

Why should the HSE adapt best practice and standards for Open Source software?

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A dissertation submitted to the University of Dublin, in partial fulfillment of the requirements for the degree of Master of Science in Health Informatics

2010

Author's Declaration

I declare that the work described in this dissertation is, except where otherwise stated, entirely my own work, and has not been submitted as an exercise for a degree at this or any other university.

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Acknowledgments

I wish to thank the following who made it possible for me to complete this dissertation:

My supervisor, Dr. Frank Bannister for his excellent guidance and support

Course coordinator, Lucy Hederman who made it possible for me to resume, and for her continuous support

My manager for his support and my colleagues for their valuable contributions and generosity of time

The most important person in my life my husband Norman, for his love, encouragement, patience and support

My children, extended family and friends for their encouragement and understanding

Dedication

I dedicate this work to the loving memory of my sister,

Miriam

Summary

Healthcare systems are becoming increasingly dependent on ICT (Information and Communication Technology) to assist in the deliver high quality care. Although ICT has been revolutionising the healthcare sector in recent year's fragmented systems still exist, particularly in Ireland, which have to be centralized and made interoperable.

Historical autonomist divisions of the previous eleven health boards, led to the implementation of disparate healthcare information systems, which the HSE has decided to rationalise by building comparative modernised national systems, which can be used from any location in the country. This step allows for the phasing out of disparate local systems in favour of nationally centralised and maintained systems.

As national systems are developed it is important that the HSE develops these whilst also keeping one eye on European Health and procurement directives, in order to include any requirements originating from these directives, so as not to have to address these again and risk the redevelopment costs. It is particularly important to note the central role open standards and open source plays in European Health and eGovernment policies.

Open source is a development method for software that utilises the power of global programming experience, in order to create transparent and effective programs for use in many applications, across many communications platforms.

The flexibility of Open Source software allows interfacing with many legacy systems which otherwise would not be possible, given the economic environment that exists and the availability of suitable resources and skills.

In the past, the majority of healthcare systems were vendor supplied and in some cases, this trend may continue. However, there are areas where national applications can be built, using open source products. Open source provides solutions for many aspects of healthcare.

Objectives

To provide an overview of Open Source software and its capabilities based on the literature review. Give the European perspective on Open Source software, in particular with relation to healthcare. To establish what a best practice is, for using Open Source software in procurement, implementation and support.

To ascertain what practices are used for the procurement of Open Source software through semi-structured interview with personnel who are experienced in implementing Open Source software projects.

Conclusion

Recommend a best practice for the HSE in using Open Source software based on research findings.

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Abbreviations

A&E (Accident and Emergency)
BRM (Business Relations Manager)
CAB (Change Advisory Board)
CMOD (Centre for Management and Organisation Development)
CMS (Content Management System)
CORDIS (Community Research and Development Information Service)
DCU (Dublin City University)
DoHC (The Department of Health and Children)
EC (European Commission)
EIF (European Interoperability Framework)
EU (European Union)
EUPL (European Union Public Licence)
EuroRec (The European Institute for Health Records)
FS (Free Software)
HIQA (Health Information and Quality Authority)
HISI (Healthcare Informatics Society of Ireland)
HSE (Health Service Executive)
ICT (Information Communication Technology)
IDABC (Interoperable Delivery of European eGovernment Services to public Administration, Business and Citizens)
LIS (Laboratory Information System)
NHS (National Health Service)
OSOR (Open Source Observatory and Repository)
OSS (Open Source Software)
PAS (Patient Administration System)
ProRec (PRoMotion strategy for European electronic health RECOords)
RCSI (Royal College of Surgeons in Ireland)
RIS (Radiology Information System)
SLA (Service Level Agreement)
VMS (Virtual Memory System)

Chapter 1 - Introduction

Officially, less than one percent (0.75%) of the annual HSE budget is spent on Information Technology, which is considerably less than, for example the UK NHS spend which is two and a half percent (2.5%), therefore it is essential that these funds are used effectively. As tax revenues continue to shrink so does the HSE budget, it is now even more essential to utilise this minimal resource effectively.

The HSE, from its inception in 2005 envisaged that there would be one central location for all major ICT healthcare systems to centralise information for the first time allowing information to be disseminated nationally and to be simply utilised for national statistical purposes.

The procurement process for suitable national healthcare systems is a long process, due to both budgetary restraints and selection criteria. Because of the complexities involved in health information systems, it is necessary to retain systems at local level, whilst using a bi-directional communication system to interchange data with the main data warehouse and extract this data when required for another location or a national project or statistics.

There is a number of issues that must be resolved before data can be centralised, the most important being a unique identifier for individual patient records. Indecision in establishing this unique identifier has been a hindrance for healthcare management and information technology projects for a number of years.

Whilst the aforementioned issues are being resolved, current systems must be supported, upgraded and maintained. Some healthcare legacy systems, which require external support, add to budgetary pressure. Internal services also require support on existing healthcare systems; some require new healthcare systems to cope with growing demands. These services have to continue despite budgetary restraints.

Historical autonomist divisions of the eleven health boards, led to the implementation of disparate healthcare information systems, which the HSE has decided to rationalise by building comparative modernised national systems, which can be used from any location in the country. This step allows for the phasing out of disparate local systems in favour of nationally centralised and maintained systems.

Furthermore, the conduits on which these national systems would be delivered could potentially also be used for the upkeep of local legacy systems if suitable interfacing applications were available.

1.2 Open Source

Open source is a development method for software that utilises the power of global programming experience, in order to create transparent and effective programs for use in many applications, across many communications platforms. This not for profit software was created for the benefit of the global community. Open source philosophy is to deliver better quality, higher reliability, more flexibility, cost effective software, whilst ending vendor dependency.

The flexibility of open source communications software allows interfacing with many legacy systems which otherwise would not be possible, given the economic environment that exists and the availability of suitable resources and skills.

Over the past three years, the HSE Dublin North East information technology department, have undertaken a number of local, regional projects using open source products. Initial reluctance to take this path, was eroded by the success of projects undertaken utilising some of the products, together with the ongoing cuts in budget. It is now realised that there are multiple advantages derived from using open source products.

Projects have also been undertaken, using Open Source software, to interface legacy systems, working in partnership with the vendors who supported these systems, to optimise efficiencies at local and national level, as well as, in some instances, allow for bi-directional software intervention.

An aging population will increase the demand on health care in the coming decades and a depressed economy will add to that strain.

Change in how healthcare information is utilised is inevitable. In the past, the majority of healthcare systems were vendor supplied and in many cases, this trend may continue. However, there are areas where national applications can be built, working in partnership with vendors, using open source products.

This creates flexibility and gives the HSE the control required to make any changes necessary to applications. In turn, this means changes are cost effective as they can be carried out by skilled staff, at any central location within the organisation, whilst adhering to the “quality and safety” and “value for money” policy.

Healthcare has common software needs in areas such as clinical data and patient services. The provision and maintenance of high quality care is universally important. The quality of the services delivered is heavily dependent on the software used and the data gathered using it.

1.3 Objective of this Study

The aim of this research is to investigate:

- Why a best practice standard platform needs to be put in place before the wider use of open source software is promoted, to avoid repeating past mistakes, in relation to software flexibility, scalability and accessibility?
- How the adoption of such a best practise will ensure that future healthcare systems, which use open source software applications, will have to meet the criteria necessary to support future developments?

1.4 Methodology

Open source collaborative development can produce high quality work. Best practice can be established by putting in place frameworks and methodologies to create standards for this development method. A number of healthcare organisations around the globe are using open source software successfully. Research of how successful the standards used in these organisations have been, will facilitate in setting Open Source software development standards and best practice in the HSE.

1.5 Dissertation Structure

Chapter 2 explains Open Source software and the differences between Open Source software, Free software and Proprietary software. It provides the history on how Open Source software evolved and where it is positioned in today's market.

Chapter 3 gives the European Union perspective on Open Source software and the number of projects that have been setup by the European Union to assist public administration with the implementation and deployment of Open Source software. It also reviews Open Source software in healthcare and gives an overview of tools, applications and organisations promoting and using Open Source software in healthcare.

Chapter 4 looks at proven best practice and standards for the procurement and implementation of Open Source software projects by the European Union. It looks at how these practices and standards can be of benefit to Ireland.

Chapter 5 explains the research methodology.

Chapter 6 examines Open Source software case studies in the HSE to ascertain what, if any, policies and procedures were used during the project life cycle and how these compare to best practice.

Chapter 7 reports Government policies, the findings and provides recommendations for future Open Source software project implementation. These recommendations are in-line with EU recognised best practice and standards.

Chapter 2 - Literature Review

"If you have an apple and I have an apple and we exchange apples, then you and I will still each have one apple. But if you have an idea and I have an idea and we exchange these ideas, then each of us will have two ideas." Attributed to George Bernard Shaw

2.1 Open Source Software

Prior to discussing the Open Source literature, some definitions may be of assistance.

2.1.1 A definition of Open Source software

OSS (Open Source software) is software for which the constituent source code is freely available for the recipient to access, in fact the recipient is encouraged to view, modify and improve the code for their individual needs or for distribution back to the open source community (Feller et al, 2005). OSS may be commercially orientated. OSS is considered a development method for software, as during the development cycle the source code is shared with the open source community for peer review, unlike other software development methods.

2.1.2 A definition of Free Software

The FS (Free Software) movement is described in the literature as a social movement, (Raymond, 2001; Stallman, 1995; Feller et al, 2005). The definition of FS, which is to be found on their website, is:

"The freedom to run the program, for any purpose (freedom 0)

The freedom to study how the program works, and change it to make it do what you wish (freedom 1). Access to the source code is a precondition for this.

The freedom to redistribute copies so you can help your neighbour (freedom 2)

The freedom to distribute copies of your modified versions to others (freedom 3)

By doing this you can give the whole community a chance to benefit from your changes.

Access to the source code is a precondition for this" (Stallman, 2008).

2.1.3. A definition of Proprietary Software

Proprietary software is software for which the constituent source code is not available for the recipient to access, thus sometimes it is referred to as closed source software. The software is regarded as valuable intellectual property, and is protected by copyright and license agreements (Raymond, 2001). Proprietary software is usually though not necessarily commercial.

Proprietary software's restrictions make it an antonym of both free open source and open source software.

2.1.4 Free Open Source Software

Like OSS, Free Open Source software is often developed by an individual or a small group for personal use and offered to the community to use or for enhancement. However, by nature, support can be haphazard in the Free Open Source software community and commercial users are reluctant to depend on it or on third party support. Therefore in the commercial market OSS is viewed as more business centered than Free Open Source software (Fitzgerald, 2006).

2.1.5 The difference between Proprietary and Free and Open Source movements

The principal difference between proprietary software and FS and OSS is the origin of and access to the source code of the software, as is evident from the above definitions.

The descriptions of the two different approaches to producing software are; Proprietary is the monolithic and closed “cathedral” style typified by Microsoft’s Windows operating system. The development process is top-down management with teams working within tight and rigid controls. Open Source is the “bazaar” style, used by the collaborative community and exemplified by the development of the Linux operating system. The development process differs, as the open source community is largely a voluntary group of developers providing a wide range of inputs and effort working under loosely controlled management (Raymond, 2001).

2.1.6. The difference between Free and Open Source Movements

It is important to note there are two communities that promote the philosophy of unrestricted access to source code. They are the *Free Software* and the *Open Source Software* communities. The principal distinction between FS and OSS, is that OSS is more commercially orientated (Fitzgerald, 2006). They both agree on most practical recommendations and often work together on projects. Richard Stallman widely accepted as the founder of the Free software movement describes “ Open source is a development methodology whilst free software is a social movement” (Stallman, 2009).

However, despite these differences they both have one common competitor, proprietary software in general (Sandred, 2001).

When referring to open source, much of the literature recognises the difference between the two movements of the OSS and FS communities and their core principles. However, when referring specifically to open source it is more difficult to distinguish between the two, in fact many authors see no differences between FS and OSS. A number of authors when discussing the terminology do not distinguish between the movements; instead, they refer to both movements as the Free/Open Source Software movement or F/OSS movement making little or no distinction.

2.2 The Early Days of OSS Development

The sixties was a period dominated by large computers, for example, the IBM System/360 in which software was distributed together with the hardware, and usually with the source code. Originally they were inextricably intertwined, one required the other to work (Feller et al, 2005). During the seventies however, these were unbundled and software started to be sold separately. Soon proprietary distributions that did not include source code and did not give permission to modify or redistribute became almost the only option.

2.2.1 Background of Early Collaborative Software Development Projects

There is a tradition of sharing and cooperation in software development. Many of the key aspects of the computer operating system and the Internet were developed by developers from different organisations who shared the programming code of computer programs – today known as the source code. It was soon realised that community knowledge produced superior results to that of individual knowledge.

In the early 1970's the focus of computer software and hardware organisations was to develop an operating system that could run on multiple hardware platforms. The most successful examples of these systems were UNIX, and the C language used to develop UNIX applications, which were originally developed at AT&T Bell Laboratories (Lerner and Tirole, 2005). This software was installed across institutions. Further improvements were made to the software at these institutions and in turn, this software was shared with others, this was an example of a community knowledge sharing.

The sharing of code grew, getting much faster with advances in computer internet networking linked the UNIX programming community. This in turn made possible the rapid sharing of technologies between universities and corporations. These collaborative software development projects were conducted on an informal basis, no one ever thought of restricting the use of the software between the organisations.

This community based sharing was how such rapid progress was made. Consequently, many open source projects were motivated by programmers who encountered technology problems in their day-to-day work and worked with the open source community to resolve these issues and/or further develop their ideas (Lerner and Tirole, 2005).

2.2.2 Subsequent Events

Collaborative software development became problematic in the early 1980's when AT&T introduced intellectual property rights on its purported share of Unix (Josh Lerner 2005). As a result, of the introduction of intellectual property rights, ground rules for the collaborative software development community had to change. The need to develop and organize the distribution software without cost emerged. Driven by the latter change, the Free Software Foundation was set up by Richard Stallman of the MIT Artificial Intelligence Laboratory in 1983.

2.2.3. The introduction of Formal Licensing

An important innovation of the Free Software Foundation was the introduction of formal licensing procedures that aimed to prohibit any claim of patent rights. This license is referred to as GNU GPL General Public License. GPL is also known as "copylefting". GNU is the acronym adopted by the Free Software Foundation. Under the license, the software developer has to agree to make the source code freely available. The user has also to agree not to impose licensing restrictions on others. Fitzgerald (Fitzgerald, 2006) affirms this by stating that property rights are vested in the author through copyright, with liberal rights granted to others under the license.

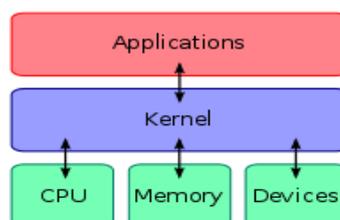
Under the Free Software Foundation, the model of collaborative development continued and contributions from many developers were accepted, projects were regularly publicly distributed. Some of these projects were managed and developed by smaller groups (Josh Lerner 2005; Feller et al, 2005).

With the widespread expansion of the Internet in the 1990's the activity in collaborative projects grew. The diversity of contributions expanded the number of new projects that emerged, the most well known of these perhaps is the Linux operation system developed by Linus Torvalds in 1991.

2.2.4 Linux a Brief History

In 1991 a Finish student by the name of Linus Torvalds posted a message to a newsgroup on comp.os.minix, "*stating that he was working on a free operating system as a hobby*", this attracted considerable interest. The kernel, which later became known as Linux was developed by Torvalds and a growing number of volunteers communicating over the internet throughout the 1990's. During this time, the Linux kernel started to be used in large scale applications such as web hosting, networking and database serving, proving it was ready for production use. By the year 2000, a number of companies support Linux in one way or another, recognising its value and stability (Internet, 1996-2010).

Diagram 1: A Kernel Connects the Application Software to the Hardware of a Computer



Source: [http://en.wikipedia.org/wiki/Kernel_\(computing\)](http://en.wikipedia.org/wiki/Kernel_(computing))

2.2.5 The Effects of the Introduction of Intellectual Property Rights

In 1995, an organisation, called Debian, was created to disseminate Linux. It developed the "Debian Free Software Guidelines". These guidelines allowed licensees greater flexibility in using a program. This included the right to package collaboratively developed software with proprietary code.

A number of open source developers adopted this approach and were referred to the “Open Source Definition” (Josh Lerner 2005). In 1998 the Open Source Initiative was jointly founded by Eric Raymond and Bruce Perens (OSI, 1998), which uses the open source development methodology. Through the Open Source Initiative, the Debian Free Software Guidelines have been revised and are now known as “Debian GNU/Linux”.

2.2.6 Licenses Today

OSS has a number of approved licenses by the Open Source Initiative (OSI) and the Free Software Foundation (FSF). The OSI and FSF have collectively approved nearly 100 distinct licenses to date, though only about a third of these licenses have been approved by both the OSI and the FSF.

