must be run from a multidisciplinary angle rather than as a basic academy of computing. Evandro explains that the second step, once students have completed the basic computing course, is for them to continue their process of digital and social inclusion. "The idea is that we convert the telecentres into digital community centres. The Altamira telecentre, which has been operating for two months, is used as a cultural centre and is proving successful", adds the coordinator with satisfaction.

This project will certainly not solve the problems of the region's digital exclusion but it is emblematic in the contradictions it generates between the digital revolution and the perspectives of this evolutionary transformation of technology, used to improve quality of life for these ancestral peoples. This project, through its many collaborations – public and private, national and international – can be regarded as one of the most significant cases of social and digital inclusion of Brazil's information society programme.

Technical features of the project

- The project uses the Debian-based GNU/Linux (www.debian.org) distribution of the telecentres of São Paulo: SACIX.
- Local area network "client-server" model using LTSP – Linux Terminal Server Project (www.ltsp.org). The twenty computers access programs run on a local server.

Website

SACIX:
www.sacix.org/

- 128 Kbps Internet connection, via satellite or fibre optic cable.
- Proxy, DNS server and local DHCP running on a GNU/Linux server.
- The project web pages are hosted by the ITI on an Apache server.
- The POP e-mail uses the structure of the Internet provider, IG, which manages the accounts and domains. IG has set up 300,000 e-mail accounts with the name of the project xx@topawa-kaa.com.br for ELETRONORTE to distribute among users of the telecentres.
- Main programs: Debian-GNU/Linux operating system, Desktop GNOME 2.6 and KDE, OpenOffice.org office applications, Ximian Evolution e-mail client, Mozilla browser, Gpaint and Gimp.
- Server: Pentium 4 or similar with 2 HDs 40 GB, 2 GB RAM, CD burner, floppy drive.
- Workstations: Celeron 800 or similar with 128 Mb RAM, floppy drive, laser printer.

Bibliographical references

For more information on the Marea project, see the website of the Special Department for Fishing and Fish Farming of the Brazilian President's Office:

<http://www.presidencia.gov.br/seap/>

You may also find it interesting to look at the following work, which is the source of the quotations that you will find in this section:

Adriane Lobo Costa, Gilson Ribeiro de la Silva, Josémilton Florêncio Lima, Karin Bacha, Luiz Eduardo Bonilha, Maria Luiza Gonçalves Ramos "Project for the Digital Inclusion of Traditional Fisherman and women"

2.3.8. Fisherman and women discover a new "Net". The Marea programme or fishing telecentre

In Morpará, in the state of Bahía near Xique-Xique and Bon Jesús de la Lapa, as in most of Brazil's fishing communities, its inhabitants live in a situation of isolation. They have problems receiving information and are socially marginalised. Morpará, like many communities like it, has no landline telephone and there is no mobile coverage either.

However, this situation began to change with the *Programa Maré de Inclusão Digital* (Tide Digital Inclusion Programme), launched by the Special Department for Fishing and Fish Farming of the Brazilian President's Office. The arrival of the first computers donated by the Bank of Brazil to the association of fishermen, with a broadband connection through a Ministry of

Communications satellite antenna, is enabling this community to participate in the new information society and changing the lives of many people for the better.

João da Silva, aged 60, has been a traditional fisherman for over 40 years and masters the tool of his trade, the fishing net with a skill known to few. João's greatest joy this year was to discover the new possibilities of another type of Net: the Internet. He has been separated from his son for more than six years since, upon seeing the lack of opportunity and bleak outlook of the region, his son left home to study and seek out new opportunities in the big city of São Paulo. João had kept his son's e-mail address at home, written on one of the few letters that had reached him in all these years. On the day of the inauguration of the telecentre of Morpará, once the use of e-mail had been explained to him, João wasted no time and sent his first e-mail to his son. "It was one of the most exciting things that have happened at the centre", says Gilson Ribeiro da Silva, cabinet official of the Ministry of Fishing Project Management and one of the organisers of the digital inclusion programme. It was our happiest moment because João's son replied immediately and he sobbed his heart out and said: "I want to talk to my son every day". The fishing telecentre is open 24 hours a day, so the fishermen drop by in the early morning when they return from fishing.

According to Adriana Lobo Costa, manager of the digital inclusion project of the Special Department for Fishing and Fish Farming, "some staff of the Department who know about the Federal Government's Digital Inclusion Programme realised that fishing communities could benefit from it because of the isolation in which they live, the problems they have in receiving information and because of their marginalisation. After lots of preparatory discussions, we launched the digital inclusion project, realising that it would be a tool for the social organisation of communities. This was our main motivation in carrying out the project. We think that telecentres can intensify the interaction of communities in the global computer network through a critical interpretation of the information received".

Collaboration

The Maré programme was made possible through agreements signed with other Federal Government bodies – the Bank of Brazil provided the used computers and the Ministry of Communications installed the GESAC antennas – and the organised community which, through its organisations, settlements, associations, rural communities and social movements, provided the furniture and infrastructure for the centre where the telecentre was installed.

By the end of 2004, the country will have 27 telecentres and the plan is to double this figure in 2005 and in 2006. The computers will only use free software, based on guidelines issued by the Federal Government. "We believe

that all of the features of free software are in line with our observations on the organisation and independence of the communities and the autonomy that we wish to enjoy", explains Maria Luiza Ramos, technical advisor to the Project Management.

The arrival of the telecentres to the communities has interrupted traditional practices and free software is among these newcomers. "We visited some IT academies with proprietary software and saw that they put limits on the users, restricting the learning of how to handle the technological tool. In the telecentres running free software in fishing communities, users have greater freedom to investigate. They have just discovered computers and the Internet and they are now discovering themselves, seeing that they are capable of so much more – and this is very important", concludes Gilson.

The Special Department for Fishing trains two monitors and one technician for each telecentre, who are chosen by the community for the local knowledge they can add to the project. Age and sex are also taken into account in the selection criteria and there must be at least one female and one more mature candidate. With young people, the programme gives priority to the selection of those who are familiar with the community context so that they can recover its history, gain self-confidence through the profession and tell their story and describe their experience to other communities.

One of the main aims of this digital inclusion programme is to stimulate and develop the organisation and structuring of the communities. In some cases, the theoretical contents are applied in collaboration with ANCA, the National Association for Farming Cooperation, which is linked to the MST (No Land Movement). "Some individuals are being trained in collaboration with MST because this increases the potential of the community organisation contents", adds Maria Luiza.

The selection criteria used for the towns where the telecentres will be set up take into account a number of issues, such as the insecurity of the premises, the physical isolation caused by the lack of information and communication and, most importantly, the level of organisation for the survival needs of these communities. Some telecentres were set up in bigger cities on the coast to help people defend themselves from real-estate speculation, predatory tourism and the lack of attention from some governments to fishing communities.

A financial issue too

This programme is already seeing that the inclusion of communities in the paradigm of the digital revolution can also have financial benefits.

"Traditional fishing has a significant socio-economic relevance, particularly if we take into account the activity's social role as provider of food and quality animal proteins for the population, particularly in the north-eastern states

of Brazil" (Galdino, 1997). Fonteles Filho (1997) explains that the traditional fishing system survives in Brazil because of the diversity of tropical species, as it is difficult to create industrial companies that can concentrate production and specialise the catching technology, consolidated through socio-economic conditions that are more favourable to the creation of job opportunities and the generation of income.

The biggest problems affecting traditional fishing include precarious living conditions, poor organisation within the sector, the traditional lack of support and incentives, the high rate of illiteracy, inefficient storage and preservation infrastructures, occupation of the coasts by real-estate speculation, the competition of industrial fishing, pollution and environmental degradation.

The techniques and tools used in some cases are also primitive and inefficient. In addition to all this, fishermen find it hard to obtain loans. The long-term result of all this has been to generate a process of social exclusion that has persisted over time through social reproduction in these communities, severely undermining the self-confidence of traditional fishermen and their culture.

To confront the challenge of digital inclusion, this project hopes to trigger an educational process based essentially on fostering participative citizenship, which will no doubt generate specific results in the social organisation of production and in restoring the self-confidence of traditional fishermen and women, creating social inclusion in the political and economic spheres too.

To reach this aim, technical advisory instruments are being created to educate local workers with literacy processes and access and information to loans. According to the planning, a specialised professional will visit these telecentres once or twice a week to provide technical advice and help draw up projects for production and sale.

The organisation of the producers through the network of connected fishing communities, the exchange of experiences and the possibility of contact and selling their products all over the world, have all been successful.

According to Maria Luiza, "in the most recent telecentre to be set up in Cabo Frío (RJ), the women are producing flower craft with fish scales. They found out about the experiences of Belén and Río Grande do Sul with fish scales through the network. The women began to exchange information, perfect their techniques and spread the word about their work over the Internet, which sparked the idea of selling it – even to countries abroad. It is a huge umbrella that covers not only computing but also the organisation and recovery of culture".

"The introduction of telecentres in traditional fishing communities is bringing digital inclusion to this population segment, enabling access to new technologies, wider relations, Internet access, the democratisation of communication, the use of new technologies for education, increased access to knowledge and incentives for investigation, the speed and skills to deal with demand, and the possibility of exchanging experiences and results with other communities connected to the network. All this generates a context that strengthens the organisation of the sector. In short, a new world is being discovered.

Specific aims of the project

- 1) To qualify the profession of traditional fishermen and women.
- 2) To set up a national communication network using computers.
- 3) To give the population access to basic digital inclusion.
- 4) To improve the technical profile of communities and increase their job prospects.
- 5) To educate young people from fishing communities in technical IT support.
- 6) To train educators/multipliers in digital inclusion.
- 7) To provide a catalyst for the social organisation of the traditional fishing sector and its social integration.
- 8) To promote the development of free software for the fishing activities of associations, cooperatives and communities.
- 9) To encourage the habit of recording fishing data and storing it in free databases.

Points of culture. The digital inclusion programme of the Ministry of Culture

"What we are seeing in digital computing in the world today started out in the libertarian counterculture movement. So what could be more natural, from our politico-cultural perspective, than a movement promoting free software for the pragmatic implementation of another of our realistic Utopia projects.

It is a strategic stance. Free software will be basic and essential if we are to have freedom and autonomy in the digital world of the twenty-first century. It is a *sine qua non* condition of any truly democratic digital inclusion project.

We cannot settle for paying *income* for all eternity to the owners of closed languages and models. Free software is at odds with all this. It will permit the mass inclusion of the people. It will enable the development of small companies in Brazil, of our future *soft houses* and it could create jobs for thousands upon thousands of technicians.

This is why the Ministry of Culture of Lula's Government believes that Brazil must be prepared to become a world free software leader. This is the path to the absolute mastery of digital culture. This is the road to inclusion of each and every Brazilian in the contemporary cultural universe."

Gilberto Gil, 19 August 2003

The words of Minister Gil leave no doubt as to the position and plans of the Ministry of Culture for Brazil's digital inclusion. The first steps were taken with the launch of a public bid for the creation of "Points of Culture". A total of € 4,510,000 will be invested in the project, which plans to create a thousand points of cultural irradiation in *favelas* and among indigenous tribes. One hundred "points" will be installed by the end of 2004, a further 500 in 2005, and another 1,000 by the end of 2006.

The "Points of Culture" consist of the distribution of complete kits of computers, microphones, scanners, video cameras, digital cameras and funds for hiring monitors and training multipliers, all through a series of public bids. The aim is for each point to act as a laboratory of digital culture, making full use of the benefits brought about by the digital revolution. The aim of digital literacy, in this case, is to train cultural producers and artists, who will then be able to experience the new possibilities of the converging digital language for creation, production, advertising and distribution of their work.

The challenge of breaking down the barriers posed by the traditional forms of cultural diffusion and appropriating this new paradigm for the communities involved is the crux of the project. The use of free software is the natural option, but the need to perfect free tools for image and audio production does not worry Claudio Prado, digital policies organiser of the Ministry of Culture and architect of the project. "We believe that there is a possibility of literacy in languages based on free software because we will have full knowledge of what we are doing, why we are doing it and how we are doing it", he explains.

This challenge is supported by Minister Gil, who underlines the Brazilian Government's commitment to fostering what he has termed "agrarian reform" in cultural property, comparing free software to "a clear example of confiscation of intellectual estates, essential for opening up the field to future new creations."

The "Points of Culture" project will be a permanent bridge between technology producers, *hackers* and digital art, and forms the substantive part of the needs of digital inclusion and for sharing knowledge of art. It is the road to mastery of digital culture.

But Prado goes further. For him, "the Ministry of Culture considers that revolutions in digital technologies are essentially cultural and have translated into a paradigm shift. Technological convergence is generating an extraordinary possibility of rethinking all issues. Digital culture is an iceberg with three visible tips. The biggest visible tip of digital culture is the Internet, the second is free software and the third is the digital distribution of cultural and intellectual goods. These are the main areas of action of the Ministry of Culture.

Our digital culture programme is a digital inclusion programme because we understand digital inclusion to be social and cultural inclusion through digital technologies. This is the idea that technology can be transformed for social policies. The innovation we are bringing about for digital inclusion is based on the premise that the foundation stone of digital inclusion is an interactive multimedia studio, which requires broadband and, at the far end of this broadband, interaction in all transportable languages: text, 2D image, audio-visual and software. For us, the focus of digital inclusion is a space where it is possible to become literate in these languages."

Alexandre Freire and Dalton Martins, project consultants and postgraduate students of Computer Science at the University of São Paulo, explain: "we want to work on two focuses of production. The first is multimedia production, which follows the line of audio-visual development and includes a small technical infrastructure for working with video, audio, image, text development, Internet, editing, etc. And the other is technological production, the aim of which is to work with hardware, programming, GNU/Linux customisation, server listing, *firewalls*, writing *scripts* – the "hacklab" part.

We are customising the distribution (the *script* testing and customising the software that will be used and creating "survival kits" to keep these laboratories running. The infrastructure will be connected to a national network and provide a collaboration system with an effective distribution, where each point will publish everything that it is producing and all of the points will communicate with one another".

Instead of outsourcing maintenance, the project will train people from the communities involved to receive *online support*). The idea is to provide complete autonomy to the points of culture and encourage the multiplication of these points across the region. "We need to create solid cores at these initial

points that can be transformed into replicators for the other points that will be set up next year. Thus, the project will multiply the number of people required to host the workshops", says Prado.

The first "point of culture" to open is based on an agreement with the local authority of São Paulo. The space will consist of a telecentre and a large adjoining area for the recycling of hardware and digital technology. "It is a very interesting project and we will be spreading it to other areas. Recycling is a big step for us in the task of breaking down two digital exclusion barriers: one is that of people who think that only those with studies can be included, because everything is very difficult and complicated, when we see boys learning to build a computer in two days in the recycling office. This simple fact of assembling and disassembling a computer, switching it on and off, and doing something with this material gives them a power that they did not know they had and makes them feel included.

They can then start asking questions and discovering means and possibilities. And those with "technical DNA" in their blood begin their technological literacy process when they discover that there is something that can be understood in two days inside that machine, even if they have never stepped foot inside a school. The second exclusion barrier is cost, because people often think that technology is only for those who can afford it. And what actually happens with technology is that prices are falling dramatically. Technology access is then increasingly democratised and open; many more people can have a recording studio, for example. Thirty or forty years ago, a studio cost € 1,500,000 while nowadays, you can set up your own studio with a computer and another € 150", explains Claudio Prado.

"We believe that this other vision, that in which we begin to transform computers that were tossed on the rubbish heap and convert them into state-of-the-art technology, adapting them, making *clusters*, adding computers to make small-scale servers, etc., when we see that it is possible to transform rubbish into cutting-edge technology, that we are doing the things we want to do. Free software is a great help with all this because this alchemic possibility of transforming garbage into things that work – not into an old computer for poor people but into working technology – is another element that cancels out the exclusion factor", explains Prado.

Intellectual property and copyright

A critical view of intellectual property and the recovery of the true meaning of copyright is a hot topic that has come to the fore over the course of this project. We are seeing a situation in which the authors of intellectual works, be they musicians, film-makers or software developers, currently transfer their works and rights to intermediaries. These intermediaries, protected by intellectual property laws, take over the works of their authors. This intermediation that simply "copies and distributes" the works of the authors

is being questioned in the digital revolution, since the Internet does this alone; in other words, digital technology and the global network of computers can restore a direct relationship between the producers and their public without the need for intermediaries. The Ministry of Culture has supported and discussed alternative licensing options for cultural works in the digital context, such as the Creative Commons.

"The idea of intellectual property is one of the paradigms of the three tips of the iceberg I mentioned earlier. I will use the example of music to explain how all this works and how it is integrated into the Points of Culture. For example: When a young boy comes into a Point of Culture studio to record a CD or a song, he is sent to a workshop where he is informed about what a licence is and how it works in this new Creative Commons model. This means that when the boy records his song, he will have already been introduced into the logic of a system that is exactly the same logic of the musician. The musician and the boy can understand the logic of the system, of having the song recorded and having it distributed on the Internet so that it can be made available and possibly marketed in the future. This is how we see all this relating to the situations that arise at the Points of Culture.

Nowadays, there is an exclusion pyramid based on the closed concept of copyright. All reserved rights exclude anybody who does not have a commercial perspective for their music. This is true of 100% of the boys who record their music for the first time; nobody is looking to market it, they just want it to circulate. The logic of circulation is flawed because this circulatory movement is excluded from the system while, in the Creative Commons model, it can be included in the system. He authorises his music to be made available under the conditions he chooses, and this is included in a logic of music management in the twenty-first century. We believe that doing this in the multimedia studios we set up in the Points of Culture will give the musicians that come out of these studios a direction. At the moment, hopefuls who want to enter the world of music have to leave wherever they are for Rio/São Paulo and prostitute themselves artistically – and possibly physically – to get a break on *Fantástico**. It is a flawed pyramid", adds Prado.

The Ministry's policy is to bring attention to the fact that the digital revolutions have introduced an aspect of non-viability into the traditional system of distribution. "The Creative Commons model flexibilises the rights of authors and establishes a possibility of circulation forbidden by the current copyright model. The Ministry of Culture considers that the progress made in digital distribution is inexorable and there is no point in fighting it. Indeed, digital distribution has been accused of being responsible for piracy. We prefer to look at the possibilities of digital distribution as offering great potential, an excellent possibility of democratising knowledge and information. This new form of distribution must be regulated in ways other than those used in the nineteenth and twentieth centuries, using a model devised and generated

Note

Fantástico is a very popular open television programme that showcases new talent, among other features.

on the basis of rights of the authors, on reserved rights. We understand this flexibilisation of the rights of authorship to be essential to an understanding of the new management model we need for cultural matters.

In music, the record labels will logically fight digital distribution because it excludes them from the wonderful bounties of which they were usufructuaries in the twentieth century. In other words, those who fight against making the system more flexible will be fighting to maintain their profits. We, the Government, are obliged to see this as an excellent opportunity of giving access to people who were always excluded. And this cannot be achieved without a change in attitude towards the rights of authors", says Prado.

Combating functional digital illiteracy

We know that "functional digital illiteracy" exists today. It refers to people who can use e-mail and browse the Internet but do not know what to use it for because it has no place in their everyday lives and context. Digital technology "did not penetrate fully enough to be transformational for that person, as the implementer of what they produce. He or she stopped at the use of programs and tools and did not delve further into the appropriation of the technology or the possibilities that it offered. This represents an enormous gap and functional illiteracy exists both among excluded people and among those considered to be included from a technical point of view" says Prado.

"Digital culture presupposes an understanding that commercial sites are a sort of screen that hides the reality of the Internet, its wealth and the possibility of making technology one's own. On a commercial site, we are in the same situation as when we go shopping. We go in and find a myriad of things to buy, but most people do not have access to these things, so they are excluded." Professor Nelson Pretto of the Federal University of Bahia, goes a step further and compares the sites to "pens" that restrict the possibilities of Internet users, herding them along a single path.

This project acknowledges the need for citizens to appropriate this digital revolution, not as consumers of technology or content, but as producers, as active and restless subjects of the digital revolution.

2.4. Porto Alegre, a free thought factory

The city of Porto Alegre in the far south of Brazil has become a world reference for its practices in the construction of a new citizenship based on participative democracy. Every year, tens of thousands of people meet at popular assemblies to decide how to allocate the municipal budget funds and set down the priorities for its public policies. This experience of direct democracy known as *orçamento participativo* (participative budget), in use since 1989, is responsible for an increase in popular participation in all areas and has acted as a launch

pad for an exchange of experiences never before seen in an international community seeking a new point of reference for social development that was different to the neoliberal thinking dominating the planet at that time.

The relationship between the state authorities and the city's inhabitants, and between the latter and avant-garde sectors of new international thinking, culminated in the 1st World Social Forum of Porto Alegre in January 2001, in contraposition to the World Economic Forum of Davos.

"The World Social Forum is an open meeting place for reflective thinking, democratic debate of ideas, formulation of proposals, free exchange of experiences and interlinking for effective action, by groups and movements of civil society that are opposed to neoliberalism and to domination of the world by capital and any form of imperialism, and are committed to building a planetary society directed towards fruitful relationships among mankind. The WSF proposes the debate of alternatives for the construction of a globalisation in solidarity that will respect universal human rights, and those of all citizens of all nations and the environment and will rest on democratic international systems and institutions at the service of social justice, equality and the sovereignty of peoples."

Website

Charter of Principles of the World Social Forum:

http://www.forumsocialmundial.org.br/main.php?id_menu=4&cd_language=2

Against this backdrop, the municipal authorities of the city of Porto Alegre began to draw up policies for a new information society. Full access to digital knowledge as a "human right" and a vision integrated with state policies of social inclusion were the guiding principles of the municipal actions in information technology.

2.4.1. Municipal digital inclusion policies

Since 1977, the municipal authorities of Porto Alegre have had their own public ICT company, PROCEMPA, which develops the municipal government's systems for health, taxes and finance, education, transport and traffic, sewage system, cleaning, planning, building and administrative management.

Almost coinciding with the launch of commercial Internet in Brazil, in 1995, the municipal authorities of Porto Alegre, through PROCEMPA, took the pioneering step of creating the Internet service provider (ISP) PortoWeb. This measure sought to encourage the population's participation in the global network of computers and help to modernise and de-bureaucratise the civil

service by making it accessible from the Internet. This, the first government action for integration into the information society, was a great success and registered thousands of Internet users in the first few months of its operation.

Another important milestone was reached in 1996, with the creation of the "Infovía", a fibre optic network connecting the main public buildings, which have over six thousand computers installed and connected to the Internet between them, and the poles of economic development with modern multi-service broadband technologies. This created a backbone of over 210 km of fibre optic cable illuminated by ATM/IP technologies and alternative broadband access using radio-linking. During this period, the authorities began introducing computers in all municipal schools.

Later, in 1999, the municipal authorities took their first steps in the use of free software and took part in the creation of the *Software Livre RS* (RS Free Software) project and the "International Free Software Forum". In 2003, the authorities officially assumed the use of free software as a government policy and began to break free of proprietary environments.

2.4.2. Free software in schools

The municipal schools of Porto Alegre are mainly located in areas with a high rate of social exclusion. The introduction of computers to the *Rede Municipal de Ensino* (Municipal Education Network) was defined as a politico-educational principle of the Municipal Department for Education of Porto Alegre and has resulted in progress from educators and in the comprehension of students as regards access to new technologies and the furthering of knowledge construction possibilities. Access to the global computer network paves the way for the educational task of using its countless resources for communication, research and interaction, all available in the digital context.

The "IT in education: a network of digital inclusion" project, incorporated into Porto Alegre's Municipal Education Network, uses free software. The preference for free software was down to the need to make available more suitable tools that were coherent with the municipality's particular educational policy: *Escola Cidadana* (Citizen School). The latter organises the World Forum on Education, also in Porto Alegre.

According to Professor Sofia Cavedon, a municipal member of parliament who was Municipal Secretary for Education and one of the architects of this policy, "the educational project should be viewed as an educational Utopia. This is because it offers the challenge of being a school for all and of being a generator of citizenship, with emancipating assessments and a relevant syllabus that

welcomes the diverse cultures of the community. And a Utopia because it promotes the critical and creative construction of knowledge and educates students as the subjects of their learning".

