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Open Source Migrations: Experiences from European Public Organizations

The landscape of public organizations in Europe is diverse and complex. Public administrations differ in the services that they provide and on their characteristics, but they all rely on computing to deliver their services, even if it is to varying degrees. This paper analyzes the experience of a group of European public organizations investigating the possibility of supporting their services through the use of Open Source. Open Source is software developed inside a community committed to producing software that is free to use, modify and redistribute.

The group under examination is composed of a number of public administrations varying in size, from four different countries. While the motivation for starting the migration varies across the members, the results from the different experiences are consistent and show that Open Source is a realistic opportunity to consider. Technical, strategic, and environmental aspects that arose during the migration have been investigated and analyzed.

1 INTRODUCTION

The landscape of public organizations in Europe is diverse and complex. Public organizations cover a vast area of activity, varying greatly in size, in the type of services provided and in wealth.

The increasing use of and reliance on computing and communications technology in order to deliver services to the public has focused attention on how this phenomenon can be supported and accelerated. Interest in *e-governance* (West, 2004; Edmiston 2003) and the technological innovations coming from, for example, mobile telephony, the Internet and, more generally, ubiquitous computing (Jessup & Robey, 2002; Banavar & Bernstein, 2002) offer both opportunities and challenges. Technological innovation comes at a price, and in many countries the resources available to are insufficient to support what they need to do.

To overcome this problem, one solution that is being actively investigated is the use of Open Source software. Six main projects, for a total cost of €9.6 millions, have been funded by European Union through CORDIS (Community Research & Development Information Service, www.cordis.lu) on the study of different aspects of Open Source between 2001 and 2006. Furthermore, more than 80 projects that involve the development of Open Source have been funded by CORDIS in the same period, the largest to date being RODIN (€4.4 million).

Currently there is very limited amount of literature focussing on actual Open source software migrations (Waring & Maddocks, 2005; Fitzgerald & Kenny, 2003) and in this paper we present the experience of a group of European public organizations investigating the possibility of implementing supporting their services through the use of Open Source.

1.1 The Open Source movement

The Open Source movement (Perence, 1999) is an offshoot of the Free Software movement (Stallman, 2004) and advocates the freedom to use, modify and redistribute software, on both pragmatic and philosophical grounds.

Freedom to use, to modify and to redistribute are the main attributes of Open Source software: in some cases, for example, the user will have the freedom to use and redistribute the software, but not to change it and thus the software does not qualify as Open Source. This is the case, for example, of freeware and shareware (Werbach & Dreben, 2003), that are merely royalty-free. Proprietary software is, regardless of price, software which does not provide all the liberties of Open Source.

Research on Open Source has already examined in depth the business models that drive the development of Open Source (Bonaccorsi & Rossi, 2003; Haruvy, Prasad, & Sethi, 2003; Hertel,

Niedner & Herrmann, 2003; Lakhani & Wolf, 2003; Lerner & Tirole, 2001; Lerner & Tirole, 2002). We will focus on the practical implications of the migrations that we studied.

2   PROJECT OUTLINE

The research described in this papers was undertaken as part of the COSPA project, a 2 years and half project funded by the European Commission to investigate the viability of using Open Source on desktops within European public organizations (Kovacs, Drozdik, Zuliani & Succi, 2004). The consortium consisted of 15 partners throughout Europe from public organizations, academia and industry.

Real-life experiences of public organizations adopting Open Source have been collected (Chambers, Baravalle & Holcombe, 2005) by our group as part of its involvement in the project and are described and discussed within this paper.

The collection of the information about the experience and the motivations of the public organizations was divided in two parts. The first part ran between August 2004 and January 2005, and focused on collecting administrative business processes used within the public organizations, which resulted in over 300 processes being collected. The second part ran between February and March 2005, and involved collecting reports about their open source experiences written by the public organizations, using questionnaires and interviews where necessary.