These licenses are grouped into four broad categories: reciprocal licenses, which are derived from Free Open Source Software, academic-style licenses, corporate licenses, and non-approved (by the OSI or FSF) licenses such as Microsoft’s Shared Source family of licenses.

Open Software License (OSL), has emerged as the license that is most acceptable to corporate users and developers. Some developers in the open source communities have concerns in relation to the OSL, as it may lead to OSS products being more proprietary in nature (Fitzgerald, 2006).

There is much debate in the literature around OSS licenses, this may be because of misinterpretation or misinformation (Kennedy, 2007). There are equally as many issues around proprietary software licenses, this is evident from the number of times Microsoft have been in the media because of legal proceedings. The flexibility of open source licenses allows for the coexistence of open source and closed source code.

Users of OSS in a commercial market need to be aware of the license that governs the software and ensure they are adhering to the requirements of the license. Infringements of the license applicable to the product can have consequences, although to date there is no evidence of the open source communities taking legal action to date.

2.3. OSS Development Model

Software projects largely rely on people and their knowledge and motivation. The management of these people, their knowledge and effort are the keys to the success of a software project, not their location, income or time.

Many OSS developers have recognised these key points leading them to use project management fundamental techniques of people management when working together on software development. (Sandred, 2001) Sandred argues that the proprietary software development model, does not involve sharing its source code with the community, which historically has led to software developed by this model failing, crashing or hanging, when it may have been avoided. Community knowledge tends to be superior to that of individuals or small groups.

A number of authors have pointed out that code developed under open source can be more consistent and easy to maintain, than code developed by proprietary developers, as errors are identified and amended early in the development cycle of open source code. In contrast, proprietary software development does not share the source code openly, thus errors often only manifest themselves later in the development cycle during testing processes, leading to costly code rewrites (Sandred, 2001; Feller et al, 2005). OSS developers may work directly with the customer or end user this is of value to the open source community, as the community gains technical vertical market awareness.

2.3.1 Commercial Development

OSS offers greater potential than FS, for the development of commercial software, due to its greater flexibilities, higher degree of structured project management and vertical market specific development.

An important difference is that FS tends to be horizontal, for example administration, telecommunications, pay roll, email, sales and purchasing whilst OSS has entered the vertical market in areas such as engineering, scientific, medical, clothing, industrial service, public service, entertainment (fsf.org; ubuntu). This has resulted in OSS rather than FS gaining a greater level of acceptability with commercial and state organisations worldwide, as a credible alternative to proprietary software.

As the OSS project development model has become more structured, so has the software product support. Well-managed projects direct customer service needs to the most appropriate expert in the field, as experts in each field are identified during the development phases of the projects (Fitzgerald, 2006).

Free, as in zero cost, has been replaced by value for money cost, as customers are willing to pay for the professional service, associated with support and a guarantee. The value for money approach together with reliability may make OSS more appealing to the commercial market (Fitzgerald, 2006).

There are many benefits for a developer who has successfully contributed to an OSS project. First, there is acknowledgement in the open source community itself and according to Raymond 2001, "good reputation among one's peers brings higher status in the exchange economy". There are many benefits for programmers in open source development that are intangible but have their rewards, such as improved performance, recognition, acumen and ego gratification, in turn leading to the tangible benefit of greater income.

A number of well-known products such as, Linux (an operating system similar to the Microsoft Windows operation system) Apache (Web Server for Internet sites), MySQL (a database) and Eclipse (a development platform that builds and deploys tools for managing software) have been developed as either FS or OSS through collaborative work. OSS developers are just as driven as FS developers are but the methods for achieving their goals differ. The principal difference is that Open Source developers may achieve their goals with commercial support (Sandred, 2001).

2.4 Current Market Position of OSS

Propriety software dominated the market for over 20 years; the introduction of OSS over the last few years to the commercial market is changing the software landscape. High quality, reliable, popular OSS products are pushing propriety products out of the horizontal software market, as they are no longer commercially viable, whilst gradually moving in to some vertical market segments (Fitzgerald, 2006).

Companies such as Microsoft are threatened by the strength and rapid growth of OSS in the market. They have realised that the collaborative open approach that is central to OSS community is key to its success, as it ensures the community gets application systems it needs. This has led to Microsoft's Shared Source Initiative. Microsoft is likely to be a player in OSS in the future, as it already has a number of OSS projects available on Source Forge (Fitzgerald, 2006). Microsoft, as a primarily proprietary software developer recognise the fundamental need to provide the community with software that meets the community's needs, which allows them to better understand market place developments as well as source solutions for these requirements.

As OSS is becoming more commercialised, the shift in the management process of OSS projects to a more structured professional approach is evident from the number of conferences and annual meetings that are taking place. For example, the Apache (Apache software) conferences in the United States and the regular Zope/ Plone (“Plone, is a content management solution that allows non-technical people create and maintain information for a public website or intranet using only a web browser”) (<http://plone.org/about>) development meetings in Europe. Meetings like these provide the background for developers to coordinate and plan future development.

2.4.1 OSS Strategic Adaptation for the Commercial Market

OSS providers have adapted formal structures to their methodology, which has led to a more structured project management approach to OSS products. The core element of this change has been the involvement of strategic planners or specialist developers with key knowledge of the vertical market in which a new OSS product is to be developed (Fitzgerald, 2006).

This OSS development model differs from the traditional proprietary software model, in that the OSS model looks outwards for both inspiration and solutions, whilst the proprietary software model tends to be inward focused. The OSS model are derives specific advantages from the community knowledge it harnesses.

Typically, successful projects start with a vision, which is developed into a prototype, by a developer within the vertical market segment. Additional requirements and new features are contributed by the community. This leads to products that are more likely to meet the general market needs.

Pre-implementation work, such as testing and bug fixing, tend to be more efficient, as there is normally a broad test platform in the OSS community, which is willing to also offer solutions to any bugs which may be present. Whilst this pre-implementation work is essentially the same work that is carried out in the proprietary software model, it can occur quicker and to a higher degree of reliability (Asiri, 2003).

2.4.2 Flexibility of OSS

Examples of this growth and success are evident in prestigious companies such as Amazon and Google, who benefit from the low cost and the high reliability of OSS. Another major benefit being that their systems have been developed by the community to meet the community's needs. Each company has been using OSS to create a platform on which they can offer value added services in their horizontal business domains (Fitzgerald, 2006).

The use of OSS is mainly invisible to their customers. These companies have also customised OSS products for their own needs because they are not redistributing the software they are not open to any non-compliance from the open source community, in relation to licensing.

OSS is moving to the fore across the software industry and is now being more frequently deployed in IS (Internet Service) front- end applications for example Open Office, (similar to Microsoft office) Mypaint (a painting and scribbling program), and Firefox (web browser) (Fitzgerald, 2006).

2.4.3 Diversification of OSS into Vertical Market Segments

An example of OSS in a previously, unlikely vertical domain (medical administration), is the Beaumont Hospital case study, in Ireland, where a number of applications have been developed in-house and are now being made available on an OSS basis to other health agencies. In the context of open source, this progress was significant, as vertical domains did not normally offer a broad enough customer base to be of interest for OSS developers (Fitzgerald, 2006).

It had been assumed that open source products would not greatly influence businesses in such vertical domains, as OSS developers would not work in such a perceived controlled environment. If, however organisations subscribe to the OSS philosophy and contribute high quality, specifically skilled resources to open source projects, the open source model will become more acceptable in such future vertical applications.

Proprietary software, because of its containments, often being market specific, is designed to meet the needs of its customers not what all customers may want, to meet the requirements of their organisation. OSS meets both the needs and the wants of its customers because of its openness, which allows the product to evolve, gaining more appeal as wants are addressed by skilled developers, who have access to the open source code (Fitzgerald, 2006).

OSS entrance into the commercial market, particularly into vertical market segments has been growing at a steady rate. This growth tends to occur quicker in engineering and scientific fields, as these markets have been actively promoting participation in open source projects. The scientific and engineering disciplines have many graduates who already have some degree of experience with software either through their education or from working with computerised systems in their work-place (Hongyan and Tesfatsion, 2009).

This willingness to participate and fundamental software knowledge lends itself immediately to the spirit of the OSS community, thus accelerating the growth of OSS products in these areas.

2.4.4 OSS and Proprietary software the Commercial Differences

What are the differences, if any? What are the risks involved in using either? These represent some of the questions that are considered by commercial users. Concerns such as security, support, training, upgrades, interoperability and documentation are applicable to both OSS and proprietary software during the procurement procedure. These concerns are applicable to both OSS and proprietary software during the procurement procedure. Market place forces make the procurement procedure more difficult for OSS developers, as they are sometimes regarded as not having emerged from a “sensible environment” (Neumann, 2005).

OSS developers can focus on the development of the project and delivering a “value for money “ product rather than marketing the organisation for profit, thus sometimes failing to assure a potential customer on other important aspects of a software project, such as security, maintenance or survivability. By addressing all such concerns at an earlier, project management stage the customer can be assured that the most viable decision has been reached.

2.5 Perceived Risks

There are issues around the use of OSS, which are also relevant to proprietary software, but do not raise the same concerns from potential procurers. Although OSS has expanded in the commercial market, it cannot seem to be rid of the doubts around security and intellectual property issues (Messmer, 2008).

OSS can be as reliable as proprietary software as it has many quality assurance tools available that offers a wide range of solutions such as:

- Installation and Configuration
- Customisation and Development
- Professional Support
- Free Upgrades
- Administrator Training
- No Vendor Lock-In

As OSS is integrated into the commercial market and in particular vertical markets, companies developing products for these markets offer support, training and hosting, thus are reducing some of the concerns for consumers.

In OSS, disadvantages that have been identified over the last few years, are being resolved by committed OSS developers (Waring and Maddocks, 2005). Findings by (Robert, 2005) state that there is plenty of subjective evidence to back the security claims of both OSS supporters and their proprietary equivalents, there is no real definitive evidence to cause either side to be triumphant. According to (Weinstock and Hissam, 2005) most government software is purchased through contracts with suppliers. Clearly all aspects of the acquisition need to be addressed for suitability before any decision is reached.

2.6 Conclusion

In the OSS debate there is a plethora of information. In summary, the key points in the debate are as follows.

Weinstock and Hissam state two risks facing organisations wishing to use OSS need to be aware of:

- **The software may not meet the needs of the organisation**
- **That there is no real support**

Whilst (Fitzgerald, 2006) suggests that the very nature of OSS development coupled with the fact that OSS products are being developed to gain share in vertical markets not only meet customer needs but in some cases exceed expectation.

(Waring and Maddocks, 2005) believe that the change in the business model of companies such as IBM, Hewlett-Packard and Oracle to include support for OSS is reassuring to organisation and customers considering investing in OSS.

(Asiri, 2003) states that OSS supporters will often praise the security benefits of their software, although not inherently more secure than proprietary applications, it has the advantage of a larger developer base. Both open and closed projects will contain code that can be exploited by hackers, however, it can be easier to mobilise developers in the open source community to identify and resolve bugs and other vulnerabilities.

According to Weinstock and Hissam (Weinstock and Hissam, 2005) OSS is no better or worse than proprietary software and should be chosen based on the organisations requirements and on the requirements of its users. Organisations should consider the advantages and disadvantages of OSS before adopting it.

Larry Augustin, an open source visionary and current CEO of SugarCRM (a commercial OSS customer relationship management product) states that the maturing of the software industry will change the customer/vendor relationship. It will not be a case of OSS versus proprietary, rather how much control the customer wants and how much control the customer wants to give to the vendor (Fontana, 2009).

The aim of this study is to provide the HSE with standards and best practice for the use of OSS in the Irish healthcare service based on the literature. Therefore, it is important to understand that open standards are a significant element to success in the use of OSS, in particular if the software is required to be interoperable with existing systems.

The uptake of OSS by EU Member States for use in public administration is on the increase, so much so that the organisation OSOR (Open Source Observatory and Repository) for European public administrations was setup by the European Union to provide a platform for exchanging information and experiences of OSS. The EU Member States made provision for best practice to resolve widespread “poor practices” in public service procurement, in relation to software.

Amongst the issues of concern was the notable preference that was demonstrated for Proprietary software over OSS. Monitoring and recommendations for best practice is provided through the OSOR, in order that public service procurement of software is conducted appropriately. The member states have thus endorsed the use of OSS in the EU public bodies.

In recessionary times, attitudes and mind sets change, survival instincts come to the fore. Government and business organisations tend to explore alternatives for obtaining value for money, whilst retaining the same levels of service and productivity expected by customers both internal and external to the organisation.

Chapter 3 - The European Union and Open Source Software

This chapter gives an overview of the use of OSS by European governments in public service administrations and events that brought this about, from OSS community groups lobbying the European Commission (EC) to the eventual acceptances of OSS as a viable alternative. After research and surveys conducted in the Member States, support agencies were setup for the research, development and support of OSS in public administration. These agencies were also to monitor this usage through continues surveys. A specific license EUPL was developed, which is a unique legal instrument that covers 22 European languages. In parallel healthcare support agencies were also established by the European Union (EU).

“The European Commission is keen to encourage public bodies in Europe to examine the viability of using Open Source software as an alternative to proprietary software. Favoring Open Source software can help spread good practice in eGovernment more quickly and reduces the cost of installing and maintaining applications. Greater use of Open Source software will stimulate competition in the market for ICT products and services, which should also help to reduce costs to taxpayers” (European Commission, 2007b, Information can Save Your life at) .¹

¹ (http://ec.europa.eu/information_society/tl/qualif/health/index_en.htm)

3.1 Introduction

Tracing the development of OSS in governments throughout the EU is complex, because of the range over the last 12 to 15 years. Many European governments are considering the use of OSS as a means of reducing costs, increasing transparency and sustainability in information technology systems. The acceptance of OSS in Europe's public sector is an ongoing process.

The OSI (Open Source Initiative) the body responsible for OSS in the economic market, referred to previously, led a campaign during the late 1990s to convince the EC of the benefits of using OSS in the EU. A number of motivated people, driven by a variety of reasons including:

- Growing frustration with the poor dissemination, usage and commercial exploitation of software research results licensed under proprietary terms
- A positive vision based on open creation and exchanges of information, knowledge and content for the information society
- Privacy and security concerns
- Excessive dependency on proprietary suppliers
- Long-term cost control needs

In 1999, resulting from these concerns, the EC setup an informal group of external experts from different countries with diverse experience in OSS to investigate the full benefits of application throughout the EU. This group presented its findings at the IST'99 (Information Society Technology) Conference in Helsinki.

There was sufficient evidence to convince the decision makers in the EC that it was worth "*giving it a try*" (Aigrain, 2005). Resulting from this successful campaign, research into the benefits of OSS was sanctioned by the European Commission.

3.2 Actions taken by the European Commission to Alleviate Concerns with Proprietary Software

The group made a number of recommendations in various domains, including research and development policy, standardisation, rejection of software patentability, education, and usage in administration (Aigrain, 2005). These were widely adopted in European countries, which helped create a positive environment for implementing some of the proposed actions.

Reports from interested parties, such as the researcher Roberto Di Cosmo, highlighting the risks of over reliance on one company (i.e. Microsoft controlling the essential tools for information technology), led to the European parliament adopting (in 1999) a resolution which was a clear political signal for the acceptance of OSS in eGovernment agencies (Aigrain, 2005).

Four years later, in 2003, policy for the use of OSS was in place in several countries. This policy;

- Encouraged the exchange of experiences between administrations
- Recommended the use of standards for the implementation of OSS
- Provided guidelines on tendering for OSS components such as cryptography and security

3.3 Early Survey

During this time, a number of surveys were conducted to monitor the use and adoption of OSS throughout the Member States. The first survey sponsored by the EC was carried out in 2002. The survey found that there was a wide diversity in the rate of adoption and extent of use of OSS.

For example, in Germany some agencies in the public sector were using OSS, the usage varied from 44% to 69%. While in Sweden, the comparable figures ranged from 16% to 23%. Figures for usage of OSS in the private sector were similar in both countries (Aigrain, 2005).

In another survey in 2003, the Dutch government passed a motion encouraging the use of OSS and open standards in public administration. In addition, a comprehensive legal analysis was conducted and as a result a practical guide manual was introduced for open standards and OSS tenders in 2007.

These surveys and investigations resulted in the EU making a decision to provide a central agency to address the concerns of distribution, cost effectiveness, quality and standards and have in place best practice recommendations for the use of OSS. This is similar to the situation in the Irish health service prior to the HSE's drive towards national systems.

The objective of interoperability across the Member States can be seen in microcosm in the HSE. Much can be learned from the situation in Europe as the Irish health 'systems' evolves towards a single national system. There are opportunities for the HSE to take advantage of the work done in the EU in reaching interoperability and critical to this success will be the support provided by the EU agencies.

3.4 Support Agencies

There are a number of agencies set up the EU to provide support to public administrations adopting OSS. The key support agency is the OSOR (Open Source Observatory and Repository), its functions will be explained in detail. The following is a brief summary of other agency functions.

