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By Paul Dravis

Open Source Software

Perspectives for Development

infoDev

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The Dravis Group

Preface

During its first forty years of existence, informatics has moved from heavy centralization to distributed systems. Initially characterized by the multiplication of isolated smaller machines, micro-informatics was soon to be transformed by the Internet, i.e. the ability to connect a practically unlimited number of computers regardless of distance. In the process, new modus operandi and modus communicandi were introduced, whereby information could be exchanged between machines that functioned under different operating systems.

It did not take long before networked communities of users started to invent and share code about how to instruct various pieces of hardware to work together, and, progressively to develop application-specific software. Progressively, and sometimes erratically, new operating systems and software were being developed and used by an increasing number of individuals. Because the code on which this software was based was made available to all, and because any user could offer modifications and enrichments to any part of such code, the phrase 'Open Source Software' (OSS) became a natural way of describing it. Today, the number of individuals using and/or contributing to OSS has reached a sizeable level. A growing number of enterprises, and administrations, are using OSS.

Largely because a confusion is often made between OSS and 'free software', the debate about the respective merits of existing commercial solutions (proprietary software and operating systems) on one hand and those of OSS on the other has often been clouded by controversy. For developing countries and their enterprises, such confusion and controversy have been less than helpful. Today's reality is that users have a choice between many possible solutions to best satisfy their computing and networking needs. The more they know about the relative merits and possible limitations of such solutions, the likelier they will be to make the choices best adapted to their respective situations.

Much remains to be known, analyzed and measured about the visible and possible importance of Open Source for developing countries. As part of its mission to identify and share evidence of how information technology can contribute to development, infoDev is proud to have commissioned a study that explores how OSS has started to be used in developing countries, and what its potential could be in the future.

This study should not be regarded as a plea in favor of one type of operating system and software (OSS) as opposed to another (proprietary), but as a practical attempt to better inform the choices which enterprises and governments may face in developing countries when trying to do their share of 'bridging the digital divide'. It aims to help information technology decision makers in developing countries to understand the dynamics associated with OSS solutions. It informs about the technological trajectory of OSS development. Moreover, it illustrates the benefits and challenges related to using OSS as an alternative to other software. It also attempts to identify and describe examples of successful use (and possible best practices) of the OSS option in developing countries.

While the findings and opinions stated in this study do not necessarily reflect the views of either infoDev's or the World Bank Group, we hope that this modest step will be seen by all as a positive contribution to a healthy and productive debate about the respective merits of the various software solutions currently available to developing countries.

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Executive Summary

This report intends to help information technology decision-makers in developing countries understand the dynamics associated with implementing open source software solutions. We present information on the forces shaping the open source market in both the public and private sectors. Case studies, in Part II, illustrate ways in which Open Source Software is used or adapted to meet needs in developing regions. Perspectives from some who have examined the market are also presented to encourage the exchange of information and promote discussion of this important topic.

- ***Interest in Open Source Software (OSS) is increasing globally.*** Technology providers are broadening their support, deployments are increasing, investors are taking notice, new open source projects are appearing, and competitors and lobbyists are marketing against it. While the strength of these dynamics can be difficult to gauge, the trends are positive for OSS. However, concerns of an unproven business proposition, beliefs that the software is unreliable, along with technology terms, acronyms, and products that are unfamiliar to decision-makers necessitate continuing education and awareness building.
- ***OSS is about choice.*** While initial OSS interest is brought about by the potential for lower cost, a longer-term benefit may be increased choice to consumers of Information and Communication Technology (ICT). The emergence of OSS creates more options to address ICT needs. Solutions can mix both proprietary and OSS components. New development models emphasize collaboration and community. Market competition increases. Projects, when coupled with a focus on interoperability and open standards, should benefit from a greater emphasis on process/business needs and less on technical underpinnings.
- ***Government leaders have a key role to play.*** As software use expands into more areas of human endeavor, consideration should be given to improving access to the market for all software providers. The software market is dominated by a few proprietary providers who spend over $6.5 billion annually to communicate their message. There is a need to assist OSS initiatives in accessing market opportunities.
- ***There is opportunity for local capacity development.*** The nature of OSS lends itself to providing an ICT environment based on local ownership and autonomy. Software can be adapted to address localization, while introducing more flexibility and independence to the software development process. With OSS growth in an early stage for development, business opportunities exist for various complementary solutions and services.
- ***The debate: "open" versus "proprietary" software.*** The OSS debate is multifaceted and the rhetoric is increasing. Some organizations position the debate on the merits of commercial versus non-commercial software. With commercial interest in OSS increasing, the discourse should be centered on the merits of OSS versus proprietary solutions.
- ***OSS is but one part of an ICT strategy.*** Traditional development methodologies are still required to deliver high quality, usable and functional applications. OSS should be evaluated and deployed using the same methodologies and disciplined care as any other ICT solution.

While some challenges related to open source use in developing countries may be unique because of the social and economic landscape, most dynamics are global, requiring consideration by decision-makers in all countries.

Introduction

The emphasis on "openness" in open source software has fostered the growth of a world-wide community of developers contributing to the evolution and improvement of various software programs for use in networked servers and desktop systems ranging from operating systems and web servers, to e-mail, word processing and spreadsheets. While such a diffused structure for software development may seem chaotic, this approach is being considered as a more democratic alternative to monolithic single vendor efforts.

Interest in OSS is Likely to Grow

While ICT priorities will vary among countries, as it increases as a component of a country's development strategy, understanding OSS dynamics should also have more importance. With some discussions becoming quite passionate, decision-makers will have questions about the potential that open source software may offer, where and how it should be used, along with its potential risks.

OSS is Different from Proprietary Software

With OSS, the programming code used to create software solutions is available for inspection, modification, re-use and distribution by others. It is often assumed that open source software is free of charge. While this can be the case, OSS can be purchased for a fee as well. The concept of "free", in this context, emphasizes what can be done with the source code rather than its cost. Because of its collaborative nature, the open source model lends itself to allow participants to be both producers and consumers/users of the software.

OSS Arguments Range from the Technical to the Economic

The OSS topic incorporates the concepts of community, public good, non-commercialism, ecosystems, and issues of intellectual property, copyrights and patents. Underlying much of the discussion is that "information" in general, and "software" as a means of delivery is unlike other goods and services. Central to the discussion are the issues of when and if information should be "owned" versus "shared", what is the "value" of software, and when is it considered a commodity.

Structure of the Report

This report is presented in four parts. **Part I: Governmental Perspectives on Open Source Software Use** provides selected views, along with a review of governmental initiatives on OSS use. **Part II: Case Studies in Developing Regions** overviews implementations in Goa, India schools; telecenters in Sao Paulo, Brazil; and OSS adaptation efforts for use within Laos and Tajikistan. Each case presents the needs addressed, the technology used and lessons learned by the project teams. **Part III: The Current Dynamics of Open Source Software** presents a discussion on capacity development opportunities and varied benefits, selected private sector implementations, support by commercial technology providers and the status of the legal landscape. **Part IV: Pursuing the Open Source Software Option** presents issues for consideration when implementing OSS solutions, or starting an OSS development project.

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Governmental Perspectives on Open Source Software Use

Governmental Interest is Global

OSS, as a significant change agent in the software industry, has drawn interest from proprietary software interests, lobbyist groups, industry analysts and regulatory bodies. Accompanying the discourse is the creation of myths, misperceptions and concerns. In the process, governmental organizations, from the local to the national level, are considering or proposing rules or providing guidance in an effort to "level the playing field" between OSS offerings and those of proprietary providers.

There is a growing desire to more equitably share the benefits of software among both software users and software providers and pursue options which support the flexible use and interchange of data and information between systems, users and communities.

Motivations and proposals vary. Because the scope of OSS is broad, developing a single consensus perspective is unrealistic. Motivations driving governmental initiatives include: 1) controlling costs of both initial software licensing and upgrades, 2) increased control and access to intellectual property, 3) reducing reliance on proprietary software development organizations, and 4) promoting software use in the public sector as a public good. Some initiatives wish to "mandate" that open source solutions be used when all things are equal, others address the need for "consideration" of open source software alongside proprietary offerings when new purchasing decisions are being pursued.

It is noteworthy that governmental interest and activism is global and not aligned by geographic area, economic group or political philosophy. The following are examples of current governmental initiatives in various stages of review or implementation.

Australia

The South Australia government in Adelaide has introduced The State Supply (Procurement of Software) Amendment Bill 2003 which states that: "A public authority must, in making a decision about the procurement of computer software for its operations, have regard to the principle that, wherever practicable, a public authority should use open source software in preference to proprietary software."

Brazil

President Luiz Inacio Lula da Silva is finalizing a policy recommending that federal ministries, agencies and state enterprises install open-source software, such as Linux, instead of proprietary software on new computer systems. A goal of this policy is to have at least 80% of government computers purchased during 2004 support open source software.

In October 2003, Free Software Implementation Guidelines in the Federal Government was published.

China, Japan, and South Korea Collaboration

In September 2003, the governments of Japan, China and South Korea announced that they will work with the private sector to develop new operating system software for devices such as cell phones, digital cameras and car

navigation systems and the network server market. It is anticipated that the work will be based on Linux.

In November 2003, Gou Zhongwen, a vice minister at the Chinese Ministry of Information Industry said "Linux is an opportunity for us to make a breakthrough in developing software," "But the market cannot be developed on a large scale without government support."

Denmark

In October 2002, the Danish Board of Technology, in its report "Open Source Software in e-government", recommended that governments take an active role in promoting standardized file formats and alternatives to proprietary applications formats.

European Commission

In the "eEurope – An Information Society for All" (June 2000) it noted that "during 2001 the European Commission and Member States will promote the use of open source software in the public sector and eGovernment best practice through exchange of experiences across the Union (through the IST and IDA programmes)".

The European Commission released a report "Pooling Open-Source Software" to address cost savings by sharing software on an open source licensing basis. European administrations should share software on an open source licensing basis, to cut soaring eGovernment information technology costs. The study recommends creating a clearing house where public sector software applications can be donated for re-use and could encourage the replication of good practices in eGovernment.

In August 2003, the European Commission initiated an effort for "Encouraging good practice in the use of open source software in public administrations". The initiative will primarily focus on the development of national and regional open source competence centers to facilitate the exchange of information about opportunities and risks associated with open source software. In October 2003, the European Commision's "Interchange of Data Between Administrations (IDA) Open Source Migration Guidelines" noted that "There are many reasons for Administrations to migrate to OSS. These include: the need for open standards for e-Government; the level of security that OSS provides; the elimination of forced change; the cost of OSS. All these benefits result in far lower IT costs.

Germany

In May 2003, the City of Munich announced its plans to migrate 14,000 computers in its public administration to Linux and other open-source office applications. The migration program begins in 2004. Munich Mayor Christian Ude said the city was seeking greater IT independence and wanted to "set a clear signal for greater competition in the software market."

In June 2003, Otto Schily, Minister of the Interior Federal Republic of Germany stated "We raise the level of IT security by avoiding monocultures; we lower the dependency on single software vendors; and we reach costs savings in software and operation costs."