2.1 Public organizations involved in the study

This paper is based on data collected by organizations located within Denmark (Hanstholm), Hungary (Torokbalint), Ireland (South West Regional Authority) and Italy (Consorzio dei Comuni and Province of Pisa).

Beaumont Hospital is a hospital located in Dublin, Ireland. In 2000, Beaumont Hospital had an obsolete software environment based on proprietary software, and was at the very least unclear its observance on software licenses. Ensuring compliance to the copyright legislation by acquiring obsolete software did not make sense from neither financial nor technical perspective. On the other hand, the budget required to update the current software and to acquire the correct number of licenses was estimated to be 1 million euros, which was deemed to be unaffordable by the hospital. Use of software with a low or null cost of acquisition, such as royalty-free software and Open Source, became the focus of the new strategy. A full migration plan was prepared, including the migration of the backoffice and middleware applications and a migration of the desktop software in many departments.

Consorzio dei Comuni dell'Alto Adige is a consortium of more than 150 public organizations in the province of Bolzano, Italy. Almost all these are small and the consortium manages their IT infrastructure, including approximately 2,500 desktops. The first migration of server software to Open Source was in 1997, when Linux and the Samba file sharing technology were adopted as the new bases of their network infrastructure, in a incremental migration process that required six years. The migration of the desktop software began with the COSPA project and was focused on changing the office suite to OpenOffice.org.

Hanstholm is a Danish municipality of approximately 70 employees. During the COSPA project, a number of desktops have been migrated to StarOffice, a proprietary derivative of OpenOffice.org and a migration of the middleware was ongoing at the end of the COSPA project.

The Province of Pisa (Italy) decided in 2003 to proceed towards the adoption of Open Source and towards the promotion of the development of Open Source solutions that could be reused by others. The province has thus developed Open Source applications for internal use and a transition to OpenOffice.org was done during the COSPA project.

The South West Regional Authority comprises of three public organizations based in the South West Region of Ireland. The main objectives of its Open Source experimentation is to reduce the costs of IT services and ensure its citizens could gain benefits from open access. The initial experiments with Open Source began in May 2004, with a trial of OpenOffice.org, involving 50 desktops.

Torokbalint is a Hungarian municipality of nearly 40 employees. Employees are using rather old computers. A network is present but its use is mainly for incoming and outgoing communication, not for internal communication. Economic motivations are driving the adoption of Open Source. The main aspect of the migration is the replacement of Microsoft Office with OpenOffice.org; Torokbalint is already using Linux on all their servers, and a partial migration of the desktops is ongoing.

3 DISCUSSION

The public organizations within the study submitted experience reports describing their use and experiences of Open Source to date. These were considered in conjunction with the requirements obtained by studying the more than 300 business processes collected from these organizations and the software requirements that they explicitly stated. The subsections that follow focus on a qualitative analysis of the issues that arose, while more information on the process of data collection and on the raw data itself can be found in the deliverables 2.4/2.5 (Chambers, Baravalle & Holcombe) and 4.3 (Baravalle, Chambers & North) of the COSPA project.

3.1 Strategic aspects

Efficient use of resources is one of the main topics that the public organizations need to consider and different strategies may be required according to the temporal horizon. The public organizations within the project could focus on medium to long term objectives, thanks, at least in part, to the funding that they received towards the experimentation costs.

Savings have been clearly identified by some partners, mainly in licensing costs. Beaumont Hospital identified savings of 8 million euros (over a five year period). Consorzio dei Comuni identified 1.5 million euros of savings (the cost that would be needed to buy a proprietary alternative of the Open Source software that they are using). At Hanstholm they estimate a saving of 41,000 euros per two year cycle, that correspond to the amount currently required to upgrade their office suite according to the licensing policy of their IT supplier. Torokbalint estimates 17,000 euros of savings for the next year. For the South West Regional Authority and for the Province of Pisa and Genova, economic savings are, again, in licensing costs.