IDABC (Interoperable Delivery of European eGovernment Services to public Administration, Business and Citizens) was setup by the EC to use opportunities presented by ICT to encourage and support the delivery of cross-border public sector services. IDABC seeks to Improve efficiency and collaboration between European public administration and contribute to making Europe an attractive place to work, live and for investment (IDABC).

CORDIS (Community Research and Development Information Service) has three main tasks, to help researchers get EU funding for their work, ensure research results are exploited more effectively (especially in sectors essential for the EU's competitiveness) and promote the spread of knowledge by stimulating business innovation and social acceptance of new technologies (CORDIS, 2009).

OSOR (Open Source Observatory and Repository) supports OSS as a standard for the collaborative development of software in the European public sector (OSOR.EU).

3.4 EUPL (European Union Public License)

The EC sanctioned a license for OSS, the aim of the EUPL (European Union Public Licence) is to distribute and promote the use of software owned by itself and other European Institutions. This is discussed before the introduction of the OSOR because of its relevance.

The intention of the EU in creating the EUPL goes one-step further than the already hundred plus F/OSS licenses, in that it sets out to encourage developers to provide software that is both Open Source and interoperable across Europe. This is beneficial for developers as their software reaches the much wider European market. The purpose of the EUPL is not to compete with other licenses, rather to have in place a unique legal instrument in 22 European languages, to encourage public administrations across Europe to embrace the OSS model.

Under the EUPL, the main objective of the EC is to distribute and promote the use of software owned by itself and other European Institutions. A distribution of software under the EUPL makes it possible for the growth of a stronger developer and user's community and ensures the continued support for OSS development programs.

The EUPL is an instrument that promotes the European Public sector developing collaborative initiatives. Another example is the framework of the Open Source Repository. The Open Source Repository ensures the availability of the latest software developments to the Member States (OSOR.EU).

3.5 The Creation of the OSOR by the European Commission

In 2003, in recognition of the gradual acceptance of OSS, and mindful of working towards standardised public administration systems in the European Member States, the EC set up the OSOR, to support OSS as a standard for the collaborative development of software in the European public sector.

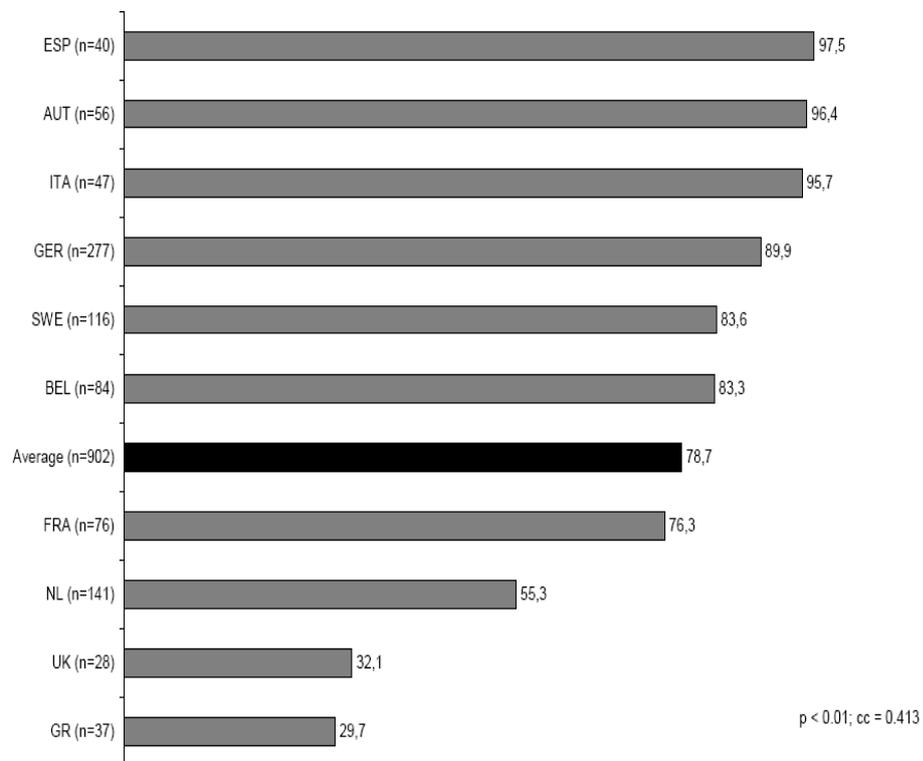
The OSOR provides a platform for the exchange of information on and experience of OSS for use in public administrations. It also provides guidelines for areas such as procurement, licensing, and legal requirements.

The OSOR provides updates on the status of current projects throughout EU States. The OSOR has links to EU approved sites for Open Source tools. These tools are for use in specific areas such as healthcare and education. OSOR has a repository of over 140, what are termed, successful OSS projects, available for use in public administrations. The EC distributes these projects under the EUPL.

3.6 OSOR Surveys

The OSOR has carried out a series of surveys over the years on OSS. In 2005, a survey carried out by OSOR on the usage of OSS in European local Governments, revealed that an average of 79% of these institutions were using OSS to some degree. Countries such as Spain, Austria, Italy and Germany were heavy users, while countries such as Netherlands, UK and Greece were comparatively lower users. In 2007, a survey undertaken by Kable showed similar results (Ghosh et al, 2008).

Figure 1: Usage of OSS in the Public Sector of ten European Countries



Source: MERIT 2005 (FLOSSPOLS LocGov Survey)(OSOR.EU)

3.6.1 OSOR 2008 Survey Findings

In 2008, the OSOR surveyed all the EU States and identified three different levels of users of OSS in European public administration. The most advanced Countries are Denmark, Finland, Iceland, Netherlands, Norway, Sweden, Austria, Belgium, Germany, France, Luxembourg and the UK. Fairly, advanced Countries are the remaining around the EU with an average profile. The least developed Countries are Bulgaria, Cyprus, Greece, Poland and Romania, Slovakia, Hungary, Italy, and Latvia. This demonstrated the increase and the uptake of OSS since 2005.

Although Ireland was found to be among the frontrunners for e-commerce, Ireland is not listed amongst the ten major users of OSS, as shown on the above graph from a European survey in 2005 (Ghosh, 2008).

A survey conducted by the OSOR in 2008, found that the online availability of eGovernment services for citizens and businesses in Ireland was below the EU average. No OSS policies or major initiatives could be found even though Irish public universities have led or been involved in several OSS related research projects (Ghosh et al, 2008).

Ireland has however contributed to the OSOR with its project “Health Atlas Ireland, an Open Source application to analyse health related datasets using geographical information systems (GIS) and statistical software” (OSOR.eu, 2008). The project was based on the Open Source content management system Plone and the Open Source application server Zope. The software was selected through OpenApp and Siemens Ireland was chosen as the development partner. The project has helped improve the quality and service delivered by the HSE as data collected is analyzed and used for purposes such as service planning and delivery, research and epidemiology.

The OSOR has many programs developed for public services across the EU, which could be used in Ireland’s public sector. These include some that are applicable to the health sector, such as PatientOS, which is a clinical information management system that includes applications for patient registration, medical record management, processing lab results and pharmacy data.

Aside from being in line with EU interoperability, compatibility and best practice these projects are also significantly advanced compared to where an Irish project may be at set-up thus removing many direct and indirect costs incurred should such projects be adapted for Irish use.

3.7 The Development of Procurement Policy by the OSOR

Research conducted by the OSOR in 2008 to construct guidelines on how EU public administrations should procure OSS. In conjunction with other support agencies, such as IDABC, the OSOR developed a procurement policy, best practice and standards for the use of OSS in Europe's public administration. At that time there was no EU policy regarding the procurement of OSS (Ghosh et al, 2008).

Ireland appears not to have any OSS policies in place, according to surveys conducted by the OSOR. It would therefore be in the Irish Government's best interest to adopt the European policies for OSS, as by doing so the Irish policies would immediately be in line with those being implemented across Europe. Furthermore, Ireland would benefit enormously from doing so at this time, when public service costs are constantly being reviewed and transformed. Adapting European policy brings with it both cost efficiencies and a wealth of experience.

The survey revealed that there was widespread bias in support of proprietary software and specific vendors (Ghosh, 2008). Survey results presented at the Open Source Conference in Malaga, October 2008, showed that of a sample of 3615 public software tenders published between January 2006 and August 2008, 16% explicitly named the top 10 software vendors. The EU introduced guidelines for best practice in line with Directive 2004/18/EC for the acquisition of software by public policies, which removed the elements of bias therefore enhancing the opportunity of OSS.

A lack of standards and best practice for the procurement of OSS may have been because acquisition did not necessarily require the use of the eGovernment procurement process as the cost of OSS is below tender requirement. However, the procurement process does not deal with cost alone. It is a method for ensuring the quality of the software, training and future support.

3.8 OSOR Principles for Defining Policy

To assemble information for the “OSOR Guidelines Public procurement and OSS” which is an important step for future OSS projects, the OSOR used the Dutch guidelines as a base for their document. Dutch guidelines contained a detailed legal analysis, which only became policy after four years of research into attitudes towards open standards and OSS in their public administration. The Dutch government recognised that public procurement must not discriminate between individual vendors of software.

The Dutch government system was chosen, as it was closest to what OSOR was seeking to achieve, when compared to the policies in other European countries such as France, Italy, Denmark and Finland. The OSOR recognises that basic principles are required to ensure sustainability of OSS in government ICT processes and systems, and are the basis for providing best practice and standards. These principles are:

1. **Transparency:** OSS is available with the source code, which can be studied or modified. This can help to ensure the security of the software.
2. **Interoperability:** Open standards ensure interoperability. OSS supports interoperability, as its processes can be adapted to work with other systems.
3. **Independence:** Transparency and interoperability allows current and future vendors to work together, eliminates dependency.
4. **Flexibility:** Allows systems to be adapted and extended as user needs evolve. New suppliers can be selected on competitive basis.

The OSOR Source Forge also provided a host for "free to use EUPL approved" software, which is capable of delivering considerable benefit to Ireland. It would do so by reducing costs and providing vast amounts of support and knowledge.

3.9 Interoperability

Open standards are an essential part of interoperability as these standards ensure maximum accessibility whilst maintaining minimum costs. For instance, eGovernment services that allow full interacting with citizens require open standards to ensure there is no dependency on specific software or hardware vendors, and to allow previously installed systems to work seamlessly with future systems.

The EC compiled a document on interoperability, the EIF (European Interoperability Framework), which is the current official publication relating to interoperability in European public administrations.

3.10 OSS in European Health

The European Commission's strategy for e-Health is to provide a European e-Health region that facilitates the needs of all European citizens. Fragmentation identified in Member States and across the pan-European health platform resulted in the EU devising an e-Health action plan in 2004. Under the action plan, the EU encourages each health authority to learn from the experience of others. The rationale for this is the sharing of ideas and experiences among the member states, all citizens of the EU will benefit from more effective, efficient, reliable e-Health systems.

To assist with this plan, a number of parallel agencies and institutions such as EuroRec (The European Institute for Health Records) have been setup to assist in the efficient exchange of information across member states, whilst ProRec (PROMotion strategy for European electronic health RECORDs) provides similar support at a local level. Efficient

exchange of information is a key element to managing resources, evaluating quality and monitoring costs.

Table 1: Healthcare Agencies

Institutions	Function
ProRec	PROMotion strategy for European electronic health RECords
WideNet	Is the network of national ProRec centers and the foundation for the EuroRec Institution.
EuroRec	Lead, support and coordinate the work of the national ProRec centers.
Open Health Tools	An open source community where members of the Health and IT professions can collaborate and build interoperable systems that allow patients and healthcare providers to have access to reliable information when and where it is required.

The EC believe that ICT can be of great benefit in all aspects of healthcare, from delivering information on healthy living to providing new tools for the development of tomorrow's medicine. The advances in ICT technologies allow for patients with certain conditions such as diabetes to manage their health from the comfort of their own home, giving the patient control of their own healthcare and reducing the need for the patient to attend clinics or other services, which in turn frees resources.

ICT healthcare systems will help health services to ensure European citizens have the best healthcare available at all life stages (European Commission, 2007a).

3.10.1 ProRec

The EC initiative for ProRec (PROmotion strategy for European electronic health RECORDs) was the consequence of a report from MediRec (1994-1995) (MEDIREC, 1997) *Concerted Action on the Electronic Medical Record*. The report examined reasons why Electronic Health Record (EHR) systems were not widely used in the EU States, particularly as part of the Lisbon Declaration suggested remedying this situation.

ProRec is a network of national non-profit organisations and is supported by the DG (Directorate General) of the Information Society of the EU. A further initiative by the EC established WideNet, which is the network of national ProRec centers. The focus of these centers is to distribute information and support complete, communicable, secure EHR's through:

- Raising awareness of issues related to EHR's. Providing ways, they can be used in improving healthcare delivery, by methods such as conferences, workshops or seminars, and through publications or websites.
- Providing a forum for connecting users, suppliers or developers and those concerned with policy and resource provision in healthcare.
- The mission of national ProRec centres is to promote the adoption and use of high quality Standardised Electronic Records in the correct infrastructure (ProRec, 2009).

3.10.2 EuroRec

WideNet had been the foundation for the EuroRec Institution. EuroRec will lead, support and coordinate the work of the national ProRec centers. EuroRec provides a number of services in relation to EHR's, such as the development of criteria for the evaluations of healthcare ICT solutions and a method for accrediting products and solutions.

The EuroRec Institute interacts at an international level with many organisations, principle amongst these are:

Table 2: Organisations Interacting with EuroRec

Type of Organisation	Name of Organisation
Standards Organisations	CEN. (European Committee for Standardization)
	ISO. (International Standards Organisation)
	HL7. (Health Level Seven)
Institutional Organisations	WHO (World Health Organisation)
	UN/Edifact (United Nations/ Electronic Data Interchange for Administration, Commerce and Transport)
	EFMI (European Federation for Medical Informatics)
	IMIA (International Medical Informatics Association)

These interactions provide Europe with a wealth of information on worldwide developments in fields relevant to its work with ProRec centers.

Future actions for EuroRec are:

- Reinforcing its internal structure and is redefining its business plan.
- Further deploying certification services (one of its main missions) in Europe.
- Broadening the spectrum of its research and development activities allowing it to begin focusing on the additional area of semantic interoperability (EHR content).
- Continue striving to get to more convergence with other organisations at global level (Moor, 2009).

EuroRec has a liaison with a number of organisations for the development and sharing of experiences in implementation of EHR's and other healthcare systems. Many of these organisations have vast experience in the successful use of OSS in healthcare. See Appendix 1 for full list. Annual conferences, workshops and meetings are a mechanism for members to meet, share their most recent experiences and are a means for members to be made aware of any new or revised regulations, standards and best practice initiatives.

Figure 2: Organisation Liaising with EuroRec



Source: <http://www.eurorec.org/whoarewe/liaison.cfm>

The functions of some of the organisations listed in Appendix 1 are outlined below:

OpenEHR enables ICT to support healthcare and medical research, through OSS and tools on a health-computing platform where complex meanings can be represented and shared.

IHE-Europe (Health Information Exchange) provides standards for the seamless flow of patient information between different IT healthcare systems and achieving interoperability between IT environments where systems are supplied by different vendors.

HIMSS (Healthcare Information and Management Systems Society) is about transforming healthcare through ICT. HIMSS focus is on providing global leadership for the best possible use of ICT and management systems for the enhancement of healthcare. HIMSS guides public healthcare policy and industry practices through education, professional development and supporting initiatives that are designed to promote quality healthcare (HIMSS).

HIMSS Survey of OSS in Healthcare

HIMSS have conducted a number of surveys and evaluations on the acceptance and use of OSS in Healthcare, for example, in 2008; HIMSS published a paper on “Evaluating OSS for Health Information Exchange” this paper explores the potential use of OSS in healthcare and revealed both the advantages and disadvantages for application.

Advantages highlighted in this paper are:

- At data level, an OSS application does not lock critical health data, as is the case in proprietary format.
- Healthcare organisations are protected from vendor risk.
- Upgrades are inexpensive and there is no disruption to workflow.
- OSS increases the bargaining power of a healthcare enterprise.

Disadvantages from the paper are:

- If there are, no qualified ICT staff on site support for users may be limited.
- Healthcare verticals may be narrowed if there is no OSS alternative to the dominant proprietary software vendors.
- There may also be indemnification and liability risks associated with an OSS solution if there is a lack of a well-capitalised vendor to support the product.

The HIMSS survey concluded that there are no differences in the challenges of managing OSS compared to those involved in managing proprietary software, and most importantly there was no increased risk, which may be a factor for some potential users adopting OSS (HIMSS, 2008).

3.12 Open Health Tools

Open Health Tools is an open source community where members of the Health and IT professions can collaborate and build interoperable systems that allow patients and healthcare providers to have access to reliable information when and where it is required. This is achieved through the creation of a common health interoperability framework, with the correct tools and references to support health information interoperability (Kolodner, 2007).