The idea of Citizen School has been taking shape in the daily activities of the Municipal Education Network over the last 14 years and is the result of an enormous group effort in conformity with the decisions of the city's inhabitants, aided by the participative budget.

"It is in these spaces where, with the deeper involvement of the community, through new practices, reflection on results, systematisation and theoretical consideration, we search incessantly to build solutions that will guarantee learning with social quality for those who were unable to continue at school", says Sofia.

The classrooms with computers running free software are already benefiting 91.3% of the students of a system that interconnects 51 local school networks in diverse parts of the city, which amounts to 56,533 students and 3,762 teachers. All schools have free Internet access through a variety of technologies, such as private 64 kbps data communication lines, the PROCempa infovía, *wireless* and ADSL.

Implemented as part of the educational policy, the free software computer rooms are used to develop the content for various disciplines. The project, which has won national awards, attempts to break with the logic of social exclusion, creating means for the appropriation of IT at schools.

2.4.3. Community telecentres in Porto Alegre

The city of Porto Alegre has the most telecentres per inhabitant in Brazil, which it began to install in 2001. "The idea of community telecentres goes hand in hand with other initiatives adopted by the municipal authorities of Porto Alegre to reduce digital exclusion and promote e-citizenship, installing computer equipment and Internet connections in community spaces on the edge of the city, where access to these resources is socially and economically difficult for most of its inhabitants", explains Joel Raymundo, CEO of PROCempa (public IT company of Porto Alegre).

The telecentres of Porto Alegre are not "municipal" spaces; in other words, the centres where they operate are community spaces such as parent associations, churches, community associations, business associations and public buildings. The community also looks after administration of the centre through a Management Council and their priorities are defined at the participative budget assemblies.

The telecentres are the subject of many collaborations, as Joel Raymundo points out: "telecentres can be set up on the joint initiative of the public authorities and a variety of organisations, governmental or non-governmental, in which the Internet is positioned as a tool within the reach of the more disadvantaged members of the population, with specific applications to make their lives easier and place them in the new context of the information society. Social inclusion policies are strategic objectives of public action, given the serious shortcomings affecting large sectors of the population. In this sense, community telecentres form part of a policy to reduce social *apartheid* through digital inclusion".

Ilton Freitas, executive coordinator and one of the architects of the programme explains that "a digitally excluded citizen will be unable to access the flow of information, services and symbolic wealth on the Internet and will see his or her right to information and expression threatened by the new communication system brought in by information technologies.

The inclusion of individuals in the digital world is a new topic on the public agenda. The right to freedom of expression and information must be complemented by the right to digital knowledge. This new social right must be instrumented by a government policy that can universalise it. The State needs to democratise access to computers and the Internet and to foster the training of citizens in the use of these tools".

Porto Alegre now has 30 telecentres up and running, which serve 25,000 users.

Through PROCempa, the municipal authorities supply and install the hardware equipment, free software and logical network, carry out maintenance and meet the costs of the data transmission line.

Maintenance of the physical space, the supply of energy and office materials, and municipal security and conservation are all paid for by the community organisation or association. The initiative has collaborators from the private sector and civil society, including SEPRORGS (Trade Union of IT Companies of RS), the Pensamiento Digital Foundation, UFRGS (the Federal University of Rio Grande do Sul), the organisation Pessoas.Info, UNESCO, SENAC, the Free Software RS Project and the Federal Government, through the Bank of Brazil, which donated many of the computers used in the telecentres.

2.4.4. Government migration plan

In accordance with a municipal law giving priority to the use of free software in the government and a political ruling by the executive branch of the municipal authorities, in 2003, technicians of PROCempa launched a bold

plan to migrate the entire technological structure of the municipality of Porto Alegre – a metropolitan network with over six thousand computers in 370 subnetworks.

A new systems development environment with 44 system analysts, 50 programmers and 25 trainees is now ready to develop all of the information systems of the Porto Alegre municipality on a free platform.

2.4.5. Some technical details

The choices made were: PHP programming language for websites, Apache web server, MySQL database and the GNU/Linux operating system. To develop the initial pages, the municipal company created "Proweb Libre", a tool used to include content and manage the websites of all the organisations and departments of the municipal authorities. "We have a working system that can be connected with a password anywhere with Internet access", explains Volney Alves, Internet and e-Government supervisor at PROCempa. By the end of 2004, the sites of all municipal agencies will be remodelled using this tool.

For critical missions systems, the chosen option was the J2EE platform (Java 2 Enterprise), which avoided dependence on proprietary libraries and compilers. The productivity tool that will be used to develop these systems will be Eclipse.org.

These development environments are using version control (CVS – Concurrent Versions System).

In the municipality's network infrastructure, proxies using Microsoft software were replaced by a GNU/Linux proxy with the following services: HTTP/HTTPS/FTP support (Squid); SOCKS support (Dante); FTP uploading/downloading support (jftpgw); Site/URL blocking (SquidGuard); NTLM authentication (Samba); access querying (MALA).

The network services servers that used Microsoft Windows NT are being migrated to GNU/Linux to guarantee a heterogeneous environment in the transition, with support for authentication, printing, DNS, DHCP, NTP, Samba directory and LDAP.

Related links

Municipal authorities of Porto Alegre: www.portoalegre.rs.gov.br

World Social Forum: <http://www.forumsocialmundial.org.br>

Charter of Principles of the World Social Forum:
http://www.forosocialmundial.org.br/main.asp?id_menu=4&cd_language=4

PROCempa: www.procempa.com.br

Municipal Department for Education: www.portoalegre.rs.gov.br/smed/

World Forum on Education: www.portoalegre.rs.gov.br/fme/

Software livre project: www.softwarelivre.org

International Free Software Forum: www.softwarelivre.org/forum2004/

Telecentres of Porto Alegre: www.Telecentros.com.br/

Eclipse Foundation: www.eclipse.org/

2.5. Telecentres in São Paulo

The city of São Paulo was founded in 1554 by Jesuit priests at a time when the Portuguese were occupying and exploiting the land in South America, around the sixteenth century.

It is now the financial, commercial and industrial capital of Brazil and one of the world's biggest metropolises with almost 16 million inhabitants in its metropolitan region. Of all Brazil's cities, São Paulo has the most marked social contrasts and cultural diversity.

High crime rates, a lack of basic infrastructure and major social problems caused by erratic growth are some of the traits of this typically Latin-American capital.

From all this, we can imagine that launching a digital inclusion programme in a city with these characteristics is no mean feat. In 2002, however, the e-Government Coordination Department of the municipal authorities of São Paulo began to respond to this challenge with the creation of its telecentre project.

This project is now one of the biggest digital inclusion projects of Latin America and has served almost 500 thousand people to date. And of course, it has all been done with free software.

2.5.1. Telecentres and the digital inclusion plan

The newest type of social exclusion and the inequalities left behind by the digital revolution can be seen in this great metropolis in the digital exclusion that denies its citizens access to information and technological knowledge, widening the existing gap between rich and poor.

The Digital Inclusion Plan, also known as e-citizenship, is setting up telecentres in the most deprived and peripheral areas of the city. It is based on the idea that it is only possible to combat digital exclusion if governments approach the task from the angle of government policy.

The premises for the telecentres were selected on the results of an analysis of the city's Human Development Index (HDI) and priority was given to regions with lower quality of life and less state presence. There are now 120 units up and running which, in addition to actions for teaching IT skills and using Internet tools, are linked to popular participation and citizenship programmes.

The main aims of the programme are to reduce the rates of social and digital exclusion, retrain professionals, requalify the space around the unit by increasing the flow of people through the streets in the area; spread free software, stimulate popular participation through management councils and generate community journalism.

2.5.2. Structure and operation of the telecentres

Each telecentre has 10 to 20 computers with a broadband Internet connection. Users can use the computers in a variety of ways: free use of the equipment, basic IT courses and special workshops. Free use of the equipment, as one might guess, is where users learn how to use the technology for their specific needs. Individuals can freely browse the Internet, conduct research, read the news, visit chat rooms, play on-line, scan documents and CVs, send e-mails and use the resources of the Internet to the full. The only content that is strictly prohibited is pornography.

Monitors are selected from the community to teach basic IT, basic GNU/Linux, OpenOffice and the GNOME GUI. The programme's biggest success is its special units, whose results suggest social inclusion. The programme teaches *workshops* on Community Communication, Connection of Knowledge, Website Creation, Environmental Education, Professional Training, Digital Art and Access to Public Services over the Internet.

Digital inclusion does not only involve guaranteeing access to computer programs and the Internet or training individuals to enter the labour market. This would be a very limited vision and could lead to failure because it suggests that knowledge of an office automation tool is enough to secure a job. The construction of alternatives to ensure improved quality of life must involve the community and immerse it in the digital world, applying technology across the board to deal with individual needs and the area's organisational requirements. If we can comprehend this, we will have tapped into the secret to the success of any digital inclusion programme.

The special units were set up to structure the community through cultural and educational activities that use technology as a means for the exercise of citizenship and reaching out to individuals. Hence, the collaboration of the participants has been vital to the construction of a collective project in the telecentres of São Paulo.

The telecentre employee is a further ally because he or she acts as an educator, catalyst and community agent all in one. Each unit has a set number of regular meetings but the group activities invite interested participants to work together to develop projects, which might be a presentation, show, website, *fanzine*, etc.

Each telecentre has a Management Council formed and selected by members of the community. This Council assists municipal employees with tax aspects and management of the space. Some telecentres were set up on pre-used or abandoned public premises as part of a process to regenerate the surrounding streets. Many were refurbished and adapted to receive the equipment and community. They open from Sunday to Sunday, except for public holidays.

There is another type of telecentre called the convened or community telecentre, installed in spaces provided by civil agencies or non-government organisations. They are set up in cooperation with the municipal authorities of São Paulo, which also provides the equipment, municipal employees and resources for maintenance. These spaces open from Monday to Saturday, except for public holidays.

2.5.3. Free software used in the telecentres: SACIX

The needs and experience of setting up telecentres led the municipal authorities to develop their own distribution called SACIX. Based on the Debian distribution (one of the most common distributions among government authorities, such as Porto Alegre and Extremadura), SACIX includes a free software package adapted for use in the telecentres that can be freely copied and distributed. There are two versions of SACIX, one for government agencies and civil organisations seeking to develop their own telecentres, and one for domestic users, who can have a diverse package of computer programs on their PC in GNU/Linux.

The free operating system used in the telecentres is GNU/Linux with the GNOME graphical user interface, chosen for its user-friendliness. The main applications available on SACIX are the OpenOffice.org package, which allows users to carry out basic office tasks, and G-Paint, which is a common design application.

2.5.4. Required investment

In order to offer users a suitable environment, the e-Government coordination department adopted a strategy of obtaining quality equipment at low prices.

Website

SACIX:
www.sacix.org/

Data obtained from the programme coordination department reveal that the cost of setting up a new telecentre, including refurbishment of the premises provided by the municipal authorities, is around € 34,570, or € 73,000 if the telecentre is to be built in a brand new space.

If the programs used on the equipment at the centres had not been free software, this cost would have increased by at least 50%. Besides economising on licence fees, the installation of free software allowed the use of less powerful computers with less sophisticated hardware and, hence, cheaper equipment, with a similar performance to superior and more expensive hardware and equipment running Microsoft Windows.

In most cases, to allow network administration and optimise processing, LTSP (*Linux terminal server project*) is used with a server with greater processing capacity to host the applications, which are then run by more lightweight clients.

2.6. Municipal authorities of Río das Ostras

2.6.1. Sand, oil and free software

The city of Río das Ostras is located between Macaé and Cabo Frio on the Costa do Sol, part of the beautiful coastline of Rio de Janeiro. It is a young municipality undergoing a major economic boom. Besides tourism, which triples its population of 45 thousand inhabitants in the summer months, it is also rich in oil and the *income* generated by this activity is sufficient to stimulate the local economy and fill the coffers of the municipal authorities.

But besides its oil and the natural beauty of its beaches, this coastal city has become a reference across the country for its free software implementation initiatives.

2.6.2. Public & free

The municipal authority's free software project, entitled "Public & Free", was launched in 2001 on the initiative of the recently created IT Advisory Office, reporting directly to the Mayor's Office.

The initial concern was to reduce the costs of software licences for operating systems and office productivity suites for the whole of the local government. Replacing Microsoft Windows with GNU/Linux and Microsoft Office with a "Free Office" package was a great initial idea. But it did not stop there.

This initiative also resulted in benefits from the improved allocation of funds. What had previously been spent on software licences was used to purchase more computers, develop new solutions such as print centres, set

Website

Municipal authorities
of Río das Ostras:
www.pmro.rj.gov.br

up an Internet services provider (ISP) for the municipal authorities and invest in employee health at the municipal government with the purchase of equipment to prevent RSI (repetitive strain injury) and WROD (work-related operational disorders).

It was later seen that the programme had many technical advantages too, particularly in the area of maintenance. "We now encourage the use of free software on all government computers, even by trying to incentivise civil servants who collaborate with us on this – they are first to benefit from equipment improvements, such as new computers and liquid crystal display monitors. Our aim is to have 100% of our computers using free software", adds Marcos Vinicius Pecly Marini, the man behind the project and head of the municipal authority's IT Advisory Office.

2.6.3. Savings and technological freedom

The savings obtained by the use of free software were approximately € 370,000, since the municipal authorities did not purchase any more licences for operating systems (Microsoft Windows), office automation packages (Microsoft Office), databanks, development tools or graphics programs. "Besides an improved use of public funds and technical advantages, it was vital to adopt a stance whereby we could not fall victim to "technological slavery" using an expensive product that did not fully meet our needs and over which we had no control", explains Vinicius.

Free software has now been installed on more than 130 computers in the municipal authority of Río das Ostras, the municipal departments of Social Welfare, Administration, Planning, Sport and Leisure, Tourism, Social Communication, Attorney General's Office and Internal Control, as well as the Mayor's Office. It is also being used in special government projects, such as the "Un Bien Mayor" and "Curumim" youth centres, and in the activities of the "IT for all" programme.

Since the project launch, these activities have recorded a continuous rate of growth and the municipal authorities of Río das Ostras are discovering new possibilities every day for the use of free software. This year, the main focus is "social and digital inclusion" programmes. Free software has grown from the internal context of the municipal authorities and now has a constant presence in diverse activities connecting it to the population, such as the creation of telecentres and basic IT courses, by agreement with neighbourhood associations. All entirely in free software.

2.6.4. Tatuí, the Río das Ostras distribution

The municipal authorities of Río das Ostras created their own GNU/Linux distribution called Tatuí (working environment technology for IT users). This distribution is based on the work of the young Carlos Eduardo Morimoto, creator and developer of the most popular distribution in Brazil today, "Kurumim", which is even used by the Federal Government. Morimoto also runs the "Hardware Guide" site.

Website

Hardware Guide:
www.guiadohardware.net

Kurumim is a live CD (it runs directly from the CD without installing the programs on the computer hard drive) based on Knoppix/Debian and has a relatively easy installation process combined with an excellent recognition of hardware components. Another advantage is that its basic version only takes up 200 MB. It is now the easiest way to install the Debian distribution on workstations. Afterwards, we simply need to upgrade and install the new programs required by each user with the Debian "apt-get" commands.

The developers of Tatuí are in the process of completing a version of the program for IT laboratories in municipal schools. It must be distributed freely to students, which will allow them to use the programs and environments of their schools in their own homes. And because it is a live CD, the children will be able to use their parents' computers without this affecting the other software and files on them, since any changes made are saved to Tatuí. At the same time, the parents and guardians of the students will be able to discover free solutions in a less direct way.

The beta version of Tatuí for Education was presented to the teachers and coordinators of the municipal education department and a study group was set up to select other tools to incorporate into the system. There will be different versions for first and second (before and after what was previously the fourth year of the first level) segments.

The municipal authority of Río das Ostras has also developed and is now using SALI (Free Administrative System) to integrate the diverse sectors and procedures of the municipal authority, along with other systems in PHP and PostgreSQL. For Internet sites, the authorities decided on PHP-Nuke, which offers greater interaction and speed of content management.

All of these initiatives show that, besides oil and beautiful beaches, Río das Ostras has a great deal more to contribute to Brazil's information society programme.

2.7. The Brazilian Parliament and the information society

2.7.1. Parliamentary association for free software and digital inclusion

Brazil is now one of the few countries in the world to have a parliamentary association for free software and digital inclusion in the national congress (Senate and House of Representatives) and is one of the biggest parliamentary associations in the congress with 135 representatives and 26 senators. The association is chaired by Senator Serys Slhsarenko and its honorary chairman is no less a man than the former President of Brazil and current President of the National Congress, Senator José Sarney.

2.7.2. A story that began in the Basque Country

It is an interesting historical fact that the management of this association began in Bilbao, Spain, in February 2003, during the IT4ALL [1] event "Opportunities and Challenges for Regions in the New Information Society". It was a preliminary meeting prior to the first phase of the Information Society Summit and its Brazilian speakers were the President of the Congress, Senator José Sarney, and myself. On the last day of the event, following the brilliant addresses of Diego Saravia and Manuel Castells, I had the pleasure of talking in my speech about the main ideas and philosophies of free software and the status of our movement in Brazil, in the presence of Senator Sarney, who was waiting his turn to give the closing speech for the event. In the evening, at the hotel, we had the chance to exchange impressions on the idea of the information society and free software. This meeting sparked a keen interest in the Senator that would have important consequences for the future of free software in Brazil".

Website

"Opportunities and Challenges for Regions in the New Information Society" and preliminary meeting prior to the first phase of the Information Society Summit, organised by the Basque Government and the Diputación Foral de Bizkaia - Spain, with the backing of the EU's Directorate-General for the Information Society and by the UN/UIT through the Executive Secretariat of the "World Summit on the Information Society"

<http://www.it4all-bilbao.org>

2.7.3. A week of free software in the Brazilian Parliament

On 2 April, we met Senator Sarney in Brasilia to discuss the initiatives of the National Congress to promote free software. His interest in the issue led to the organisation of the "1st Week of Free Software of the Legislative Body" in August of that year". Under the slogan "Free Software and the Development

Note

<http://www2.camara.gov.br> y
<http://www.senado.gov.br>

of Brazil", the relationship between free software and digital inclusion and the country's development were discussed in the Brazilian Parliament throughout the week.

Richard Stallman and Miguel de Icaza were speakers at the event and took part in its inaugural act. The Brazil free software community also participated in the event on various panels.

The speakers at the prestigious inaugural act, besides Richard Stallman, included the presidents of Brazil's two legislative chambers, Senator José Sarney, the MP João Paulo Cunha and three of Lula's cabinet ministers: the Chief of Staff, José Dirceu, the Minister for Culture, Gilberto Gil, and the Minister for Science and Technology, Roberto Amaral. The addresses of these government officials were the important political statements needed to consolidate free software as a relevant political issue for Brazil.

"This event organised by the national congress is a milestone showing that free software is more than a mere possibility for our growth; indeed, it is here to stay", affirmed the Chief of Staff, José Dirceu.

"Today, we are closing the Week of Free Software and the 'Free Software and the Development of Brazil' seminar. This week's success is a strong indication of the vitality of IT in Brazil and has brought me great personal satisfaction; thus, I feel truly rewarded for being a part of its organisation.

This event is of strategic importance because it marks the adoption of a position vis-à-vis free software by many areas of the State. Brazil decided that the public sector would consider open programs as an alternative to be fully exploited and stimulated, both in its economic aspects and, more importantly, in its conceptual aspects. It has been adopted in order to discover and carve out paths of cultural independence, of creation, of national identity.

From now on, with the aim of disseminating IT, we will always keep in mind the idea that computer languages must be public, developed by users, and not subject to international monopolies", stated Senator José Sarney in his closing address of the event.

"Education is an essential stage of this road. I believe that, as Professor Stallman suggests, our children should learn the basics of programming in open languages so that they can play a part in their evolution and retain their independence", concluded Sarney.

Website

Opening address of the President of the National Congress, Senator Sarney

<http://portal.softwarelivre.org/news/1191>

Minister Gil's speech

<http://portal.softwarelivre.org/news/1186>

Website

Address of Minister Dirceu

<http://portal.softwarelivre.org/news/1188>

Website

Closing address of the President of the National Congress, Senator Sarney

<http://portal.softwarelivre.org/news/1202>

2.7.4. Creation of FRENDOFT

Crowning the efforts of the ministers Walter Pinheiro and Sergio Miranda, pioneering in their historic defence of free software in the Brazilian Parliament, the end result of this event was the formation of FRENDOFT (the Mixed Parliamentary Association for Free Software and Digital Inclusion, whose President is Senator Serys Shsarenko).

"The result of these debates is the Parliamentary Association for Free Software, which is proving itself to be an influential group that will bring to the agenda of our legislative chamber the concern for supporting open systems in order to instrumentalise our independence in the IT sector", concluded Senator Sarney.

The Parliamentary Association for Free Software and Digital Inclusion is strengthening institutional actions and extending the possibilities of alliances needed to consolidate free software in our country, revealing itself as one of the most important political initiatives for the construction of a Brazilian alternative to the information society.

2.8. Brazil at the Summit on the Information Society

The first phase of the World Summit on the Information Society, an official UN event held from 11 to 13 December 2003 in Geneva, Switzerland, was marked by profound differences in the interests of representatives of the governments of the wealthier countries and the bloc of developing and poor countries spearheaded by Brazil, India, South Africa, Egypt and Argentina.

The government delegations of the United States and the European Union almost always worked as a united front, leading the conservative bloc, and did not beat about the bush when it came to defending the sole interests of the big US monopolies.

2.8.1. Socialisation of knowledge at the Summit on the Information Society

One of the major controversies at the Geneva Summit revolved around the free software alternative and the socialisation of knowledge as instruments of digital inclusion and stimulation for innovation and technological development. Brazil and India led the bloc that saw focusing on the exchange of technological knowledge between peoples as being more suited to the development of a democratic society of information and inclusion, being the only chance for developing countries to make up for their technological backwardness.

The Brazilian thesis was taken up by the bloc led by the United States, which championed the alternative of tightening intellectual property laws on digital works, increasing penalties and criminalising users who seek to

copy and freely share works on the Internet. Most of the governments of the wealthy countries, led by the United States, revealed that they wished to maintain a tight and selfish control over technology, protecting themselves by intensifying the ideology of intellectual property.

Besides being a clearly protectionist policy, this stance proposes an information society "without information" and without shared knowledge. In effect, a disinformation society. Clearly, poor and developing countries would be left to play the role of consumers of technology and "packaged" products manufactured in the northern hemisphere, preventing universities, research centres, private sector companies, governments and the population in general from mastering and obtaining knowledge of the technology being – or which ought to be – disseminated.

2.8.2. International governance of the Internet

Another relevant topic was the debate on the "democratisation of Internet governance". The bloc, also led by Brazil, argued that control of the addresses, names and management of the Internet should be tripartite (governments, civil society and the private sector) and be subject to an international body. ICANN (Internet Corporation for Assigned Names and Numbers) is the body currently in charge of establishing the rules of Internet use around the world and it is unilaterally dependent on the US Government.

The Brazilian Government does not argue that governments or even large companies should govern the Internet. However, it does favour the increased participation of users and civil society in Internet definitions. The Brazilian government also argues that in government forums debating Internet governance, all countries should be represented multilaterally – not only the US, as is currently the case.

2.8.3. Digital solidarity fund

The African countries and a ruling of the World Summit of Cities and Local Authorities, held in Lyon (France) a week before the Geneva Summit, supported the creation of an International Solidarity Fund for Digital Inclusion. The proposal is also backed by Brazil and the bloc of developing countries. The resources for this fund could come from a tax on a small part of the profits obtained from the international transactions of IT companies, for example.