India

The Indian government has launched the Linux India Initiative that focuses on developing resource centers, special interest groups, pilot projects, assisting in the localization of Open Source software and to support the development of research studies.

Malaysia

The government is establishing a national OSS reference center directed by the Malaysian Administrative Modernization and Management Planning Unit. Among the activities to be carried out are the management of OSS implementation through the provision of consultancy, support and audit, formulation of policies and standards, certification and training, and OSS research and knowledge building.

In October 2003, The Ministry of Finance announced its plan allocate funds to the Malaysian Venture Capital

Management Bhd to sponsor independant OSS companies through its "OSS-Platform Investment Programme".

Philippines

The Philippine government has initiated an effort to develop a package of open source software products as well as a support mechanism for government agencies, schools, and small businesses. The Advanced Science and Technology Institute (ASTI), which falls under the Philippines' Department of Science and Technology (DOST) has released a simplified version of Linux called Bayanihan Linux (bayanihan.asti.dost.gov.ph).

ASTI is also developing enhanced thin client and embedded solutions using OSS. The DOST has also funded an OSS based information system that is being implemented by the National Computer Center for use by more than 3,000 local governments.

Pakistan

The Government has announced that Linux and Open Source products are at the forefront of its initiatives to curb piracy and protect intellectual property. TReMU, Pakistan's Technology Resource Mobilization Unit, has created a task force it calls "Linux Force," to review the value these offerings can provide to their computing needs.

Thailand

The government's ICT Ministry is targeting to have 5% of government agencies use Linux during 2003. Dr. Surapong Suebwonglee said the ICT Ministry would encourage the use of Linux, with a long term goal to have Linux support 50% of installations in government agencies.

The ICT Ministry also introduced a series of low-cost PCs to increase computer literacy among the poor. The government-subsidized project initially planned to include Linux TLE, a Thai version of Linux, along with the OpenOffice productivity suite. Microsoft responded by agreeing to deliver its operating system and Office suite for $36 (typically priced at +$300 US), translate the programs into Thai, and develop new licensing agreements.

Spain

In April 2002, the Extramadura Ministry of Education, Science and Technology initiated a project to convert computer systems from proprietary systems to OSS which include the creation of their own OSS distribution called GNU/LinEx. According to Luis Millán Vázquez de Miguel, Minister of Education, Science and Technology, "We chose OSS for two reasons: first of all, because we cannot afford paying for 100,000 licenses. We have saved 30 millions Euro alone in licenses. Secondly, because of safety reasons. We cannot carry out such a huge project and not have access to the codes, we cannot depend on a single company either. Using OSS, we update everything we need when we need it".

Project goal is to support the Red Tecnológica Educativa (Educational Technology Network) for providing one computer for every six primary students and one for each secondary student in the region. A secondary school history teacher in Calamonte said "From the educational point of view, there is no difference between GNU/LinEx and Windows. Students need transparent software. They use the computer to make a task and do not worry who is the proprietary of the license".

Under their Digital Literacy Plan, Nuevos Centros del Conocimiento (New Knowledge Centres) computers are placed in 33 communities. Over 30,000 citizens have taken advantage of the program. Economic and social goals are being met by distributing OSS through the Plan de Alfabetización Tecnológica (Technology Literacy Plan), to small businesses and the regional government administration. The Vivernet program helps new businesses by providing young entrepreneurs with access to ICT resources. Vivernet has two Centres (in Cáceres and in Badajoz) and has more than 4000 users and over 38 businesses participate.

South Africa

In January 2003, the government's report "Using Open Source Software in the South African Government" recognizes the educational and commercial benefits of Open Source development and recommends that partnerships between academic, industry and government institutions be implemented. The report proposes that 1) "discrimination and prejudice will be avoided in software procurement procedures, making choices based on merit, thus giving OSS and proprietary software (PS) equal opportunities to be selected" and 2) "as OSS offers significant indirect advantages, opting for OSS will be preferable where the direct advantages and disadvantages of OSS and PS are equally strong, and where circumstances in the specific situation do not render such preference inappropriate."

In July 2003, Geraldine Fraser-Moleketi, South African Minister of Public Service and Administration provided the following comments on OSS: "Support - As long as there is a market for support, the open source code allows anybody to provide it, whereas proprietary software (PS) support is dependent on the development company. If that company goes out of business, the support can disappear with it.

Security – Some critics maintain that using OSS is a security risk. Real experts can allay that fear. In fact, the availability of source code has the added advantage of enabling the user organization to study it, determine whether its functioning poses any security risks and amend the software if so desired. Furthermore, when new problems are found, solutions are available far sooner than with PS, as anyone can examine the problem and find its solution."

Sweden

In February 2003, Statskontoret, the Swedish Agency for Public Management published a study stating the following: "The conclusion of the working group is that free and open source software in many ways, both functionally and qualitatively, is quite equivalent to – or better than – proprietary products. Free and open source software should therefore be judged on an even par with proprietary software in a procurement process in order to establish better market competition. It is also necessary to place demands on open standards and file formats in order to achieve interoperability between different systems."

United Kingdom

In its policy document "Open Source Software Use Within UK Government" (July 2002), it states that the "UK Government will 1) consider OSS solutions alongside proprietary ones in IT procurements. Contracts will be awarded on a value for money basis, 2) only use products for interoperability that support open standards and specifications in all future IT developments, 3) seek to avoid lock-in to proprietary IT products and services, 4) consider obtaining full rights to bespoke software code or customizations of COTS (Commercial Off The Shelf) software it procures wherever this achieves best value for money and 5) explore further the possibilities of using OSS as the default exploitation route for Government funded R&D software."

In October 2003, the Office of Government Commerce announced plans to test open source software in nine different areas of government. Lead by the Office of the E-envoy, the project will measure the benefits of OSS with those of proprietary systems.

United States

In October 2000, The President's Information Technology Advisory Committee (PITAC) report "Developing Open Source Software to Advance High End Computing" recommends that "a 'level playing field' must be created within the government procurement process to facilitate Open Source development."

In April 2003, the report Developing an Open Source Option for NASA Software, stated that "For NASA, the adoption of an Open Source option for software distribution would lead to three main benefits: 1) improved

software development; 2) enhanced collaboration, in particular across organizational boundaries; and 3) more efficient and effective dissemination."

State Of Oregon In March 2003, House Bill 2892 was introduced which would require State agencies to "consider the use of Open Source software" for all new software acquisitions.

State of Texas Senate Bill 1579 proposes that, "for all new software acquisitions, a state agency shall: 1. consider acquiring open source software products in addition to proprietary software products; 2. except as provided by Subdivisions (4) and (5), acquire software products primarily on a value-for-money basis; 3. provide justification whenever a proprietary software product is acquired instead of open source software; 4. avoid the acquisition of products that do not comply with open standards for interoperability or data storage; 5. avoid the acquisition of products that are known to make unauthorized transfers of information to, or permit unauthorized control of or modification to the state government's computer systems by, parties outside the control of the state government."

State of Oklahoma Oklahoma bill, HB 1627 introduced in January 2003 states that "No state agency nor the Purchasing Division of the Department of Central Services shall enter into a contract for the acquisition of computer software developed exclusively for the agency or the state, unless the vendor agrees to provide to the agency or the state the source code for the software." It was also noted that "For purposes of this section, 'source code' means the programming instruction for a computer program in its original form, created by a programmer with a text editor or a visual programming tool and saved in a file. "

2

Case Studies of OSS Use in Developing Countries

Uses of OSS in Developing Countries

Consideration for the OSS option in developing regions will occur in the context of the broader ICT priorities. Assuming that there is appropriate access to ICT resources, OSS solutions can be applied in addressing individual needs, along with pursuits in the public and private sector.

Web sites based on OSS can be used for needs such as e-government portals, educational information sharing or advertising a small business' products and services. E-mail services can be established to provide communication with regional or global contacts. Efforts are also being pursued to localize a variety of OSS solutions to support microbanking and other business software needs.

The Case Studies

Examining OSS on a global basis is a complex and multi-faceted topic. Work remains to address many development policy considerations. Questions of scale, approach, localization dynamics, and replicability of process require exploration. Key to the process is the sharing of information of its use in varied setting. The case studies intend to in increase awareness of how and why OSS is being. While the cases represent a fraction of the potential scenarios for OSS use, they present some OSS project dynamics that should enrich the OSS public policy discussion.

Four case studies present the use of OSS in developing regions. Each case overviews the needs addressed by the initiative, the OSS technology used and lessons learned by project team members.

- ***Sao Paulo, Brazil — The Telecenter Project.*** The city establishes telecenters to provide free computer use and Internet access to marginal neighborhoods. 72 telecenters are functioning, with 128 centers planned by the end of 2003.

- ***Goa (India) Schools Computer Project.*** The project has delivered recycled PCs running Linux to 125 schools in the region.

- ***Tajikistan — Introducing Localized ICT.*** The project is translating desktop OSS into Tajik, and developing secondary school educational materials into Tajik computer based educational courses. 30 new PCs have been shipped for deployed in 3 locations.

- *Laos – The Jhai Computer.* The system design addresses needs in Phon Kham and four other villages to make local calls and calls overseas via the Internet. Providing basic computer functions such as document preparation and spreadsheet use are components of the effort.

Sao Paulo, Brazil – The Telecenter Project

The Municipality of São Paulo has initiated a project to establish a network of telecenters to provide free computer use and Internet access to marginal neighborhoods. The implementation and management of the telecenters it provided by The Electronic Government initiative. 72 telecenters are functioning, with a goal of having 128 centers operational by the end of 2003.

Each telecenter provides service to about 3,000 users. The cost of setting up a telecenter is $10,000. Usage of telecenter facilities is free of charge for the local community with participants scheduling for access time in 30 and 60 minute increments.

Addressing a Variety of Community Needs

Workshops and courses provided to the community at the telecenters include Web-site creation, journalism, image processing, Internet research, and history of each neighborhood and the local environment. Participants are encouraged to write articles about everyday life and events in their communities. Efforts are encouraged to pursue artistic activities, such as creating rap lyrics and poetry online.

Support staff is available to assist users. The program is designed to develop support staff from within each community to provide new skills and create work for citizens. Students are provided with free lecture notes and receive a certificate at the end of each course.

The Rationale for using OSS

Pursuing the government's "Digital-inclusion" initiative, while operating within budgetary constraints, required a strategy of investigating low cost technology alternatives which provided a high quality of service. The combination of OSS and diskless workstations allowed the Telecenter project to acquire computers with less hardware and power requirements than required by a Microsoft Windows solution. Additionally, the project is not constrained by proprietary software licensing requirements.

The Technology – Linux and Diskless Workstations

Each Telecenter runs a high-end server and 20 diskless workstations (Pentium class systems). The diskless Linux workstations are connected to the server with a 100MB network. The underlying infrastructure technology consists of Debian Linux and Linux Terminal Server. Application software includes the GNOME desktop, work processors, spreadsheets, Web browser and Gimp (graphic/image processing). Documentation and tutorials have been developed and are available in Portuguese.