Open Health Tools hosts a number of successful healthcare Open Source projects, such as:

- **NHS Connecting for Health:** Is an agency of the U.K. Department of Health providing support to the NHS in introducing new computer systems and services to help deliver better, safer care for patients.
- **Cambio Healthcare Systems:** Scandinavia's leading healthcare IT Company, its main product Cambio COSMIC is a patient-centered electronic health record system that covers care in health organisations of all sizes.
- **HL7 (Health Level 7):** ANSI-accredited Standards Developing Organisation, which is the most widely used standards in healthcare.
- **Palamida:** The industry's first application security solution exclusively for OSS.

- **Healthcare Services Specification Project (HSSP)** is a consortium of organizations developing healthcare interoperability standards, primarily focused on service-oriented architecture (Kolodner, 2007).

Open Health Tools has a number of international members from Canada to Australia. Well-known organisations like Google and IBM use Open Health Tools. For example, in February 2009, Google Health launched a new initiative that allows people to automatically stream data from medical devices, such as those used to monitor glucose levels and blood pressure into their online personal health records.

This OSS technology allows patients to instantly exchange data with their doctors or other healthcare professionals in real time, and is a significant step for the Open Source communities dedicated to supporting advancements in healthcare (OpenHealthTools, 2009).

3.13 Conclusion

The EC recognises the benefits OSS brings to eGovernment and e-health, for EU States and the wider pan European ICT platform. As proprietary software dominated the market until the late 1990's, the Open Source community had to prove the merit of its software to the EC.

The EC setup the OSOR, IDABEC, CORDIS, ProRec and EuroRec agencies because of this acknowledgment. The functions of these agencies is to provide guidelines, standards, best practice, support and further research into OSS, thus endorsing the use of OSS in European public bodies. Responding to the September 2007 Lisbon Ministerial Declaration, the Open Source Community emphasised the input that OSS and open standards could make to Europe's economy.

Whilst Ireland takes direction from the European Commission, the surveys reveal no apparent evidence of the use of OSS in eGovernment in Ireland. Despite the fact that the EC has provided clear goals for the Member States on what is achievable through an increase in the use of OSS.

Examples of these goals are:

- Improved transparency in Government
- Improved cross-border interoperability
- Reduced administrative cost
- Ensuring no group in society is excluded from participation

Several EU States are already advanced users of OSS in public administrations and health. The EC set a goal to achieve EHR (Electronic Health Record) interoperability by 2015. The EC has called for conformity in testing procedures across the EU, and has placed the responsibility on the Member States for provision of resources for the research, inter-country dialogue, risk analysis and implementation (Monegain, 2008).

Through EuroRec the EHR Implementation project provides best practice, policy and strategic recommendations to facilitate EHR implementation initiatives throughout Europe (EuroRec). Ireland is further assisted through ProRec and HISI (Healthcare Informatics Society of Ireland). HISI was established in Ireland over 30 year ago with the aim of bringing together healthcare and IT professionals interested in improving healthcare through technology (HISI, 2009).

Whilst Europe recognises this, Ireland has still to do so and needs to adopt European policy and work with the other Member States in achieving the overall vision for common European ICT platforms.

Chapter 4 - Best Practice

4.1 What is Best Practice?

A best practice is a slightly, problematic practice as it differs from profession to organisation. Some descriptions define it as:

“A technique or methodology that, through experience and research, has proven to reliably lead to a desired result” (TechTarget, 2010).

“The methods and achievements of the recognised leader(s) in a particular field” (TEN, 2002).

“A process, practice or solution judged as the ultimate way to reach a goal or result; held up as a model to be learned from or followed” (Kioga, 2009).

However, a best practice tends to spread throughout a field or industry after success has been demonstrated. The development of well-designed software is a challenge, (this is applicable to all software) because technologies are changing so fast that systems and environments are becoming more complex. This further emphasizes the relevance of best practice and standards in this evolving situation.

4.2 What is Procurement?

The understanding of the procurement process has evolved over time. There is a considerable difference between the process 20 years ago and the process today. The Internet and e-commerce have drastically changed the way procurement is done.

Procurement is best described as *“The process of acquiring goods, works and services, covering both the acquisition from third parties and from in-house providers. The process spans the whole cycle from identification of needs, through to the end of a services contract or the end of the useful life of an asset. It involves options appraisal and the critical 'make or buy' decision which may result in the provision of services in-house in appropriate circumstances”* (Prescott and Beecham, 2003).

Procurement as a process differs from the purchasing process, as the later is considered a transactional or administrative function, whilst procurement is considered a strategic function. Research for this paper revealed that a significant number of people that had not participated in a procurement process did not understand the difference between procurement and purchases.

4.3 Best Practice and Standards for Software Procurement in Europe

This chapter examines policies for best practice and standards for software procurement. The definition of best practice calls for a technique developed through research and experience reliably leading to a desired result.

The area for which best practice is required is OSS procurement or development, preferably procurement or development for public administrations. The EU has a procurement directive specifically aimed at software procurement for public bodies (2004/18/EC). Best practice guidelines for the procurement of software for public bodies within the EU have been established.

The need for guidelines arose from procurement experiences throughout the Member States. A major survey presented to the ‘Open Source World Conference 2008’ in Malaga, found strong evidence that four major principles of procurement, as set out in the EU

Procurement Directive (2004/18/EC) were not adhered too. Of 3615 public body software tenders, 16 % showed explicit bias.

The principles compromised were:

- Non-discrimination
- Equal treatment
- Promotion of competition
- Transparency

These findings together with court actions in various EU Member States established the need for best practice procurement guidelines to deliver maximum benefits and minimal costs, whether proprietary or OSS is involved.

Final guidelines for best practice procurement were published by IDABC, in March 2010. These guidelines stress the need for neutral procurement policies (Ghosh, Glott and Patrice-Emmanuel Schmitz, 2010).

The EU's experience and research makes it a reliable source of best practice for procurement of software for public administration. Similarly, the EU has published guidelines for best practice in working with developers and for working with a EUPL license.

4.4 Benefits of Neutral Procurement Policies

According to a report sourced from the UN-APCICT Website, neutral procurement was found to be a better public policy approach and one that is most consistent with the constitutions and laws of jurisdictions across the globe. While developing policies, policy makers found that neutral procurement policies do not advantage or disadvantage business or licensing models and allows government agencies to choose the best software and business models in a given situation based on reasonable, objective criteria, such as the following:

- The overall cost of procuring the software
- Administration over the life of the product
- Interoperability
- Reliability
- Vendor support
- Ease of use
- Security
- Availability of warranties and indemnities for intellectual property (IP) claims

Such neutral policies can be beneficial as they open up competition in government contracts to suppliers of both OSS and proprietary software, which results in a vibrant IT ecosystem.

Neutral policies allow companies to protect the intellectual property (IP) of their innovations without fear of being disadvantaged in a procurement process that penalises IP-based solutions (as is often the case where OSS is mandated or preferred).

Neutral procurement policies have a broader positive social impact across a wide range of “quality-of-life” areas, especially in developing countries. The benefits of competition, continuous innovation, and greater choice in the marketplace, include better healthcare and government services, such as education and infrastructure.

The EU has embraced a neutral policy for procurement decisions based on choice and objective criteria as follows:

4.4.1 European Union: Treat Economic Operators Equally and Non-Discriminatorily

The EU Directive on Public Procurement Law (Directive 2004/18/EC) establishes that “contracting authorities shall treat economic operators equally and non-discriminatorily and shall act in a transparent way.” Derived from this principle, Article 23 of the directive says, “*Technical specifications shall afford equal access for tenderers and not have the effect of creating unjustified obstacles to the opening up of public procurement to competition.*”

4.5 OSOR Guidelines on Public Procurement and OSS

In October 2008, the OSOR published a draft version of guidelines for Public Procurement and OSS, using case studies from across the EU to establish the guidelines.

Under the Directive 2004/18/EC public administrations using IT solutions have a duty to support interoperability, transparency, flexibility and economical use of public funding.

Procurement rules, especially European Directive 2004/18/EC, govern that the acquisition of anything, including software, must be put through a public contract, i.e. a formal procurement process such as a call for tenders.

The procurement procedure for OSS differs from that of proprietary software. These points of distinction are both positive and negative, it is therefore necessary to establish elements of the procurement procedure, which uniquely identify requirements specific to each type of software.

4.6 Best Practice Guidelines for Adopting OSS

Clearly, defining the terms of use for OSS and stating the goals and aspirations the organisation needs to accomplish by adopting OSS makes it easier for developers to accept an OSS project framework. It is important to create a policy document that meets the needs of all stakeholders both technical and business as the use of OSS will introduce change to the work practice (Hammond, 2009).

As with any purchase in an organisation, there are procurement policies and guidelines for all acquisitions. These are in place to assist in the decision making process and finding the most efficient, reliable, cost effective product for the organisation in an unbiased manner. Benefits of such policies are outlined in the next section.

Table 3: Open Source Adoption Best and Next Practices

Best Practice	“How to”	How to avoid Pitfalls
Create a clear OSS policy.	<ul style="list-style-type: none"> • Specify your goals and objectives for OSS usage. • Get general advice early and often. • Ensure that developers understand the information in the policy document. • Categorise software by license type and deployment impact. • Gain an understanding of the potential dangers of distribution and viral licenses. 	<ul style="list-style-type: none"> • Don't treat policy-making as a one off task. • Don't declare success until testing is complete. • Don't let non-technical lead the policy setting process.
Re-engineer the software acquisition process.	<ul style="list-style-type: none"> • Define consistent criteria to evaluate all types of software. • Make sure costing includes the entire cost profile of commercial and OSS alternatives. • Reorder acquisition tasks for evaluation and selection. • Demand a realistic assessment for evaluate of performance. • Start OSS adoption at the lower levels of the application platform stack. • Encourage the use of OSS alternatives to drive better deals with conventional suppliers. 	<ul style="list-style-type: none"> • Don't rely on procurement authority for the management of software acquisition. • Don't overemphasise direct costs simply because they are easier to calculate. <p>Make targeted adjustments for people, processes, and tools.</p>
Make targeted adjustments to people, processes, and tools.	<ul style="list-style-type: none"> • Require project leaders to identify OSS dependencies. • Trust but verify with code-scanning utilities. • Use architectures to regulate OSS development and maintenance. • Maintain a repository of pre approved OSS components. 	<ul style="list-style-type: none"> • Don't dwell on development processes, focus on outcomes. • Don't expect perfection, plan for errors and how to rectify them.
Next practices	<ul style="list-style-type: none"> • Join and contribute to OSS communities. • Vary support-sourcing strategies by measuring delivered value • Model internal reuse strategies on the example of successful open source communities. 	

Source: (Hammond, 2009)

4.7 Determining Best Practice Requirements

Best practice in IT procurement is established on defining clear requirements and finding the best match to them. The principal requirements are as follows:

4.7.1 Functional

Functional Specification is the documentation that describes what is being developed, giving an understanding of requirement by all parties prior to the design or development process.

4.7.2 Technical

Technical requirements examine compatibility with existing systems and ascertain if there are constraints or needs that require an IT solution for interoperability.

4.7.3 Business or service model

Defines and meets the needs of the business/service user taking into account that different models fit different business and services and adapt to meet customer needs.

4.7.4 Open Standards

Good practice in eGovernment services should provide access based on open standards as the main advantage of using open standards is the capacity to be interoperable with other software systems across organisations. This should also allow citizens to interact with IT solutions provided by public administrations and be in line with the European Interoperability Framework.

Open standard requirements can also be defined within tenders in terms of these functional, technical or business needs. Standards are complex and are usually referred to by name in the procurement process. Tables 4 and 5 provide a list standards used in healthcare and e-health organisations.

Table 4: Organisations Dealing with Standardisation

Standard	Organisation
ACR	American College of Radiology
ASTM	American Society for Testing and Materials
CCHIT	Certification Commission for Healthcare Information Technology - USA
CDISC	Clinical Data Interchange Standards Consortium
CEN/TC 251	European Standardisation Committee, Technical Committee 251 - Medical Informatics
DICOM	Digital Imaging and Communication in Medicine
EEG9	European Board for EDI/EC Standardisation Expert Group 9 for Healthcare
ETSI	European Telecommunication Standards Institute
EWOS	European Workshop for Open Systems - This organization was closed in 1997; its successor is CEN's ISSS
IEC	International Electro technical Commission
IMIA - WG16	Working Group on Healthcare Informatics and Telematics Standards
ITU	International Telecommunication Union
OMG	Object Management Group
OSF	Open Software Foundation
SFS	Finnish Standards Association
Standards Server of the IEEE	Institute of Electrical and Electronics Engineers, Inc.

Table 5: Standards Organisations in the Field of e-Health

Standard	Organisation
ANSI	American National Standards Institute
CEN	Comité Européen de Normalisation / European Committee for Standardisation
Health Level Seven	HL7
Health Level 7 Australia	HL7 Australia
HL7 Finland r.y.	HL7 Finland
IHTSDO	International Health Terminology Standards Development Organisation
IMIA	International Medical Informatics Association
ISO	International Standards Organisation
National E-Health Transition Authority	NEHTA
Standards Australia	SA

4.7.5 Costs

OSS licenses may be available free of charge, however there are indirect costs associated with the use of OSS. These costs may be incurred in the operation of the software such as hardware requirements, support and maintenance, training and other ongoing services.

4.7.6 Vendor Lock-in and Exit Costs

Organisations are 'locked-in' to software products when the costs of switching to alternatives are prohibitively high. Vendor lock-in and exit costs are likely to be encountered when software needs to be changed. Vendor lock-in costs include costs of upgrades, cost of re-engineering when vendor change is required. Exit costs can include re-engineering, re-training and additional hosting software.

4.7.7 Mitigation of Vendor Failure Risk

Organisations can fail or can choose to discontinue support of software, this would necessitate change to alternative software creating costs. Vendor and product support lifespan assessment is therefore required.

4.7.8 Vendor Independence

Vendor independence is key to the long-term sustainability of OSS, with the added benefits of flexibility and transparency.

4.7.9 EUPL

The approval of OSS for a European Union Public Licence (EUPL) requires the software to meet the requirements and specifications for interoperability across the Member States. This interoperability encourages sharing, which in turn negates concerns in relation to the support and quality of the software.

Sharing negates quality and support concerns as it has the effect of making more programmers familiar with the code, removes bugs and creates a broad support platform. Sharing of EUPL software between European public administrations was unanimously supported by the ministers in member states responsible for e-Government.

4.7.10 Download or Purchase

Downloading OSS from the Internet is a means of acquiring software free of charge and does not require the use of a formal tender. However, this process requires knowledge to search for the appropriate software. If services such as support are required, they may need to be tendered for separately.

4.8 Establishing Best Practice Standards for OSS Procurement or Development for Healthcare in Ireland

The reason for not having established best practice standards heretofore is partially attributable to the fragmented nature of the old “boards” systems and to the relatively recent emergence of OSS as an approved and credible alternative.

The creation of national systems presents the HSE with an opportunity to procure or develop new systems so that they can be interoperable with other EU health systems and the goal of a common EU Health Record may be more readily attainable.

Ireland’s health service is presented with an excellent opportunity to avail of the experience of other European public administrations, whilst saving costs by not reinventing the wheel. The current procurement and development of national systems to replace a previously fragmented systems, has certain correlations with those the EU faces to achieve its interoperability goals.

Best practice standards that incorporate these goals will benefit Ireland’s HSE when adapting or replacing national systems and later will be of great benefit as the need for greater integration with a common EU platform develops. The adoption of EU best practice standards and guidelines will reduce or avoid difficulties arising downstream due to quality, support or interoperability issues, whilst minimising the expense and resources required procuring suitable software solutions.

The HSE will have to adapt elements of the EU guidelines for best practice to suit its structure and requirements, as the use of open source increases. However, the guidelines need to be used as they are currently provided, until sufficient experience has been developed to justify change.

4.9 Summary of Best Practice Standard for OSS Procurement or Development for Healthcare in Ireland

The best practice guidelines of the EU are clearly the best fit for the HSE's requirements due to the experience on which they are based and the future goals of the HSE in terms of EU interoperability requirements.

The adoption of EU best practice standards and guidelines for OSS procurement or development for healthcare provides the HSE with immediate advantage of ready-made guidelines provided specifically for public bodies.

The EU provides the following guidelines as recommended best practice for procurement, development and support of software for public administrations:

1. "Guideline on public procurement of OSS". March 2010. Prepared for the IDABC program (Rishab Aiyer Ghosh and Patrice-Emmanuel Schmitz, 2010).
2. "Guideline for public administrations on partnering with free software developers". December 2010. Enterprise Director General (Ghosh, Glott and Patrice-Emmanuel Schmitz, 2010).
3. "European Union Public Licence V1.1, Guidelines for Users and Developers" 2007 & 2009. Prepared for the IDABC program (Patrice-Emmanuel Schmitz, 2009).