The representatives of the countries led by the United States wished to have no talk of this fund, even if it were a non-governmental voluntary fund. They argued that the "market" should lay down the rules for digital inclusion; in other words, whoever has the resources to pay for and purchase from the

monopolistic giants of the north will be able to take part in the information society. The others will need to wait their turn in the long line of digitally excluded individuals.

2.8.4. In Tunisia, for a more inclusive information society

In Geneva, all these points had a questionable and contradictory outcome, owing to the tough diplomatic negotiations. Brazil was a key player on the world stage and this was important, but the result of the Geneva Summit was light years away from reflecting and revealing new ideas for the information society or any type of innovative thinking. It was a summit dominated by "conservative reaction" to the new possibilities opened up by Internet and the digital revolution. The debate must continue and we must try to spread these ideas among civil society until the second phase, which will take place in Tunisia in 2005. There is a great deal to be done. We need to lay this debate on the table and show society the positions adopted by its governments.

Representatives of civil society at the Geneva Summit approved an alternative statement in line with the position adopted by the Brazilian Government and its international bloc.

I consider it vital to organise the support of international public opinion immediately so that the world's governments begin to comply with the wishes of peoples across the planet in the search for a new, more democratic and more inclusive information society. This will allow the benefits and results of the digital revolution to be considered as human rights and not as a simple tool for the accumulation and concentration of wealth.

The digital revolution is on our side.

3. Sun Microsystems

3.1. Business analysis

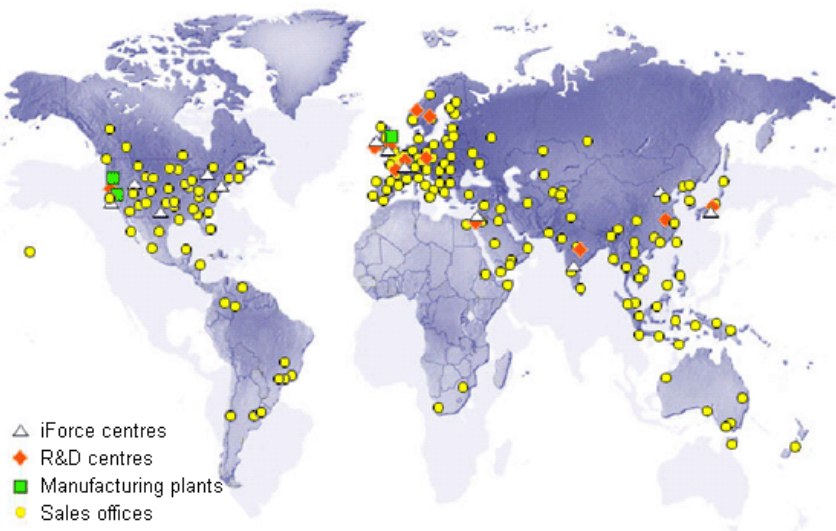
Sun Microsystems Inc. is a US company that was founded in 1982 by three students of Stanford University (Scott McNealy, Andy Bechtolsheim and Vinod Khosla) and one student from the University of Berkeley (Bill Joy).

The main purpose of the company was to design microprocessors and workstations for the University of Stanford, which is why the company was named Sun (after the Stanford University Network). From the outset, the founders were aware of the importance of using open standards to develop their products, which is why they chose to design their microprocessors using the SPARC standard. They also chose an operating system based on an open standard, Unix, to act as the driving force behind the systems they designed. In doing so, they had a great advantage because Bill Joy had developed Berkeley's Unix operating system (BSD) some years earlier.

Since 1982, the company has continued to grow and it markets its systems in virtually every country of the world. Sun's designs have also been adapted to market needs, which has seen the sale of workstations evolve into a wide range of servers and multiprocessor systems.

Sun Microsystems was and still is an innovative company that, as we will show, has always maintained a close relationship with communities that support open standards. Proof of this are the many technological contributions made to these communities by Sun.

Figure 14.

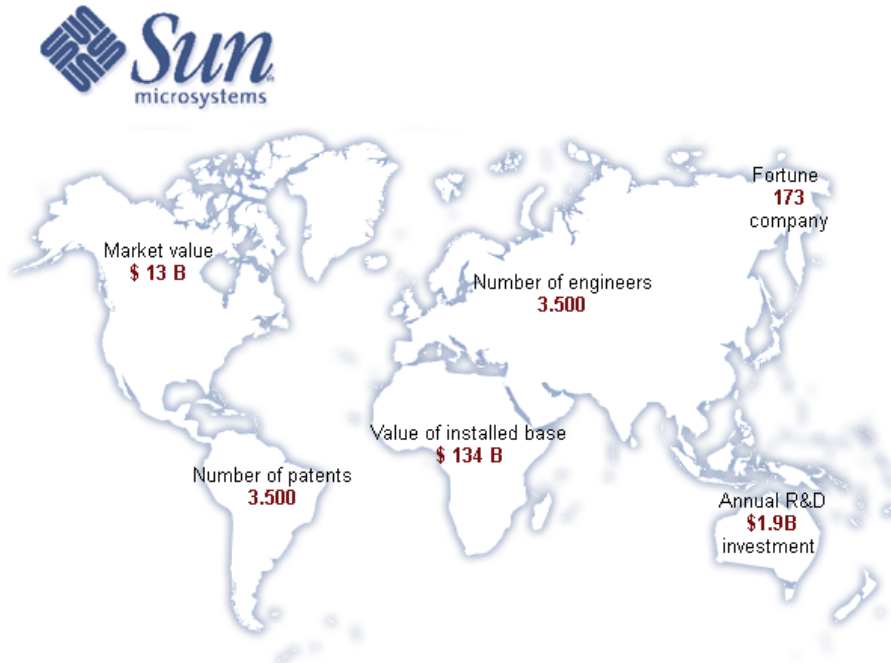


Sun Microsystems has commercial offices in over 170 countries around the world, which means that it needs a wide area network to offer top communications and services to its 35,000 plus employees. This network is referred to as SWAN (Sun Wide Area Network) and consists of over 6,800 subnetworks with 6 data processing centres (DPCs) that house the over 1,700 servers and 500 TB of data. The number of subnetworks, servers and storage systems increases as needs grow. To cite some key figures, Sun servers currently host over 400 network applications and 18,000 websites of over 4 million pages that receive 600,000 visits and move over 6 million e-mail messages every day.

Sun has over 3,500 engineers working on the research and development of innovative new technologies that could help businesses and end users to cut the cost of implementing new network services. The free software community is one of the groups that most benefits from the investments in research and development made year upon year by Sun, since most of these technologies are donated to the community to ensure its continuous evolution.

A prime example of the sizeable R&D investments made each year by Sun are the USD 1.9 million allocated to this heading, which represents approximately 18% of the company's turnover. The more than 3,500 registered patents are the result of these efforts.

Figure 15.



3.2. The private sector and the role of the free software community

The private sector's main concern when it comes to software is how to innovate efficiently. Innovation is straightforward and relatively common and yet, predicting which of the products being developed in R&D laboratories will have an impact on the market and generate profits for the company is no easy task.

Innovation expenditure can be very high for a company if it cannot obtain an efficient return on its products. This is one of the main reasons why the private sector has been paying more attention to the free software community in recent years. The amount of money that a company can afford to pay for top engineers is irrelevant; it needs to realise that no matter how brilliant the company's development team is, there will always be others who can innovate more efficiently. So the old expression "innovation is all around us" rings true here; we just need to find the mechanisms to profit from it.

There are a number of reasons why a private sector company might decide to launch a free software project. Here are a few of the main ones:

- It can obtain quality software at low costs.
- It can obtain a group of users who will test the software in a very wide range of environments.
- Quicker TTM (*time to market*).
- Good positioning of the company, which is seen as an ally rather than the enemy.
- Creation and positioning of standards.
- Lower maintenance costs.

- Fewer risks.
- Greater customer satisfaction.
- Improved integration with third-party products.
- Does away with being tied to companies that create proprietary software products that do not use the available open standards.
- Changes the rules of the games vis-à-vis market prices.
- Encourages free competition.

When a multinational launches a free software project, it contributes experts and a series of procedures and processes that do not generally match the way the developers of this community work. Its main contributions are:

- Project management.
- Management of quality and metrics.
- Development methodology specifications.
- Documentation writers.

The company must still use the project launch and management paradigm that it usually uses because this is the only way to control expenditure and project time, thus avoiding delays and unforeseen expenses that could lead to failure.

On many occasions, the costs of a project based on free software are higher than those that use a proprietary software approach.

One of the key points to bear in mind is the model adopted for licensing the free software applications. One of the myths surrounding free software is that it is not owned by anybody and that when a company develops a free software product, it must forego its rights and control over ownership. There can be nothing further from the truth: the free software model recognises ownership and its concomitant rights.

Companies need to think carefully and consider whether there is any point to launching a project linked to the free software community; in other words, it will need to study whether the code adapts to the needs of the company, whether the licences suit the deployment model that the company wishes to adopt, etc. Following this preliminary study, the company will no doubt need to adapt the source code, choose the licence model, establish a development model, draw up a cost study for launch, etc. We will deal with all of these points later.

Earlier, we listed some of the reasons why a company might opt for a free software project. We will now look at some of these in detail:

- **Visibility.** Launching a project in free software gives it visibility in the developer community outside the company walls. It is possible to use the standard communication channels of the free software community to

exchange opinions, ask questions and even, in the phases prior to product launch, conduct a series of validation tests.

- Enhanced development of standards. Some projects are designed to develop a standard. When we open this process up to a community of users and developers, we are increasing our possibilities of obtaining outside help and of the effective adoption of this standard.
- Creation of proprietary products. Some free software licences allow proprietary products to be based on free software products through the addition of new features or simply by improving the existing product and offering after-sale support.
- Creation of a market for a proprietary product. When a company has a product built from another free software product, it can gain customers and increase its potential market. This is because the free version of the product encourages users familiar with its use to purchase the proprietary version to obtain support, training and extra consulting services. Moreover, the fact that there is already a free version makes things difficult for the competition, which will need to penetrate the market with another product with better features.
- Better quality. Because the different versions of the applications are made available to a community of developers and/or users before they hit the market, it is easier to detect and fix any minor development bugs in a short space of time. In addition, developers from the community (who are not employed by the company) can add new features that the R&D development team may not have added to the product due to lack of time.
- *Time to market.* By using the code available in the free software community, a company can guarantee a product's quick release on to the market, simply because it does not have to start from scratch. Most of the features it is looking for in the product have already been designed, so it only needs to focus on the additional features without compromising on quality.
- Fewer risks. One of the most common problems faced by companies is the discontinuity of software. Products very often rely on other ones, production of which may be stopped for a number of reasons. With free software applications, development of the product can continue even if the original developers have abandoned it.

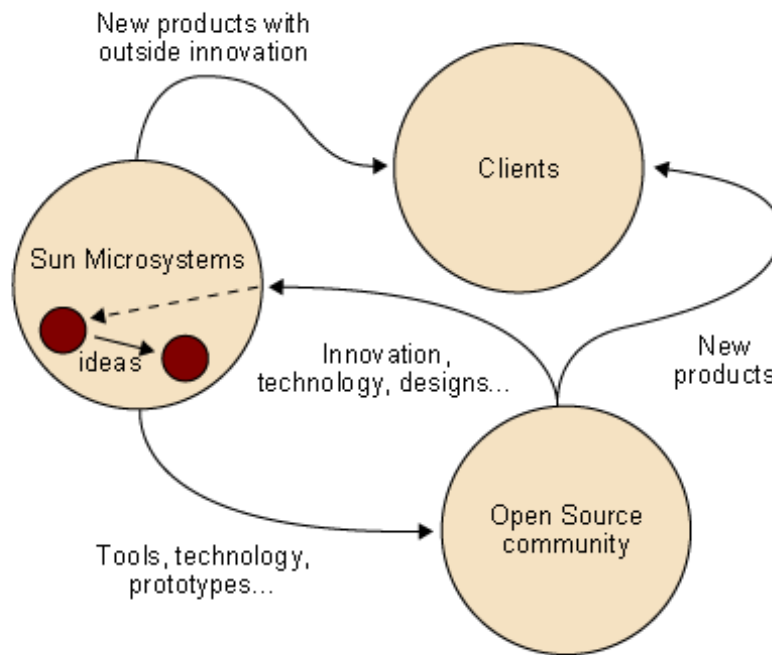
Most customers have misgivings about purchasing products from small companies. The risk of the company going bankrupt and no new versions or support being available for the application they have bought means that small companies very often have problems selling their products, even though they might be excellent.

By adopting a free software strategy, small businesses can convince their customers that, even if the business winds up, continuity of the product is guaranteed because there will always be an up-to-date version available.

3.2.1. Feedback

Private businesses can use the free software model as a basis for sharing tools, technology and prototypes. However, it is more important to create an ecosystem around the free software in which the company and the community join forces and share common aims in order to strike a perfect balance.

Figure 16.

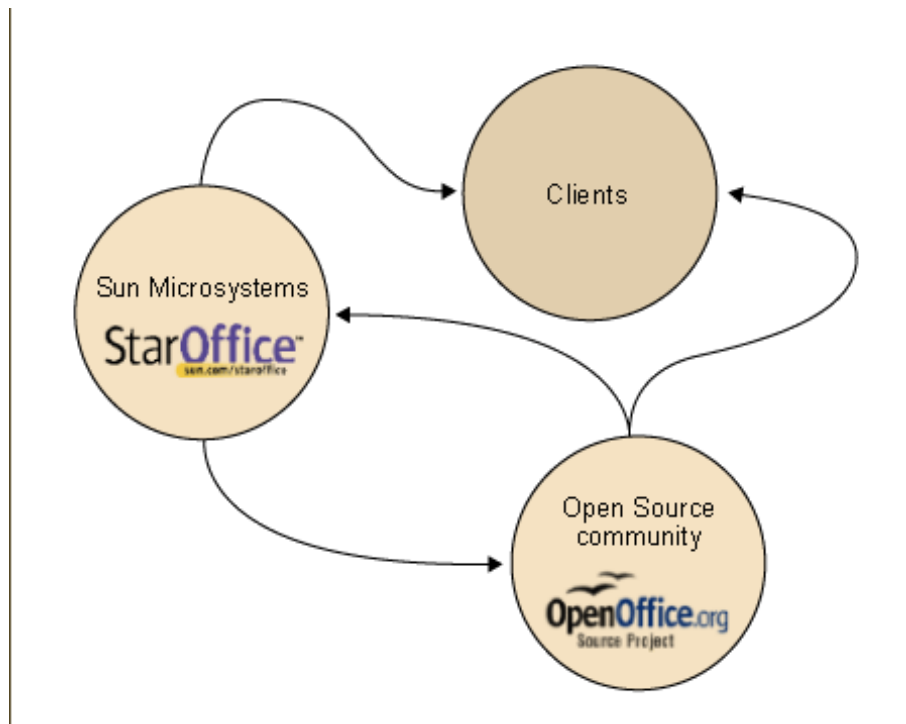


All of the participants in this model reap benefits from it:
 The customer obtains a top product with minimal risks and a guarantee of continuity.
 The private company helps and supports the developer community in exchange for improved products that it can subsequently market.

A prime example of this type of ecosystem is that created by Sun Microsystems with its StarOffice office suite. In version 6 of StarOffice, Sun Microsystems released the source code, which led to the creation of openoffice.org. Developers from the free software community have now evolved this product, adding new features and allowing the ecosystem to operate just as we have described.

The community developers add new features and Sun subsequently markets the new version of the product after extensive quality testing, with an additional user support service.

Figure 17.



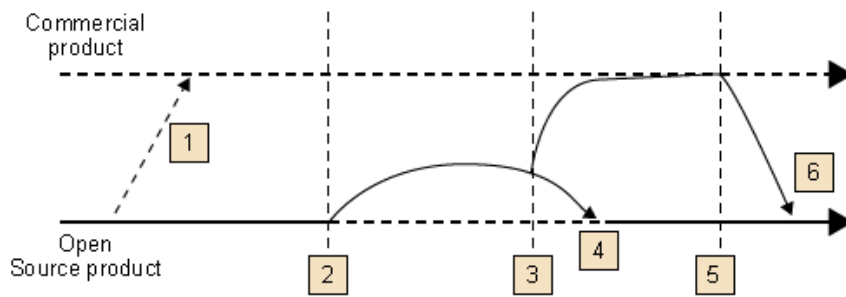
3.2.2. Creation of an appropriate development plan

When a private sector company embarks on a free software project, regardless of the purpose of the end product, it is going to need a coherent development plan that adapts to the company's standards and allows deadlines to be met.

It is important to consider that a project developed entirely by the private sector will be subject to a series of working methodologies and procedures that products developed by the free software community do not have. Therefore, both parties (the company and the free software developer group or community) must be clear on the parameters and paradigm used in the development cycle of the end product, since the two products need to be connected throughout the cycle in order to avoid incompatibilities. There are a number of models for linking the two versions:

- One involves basing the brand version on a stable version of the free software application. In this model, any changes to the commercial product flow in the direction of the code of the free software application. This process ensures that the two codes are compatible and that they have the greatest possible number of similarities in order to minimise version problems. The development plan requires the development cycle of the commercial product to be in step with the cycle of the free software application.

Figure 18.

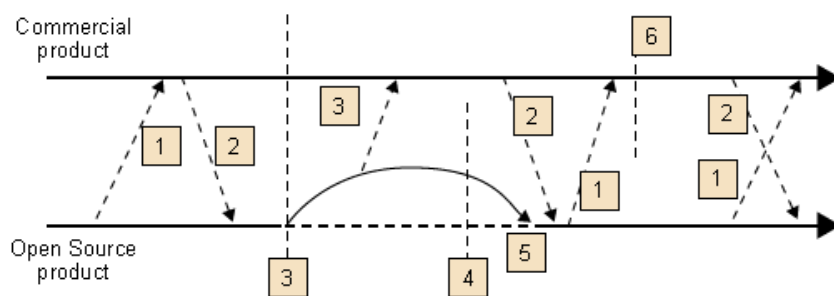


- 1) Incorporation of changes from the free software version to the commercial product code.
- 2) Start of the development of the free software code. The solid lines represent developments in the next stable version while broken lines reflect the current development (new or experimental).
- 3) End of the cycle of the free software project. Stable version available. Start of the development of new versions of the commercial product, based on the stable version of the free software platform.
- 4) Merger of the versions.
- 5) End of the development cycle of the commercial product. Stable version available.
- 6) Merger of the commercial product code with that of the free software application.

As we can see, there will not be many differences between the free software version and the commercial version. The latter may have the odd new feature or functionality but most of the parts it has in common with the free software version will be a subset of the official free software version.

- Another, less desirable, development process involves having two code bases and leaving it up to the developers of the private company to decide when to merge theirs with the free software application. This model has an advantage over the previous one in that it gives greater flexibility to the company developers. However, it also has the disadvantage of complicating source code management due to the existence of two bases evolving independently.

Figure 19.



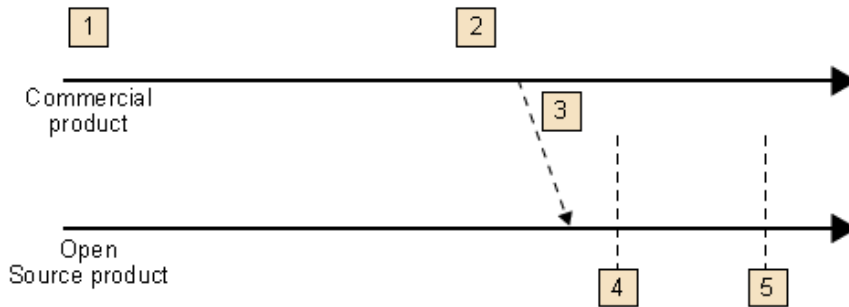
- 1) Incorporation of changes in the free software version to the commercial version.
- 2) Incorporation of changes in the commercial version to the code of the free software version.
- 3) Start of the free software application versions.
- 4) End of the cycle of the free software application. Stable version available.
- 5) Merger of the free software version with the commercial version.
- 6) End of the development cycle of the commercial version. Stable version available.

Development of the two products is parallel and there is no relationship between their delivery cycles. The code from one of the projects is simply injected into the other when the developers of the company consider it convenient to do so.

This model has the advantage that the two versions will have different features, since they are essentially two different products with very similar appearances.

- A third development model is as follows:

Figure 20.



- 1) Start of the development cycle of the commercial product.
- 2) End of the development cycle of the commercial product. Stable version available.
- 3) Incorporation of the changes in the commercial product to the free software application.
- 4) Start of the free software application development cycle.
- 5) End of the cycle of the free software application. Stable version available.

In this model, development of the commercial product is internal and not visible to the developer community. When finished, it is shared with the free software developer community. The private sector companies that use this model generally have their own developers working exclusively on the commercial product, leaving the development of the free software to outside volunteers.

This model requires the least contact between the company and the free software developer community. Many companies opt for this model to add their name to the list of companies that promote free software and collaborate with its community. However, these projects usually fade away after the first version because the company no longer collaborates to allow the project to evolve satisfactorily.

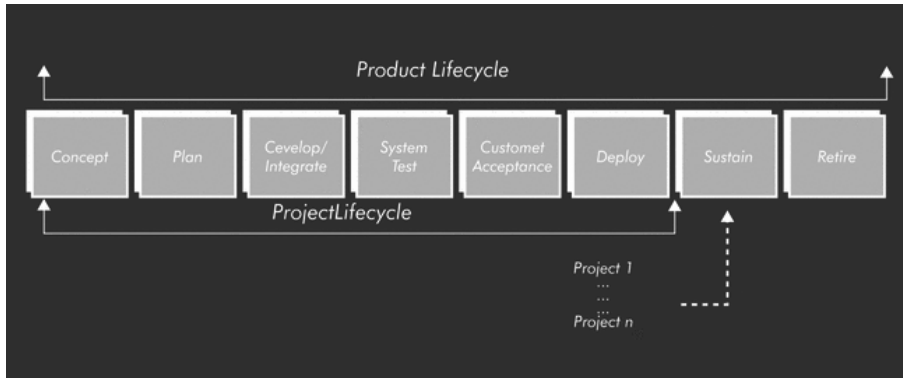
Sun Microsystems began the openoffice.org in this way but adopted a different strategy to prevent the free software project from petering out. Its strategy was to combine this development model with the first one we described: after creating the commercial product, the code is released and handed over to the free software developer community (Model 3), after which Model 1 is adopted, allowing both communities to release new versions.

3.2.3. Software life cycle models: SBS PLC

SBS PLC (Sun Business Systems Product Life Cycle) is the standard life cycle model for information technology infrastructure projects and their developments.

Any project developed by Sun Microsystems is subject to the procedures and methodologies set down in this standard. The model may vary according to the type of project, its priority, critical status, etc. Nonetheless, the life cycle of a project is always divided into the same stages:

Figure 21.

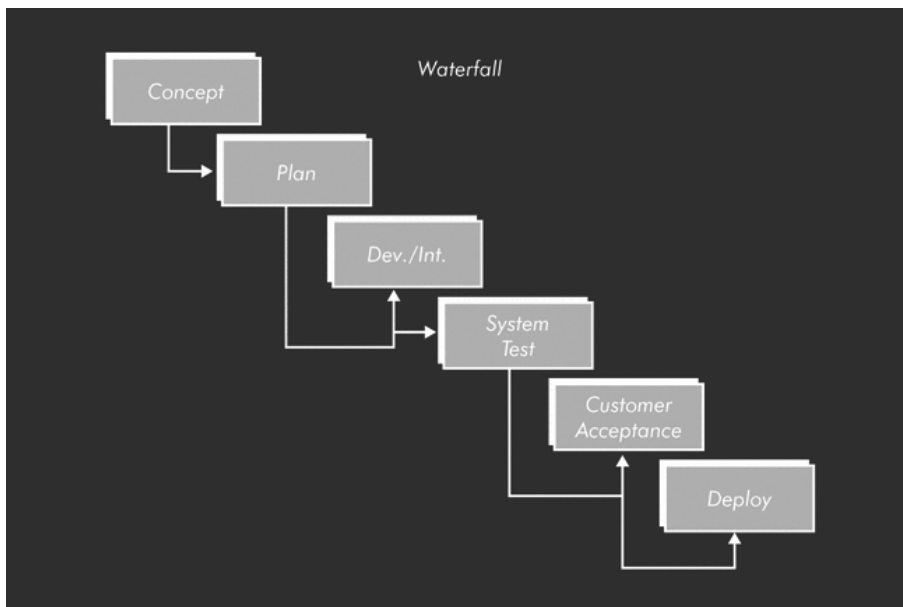


The life cycle of a product extends beyond the life cycle of the project because the product maintenance phase generally falls outside the scope of the project.