Telecenters, City managed, along with Private Partners

The program supports telecenters that are directly managed and have been installed in buildings owned and operated by the city. In areas where municipal building space is not available, partnerships with private companies have been established to implement and support telecenters.

Lessons Learned

The following observations shared by Beatriz Tibiriçá – Coordinator of the Electronic Government are from experience with the telecenter initiative:

- *Using OSS was easier than expected.* The perception that GNU/Linux is extremely complicated to understand and use turned out to be unfounded at the telecenters. Children, the elderly and individuals with minimal education have easily learned to use the systems.

- ***Building local ownership is important.*** Each telecenter has its own Advisory Council formed and elected by the local community to determine some rules of use for the telecenter. Being a member of the Council has its own stature and is viewed as an important duty. The Council helps guide the management of the telecenter in issues such as security.

- ***Providing a quality service can build respect.*** Providing a public service in a quality fashion can result in a high level of respect by the community. Pursing this strategy has resulted in a low rate of vandalism at the telecenters.

- ***Telecenters are more than just the technology.*** While each telecenter is supported by computers and a broadband Internet connection, their physical appearance and layout are different from one another. The unique "character" of the telecenter is determined by the actions taking place in the telecenter and the work going on there.

- ***Usage can vary among different age groups.*** Usage of the telecenter can differ among various age groups in the population. For example, in some situations, the elderly can have very specific and practical uses for the telecenters, such as communicating with people from other cities, while the behavior of young people may be more focused on school related activities and entertainment.

Tajikistan — Introducing Localized ICT

Tajikistan has a population of approximately 6.8 million and the lowest per capita GDP among the 15 former Soviet republics. Among the issues limiting computer usage has been the lack of systems supporting the native Tajik language. A project, managed by Khujand Computer Technologies, has developed a team of volunteers focused on translating desktop software into Tajik, and developing secondary school educational materials into Tajik computer based educational courses.

According to Roger Kovacs, the project's leader, there is "a tremendous group of young intellectual citizens ripe for computer education. The country could prosper from a strong computer/software education program." With typical monthly salaries of $20, new computers are very expensive and low cost approaches need to be considered to address the opportunity for ICT introduction.

The Project

In July 2003, the project shipped 30 new PCs to Tajikistan. These systems were assembled in the US and configured with a preliminary Tajik version of Mandrake Linux 9.1. The systems are being deployed in 3 locations.

In Tajikistan's two largest cities, Dushanbe and Khujand, community computer centers will be opened. The PCs will be used primarily by the volunteer translators, along with secondary school students for their studies. On a restricted basis, the centers will be available to small businesses and the general public to develop programs for future sustainability.

A third computer center is located in the school of an orphanage with over 900 students. In addition to translating Linux into Tajik, the project will develop secondary school educational materials in Tajik for use on the computer.

Once the translation is completed, it is expected that the centers in Dushanbe and Khujand will become more accessible to the public. The centers will continue to maintain the updates to the translated applications, while providing public education in computer technology.

Rationale for Using OSS

When considering desktop computing platforms for the project, there was no version of Microsoft software available in the native Tajik language and translation

would be very expensive. Also, translating a proprietary offering would result in dependence upon a foreign company for all of the country's computer technology, with no assurance that all future products would continue to be translated. By using OSS, Tajikistan can control its own ICT destiny.

After a trade study of various Linux distributions, Mandrake Linux was selected as the target for translation. Mandrake's support for localization has been very helpful as the team adapts the software to their needs. Following the translation of Mandrake Linux, work will start on KDE, including the KOffice Suite, and Mozilla.

Current Status

The country has many educated youths interested in providing a positive contribution to the community. Volunteers have worked hard on translation and with a combination of mentoring and training, the team has translated over 50% of Mandrake Linux.

Funding has been obtained to support the efforts of 3 to 6 Tajik translators. University students interested in improving their English skills have been recruited to convert Mandrake Linux (its user interface, dialogue boxes, menus, help screens, etc.) into Tajik. Work is taking place in Tajikistan, with project completion targeted for December 2004.

The Central Asian Development Agency (CADA) is providing a critical e-mail link from the US to Tajikistan which allows the translator's work to be integrated into the entire project. In addition, their on site presence provides for tremendous consultation advice and support.

The Keyboard and Font Challenge

At the beginning of the project, there was no PC keyboard layout for the Tajik alphabet, nor was there a process to define, develop, approve or maintain such a computer standard. Setting such a standard is required to avoid the fragmentation to different keyboard layouts when training citizens on computer use.

As this effort is the first of its kind in Tajikistan, the project team has established a de facto standard. Committees are being defined to address issues associated with accelerator keys and conventions for use with menu items.

Standard open source fonts which include the Tajik character set are limited, and additional work is required. The open source is likely to provide the means for volunteers to implement the Tajik character set in other existing fonts.

Lessons Learned

The project was developed by nurturing grass roots computer enthusiasts interested in improving their skills and delivering ICT capabilities to their community. Mr. Kovacs continues to manage the project, with very limited familiarity with Tajik. His mentoring of volunteers resulted in the initial 30% Mandrake Linux with no budget or grants. Today, there are two Tajik NGOs involved as well.

Lessons learned from the project include:

- ***Establish goals, both strategic and tactical.*** Develop goals that are measurable, achievable and understood by the varied stakeholders. Without goal setting, the potential to lose project focus and momentum can increase.
- ***Build on the strengths of the team.*** Identify the skills that are available among the team members and align them with the project objectives.
- ***Patience and understanding is needed.*** Generally, project activities will take longer than planned. In this project, E-mail has been used extensively as a training medium, which can slow the progress of the project. Understand the constraints of the project and work within them.
- ***Communication is important, especially when working between languages.*** If there appears to be a misinterpretation among team members, quickly move toward clarification.

- ***Think and work positive.*** Do not be distracted by events that some may interpret as potential competition or conflicts. All projects have distractions. Understand and when needed evaluate them. Remain focused.

As the project team progressed, it has learned that software engineering is only one of the skills required in their efforts. A focus on logistics and general project management are also critical for success. Challenges exist, but soon there will be an open operating system and applications in native Tajik for schools, business and government to use.

Goa (India) Schools Computer Project

The Goa (India) Schools Computer Project (GSCP) was started in 1996 as an informal community effort by overseas Goans living mainly in the US. The goal was to help facilitate access to PCs by students and the surrounding community where the respective schools were located. The project was aimed mainly at schools in rural areas.

Goa has 360 secondary schools. 70 are government operated, with the remainder government aided schools, of which 50% are run by the Archdiocese of Goa. Total enrollment is 110,000. Since 2002, the Goa government has supplied an average of 2 PCs per school, a training person, and a government syllabus. Students are taught basic computer use including an introduction to word-processing and spreadsheets.

The Project

In January 2002 GSCP provided a shipment of 380 recycled PCs to Goa under an agreement between GSCP and the Goa Department of Education. GSCP tested and refurbished the equipment before distribution and provided training to teachers in the use of the Linux operating system. The schools were to provide electric wiring and furniture. GSCP provided hardware maintenance during the first year after installation. The schools are to arrange for maintenance after this "warranty period".

Uses of the System

Stand-alone and networked systems have been installed in schools. Depending on the configuration, they are used to learn computer skills as well as provide Internet access. Some computer labs are also available after school hours to allow interested students computer access and for general community access to Internet.

The Technology

The GNOME desktop was selected initially for its ease of use and lower resource demand than KDE. RedHat India offered free boxed packages for all the schools. Systems with small hard-disks were configured with minimal system software installed.

Spreadsheets were taught using Gnumeric and word-processing using Abiword . During 2003 OpenOffice was also introduced. The project team uses Linux Terminal Server (LTSP) in schools where 4 or more networked computers are installed. ICEwm has replaced Gnome as the window manager on all LTSP systems because of its lower resource requirements.

Rationale for OSS Use

GSCP wanted to avoid software piracy and the cost to install Microsoft software was greater than the $60 cost of the recycled computers. Access to a local Linux User group providing volunteer support to schools was also a factor in the open source decision.

Current Status

As of July 2003, 125 schools received recycled PCs, ranging from 1 to 6 computers. The number of PCs issued was determined by number of students, willingness to work with Linux and funds available to provide the appropriate infrastructure. GSCP offered free support and maintenance to all 125 schools for a period of

one year. The systems, most of which are Linux based, were installed primarily in rural and semi-urban settings. GSCP was thus able to provide 1 or more systems to approximately 30% of the schools in Goa. A locally registered organization called the Knowledge Initiative Trust has now been formed to manage GSCP.

Lessons Learned

According to Alwyn Noronha, GSCP project manager "The experience of the GSCP team is that low cost and sustainable school computer labs can be established in rural schools using recycled equipment and open-source software. GSCP has demonstrated that PCs running both Linux and Windows environments can effectively be used simultaneously in the same computer lab."

- ***The Effect of Introducing Linux.*** Initial training was required for computer teachers familiar only with Microsoft Windows and standalone environments. GSCP continues to invest in teacher training. The state's computer program was developed assuming the use of Microsoft Windows and teachers had to be instructed how to adapt it for a Linux environment. There are 3 Linux User Groups (LUGs) in Goa. Volunteers from them helped when schools have experienced problems.

- ***Compatibility with Proprietary Software.*** GSCP found no significant requirement by schools to exchange data between open source and proprietary systems since the systems are used primarily for teaching purposes. The increasing use of OpenOffice has resulted in less problems conforming to the government's syllabus which assumes the use of Microsoft Word and Excel. Since OpenOffice can read and write MS Word and Excel formats there are minimal problems in exchanging data.

  After the 3 year Goa government maintenance contract with the vendor supplying PCs to schools expires, school authorities will have the option of having the government provide PCs to join the LTSP networks for access to email and web browsing of Intranets. All open source expertise required is available from the Goa Linux User Groups.

- ***Training*** Initial training helped familiarize teachers with Linux basics and the differences between OSS and proprietary applications. PCs running in both of these environments are used simultaneously in computer lab. The training focus now is on Computer Aided Training for teachers on non computer-related subjects. Efforts are being pursued to find software to supplement traditional teaching methods in subject areas such as physics, mathematics, chemistry and geography.

- ***The Physical Infrastructure*** The GSCP assumed there would be higher than usual hardware failure when using recycled PCs. However, a 2002 survey shows that both GSCP and government donated PCs had a comparable rate of failure. This can be attributed to the generally poor quality of electric power in Goa, ie. power fluctuations and frequent power failure. Some schools have not yet installed the PCs because of physical infrastructure issues such as lack of electric wiring in rooms reserved for the computer lab or limited space. Schools using Linux in a semi-urban area were more successful in maintaining their equipment because these schools generally have better access to technology support resources.

Laos — The Jhai Remote Village IT System

To help the communities of Phon Kham and four other villages obtain information on agricultural market pricing and pursue initiatives to improve the village's income requires improved access to communication services. The Jhai Remote Village IT system, currently in development, is designed to address these needs by

providing support for local calls and overseas connections via the Internet, along with document preparation and spreadsheet capabilities.

