AFRICAN VIRTUAL OPEN INITIATIVES AND RESOURCES (AVOIR)

Component1. An African virtual "centre of excellence" in open source software engineering
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Abstract

Project AVOIR
This project is about harnessing the enormous potential that exists within Africa and the African diaspora to create a core of open source software developers who are able, through software development activities, to create educational and business opportunities that contribute to development on the continent. Although world class software will be produced within this project, this is not a software development project. Rather it is a project about human development, about capacity building, and about creating opportunities for people through the formation of trans-national alliances both within Africa and out.

The basic idea is a simple one. We intend to take an existing open source application that we developed at the University of Western Cape (UWC), a sophisticated learning management system called KEWL (Knowledge Environment for Web-based Learning), and use it as the basis for building a next-generation learning management system. To achieve the next generation system, it will be necessary to modularize the existing system and convert it entirely to PHP, an open source programming language. This will give us the basis from which to build the most advanced learning management system in the world, using largely talent that exists within African higher education, other organizations, the Diaspora, businesses, and partners around the world.

Using this tool, we will build a core of developers in African institutions, mainly universities but also other organizational structures. This core will do the conversion of KEWL to PHP, and initiate the development of new cutting edge tools based on sound educational practices. It will be a bringing together of cutting edge educational research with cutting edge computer science to produce the world's most advanced learning management system. Once the first working code is released; other institutions and individual volunteers will be encouraged to volunteer or contribute to the project in true open source community fashion. In this way, the code will grow rapidly in relation to the original core funded group.

Best practices from commercial software engineering will be made available, and developers in Africa will have opportunities to be exposed to the latest software development techniques. Students in higher education, including those participating in short term training programmes, will be exposed to industry standard practices, as well as to learn from the source code created in this project. This will allow the talent pool in Africa to grow, and contribute to development in Africa.

At the same time, the core team will be able to offer a service to government, education and business around the development and use of open source software, as well as provide a service to elearning and other open source platforms. The KEWL component of the AVOIR project is expected to be funded for three years, following which it is expected to have gained enough momentum and support to be self-sustaining.

Keywords: *Open Source; Collaborative Project; Software Development*

1. Introduction

"There is a risk that the continent's poverty could be compounded by a lack of access to the online revolution" — Thambo Mbeki, President of South Africa.

This project is about harnessing the enormous potential that exists within Africa and the African Diaspora, to create educational and business opportunities that contribute to development on the continent by using the open source philosophy. This is a project about human development, about capacity building, and about creating opportunities for people through the formation of trans-national alliances both within Africa and out.

Although world-class software will be produced within this project, this is not a software development project. Software and web-enabled services, is merely the collaborative tool to be used for creation of jobs, skill development thus preventing the African brain drain and helping Africa on her way to independence. In Africa, computer literacy has become synonymous with knowledge of proprietary software. We aim to promote the paradigm shift, which has already taken root on other continents.

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2. Purpose of an African Virtual Open Initiatives and Resources

2.1 Background

The status of Information and Communication Technologies (ICT) in Africa shows that although the use of ICT is increasing, the gap between Africa and the developed world may be widening. One reason for this is the vicious cyclic relationship between a shortage of ICT skills and a critical shortage of opportunities for skilled graduates in ICT disciplines. Statistics coming out of a number of organizations concerned with the African diaspora indicate that, with the exception of a few countries, there are probably more African ICT professionals living outside of Africa than live in African countries. For example, there are currently approximately 70 000 Nigerian IT professionals living in the USA, more IT professionals than are currently living in Nigeria itself.

Higher Education Institutions (HEIs) in Africa which should be in the forefront of ensuring Africa's participation in the ICT revolution, but they are severely under-resourced in comparison to their counterparts in the developed world (Gauci 2001, Nwuke 2001). Furthermore, the information infrastructure of African Higher Education is poorly developed and unevenly distributed. Despite these difficulties, a number of Higher Education Institutions in Africa have made significant progress in building an ICT infrastructure, and developing computer science and other ICT disciplines. One area with potential for African higher education is the development, maintenance and support of open source software.

2.2 What is open source?

The concept of open source is a software engineering concept in which the source code for a software programme is kept open, and the software is freely distributable, distributed along with its source code and in which anyone is free to modify and improve the source code and change the program, as long as the resulting program is also freely distributable and modifiable (Drummond, 2000). However, more than a software engineering concept, like 'open content', 'open source' is a philosophy as well as a way of engaging in large scale collaborations (Sandred, 2001; Williams, 2002). As a philosophy and a means of collaboration, open source principles can be applied as much to content as to software (Keats and Shuttleworth, 2003).

Open source software development methods are well developed, and reasonably well-studied processes (e.g. Crowston and Scozzi, 2002; Sandred, 2001; Stalder and Hirsch, 2002). One of the biggest successes of the Open Source movement has been the operating system known as Linux. Linus Torvalds began Linux 1991 when, as a student at the University of Helsinki in Finland, he started experimenting with ways to improve MINIX, a Unix-like operating system for PCs developed by the Dutch computer scientist Andrew Tanenbaum (Anon, 2000). Initially he just wanted to make a terminal emulator for connecting to the University mainframe.