Sun Microsystems carries out projects to develop applications for use in its own departments, while others are designed for global use. Hence, it classifies project models according to type, which include:

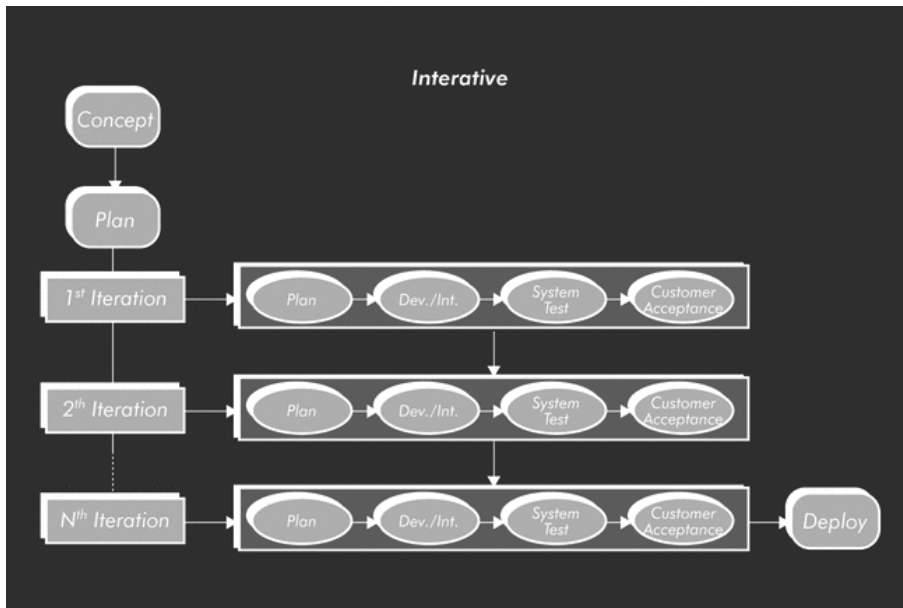
- Waterfall

Figure 22.



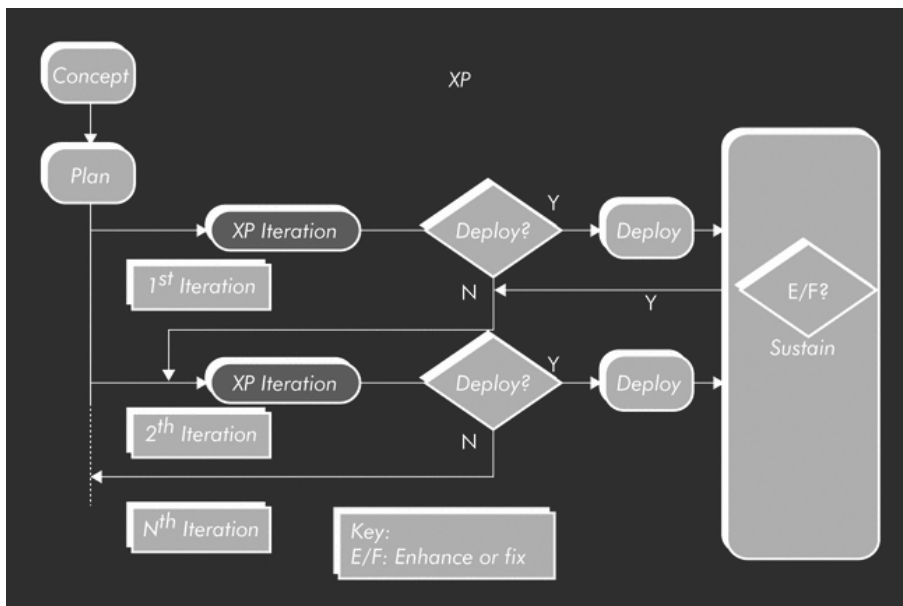
- Iterative

Figure 23.



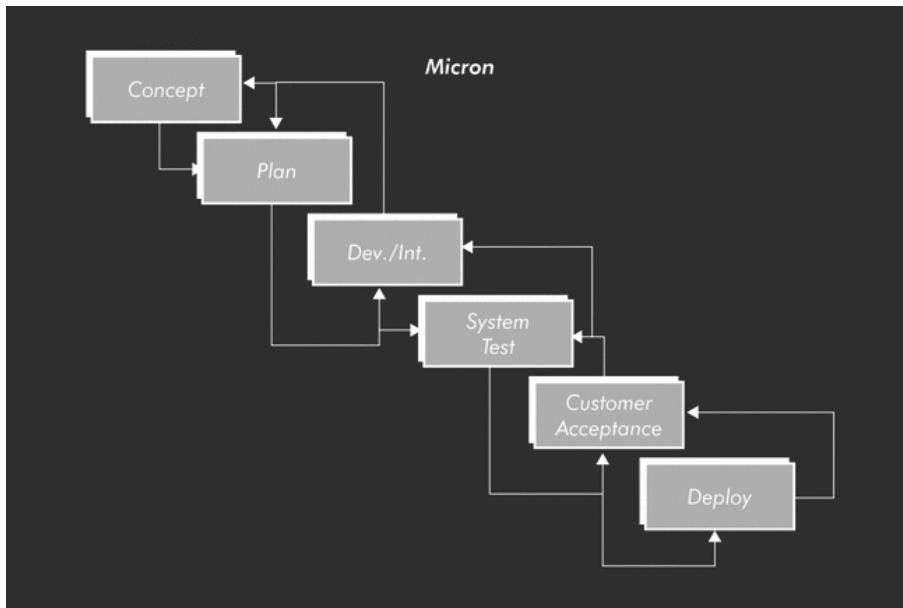
- XP

Figure 24.



- Micron

Figure 25.



Depending on the duration of the project and the time and people required for its development and subsequent deployment, we can draw up the following table to identify the type of model that needs to be used in each case:

Figure 26.

	Development/Deployment (ASP, integration, etc.)		
Major Project	Waterfall	Iterative	
Minor Project			
Micro Project			
			XP
			Micron

Major: over 90 months/employee
 Minor: 9 months/employee to 90 months/employee
 Micro: Less than 9 months/employee

We will now look at the aims and potential risks of each of the phases of a project in this life cycle model:

- **Diagram phase (pre-concept phase).** By creating, reviewing and subsequently approving diagrams, the company can guarantee that the project will have a business case coherent with its strategy and priorities. The most obvious business risks in this phase are the possible lack of justification for the project or discrepancies with the company's strategy and priorities.

- Concept phase. This guarantees that the concepts have been reviewed and that there is no better alternative than the one proposed. Approval from the management committee is required to ensure that the project meets the business aims.

Potential risks may stem from a poor assessment of the alternative products, which could lead to a system being implemented that does not meet the needs of end customers and is hence doomed to failure.

- Planning phase. This ensures that the project meets the architectural requirements and complies with the security conditions, standards and policies of the company. All of these parameters need to be validated before we can move on to the next phase.

The most obvious risks usually concern a functional, technical and deployment design that is not in tune with company policy and would result in a product veto in the next phase.

- Development and integration phase. This ensures that the product has been correctly developed and integrated and ready to move on to the next phase.

The only risk associated with this phase is that the product is not ready for the validation phase.

- Validation and product testing phase. This phase ensures that the product has undergone rigorous revision and validation with the sole aim of moving it on to the next phase (customer acceptance). The product validation and testing reports must be submitted to the Management Committee.

The only risk associated with the product in this phase is that it does not qualify to move on to the next phase.

- Customer acceptance phase. This phase can be seen as a condensed version of the previous phases, since it allows the company to review all of the deliverables obtained in the previous phases and approve the project for launch.

There are no risks other than the possibility of the product not being ready for the launch phase.

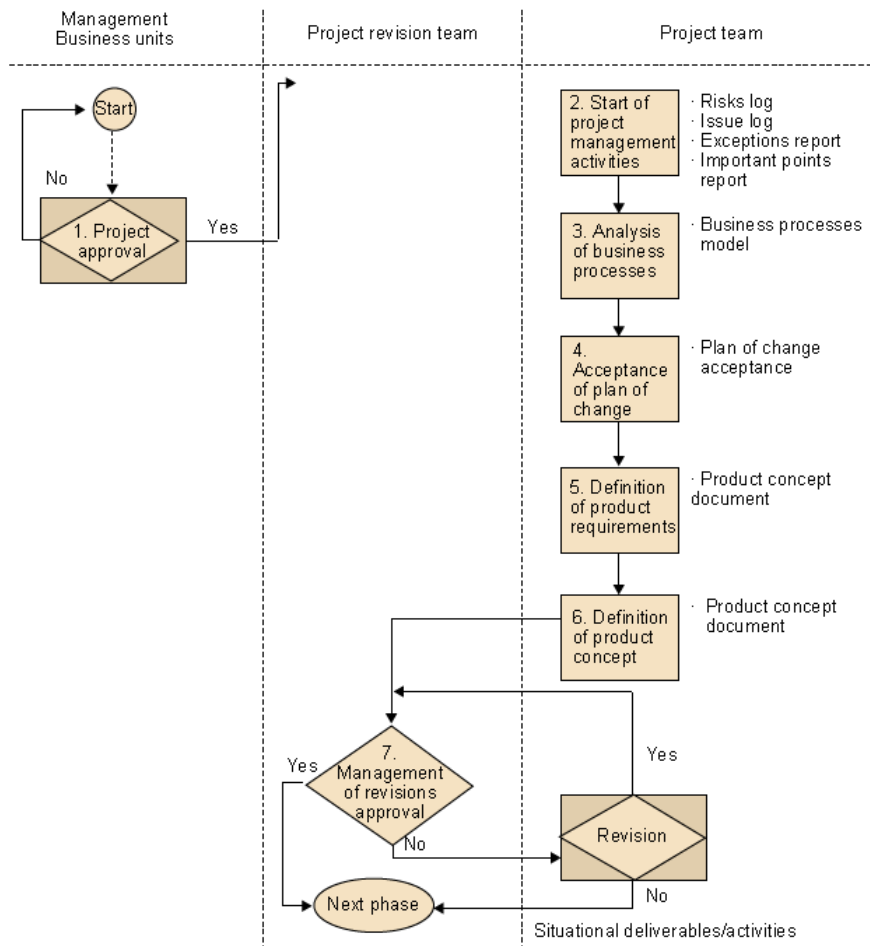
- Launch phase. This ensures that controls and measures are in place for the solution in order to ensure that the product meets the client's needs for the duration of its life cycle.

The risk associated with the product at this stage is that it may be unsuccessful if any of the previous phases were carried out inadequately.

3.2.4. Process flows for the implementation of a project at Sun Microsystems

Concept phase

Figure 27.



- 1) The flow diagram is used as a starting point for the project conceptualisation phase.
- 2) The key activities at this stage are risk management, issue management and the progress report.
- 3) The business process is only analysed when the project team considers that the result can be used as a starting point for refining the business requirements.
- 4) The change approval plan is implemented to ensure that the changes are accepted by those in charge of decision-making.
- 5) The business requirements are converted into product requirements. Before this, a document indicating the product's requirements is required in order to define them correctly.
- 6) A high-level product concept is defined, which must be approved by those in charge in order to develop the solution.
- 7) The resources needed to carry out the project are approved (staff, financial and technologies).

Planning phase

Figure 28.

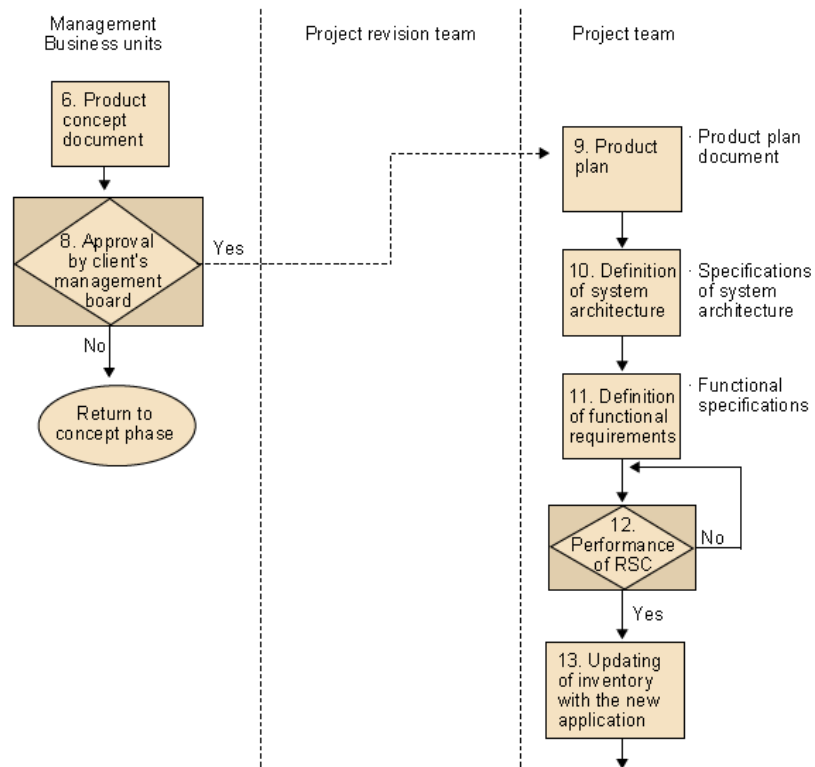
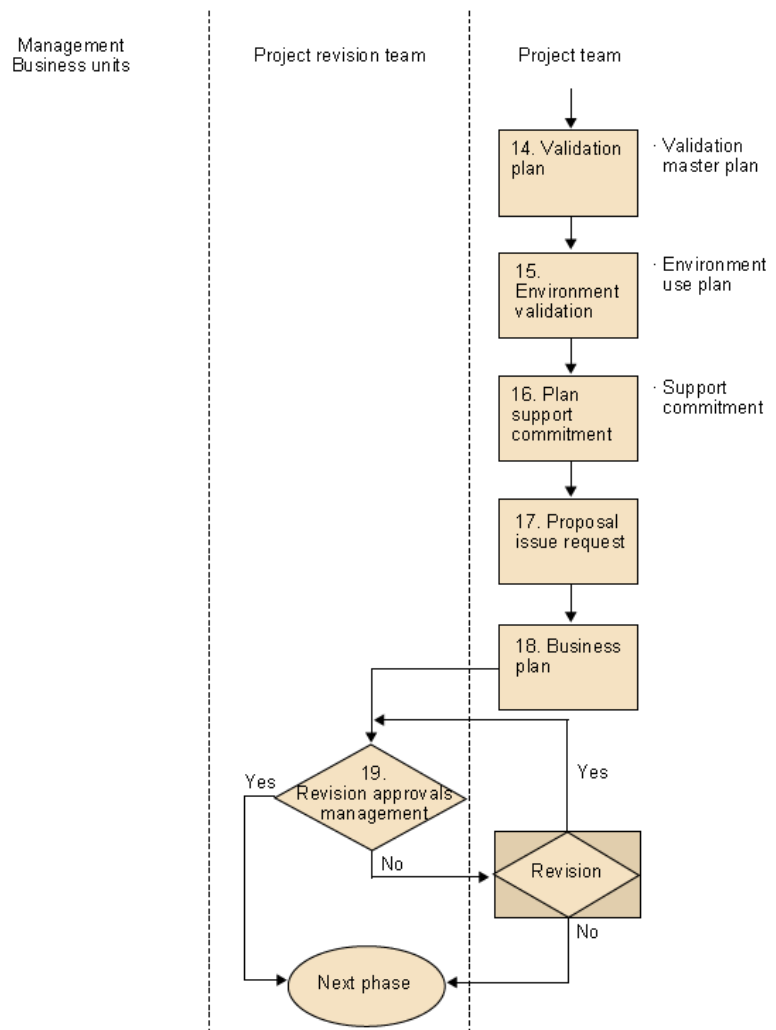


Figure 29.



8) If the solution is approved but requires acceptance of some sort from the end client or department (for which the product is being developed), the approval of a higher-level body will be needed.

9) At this point, the project can be given the go-ahead as it already has a detailed implementation plan.

10) The system architecture specifications are defined and approved based on the documents generated up to this point: product requirements, product concept document, etc.

11) The specifications that define all the features of the end product, are created.

12) (RSC: review of security compliance). The solution is studied and checked to ensure that it does not breach any company or third-party security standards (if it is a project that uses a free software licence).

13) The product is registered in the company inventory.

14) The validation master plan, which is used for high-level testing, is created.

15) The environment in which the product will be tested is checked to ensure that it is correct.

16) The quality of the subsequent product support is verified.

17) The version management processes are launched.

18) The business preparation plan is defined for the effective launch of the solution.

19) Guarantees are put in place to ensure that the project complies with the quality requirements, architecture constants, security considerations, standards and policies.

Development and integration phase

Figure 30.

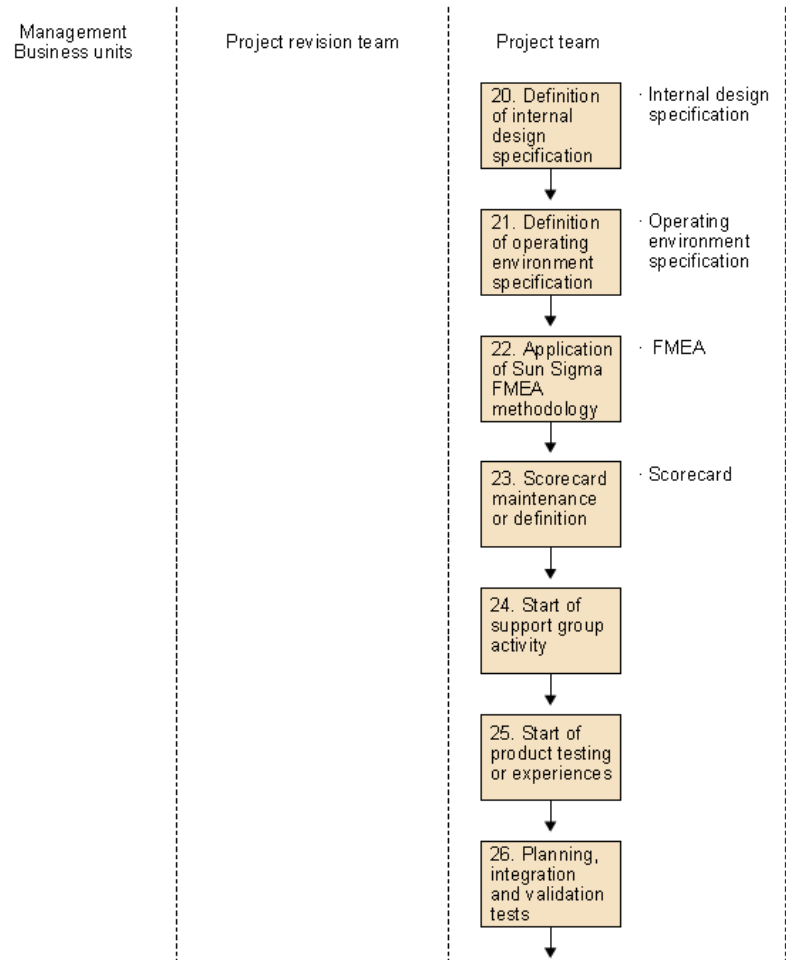
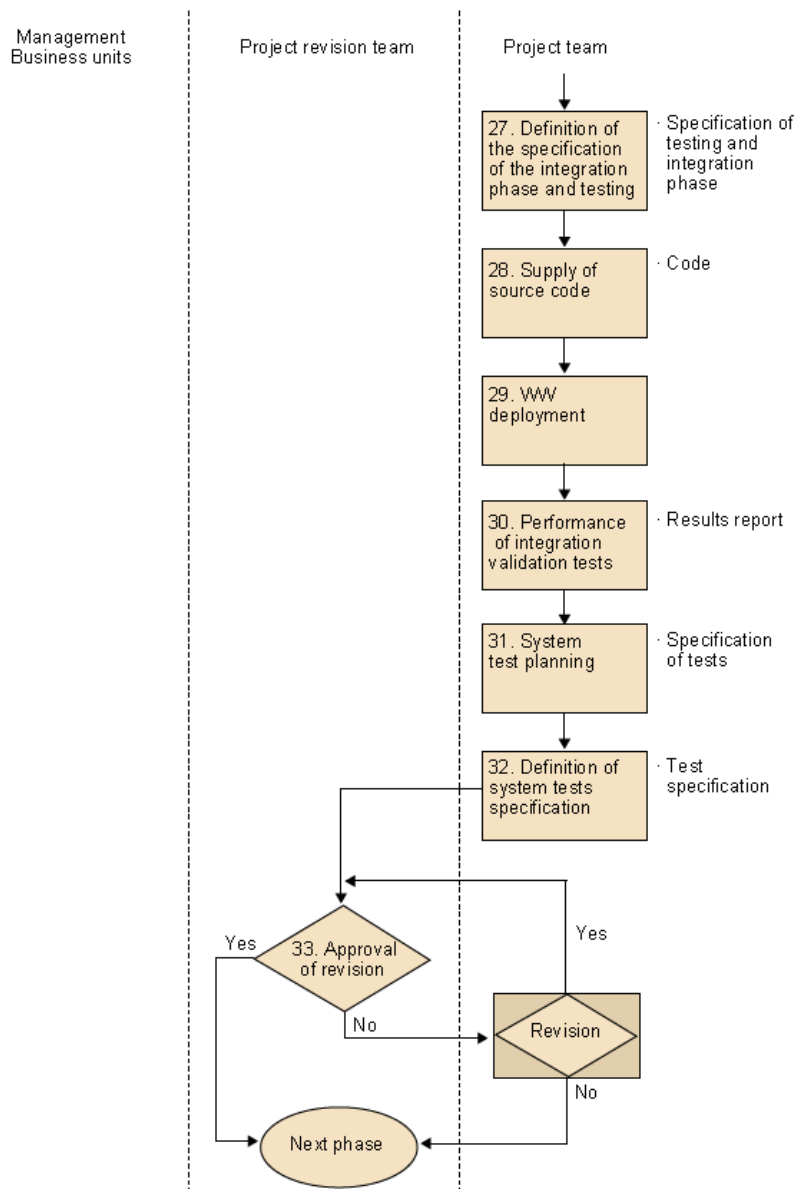


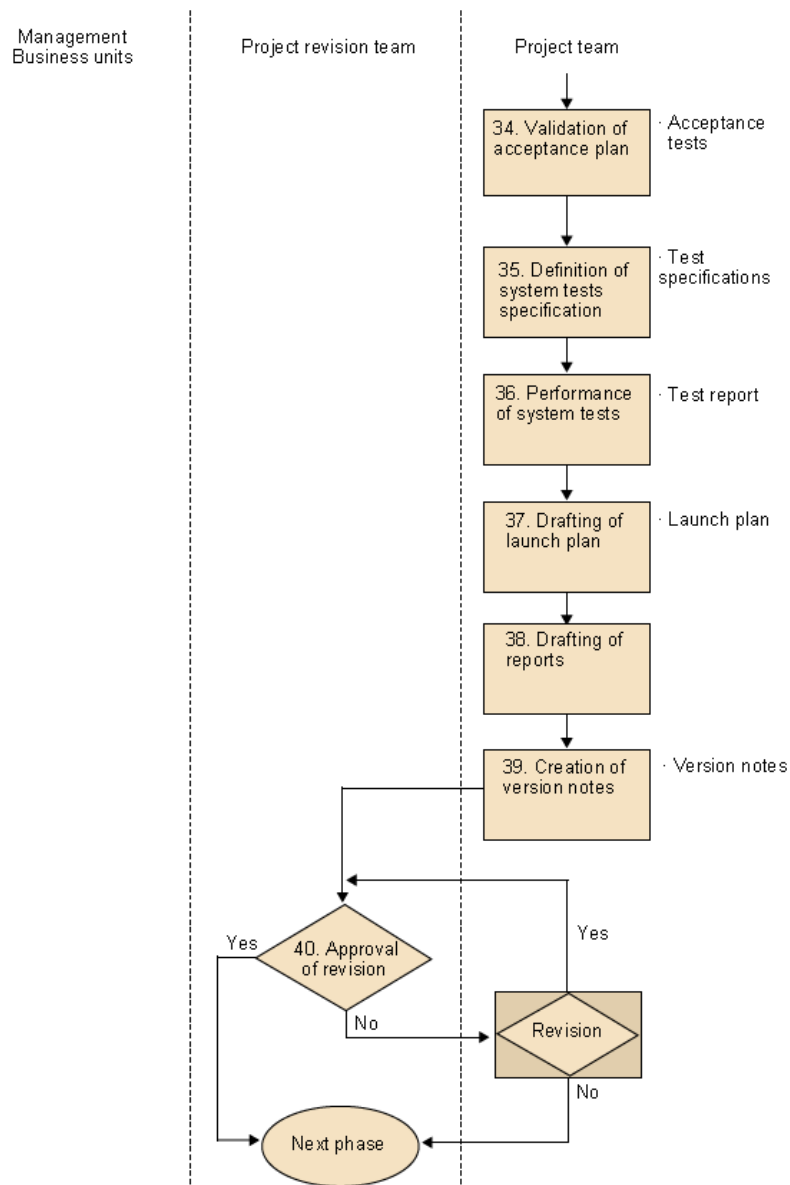
Figure 31.



