

# Free Software Tools For IT Management and Processes Organization: Case Study In Scientific Research Environment

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## ABSTRACT

This paper promotes the need of choosing some and integrating the large variety of Free and Open Source Softwares (FOSS) to provide an integrated solution for information technology management and process improvement. The main motivation is that the amount of FOSS that can be used in a working environment is so large that only very specialized companies can fully benefit from them in an integrated way. Hence, to allow smaller groups to efficiently use FOSS this work not only advocates the need of creating a complete package of tools, but presents a case study consisting of a set of tools for project management, access control, file sharing and other essential processes. For the sake of concreteness, the adoption of these tools by a group composed by approximately fifty people of a research laboratory, illustrates how they can improve the productivity of relatively small companies.

**Keywords:** Open Source, Free Software, high availability, uteckpack, research.

## 1. INTRODUCTION

Softwares (FOSS) [1] has increasingly gaining market share. Free from financial costs and with the benefit of being freely modified, FOSS represents a cheap alternative to commercial softwares on academic and business environments.

Some research groups generated discussions to evaluate whether FOSS are able to evolve

as a business model. In [2], it is discussed the importance of FOSS for scientific research, due to its strong economic impact on society. It is possible find free software in the business environment, as discussed in [3].

The FOSS also had strong growth in public organizations, with programs such as E-Government [4], [5], whose main goals are: better service, lower cost, better communication and interaction between citizens and government processes, using information and communication technologies (ICT) to facilitate the operations of public services. In Brazil there is the Public Portal Software [5], in which can be found the softwares used in government agencies.

The objective of this work is not to discuss the possibility of the success of FOSS. Instead it aims at demonstrating the FOSS potential through a report of its use in a scientific research environment presenting a real scenario in which various softwares were used for process improvement and organizational development environment.

The case study presented in this paper was conducted at the Signal Processing Laboratory (LaPS) from Federal University of Par (UFPA), whose needs were planning and organizing processes, such as hiring researchers, file sharing, storage of user data, among others. For such improvements we used both softwares developed by the Free Software Community and softwares developed by the LaPS development team. The softwares listed below compose the proposed solution:

- 1) OpenLdap - Directory service.
- 2) LapsDirectory - Web software for manage OpenLdap base.
- 3) OwnCloud - File sharing service.
- 4) Redmine - Project manager.
- 5) Wiki - Web software for documentations.
- 6) Etherpad - Editing documents in group.
- 7) Scape - Access control system.
- 8) Alta Disponibilidade - High availability system for IT services.

## 2. USED SOFTWARES

This section describes the softwares used to compose the solution.

### 2.1. OpenLDAP server: Directory service

The OpenLdap [6] is an *Lightweight Directory Access Protocol* (LDAP) server, which in turn is a directory access protocol, whose main purpose is to store information in a centralized way. This follows a directory tree model. Unlike databases, directories are seldom modified, thereby experiencing many more reading operations than writing operations.

Managing an environment with softwares which use independent databases is not a trivial task, due to the fact all users would have their data replicated on each database existent, thus increasing the chances of data inconsistency. Using the OpenLdap keeps a directory organization centralized.

### 2.2. LapsDirectory: Management for information stored in the OpenLDAP server

The LapsDirectory [7] is an Open Source software developed by the LaPS development team, aiming to manage the user's data (e.g name, telephone, address and so on). In the software, common users can update their own personal data only. The admin users can create, delete and update data about all users on the system, in addition to manage groups and so on.

This software has the advantage of being a web tool, developed using PHP [8] as programming language, besides being an Open Source and Free Software tool.

### 2.3. OwnCloud: File Sharing Cloud

The OwnCloud [9] is an Open Source solution, developed to file sincronization and sharing. It is possible to use a network, like Internet, to access files stored in a cloud instead of a local machine.

This software was developed using PHP as programming language, and can use the MySQL [10] as database server, besides being able to communicate with LDAP server. The OwnCloud allows file manipulation through a web browser. Also there are client softwares for various platforms, such as Windows, Linux and Mac OS, which are capable of synchronize files to a local machine.

### 2.4. Redmine: Project manager system

The Redmine [11] is an Open Source software for project management developed using Ruby on Rails [12]. This software focuses primarily on software development projects, but can be used to manage tasks, documents written, maintaining information about users participating in a project needing to centralize their informations.