The guidelines these papers contain are used in the assessment of each of the case studies to compare current practices against the established best practice of the EU, which are summarised in section 4.7.1-4.7.10 above and are therefore the basis for the methodology that follows.

Chapter 5 - Research Methodology

5.1 Introduction

This chapter describes the research process used and the reasons why a qualitative method was used to explore OSS experiences in the HSE organisation. Three case studies were examined. For convenience, these will be referred to as cases A, B and C. The following is a summary of each of these.

Case A: Beaumont Hospital OSS solutions, which were referred to in the literature review. This case is important for a number of reasons, due including the pioneering nature of its OSS projects and the subsequent developments. The Beaumont Hospital was an early adopter of OSS products in Irish healthcare. Whilst there are ongoing OSS development projects, some core OSS applications are being replaced with proprietary products. The study looks at the reasons for these replacements.

Case B: An OSS project that is currently being implemented to replace a problematic integration engine to allow interoperability between clinical systems in three hospitals that share the same core systems.

Case C: The roll out of a number of local OSS projects to replace redundant or manual systems. These projects commenced locally before being regionalized or nationalised.

5.2 Methodology

Qualitative research typically yields narrative data, whilst quantitative research yields numeric data. Narrative data as opposed to numeric data is required, as the objective of researching the case studies is to gain in-depth understanding of the processes involved in selection, design, implementation and support, therefore a qualitative research methodology was chosen.

To maximize the quality of the narrative data, a semi-structured interview process was favored. The combination of a structured questionnaire combined with closed and open-ended questions, in a semi-structured interview, provides full cover of the process, as well as encourages the interviewee to share their personal observations and experiences.

The primary method used to gather data was a series of interviews with the project team members, both users and developers. This was supplemented by a secondary qualitative method, which involved reading of internal documentation and reports relating to OSS projects, accompanied by (non-participant) observation of these systems in operation.

In preparation for the interviews, each interviewee was given a brief on the research and a list of the questions, which they would be asked during the interview. Both the brief and list of questions were approved by the HSE Director of Information Services, the HSE ethics committee and the Trinity College ethics committee. Interviews were carried out 'face to face' and over the phone.

The design of the interview questions was based on the literature review, which identified risks and challenges as well as benefits in using OSS, established by both academic and commercial studies. Questions were formulated to elicit respondents' views on these topics together with specific information as to how a process was conducted. The number of questions was determined by the key elements of best practice that were established in

the literature, thus they tried to obtain specific answers relating to key areas, whilst ensuring that all relevant project areas were discussed . During the interviews, following the initial responses to the questions, interviewees were asked to expand on their answers in order to gain further insight into the projects and the interviewee's experiences. Data gathered in the interviews was crosschecked with the literature to confirm the advantages and disadvantages identified.

Advanced awareness of the questions allowed for better preparation by respondents and reduced the risk of important details being overlooked. Conversely, preparation may have reduced personal insights from the interviewees, as predefined answers are less spontaneous. Each interviewee was encouraged to elaborate on their responses in order to gain personal insights, which may otherwise have been lost. It was decided that advanced viewing of the questionnaire would yield the best qualitative data. The content of the questionnaire was balanced and focused on the project experiences no significant biasing was anticipated from the interviewees.

The option of using focus groups was considered. Focus groups can yield valuable information in this type of research. However, because of the limited availability of potential participants and the difficulty in coordinating their timetables, the use of focus groups had to be eliminated as an option.

Table 6: Demonstrates the typical differences between quantitative and qualitative research methods to give a clearer view why qualitative was used for this study (based on Polit & Beck, 2006)

	Quantitative methods	Qualitative methods
Population	Delimit the study population through the eligibility criteria	Sample from the accessible Population
Sample size	The larger the sample, the more representative it is likely to be	No established rules. Sample size is largely a function of the purpose of the inquiry, the quality of the informants
Sampling designs	Non-random sampling may be used. Most commonly, probability sampling using random selection from the population. <ul style="list-style-type: none"> • Simple random sampling • Stratified random sampling • Cluster sampling • Systematic sampling • Quota sampling 	Non-random sampling to help select people who will make good informants. <ul style="list-style-type: none"> • Convenience sampling • Snowball sampling • Purposive sampling
Data	Numeric information	Narrative descriptions
Relationships sought	Seek relationships between independent variables and dependent variables. Typically expressed in quantitative terms (e.g. more than, less than)	Seek patterns of association (themes/processes) as a way of illuminating the underlying meaning and dimensionality of phenomena of interest

Source:(Quigley, 2009) page 25.

5.4 Sample Selection

Interview based qualitative studies often use a small sample size, taken from an accessible group in a purposeful way. This group should be knowledgeable and experienced in the study subject, to be able to provide rich data. For the purpose of this study, a list of experts was drawn up and a number of experts were selected. Selection was based on convenience and accessibility. Because such samples are not random, there is a risk of bias in the composition of the group.

To reduce this, every effort was made to ensure the sample represented as wide a spectrum of relevant parties as possible. This was invariably constrained by the willingness and availability of potential interviewees. It was felt that the group of people interviewed for this research was a reasonably representative cross section and one likely to give a reasonable perspective on attitudes to OSS.

The chosen staff possessed expertise in project management, procurement or development of software in the HSE environment. Some of those interviewed were ICT technical staff whilst others were involved with the business end of the HSE. The use of the two data source groups (ICT and business) in the sample provided a degree of triangulation and helped to provide internal validity.

Familiarity with the interviewees, their environment and terminology meant that they felt more comfortable in sharing their experiences. On the other hand this familiarity could not guarantee significant detachment (Meyrick, 2006).

Snowball sampling was used to broaden the range of data in each of the case studies. Early interviewees were asked to suggest other suitable participants. In total, eleven people were interviewed including, two ICT project managers, five developers, one systems analyst, one support and two business managers.

Anonymity was guaranteed before the interview so that the interviewees could be frank about their experiences. The diversity of the sample was helpful in making meaningful data comparisons (Mason 1997).

5.5 Data Collection

An advantage of the semi-structured interviewing technique is that it allows the participants to divert into topics that they feel may be of relevance or of which the researcher may not be aware. Another advantage of interviews is that clarification of ambiguity can be obtained there and then.

The list of questions was used as a guideline to elicit data relating to procurement, implementation and support. The interviews also provided information about the range of products being used and offered background detail on why OSS was chosen for the particular project.

Interviews were held with eleven people. Follow up interviews were held with three people who wanted to expand on their original contribution. Interview durations ranged between 30 minutes and two hours.

The most in-depth interviews were carried out with respondents involved in case study B. All of the interviews, in this case, were conducted face to face. They ranged in duration from 40 minutes to 6 hours. Some interviews were spread over a number of sessions, to facilitate interviewees but also to capture the data gained during the course of prolonged interviews.

5.5.1 Interview Technique

The key elements of best practice for OSS software procurement or development were discussed earlier. The questions used were designed to establish which of these practices were employed in each element of the case studies and if these practices were comparative to established best practice.

Further questions were used to expand on the responses of the interviewees. These questions encouraged the interviewees to explain their understanding of why choices or decisions were made. They were also used to extract the personal insights of the interviewees on their experiences. In some cases, comparative responses from interviewees were explored further, in order to gain an understanding of the experiences to which they were drawing comparisons.

Further questions were asked of some interviewees in order to obtain clarification or expansion on their initial responses.

5.5.2 Questionnaire for Semi-Structured Interview

The questionnaire is laid out according to the natural flow of a project conducted in a Best Practice environment. Each question was designed to extract key data in relation to what project elements were conducted and how these compared to Best Practice. The elements of Best Practice that the questions are intended to establish are listed beneath each question.

Table 7: List of Interview Questions

<i>Q 1. What process led to the decision to use open source software for the integration project?</i>
Established: Functional, technical, business and service model.
<i>Q 2. What standards were used in the open source software?</i>
Established: Open standards or not.
<i>Q 3. Did the open source software used meet with the standards required for health applications?</i>
Established: Functionality, business, service and standards.
<i>Q 4. Was the implementation process difficult?</i>
Established: Technical.
<i>Q 5. What was/is the support availability for this open source software product?</i>
Established: Cost, technical, vendor lock-in, failure risk and independence.
<i>Q 6. Is there a sufficient number of staff within the organisation equipped with the skills to support the project?</i>
Established: Cost, technical, vendor failure risk and independence.
<i>Q 7. Are there any plans to skill up more staff to provide internal support?</i>
Established: Cost, technical, vendor failure risk and independence.
<i>Q 8. Are there any plans to use this open source software for other integration projects in the future?</i>
Established: Functional, technical, business and service model.
<i>Q 9. If so, what criteria are these plans based on?</i>
Established: Business and service model, open standard and best practice.
<i>Q 10. If not, why?</i>
Established: Confirmation of an alternate business and service model, open standard and best practice.

5.5.3 Confirmation Process

The transcripts of the interviews were submitted to and approved by each individual and group involved in each case study. Each was asked to review their responses, add to or remove any aspect of their transcript. Once approved the transcripts were utilized in the analysis of the case studies.

Chapter 6 - Analysis of Results

The results are drawn from the transcripts of the semi-structured interviews together with the documentation associated with the case studies and some earlier OSS implementations. The interview transcripts were used to conduct comparative analysis of the best practice established in the literature review and the occurrences in each case study.

The analysis of each case study is preceded by a brief explanation of what each project entailed, as it was provided by the various project participants – be they developers or system users. This was followed by an analysis of the case study using the headings for OSS best practice as set out in Chapter 4.

6.1 Case Study A - OSS End User Applications - Beaumont

Information on the Beaumont hospital case was obtained from the OSOR.eu Website under Case Studies published on June 3rd 2008² and updated in a telephone interview with a member of the ICT team at Beaumont hospital in May 2010. In addition, a number of papers have been published on this case by Beaumont's former IT Project Manager Tony Kenny and Professor Brian Fitzgerald of Limerick University (see section LIT REVIEW). A brief history of this project is given below.

Beaumont Hospital was formed from the amalgamation of the three oldest hospitals in Ireland. The hospital directly employs 3,000 staff. It serves as the training hospital for the RCSI (Royal College of Surgeons in Ireland) and DCU (Dublin City University).

² (http://www.osor.eu/case_studies/migration-to-open-source-software-2013-beaumont)

In 1998, a decision was taken to implement OSS in the hospital where possible. This was largely driven by the necessity to reduce costs and by pragmatic considerations. In 2002, the hospital began the roll out the first of these systems, an office software package called 'StarOffice'. However, the implementation was troublesome from the start as the version of the product used lacked the functionality available in the Microsoft Office application that it was replacing.

Users quickly became frustrated with the product's lack of functionality. Despite the fact that functionality improved in later versions of StarOffice, users had lost confidence in the product. This confidence was never regained and consequently the hospital has returned to using Microsoft office.

In another part of the strategy, OSS email was used. Here, again, there were problems. The version of the OSS e-mail software that they implemented was found to be incompatible with mobile collaborative technology. Again, this product is now being phased out and work is underway to move to a proprietary product.

Despite these failures, there is a number of successful OSS products still being used in Beaumont hospital. A product called CMS (Content Management System), Zope has proven to be more durable. There is also an in-house application developed using OSS application server JBoss (JBoss is an OSS Java application server that works cross-platform), which resides on Linux servers. The Linux servers at the hospital also host a number of proprietary products.

Case A: Summary of Findings

A respondent explained, “Whilst Beaumont Hospital may have been an early adopter of OSS for the right reasons, it is clear that not all aspects of the implementation were thought through. Had a detailed gap analysis been conducted between the functionality of Star Office and Microsoft Office as part of the project feasibility study, there is a strong probability that the project would not have proceeded to implementation stage”.

Evidently, the project assessment phase for the StarOffice application did not follow best practice, as had it done so the business, technical and functional requirements would have established the suitability, or otherwise, of the product. The same is true of the later OSS e-mail application.

A principal driver in opting for both of these failed applications was direct cost. This driver also contributed to the failure of the chosen applications to meet the standards expected by the users. The reason why this occurred was that the lack of direct costs allowed some of the normal project specifications, which are drawn up for tenders, to be by-passed.

The content management system, Zope, which was successfully implemented with the assistance of an external support agency, exhibited greater similarities with established best practice. Of note was the use of an outside support agency, called OpenApp, who specialize in OSS software, with particular expertise in project design, best practice and support. The use of this agency demonstrates the effectiveness of best practice in this case.

As identified earlier in the literature, the adoption of structured project management by OSS developers, with the involvement of strategic planners who possess key knowledge of the vertical market segment in which the product is being developed.

This structured project management support was closely followed by professional support for these OSS applications. OpenApp are an example of a professional support agency for an OSS application, 'Zope', the combination of these elements, together with best practice led to the success of the project.

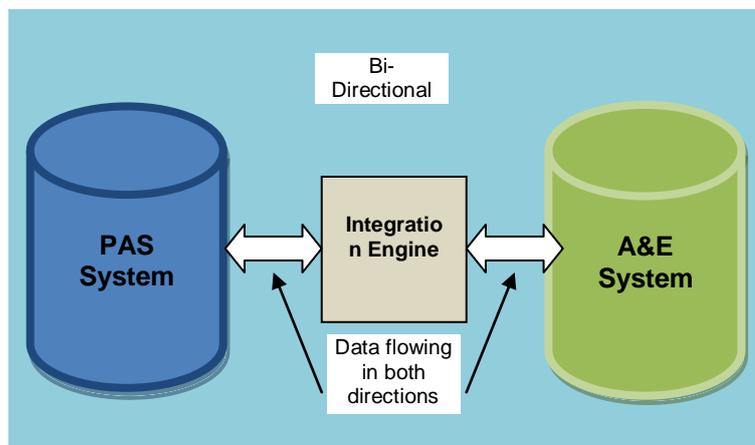
6.2 Case Study B - OSS Integration Project

The case study involved three hospitals, which are using OSS to connect a number of diverse applications. The hospitals in the study are using central systems with local instances of the PAS (Patient Administration System), RIS (Radiology Information System), A&E (Accident and Emergency), Theatre Management System and Cardiology System.

These systems communicated through an integration engine that managed data using interface software and listeners (see below). The integration engine communicated messages between the systems using Open Standards, such as CSV (Comma Separated Value) Delimited File, HL7 and XML.

The data flow through these interfaces was predominantly uni-directional from the master PAS system, however the A&E interfaces were setup to be bi-directional allowing the data to move both ways between the PAS and the A&E systems, which increased the risk of duplications.

Diagram 2: Bi-Directional Data Flow



Each interface had a separate listener supplied by the application vendor. A listener is a program that listens for incoming messages on a specific port, identifies the message type then routes, transforms and injects the message into the destination database, such as patient registration information from the PAS to the A&E. An acknowledgement message is transmitted to the sender of receipt or failure.

For the participating hospitals, a series of problems needed to be addressed:

- The interface or one of the listeners losing the connection, resulting in systems being unavailable
- Incorrect configuration on one of the interfaces between the PAS and a destination application
- Bi-directional interface setup between the PAS and a destination application creating a risk of duplication
- A disk space issue on the legacy server, which hosted the integration engine

Project Proposal

Budgetary restraints and the prospect of the hospitals being integrated in the National PAS project, which is being implemented on a phased basis, were major factors in deciding how to approach this problem. A project team of internal staff was assembled consisting of a project manager, three ICT staff, two developers, one support and a business user one from each of the three hospitals. The objectives of the project were to:

- replace the existing integration platform with a platform that is simple to manage and maintain whilst providing a secure environment where hospital applications can function
- stabilise the listener services between the applications and the interface engine
- provide a web enabled duplicate management service, allowing hospital management to quantify and manage the level of duplicates on the PAS system
- provide a facility to enable hospital staff to access the PAS during routine maintenance
- change applications using a bi-directional interface to the use of unidirectional interface
- train ICT staff to provide support for the new service

A number of factors pointed in the direction of using an OSS solution. These factors were:

- Due to the presence of multiple proprietary application systems with various suppliers, an internally customized OSS solution was preferable as this would both avoid the involvement of yet another proprietary software supplier and allow each existing supplier to co-operate directly with the HSE as their principle customer.

- The solution required was driven by cost. The cost of proprietary solutions were investigated and deemed prohibitive.
- The skill sets of the team included experience in acquiring and using OSS products.

Through internet research, speaking to commercial suppliers of OSS and organisations that have used OSS for this particular problem, an OSS product was sourced.

Product Reputation and Support

The reputation of the product was endorsed in healthcare organisations throughout the UK and the USA. The team reviewed a successful implementation of the product in an NHS hospital in the UK. They also established that there is ongoing development of the OSS product, with plans for further development listed on the web site. The team identified that third party commercial support was available.

They also identified support through the provider's web site, which contained support forums and blogs together with regular updates. Explaining the importance of support costs and responsiveness, respondent interviewed observed that:

“External support is of paramount importance to the project and for the organisation as it reduces the risk of exposure should any of the current ICT support team move on”.