Amongst the advantages, the public administrations reported a simplification in the acquisition and management of software. Using Open Source software *decreased the internal cost of license management* (as no licenses are required) and tracking the number of licenses that have to be purchased can be costly and time consuming. Moreover, using Open Source allowed the deployment of the same configuration regardless of the individuals use of the tools without wasting money whilst *simplifying the installation and maintenance* procedures which can be labour intensive and costly.

Cost of labour and technology can strongly influence the cost of a migration. Open Source tends to be more labour-intensive than proprietary software, and it might be less beneficial in countries with a high labour costs. Instead, amongst the test locations, it was perceived that the possibility to use legacy hardware systems, and was limiting the technological obsolescence of their systems.

The *types of software used* need to be considered as well, as they can have major implications for the viability of a migration. Public organizations that are using varied and highly specialized software find it more difficult to migrate to Open Source. Contrastingly, public organizations with a low level of software use (as Torokbalint) find migration much easier.

All the partner public organizations deployed incremental migrations, with different departments migrating at different times. This approach appears to have the advantage of phasing the effort and of improving the experience by trial and error. At Consorzio dei Comuni, the long term plan is to remove all the proprietary software still in use (wherever possible), but in the short term, some departments still use proprietary software, such as the accounting system. Replacing the software before the end of their life cycle is not considered as delivering sufficient benefits.

Interoperability is a further issue that public organizations need to consider. Public organizations are interconnected in different ways (Baravalle, Chambers & North, 2005) and need to exchange inputs and outputs, both internally (internal communication) and with any other organizations or individual (external communication). Deferred communication also needs to be considered: a public

organization needs to be able to have a memory and to query it, not to lose the information that has been acquired over many years.

The number, the importance and the type of interconnections of the public organizations has to be considered too, to ensure that it will still be possible to receive inputs and provide outputs from and to other organizations.

Three possible scenarios are discussed in the next paragraphs, based on the type of relation between the organizations. From an operative point of view, we consider that both external and internal communication obey the same rules.

In the first scenario, both *organizations have their own autonomy and similar contractual power*, or in any case a possibility exists that agreement can be reached on how to exchange data. Public organizations using different formats for internal use can decide a data standard to be used for external data interchange. When a consensus can be easily reached, a transition to Open Source will not cause major problems for communication. For example, public organizations that are using OpenOffice.org can easily agree to export the documents in several other data standards, including different Microsoft data standards.

In the second scenario, a *public organization which has limitations on the viable options* and is, at least for the communication with other organizations, bound to the use of specific data standards or software. This is the case, for example, when a public organization is dependent on another organization: making a transition to Open Source implies finding a way to adapt to the situation.

If the use of a specific data standard is mandatory for their communication, it might be possible to use software that exports data to that standard. If the use of a specific software package is required, it needs to be considered thoroughly. In some cases it is possible to make proprietary software coexist alongside Open Source. For example, it might be possible to make full transitions to Open Source operating systems, running the legacy applications through emulators such as Wine (Hnizdur & Briscoe-Smith, 2003). In other cases, public organizations may decide to make a migration of the office suites, but not of the operating systems, or a migration of the operating system, but not for all the computers.

For example, Torokbalint is required to use specific software to communicate with the central government and its banks, which is provided to them without cost. These software are used by nearly 50% of the users but runs only on a proprietary operating system, and that needs to be considered.

In the last scenario, the *public organization has a high contractual power* or even full power on deciding the specific data standards or even the software to be used for exchanging inputs and outputs. For example, this may be the case for large public organizations. Suppliers will be more willing to conform to the requirements of the public organization, and other public organizations may decide to follow the example. This is the case for the Province of Pisa which is involving local companies and other public organizations in a common migration scenario.

During our analysis of the administrative business processes, we found that only 2.5% of the processes reported by the public organizations were using *open data standards* (freely available and written by *super partes* organizations). If a similar percentage could be confirmed across Europe, the attention to interoperability would be essential. Public organizations face the real risk of being enclosed in multiple proprietary environments where interoperability is difficult and laborious, or a single software environment over which they have little or no control.