The villages are located in a valley 85 Km north of Vientiane. Power and telephone service is absent and cellular phone access is limited by a mountain range. Other challenges an ICT system must address are torrential rains, high temperatures, humidity, and dust.

The Solution

The Jhai system is based upon a low-power embedded computer running a localized version of KDE, called LaoNux, on the Debian Linux distribution. The village computer connects to the Internet with a wireless 802.11b card which communicates to an antenna bolted on the roof which sends a signal to a nearby solar powered access point, which is then sent to Phon Hong, which is 25 km away by road and the closest village with phone lines.

The computer runs on 12 watts of power, supplied by a bike-pedaled generator. Solar power was rejected because of the four-month monsoon season and the cost: the bicycle is only a third of the cost of solar equipment. One minute of pedaling generates about five minutes of power.

According to Lee Felsenstein, the designer of the system, "the system's technology uses readily available components and is engineered for long and reliable service". By applying available wireless and computational technology, the team hopes to minimize the cost impact of alternative telecommunications infrastructures.

Rationale for Using OSS

The existence of a growing body of open source software supporting wireless communications was central to its selection for the project. The Jhai Remote IT Project has converted the Linux-based KDE Graphical Desktop and productivity resources into Laotian, supporting email, word processing, and simple spreadsheets.

Felsenstein decided that the operating system had to be Linux because "this system had to run for 10 years, and open-source software brings with it a human infrastructure of people who know how to maintain it." Lee Thorn, Jhai Foundation's chairman, adds that Linux was also chosen because localization was easier than under other platforms.

LaoNux — Localized OSS

Working with computer science and electrical engineering students and teachers at the National University of Laos in Vientiane, under the direction of former IBM software developer Anousak Souphavanh, the team developed a Laotian version of the Linux-based graphical desktop called KDE. Its suite of business tools allows Laos citizens to browse the Web, send e-mail, and create simple documents.

Lee Thorn called the localization into Laotian "probably the hardest part of the whole project." In order to generate fonts in Laotian, for example, the team had to create its own Unicode, a standard for encoding letters and other characters in any language.

Status of the Project

After system testing in Laos in early 2003, its implementation was hindered by monsoon weather conditions and a misunderstanding with a local government official. As a result, the system is back in the San Francisco Bay Area, with the team completing documentation, testing, and hardware modification. The team hopes to return to Laos in November to provide implementation and training.

Lessons Learned

As system implementation approaches, Lee Thorn shares the following on their efforts.

- ***Project definition is essential.*** The most important lesson is that obtaining a clear and comprehensive definition of needs by end users has focused the overall project direction in developing the Jhai system.

With a clear definition established at the beginning of the project, "scope creep" is effectively managed.

- ***Obtaining OSS support has not been an issue.*** Finding and leveraging OSS resources has not been an issue for the team, and LaoNux has proved to be a supportable platform. Also, relying on open design specifications has allowed volunteers to quickly provide their technical expertise to the project.

- ***Designing for rigorous needs should allow for adaptation to other environments.*** While environmental design requirements of the Jhai system are challenging, the team believe its solution can be transferred and modified for less harsh conditions.

- ***A long term time horizon should result in affordable solutions.*** The project's design philosophy assumes 10 years of sustainable system use. This perspective focuses the team on using commodity components, along with avoiding short term technology upgrade cycles. This approach should allow for component replacement to be performed by newly trained support staff.

- ***End-user involvement creates ownership and drives economic sustainability.*** Obtaining end-user participation from conceptual design onward helps build ownership of business solutions and create local experts. Farmers and business people who know local markets, price structures and costs are used in the project to determine needs and develop business plans, with minimal use of outside 'experts'.

- ***Consideration for physical security needs is important.*** Physical security of the equipment must be addressed from the beginning of a project. Developing a social relationship with the community should create local ownership of and respect for the solution.

- ***Plan for the availability of tools and spare parts.*** Parts and tools may be more readily available where a system is built than where it is deployed. Understand this dynamic and plan for it.

- ***Maintain clear and continuous communication among the project team.*** The Jhai project relies extensively on volunteers. Outside experts in the US working with Laos end-users has lead to practical solutions. In this process, all parties must feel comfortable in maintaining good communications. Mistakes are made, but participants must keep the conversation going. This process has built respect and maintained momentum during project setbacks.

While the Jhai project still confronts issues associated with start-up efforts, they have had inquires from India, Indonesia, and 38 other countries where telecommunications and power are limited. The project team in Laos and other locations plan to refine the Jhai approach for use in other locations.

3

The Current Dynamics of Open Source Software

Benefits Vary Based on Use and Focus

Software use continues to extend into new areas of human endeavor. Benefits derived vary depending on the constituency addressed (government, consumer, education, or business), the size of both the user and developer communities, and whether the needs focus on public use or business profit.

In some settings, the activities and roles of both OSS developers and users will remain unchanged from those of proprietary efforts. However, the openness of the OSS model emphasizes the concepts of access (more transparency of the process and the product), community (leveraging local and global resources), choice (more competition), and collaboration (sharing ideas with peer organizations). Each in its own right should benefit users.

Increasing Choice and Competition

The software industry's significant consolidation has reduced the number of options available to users. With the emergence of OSS on the ICT landscape, new projects are emerging to meet a diversity of needs, some having global applicability, while others addressing much smaller communities of interest. These solutions as ICT alternatives should increase the diversity of choice and level of competition when ICT options are considered. These dynamics should also increase the focus of the ICT discussion on organization needs.

Aligning Open Source with Open Standards Objectives

While open source software does not imply an adherence to open standards, open source developers seem more aligned with open standards goals than some proprietary providers. This bias should increase interoperability and information sharing among various technology constituencies and benefit users by increasing the control of its ownership.

The evolution of open standards efforts will likely extend beyond the focus of application interoperability, toward the control and understanding of processes associated with an application, i.e., the knowledge supply chain. In this context, understanding what occurs "under the hood" of software applications should have increased relevance to software users.

Positioning Software as a Public Good

OSS is freely available, with access to the programming source code as one component. OSS can be viewed as a public good created by citizens contributing their work in an open and collaborative fashion. Participation in a global community can help broaden the opportunity to share and adapt OSS ideas among developing countries. As a public good, OSS can promote local ICT capacity development by focusing on community needs that can drive the creation of local research and development efforts.

Social benefits from fostering OSS development in an ICT strategy can include 1) increased access to government information by citizens, 2) increased trans-

parency in the functioning of e-government solutions, 3) assisting in the development of a local software industry, and 4) development of local IT skills.

Increasing Technological Self Reliance

While resource constraints can present significant barriers in pursuing ICT initiatives, most countries want to increase their participation in the knowledge economy, and to do so in a self-reliant manner. Developing countries are primarily reliant on technology from a select set of external suppliers. Notably, US based firms generated 56% of the revenues and 96% of the profits from the global IT industry [Heeks and Kenny 2001].

Technology self reliance can be defined as 1) reducing dependence on external technology providers, 2) developing skills internally to address local needs, and 3) leveraging locally developed skills to pursue revenue generating opportunities both internally and abroad.

Reducing Vendor Lock-In

The software industry has seen a reduction in the number of market participants and an increased reliance by those firms to promote product upgrade cycles to maintain their business franchises. While the software industry will continue to innovate, some product categories are reaching maturity and users should not be driven to pay for new features and product versions that have minimal impact on their needs. Using OSS can reduce the reliance on single suppliers and minimize proprietary technology lock-in that drives unwarranted upgrade cycles and vendor biased licensing provisions.

Increasing Transparency

A significant difference between the open source and the proprietary model is the transparency of the development process. With OSS, the source code that is used to build programs is open and accessible to everyone. While this access will have varied levels of utilization, it can 1) provide the opportunity to broaden the sense of ownership, 2) increase trust between developers and users, and 3) increase a project's focus. With broader participation in the development process, all parties can work toward common goals and changes are introduced for the good of the community.

Minimizing Security Risk

Data security is an important concern for governments, particularly in the wake of worldwide computer viruses and increased potential for cyber-terrorism. Among the benefits of OSS security, versus proprietary software, is the potential for fewer bugs in OSS and when identified, they can be quickly fixed. Introducing OSS can increase diversity into technology infrastructures that can reduce the risks associated with computing environments supported by a high concentration of homogeneous solutions.

The Question of Cost Savings

Debates regarding the Total Cost of Ownership (TCO) of open source versus proprietary solutions often results in questioning the variables used in the analysis. Assessing the cost of technology solutions has historically been more art than science. While acquiring OSS can be free, our view is that 1) if the OSS versus proprietary debate is centering on cost, it is likely that the value proposition of the proprietary solution is under pressure and 2) cost is likely to be one among many issues in the assessment of OSS when reviewing, developing and updating ICT policies.

Local ICT Capacity Development

As developing countries assess the opportunities and challenges presented by the global networked economy, it is important to consider strategies for increasing participation in the global ICT context and addressing local ICT capacity development needs.

As stated in Digital Opportunities for All: Meeting the Challenge — Report of the Digital Opportunity Task Force (May 2001):

> "when wisely applied, ICT offer enormous opportunities to narrow social and economic inequalities and support sustainable local wealth creation, and thus help to achieve the broader development goals that the international community has set. ICT cannot of course act as a panacea for all development problems, but by dramatically improving communication and exchange of information, they can create powerful social and economic networks, which in turn provide the basis for major advances in development."

An OSS based approach to capacity development can emphasize the use of local personnel and organizations while focusing on sustainability and self-reliance. OSS strategies, if properly executed, can alter the posture of a developing country from primarily a consumer of ICT products and services, to a provider as well. A component to sustainable capacity development is to leverage global public goods, such as OSS, to promote local capacity and create solutions targeted at traditional development challenges.

Promoting Local Ownership and Autonomy

Autonomy and ownership are significant components in pursuing capacity development opportunities. Consideration should be given to the ability of local stakeholders to provide an ICT environment that can be owned and adapted by their community. Skeptics have discounted the potential for open source software as a means for capacity building. We counter this view with the fact that the nature of OSS lends itself to providing an ICT environment with increased local ownership and autonomy.

Research and development agendas by traditional proprietary software providers generally respond to global market incentives. This can result in solutions that do not adequately address developing country needs because the economics of the opportunity do not justify the required commitment of resources. These dynamics can create gaps in addressing the needs of developing countries.

The OSS model lends itself to software adaptation for addressing local needs, while introducing more flexibility and independence to the software development process. The independent nature of OSS can also help to cultivate domestic talent to participate in the development of a local software industry that should reduce the level of external ICT spending.

Momentum of Open Source Creates Opportunities

OSS is a growing dynamic in the technology marketplace. Commercial suppliers are broadening their support and deployments are increasing across a broad array of ICT initiatives. At the same time, critics claim that the open source "eco-system" is immature and incomplete.