- 20) The technical design of the solution is obtained through the internal specification design.
 21) The operating procedures are defined through the operating environment specification.
 22) The product is guaranteed to be "fault tolerant" using Sun Sigma techniques.
 23) A scorecard is created to measure the critical parts of the design.
 24) New contact is established with the product support groups.
 25) Start of the experimentation phase for testing optimum product performance.
 26) Planning of the integration phase and final product testing.
 27) Definition of the specification of the integration phase and testing.
 28) Registration of the product's source code.
 29) The first global deployment is conducted in a controlled environment with a small group of end users.
 30) The deployment integration and testing phase is carried out.
 31) System verification testing is planned.
 32) Definition of the system verification specifications.
 33) Validation with the Management Committee to ensure that the solution meets the technical and functional requirements and that it is ready for the validation phase.

Validation and product testing phase

Figure 32.



34) Validation of the acceptance plan.

35) Definition of the testing acceptance specification.

36) Execution of the validation plan. The validation report is drafted.

37) End of the validation plan.

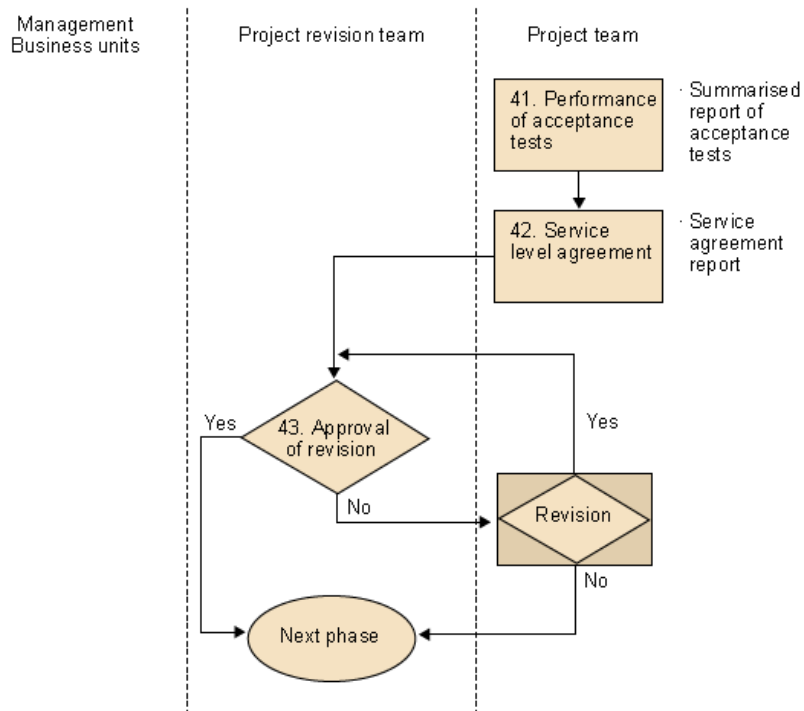
38) Drafting of reports.

39) Creation of version notes.

40) Validation in conjunction with the Management Committee to ensure that the solution meets the technical and functional requirements and that it is ready for the acceptance phase.

Client acceptance phase

Figure 33.



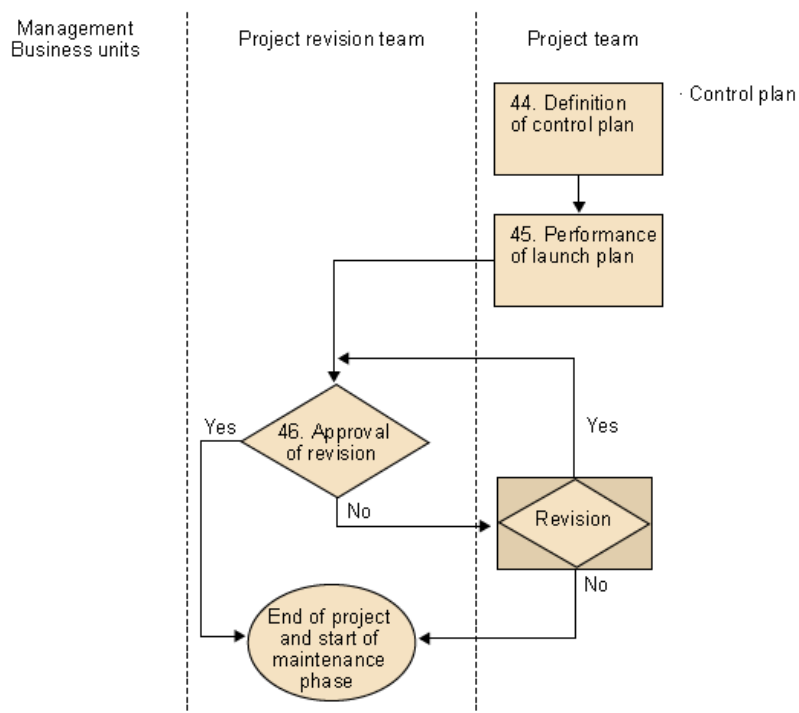
41) Acceptance testing is carried out.

42) Creation of a service type agreement.

43) Review and acceptance, where applicable, of the management of the client acceptance phase.

Launch phase

Figure 34.



44) Completion and approval of the control plan.

45) Execution of the previously approved launch plan.

46) Final validation with the management committee to guarantee that the solution meets the technical and functional requirements and that it is ready for the maintenance phase.

3.3. Sun's free software positioning

Sun Microsystems has adopted a clear stance with regard to the creation and evolution of software. From the outset, the company has always encouraged the development of hardware and software products based on open standards, with a view to fostering free competition through the publication of protocols and interfaces so that other companies working in software creation can compete freely.

Sun considers it necessary to support the free software community by contributing source code and human and financial resources to allow the community to improve or adapt these programs and for Sun Microsystems to subsequently launch them on the market with a series of added services, such as support, training, etc.

Figure 35.



After releasing the code of Solaris 10, Sun Microsystems became the number one organisation for lines donated to the free software community, ahead of the University of Berkeley.

3.4. Study of free software applications implemented inside the company

When Sun Microsystems decided to launch a workstation system based on free software technology, it did so with a series of conditions:

- To create a workstation for all types of user with a true business focus, as an alternative to Microsoft Windows.

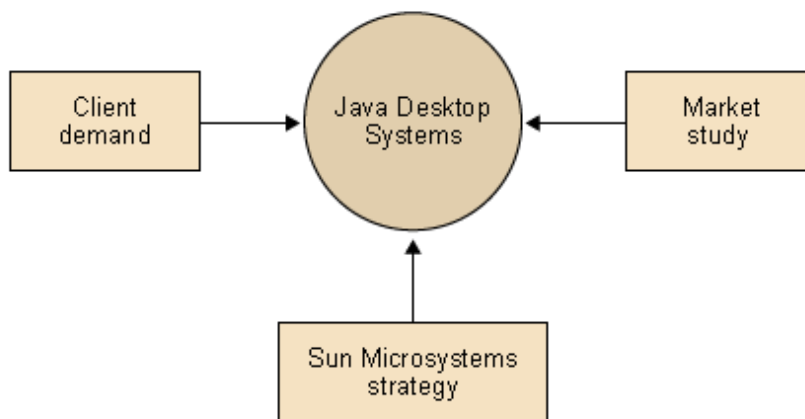
- To adapt and use this workstation to make it compatible with Sun technology, and to allow the company's 30,000 plus employees around the world to benefit from use of the product.

The project, known internally as "Mad Hatter", would thus have two types of client: on the one hand, the employees of the company and, on the other, users and companies. Although this case study will deal primarily with the first case, i.e. the launch of a desktop system known externally as the *Java Desktop System* within Sun Microsystems, the phases prior to distribution of the product were exactly the same, regardless of the end client of the product.

3.4.1. Market needs and study

The first step before deciding on the applications that would form part of the project was to pinpoint the needs of the market and the associated risks and benefits. After identifying these, they had to be guaranteed to fit in with Sun's strategy.

Figure 36.



The product had to meet the following aims in order to meet market needs:

- To provide a series of applications based on open standards that were integrated and would provide an interoperable, secure and well-defined working environment.
- To guarantee a working environment for users that would make them feel comfortable and be familiar to them.
- To use pieces of free software code to avoid being bound to a single technology.

The desired workstation features for clients were:

- An open and cheap workstation allowing them to be set free from the bonds of proprietary technologies.
- An elegant design that was easy to handle and manage.
- A working environment that could let them rest easy about computer viruses.

After analysing the market needs, Sun had to determine which applications would form part of the new workstation:

Given that Sun's main aim was to gear the product towards professionals, it had to be clear on the fact that employee needs and uses of workstations are very different to those of users in non-professional environments.

- An environment in which to run applications.
- An e-mail client, directory and calendar.
- A browser for visiting Intranet/Internet sites.
- An office automation suite for giving presentations and producing text documents, spreadsheets, etc.
- An intuitive graphical environment to run the above applications and other less important ones that had to be included nonetheless.
- All applications had to run on any of the Sun Microsystems operating systems:
 - Solaris (SPARC architecture)
 - Solaris (x86 architecture)
 - Linux (x86 architecture)

The first version of the Java Desktop System (JDS) workstation had the following components:

Figure 37.

Web Browser	Mozilla 1.4 (Browser)
Mail, Calendar, Contacts	Evolution 1.4 (e-mail client, calendar and contacts)
Office Applications	StarOffice 7 (office applications suite)
Instant Messaging	Java 1.4 environment (platform for the applications)
Java	GNOME 2.2 (desktop environment)
Desktop Environment	Operating system:
Operating Environment	Solaris (SPARC, x86)
Java Desktop System	SuSE Linux (x86)

3.4.2. Study of the Java Desktop System (JDS) applications

Before describing each of the applications in detail, we ought to think about the value of Sun's idea of offering a workstation such as Java Desktop System based on open software:

- The appearance of the graphical environment had to be as similar as possible to Windows operating environments because this is the most commonly used PC platform in the world.

The GNOME desktop environment has a series of menus and icons to allow as smooth a transition as possible.

Many business users are not advanced users of IT systems, so the main aim was to avoid rejection by this group.

- Device management had to be straightforward. It is often necessary to connect the workstation to an external device (scanner, printer, etc.) and this operation should not cause problems for users.
- The workstation had to be integrable and interoperable and not limited to a specific type of application. Therefore, it had to be based on open standards, as this would allow its integration with existing technologies in any business environment (directory servers, e-mail, databases, applications based on the Windows operating system, etc).

GNOME graphical environment	Description and features
Figure 1 ¹	GNOME is most popular desktop environment in the free software community. It has a familiar operating system management appearance with menus, icons, file management, accessories, system tools and a range of customisable screens that provide a comfortable environment for the end user to move around in.

The appearance of the working environment with GNOME looks like this:

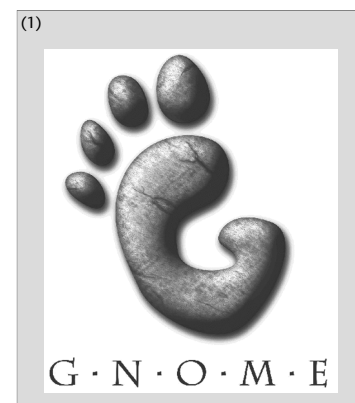
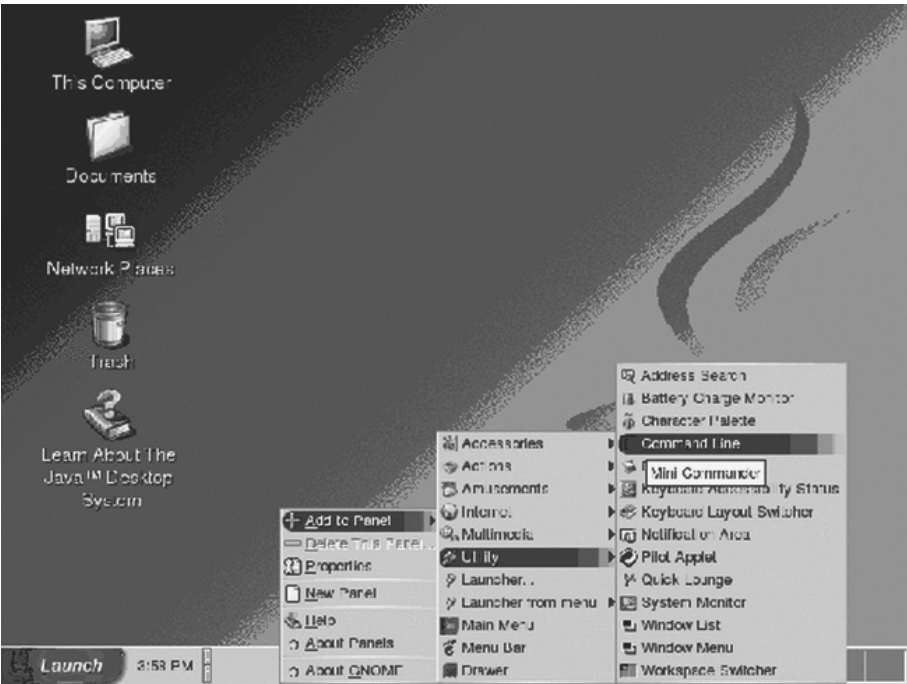


Figure 38.



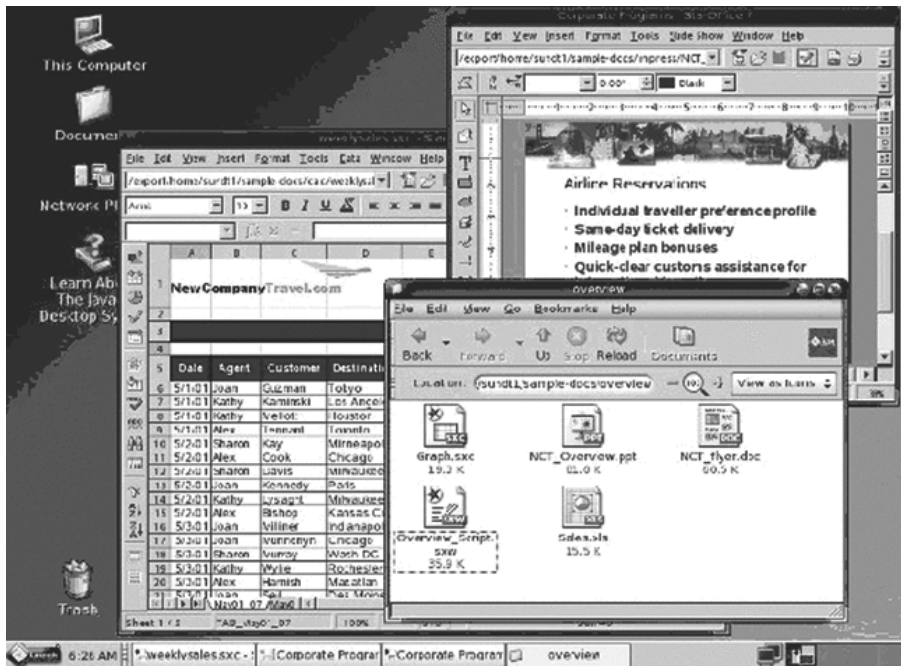
One tool that is a must in professional working environments is an office suite. The tool with the biggest market impact at the moment is Microsoft Office, which is why Sun Microsystems has invested considerable human and financial resources in producing a market alternative that matches its features and guarantees 99% compatibility.

StarOffice office productivity suite	Description and features
Figure 2 ²	Ease of use. Anybody who has used MS Office is able to work with the StarOffice tool with no further training. Interoperable. It can export any type of document to a variety of formats, including PDF, Flash XML, .doc, .xls, .ppt, .rtf, .psw., etc. Open format. It works with files with an internal format based on XML.



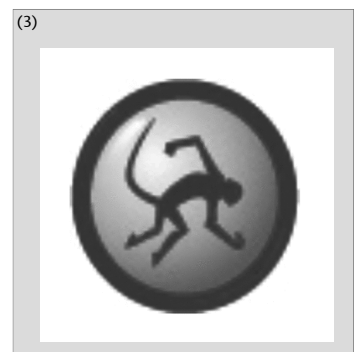
The tool looks like this:

Figure 39.



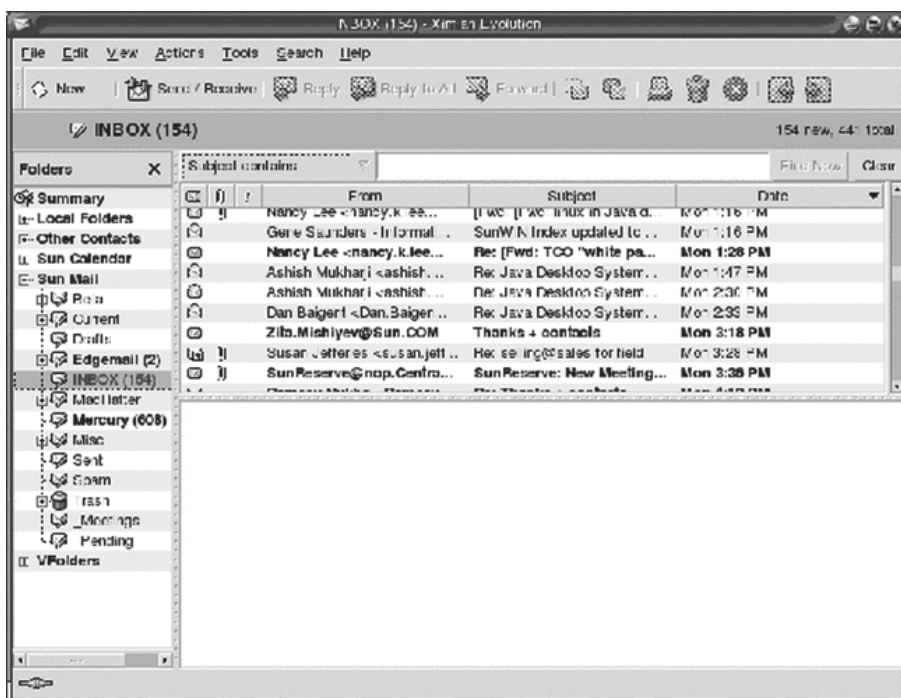
Ximian e-mail client	Description and features
Figure 3 ³	<p>E-mail client, directory, calendar, etc.</p> <p>It supports the most common e-mail protocols and can be integrated with a calendar server.</p> <p>It is very similar in appearance to the MS Outlook client.</p>

(3)

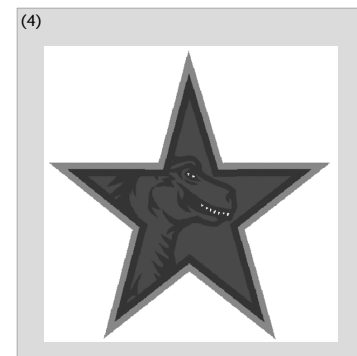


You can see what Ximian Evolution looks like in this screenshot:

Figure 40.

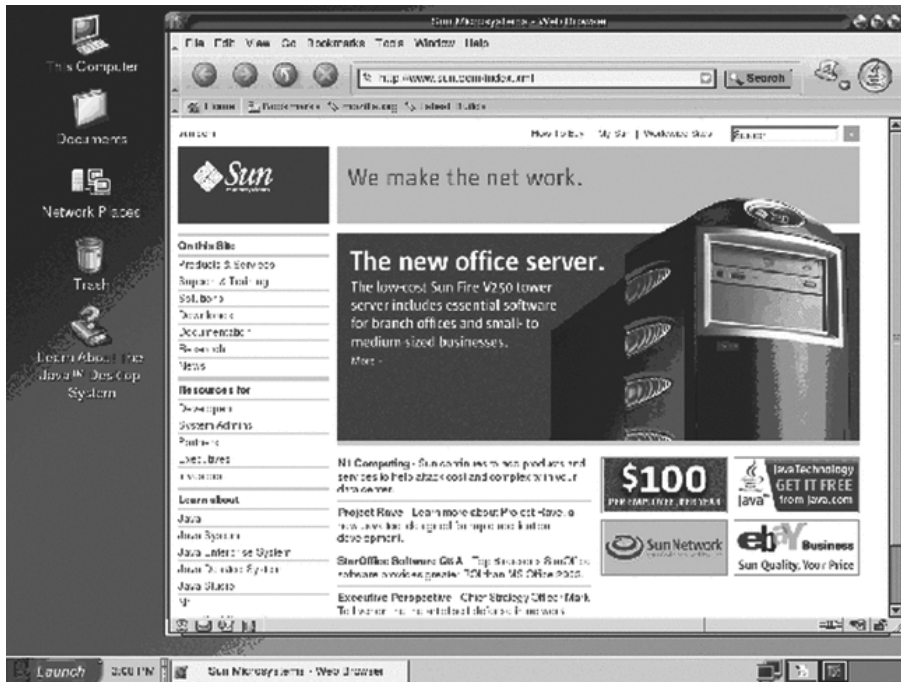


Mozilla browser	Description and features
Figure 4 ⁴	<p>Browser that supports the HTML, XML and CCS standards, among others.</p> <p>It includes an HTML editor, download manager and a wide range of advanced features.</p> <p>It is installed with pre-configured plug-ins for Java, Macromedia Flash, Adobe Acrobat Reader, RealPlayer, etc.</p>



The appearance of this browser is as follows:

Figure 41.



There are many other applications that come with the ones described here but they are not included in this study because, while useful, they are not essential to the day-to-day running of a business.