Open Source adoption can be effectively slowed by *interoperability* problems. This has been experienced, to differing degrees, in all the locations but at a higher level when the public organizations do not have high contractual power or are not wholly committed to an Open Source migration. On the other hand, proprietary software does not ensure interoperability between different versions of the same software. For example, Consorzio dei Comuni experienced difficulties in accessing documents created 10 years ago with a popular proprietary text editor that is no longer supporting its own legacy data formats. Using Open Source software allows to overcome this type of problems (Holtgrewe, 2004), ensuring that it will be possible to support any legacy format whenever necessary.

The reports from the public organizations also showed that they feel that *flexibility* is one of their main requirements and that being capable of adapting to different contexts is the key to their success (Caroll, 1988). Public organizations are interested in not being linked to just one architecture, Open

Source or proprietary. Only in 34% of the software requirements analyzed, public organizations gave a preference to just one operating system.

To conclude, public organizations need to integrate applications in their middleware. Consorzio dei Comuni has been involved in Open Source for a number of years and stated that from a technical point of view they can now easily develop customized solutions that meet their internal needs.

3.2 Environmental aspects

Public organizations take their decisions in the context of a specific environment. Political, legal and self-preservation aspects are considered at the management level and can strongly influence the evaluation.

Different political considerations play a role in the various perceptions of Open Source. From this perspective, Open Source can increase the *inclusiveness of the electronic experience.* Much Open Source software is distributed free of charge; thus a public organization that is using Open Source does not force its citizens to purchase software in order to communicate with it.

Promotion and support of Open Source has an impact not just on the public organization itself, but can affect the *local economy* and this is also considered at the political level. The vitality of local businesses can be impacted because the public organizations will require, in many cases, support for the implementation of Open Source. In the Open Source model there is a shift from acquiring a product in the global market, to acquiring a service, very often in the local market. The side effects in the local market appear to have influenced in a positive way the acceptance of Open Source, as reported by some partners of the COSPA project so far (Baravalle, Chambers & North, 2005).

Open Source by definition provides the seeds for cooperation, which can be a key factor for transforming services. Nevertheless, the approach towards cooperation can vary greatly in different contexts.

Public organizations which acquire or develop Open Source are free to pass it on to other public organizations. Thus Open Source can be strategic for lowering the cost of software acquisition, as solutions developed by or for other public organizations can be reused. Reusing and improving software can also have a high *impact on both the quality and variety* of new digitally-based services provided, especially in the context of e-government.

Alternatively public organizations may prefer not to establish links with other public organizations. From a Darwinian point of view, cooperation and competition are both possible strategies and the choice of one or the other strictly depends on the environment in which the organizations reside.

A concept that has occurred repeatedly in our study is that the decision of the migration is linked to the perceived *personal consequence of the failure of the project.*

Interviews held at the beginning of the research with a number of managers in UK public organizations indicated that their positions are not viewed as being secure in case of failure. A strong personal responsibility links the managers with their decisions, and that makes them easily subjects of Fear, Uncertainty, and Doubt (FUD) (Wikipedia 2005). Decisions may then be affected by considerations of not only of what is best for the public organization, but possibly what is the safer option for the individual decision maker. The immediate consequence is a lower propensity to migration, and innovation in general. At the same time, managers of public organizations feel that choosing a reputable company is a way of covering themselves if something goes wrong. The point of view is based on the fact that they would be better able to justify their decision if something went wrong with a reputable company or product than if they had chosen something different or new.

It is important to note that these views were localized and in most of the other locations the management was not afraid of the consequences of a failure in the migration with respect to their job. It was not clear if this can be linked to the possibility to hide the failure or to the unlikeliness that it would affect their job.

To some, pirate software is a real and practical alternative both to proprietary software and to Open Source. The advantage of pirate software, notwithstanding ethical considerations, is clear: a very *low cost of acquisition*, that tends towards to the cost of the storage medium plus the cost of transfer, as can be verified checking for "second hand" software in web sites such as e-bay (www.ebay.com).