From a business and capacity development perspective, these gaps should be interpreted as "opportunities". New applications are needed, skilled staff is in short supply, support infrastructures need to be improved, and documentation needs to be written. Given the appropriate mix of motivation, focus and skill, these dynamics present great opportunities to bring new products and services to markets, on both a local and global basis.

The OSS Planning Dynamic

For developing countries with the appropriate infrastructure, a strong ICT focus can help drive capacity development, while addressing existing ICT needs. Consideration should be given to identifying linkages between national ICT objectives and development strategies. In the process, capacity development will require building awareness on how ICT, in general,

and OSS specifically, can address development needs and deliver new solutions. Attention to skill requirements and infrastructure resource needs is essential.

OSS is Not an "All or Nothing" Proposition

A purist perspective on OSS may envision a world of solely open source solutions. It is more realistic that software infrastructures will consist of a mix of both proprietary and open source software.

OSS can be Mixed with Proprietary Software

With the high penetration of OSS in the Internet's infrastructure and Microsoft's dominant presence on the desktop, many organization's needs will be met by combining these technologies. One combination is to have servers running an OSS operating system such as Linux or FreeBSD; an Apache web server, and Samba for printer and file sharing, which are accessed by desktop computers running proprietary software like Microsoft Windows, Office and Internet Explorer. Another combination could include the OpenOffice running on a Windows desktop system.

Many OSS Applications do not required an OSS Operating System

It is incorrect to assume that OSS application programs are designed exclusively to operate on OSS systems. Many are available for use with multiple operating systems and can be deployed with proprietary solutions. For example, proprietary databases from Oracle and IBM will run on Linux, the open source databases MySQL and PostgreSQL run on proprietary server operating systems, the OpenOffice.org office suite is available for Windows, Solaris and Apple desktops and the Mozilla web browser has similar cross-platform support.

A Gradual Migration to OSS is an Option

With the availability of implementation options including running proprietary software in a Linux environment, or open source software in a Windows environment, the introduction of OSS can occur in a gradual fashion. For some organizations, it is likely that such a migration strategy can leverage their experience with OSS server based services as they develop expertise in OSS required for its broader adoption.

Open Source 101: What is it all About?

When examining the dynamics of computing, an assessment often starts from the perspective of an individual's greatest familiarity. For most, this starting point is the desktop computer. A potential challenge when assessing OSS is that much of its success has not been on the desktop, but in the areas of networked servers and Internet infrastructure solutions.

OSS has significant penetration in the Internet

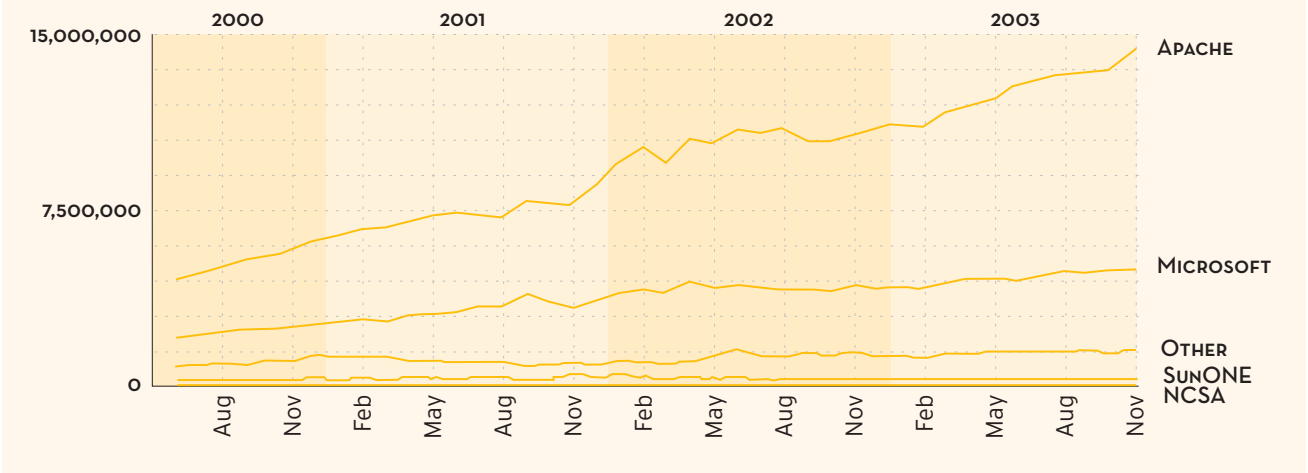
The momentum for OSS is strongly related to the growth of the Internet. This relationship is two-fold. First, much of the Internet's infrastructure consists of open protocols and software. Second, the global reach of the Internet has provided an environment in which software users and developers can effectively collaborate in the development, distribution and use of OSS solutions. OSS penetration in the Internet's infrastructure is pervasive and most organizations are reliant on it in some form to meet ICT needs.

Apache: Where Open Source is the Market Leader

In the application server market used to manage the +3 billion pages of the World Wide Web, the OSS solution Apache is the leader. According to Netcraft, of 44.9 million active public web sites, 67% use this open source program, with Microsoft's Internet

Apache — An Open Source Market Leader

Source: Netcraft (Nov. 2003)



Information Server in second place at 21%. Apache is available for all major operating systems.

Momentum Driven by Linux

Initial OSS momentum was created by the cost advantage of Linux/Intel systems over systems running proprietary versions of the UNIX operating systems. These deployments typically addressed technical workstation, high performance computing and network based service needs.

While open source is associated with Linux and the GNU licensing agreement, there are many types of open source software programs available and the Open Source Initiative has certified over 30 different open source licensing agreements.

A Sampling of Popular OSS Offerings

As awareness of OSS has increased, interest in open solutions across a variety of technology platforms and software categories has broadened. Consider the following:

Operating Systems: The software that runs on every computer and controls their operation is dominated by Microsoft Windows on the desktop, followed by Apple and Linux. Operating systems software also supports computers that are used to share information among multiple users. Servers are used for most Internet applications and are often located in a secured location. Many alternatives are available for server operating systems, ranging from proprietary systems like Sun Microsystem's Solaris and other UNIX variants, to the following prevalent OSS solutions:

- ***Linux*** — Initially designed to provide Intel users a low-cost alternative to the UNIX operating system. Released under the GNU General Public License (GPL). There are numerous distributions of Linux such as Debian, RedHat, and SuSE. While the penetration of Linux is highest with servers, there is increasing attention to Linux on the desktop.

- ***FreeBSD*** — An operating system used primarily for server computers, often in data centers. It is derived from BSD UNIX, a version of UNIX developed at UC – Berkeley. Released under the Berkeley Software Distribution (BSD) license.

Server Application Software: Used to share information and other computing resources on a computer net-

work with many users. Email, database, web servers and software to share files and printers are in this category. Proprietary solutions include Microsoft's operating system, SQLServer database and Exchange, Lotus Notes/Domino and databases from Oracle and IBM.

- ***Apache*** – Used to manage and display web pages. Runs on Linux, Sun Solaris, UNIX, and Windows 2000.

- ***MySQL*** – Relational database started in 1995 by MySQL AB, based in Sweden. The product is available under the GNU General Public License (GPL) and a commercial license.

- ***PostgreSQL*** – An object relational database, started in 1986 at UC-Berkeley. PostgreSQL runs on many different operating systems. Released under the Berkeley Software Distribution (BSD) license.

- ***Sendmail*** – Development started in 1981 at UC Berkeley to enable the routing of email between networks. Released under the Berkeley Software Distribution (BSD) license, the market leader in Internet based e-mail systems.

- ***Samba*** – Provides file and printer sharing capabilities similar to this offered by Microsoft and runs on most UNIX systems, Linux, Sun Solaris and BSD variants.

Desktop Application Software: Consists of a vast array of product categories including personal productivity, games, accounting, graphics and web browsers. Microsoft's Office, Internet Explorer and Outlook dominate the desktop. OSS solutions include the following:

- ***OpenOffice.org*** – An office applications suite available for Microsoft Windows, Linux, Sun Solaris and Apple Mac OS X systems.

- ***Evolution*** – Integrates email, calendar, meeting scheduling, contact management, and task lists, in one application. Developed and supported by Ximian, Inc., which was recently acquired by Novell, Inc.

- ***Mozilla,*** a web browser available for the Windows, Apple Macintosh, Sun Solaris, and Linux platforms.

Development Tools: Software for creating and developing websites and applications including programming languages such as Perl, PHP and Python. There is also a wide array of OSS content management solutions available.

GNU: Where OSS Started

The work that led to the open source movement is derived from efforts at MIT in the early 1980s when Richard Stallman started the GNU project to prove that an operating system could be developed and shared freely. In 1996, the project added a kernel providing a complete GNU system. All programming code from this project adheres to the GNU General Public License.

Linux: A Brief History

In 1991 Linus Torvalds, then a student at the University of Helsinki, started work on Linux as an open source operating system. In 1994 version 1.0 was released, based on a kernel he developed and code from the GNU project. As a result, Linux falls under the GNU General Public License. The current Linux version, 2.4, was released in January 2001.

The Linux operating system is used in many ways including support for networking, software development, servers and desktop platforms and is considered as a low cost alternative to other operating systems.

What is a Linux Distribution?

The Linux community consists of dozens of different software "distributions" which can be downloaded for free or purchased from commercial organizations. A Linux distribution is a collection of software programs that include the operating system, along with

tools to install the operating system and setup the user interface. Word processors e-mail and web server programs can be included in a distribution as well. Various distributions target specific need such have emerged to address targeted needs, such desktop or server use, or the need of the educational market.

With Linux development involving multiple teams in the open source community, the distributor works to assure that the collected components work properly together. Distributors can provide different levels of product support resulting in a variety of pricing schemes in commercial offerings.

The following are among the dozens of available Linux distributions.

- ***Conectiva S.A.*** – Targeted at the Brazilian market
- ***Debian*** – Typically used by a technical audience, with increasing use by non-profit organizations
- ***MandrakeSoft*** – This distribution provides solutions for desktops and servers (web server, e-mail server, print server, etc.). Mandrake supports over 40 international languages
- ***Red Hat, Inc.*** – Supports Linux from the mainframe to the server to the embedded devices
- ***SUSE Linux AG (Germany)*** – Primarily targeting the European market (acquired by Novell, Inc.)
- ***Turbolinux, Inc.*** – Focused on the Japanese corporate market
- ***GNU/LinEx*** – A custom Linux distribution based on Debian, for use in the Extremadura, Spain project
- ***Redflag*** – Beijing based Red Flag Software focuses on the Chinese Linux user in the desktop, server and embedded markets

What is LAMP?

The OSS market is often associated with the Linux operating system. In fact, many software tools are used to develop and deliver OSS based solutions. A combination of these tools used by developers to create applications is often referred to as LAMP, a mix of the Linux operating system, an Apache web server, the MySQL database and Perl, Python, or PHP as tools to build custom applications. Other notable OSS components in use in development efforts as well, such as the PostgreSQL database.