3.4.3. Control metrics used by the IT operations department

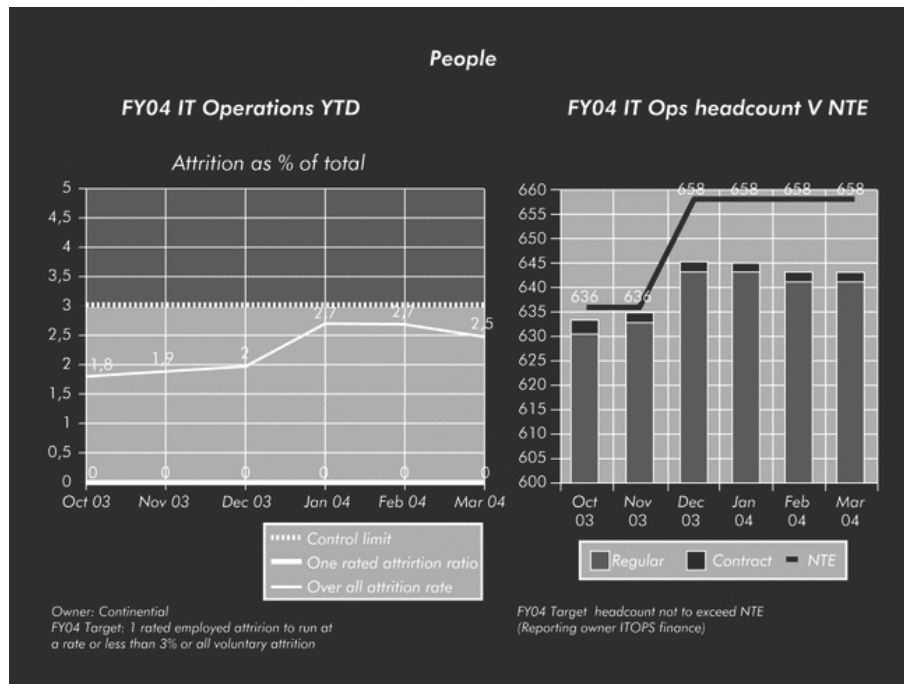
One of the most significant processes of the design and subsequent implementation of a free software system at Sun are metrics, which help to predict the guarantees of success of a product.

There are many metrics for estimating costs, risks, quality, efficiency, etc., studied by the Head of Operations for the geographical region in which the system is to be implemented.

The key data managed in these metrics are those concerning the staff available to implement the applications correctly. They include the ratio of end users to the number of engineers occupied with these tasks.

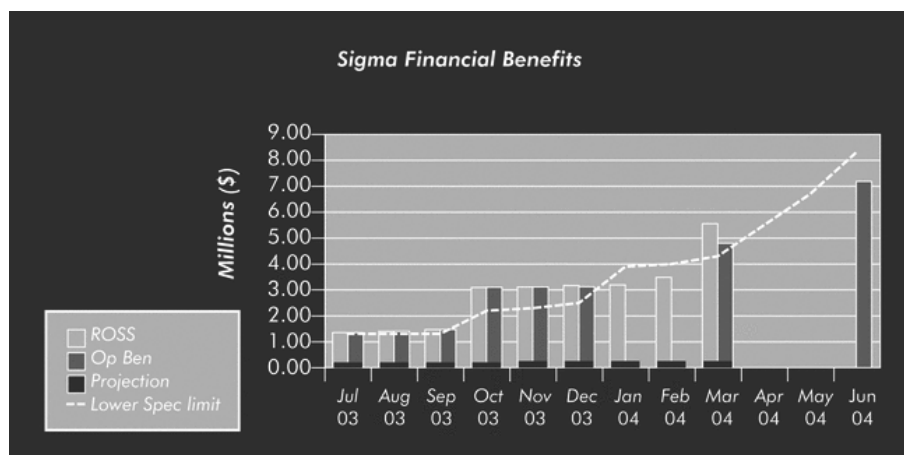
The Sun Microsystems IT Operations Department has a total of 265 staff administrating and installing corporate applications on over 1,810 servers, which serve the 35,000 plus employees. To put it another way, each system's administrator is responsible for managing and monitoring more than 135 workstations.

Figure 42.



Another interesting metric is that concerning quality and productivity: Sun Sigma methodology. Sun Sigma is an adaptation of Sun's Six Sigma methodology, which is basically a scientific method for improving processes, products and services. All decisions on the introduction of improvements are based on data collected from the various departments.

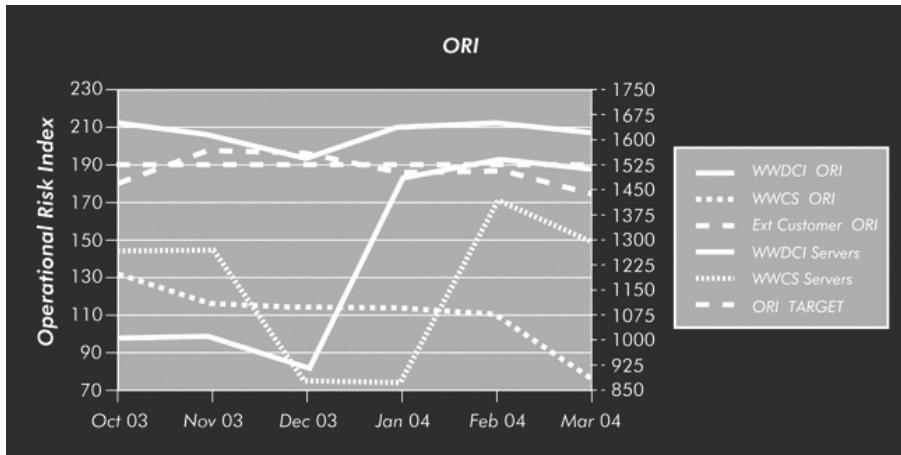
Figure 43.



These metrics can be used to pinpoint the areas in which processes can be improved in order to help to cut costs.

ORI (*Operational Risk Index*) is an index obtained by analysing the environment of Sun's systems in production. It analyses the systems and studies their risks, classifying them according to status (low, moderate, high and critical). Once we have the values for each system, we can then obtain their risk of failure.

Figure 44.



The above diagram illustrates the ORI of the systems in some departments of Sun Microsystems in the EMEA (Europe, the Middle East and Africa) region. As this index concerns the number of servers in production, this number is indicated to the right of the diagram.

The formula for obtaining a department's ORI is:

$$(10 \cdot \text{critical}) + (5 \cdot \text{high}) + (3 \cdot \text{moderate}) + (1 \cdot \text{low}) = \text{ORI}$$

After analysing a system in production with a tool called Explorer, the results are compared to the values that Sun Microsystems believes the system should have in an ideal environment. Risks are classified by criticalness using the above formula.

A system has been evaluated and the following results have been obtained:

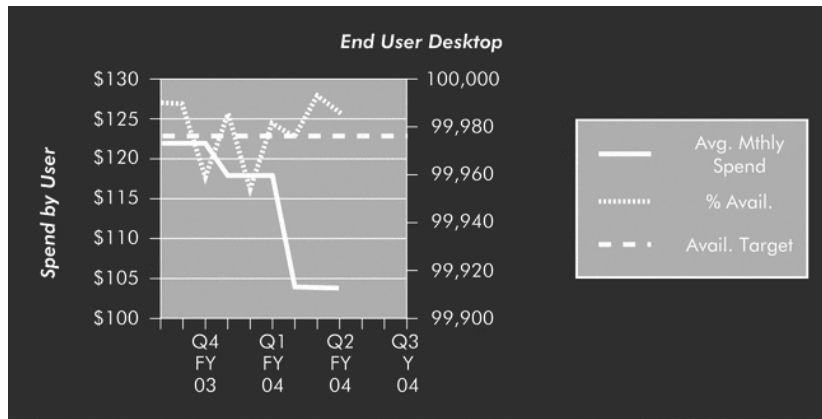
Risk level	Number of potential problems
Critical (critical)	2
High (high)	5
Moderate (moderate)	8
Low (low)	10

The ORI of this system would be 79.

$$(10 \cdot 2) + (5 \cdot 5) + (3 \cdot 8) + (1 \cdot 10) = 79$$

Finally, it is important to obtain metrics for the efficiency of the workstation, local network services and wide area network services.

The figure below illustrates an example of the cost savings obtained by Sun through workstation efficiency:



3.5. Development and worldwide launch of the platform

When the product is ready to be installed on all file servers and SWAN network applications, the company needs to adopt a global approach to its *deployment* that will allow the software currently installed on the systems to be replaced with the new product. Deployment management allows the diverse groups responsible for hardware or software to coordinate implementation of the new system in an environment of centralised servers located in different countries around the world.

The responsibilities associated with this management can be summarised as follows:

- Planning and supervision of the effective deployment of the new software (and hardware if applicable), removing any programs classified as obsolete.
- Coordination with change management if any part of the software requires a simple upgrade.
- Guarantee that all the elements to be installed are secure and can be located in the corresponding database.
- Management of end-user expectations.

On occasion, installation affects a specific group of company applications that can be treated as a single group while at other times deployment only involves upgrading the version of an application. Hence, there are several types of launch, each depending on the nature of the components to be installed:

- Complete launch: all launch modules and components have been created, interconnected and tested as a single unit.
- Differential launch: only the components that have changed since the last launch are included.

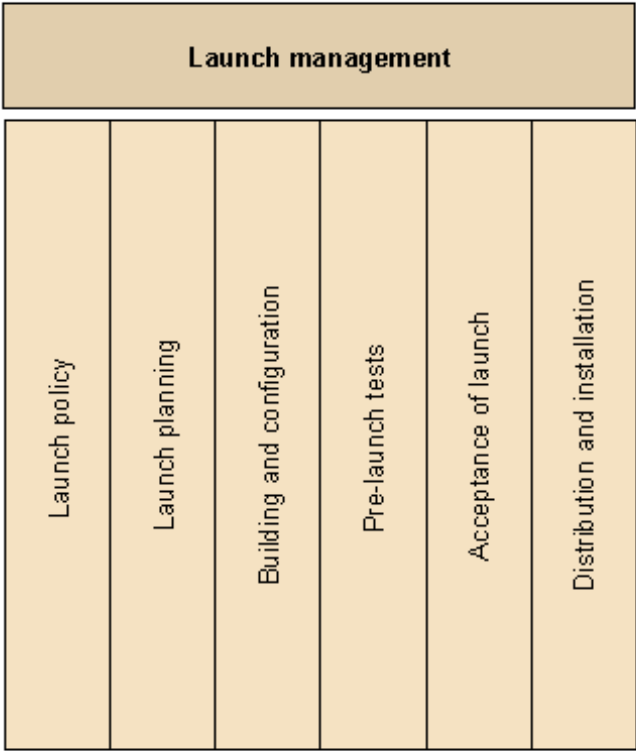
The corporate software database contains the master copies of all software controlled in the company (both purchased programs and software developed in the R&D laboratories). The exact configuration of this database must be defined and revised before any launch.

The software components included in a new installation should be assembled under controlled conditions to ensure a reproducible process. It is quite common to automate this process to reduce dependence on human involvement, thus increasing reliability. Sun Microsystems has developed an entire systems and processes architecture called *N1*, by which this process can be carried out with minimal human intervention.

The launch must undergo rigorous testing and obtain user acceptance. Due to the high number of end users in a multinational like Sun, a small group of users (with different technical profiles) is selected to pass and validate the tests for global launch. Sometimes, despite completing each of the steps described in the launch procedures, a software version can generate a run error or prevent the installation from working correctly. In this case, we need a backtrack plan that documents the steps to take after a launch fault.

3.5.1. Launch management

Figure 45.



A centralised launch management like the one described has countless advantages over a non-centralised one:

- The installations are carried out on a limited number of servers, which means that the database of registered equipment is not too large.
- The time spent on the last phase of the launch is reduced to a few minutes.
- The performance of backtracking procedures and reinstallation of the previous software is also a matter of minutes.

This is very useful when an error occurs or a fault is generated in one of the installed applications.

- Improved quality of service due to more successful installations and a considerable reduction in business downtime, which is zero in most cases.
- It ensures that the installation remains in the hands of professionals who specialise in this type of management: the end user will never have to perform operations with the installed software.
- Improved use of resources.

3.5.2. Distribution tools

The IT Operations Department of Sun Microsystems uses a procedure called *SoftDist* to distribute the software once it has been launched. The aim of this process is to ensure that the central servers in each of the regions have the latest version of the software that the company wishes its employees to use.

Before moving on to the steps for distribution of this software, we need to be familiar with the following terms:

- *Submitter*: Sun Microsystems employee in charge of preparing packages for distribution.
- *Package*: software application that can be used by any Sun employee inside the company.

Requirements for software distribution

- *Identification*. All packages for installation must be assigned to a Sun employee before distribution can begin. This employee is usually the Head of the Operations Department for the region. The information required is:
 - Name of the individual or department group.

- Identification and supply of the resources needed to deal with any problem with the application, regardless of whether the questions concern the end of the product's life, support, bugs or maintenance.
 - Identification of the contact person for any product support issues.
- Approval. All packages for installation must be approved by the Head of the Operations Department for the corresponding region, which guarantees functionality of the application and coordination of compatibility with other products, databases and applications relevant to the business aims. The Head of Operations must be perfectly aware of the company's aims, the risk of a fault in the product launch and the product requirements in order to determine departmental resources needed to make the distribution a success.

Product distribution requirements

- Use of `preptool`. This tool, exclusively for Sun Microsystems' internal use, allows us to combine and organise the data needed to prepare a package for distribution. All of the relevant information must be entered to ensure operability of the package across the company.
- Export control. Since Sun Microsystems is a US company with offices in different countries, the product must meet the import/export regulations of each country. These regulations are described in Sun's export control department (*Sun International Trade Services*).

The *SoftDist* distribution hierarchy and the network topology allow software packages to be distributed to all Sun offices around the world, even in countries where trade with the US is restricted, thanks to agreements with their governments.

The products developed at Sun Microsystems R&D centres in countries other than the United States must also abide by the regulations of the International Trade Services department.

- Contact with the Product Support Centre. The Head of the Operations Department must contact the Head of the Support Centre as part of the pre-distribution preparations for the package in order to define the product support mechanisms and the support resources and contact person.

Verification of package functionality during distribution

- Functional testing. The Head of Operations must ensure that the packages for installation will not compromise the productivity or functionality of other applications and that they will not affect business operation from the point of view of systems performance.

The packages for distribution must run correctly on the two operating systems supported by Sun: Solaris and GNU/Linux.

As explained earlier, the packages must be validated in a simulated environment before global distribution. The package proprietor is responsible for setting the criteria to determine whether the package is suitable for distribution; in most cases, this figure is the person responsible for development of the product or the Head of IT Operations.

- Management of application faults. The Sun IT Operations Department, acting under the head of this department, must provide global network users with a guarantee period and respond to any issues raised during this period, which begins on distribution of the package. Risk situations are processed differently from the standard procedure.

If a bug has not been detected in the application for distribution and it appears within the first week of distribution, the Operations Department must assume any expenses arising from this moment on. This same procedure is applied when the distributed package has a severe impact on Sun systems performance, causing delays that affect normal activity or prevent users from opening other applications from their workstations. The criteria for determining whether a package has been distributed correctly are as follows:

- Users must be able to launch the application from their workstations without administrator intervention.
- The application cannot access areas that the user launching it does not have permission to access.

After distribution of the software, the Head of IT Operations for each region must obtain metrics of its results by auditing the installations and reporting any unsuccessful cases, detailing the reasons for them and the plan of action to be put in place.

Figure 46.

	Q1 FY04			Q2 FY04			Q3 FY04			Q4 FY04			Q1 FY05			
	Pass	Fail	Exempt	Pass	Fail	Exempt	Pass	Fail	Exempt	Pass	Fail	Exempt	Pass	Fail	Exempt	
Printer Alias	100.00%	0.00%	0.00%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Printer Alias
Printer Firmware	100.00%	0.00%	0.00%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Printer Firmware
Console Server	98.36%	0.00%	1.64%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	Console Server
DHCP	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	DHCP
ENSMail	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	ENSMail
IAS Audit Client	97.84%	0.00%	2.16%	95.59%	0.00%	4.41%	97.95%	0.00%	2.05%	99.49%	0.00%	0.51%	98.35%	0.00%	1.65%	IAS Audit Client
Infrastructure Aliases	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	Infrastructure Aliases
Samba	97.73%	0.00%	2.27%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	Samba
SOMS	0.00%	0.00%	100.00%	100.00%	0.00%	0.00%	87.50%	0.00%	12.50%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	SOMS
Sun Cluster	95.83%	0.00%	4.17%	100.00%	0.00%	0.00%	70.97%	0.00%	29.03%	78.57%	0.00%	21.43%	100.00%	0.00%	0.00%	Sun Cluster
SUNMC 3.0	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	98.97%	0.00%	1.03%	99.45%	0.00%	0.55%	97.84%	0.00%	2.16%	SUNMC 3.0
Sunray	95.24%	0.00%	4.76%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	Sunray
Sunray Naming	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	Sunray Naming
Timetone	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	Timetone
Solidist	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	Solidist
Java Desktop System	N/A	N/A	N/A	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	98.89%	0.00%	1.11%	Java Desktop System
ITNetGen	N/A	N/A	N/A	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	ITNetGen
NAMM	N/A	N/A	N/A	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	NAMM
Printer	N/A	N/A	N/A	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	Printer
Patches	N/A	N/A	N/A	100.00%	0.00%	0.00%	94.59%	0.00%	5.41%	79.31%	0.00%	20.69%	96.76%	0.00%	3.24%	Patches
Webcache	N/A	N/A	N/A	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	Webcache
Puppet	N/A	N/A	N/A	30.00%	0.00%	20.00%	97.56%	0.00%	2.44%	97.30%	0.00%	2.70%	97.44%	0.00%	2.56%	Puppet
Regtool	N/A	N/A	N/A	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	Regtool
Backup	N/A	N/A	N/A	N/A	N/A	N/A	97.30%	0.00%	2.70%	96.97%	0.00%	3.03%	96.97%	0.00%	3.03%	Backup
GSM	N/A	N/A	N/A	N/A	N/A	N/A	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	GSM
UAM	N/A	N/A	N/A	N/A	N/A	N/A	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	UAM
Printer Centralization	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	Printer Centralization
Total Results	92.33%	0.00%	7.67%	98.84%	0.00%	1.16%	97.70%	0.00%	2.30%	98.04%	0.00%	1.94%	99.45%	0.00%	0.55%	Total Results

Installations have a quarterly review, at which the support group covers issues detected after the first week of installation.

Other metrics that need to be taken into account by Sun's Operations Department are DPMO (Defects Per Million Opportunities), which attempts to reflect the final result of the quarterly software distributions.

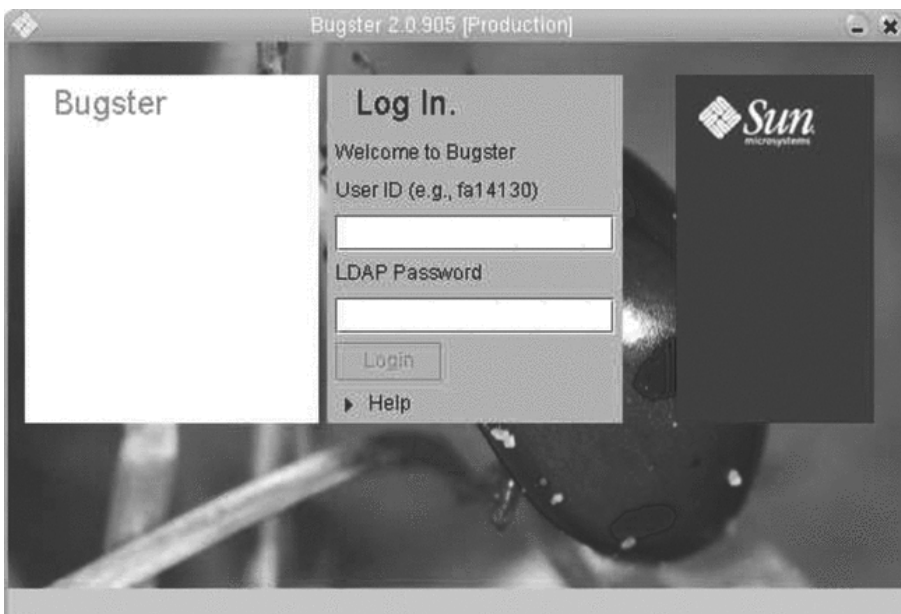
3.6. Product support

We have already explained that the IT Operations Department is responsible for the correct performance of applications (both free and proprietary software) at Sun. However, any problems detected in distributed packages, whether in design or development, are the responsibility of the product development group.

Any detected bugs can be fixed during the product maintenance phase but it is often the case that a bug found in a package can have a direct impact on a systems performance, and hence on the day-to-day activity of the company. To avoid these problems, there is a standard procedure for assigning a higher priority to the JDS code review, allowing the engineers in charge of product maintenance to solve it as soon as possible.

When a bug is found in a package or application, it is usually reported to the Operations Department, which must then contact the product support team. To do so, Sun has created a bug reporting tool for users to enter information on the type of bug, the part of the application where it occurs, etc.

Figure 47.



The tool can be accessed from any workstation. Users simply need to enter "bugster" and a Java application will ask users to identify themselves and enter the corresponding information.

3.7. Corporate training

The Sun Microsystems Education Department draws up tailored training plans for departments that require special JDS workstation training, offering users intensive courses on the product (user level). This training is only provided if formally requested by the department that needs it, which must also indicate the staff that will attend the courses.

There are different course formats depending on the availability of the employees:

- Users with basic training needs or who cannot leave their workstations can attend on-line training with Internet courses.
- More advanced groups or employees who are able to travel can receive on-site training with an instructor.

In all events, each department must assume the costs of training its staff.

4. Cometa Technologies

4.1. Introduction

This chapter will look at open source software from a business angle, using the real case of an SME, Cometa Technologies, that uses it intensively.

As we will explain, when a company chooses to use free software in the technology solutions it adopts, it opens itself up to a series of benefits that would not otherwise exist or be so obvious. For example, the use of free source software results in cost savings, supplier independence, shorter development times, etc. With open source solutions, the suppliers of related services also reap the benefits.

Free software offers a myriad of possibilities to companies wishing to provide related solutions. This chapter will describe the basic services that Cometa Technologies offers to its clients in order to help them rise to their challenges: development and integration of projects based on the use of free software tools, and training and consulting on the subject.

The cases described in the different sections show how Cometa Technologies uses free software in projects for very diverse companies. They show how this type of solution is now a real alternative to those based on proprietary software.

At the end of the chapter, the student should:

- understand the basics of the business model of Cometa Technologies, as an example of an SME that bases a considerable proportion of its business on the use of free software;
- understand the business benefits of an intensive use of open source tools, from the point of view of a technology solutions provider and from that of clients;
- be able to reflect on the main services associated with free software that companies can offer; and
- be familiar with real examples of free software in diverse business sectors.

4.2. Company presentation

Cometa Technologies is a private sector company that provides information technology solutions based on free software tools and standards.

Figure 48.



Website

Visit Cometa Technologies' website at:
<http://www.cometatech.com>.

Broadly speaking, Cometa Technologies offers two lines of services to clients:

- Development and integration of technology solutions. This line of solutions is designed to fully adapt to the functional needs of clients and to make the most of the products available in order to minimise development and implementation time.
- Training and consulting. This line of solutions has been designed to equip clients with the knowledge to choose the right technologies, know their possibilities, and use them.

Note

We will look at these services in detail later on.

The staff of Cometa Technologies are experts in information technologies and in using them to solve real business problems. With its knowledge of the free software movement (philosophy, aims, available tools, etc.), Cometa Technologies can help its clients to tackle their concerns by applying and integrating the most appropriate technologies into long-term reliable solutions at economical rates.

Cometa Technologies was founded to bridge the gap between the free software community (their knowledge of the tools that they have produced, how they relate to each other, which ones are the most interesting, etc.) and companies (which need turnkey solutions with subsequent maintenance).

This knowledge and its application constitute the *core competency* of Cometa Technologies, a skill that sets it apart from its competitors and gives it an edge, since:

- it offers potential access to a wide variety of markets;
- it increases the benefits for clients; and
- it is difficult to imitate.

Given that Cometa Technologies offers solutions through the use of technology, we will now describe the main technical features of the projects that it carries out:

- Reliability and scalability. The solutions provided by Cometa Technologies are stable, always function as planned and can grow with the client company.
- Application of the most appropriate technologies. The Cometa Technologies team is aware of the possibilities of the various technologies available at any given time and is thus able to apply the most appropriate one to each case.
- Use of free software tools. Cometa Technologies specialises in the use of this type of tool, which means that it can take full responsibility for their correct operation and incorporate their advantages into the projects in which it participates.
- Use of standards. Cometa Technologies uses technology standards wherever possible, both in the solutions it develops internally (tailored development) and in those incorporating third-party products (open source project integration).