Linux quickly became the largest collaborative project in the history of the World, and has now developed into one of the most popular server operating systems in the world, and it is making great inroads into desktop systems as well. There is little doubt that as a server, Linux is at least equal to any of the available commercially-developed products, and substantially better than many. Why is such a freely distributable operating system more stable than a commercial product?
Part of the explanation for the stability of Linux likes in the absolute right to decide what code goes into the kernel. In this way, the person who knows the code best is able to exercise quality control. A new version of the kernel is only released once Torvalds is happy that it is stable and contains fully functioning features. Torvalds thus acts as a gatekeeper, ensuring that only a stable kernel gets through to public release.

Most other Open Source projects also use this concept. There is either an individual or a team who act as gatekeepers to ensure that the project only releases stable code. Unstable code is still

available to programmers and anyone who likes to live dangerously, but only stable code is released to the public.

Another feature of Open Source software development is the small army of developers spread around the world, often speaking different languages, who contribute to the code. At first this may seem like a liability, but it means that development can be rapid, and bugs quickly fixed, sometimes within hours of being found. With the quality control imposed by the gatekeeper, this army of dedicated developers works rapidly to produce effective and stable software. Open Source software doesn't just have to be for the Linux operating system, although it is easier to create a sense of community around Open Source for Linux because the ethos is better developed there. However, one can also apply Open Source principles and tools to proprietary operating systems such as Microsoft Windows and others. At the University of the Western Cape we have created an open source learning management system that runs on Windows, and an open source community is beginning to develop around it. Many open source applications these days strive to be cross platform, working on Windows, Linux, BSD and other UNIX versions, and MacIntosh.

> For Africa to create an Information Society to support all Africans, we have to build on our own strength. It is crucial that Africa develops its own answer to the problems it faces, rather than simply importing ideas from other countries. Appropriate use of ICT comes through local adaptive learning to find uses for the technology that meets real local needs. There is a great deal of expertise already in Africa, though often not recognised or known by others in the continent. Sharing of experience and skills is an important component of building capacity to shape the Information Society in a truly African image.
>
> –http://www.ariseafrica.org/english/index_eng.html

There is expertise in software development and other disciplines in African Higher education institutions scattered among diverse institutions rather than concentrated at single centres as they are for example in the USA and Europe. Through alliance building and creative use of technology, it is possible to create virtual concentrations of experts who are engaged in computer science, information systems as well as any academic discipline. Here we propose the building of an alliance among higher education institutions for the establishment of a virtual centre of excellence in the development of Open Source solutions to the problems in Africa as well as Open Source business models. The proposed virtual team will engage in Open Source software development with the focus on the education sector, act as a locus of advice for education, business, government, and others embarking on Open Source processes and conduct research into best practices in Open Source development and deployment in these sectors.

2.3 Building Alliances

In the developed world of North America and Europe, such an alliance would be easy to build as there are many higher education and research institutions with a complementary and balanced profile of skills and expertise in all aspects of ICT. Therefore, to undertake almost any kind of research, teaching-and-learning, or software development in ICT fields one does not have to look at a scale much beyond that of the individual institution, even when the undertaking is of a strongly multidisciplinary nature. This is in contrast with the distribution of skills and expertise within higher education in Africa. With a relatively small number of exceptions, higher education has been so neglected in many countries that there are critical shortages of skills and expertise within individual institutions (Gauci 2001, Nwuke 2001). Therefore, when conceptualizing new programmes, one is often faced with the need to bring in skills and expertise from outside Africa.

Aid agencies and international collaborations often focus on forming relationships with individual countries, and some donors with individual institutions. While there are some notable exceptions, where one-to-many and many-to-many relationships have been established, they have typically involved one developing country institution in partnership with many developed institutions.

The widespread development of the Internet can change this pattern, allowing developing countries in Africa and elsewhere to form virtual partnerships and to use these partnerships to create innovative

and synergistic programmes of action that would not be possible otherwise. Internet connectivity within Africa, and the existence of a core group of more technologically advanced institutions, allows strong virtual programmes to be based in African higher education institutions. Unlike programmes brought in from outside, such collaborative virtual programmes can only strengthen the participating institutions, help build institutional confidence and contribute to the development of higher education in Africa.

Here we propose forming a core alliance of such institutions, and using this core to develop and grow a significant capacity in open source software development.

2.4 Target population and how they will benefit

The target population includes public higher education institutions and software developers in Africa, working in collaboration with one another and with software developers in other parts of the world. Side benefits of the tools being developed will also accrue to other educational institutions, including schools, private education and training organizations, and businesses. We have been approached by representatives of the medical and pharmaceutical sector of government and are underway to produce open source software for the distribution of AIDS medicine in the townships. The main benefits are rather more intangible than the specific benefits associated with the development and enhancement of a particular software tool. If we can make the analogy between AVOIR and an engine, the particular tool is only the means with which to start the engine.

Desired outcomes include:

- *Higher education institutions in Africa drive the production of new and innovative software for use in the higher education sector, as well as in other educational sectors, businessand government;*
- *Improved open source advice available to education, business and government;*
- *Improved accessibility and enhanced local support for open source software in education, business and government*
- *Increase in the number of graduates trained in the application of open source principles;*
- *Enhanced relationships between higher education and business built around the development and support of open source software;*
- *Enhanced employment opportunities for graduates of higher education institutions.*

Aside from these medium-term outcomes, a long-term outcome will be a contribution towards sustainable growth and development within Africa