In some contexts *it is realistic to estimate that proprietary software is, in fact, not an option under consideration*, but that organizations are willing to consider only software with a very low cost of acquisition. The GNI per capita in 2004, as published by the World Bank (The World Bank Group, 2005) is $ 8,270 in Hungary, and $ 2,350 in the FYR of Macedonia, compared to $ 26 120 in Italy and $ 34 280 in Ireland, but the price of software is only loosely linked to the local economy and is quite constant across Europe. Therefore, proprietary software in less wealthy countries can be far less appealing. Moreover, the level of enforcement of copyright legislation may vary across countries, making in some cases pirate software a low cost-opportunity option as it is not likely to be actively persecuted.

Statistics on software piracy published in 2004 by Business Software Alliance (BSA) (BSA 2004a; BSA 2004b) show that the estimated piracy level is at 29% in the UK, compared to 37% across the European Union and an average of 70% in Eastern Europe. The other countries represented in the COSPA, apart from Denmark (26% of estimated piracy) all have an higher estimated piracy rate: 49% for Italy, 42% for Hungary and 41% for Ireland.

A possible consideration is that public organizations in countries where piracy is more widespread are more likely to be affected by the problem. It is possible that the decision in favour of an experimentation with Open Source might be linked, in some cases, to the need for action on software piracy.

3.3 Technical aspects

When considering any change of software, technical considerations are of major importance: software unable to meet the technical requirements is unlikely to provide a suitable solution.

It is important to know what are the *requirements* and to analyse whether the software can meet them. However, identifying the requirements may be far from trivial: the effort required may depend on numerous factors, including whether the software will be used to replace a manual system, existing software with similar functionality or whether increased functionality is required.

From our study it appeared that many users simply do not need lots of the advanced features that the general software such as office applications provide. It could be the situation for example that an office suite that is currently in use in the organization is far more advanced than an Open Source alternative, but if the requirements were simple and the funds limited, this could be a good alternative.

Different members of staff may have different requirements of the same software packages and not all staff opinions are necessarily equally influent. For example at Beaumont Hospital the senior management was not happy to use the newly installed e-mail system and was dissatisfied with the office suite. While these users were few in number, they have a large influence on the software that is used and consequently a migration back to the software packages they were previously using is a possibility.

Also, there might not be a suitable Open Source option. This concurs with the results of the Open Source trials by the UK government that were published in October 2004 (Office of Government Commerce, 2002; 2004).

Further studies might investigate if the lack of advanced software requirements is linked to a Taylorization of the work process, and if so what are the implications connected.

The public organizations report that one of their main preoccupation is to have a software environment that is *secure, reliable and stable*. It needs to be secure, meaning that it must be possible to operate only actions that have been allowed. It needs to be reliable, that is to work in a predictable way, so that to the same set of procedures always corresponds the same, predictable reaction (e.g. the software should not crash). Finally, it needs be stable, meaning that it should not be subject to sudden or extreme evolutionary change.

Thus public organizations have to deal with the possibilities of contrasting requisites. At the present time, having a secure and reliable software environment often means constant software and/or hardware updates. Software updates depend on the support cycle of the product, often forcing an upgrade or a migration to newer products. Similarly, hardware updates are a recurring preoccupation for public organizations, both for the cost of hardware itself and for the cost of labour required for the

set-up. This has been mentioned in their reports by Beaumont Hospital, Consorzio dei Comuni and Torokbalint, and it is likely to be relevant to most public organizations.

Open Source can help the public organizations in this context. Open Source operating systems offer systems to manage and automate software updates using custom repositories. Public organizations can set up repositories of updates and force automatic update of the computers, which can be tailored to their specific requirements.

Similarly there are companies that specialize in support for legacy software, which are no longer supported by the original distributor. Finally, graphical environments such as XFCE or IceWM can be used on quite old computer hardware, whilst still taking advantage of the security updates.