From the Low to the High End of Computing

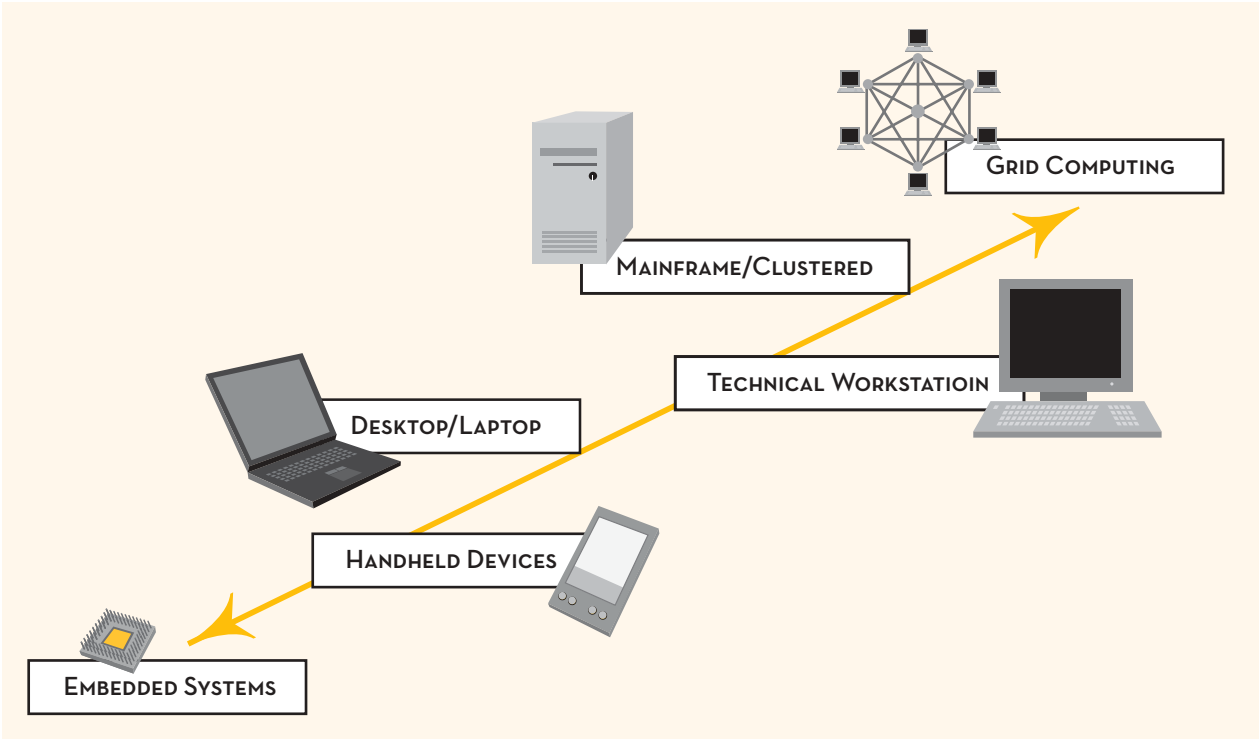
The OSS universe consists of hundreds of projects, communities and solutions. The spectrum of needs addressed range from operating systems, which control how a computer works, to end-user applications encompassing web servers, databases, browsers, network management, media servers, e-mail systems and workgroup collaboration and Enterprise Resource Planning (ERP) and Customer Resource Management (CRM) solutions. Desktop computer use of OSS remains limited but is gaining interest as usage gains momentum and professional support improves.

The breadth of OSS hardware support extends from low-end embedded systems to high-end mainframe and distributed environments.

OSS Moves into the Embedded Systems Market

The embedded systems market addresses solutions that integrate computer hardware and software resulting in products as diverse as communication routers, factory automation equipment, medical equipment, test and measurement devices, entertainment systems, set-top boxes, video recorders, cameras, phones, and Personal Digital Assistants (PDA).

OSS: From Embedded to Grid Computing



Consideration should be given to the increasing penetration of the Linux operating system in this market when assessing the need to develop OSS skills in support of capacity development initiatives.

In June 2003, Matsushita Electric Industrial Co., Ltd., Sony Corp., Hitachi, Ltd., NEC Corp., Royal Philips Electronics, Samsung Electronics Co., Ltd., Sharp Corp., and Toshiba Corp. formed the CE Linux Forum to promote usage of Linux for Consumer Electronics products.

The following are a few notable product offerings using embedded Linux:

- ***Simputer*** – Encore and BEL - PicoPeta, provides a PDA with a touch-sensitive screen designed to support several Indian languages and be shared by several members of a village.
- ***Sharp Corp.*** – Introduced the Linux based Zaurus product line of PDAs. Work is also being pursued with SAP AG to provide applications on this platform.
- ***Linksys Group Inc.*** (division of Cisco Systems) – Uses Linux in its 54G Wireless Router.
- ***Sony Corp.*** – Will release in Japan (Nov. 2003), a digital video recorder based on Linux.
- ***Intel Corp.*** – Provides a PC peripheral called the digital media adapter, which provides a link between PCs, TVs, and stereos run on an embedded Linux operating system.
- ***Motorola, Inc.*** – Introduced a Linux based smartphone combining PDA and voice functions with internet access. The Motorola A760 is available in

the Asia-Pacific region, and expects to ship in Europe early in 2004.

- ***TiVo Inc.*** – The creator of the personal television recorder, supports its 1 million receivers used by its customers with a Linux based system.

- ***Volvo Mobility Systems*** – Uses Linux on a GPRS system to provide traffic information including vehicle location, arrival/departure monitoring, and text messaging.

OSS and the Grid: The High-end of Computing

Another wave of technology innovation may come from grid computing in which the processing power of servers and workstations are combined into a single resource. Linux and open source are becoming more prevalent in these projects.

- ***The Chinese Ministry of Education*** plans to connect up to 200,000 students at 100 universities with its China Education and Research Grid. The effort will address remote education needs including a University of Hong Kong language instruction application, video software developed by Peking University and bioinformatics applications.

- ***The State University of New York (SUNY),*** Buffalo launched a supercomputer consisting of over 2,000 servers running Linux to conduct drug research to combat cancer, Alzheimer's disease and AIDS.

- ***Los Alamos National Laboratory*** will have two large-scale Linux clusters to be used in support of medical, environmental and national defense modeling and simulation.

- ***University of Liverpool*** is constructing Linux clusters to support research work with the World Health Organization to simulate the spread of epidemics of diseases such as SARS, and to support a planned research Grid with the European Center for Nuclear Research (CERN) in Switzerland.

The Desktop Remains Challenging

While OSS has significant penetration in the Internet infrastructure and networked environments, progress in the desktop market has been slower to demonstrate traction. Desktop computing dynamics are different from those of the server market. There is greater diversity of application software and hardware components, and user expectations are quite varied. As a result, mainstream access to Linux and OSS desktop has been limited. In select geographic regions, systems suppliers are test marketing desktop OSS and some governments are pursuing projects with this focus as well.

The Installed Base Dilemma

Whether the desktop software is legally licensed or pirated, organizations considering open source solutions in the desktop environment must address the +90% penetration of Microsoft software in this market. Therefore, any introduction of OSS or migration to open source desktop software will require consideration of costs and processes related to: 1) installation of new software, 2) assessing the compatibility of data files with the new software and 3) retraining staff on how the new software functions and how it is different from the software previously used.

Balancing Innovation with Familiarity

The most significant challenge in migrating to OSS desktops is the dynamic of change. Some technologists are driven by the application of cutting-edge innovation in their solution. However, while many technology users may appreciate innovation, they are more likely to adapt to innovation when it is presented within a familiar context. For this reason, desktop OSS solutions are becoming more "user friendly" with a "look and feel" resembling the Microsoft Windows platform.

Several Linux distributions focus on usability and include "Microsoft Outlook like" offerings such as Evolution, the office productivity suite OpenOffice and Web Browsers such as Mozilla. The GNOME and KDE

desktops environments also reduce the usability gap between OSS and those of Windows and the Macintosh. The OSS desktop may not be completely on a par, but the gap is not broad, and improvements continue.

Is Microsoft Compatibility Needed?

For many users, PC's are primarily used to and prepare documents access electronic mail and share files. While OSS solutions are available to address all of these needs, the degree to which many solutions address individual needs , and the availability of support need to be assessed. In this context, many organizations will require a mechanism to deliver Windows based solutions to the Linux desktop. For organizations interested in running Windows applications on Linux desktops, solutions from Codeweavers, Inc.'s and VMware are among the tools available

Private Sector Use is Increasing

Initial OSS implementations often support departmental file, print, mail or Web servers. With organizations such as Dell Computer, Hewlett-Packard, IBM, and Sun Microsystems increasing their involvement in OSS, its deployment should expand. Already implementations are extending beyond OSS' roots in the education and government sectors, and being adopted in many industries as an alternative to both UNIX and Microsoft's Windows platforms. As OSS demand increases, many deportment are likely to consist of both OSS and proprietary software running both on the desktop and on servers.

Internet Services

Amazon.com migrated most of its technology infrastructure to a Linux platform to help reduce costs. Afilias, Ltd uses the OSS database PostgreSQL in the management of the .Org domain service. Google runs over 10,000 Linux based Intel PCs in support of their search engine service. Verisign, Inc. has implemented over 1,200 Linux servers in their Network Solutions infrastructure. Yahoo is using the FreeBSD operating system in support of various servers and MySQL database for some information services. NTT/Verio uses FreeBSD, as well, to support their Internet hosting services.

Financial Services

Credit Suisse First Boston migrated to a Linux/Intel platform to support its Agora enterprise notification system which resulted in both server consolidation and improved performance. They are also using Linux supporting Web Services, messaging and application server needs. Merrill Lynch has increased it use of Linux systems throughout its infrastructure. Reuters has made its Reuters Market Data System available on Linux/Intel Systems. India's National Stock Exchange uses Linux-based Intel clusters to address some of its processing needs. Life Insurance Corp. of India, the country's largest financing company, will roll out 10,000 Linux/thin client systems in 2,000 offices by the end of 2003.

Entertainment Industry

Industrial Light and Magic converted its workstations and animation rendering farm to Linux in support of the production of films such as "Star Wars, Episode II: Attack of the Clones". DreamWorks used Linux systems in the production of films such as "Shrek" and "Sinbad". Pixar Animation Studios, the developer of "Monsters Inc." and "Toy Story," is switching to Linux/Intel systems. Sony Pictures' Imageworks has pursued a similar technology direction. Regal Entertainment Group, the movie theater operator, uses Linux based kiosks at their theaters.

Oil Exploration

Royal Dutch Shell has worked with IBM to build a Linux based supercomputer linking 1,024 servers to analyze seismic data and other geophysical information as part of its efforts to find new oil reserves. WesternGeco supports their business of seismic imaging requiring intense computations with a cluster of 256 systems running Linux. Amarada Hess has also implemented Linux based systems to address oil exploration needs.