### 2.5. Wiki

The Wiki is a web software which allows various users to edit some content through a web browser, using simple markup languages. This tool can be used to create tutorials, provide information about an given subject, create documentation about softwares or projects, etc. There are some wiki software available on the internet for users, and mediaWiki is used to compose the solution presented at this work.

### 2.6. Etherpad: Editing Documents in conjunction Simultaneously

The Etherpad [13] is a web software which allows various users to edit text documents at the same time. This software is able to show the user's editions in real time, also it is able to differentiate the text entered for each author.

### 2.7. Scape - Access control system

The Scape [14] was developed by the LaPS development team in order to manage the schedules of working students and researchers

linked to LaPS as well as inbound and outbound movements in the physical environment of the laboratory. It generates reports referring to times when the door was opened and times of entry and exit (working point) of the members. The software also differentiates working hours in office hours, or outside, and faults, justifications and optional days, worked or not. This way, it is possible to manage the attendance, tardiness, punctuality, without the coordinators observation or even their presence on the laboratory.

### 2.8. High availability system for IT services

A high availability system [15] has as its main feature the use of mechanisms for detection, recovery and fault masking, aiming to avoid possible system failures.

The system is considered unavailable in the case when an user can not access it properly. In availability calculations scheduled maintenance shutdowns are not included. It is important to calculate the absolute value for unavailability. A value of 99 % appears to be a good level of availability, but it means a system unavailable 87.5 hours in 1 year. Thus, based on the monthly and yearly downtime, it can be defined the levels of availability presented in table I.

TABLE I  
HIGH AVAILABILITY LEVELS.

Availability (%)	Downtime / Monthly	Downtime / Yearly
95 %	1d 12h	18d 6h
96 %	1d 4h 48m	14d 14h 24m
97 %	0d 21h 36m	10d 22h 48m
98 %	0d 14h 24m	7d 7h 12m
99 %	0d 7h 12m	3d 15h 36m
99,9 %	0d 0h 43m 11.99s	0d 8h 45m 35.99s
99,99 %	0d 0h 4m 19.20s	0d 0h 52m 33.60s
99,999 %	0d 0h 0m 25.92s	0d 0h 05m 15.36s

A high availability system was set up comprising IT services used in our laboratory. This solution was planned to be executed automatically. The solution focuses on servers, because them store and manage services used by users.

The high availability is configured: in hardware, with redundancy of the servers. For each server there are another one as a backup server, with replicated data and the services was

set up equally, and in software, which consists to configure the softwares: Heartbeat [16], which is responsible for making decisions about the system, the Moni [17], which is responsible for monitoring the services status, and DRBD [18], which is responsible for replicating the data between servers via a network link.

## 3. CASE STUDY

In this section, it is described the environment taken as case study. The environment is a research laboratory located at the Federal University of Para, named Signal Processing Laboratory (LaPS). In this laboratory there are a number of processes that can be improved and automated. The purpose of this work is the use of a toolkit Open Source and free software to configure a solution that can automate, and therefore facilitate the operations of the processes presented here. In the next sections will describe the procedures used in the laboratory.

Some processes examples will be briefly discussed below. These processes will be described in a defined order from the time researcher or student are hired until the time they participate or use the resources of the environment for the development of their research work.

### 3.1. Hiring a new member

When a new member is hired (student or researcher) it is used the directory base from OpenLdap server (Section 2-1) to store their information. This service works as an user accounts server for all applications (resources) from with the laboratory, such as the operating systems login, internal softwares and so on.

To manage this user base, the laboratory has developed a tool called LapsDirectory that is used by the human resources manager, since it is responsible for maintaining the information regarding the users who frequent the environment.

### 3.2. Access control

The LapsDirectory software (Section 2-2) also manages passwords for the access to operating systems, internal softwares and control physical access to the environment,

which is done via Scape. Thus ensures greater security since access to the physical environment is required to enter login and password on a keypad located on the front door.

The Scape is also composed by a web interface, and it is possible to track hours worked, attendance, among others, as described in Section 2-7. Thus the Scape can be used both by management of human resources, as the coordinators of research groups.

### 3.3. File sharing

Users from the laboratory daily edit and read documents as tutorials and articles among others. To facilitate file sharing among the members, the OwnCloud software (Section 2-3) is used.