Note

We will return to this point in the "Use of free software at Cometa Technologies" section.

4.2.1. Working methodology of Cometa Technologies

The life cycle of a Cometa Technologies project generally encompasses the following phases:

- Initial study in conjunction with the client of the new needs and possible ways of meeting them.
- Drafting of a proposal that sets down the general lines of the suggested solution and the time/staff required to carry it out, together with a financial appraisal.
- Design of the solution, including a detailed analysis of free software tools and standards that could be used to add value to the project (shorter development time, enhanced security, etc). In this phase, constant communication with the client is critical for the validation of partial results.
- Acceptance and implementation of the solution with a strong focus on the training of the users or technicians who will be involved in the everyday operation of the solution so that it can be used to its best advantage.
- Maintenance of the solution to guarantee correct operation (corrective maintenance) and evolution (upgrade maintenance), depending on the needs of the client.

Cometa Technologies also markets its knowledge and expertise in certain areas of IT in a variety of ways: consulting, training, etc.

To sum up, we could say that the aim of Cometa Technologies is to offer a quality service to its clients, which means emphasising the following points in particular:

- Accessibility and communication. Clients are able to contact Cometa Technologies easily for the hire of its services. Communication with clients is fluid and constant and uses a language that both parties can understand (which is not always easy when talking about technology).
- Quick response. Clear willingness to respond and provide a quick service based on the description of the client's needs.
- Understanding of clients. Efforts are made to assimilate and deal with the needs of clients.
- Professionalism. Cometa Technologies has and uses the knowledge to propose the best solutions and implement them effectively.
- Credibility and reliability. The company portrays an honest image based on getting the job done well with total transparency and on providing the promised solutions (which work as planned) by the agreed deadline.
- Security. With the service provided by Cometa Technologies, clients do not feel that they are taking risks of any sort and there are no pitfalls or concerns about the service provided.

Its use of open source and standards allows the company to offer some of the service features described above, particularly those concerning factors such as reliability, professionalism and security, which can help to enhance the overall sense of quality perceived by the client.

4.3. Use of free software at Cometa Technologies

4.3.1. Information technology challenges for companies

In this climate of economic instability and constant technological change, all firms, whether small businesses or big corporations, face challenges in this area:

- Reducing the time to project launch from its conception. Information technology projects have to produce short-term results: we need to see the benefits of our actions and investments in a short space of time.

Note

The "Solutions offered" section contains a detailed description of the solution development phase of the project life cycle and the different approaches taken.

Note

Understanding of clients and professionalism are key to the activities of Cometa Technologies: the aim is to generate benefits for the client.

- Improving integration with other systems. Companies increasingly find themselves with inherited components in information technologies (rarely do they start from scratch), so project success is not simply about obtaining the expected results in isolation but rather that the project integrates seamlessly with the other technology used in the various business processes of the company.
- Increasing security. Companies need to prevent the theft of confidential information, keep their technology systems running around the clock, guarantee the privacy of the data they handle, etc. In our increasingly complex technological environments, security has become one of the chief concerns of many companies.
- Maintaining independence from suppliers. Companies are becoming increasingly interested in remaining independent from their technology suppliers in order to avoid situations (as has occurred in the past) in which suppliers, seeing that their clients are in no position to make demands of them, tend not to meet their needs as they once did (for instance, putting up their prices for no apparent reason).
- Improving the use of technology solutions, taking into account that they are used in different countries and cultures. It is increasingly common for companies to have systems used by international teams. Technology projects, like all other company actions, must take into account the need to adapt to this variety of circumstances.
- Cutting costs. The pressure is on to cut the TCO (*total cost of ownership*) and increase the ROI (*return on investment*) of projects carried out in our uncertain economic climate.

Note

* TCO: cost of hardware and software purchasing, staff costs (technical and user training, engineering, etc.), cost of support (installation, maintenance, etc.) and costs incurred through malfunctions (downtime, lost business opportunities, etc).

4.3.2. Role of Cometa Technologies in meeting business challenges

Since Cometa Technologies provides solutions through the use of information technologies, it needs to respond to the challenges faced by its clients. As explained earlier, the use of free software tools and standards allows Cometa Technologies the possibility of enhancing the quality of the services it offers and equips it with the know-how to help deal with these challenges. The following sections will look at each of these points in turn.

Use of free software

Free software provides us with the source code, which can be freely redistributed and modified. Thousands of people around the world create and maintain free software and millions more use it on a daily basis.

The advantages of basing solutions on free software for Cometa Technologies and its clients include:

- Increased reliability and security. The use of free software improves security, particularly because:
 - It offers greater transparency: anybody can detect and fix bugs; *a peer review process is used for this purpose.*
 - There are more privacy guarantees, since code audits can be carried out (this is impossible or difficult to do with proprietary software.
 - It allows independence from suppliers: a client company can freely decide to terminate relations with a supplier if dissatisfied with its services. The company will not find itself trapped again because it has everything it needs to continue the project alone or with a new supplier.
- Enhanced performance and scalability. In some cases, we can use free software tools to take full advantage of hardware that would otherwise be regarded as obsolete or which would be under-used. Scalability is guaranteed through the various free software applications (ones that normally perform critical functions in a solution) equipped to grow with the problem we are dealing with (all without having to pay for new licences, extend existing ones, upgrade professional versions to enterprise editions, etc).
- Absolute flexibility and freedom. The use of free software tools helps to reduce the time between the conception of a project and its launch because software components – and their source code – that have already been developed can be reused (with no purchase fees). Hence, this code can be adapted to the specific needs of individual clients. The ability to modify existing tools also means that they can be adapted for different countries and cultures.
- Savings in purchase fees and maintenance. These savings are made because there are no purchase fees for the various software tools used (libraries, database engines, content managers, web servers, etc). Hardware purchase costs are slightly lower and maintenance costs could also be reduced because of increased security, the absence of recurrent licence expenses (which add no real value to the solution), etc.

The following is a list of some of the open source tools that Cometa Technologies regularly uses in the solutions it designs:

- Databases: MySQL (<http://www.mysql.com/>), PostgreSQL (<http://www.postgresql.org/>).

- Operating systems: different GNU/Linux distributions, such as RedHat, (<http://www.redhat.com/>) and Debian (<http://www.debian.org/>).
- Web servers and applications: Apache (<http://httpd.apache.org/>), JBoss (<http://www.jboss.org/>), Tomcat (<http://jakarta.apache.org/tomcat/>), Cocoon (<http://xml.apache.org/cocoon/>).
- Office productivity: OpenOffice (<http://www.openoffice.org/>), DocBook (<http://www.docbook.org/>).

Use of standards

As with the use of free software applications, intensive use of standards can help improve the quality of the solutions offered and meet the challenges of Cometa Technologies' clients.

Free software and standards are clearly complementary. We understand *standards* in the broadest sense of the word to mean:

- de jure standards. Standards approved by an organisation set up for their formal definition, such as ISO (<http://www.iso.org/>).
- Open standards. Standards approved by consensus and public acts for use by any company, such as those defined by OASIS, Organization for the Advancement of Structured Information Standards (<http://www.oasis-open.org/>).
- de facto standards. Standards adopted as a result of their extended use and general acceptance, such as the PDF format created by Adobe (<http://www.adobe.com>).
- Proprietary standards. Standards controlled by a particular company that are not made public for use by other companies, such as some Microsoft file formats (<http://www.microsoft.com>).

As far as possible, free software projects will generally use existing standards because they coincide with many of its aims, such as reuse and interoperability. Indeed, it is increasingly common to come across organisations that create standards developing reference implementations for these, which they release under one of the existing free software licences.

By using standards in the fields in which it implements solutions, Cometa Technologies can:

- Make the most of the experience and know-how of others in their respective fields of business or technology. This results in lower project costs because better solutions are reached in less time.
- Offer interoperability and ease of integration with other systems. The use of standards allows improved and easier connection of new systems to existing ones through the use of standards common to both.
- Reuse existing tools or create new ones that can be reused in the future, with the associated cost savings. Many standards have reference implementations or associated free software projects, meaning that when we use them, not only do we benefit from their inherent advantages, but we also obtain access to a series of tools that have already been developed and tested.
- Maximise the longevity and growth capacity of developments. By using standards, we are encouraging the future evolution of solutions because they are supported by a series of elements (specifications, free and open source implementations, etc.) that improve by themselves, allowing integration with new elements that did not exist or were unknown at the time.

The technology standards regularly used by Cometa Technologies include:

- Presentation of information: XHTML (<http://www.w3.org/TR/xhtml1/>), PDF (<http://www.adobe.com/>), SVG (<http://www.w3.org/Graphics/SVG/>), VoiceXML (<http://www.voicexml.org/>), WML (<http://www.openmobilealliance.org/>).
- XML and web services: XML (<http://www.w3c.org/XML/>), XSL (<http://www.w3.org/Style/XSL/>), SOAP (<http://www.w3.org/2000/xp/Group/>), WSDL (<http://www.w3.org/2002/ws/>), UDDI (<http://www.w3.org/2002/ws/>).
- Programming languages: Java (<http://java.sun.com/>), Perl (<http://www.perl.com/>), PHP (<http://www.php.net/>), JavaScript (<http://www.ecma-international.org/>), C (<http://std.dkuug.dk/JTC1/SC22/WG14/>), C++ (<http://std.dkuug.dk/JTC1/SC22/WG21/>).
- Methodologies and support tools: Métrica 3 (<http://www.csi.map.es/csi/metrica3/index.html>), UML (<http://www.uml.org/>), Extreme programming (<http://www.extremeprogramming.org/>).

4.4. Solutions offered by Cometa Technologies

The solutions offered by Cometa Technologies can be grouped into the following broad areas:

- Tailored project development based on the use of free software programs and standards.
- Integration of existing free software applications into new or existing projects.
- Consulting on the use of different technologies, standards and free software tools.
- Training in different technologies, standards and free software tools.

Note

The following sections will describe these areas in more detail, analysing the advantages that they can offer to clients using the example of a real case for each.

The services offered by Cometa Technologies relate to the company's knowledge of information technologies and the specific development (in the broadest sense of the word) of projects in the framework of free software tools and standards. Hence, its services are merely different ways of utilising this knowledge, i.e. of maximising its use of the skills that constitute competitive advantages for the company.

This knowledge has become even more valuable in the light of the current use of free software solutions in companies, which are facing the following problems:

- Lack of support, whether because they lack qualified staff or because there are no stable organisations that can provide support to projects. Cometa Technologies offers the possibility of outsourcing projects and carrying out their subsequent maintenance (hence assuming responsibility for them) or of passing on the necessary know-how so that companies can carry out this task internally. Besides its training and consulting services, Cometa Technologies affords help to companies for selecting and discovering which free software projects will obtain greater success now and in the future, in order to minimise the risks involved in their adoption.
- Immature business models. The projects carried out by Cometa Technologies are guaranteed by the experience it has accumulated over the years in information technologies, specifically in free software, for which it can cite many success stories.
- Lack of applications or immature applications, supported by *de facto standards*. With its consulting service (whether in isolation or as an integral part of a large-scale project), Cometa Technologies helps its clients to find and use the most mature and stable free software applications, complementing them where necessary – hence contributing to the

evolution of the tool through its development and integration services – and taking responsibility for its correct operation.

- A lack of organisations that can systematise free software diffusion and training. Cometa Technologies offers a training service tailored to client needs that provides specific information on given areas (mainly standards and free software tools). In addition, the UOC offers the possibility of obtaining a generic but very comprehensive background in free software with its International Master's Degree in Free Software.

4.4.1. Development of tailored projects

The tailored development services offered by Cometa Technologies consist of the design and implementation of solutions adapted to the specific needs of its clients, with the most suitable technologies for meeting these needs and an intensive use of free software tools and standards.

The main tasks carried out by Cometa Technologies for its tailored projects are:

- Project management: Cometa Technologies plans, controls and monitors the project outsourced by the client.
- Feasibility study: Cometa Technologies carries out a study prior to the project launch to confirm its financial and technical feasibility, among other aspects.
- Analysis: in conjunction with the client, Cometa Technologies conducts a functional analysis of the project, i.e. it specifies the business requirements that need to be met.
- Design: Cometa Technologies obtains the models and specifications defining the technology project based on the functional analysis performed with the client. The various free software solutions to be used and standards to be followed will be introduced at this stage.
- Construction: Cometa Technologies takes care of the technical development of the project, for which it uses free software tools such as frameworks, libraries, services, etc. Each of the modules required to meet the business requirements are developed and the necessary unit and integration tests are conducted.
- Implementation: together with the client, Cometa Technologies takes the developed systems to the production stage, carrying out any migrations and the appropriate implementation tests. It is during this phase that training is carried out for the end users and technicians of the client

company who will be using or carrying out maintenance of the developed solution.

- **Maintenance:** once the developed project has been accepted, Cometa Technologies takes over its maintenance, which may be corrective or upgrade, depending on the level of service agreed with the client.

To carry out these tasks, Cometa Technologies uses free software programs, either with the express knowledge of the client when these tools form part of the solution provided (such as use of a database management system like MySQL or web service programming libraries like Apache Axis), or without it, reporting only the results obtained (such as project planning using Planner or writing up of project documentation with DocBook).

Website

Apache Axis:
<http://ws.apache.org/axis>
Planner: <http://live.gnome.org/Planner>

Once the system developed to meet the needs of the client has been accepted, Cometa Technologies provides the client with the full source code for the solution. This code can then have one of the following destinations:

- **Release via the projects of the free software tools used in the solution.** Cometa Technologies maintains a strong commitment to free software so any development produced for a client will adhere strictly to the licences for the tools used. The changes made to the free software tools used in the projects (bug fixing, new features, etc.) are released under the corresponding licence and sent for incorporation into the aforementioned tools (with the corresponding benefits for the client of the solution).
- **Non-release, if the client so wishes.** The source code developed specifically by Cometa Technologies for a given solution, which is not subject to compulsory release under any licence, will remain in the hands of the client. The client is thus the proprietor of the code and may decide not to release it for a variety of reasons.
- **Release, if the client so wishes.** Cometa Technologies always encourages its clients to release the source code of the developed projects that they own exclusively, explaining the advantages of the free software development model over proprietary alternatives.

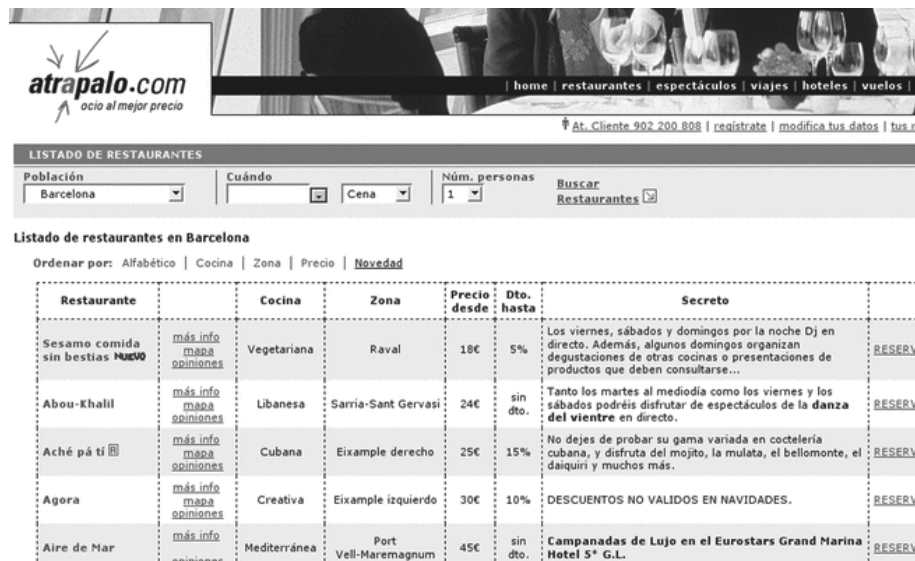
Atrapalo.com

The private sector company Atrapalo.com (<http://www.atrapalo.com>) bases its business on e-commerce with the promotion and placement of surpluses from the leisure sector (flights, hotels, car rental, shows, etc.), transforming them into offers on the Internet.

Cometa Technologies developed the restaurant table booking system of the Atrapalo.com website using the site's technology platform and diverse free software tools.

The table booking system was approached from the outset as a tailored project, given that it had to be fully integrated into the Atrapalo.com system, using the existing technological infrastructure and maintaining its technical approach. The end result was a series of applications based on the use of open source tools (including PHP and MySQL) that met the needs of the client.

Figure 49.



atrappalo.com
ocio al mejor precio

home | restaurantes | espectáculos | viajes | hoteles | vuelos

At. Cliente 902 200 808 | regístrate | modifica tus datos | tus r

LISTADO DE RESTAURANTES

Población: Cuándo: Cena Núm. personas: [Buscar Restaurantes](#)

Listado de restaurantes en Barcelona

Ordenar por: Alfabético | Cocina | Zona | Precio | **Novedad**

Restaurante	Cocina	Zona	Precio desde	Dto. hasta	Secreto	
Sesamo comida sin bestias NUOVO	Vegetariana	Raval	18€	5%	Los viernes, sábados y domingos por la noche Dj en directo. Además, algunos domingos organizan degustaciones de otras cocinas o presentaciones de productos que deben consultarse...	RESERV
Abou-Khalil	Libanesa	Sarrià-Sant Gervasi	24€	sin dto.	Tanto los martes al mediodía como los viernes y los sábados podréis disfrutar de espectáculos de la danza del vientre en directo.	RESERV
Aché pá tí	Cubana	Eixample derecho	25€	15%	No dejes de probar su gama variada en coctelería cubana, y disfruta del mojito, la mulata, el bellomonte, el daiquiri y muchos más.	RESERV
Agora	Creativa	Eixample izquierdo	30€	10%	DESCUENTOS NO VALIDOS EN NAVIDADES.	RESERV
Aire de Mar	Mediterránea	Port Vell-Maremagnum	45€	sin dto.	Campanadas de Lujo en el Eurostars Grand Marina Hotel S ^a G.L.	RESERV

4.4.2. Integration of tools

The tool integration services offered by Cometa Technologies use existing free software solutions that are parameterised to adapt them to the features of client businesses. The basic tasks carried out by Cometa Technologies in its tool integration projects are the same as those for a tailored development.

The integration of free software tools, in contrast to tailored development services, is not limited to the use of libraries, *middleware*, and so on, as it uses projects that can cover entire functional areas simply by parameterisation or with very specific changes.

Cometa Technologies offers complete solutions based on the use, parameterisation and customisation of open source content managers, such as ezPublish (<http://www.ez.no/>) and monitoring tools, as Nagios (<http://www.nagios.org/>).

By starting out with mature final solutions that have been tested by teams the world over and whose source code is available under a licence allowing its modification at no extra cost, Cometa Technologies can offer solutions tailored to the needs of its clients while minimising the time and cost of development.

BJC Diálogo

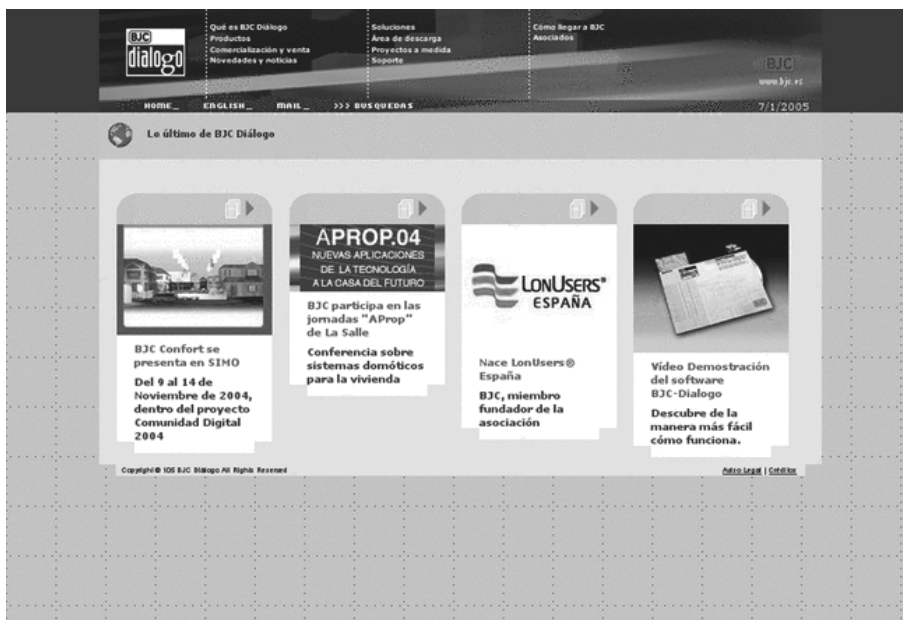
BJC Diálogo (<http://www.bjc-dialogo.com/>) is a subsidiary of BJC that markets intelligent technical home management systems to automate and manage power in small or medium-sized homes and to control the facilities on sales premises and in hotels and offices.

Together with the Grasa Studio company (<http://www.grasa.net/>), Cometa Technologies developed the corporate website of BJC Diálogo, where users can request information on tailored projects, find out news and discover innovations, access the company product brochure, read about domotics, etc.

The integration services offered by Cometa Technologies were the perfect partner for the BJC Diálogo corporate website, since the client's needs could largely be met by the use of free software applications developed essentially for content management.

Based on the graphic design provided by Grasa Studio, a series of templates were made; these templates were used with ezPublish, a free content manager. ezPublish needed some modifications and the addition of new modules to fully meet the specifications agreed with the client but a complete solution was provided in less time than would have been needed if development had been carried out from scratch, which also reduced the financial cost of the project.

Figure 50.



4.4.3. Consulting

The consulting service offered to clients by Cometa Technologies consists of providing professional support in decision-making processes within its specialist areas.

Through its consulting service, Cometa Technologies furthers the knowledge of its clients in specific areas allowing them to take more informed decisions and make the most of certain technologies, tools and standards, which they can use to their full advantage in their business.

Example

Cometa Technologies has helped clients in areas such as security in environments that make intensive use of free software solutions, particularly GNU/LINUX, *e-learning standards* such as ADL SCORM (<http://www.adlnet.org/>), security improvements and

Note

Cometa Technologies mainly provides advice on the selection, use and adaptation of free software solutions and standards, and on certain technologies in which it has expert knowledge.

optimised performance of specific tools such as Apache web server or the Tomcat applications server.

Context Scanning Technology A/S

Context Scanning Technology A/S (<http://www.context.com/>) is a multinational with head offices in Denmark. The company produces and markets plotters and scanners for professionals.

Cometa Technologies provides technological security consulting services to Context Scanning Technology A/S and audits some of its products in this field.

Cometa Technologies conducts two types of security audit for Context Scanning Technology A/S: monthly, designed to check the security of the system, taking into account its various points (operating system, services offered, etc.), and one-off, of a wider scope, before *release* of the audited product (generally every nine months).

The audits generate documents and sets of tests as output that inform the client of possible security issues with its products, if applicable: how a potential attacker might take advantage of them and what risks they would pose. The audits require the performance of security tests for the various free software tools used by Context Scanning Technology A/S in its products and the use of free software applications used to verify system security, such as Nessus (<http://www.nessus.org/>).

4.4.4. Training

With its training service, Cometa Technologies transfers its knowledge of specific technological areas (free software tools, standards, etc.) to the staff of its clients.

The purpose of this training is to equip staff at the client company with the skills for understanding and using certain technologies, free software tools and standards that could generate competitive advantages.

Cometa Technologies provides systematic and rigorous training based on the programme agreed with the client and tailored to the specific needs of the latter. In addition to the knowledge gained by the company staff who participated in the training, this service also includes a complete set of documentation describing the issues dealt, which can be used as reference at a later date. Where the client gives its express consent – always with the encouragement of Cometa Technologies – this documentation is released under an open licence, such as GFDL, GNU Free Documentation License (<http://www.gnu.org/copyleft/fdl.html>) or Creative Commons (<http://creativecommons.org/>).