Training in the Open Source technologies is another important issue and different approaches have been used. In Torokbalint, the training was delivered one-to-one, during the migration, due to the very small size of the public organization. In the other locations, training has been carried out using a two-tier approach, with courses for internal staff who later spread the acquired knowledge to the entire organization through internal courses.

To conclude, changes in the IT infrastructure need to address the conflicting interests of users and project managers (Sauer, 1993; Drummond & Hodgson, 2003), in order to minimize the possibility of failing.

4 CONCLUSIONS

The future scenario of Open Source is not yet clear; what is instead taking shape is a *digital divide*, between organizations that decide to use proprietary software and organizations that have a widespread use of Open Source.

Many successful Open Source projects are or can be used in the public organizations. Public organizations can use on their desktops a Open Source o*perating system* (e.g. Linux), a Open Source *desktop environment* (e.g. Gnome and KDE), an Open Source *office suite* (e.g. OpenOffice.org), and Open Source s*oftware for e-mail and web navigation* (e.g. Mozilla). Similarly, the IT infrastructure can use Open Source software such as Apache, Bind, Samba. However, no sufficiently advanced groupware solutions are currently available, and the same applies to middleware applications such as payroll system, business analysis software, financial analysis software, to name a few.

Several different licenses are used in the Open Source community, to release software and documentation. In July 2005, we performed an analysis of the software map at SourceForge (sourceforge.net), the widest existing repository of Open Source (including more than 65,000 Open Source projects) to study the diffusion of the different licenses. At that time, we found that nearly 69% of the software included was released under the GPL license, 11% under the LGPL and 7% under the BSD license. A previous analysis by Wheeler (2005) showed similar results: in 2003, 71% of SourceForge Open Source projects (45,000) were using the GPL, 10% the LGPL and 7% the BSD license. It needs to be noted that the software can be released (and often is) under more than one license and these data refers to software that included the GPL as possible license. Furthermore, in Wheeler's earlier analysis (2002) of Red Hat Linux 7.1 (Red Hat was and still is the most popular Linux vendor) he found that nearly 50% of its code was released under the GPL only.

The GPL requires that the rights that a user received with a GPL software must be granted by any program derived or linked to it, which means from a practical point of view, that developers including GPL software in their projects must release their work *under the same conditions*. The LGPL is used mainly by libraries (shared components), and allows to use it in any type of software, but requires that any modifications to the software are released under the same conditions. The Open Source movement is developing a new environment, that is taking advantage from the licensing conditions to spread.

Innovation can spread both inside the Open Source community and amongst developers of proprietary software, but the two groups cannot easily communicate. Open Source and proprietary technology currently cannot be easily mixed. Users can use Open Source and/or proprietary applications, but in most cases Open Source applications cannot have proprietary components and vice versa. Public organizations that decide not to use proprietary software are enrolling in a community that is open to the members and very closed to the non-members.

Open Source is a phenomenon that public organizations could be looking towards in the future as a viable way forward to deliver high quality administrative services to citizens in a cost-effective manner. However, there are many issues that need to be explored and resolved before it will be possible to exploit these opportunities to the full. One of these is the relationships between the users and developers of Open Source. Whilst standard Open Source packages such as office applications are of a generic nature and can, in many cases, be adopted into an administrative environment there will be many areas where new software, compatible with other Open Source applications and open data standards needs to be developed. These may be replacing propriety packages, bespoke solutions or may be new applications to support a new administrative function or a manual activity. Thus, it is essential that an effective communication framework be established that will bridge the gap between the public organizations and Open Source developers.

The data collected does not cover all types of public organizations in all countries of the European Union. However, the consistent nature of the data collected leads the authors to believe that it is likely to be representative of a much wider community of public organizations. What may differ is the amount of progress different public organizations have made towards supporting their administrative processes with IT. Thus. there is a possibility that the more experienced public organizations might be able to assist others in adopting solutions for processes that are essentially the same.

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