Technology Suppliers are providing Support

Much of OSS use has been in Internet applications, technical workstations and high-end processing environments. Among the next challenges is support for more traditional enterprise application environments. While information technology spending remains constrained in today's economic environment, enterprise software firms have increased their efforts to address the OSS market.

The following overviews OSS initiatives by major technology providers:

- ***Acer*** has launched a PC with a Linux option for the home PC segment.
- ***BEA Systems, Inc.*** offers an application server platform and Java Virtual Machine optimized for a variety of Linux versions.
- ***BMC Software, Inc.*** provides varied infrastructure and service management needs for Linux.
- ***Borland Software Corp.*** released a Linux version of their Delphi application development tool.
- ***Computer Associates, Inc.*** provides over 50 products addressing the Linux market. Through its ACCPAC subsidiary, it provides an accounting application for Linux servers and desktops.
- ***Hewlett-Packard Company*** has established a Linux division which pursues and coordinates a variety of OSS initiatives.
- ***IBM Corp.*** has a variety of Linux initiatives including work with the Brazilian Government to develop technology based on open standards and with the Russian government to establish a Linux Competency Center in Moscow.
- ***LG Electronics*** launched a Linux based desktop computer, called MY PC, for the Indian market.
- ***Novell, Inc.*** continues to expand its OSS support with its acquisition of Ximian, Inc., and SUSE, both providers of solutions for Linux desktops and servers.
- ***Oracle Corp.*** provides Linux support for its database, application server and E-Business Suite. It also worked with Red Hat in the development of their Advanced Server offering.
- ***SAP AG*** established the LinuxLab to focus on the development and release of mySAP, their core proprietary solution platform, on Linux and address related support considerations. They are also working with MySQL to support OSS database technology.
- ***Sun Microsytems, Inc.*** introduced a Linux desktop offering which includes Mozilla Web browser, StarOffice (a commercial version of OpenOffice), Evolution and support for Java.
- ***Veritas Software, Inc.*** provides storage management software for Linux and MySQL databases.

The Legal Landscape is Evolving

A large part of the debate around OSS, its implications and its significance for developing countries, focuses on Intellectual Property Rights which encompass software licenses, patents and copyrights. The following excerpt from UNESCO's "World Information Report 1997/98" provides insights on the forces driving the discussion.

> "The creation and ownership of knowledge products are of increasing importance because of the centrality of information and knowledge to post-industrial economies. The concept of copy-

right, originally intended to protect authors and publishers of books, has broadened to include other knowledge products such as computer programs and films. Copyright has emerged as one of the most important means of regulating the international flow of ideas and knowledge-based products, and will be a central instrument for the knowledge industries of the twenty-first century. Those who control copyright have a significant advantage in the emerging, knowledge-based global economy. The fact is that copyright ownership is largely in the hands of the major industrialized nations and of the major multimedia corporations placing low per capita income countries as well as smaller economies at a significant disadvantage."

Open source software is differentiated from proprietary software because the programming code used is available for inspection, modification, re-use and distribution by others. While OSS can be free of charge, it can be purchased for a fee as well. The concept of "free", in this context, emphasizes what can be done with the source code rather than its acquisition cost.

Many Open Source Licenses Exist

While open source is associated with Linux and the GNU GPL licensing agreement, there are many types of open source software programs available and the Open Source Initiative has certified over 40 different open source licensing agreements. The following are among the most prevalent licenses in use.

- ***GNU General Public License (GPL)*** license was written by Richard Stallman in 1989, for the purpose of distributing programs released as part of the GNU project. It is the most widely-used of the open source software licenses and is considered to be the "purest" by requiring that all source code is free and available and that changes must be shared with the community of developers. Linux is among ht software available under this license.

- ***BSD (Berkeley Software Distribution) License,*** adopted from Berkeley Unix, requires copyright notification, and permits the source to be used in any manner, as long as notification is provided. The FreeBSD operating system and PostgreSQL database uses this license, and Apple Computer's OS X is a derivative work based on BSD licensed technology.

- ***Mozilla Public License (MPL)*** defines terms and provides for code that can remain proprietary under very specific terms and dual licensing when necessary under the provisions of the GPL. The MPL is likely to be among the more flexible models for open source organizations. The Mozilla, Firebird and Thunderbird Web browsers are available under this license.

Each of these licenses state that source code is open and users are free to use, copy, duplicate, distribute, modify them. The GNU GPL includes the added provision that modified versions of the software, if distributed outside an organization, will come under the conditions of the original work's license.

Limited Open Source Case Law Exists

While much of the success of OSS has been associated with the development of the Linux community and the GPL, one must note that only once has a GPL licensed product has been tried in a court of law, in the MySQL vs. NuSphere lawsuit. In this action, the legal issue was not directly related to the GPL and the matter was settled out of court.

With virtually no case law challenging OSS to date, more specifically the GPL, it remains to be determined where its legal strenghts and weakeness are and how enforcable its terms will be.

The Dual Licensing Option

Several commercial organizations are pursing a dual licensing model to support their business. These organizations provide their software to users, with a choice of

an open source license or a propriety license. Users can decide, based on their needs, the type of relationship they will have with the software and its developers. Examples of commercial organizations pursuing a dual licensing model are Sleepycat Software Inc. (database); MySQL AB (database), TrollTech AS (development tools) and eZ systems (content management).

Hybrid Models are Emerging

As the open source market evolves, adaptation will continue in its legal infrastructure. Potential benefits include increased data interchange, and added value features incorporated into proprietary derivative offerings.

The core technology of Snort.org, an OSS project focused on intrusion detection security, is licensed under the GNU GPL. Its founding developers offer a commercial and proprietary offering through SourceFire, Inc.

RealNetworks, Inc., a proprietary software firm, is sponsoring an open source project, Helix.org, to deliver a media player to the Linux platform. This project intends to deliver an offering incorporating both proprietary and open source technologies.

Microsoft's Shared Source Initiative

In 2001, responding to the open source movement, Microsoft Corp. announced its Shared Source Initiative, a program to share Windows source code with governments, companies and educational institutions. The program allows governments signing up to obtain free online access to source code and other technical information needed to perform security reviews.

In January 2003, Microsoft announced the Government Security Program (GSP), which allows governments and international organizations to assess the security and integrity of Microsoft software. Austria, China, Finland, Norway, Russia, Taiwan, Turkey, the U.K. and the North Atlantic Treaty Organization (NATO), among others, have signed up for this program. The GSP covers current versions of Windows 2000, Windows XP and Windows Server 2003 and Windows CE.

In contrast to open source licenses, Microsoft's shared source efforts do not allow users to modify the code or turn it into derivative Windows programs themselves.

Observations on Software Patents

Until the 1980s, it was generally believed in the US that patent law did not cover software programs. A frequently cited memo by Microsoft's Bill Gates in 1991 included the statement "If people had understood how patents would be granted when most of today's ideas were invented and had taken out patents, the industry would be at a complete standstill today."

Organizations have increased the frequency and scope of software patenting. Recently, the US Patent Office has been criticized for actions such as its patent to Amazon, giving the firm exclusive rights to the "one-click" method for selling merchandise online. On Feb. 7, 2003; the Patent Office's head James Rogan said, "This is an agency in crisis and it's going to get worse. It doesn't do me any good to pretend there's not a problem when there is." During Microsoft's financial analyst meeting (July 2003), Bill Gates noted, "last year we applied for 1,500 patents, and that's a number that's been going up at a pretty steep ramp". The US Patent and Trademark Office issues over 20,000 new software patents every year.

4 Pursuing the Open Source Software Option

Guidance for Decision–Makers and Project Leaders

Organizations can approach the OSS option in a number of ways including: 1) running and operating a computer using OSS, 2) developing the open software for use by others and 3) contributing to an OSS project in efforts such as testing, providing enhancements, or supporting advocacy efforts.

Solid Project Planning is Required

Regardless of the manner of participation in an OSS effort, solid project planning and management are still required. Attention to the following project dynamics is helpful:

- Define and document the needs to be addressed by the project
- Understand the expectations of the project by all stakeholders involved
- Pursue project objectives within the context of the available resources, including economic funding, technical infrastructure and personnel skills
- Deploy OSS with the same structured methodologies as other ICT projects
- During initial OSS introductions, it is recommended to begin with small-scale projects, learn from experience, and leverage the capacities of others.

Review both OSS and Proprietary Alternatives

OSS is still in a very early state of development, deployment and use. Skills have to be developed and education on OSS dynamics is needed. When assessing OSS solutions, the following activities should be pursued:

- Obtain information on the types of open source applications available
- Identify the availability of resources to support the OSS implementation
- Review case studies relevant to the needs being addressed
- Review OSS and proprietary alternatives from a functionality and usability perspective
- Understand the economic trade-offs in pursuing both alternatives
- Understand the manner in which the OSS community for a given solution can support your needs

Be Pragmatic about Change

OSS is one component in delivering an ICT solution. The dynamics associated with the need being addressed by the project are likely to change. Users will change their minds based on their perceptions of what the problem is. Budgets may be reduced. New technologies and alternative solutions are continually introduced into the market. Managing these dynamics and their potential impact on a project is critical.

How to Acquire OSS Skills

The availability of professional technology support skills vary significantly between geographic regions. When these skills are available, they will

generally focus on proprietary software. At this stage in its evolution, OSS faces a classic supply versus demand paradox: greater demand for OSS should create a need for more OSS solutions and capabilities, but the demand could be impeded by supply constraints. As momentum for local OSS solutions increases, the skill set imbalance should decrease over time.

As an alternative to "on site" support, OSS skills can be developed by accessing and participating in on-line communities, such as user groups and mailing lists. Many governments are also developing OSS training initiatives.

Creating an Open Source Community

Creating an OSS project does not assure that external software developers will provide assistance in establishing an open source community centered on the project. When building an OSS development community, it is critical for the project to provide value to both software developers and the users.

Be practical about what the project can achieve. Understand the need to address and the limited resources available to achieve the goal. As simple as this may seem, many projects fail because the objective is not well defined, the objective changes without a complete understanding of the implications to the project, or the scope of the objective is greater than the resource available to address it. Clarity in the definition of the project, a highly motivated team leader and skilled team members are important components in assuring success.

Most OSS projects start and stay small. A few publicized OSS projects have benefited from the contributions of numerous developers distributed across multiple continents. Realistically, most projects will start small and remain relatively small, with the direction and management of the project in the hands of a small group of individuals.

Project leaders will manage the direction. Project leaders will evaluate requests for new features and ways to improve functionality. Team leaders must mediate these various ideas in a responsive fashion. Balancing resources and pacing the development process are important to the project as well.

Communication is critical. As with most social organizations, communication among the members of the community is critical. Disseminating information about the project status, building and maintaining interest among stakeholders, and soliciting input on potential changes are all required to maintain project momentum.

End-users are part of the community. Keep users engaged in the project. The means of addressing this need can be different depending on the circumstances of the project. End users are primarily interested in the timely delivery and usability of a solution rather than its technical elegance.