### 3.4. Project management

Projects from the laboratory are commonly dealing with software or hardware development and are documented and managed via Redmine software. Thus it is possible to identify participants for each project, delegate tasks and monitor their developments, view the source code of software projects among other features.

The Redmine (Section 2-4) also provides a Wiki (Section 2-5), and it is possible for example to document projects, procedures and software used in the laboratory.

### 3.5. Meetings

The preparation of agendas and minutes for meetings is a common practice in business or academics environments, and when performed by a single individual, can become a laborious and time-consuming task. At LaPS, the meeting is a frequent practice. To reduce the investment in both time and effort expended in creating such documents, nowadays editing the agenda and the minutes of the meetings is done in a decentralized and collaborative way through the Etherpad software (Section 2-6).

With Etherpad, publishing the minutes of the meetings, especially, can today be performed along the same and more than one participant simultaneously, thereby reducing the time and effort undertaken in individual task.

## 4. CONCLUSIONS

Systems based on FOSS have advantages when compared to commercial systems, but also require attention to specific aspects. One important aspect is the configuration of several solutions that compose a collaborative environment. Sometimes the distinct FOSS systems are difficult to integrate. For example, in can be the case that there is a lot of documentation about each software but they are presented in isolation, not considering the other softwares that compose the collaborative environment.

This work provides a step in the direction of integrating important tools and documenting their integration. Special emphasis was given to data sharing via LDAP. Another discussed topic was high availability, which will be a topic of future work.

## REFERENCES

- [1] FSF, "The Free Software Definition. <https://gnu.org/philosophy/free-sw.html>," Accessed in 18/01/2013.
- [2] Georg von Krogh and Sebastian Spaeth, "The open source software phenomenon: Characteristics that promote research," *The Journal of Strategic Information Systems*, 2007.
- [3] Amir Mostafa Saleh, "Technology adoption: a study on the use of Free Software in firms (in Portuguese)," M.S. thesis, Faculty of Economy, Administration and Accounting, 2004.
- [4] Marco Natale, Tommaso Cucinotta, and Shiva Kolachalam, "A Modular Open-Source Architecture for ICT Services in the Public Administration," in *Electronic Government*, Roland Traunmiller, Ed., vol. 2739 of *Lecture Notes in Computer Science*, pp. 167–172. Springer Berlin Heidelberg, 2003.
- [5] SPB Portal, "Brazilian Public Software Portal. <http://http://www.softwarepublico.gov.br>," Accessed in 19/11/2012.
- [6] Matt Butcher, *Mastering OpenLDAP Configuring, Securing, and Integrating Directory Services*, Packt Publishing Ltd., 2007.
- [7] Andr A. da S. Pereira, *Secure and centralized authentication system using Lightweight Directory Access Protocol - LDAP (in Portuguese)*, 2008.
- [8] Luke Welling and Laura Thomsom, *PHP and MySQL Web Development*, Addison-Wesley Professional, 2010.
- [9] Dmitri Popov, "A cloud to call your own (in Portuguese)," *Linux Magazine*, vol. 87, pp. 55–59, 2012.
- [10] Michael Kofler, *The Definitive Guide to MySQL 5*, Apress, 2009.
- [11] Redmine, "Redmine online Documentation. <http://www.redmine.org>," Accessed in 17/01/2013.
- [12] David Flanagan and Yukihiro Matsumoto, *The Ruby Programming Language*, O'Reilly Media, 2008.

- [13] Etherpad, "EtherPad online Documentation. <http://etherpad.org>," Accessed in 19/01/2013.
- [14] Flavio Hernan Figueiredo Nunes, Bruno Gomes Haick, Andrey Lopes Maia, Silvia Cristina Feij Lins, Lilian Coelho de Freitas, and Aldebaro Barreto da Rocha Klautau Jnior, "SCAPE: Design and Implementation of an Access Control System," *Research Policy*, 2010.
- [15] Bruno Gomes Haick, *Free solution for High Availability Computing: case study using DRBD, Heartbeat e Mon (in Portuguese)*, 2011.
- [16] Heartbeat, "Heartbeat Documentation," 2012, Accessed in 17/12/2012.
- [17] Mon, "Mon Documentation," 2012, Accessed in 15/11/2012.
- [18] Drbd, "Drbd Online Documentation," 2012, Accessed in 18/11/2012.