When explaining the importance of support costs and responsiveness.

Implementation

After the decision had been made to use the product, the project plan was put forward for approval by CAB (Change Advisory Board). HSE ICT projects require CAB approval at build, test and implementation phases. CAB approval ensures the proper support structures and resources are in place for each phase of the project. Examples of support structures and resources are staff assistance, access to environments, security and hardware requirements.

The project is currently being implemented on a phased basis; each phase requires CAB approval to ensure that existing criteria are adhered with before the next phase can seek approval. This includes a software release checklist. An impact assessment is carried out for both ICT and Business Services before each phase and a change request form is completed and approved before initiation. Details of which are in appendix 2, 3 and 4.

Phase One - Test and Implement in a the New Environment

The OSS was implemented and tested on a Windows platform. The OSS interfaces were built, configured and tested to ensure they operated correctly in a replica of the live environment.

The data flow that had been bi-directional was changed on two of the interfaces, to uni-directional, making PAS the master. At the time of this research, the data flow on one of the interfaces was still bi-directional. This phase of the project was not without challenges both technical and environmental. A respondent interviewed stated that:

“Testing is vital, as unforeseen issues can be identified and resolved prior to implementation in the live environment”. They added “non technical issues took longer to resolve, however the challenges identified during this phase were successfully overcome”.

Phase Two – Implementation in a ‘Green Field’ Interface Environment

With CAB approval, the OSS integration engine was used to interface the PAS and the LIS (Laboratory Information System) at one of the hospitals where there had been a longstanding requirement for integration between these two systems. This was an ideal environment, being a ‘green field’ interface environment, as no previous interface existed, to test all the functionality of the OSS integration engine before implementation in the live environment.

Phase Three – Current

Subject to CAB approval, implementation will take place in the live environment where the cardiology and theatre interfaces will be replaced. The methodology deployed will be parallel implementation, where the old and new integration engines are run simultaneously, this reduces risk by allowing roll back should any problems be encountered. The interfaces will be replaced one at a time. Only when all the interfaces have been successfully transferred to the new system will the old system be disabled.

Phase Four

Subject to CAB approval, proposes to replace the RIS and A&E interfaces. These systems require 24/7 support.

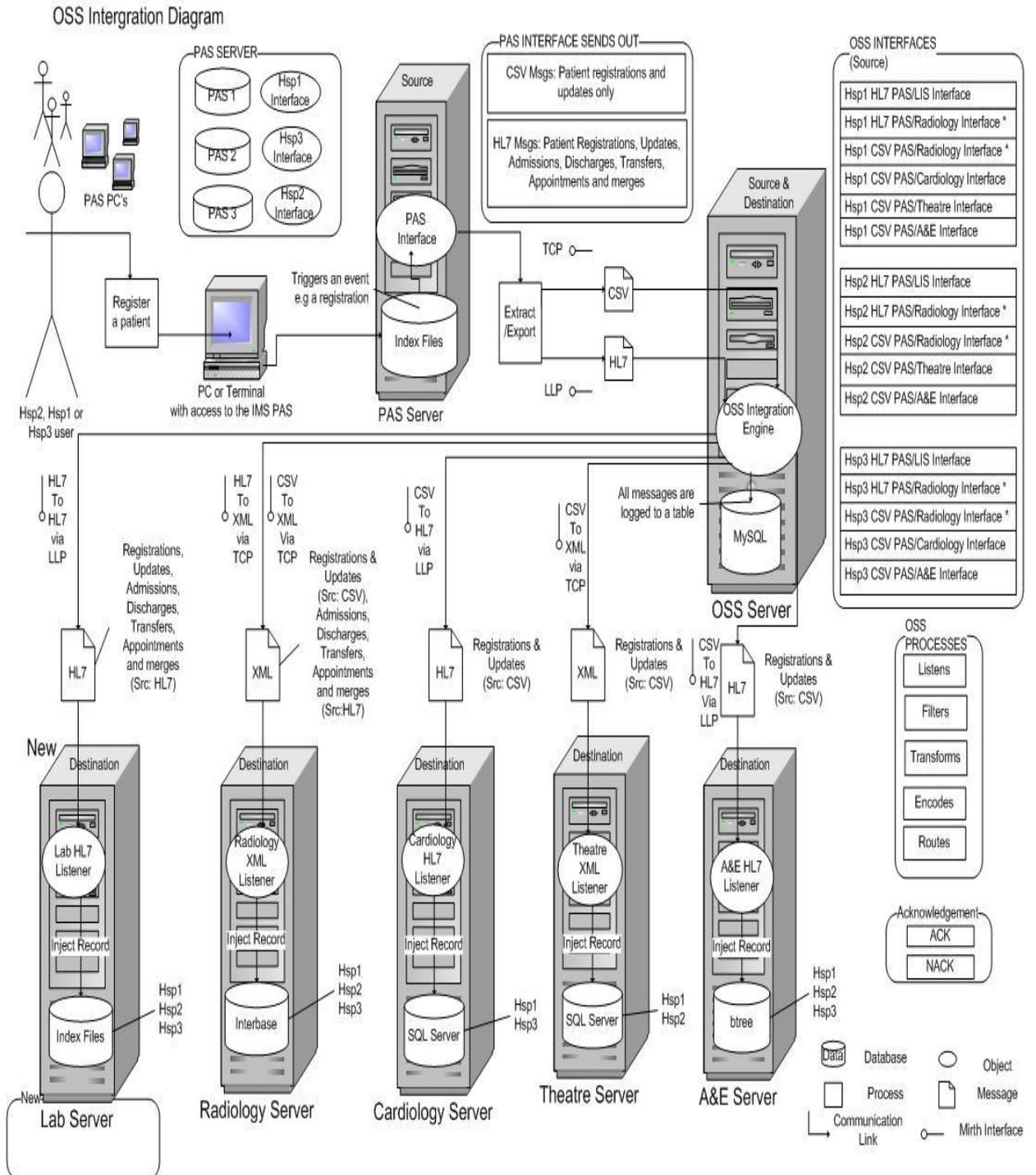
Phase Five

Disable the old integration engine.

To date no problems were encountered within the time-limitations of this research, phases one and two have been successfully implemented and the environment is ready to commence with phase three upon CAB approval.

The diagram is a visual representation of the completed OSS integration project.

Diagram 3: Schematic of Case Study B OSS Integration Project



Support and Training

Support for this product will be provided by the commercial developers. The HSE have purchased a forty-ticket package to avail of this support. Each ticket is for one support incident. Support can range from incident, development support to bug issues. The cost of this support package is a third of the current annual cost paid to the proprietary software suppliers. The provision of commercial support reduces the risk of exposure due to inexperience for the organization.

Table 8: OSS Support Features

Support Features of the OSS Product
Online Training
Web/Email Support
Emergency Bug Fix patches
Developer Q&A
Phone Support
24x7 Emergency Support
Remote Troubleshooting
Build in alerts based on user-defined rules to constantly monitor interfaces and notify dedicated support staff via email and/or text messages to take action.

Training of ICT support staff is being provided by members of the project team. The project team has provided documentation and a training database. This training should give support staff the necessary skills to deal with any problems that may arise and if they are unable to resolve the problem, to direct it to the appropriate commercial support service.

Case B: Summary of Findings

The project team and the end users are satisfied with the progress of the project to date as the objectives set out are being achieved. This project has been successful due to a combination of careful planning and getting buy-in from all the stakeholders affected by the change in work practice.

Project Specification:

Cost

A manager involved in the project commented, that cost was the driver for the project. When asked if the entire costs of the project were considered, they added that:

“Management is constantly under pressure to reduce cost without impacting on the service. Staff is deployed to work on projects based on priority”.

The literature review establishes cost as being one of the main drivers for adopting OSS; it also notes that cost for the whole of the life cycle should be taken into account. Clearly, the direct costs were given consideration, as these were recognised by the manager interviewed. The manager also recognised some of the indirect costs, such as labour and support. However this recognition was not apparent in a structured form as would be the case had the best practice suggested in the literature been in place.

Another respondent stated that:

“The facility to test and implement without having to commit to buying the software saves significantly on outlay costs, as does not having to commit to commercial support, which also keeps cost to a minimum. The added advantage of the availability of commercial support if and when required is significant”.

This respondent clearly identifies a significant advantage inherent to using OSS and recognises the savings to be derived from OSS.

Furthermore, there was clear awareness of the substantial difference in the costs of support when using OSS. Whilst the potential benefits of OSS for testing and support costs are recognised, this was not arrived at formally as would be the case with best practice. The actual savings were not quantified nor were the comparative costs of the various OSS systems tested.

Another respondent commented that the data is stored on a MySQL OSS database, therefore is without annual license and maintenance fees. The respondent recognised further savings on direct costs as would have been the case if best practice had been followed.

In conclusion, whilst there was recognition of both direct and indirect costs, there was a lack of the formal process present in best practice. The project team acknowledge that some of the savings only became apparent as they proceeded, which is indicative of the lack of a formal process for cost recognition. They also recognise the need for a best practice process as they identified that they could have made further savings had they had better experience to be guided by.

Support

The literature suggests one of the initial barriers to the uptake of OSS was the availability of continuous support. It also pointed out that as the development model has become more structured so has the support. This is evident from the findings in this case study as commercial support was a prerequisite. One business respondent noted that:

“There had been problems with support from a proprietary supplier for one of their key applications”. They added, “The support they have received so far with this OSS product is considerably better than some of their proprietary support”.

The respondent was referring to a lack of product language expertise required to fix an on-going bug with the application.

These comments correlate with the literature review findings, as one of the significant benefits of OSS is the community nature of the support bestowed upon the user. Community support eliminates the possibility of a lack of knowledge of the software application’s source code. Whereas a proprietary sourced program may be affected by such a difficulty as the company supporting the product may choose to stop support altogether or may naturally discontinue support in favour of newer product version.

The product supports secure access, over the intranet or internet, for dedicated support staff for ease of monitoring and maintenance. The OSS application sends alerts to dedicated support staff via text message or email. These alerts allow the staff member to distinguish between errors that can be resolved internally or ones that must be referred to the commercial support. By making this distinction, the external outlay of funds to commercial support is minimised.

The above additional functionality was identified as an area for cost savings during discussions regarding the legacy application that was being replaced. Best practice guidelines would ensure that such functionality requirements would be identified on a formal basis during the project specification phase.

Ease of Use

A respondent explained that:

“The product is easy to use as it has a graphical administration tool that connects to the server. This allows configuration of interfaces, monitoring of interface activity and allows for browsing of stored messages”.

The product has the ability to work across platforms such as Windows, Linux, MAC and VMS using a windows graphical user interface that manages the service, displays log files and contains other configuration settings for the Server.

This is an excellent example of one of the key benefits derived from community knowledge in a vertical market segment. The key benefit being the community knowledge added graphical functionality as it recognised this as a need of the potential customers for the product.

Standards

The respondents to this case study were aware of the need for Open Standards, as the project was primarily about integration of systems. In order to achieve the required integrations interoperability via Open Standards was a necessity.

The significance of Open Standards to interoperability was discussed in Chapter 3. The awareness of interoperability and Open Standards was in line with best practice guidelines.

Capabilities

The literature suggests that OSS is moving to the fore across the software industry, because of its flexibility and value added services. An example of the capability of this OSS product was noted by one of the respondents, who commented that.

“It is extensible via the source code, has plug in architecture, which allows for added functionality and robustness. The multiple routes and transformation ensures easy connection between services.”

The application uses LLP (Lower Level Protocol), which is the standard protocol used for exchanging HL7 messages over networks, providing the following capabilities:

- Graphical User Interface for easy management
- Reports on message status, i.e. acknowledge /not acknowledge
- Stores all transactions are in a log, which can be archived and held indefinitely
- User login is secure
- Messaging standards such as HL7, XML, DICOM, EDI (Electronic Data Interchange)

Exit Costs

In relation to exit costs, a respondent explained:

“Vendor lock-in was one of the challenges encountered during testing and every effort was made to ensure this would not recur”.

The respondent was referring to a vendor whose legacy proprietary application created difficulties, as it was no longer being properly supported, however the vendor still was contracted to provide support.

Exit costs measure the cost of being able to change a chosen vendor or system in the future. Should there be a requirement for these systems to be integrated into a national system no exit cost will be incurred. Whilst exit costs were considered, the consideration occurred due to the difficulties encountered with a legacy system as opposed to forming part of a best practice process.

Conclusion

Overall, the project to date has been successful and the team members interviewed are impressed with the features and functionality provided by the OSS. They wish to be able to use it where possible in projects throughout the organisation as many lessons have been learned with the implementation to date, from identifying the problems to achieving the project objectives.

In relation to best practice, whilst the project team conformed to best practice in many of the key areas of the project, there was no evidence of a formal process being in place. On some occasions, the team encountered issues that they might have avoided or been better equipped to deal with if they had the OSS best practice process in place.

The key lesson to be learned from this case study is that there is a clear need for best practice guidelines for future projects so that the lessons learned here will not have to be learned again elsewhere. The definition of best practice, learning from the lessons encountered the best way to achieve a project goal, has clearly been the experience of the project team.

6.3 Case Study C - OSS as a Development Tool

HSE staff in the South, Dublin North East and Dublin Mid-Leinster, are using OSS for development projects. Projects vary in size from local to national; these projects are being developed by individuals or small teams.

Background

Initially OSS projects were developed at local level for small user groups that had a requirement to gather data for record and statistical purposes. Some of these groups had an existing database that no longer met their needs, due to an unstable environment such as obsolete hardware or limitations within the original design; others were using paper-based systems.

A number of these projects was considered too small to require any formal tender structure and viewed as a temporary measure prior to national systems. Others were required to go through the normal channels of project proposal as stated in the case study on interoperability.

As confidence grew in the technical and functional ability of these open systems developments, apprehension regarding support decreased and projects grew in size from local to regional. Regional projects permitted users from the same discipline but geographically dispersed to accumulate and manage data from a centrally hosted database, providing managers with the ability to gather statistics for the region, which previously was not electronically possible.

National Development Project

As a result, of these successful projects, a national project has received both local and national approval, which is in-line with CAB approval.

A deciding factor for this project was the number of internally developed disparate systems throughout the service doing the same job. The original developers of some of these systems are no longer in a position to provide maintenance. Based on the disparity and difficulty of support the pragmatic decision to develop a new national system was made. The skill set of the internal developers facilitated the project to be developed in OSS.

Work on this project is collaborative between a team of developers in the South and Dublin North East. The evolving structure of the HSE ICT provides opportunities for developers in geographically dispersed locations to work on collaborative projects, using a dedicated virtual server. The virtual server will be shared by team members. Each team member should be able to use and administer the server as though they have complete control of the server, so that changes and updates can be reviewed by all the team members, utilising the full potential and knowledge of all the team members. A respondent interview added:

"However, for this project space was allocated on an existing Windows server which was not ideal and presented performance issues, fortunately the team were able to rectify this by rewriting code. Future OSS projects of this size would perform better on a dedicated server which would be less problematic."

Another respondent added:

“Testing software before going live is critical especially when working across platforms, some of which are legacy platforms. During testing, it was noted that running the application in locations with low bandwidth resulted in poor performance. However running the application on a web portal through virtual desktop software resolved this issue.”

One respondent commented that this project, together with the practical experiences, will increase the knowledge of OSS development within the organisation and build on the internal support mechanism”. The flexible access to the source code allows for customizations. This is regarded as a major advantage of OSS as the requirements of all the stakeholders are met and the project can be developed to the highest standard. For this national project, a systems analyst stated that:

” There is a lack of standardisation of business requirements. Finance managers in different areas had different requirements; we had to include all the requirements in the database to make sure all the needs of all the users were met.”

As with the integration engine project a software release checklist, an impact assessment and a change request form are completed and approved before the projects are initiated. Training for users is initially provided by the developer of the system for business administrators who in turn train other business users.

Within the time parameters of this research, the testing of the national system was completed and the implementation had commenced.

Case C: Summary of Findings

Projects Specification:

Cost

No consideration was given to the overall costs of the projects as suggested in the literature on best practice. A manager, when asked acknowledged this as fact added:

“Our main concerns are keeping the service operational at the same time reducing expenditure where possible. The environment we work in is constantly changing. Predicting long term costs of any projects is difficult, however in the short term OSS does reduce initial outlay by a considerable sum”.

There are no annual license fees. There was also availability of commercial support with the option to purchase this on a ‘needs be’ basis can reduce ongoing costs. These cost factors were described as the primary driver for these development projects.

Support

The availability of both commercial and internal support is a key requirement to sustaining these developments and providing a high level of quality services whilst delivering value for money service. A respondent explained:

“There are a number of companies that are willing to provide training and support for OSS products. We checked this out before we commenced the project.”

This provided an external reference point, as a precaution, should one be required.

A further comment was community support through forums and blogs are very helpful. Some products provide video training.