Pay attention to "Look and Feel". Many OSS efforts have addressed server-based offerings such as operating systems and databases, where technical elegance is greatly valued. It is likely that many projects in developing countries will have a user interface component. Whether the software will run on a PC, PDA, Web interface or cellphone, attention to the "ease of use" of the application is critically important.

Achieving simplicity in the user interface design can be a time consuming effort. However, investing in this area should increase the level of acceptance of the solution by users and provide solid feedback to the development team.

The development platform should be open source. If you want volunteer developers to contribute to your project, ensure that the software development tools are freely available. Releasing a solution developed with a proprietary development environment can reduce contributions because the

tools may be economically out of reach of some potential developers.

What if the Project Fails?

As uncomfortable as project failure can be, it occurs often. Many project failures are not directly related to the technology used (either open or proprietary), but are a result of other issues. Numerous studies have examined the failure of technology projects in commercial settings. Fail, in this context, is a project not completed on time and/or on budget, or meeting client needs. Based on these criteria, a failure rate of greater than 50% is common. According to the Standish Group, CHAOS Report, 2000, only 26% of software projects succeed.

Reasons for a high failure rate among software projects include: user input was inadequate, the project objectives were unclear, there were frequent changes in requirements and specifications, and availability of skilled resources was poorly estimated. Requirements management is important. As stated earlier, be pragmatic and responsive.

A Broader Context for OSS Projects

While the Linux operating system has received much of the attention, the OSS approach lends itself to many types of software efforts. Therefore, it is important to understand the potential for such activities.

The following examples are intended to illustrate that OSS projects can 1) bring value to small, specialized communities; 2) address new technology needs, 3) attract business investment, and 4) extend the concept of open source beyond software.

Compiere — An Open EPR Solution

Compiere is open-source Enterprise Resource Planning (ERP) software integrated with customer-relationship-management (CRM) software. Functionally, the system handles tasks such as managing inventory, entering sales orders, creating invoices and recording shipments, creating purchase orders, and managing journal entries.

A Mix of Open and Proprietary Software. While the applications software for Compiere is open source, an Oracle database is required to store the data. Database independence is currently being addressed, with support expected in the first quarter of 2004.

The complete software suite consists of accounting, stock, sales, and staffing modules and runs on UNIX, Solaris, Linux or Windows 2000 servers and Java enabled clients.

Expanding Global Support The system is currently available in English, German, French, Romanian and Spanish. Recently, it was announced that GrandLinux Solutions, a partner in Thailand is localizing the system. The company is implementing some modules for two Thai companies in the manufacturing and agriculture industries. The company plans to provide the complete ERP package to Thai customers by the end of this year. Currently, the project is 40% complete and should be the first open-source ERP software for the Thai market.

Partners also exist in South Africa, Latin America, China, Taiwan, Hong Kong, Singapore, Malaysia, Viet Nam, Korea, Japan, and Indonesia.

The Compiere License is based on the Mozilla Public License Version 1.1 and the Netscape Public License.

Koha.org — Addressing the Library Management Market

While high profile open source projects garner much news coverage, there is no reason an open source project cannot address a specialized need with much smaller market dynamics. Often, an

open source effort is driven by addressing a personal need (Linux started that way), and becomes more pervasive as it attracts a large community of users and developers. Koha, an Open Source Library System, is such a project.

The Need to Address Y2K Compliance Initially developed in Wellington, New Zealand by the Horowhenua Library Trust and Katipo Communications Ltd. to meet Year 2000 computer compliance requirements, the Koha system is a full catalogue, circulation, member management and acquisition system. Koha uses Linux, MySQL, Perl and Apache as components of the system, and is licensed under the GPL.

Koha means "Gift" and its developers provided it to the open source community with the hope that the Koha community can create a system beyond the initial needs of the Library Trust, thus benefiting the community and initial users as well.

Usage is Global. Currently, work is contributed by volunteers and the Katipo Communications staff, with funding from the Horowhenua Library Trust and other libraries. The system is used by public libraries, private collectors, university faculties, not for profit organizations, churches, schools and corporations. Users include The Ecole des Mines de Paris, Gould Academy and Nelsonville Public Library.

Linux Terminal Server Project

A consulting project, started in 1996, to re-engineer a hospital supply company's purchasing, inventory, point of sale, general ledger, accounts payable, and order entry processes lead to the open source Linux Terminal Server Project (LTSP.org).

The Objective. Over several years the relationship between the hospital supply company and the consultants, lead by Ron Colcernian of Dynamic Results, investigated different Linux system configurations with the goal of delivering a $500 per user solution requiring minimal maintenance.

The Configuration. The Linux Terminal Server Project (www.ltsp.org) started by Jim McQuillan and Ron Colcernian is dedicated to developing Linux thin-clients that use diskless workstations that are activated by a networked server. The thin client workstations provide users with access to applications (office productivity, Web browsing, email etc.), with the computing work taking place on a networked server.

Because the thin client workstations typically have no hard disks, floppy drives or CD support, their failure rate is lower than traditional PCs. This configuration simplifies the management of the systems and allows users to access their personal desktop from any workstation in the network.

The Benefits. Linux Terminal Server technology benefits include: 1) technology staff spend less time administering their infrastructure, 2) a thin-client architecture to store all user data on the network and minimize the risk of losing data, 3) replacement workstations can be easily installed and 4) the elimination of many security issues, such as concerns about staff loading personal software onto the system.

The Users. This technology solution is finding use in both developed and developing world implementations where there is a high level of cost sensitivity and multiple users (e.g. educational computing), such as Goa, India schools, Youth with a Mission, Vienna Adventist Academy, Escola Alicerce, SchoolNet Namibia, and Telecenters in Sao Paulo, Brazil.

MySQL — Attracting increased Business Interest

MySQL is an open source database created by David Axmark, Allan Larsson, and Monty Widenius.

They developed the offering in 1995 and started MySQL AB, which provides fee-based technical support for it. MySQL is used by Associated Press, Cox Communications, Yahoo, Cisco Systems, NASA, Lucent, Google, Hewlett-Packard, Xerox and U.S. Census Bureau among others, and has an installed base estimated at over 4 million users.

The Dual licensing Model. MySQL AB uses a dual-licensing model allowing software developers to use a commercial license, while allowing users of the GPL free version to buy product support and services from MySQL. The non-GPL commercial license allows a user to resell a product that contains MySQL code without violating GPL rules.

Venture Capital Investment Increases. In June 2003, MySQL AB announced a $19.5 million round of venture capital financing lead by Benchmark Capital of Menlo Park, CA.

Developing Relationship with SAP AG. In May 2003, MySQL announced a technology partnership with SAP AG and have acquired the commercial rights to SAP's open source database, SAP DB. They will work with SAP to jointly build the next-generation MySQL open source enterprise database based on MySQL and SAP DB technologies.

The Business Model. MySQL AB positions the commercial version for software suppliers, mobile applications, telecom equipment, testing equipment, consumer electronics, automotive applications, and others for non-GPL licensing. MySQL AB has built a business by selling commercial licenses, support agreements, partnership agreements, training courses, and consulting centered on an OSS product.

Wikipedia — Built with Open Source, Delivering Open Content

Wikipedia (www.wikipedia.org) is a multilingual, open content, collaboratively developed encyclopedia. The term Wiki is Hawaiian for "quick." The system provides a fast and easy way to publish information.

The project started in January 2001 and currently the Wikipedia has over 17,000 articles in English and over 75,000 articles in other languages. The content is open and editable by anyone with Internet access and Web browsers. The project promotes the concept that "open content" improves with the collaborative efforts of a global community. With an "open content" perspective, the Wikepedia follows the open source model on the premise that as access is shared among a global community, usage and collaboration will increase and the quality of the information should improve as well.

The all-OSS system is written in PHP, and uses a MySQL database. The server consists of a dual CPU Athlon 1700+ with 2 GB of RAM, running Red Hat Linux and the web server Apache.

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Terms to Know

Apache: An open source Web server available on most UNIX based systems (such as Linux, Solaris, Digital UNIX, and AIX), and Windows NT/2000.

Application Server: A server program in a computer in a distributed network that provides the business logic for an application program. The application server is a part of a three-tier application, consisting of a graphical user interface (GUI) server, an application (business logic) server, and a database and transaction server.

Copyright: Used to protect expression of an original work of authorship; a copyright provides the owner with exclusive rights and the ability to authorize others to exercise those rights. A copyright does not protect an underlying idea or concept.

Free Software Foundation (FSF): Founded in 1983 along with its demonstration GNU project by Richard Stallman at MIT to prove that an operating system could be developed and shared freely. "Free" does not mean at no charge, but refers to the use a person who acquires software has with it.

GNOME (GNU Network Object Model Environment): A graphical user interface and set of applications including word processor, spreadsheet program, database manager, presentation graphics, Web browser, and e-mail. GNOME comes from work of the Free Software Foundation.

GNU: A UNIX-like operating system built with source code that can be copied, modified, and redistributed. Richard Stallman and the FSF started the GNU project in 1983. Linux consists of GNU components and a kernel developed by Linus Torvalds.

HTML: HyperText Markup Language used to create Web pages.

IceWM: A GNOME compliant window manager for Xwindow systems, such as Linux that is used for its speed and low resource requirements.

Java: A programming language introduced by Sun Microsystems in 1995, designed for use in the distributed environments. IBM, Microsoft, and others offer Java compilers.

Kernel: The center of an operating system providing basic services to its other components.

KDE: K Desktop Environment is an open source graphical desktop environment. KDE includes a file manager, a window manager, a help system, a configuration system, tools and utilities, and several applications.

Linux: An operating system designed to provide Intel PC users with a low-cost alternative to UNIX systems. Linux's kernel was developed by Linus Torvalds at the University of Helsinki. To complete Linux, Torvalds used components from the Free Software Foundation's GNU project. Linux is available on major hardware platforms.

License: A contract that specifies the rights that one party is granting to other parties.

Mono Project: Initiated by Ximian, Inc. to provide developers with a set of open source tools for building .NET applications that run on Windows or any Mono-supported platform, including Linux and UNIX.

Mozilla: Mozilla was Netscape Communication's nickname for Navigator Web browser, and more recently, the name of an open source Web browser project.

MySQL: An open-source database system. It is released under a GNU GPL license, and is also available under a commercial license.

.NET: Microsoft's strategy and programming efforts to address Web services. Their goal is to provide seamless interaction between applications and computers.

Open Source: Any program whose source code is made available for use or modification as users or other developers see fit. Historically, proprietary software developers have not made source code available.

Operating System: The program loaded into the computer that manages the use of the hardware and other software programs. Linux, Windows 2000, VMS, OS/400 and AIX are examples of operating systems.

Patent: Used to protect novel, useful, and non-obvious inventions.

PostgreSQL: An open source object-relational DBMS. It is released under a BSD-style license.

PHP: A development language used for building dynamic websites.

Python: A scripting language with a focus on spare programming.

SourceForge.net: An Internet based service for software developers to manage OSS development projects. It is hosted by VA Software.

Web Server: A program that manages the files that form Web pages which are presented Web users. The leading Web servers are Apache and Microsoft's Internet Information Server.

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