Universitat Oberta de Catalunya (UOC)

The Universitat Oberta de Catalunya (Open University of Catalonia) is an institution that offers ongoing training to individuals. The subjects offered by the UOC include the International Master's Degree in Free Software, one of whose courses includes this material.

Cometa Technologies assists the UOC and the education of its students through its consulting services and by auditing the materials of various courses that form part of the university's International Master's Degree in Free Software.

The task covers the design of materials for courses that make up the International Master's Degree in Free Software, which include: *Databases.*, *Advanced software development concepts*. These are released with the UOC's consent under the GNU Free Documentation License. Some of the staff of Cometa Technologies also act as consultants on a number of courses for the degree.

4.5. Use of free software within Cometa Technologies

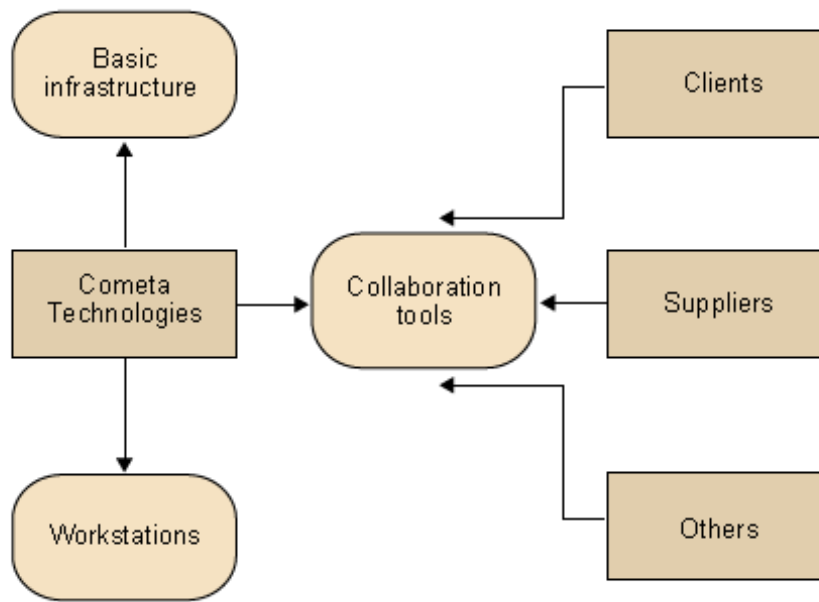
Given Cometa Technologies' commitment to free software and all that it entails, as one might imagine, the company's entire computer infrastructure is based on this type of solution.

The advantages of the use of free software applications for Cometa Technologies over proprietary alternatives are exactly the same as the ones it offers to its clients: greater flexibility, increased security, enhanced performance, cost savings, compliance with standards, etc.

The IT infrastructure of Cometa Technologies can be divided into the following broad areas:

- Basic infrastructure: tools for the everyday, basic operation of the company.
- Collaboration: tools for communication between company staff and between the latter and others (clients, for instance).
- Workstations: tools on the computers used by those who work at the company.

Figure 51.



The following sections will describe each of these areas in detail and analyse the free software tools used in each case.

4.5.1. Basic infrastructure

The basic IT infrastructure of Cometa Technologies allows it to carry out the basic operations necessary for the everyday running of the company, which include correct connection of the computer network to the Internet, sharing of files stored on central servers (which require backups to be made), etc.

The table below summarises the main software components used in the basic IT infrastructure of Cometa Technologies:

Type of application	Solution used
Operating system	GNU/Linux
Print server	Common UNIX Printing System
Routing	route (GNU/Linux OS kernel)
Firewall	iptables (GNU/Linux OS kernel)
DNS server	ISC BIND
DHCP server	ISC DHCP Server
Proxy cache	Squid
File server	Samba
Backups	Amanda

Type of application	Solution used
Directory service	OpenLDAP

4.5.2. Collaboration

The collaboration aspect of the IT infrastructure of Cometa Technologies uses tools for setting up channels of communication between company staff or between company staff and external agents (clients, suppliers, etc). These include the usual applications for Internet communication such as e-mail, as well as more specific applications to cover the particular needs of Cometa Technologies, perhaps not as common in other types of company.

Project monitoring tool

This application has a web interface and is used to manage aspects of the projects of Cometa Technologies' clients, including functional requirements, detected bugs, related documents, etc. Each user of this tool is assigned a profile (project manager, analyst, programmer, client, etc.) allowing him or her to carry out a series of actions in the areas mentioned. This tool is used to conduct meticulous project status controls and to keep clients informed of the status of their project at all times.

The table below summarises the main software components used in this area:

Type of application	Solution used
E-mail server	Postfix, IMAP
Fax server	HylaFAX
Project monitoring tool	Mantis
Web server	Apache
Database management system	MySQL
Content management	ezPublish
Version control system	Subversion

4.5.3. Workstations

Workstations are the computers, both laptops and desktop computers, used by the staff of Cometa Technologies. These individuals are assigned different profiles depending on the tasks that they perform (project management, marketing, technical development, etc.), but all of the workstations have the same basic setup, which only varies in the applications that they normally use.

Since all of the applications are free software and there are no licence fees payable for each workstation, user, etc., all applications are installed on all computers for convenience (any user can use any company computer and have access to all of the applications he or she needs).

The table below summarises the main software components installed on a basic workstation at Cometa Technologies:

Type of application	Solution used
Operating system	GNU/Linux
Office automation suite	OpenOffice
E-mail client	Thunderbird
Web browser	Firefox
Image editor	Gimp
Audio and video player	Kaffeine
Instant messaging client	Kopete
Personal information manager	Evolution
CD and DVD burning tool	K3b
Integrated development environment	Eclipse
Version control system	Subversion
Project planning	Planner
Diagram creation tool	Dia, Umbrello

4.6. Case studies

4.6.1. Tailored project

The following section describes the tailored project carried out by Cometa Technologies for the Derecho.com legal site (<http://www.derecho.com/>).

Presentation of the client

Derecho.com is a company providing quality legal services and content over the Internet to allow its clients to solve their legal issues, offering the possibility of consulting databases, asking questions about legal issues, looking up legislation and purchasing contract templates and case forms, among other services.

Presentation of the project

Derecho.com is a vertical legal website. Since its creation, Derecho.com has entrusted Cometa Technologies with the development and maintenance of the technology platform on which its business is based.

Figure 52.



Project aims

When the site was set up in 1999, the following aims were identified as essential:

- Ability to display the information managed on the site on different platforms (PCs, mobile telephones, PDAs, etc).
- Possibility of looking up content in different views for their transparent integration into third-party websites (*co-branding*).
- High availability: the platform had to be operative all day, every day.
- High performance: the platform had to support the concurrent access of hundreds of users and maintain reasonable response times.
- Minimal development and maintenance costs.

Figure 53.

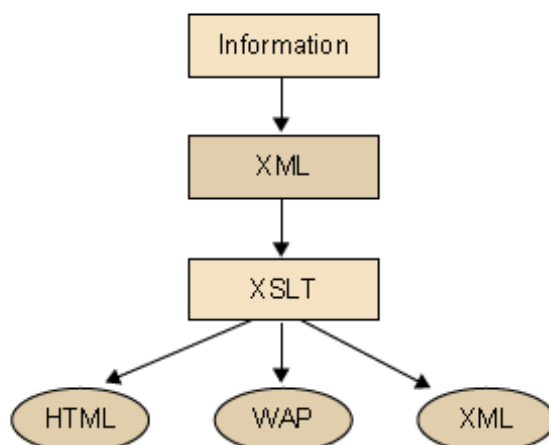
The screenshot shows the 'Derecho.com' website interface. At the top, there are banners for 'PaginasBlancas.es' and 'PaginasAmarillas.es'. Below them is a search bar and a navigation menu. The main heading is 'Consultas Jurídicas online'. A sidebar on the left lists various services like 'Consultas jurídicas', 'Control de medidas', and 'Revisión de contratos'. The central form is titled 'Formulario para plantear su consulta jurídica' and includes fields for 'Nombre y apellidos', 'Ciudad', 'País', 'E-mail', and 'Teléfono'. A 'Enviar' button is at the bottom. On the right, a section titled 'Mis informaciones' contains a list of questions about the service, such as '¿Cómo se formula la consulta?' and '¿Cuál es el coste del servicio?'.

Description of the solution

In order to meet the chief aims for content management, the decision was made to base the entire solution on XML for representing the information.

The contents are extracted from a database and expressed in XML. By transforming it using style sheets (XSL), the content is represented in diverse languages (XHTML, WML, XML, etc.), allowing it to be displayed on a range of platforms.

Figure 54.



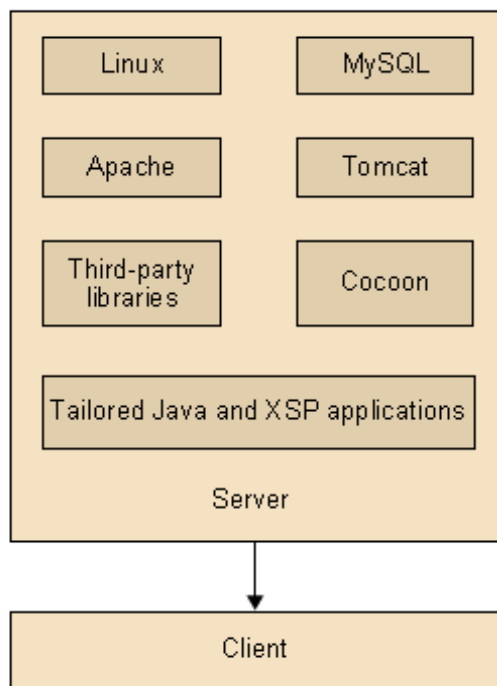
This process also adapts the graphic representation of the information to its destination. For example, a web page might be displayed differently depending on whether it is aimed at users of the Derecho.com site or users who consult it through other sites with which Derecho.com has set up agreements.

Tools used

To maximise the stability and performance of the platform and to save on development and maintenance costs, it was decided to use free software solutions, which included:

- GNU/Linux: operating system of the diverse servers housing the solution.
- MySQL: relational database management system storing all of the information.
- Apache and Tomcat: web server and servlet container on which the various applications are run.
- Cocoon: *framework* that facilitates and optimises the job of working with XML documents and XSLT operations.
- Third-party libraries.

Figure 55.



4.6.2. Integration

The following sections describe the integration project carried out by Cometa Technologies and 0 y 1 Factoría for I+C2 magazine (<http://www.fsjd.org/cat/ic2.php>), published by the Sant Joan de Déu Foundation (<http://www.fsjd.org/>).

Presentation of the client

The Sant Joan de Déu (FSJD) Foundation is a non-profit organisation created by the monastic order of San Juan de Dios (Province of San Rafael) to set up an area of action for the convergence of synergies in teaching and research

between the diverse centres and professionals that form part of the Order, particularly in Catalonia but without excluding those from other parts of Spain or even abroad.

The professional services firm 0 y 1 Factoría with which Cometa Technologies developed the project specialises in detecting innovations, stimulating creativity and coming up with distinctive digital spaces.

Presentation of the project

The online I+C2 (Investigación, Innovación, Ciencia y Compromiso or Research, Innovation, Science and Commitment) newsletter is an initiative of the Sant Joan de Déu Foundation designed to stimulate awareness and raise the profile of different innovative initiatives being carried out in research, teaching and social development within this institution.

Cometa Technologies was given the task of assisting the Sant Joan de Déu Foundation in the development and maintenance of the technology platform on which publication of the I+C2 magazine is based, working in collaboration with 0 y 1 Factoría, which was responsible for the creation, editing and publication of the newsletter contents.

Figure 56.



Project aims

The aims of the project were defined by the end client, the Sant Joan de Déu Foundation, and by the two companies that came up with the final solution, 0 y 1 Factoría and Cometa Technologies. They were:

- To create a technology platform with basic functionality for the management of an online magazine, including regular e-mails containing online news, the creation of editions grouping these news items, etc.
- To incorporate certain features that would add value to the newsletter, making the most of its use of the Internet as the channel of publication, such as search engines, customised subscriptions, multiple language support, etc.
- To allow easy and intuitive maintenance of the information generated by 0 y 1 Factoría or by end client of the solution, the Sant Joan de Déu Foundation.
- To prepare the solution for upgrade maintenance in a way that would allow the easy addition of new functional features and add value to existing ones.
- To minimise the financial cost of the solution and the time from the initial proposal to production.

Figure 57.



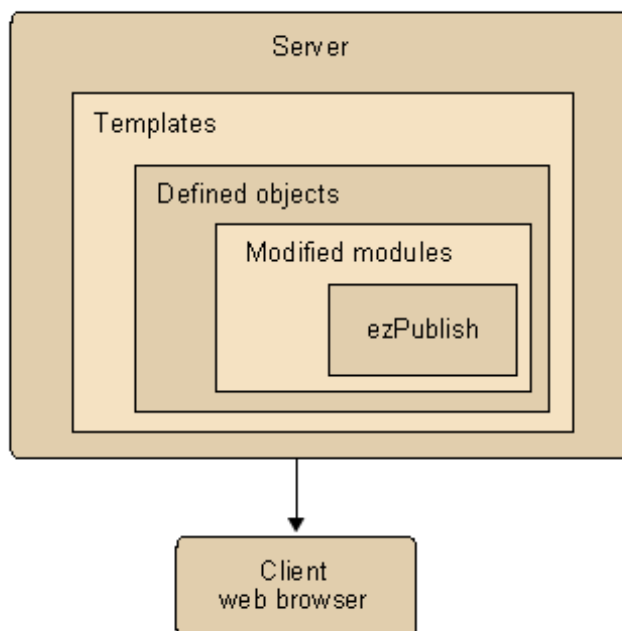
Description of the solution

To meet the required aims, it was decided to base the technological solution on the use of a content manager with a free software licence. This would give the team a large base to work with while minimising financial costs and the turnaround time for having the I+C2 newsletter site fully up and running.

The chosen content manager was version 3.3 of ezPublish, the most recent version available when the project was launched. The use of ezPublish necessitated the following tasks:

- Installation of the ezPublish content manager, integrating it with other elements such as the database engine, web server, etc.
- Creation of the objects for housing the contents of the website, such as article, edition, news item, subscriber, etc., indicating their attributes and views and taking into account multiple language support.
- Creation and modification of a series of templates used by the content manager to generate the HTML needed to publish the contents of the website; in this case, the I+C2 magazine.
- Creation and modification of a series of additional templates that the content manager uses for website content services, such as the search engine, important news, etc.
- Modification of certain content manager modules to add features that did not originally exist and are typical of an online magazine (grouping of articles in editions, management of user subscriptions and personal data, regular e-mailing of the newsletter, etc).

Figure 58.



Tools used

As explained above, the solution developed was based on the use and modification of ezPublish as a content manager of the I+C2 newsletter site. This application and those created specifically for the project were based on other free software applications, generating a stack of coordinated software that integrated a platform with the characteristics mentioned earlier in this module (reliability, security, low cost, etc).

Some of the tools used were:

- GNU/Linux: operating system of the server housing the solution.
- MySQL: relational database management system for storing all of the information used with the content manager.
- PHP: interpreter for the *script* language used by the content manager and the modifications that Cometa Technologies made to it.
- Apache: web server.
- ezPublish: content manager using the GPL licence.
- Third-party libraries.

Figure 59.



4.7. Summary

This chapter has looked at the case of Cometa Technologies, a private sector company that provides information technology solutions based on free software tools and standards.

Cometa Technologies offers its clients services in areas in which the company has an excellent knowledge:

- Development and integration of technology solutions based on the use of free software tools and standards.
- Training and consulting in specific technologies, free software tools and standards.

With these services, Cometa Technologies attempts to tackle the challenges of information technology projects faced by organisations today:

- Reducing the time to project launch from its conception.
- Improving integration with the company's other systems.
- Increasing system security.
- Maintaining independence from suppliers.
- Improving the use of technology solutions while taking into account different countries and cultures.
- Cutting the final costs of solution ownership.

The use of free software solutions is an important step in this direction because they offer the following advantages:

- Reliability and security.
- Enhanced performance and scalability.
- Flexibility and freedom.
- Savings on purchase and maintenance costs.

We have looked at Cometa Technologies as an example of a company that bases its entire computing infrastructure on the use of free software solutions. With the same aim, we described two case studies of the application of this type of solution (Derecho.com and the Sant Joan de Déu Foundation), which used the tailored project development and integration services, respectively.

Summary

The growing commitment of government authorities and major organisations to free software has worked wonders to improve its visibility and how it is perceived, proof of which can often be seen in the media.

Moreover, many experts and analysts consider free software to have the potential to drive economic development worldwide and in Europe in particular. For example, Gartner has said: "Free software is a catalyst that will restructure the industry, producing higher quality software at a lower cost".

By presenting a series of implementation cases, this module attempts to confirm the validity of the free software model as an alternative to proprietary software in diverse regions, contexts and economic sectors.

The impetus given by the Junta of Extremadura to free software in diverse areas of the public sector, particularly in education (with the LinEx distribution as its standard), was the first of these cases. Similarly, though on a much larger scale, we looked at the efforts of the Federal Government of Brazil to bridge the digital gap, a policy in which free software has played a crucial role. The cases of free software implementation in Extremadura and Brazil, despite their obvious geographical differences, have many points in common, including their motivation, and have served and continue to serve as an example to other governments and administrative agencies wishing to promote the development of free software in their respective areas of influence.

In all events, the policies introduced in both Extremadura and Brazil reveal a long-term commitment to stimulating the information society on the basis of free software. The existence of a project with mid- to long-term aims is a basic feature that sets apart sound free software initiatives with guarantees of success.

Turning to the private sector, the Sun Microsystems case study shows how a large company with a consolidated position and all that comes with it has managed to uncover new opportunities for technology and business development in free software. Nonetheless, it should be remembered here that the vast majority of free software development projects fail, even with business backing. One of the main reasons for the success of Sun and its projects lies in its ability to define a software development methodology that is compatible with the business and technological strategy of the organisation.

Lastly, Cometa Technologies shows us how free software can form the basis of a valid business model and an alternative to proprietary software, offering considerable growth potential for an SME with a local base, with the benefits of participating in the free software community and the use of free software tools and solutions whose quality has been confirmed across the world.

Bibliography

Acero, F.; Hontoria, L. (2000). *Manual de LinEx (GNU/Linux): Guía de referencia para trabajar con este sistema operativo*. Madrid: EDIT-IN.

Asociación de Usuarios Linux/Unix de Extremadura (GULEX) [online]: <http://www.gulex.org>

Asociación de Usuarios de LinEx (Sinuh) [online]: <http://www.sinuh.org/web/index.php>

Asociación Regional de Universidades Populares de Extremadura (coord.) (2001). *Alfabetización Tecnológica: Manual de Buenas Prácticas de Alfabetización Tecnológica en Extremadura*. Mérida: Consejería de Educación, Ciencia y Tecnología.

Asociación Regional de Universidades Populares de Extremadura (coord.) (2003). *Metodología de Alfabetización Tecnológica: II Manual de Buenas Prácticas*. Mérida: Consejería de Educación, Ciencia y Tecnología.

Consejería de Educación, Ciencia y Tecnología (2002). **Vivernet: Emprender en la Economía del Conocimiento**. Mérida: Consejería de Educación, Ciencia y Tecnología.

Consejería de Educación, Ciencia y Tecnología (2004). *El viaje virtual de Linextrmix: Todo lo que deseabas saber en cómic sobre gnuLinEx GNU/Linux software libre*. Mérida: Consejería de Educación, Ciencia y Tecnología.

Cosgrove, Lorraine (2002). "Open Source Gains Momentum". *CIO Research Reports*. [online]: <http://www2.cio.com/research/surveyreport.cfm?id=48>

Danish Board of Technology (2002). *Open source software in e-government*.

Fueyo Díaz, J. et al. *Manual en español de Squeak* [online]: <http://www.small-land.org>

Fundación Insula Barataria [online]: <http://www.ibarataria.org>

GNU Operating System-Free Software Foundation [online]: <http://www.gnu.org/>

Grimaldos Parra, J.J. (2003). *Guadalinex-edu: Manual básico de usuario*. Seville: Consejería de Educación y Ciencia.

Gustafson, Paul; Koff, William (2004). *Open Source: Open for Business*. Computer Sciences Corporation.

Hamel, Gary; Prahalad, C. K. "The Core Competence of the Corporation". *Harvard Business Review*.

Hickman, Amanda (2004). *Choosing and Using Open Source Software: A Primer for Non Profits*. [online]: <http://www.nosi.net/node/24>

Instituto Nacional de Estadística [online]: <http://www.ine.es/>

Linextrmix [online]: <http://www.linextrmix.com/>

Margulius, Dave (2003). *The real cost of switching to Linux*. [online]: <http://www.infoworld.com/t/platforms/real-cost-switching-linux-544>

Nuevos Centros del Conocimiento de la comunidad autónoma de Extremadura [online]: <http://www.nccextremadura.org>

gnulinux.net business portal [online]: <http://www.gnulinux.net>

www.linex.org freedom portal [online]: <http://www.linex.org>

Guadalinex project [online]: <http://www.guadalinex.org>

Guadalinfo project [online]: <http://www.guadalinfo.net>

LinExCol project (LinEx of Extremadura for Colombia) [online]: <http://www.linexcol.org/>

Vivernet project [online]: <http://www.vivernet.es>

Technological Learning Network of the Autonomous Community of Extremadura [online]: <http://www.rte-extremadura.org>

Robert Frances Group Inc. (2002). *Total Cost of Ownership for Linux in the Enterprise*.

Department for Planning, Statistics and Financial Analysis of the Autonomous Community of Extremadura [online]: <http://www.estadisticaextremadura.com>

Small-Land [online]: <http://www.small-land.org>

Soreon Research (2004). *Saving Cash: A Comparison of Open Source and Proprietary Software*.

Squeak [online]: <http://www.squeakland.org>

Stoller, Jacob (2004). *Open source: assessing the TCO picture*. [online]: http://www.managementmag.com/index.cfm/ci_id/2230/la_id/1

The Open Group. *Open Source and Standards*.

Wheeler, David A. (2004). *Why Open Source Software / Free Software (OSS/FS)? Look at the Numbers!*. [online]: http://www.dwheeler.com/oss_fs_why.html

Ullán de Celis, A.; Redrejo Rodríguez, J.L. (2004). *Linex*. Madrid: Anaya Multimedia.

Further reading

Abella, A. et al (2004). *El libro blanco sobre el software libre en España 2003: la informática libre en nuestro país*. Mérida: Consejería de Educación, Ciencia y Tecnología.

Álvarez Franco, P.M.; Martínez Montero, F. (2004). *Teseo Linex*. Mérida: Consejería de Educación, Ciencia y Tecnología.

Ball Satate University (2002). *Squeakers* [DVD]. [s.l.].

Centro de Fomento de Nuevas Iniciativas (coord.) (2004). *Aprender con gnuLinEx: experiencias docentes curso 2002-2003*. Mérida: Consejería de Educación, Ciencia y Tecnología.

Consejería de Educación, Ciencia y Tecnología (2004). *5 años de Alfabetización Tecnológica en Extremadura: 1999-2004* [DVD]. [s.l.]: Consejería de Educación, Ciencia y Tecnología.

Gómez Deck, D.; Redrejo Rodríguez, J.L. "Squeak en España como parte del proyecto LinEx" [online, in *Small-Land's Swiki*) http://swiki.agro.uba.ar/small_land

González Sánchez, J.L.; Gazo Cervero, A. (coord.) (2004). *Sociedad y software libre: Curso Internacional de Verano de la UEX sobre Software Libre*. Mérida: Consejería de Educación, Ciencia y Tecnología.

Guerrero Alonso, D.A.; Ortiz Durán, J.S. (2003). *Camino hacia Itaca*. Mérida: [s.n.].

gnuLinEx v.2.0 manual [online]: <http://guia.linex.org/pdf/manual.pdf>