The growing internal support is encouraging the continuous use of OSS among developers in the HSE. A respondent stated:

“This is a huge learning curve for us, we are encountering many challenges, which will improve our knowledge and benefit the organisation”

Standards

There is an awareness of interoperability being a requirement for future national systems. Open standards allow for interoperability between systems and help prevent vendor lock-in. One respondent commented,

“The importance of communication between developers is essential to avoid repeating the problems being encountered with legacy, disparate and unsupported systems throughout the organisation.”

The OSS products used are governed under different licenses, therefore the stipulations that the product is licensed under, are adhered to for the developments.

The awareness of standards complies with best practice, as does the use of licensed applications. However, whilst much consideration is being given to interoperability and creating national systems, there is limited if any awareness of EU interoperability goals or the EUPL license.

Capabilities

Initially, only a few internal ICT developments were OSS, however this is changing as confidence in OSS products grows through experience. The number and size of the projects currently under development, using OSS, is evidence these products have the capability to meet with certain project requirements.

The lack of formal guidelines, particularly for OSS best practice guidelines is likely to erode confidence and limit the capabilities of OSS products meeting future project guidelines. As throughout the stages of this case study the presence of some elements of best practice were confirmed, the absence of other elements was notable and overall, the benefits to cost effectiveness and efficiencies were not fully realized.

Exit Costs

There is no perceived exit cost associated with these OSS developments should there be a requirement to transfer to national systems in the future.

Change Management

As identified in chapter two, most health professionals use ICT systems during training and daily operations therefore working in an ICT environment is normal. Change management has not been an issue for these OSS projects due to the aforementioned ICT familiarity and working with internal ICT expertise.

6.3.1 Interviews with Business Managers and Users

The business managers and users are the ultimate project stakeholders and as such offered important insights to the project management, their involvement and final satisfaction with the product.

Business managers are receptive to the change in project delivery. Previously projects were largely procured at local level, which was a contributing factor to the large number of disparate and fragmented systems. This procurement took place without engaging in consultation with the HSE ICT department, whereas more projects are now being developed at regional and national level with the involvement of the HSE ICT team.

Business managers who had previously dealt with external suppliers are now also dealing with internal suppliers from the HSE ICT team. The internal support is provided by ICT staff that managers and users can identify with, due to their knowledge of the environment and its requirements. The development of regional and national projects has led to the availability of more reports from a single database, whether regional or national. Previous disparate systems meant that this was an onerous task for business management.

Business management has noted that the cost of internally developed projects is considerably lower than externally procured projects and there are fewer annual licenses or lower maintenance costs.

This feedback results from the sense that the systems are tailored to meet user needs by HSE ICT staff. This occurs as development is rapid and there is constant communication between all the stakeholders, which ensures the technical and functional requirements are met. Subsequently, support of internally developed projects is provided quickly and at a local level.

Consequently, all concerned get a greater sense of ownership of the project.

This would certainly be enhanced by introducing formal best practice guidelines, to optimize the results that can be obtained and minimizing the costs and other resources required to obtain these results.

6.4 Analysis

The analysis in the three case studies is based on the best practice in chapter 4.

Functional Requirements

It was clear in the case A, that a proper determination of requirements was not conducted. As some of the functional requirements for the software were not identified, which would not have been the case had a best practice for OSS acquisition been in place. Cases B and C carried out determination of requirements, as this is a prerequisite for CAB approval.

Technical Requirements

In respect to the technical requirements in all case studies, the best practice for OSS acquisition was followed. The principle drivers were future interoperability and avoiding vendor lock-in. The respondents provided confirmation that this was done as it was a standard requirement of any project and was overseen by CAB.

Business or Service Model

In each of the case studies the software, which best suited the business model was selected, with the exception of case A. Notably there was no mention of consideration being given to the compatibility of the software chosen in each case to the business model, at least not in any deliberate sense.

Open Standards

Open standards were used, as this is driven by a national requirement for the compatibility and interoperability with existing and future systems. Amongst the open standards encountered were HL7, XML and DICOM. The use of open standards for both proprietary software and OSS is common therefore pre-existing best practice requirement was in place for cases B and C. There was no information on open standards for case A.

Costs

The main driver for these developments was reported as being direct costs. However, due to the inherent difference in the nature of costs of OSS, the costs that were being considered were not the only costs that Best practice in OSS would actually consider. In fact, they were costs that would normally be considered when reviewing proprietary software. This was the apparent in each of the case studies.

The significant differences in OSS cost exist in the area of indirect costs, such as staff time, staff training and support time throughout the life cycle of the development.

Vendor Lock-in and Exit Costs

There was awareness of vendor lock in and of exit costs in all cases, in particular in the case B. In this case, the legacy/current vendors had to be consulted and their co-operation sought in order to conclude the project successfully. If formal best practice guidelines were in place this awareness would also be recognised and dealt with appropriately.

Mitigation of Vendor Failure Risk

In case B, the vendor's plans for upgrading and added value enhancements were considered, as was there reputation for investing effort in upgrades or enhancements. The purpose of doing so was to establish the long-term viability of the vendor for support and future requirements. It also mitigated against vendor failure, which is a minor concern with OSS, however it still must be considered. This practice would form part of any best practice guidelines. This was not of concern for cases A or C.

Vendor Independence

It is worth noting that vendor perpetuation was not a notable consideration, as the one-time win of the legacy systems has inadvertently been perpetuated by the interoperability platform to which they are now attached. This would not occur if best practice guidelines were in place, as the vendor lock-in was not given full consideration for the legacy systems.

EUPL

The European Union Public Licence (EUPL) requires OSS software to meet the requirements and specifications for interoperability across the Member States. There is no evidence of the awareness of the EUPL. However, there was awareness of the licence stipulations of the acquired OSS, which were adhered to.

Download or Purchase

There is no evidence throughout the case studies of the use of a procurement policy for the acquisition or the development of OSS or of a best practice standard intended for use in the choice or production of such a project. There is however, evidence of the use of some of the standards normally associated with proprietary software acquisition. This is apparent in various areas of the projects that were studied and in the subsequent interviews with participants.

Adhering to a procurement policy ensures that all costs associated with a project throughout its life cycle are accounted for, prior to initiation. This is achieved by applying the appropriate criteria for weighting the costs.

There was significant evidence of the conscious decision being made to download software as opposed to procuring it by tender. To commit to downloading software meant that significant product and code knowledge pre-existed within the organisation and more specifically in the teams involved. The choice to download meant that significant time and effort went into research as opposed to drawing up specifications for external bidders.

The later specifications evidently existed in a rudimentary form as the research was conducted successfully and software secured from an on line source. Once again, had best practice been in place the existence of a specification of a more detailed form would have been a requirement regardless of whether or not the software was eventually downloaded or procured externally.

It is important to note that a formal process was not evident for the formation of a specification from the research or for a potential tender to an external party. This would be a requirement of any best practice that would be employed, which would improve the acquisition process. The acquisition process for either proprietary, OSS, external or web sourced programs, has the same goal, which is to meet the needs set out in the specification.

During the interview process, several of the respondents mentioned researching where the software had elsewhere found use and conducting a review of the software in action at another location. This was not the case with all those interviewed. Whilst this process is in fact in line with recommended best practice, as no best practice was in place the referencing process was hit and miss in nature.

Another aspect of the identification and selection of software that was mentioned was the ability to download and test software without deployment, which is an inexpensive process. Again, this is an element of OSS acquisition best practice and would form part of any best practice process, as comparison of the software to the projects functional and technical requirements can be carried out.

Whilst a number of project standards have been followed for the OSS projects there are others that have been identified as best practice. Adopting these will ensure that all future OSS projects are procured or developed, implemented and supported in a manner that can be used by all project teams within the HSE and in keeping with the EU directive for interoperability of EU public administrations.

Support

Once the software has been purchased via tender or downloaded, it is then installed. Each piece of open source software must then be supported. All of the software used in the case studies was downloaded, as opposed to being purchased via tender. Each case study demonstrated varying degrees of consideration for product support. The degree of support required would be a prerequisite of a project being carried out under best practice.

The Interoperability and the National development case study implementations gave a higher degree of consideration to support than the other smaller case studies. These larger projects made it a priority from the onset of the projects to have strong support options. This was explained to have been a key deciding factor in the choice of the final software to be used.

Support is a key area of best practice in acquiring or developing software. OSS presents additional options for support, as it can be internally supported or can be supported by the community from which it arose. Support for OSS is normally more economical than support for proprietary software.

It was clear that for the most part adequate consideration was given to support. Support is a significant element of both cost and product reliability. Support is also a significant consideration in best practice and would be included in any guidelines that were adapted. These guidelines would seek to confirm what levels of internal, community or external support might be available for a piece of software.

The table, on the following page, outlines the principle strengths and weaknesses of current practice versus best practice. The inconsistency of practice was evident, as was the impromptu response to elements of best practice guidelines.

Table 9: Application of Best Practice

Best Practice	Case A	Case B	Case C
Functional Requirements	Not properly conducted	Well prepared	Prepared
Technical Requirements	Well prepared for some projects. Unprepared for others	Well prepared	Well prepared
Business or Service Model	No mention of consideration	Best suited selected	Developed specifically for the model
Open Standards	No information	Pre-existing best practice	Pre-existing best practice
Costs	Partially. Not all long term cost considered	Well prepared. Direct and indirect, initial and long term cost considered	Well prepared in the short term. Considerable less thought given to long term costs
Vendor Lock-In and Exit Costs	Aware of the implications	Acute awareness in avoiding this situation	Internal developments therefore not applicable
Mitigation of Vendor failure risk	No evidences of concern for this	Reputation and future plans of vendor examined to avoid this	Not of concern for internal developments
Vendor Independence	Well thought out as part of the long term plan	Other systems reliant on this project are vendor dependent. Total independence not possible	No of concern
EUPL	Unaware of its existence	Unaware of its existence	Unaware of its existence
Download or Purchase	No evidence of policy provided	Well experienced in downloading and adhered to proprietary software procurement policy where possible.	No policy used. Reused projects and existing OSS
Support	Used where applicable	Well prepared, support was a prerequisite and is in line with best practice	Considerable consideration given for the national project

6.5 Summary

Evidence of all the elements of best practice for the acquisition or development of OSS was present however not in any single case study. The lack of consistency alone clearly demonstrates that there is a need for best practice guidelines to work with.

Direct cost being the primary driver is not necessarily the best driver, as other costs can be overlooked, as can the overall long-term suitability of the project. With best practice guidelines in place, the correct drivers are not likely to be overlooked.

The gaping need for best practice was clear in several case studies, particularly when the initial phases of assessing the functional and technical requirements were concerned. The use of best practice would have added structure, clarity and in turn economies to the projects.

Best practice testing prior to deployment would have saved on downstream faults, costs or failure, which was evident in some of the projects. The use of best practice guidelines would have minimised or removed the loss of time and resources on such projects.

The time and expense involved in projects would be reduced with best practice was clear, even in the best of the case studies that were reviewed. Furthermore, with best practice guidelines the project software could be standardised and saved for deployment elsewhere.

Cost of the software may contribute to the weakness of the process, unlike higher cost proprietary software projects that attract full tender requirements, in particular the technical and functional evaluation elements.

I recommend that the introduction of any OSS, whether acquired or developed internally, would necessitate the use of best practice guidelines and that these guidelines be triggered by any request for software that does not necessitate a tender.

6.5.1 Limitations of the Research

The research approach gained a deep insight and rich data from the various experiences of the group chosen, thus the objective of the research was achieved. The transcript approval process allowed for areas of the findings identified as sensitive for some of the groups or group members to be withdrawn.

Relative to the limited number of OSS projects currently active within the HSE, the sample case studies represents a significant sample. The limit number of projects concurs with earlier survey findings by the OSOR.

6.6 Recommendations

- Trigger mechanism for use of guidelines (who/how and where)
- Central repository for the re-use and customisation of projects
- Project management team & developer skill sets database in repository

Chapter 7 - Policies and Recommendations

A review of the established policies that govern HSE ICT projects will help in defining recommendations for future OSS projects. The policies are defined by the Department of Finance, together with the Department of Health and Children and the Health Information and Quality Authority (HIQA).

7.1 Irish Government Policy on OSS

The Department of Finance has responsibility for Government Policy on ICT. In 2005, the then, Minister of Finance announced measures for the implementation of ICT projects in government departments. The aim of these measures was to build on progress made under the reforms in the public service, in relation to public expenditure and value for money.

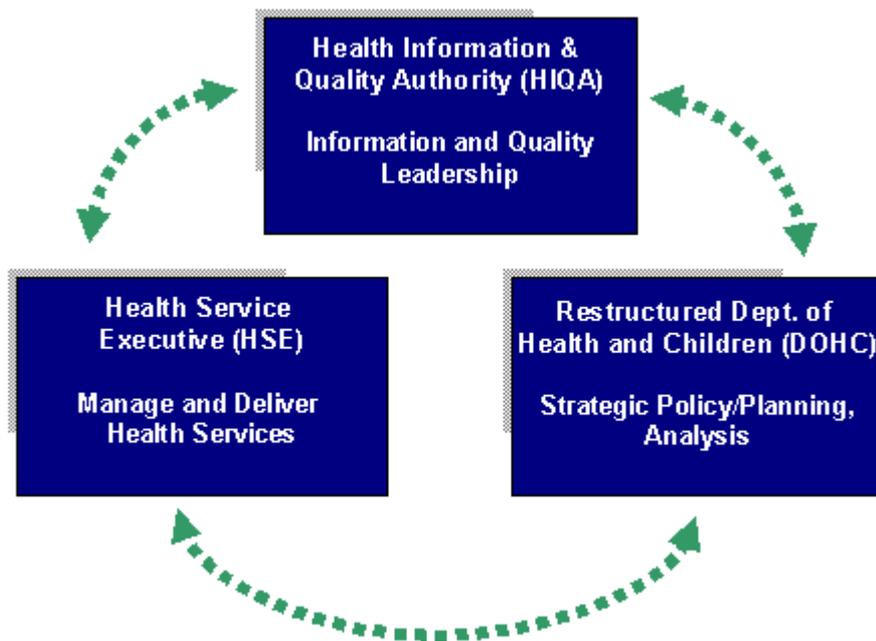
Through these measures, a National Public Procurement Policy Framework was established, to facilitate a more unified approach for public body procurement. To achieve this more unified approach, standardised contracts are being developed to ensure cost effective delivery of all projects (Finance, 2005).

The Department of Finance “Guidance on use of Generic Technical Specifications” is in-line with EU procurement law. Products are neutrally procured and the overall performances is rated using the appropriate available benchmarking methodologies (Appendix 5). Guidelines for “Office Productivity Software and Electronic Document Formats” are also available under the same criteria (Appendix 6).

7.2 Irish Healthcare Policy on OSS

The Department of Health and Children's policy is to "develop a common vision for health ICT between" the Department of Health, the HSE (Health Service Executive) and HIQA (Health Information and Quality Authority) (DoHC, 2008). Each area will have responsibilities that feed into each other as outlined in the diagram.

Diagram 4: Health Organisation Relationships



(Source the Health Service Reform Structure)

A National Steering Group on Health Information Standards was formed to make recommendations to the HIQA on achieving quality healthcare information. This group comprised of members from the following organisations:

- Health Information and Quality Authority (Chair)
- Department of Health and Children
- Health Service Executive
- National Standards Authority of Ireland
- National Cancer Registry

- Economic and Social Research Institute
- Institute for Public Health
- Health Research Board

A number of key recommendations were made by the National Steering Group on Health Information Standards, for example;

The establishment of:

- “ Unique Health Identifier”
- The success of this will be a landmark, and key in removing barriers to the implementation of future national projects.
- “Data Dictionary”
- The purpose of a data dictionary is to standardise definitions and ensure consistency in the collection of data for quality and comparability.
- “A National Standard for Health Information Governance”

A framework for health information governance is regarded as an important aspect for enabling the ethical use of healthcare information. It will gather all the legal requirements, standards and best practice that pertain to the sharing of health information. Providing a single point of reference, that is in line with best practice, for users of healthcare information (HIQA, 2007).

HIQA has responsibility for healthcare information and is addressing the broad needs from all sectors of healthcare, ensuring a quality, seamless IT driven healthcare service for Ireland.

7.3 HSE Policy on OSS

The HSE is required to adhere to the National Government policy for the acquisition and use of ICT components. This is in turn influenced by EU policy.

The appointment of a National Director for ICT, HSE, was taken up in March 2009, by Mr. Gerard Hurl. Mr. Hurl is the first permanent National Director of ICT for the HSE since its inception in 2005.

Mr. Hurl has vast experience in healthcare IT; he is Chairman of HISI (Healthcare Infomatics Society of Ireland), Vice Chairman of ProRec Ireland and Secretary General of EuroRec.

With his experience and knowledge of healthcare IT both nationally and internationally, Mr. Hurl is an asset to the HSE. In an interview, carried out by Leslie Faughnan in The Sunday Business Post on 2nd May 2010, Mr. Hurl recognises the fact that the EU Council is concerned with social and health policies. He has called on the Member States to recognise the importance of e-health and to incorporate it into health policy.

Mr. Hurl states, "That within the HSE there is a current project to develop a framework for data and systems design that will ensure interoperability". He added, "That integration and standardisation are fundamental to achieving this objective from all ICT projects".

The HSE is working with HIQA to ensure that the framework recognises and incorporates international standards and proven best practice which will facilitate interoperability across Member States in-line with the EU Interoperability Framework (Faughnan, 2010).

7.4 Conclusion

As revealed in this study OSS can play an important part in bringing the HSE to a position where interoperability can be achieved at a national level.

Key points to be aware of for Ireland are:

The EC recognises the benefits OSS can bring to eGovernment and e-health, for European Member States and the wider pan European ICT platform.

Several European Member States are already advanced users of OSS in public administrations and health.

There are a number of support agencies sponsored by the European Commission, with a wealth of knowledge and experience available to provide information and assistance with public administration and health projects.

These agencies have provided the EC with guidelines, standards and best practice for using OSS products, all of which are available to Member States.

The adoption of projects from support agencies such as the OSOR can provide Ireland with the training and experience to develop and expand ICT resources in OSS and equip Ireland for future expansion in-line with European policy.

Funding is available for the uptake and use of European approved OSS projects. Projects provided through the OSOR, have been approved by the EUPL (European Union Public Licence).

The European Union has a policy to promote the use of OSS in the public sector and to promote e-Government best practice through the exchange of experiences across the Union. Ireland as part of the European Union may have to adopt this type of policy as part of its procurement process for public bodies in the future. Ireland could benefit, through the exchange of experience and information with its nearest neighbour the United Kingdom, where the government, for example, has agreed to:

- Consider open source solutions alongside proprietary ones in IT procurements where contracts will be awarded on a value for money basis.
- Only use products for interoperability that support open standards and specifications in all future IT developments.
- Seek to avoid lock-in to proprietary IT products and services.
- Investigate further possibilities of using OSS as the default development route for government funded R&D software (e-Envoy, 2003). This is a direct example of an EU country taking direction from EU policy.

7.5 Recommendations

In conclusion, to the findings in this study, I recommend the HSE to consider using the three policies provide by the EU, in addition to existing policies.

- Guideline on public procurement of OSS
- Guideline for public administrations on partnering with free software developers
- European Union Public Licence V1.1, Guidelines for Users and Developers

Furthermore, put in place a structure to accommodate a central repository for existing OSS projects. These projects have been developed to a standard required for the HSE and are therefore suitable for reuse within the organisation.

This structure should also contain a list of team members associated with each project that can be contacted to provide internal support for new teams reusing these projects.

Finally, a mechanism should be put in place to vet and approve all new OSS projects to ensure they adhere to the best practice and standard put in place for internal OSS development projects.

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Appendix 1- Organisations Liaised with EuroRec

EuroRec has a liaison with a number of organisations for the development and sharing of experiences in implementation of EHR's and other healthcare systems. Many of these organisations have vast experience in the successful use of Open Source software in healthcare. These organisations are: -

- **openEHR** (Electronic Health Record)
- **HIMSS** (Healthcare Information and Management Systems Society)
- **IHE** (Health Information Exchange)
- **Open Health Tools**
- **AHIMA** (American Health Information Management Association)
- **AMIA** (American Medical Informatics Association)
- **CEN TC 251** (Health Informatics)
- **CCHIT** (Certification Commission for Health Information Technology)
- **DG INFSO** (Directorate-General for Information Society and Media) (European Commission)
- **EFMI** (European Federation of Medical Informatics)
- **HL7** (Health Level Seven)
- **IHTSDO** (International Health Terminology Standards Development Organisation)
- **IMIA** (International Medical Informatics Association)
- **ISO TC 215** (Health informatics)
- **WHO** (World Health Organization)

Appendix 2 - Software Release Checklist

Service	
Name of Service Affected	
Brief Description of Change	
Business Owner	
Number of Users	
User Locations	
Software Version	
Target Live Date	
Build	Yes / No / NA
Build Instructions Documented	
Back-out Plan prepared and documented	
Release Mechanism Prepared and documented	
Testing	
System / Technical testing completed	
System / Technical testing accepted by technical support groups	
UAT testing completed	
UAT testing signed off by Business	
Back-out Plan tested successfully	
Release Mechanism tested successfully	
Test results documented and handed over to Change Manager	
Workarounds for issues found during testing documented and handed over to Change Manager or relevant support groups	
Training	
User Training completed	
Technical Training completed	
Training Documentation produced	
Communications	
Service Desk notified of release date	
Technical support groups notified of release date	
Users/Business notified of release date	
Users / Business aware of impact of the release	

Appendix 3 - Change Request Form

Requestor Details							
HSE Business Contact					Phone:		
HSE ICT Contact							
Company/Vendor							
Vendor Contact Name					Date Raised:		
Vendor Email							
Vendor Phone No.							
Products/Service Affected:							
Change							
Description of Change							
Urgency Level	Emergency		High		Normal		Please select the appropriate level.
Reason for change:							
Testing Approach :							
How will change be implemented :							
Proposed Implementation Date and Time :							
Length of time required to implement change:							
Length of downtime required :							
Description of Back out Plan :							

Appendix 4 - Major Change Impact Assessment

IT Impact Assessment	
Will this change result in the provision of a new service by ICT (e.g. hosting and/or supporting of new application)	
Will this change have significant capacity implications which will need to be addressed? If yes give details	
Will this change have implications for Disaster Recovery/ Business Continuity requirements which will need to be addressed? If yes give details	
Will this change have implications for existing security baselines which will need to be addressed? If yes give details	
Will this change affect an existing core business system/s or the infrastructure supporting a core business system/s? If yes, list core systems affected?	
Will this change affect more than 50 users?	
Will this change require Post Implementation Support from Technical staff (non project)?	
Will this change require testing by technical staff (non project)?	
Will IT Dept be covering financial costs of this change?	
Will IT staff require training as a result of this change?	
Business Impact Assessment	
Will the introduction of this change require a service interruption	
Will the Business be required to carry out tasks in preparation for this change?	
Will change result in the introduction of new business processes or change existing business processes?	
Will this change have implications for Business Continuity requirements which will need to be addressed?	
Will this change require user testing?	
Will users require training as a result of this change?	
Will Business be covering financial costs of this change?	

Appendix 5 - Guidance on use of Generic Technical Specifications

1. Introduction

Public procurement Directives require that in the award of public contracts, contracting authorities must avoid the use of restrictive technical specifications. The Directives provide that, unless justified by the subject - matter of the contract, technical specifications must not refer to a specific brand, source, trademark, patent or particular process, which would have the effect of favouring or eliminating certain undertakings or certain products. The use of such references is permitted, on an exceptional basis, where a sufficiently precise and intelligible description of the subject - matter of the contract is not possible. In such cases, a provision must be made for acceptance of “equivalents”.

2. Practice in the ICT Sector

In the Information and Communications Technology (ICT) sector, it has been common practice to describe technical specifications using certain brand names e.g. “Pentium 4 or equivalent” or “Intel or equivalent” when describing microprocessors. Up to recently this was regarded as acceptable and permissible within the limits set out in the EU procurement rules. However, it is being brought to attention that in the current market, reference to such brand names is not necessary in specifying requirements and is, therefore, in breach of EU law. Similarly, specifications for microprocessors with a clock rate above a certain speed, which indirectly favour one manufacturer’s product, are also deemed discriminatory.

3. Developments at EU Level

The EU Commission has been examining this issue in the light of specifications being used for ICT contracts being advertised by contracting authorities throughout Member States. On the basis of the examination, it is concluded that Member States need to take appropriate measures to ensure that contracting authorities are not being discriminatory by using of technical specifications along the lines set out at 2 above.

The purpose of this note is to bring this issue to the attention of all contracting authorities in the State and provide guidance and clarification on how breaches of procurement law can be avoided.

4. Avoiding use of Brand or Trade Names

The following guidance on avoidance of reference to manufacturer or brand names and generically describing requirements is provided for contracting authorities when specifying requirements in tender documents and publishing notices for supply of ICT equipment.

4.1. Personal Computers

Specifications should indicate that each PC must be capable of competent performance in either a Windows XP Professional or an open source environment or equivalent. In that regard a statement must be provided confirming that the proposed PC meets or exceeds an overall performance rating using the BAPCo SYSmark 2004 benchmark. In this regard, a current minimum of “168” has been suggested. This minimum will be kept under review by the ICT Managers Forum. The testing that determines the performance rating must be carried out by an independent party using BAPCo prescribed instructions.

The configuration of the PCs used for testing must be the same as those that will fill the order. It should be noted that specifying benchmark performance in this way precludes the specification of bus speeds, cache sizes, etc.

4.2 Servers

For general purpose servers, it may be appropriate to use the BAPCo SYSmark 2004 suite as described above (albeit with a different minimum rating). However, this benchmark may not be suitable for specific server purposes. In such cases, the type of benchmark used should be both easily available and appropriate to the intended use of the server platform (e.g., database management, transaction processing, web-serving, etc.).

4.3 Other Technologies

In keeping with procurement requirements, every effort should be made to avoid specifying actual technologies when preparing tender documents. Consequently, tender documents should detail the specific qualities and requirements sought, and any appropriate available benchmarking methodologies that will be applied when comparing offerings, rather than names or types of technologies.

NPPPU / CMOD

May 2005

Appendix 6 - Guideline Office Productivity Software and Electronic Document Formats

Department of Finance Guideline Office Productivity Software and Electronic Document Formats

Introduction

This information note briefly describes the main XML-based document formats for office productivity products and some of the related issues. Other non-XML formats are referenced for information. It is being issued now because of the recent and on-going debate on the emergence of competing XML-based standards for document formats. Updates to this note may be provided as developments emerge in this area.

Two competing standards for document formats have emerged over the last two to three years: Office Open XML, developed by Microsoft, and Open Document Format, developed by OASIS (based on a format by StarDivision/Sun). In theory, an XML-based document can be opened by any application implementing the same formatting standard as the one used to create it. In practice, the ability to do this depends on how closely the document conforms to open standard document formats and how well those standards have been described and maintained. In addition, with appropriate tools, specific information from an XML document can be extracted to be used for another purpose; the application used to create the original document is not required. Another XML-based format has been developed in China: Uniform Office Format (UOF). This is not discussed below but references to further information are provided.

The availability of multiple office productivity applications has the potential to create a more competitive market for these products than currently exists. The main office productivity products up to now have been based on unpublished proprietary standards, making access to document contents difficult without the availability of the application used to create the document. A proprietary standard can be changed over time by the standard owner. This has implications for document accessibility over lengthy time-frames as the format of documents created by earlier versions of an application may not be supported by later versions of that application.

Office Open XML

Description

Office Open XML (OOXML) is an XML-based document format standard developed by Microsoft and is the default format for Office 2007 products (Word, Excel, and PowerPoint). The document formats for Microsoft's earlier Office products, over almost twenty years, were proprietary binary formats, elements of which could be (and were) changed by Microsoft between releases of Office products. Detailed documentation for the binary formats of Office products remained unpublished until February 2008. Microsoft sought to have OOXML recognised as an international standard and submitted it to Ecma International. It was approved as an Ecma standard (*ECMA-376*) in late 2006. It was also submitted, by Ecma, to the ISO for standardisation using the ISO fast-track process. In March 2008, following a number of ballots and the publication of clarifications and amendments, OOXML was approved as ISO/IEC draft standard (*DIS 29500*). In November 2008 it was published as ISO standard: [*ISO/IEC 29500:2008, Information technology Document description and processing languages - Office Open XML file formats*](#).

Application support

While the original OOXML standard proposed by Microsoft is supported by Microsoft Office 2007, the version of the standard published by ISO/IEC (i.e. *29500:2008*) is not supported currently by Office 2007 as it contains many changes from the original version. Microsoft has said it will provide updates to its products so that they support the ISO/IEC standard. It is likely to be the next version of Microsoft Office (code named "Office 14") before this happens.

In the meantime, an OOXML (Office 2007 version) compatibility pack for some earlier versions of Microsoft Office is available from Microsoft. Microsoft has also announced its intention to release an "OpenXML Document Viewer" as a command-line utility and browser plug-in to facilitate users without Office 2007 to view OOXML documents – a beta version has been released. Additionally, a number of third party products/platforms support the original OOXML format.

See <http://www.openxmlcommunity.org/applications.aspx> for more details.

OpenDocument Format *Description*

The Open Document Format for Office Applications [OpenDocument Format (ODF)] is an XML-based document format standard submitted by OASIS to the ISO for approval as an international standard. The format is based on specifications developed originally for Sun Microsystems's StarOffice products (acquired from StarDivision) and the open source office suite based on it, OpenOffice.org (suite includes Writer, Calc, and Impress). ODF v1.0 was approved in 2006 as ISO standard [ISO/IEC 26300:2006 Information technology – OpenDocument Format for Office Applications \(OpenDocument\) v1.0](#). OASIS has since published ODF v1.1 and work is continuing on the next version, ODF v1.2, which are expected to be submitted to the ISO for approval during 2009.

Application support

Applications that support the ODF file format include the OpenOffice.org office suite, Sun StarOffice, OpenOffice.org Novell Edition, KOffice, IBM Lotus Symphony and Google Docs & Spreadsheets. A number of third-party converters/translators are also available. Converters/translators work with varying degrees of success. More details can be found at <http://opendocument.xml.org/products>.

Other Formats

Many other (non-XML) document formats exist. From a standards perspective, it is worth noting that Adobe's Portable Document Format (PDF) version 1.7 (Acrobat 8) was approved as an ISO standard in July 2008 ([ISO 32000-1:2008 Document management – Portable document format – Part 1: PDF 1.7](#)). Also, in 2005, the ISO approved PDF/A, a subset of the PDF based on version 1.4, as a standard for long term archiving/preservation of documents ([ISO 19005-1:2005 Document management – Electronic document file format for long-term preservation -- Part 1: Use of PDF 1.4 \(PDF/A-1\)](#)).

Online Office Productivity Suits

Recent developments in office productivity tools include an increase in the availability of online versions of existing products e.g. [Microsoft Office Live](#), and [ThinkFree Office](#), or online only products e.g. [Adobe Buzzword](#), [Google Docs](#), [Central Desktop](#), and [Zoho](#).

Considerations for using online applications include sensitivity of documents created using or stored on online systems, data protection issues, and physical location of stored documents especially if stored outside the state or by organisations governed by data access/retention laws of another state. Once server-based versions begin to emerge, these may become an option for use within an organisation.

Compatibility

Both OOXML and ODF are similar in structure but currently are incompatible in a number of features. This can be because a particular feature isn't well specified in the standards; is available in each standard but implemented differently; or, is not in a standard. For example, in the word processing applications, page layout changes (e.g. switching from portrait to landscape) in ODF are implemented via page styles, while in OOXML sections and section breaks are used. In ODF, the last line of a paragraph can be justified, while this feature is not in OOXML. A number of converters/translators are available which try to work around these incompatibilities with varying degrees of success. Microsoft and others, including Novell and Xandros, support an open source OOXML-ODF project on SourceForge, which has developed translator add-ins for Microsoft Office products. In addition, application implementations within each standard may not offer 100% compatibility.

The quality of the results from converters/translators depends on issues such as layout fidelity versus re-visibility one-way versus round-trip conversion; and, as the standards are open to interpretation, dependency on the application used to create/amend the particular document.

In May 2008, Microsoft announced that it would now support ODF within its own office suite starting with service pack 2 of Office 2007, which is due for release in 2009. In December 2008, it confirmed that the version supported would be ODF v1.1.

Considerations

What does all this mean? If you are reviewing your office productivity tools and deciding on whether to stick with or replace what you have then the following needs to be considered.

The market is in some flux currently with the development of two main competing standards for document formats and the availability of office suites that actually meet those standards. Emerging developments in online suites, either hosted externally or running on internal servers, also need to be considered.

Conclusions

Consequently, the Department of Finance considers it prudent to await greater clarity and stability in these areas and advises that Civil and Public Service bodies should hold fast at this time.

Bodies may not “upgrade” to a later version of current office suites. Any proposals to replace a current office suite require specific Department of Finance approval setting out a detailed rationale and organisation-specific benefits together with a reasonable estimation of associated costs. If such a proposal is approved, a procurement exercise must be undertaken based on functional requirements for an office suite, i.e. not a specific technology/product.

The ISO standards must be referenced. Subsequent evaluation should be conducted on as close to a total cost of ownership (TCO) model as possible and at a minimum include the following costs: licensing; arising hardware upgrades/renewals/replacements; IT and user training; support and maintenance; planning, testing and migration; external expertise; and exit costs. Exit costs measure the cost of being able to change a chosen vendor or system in the future. Any proposed award arising from such a procurement exercise must also be approved by the Department of Finance.

Version 1.1 December 2008