

# Open source approaches to health information systems in Kenya

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## Abstract

This paper focuses on the experience to date of an installation of a Free Open Source Software (FOSS) product, Care2X<sup>1</sup>, at a church hospital in Kenya. The FOSS movement has been maturing rapidly<sup>2</sup>. In developed countries, its benefits relative to proprietary software have been extensively discussed<sup>3</sup> and ways of quantifying the total costs of the development have been developed<sup>4</sup>. Nevertheless, empirical data on the impact of FOSS, particularly in the developing world, concerning its use and development is still quite limited<sup>5</sup>, although the possibilities of FOSS are becoming increasingly attractive.<sup>6,7</sup>

The FOSS For Africa (FOSSFA)<sup>8,9</sup> initiative has collated useful material. The FOSSFA site<sup>10</sup> includes an installation of Care2X for review, and the Regenstrief Institute in the United States of America has begun work on a up-to-date FOSS system at Eldoret in northern Kenya. But these are early days in the development of FOSS for Health in Africa. However, given that the cost constraints under which health and ICT have to work, there are likely to be many health facilities and organisations wondering if they should go FOSS, and perhaps Governments too will be considering whether they should switch to using OSS<sup>11</sup> – the United Kingdom, for example has adopted a policy to consider open-source solutions alongside proprietary ones in IT procurement.<sup>12</sup>

### The AIC Kijabe Hospital

Kijabe is run by the African Inland Church; it is a 208 bedded hospital, seeing 6,000 inpatients and 89,000 outpatients per year, with a budget of \$2.3m. There is a Local Area Network with 70 terminals connected, and 10 separate Access databases, written by hospital staff, to collect patient data and monitor the usage of supplies. A proprietary financial accounting system, AccPac, has been implemented. The hospital is also connected to the Internet through a high-speed microwave link. In 2004, the Hospital was considering upgrading and integrating its information systems. Its choice was between proprietary and Free Open Source Software. It opted for the latter.

This paper reports on progress eight months after the decision to proceed with the FOSS option was made. In early July 2005, using a set of open questions based on desiderata for choosing OSS<sup>13</sup>, the Medical Director and the IT Manager were interviewed. They were the two key decision-makers at Kijabe in choosing Care2X.

### Organizational needs

Kijabe had an immediate problem in that its Access database that was used for patient registration (and with very minimal clinical information – just ICD10 for outcomes) was slowing down. The servers and screens were unable to cope with the load put on them by both the software upgrades installed and the number of patient records that were stored in the database. The hospital also required an information system to deal (separately) with the increasing numbers of HIV/AIDS patients that were being seen – particularly after the advent of the AIDSRelief/ Project Accord Programme that scaled up use of anti-retroviral medications for patients in a community-based programme.

The use of the separate Access databases to support billing in laboratories, pharmacy, stores and supplies generated no immediate requirement to replace them from the end users, who did not object to re-entering registration data that had been already entered. But for middle and senior management this was perceived as an area where the systematic introduction of systems integration could significantly improve productivity. The first stage is

perceived as the need to link outpatient order entry (e.g. to pharmacy, labs or X-Ray) and receipting information<sup>14</sup>. Electronic results reporting back to the clinician is seen as a requirement for later, as is the introduction of this integrated approach to inpatient services.

Strategically, the hospital wished to have more integration of information from all hospital departments in ways that would support operational efficiencies and improved billing and then move towards capturing more extensive clinical data to support the longitudinal, outcomes-based clinical research agenda becoming necessary to support post-graduate Master of Medicine programmes in at least family medicine and surgery. This would potentially entail development of a full Electronic Patient Record.

The features looked for in a proposed solution included:

- ability to support incremental development;
- capability for longitudinal retrospective analysis;
- completeness of the patient record;
- support for clinical decision-making and better patient care;
- availability 24/7/365;
- ability to manage “permissions”.

### Choosing Care2X

Given the fact that Kijabe already had existing IT systems in place but was guided by the long term strategic vision of an integrated hospital EPR-based information system, the first approach was to look at the option of taking a proprietary system that was operational in Africa. A major supplier of systems in the United Kingdom and the United States of America, but also in South Africa, was approached. The prices quoted were in the range of \$5-700,000. With an annual budget of about \$2.3m, even when just the capital costs were spread over four years, this option was simply unaffordable. The next alternative was to develop a home-grown solution using a MySQL type database. But the skills to do this for a whole hospital implementation were also not easily available.

However, at a Futures Group<sup>13</sup> coordination meeting that was concerned with finding ICT solutions that would meet the PEPFAR HIV/AIDS reporting requirements, Care2X was mentioned as a comprehensive solution for hospital information systems in a group of Tanzanian Hospitals. Use in HIV care for PEPFAR purposes was not an immediate goal but a welcome one.

Contact was made with the Selian Lutheran Hospital, Arusha. This is also a church-affiliated hospital, and, like Kijabe, has to be very cost conscious to be able to remain operational. Similar to Kijabe, Selian Hospital at Arusha had, over 10 years, developed an in-house system that had outgrown its ability to scale or expand. The 20 other church hospitals in the Lutheran system intend to roll out the Arusha solution by 2007 and to provide support via VSAT links – as mobile phone networks are too slow for text or email in Tanzania.

### Fact finding missions

Two fact-finding visits were made to the Selian Lutheran

Hospital, Arusha, in October and December 2004. It became clear that Dr Mauri Niemi, the IT director at the Selian and for the Lutheran hospital system, had spent two years reviewing the options available in the east African market. He kindly shared his findings, which concluded that Care2X was his preferred solution<sup>17</sup>. He endorsed the basic objective of the Care2X collaboration as being “designed to integrate the different information systems existing in these organizations into one single efficient system”<sup>18</sup>. His report noted that “In addition, the development community of over 100 programmers are giving some free support for testing and debugging and we can benefit from the developments in other countries. This programme is already translated in more than 15 languages. It is implemented in three Malaysian hospitals and it is under development in India, Mexico and also commercial versions are coming in Germany, Italy and Poland. The Brazilian government, a strong supporter of Open Source Systems, has granted money to develop the programme. In Africa, there are hospitals in South Africa, Kenya, Egypt and the Sudan interested or working on it.”<sup>19</sup> The fact that the Selian Lutheran had secured \$150,000 to develop the system to support implementation across their 20 other sites meant that there were likely to be some significant contributions from them into the Open Source domain. Given the time constraints that Kijabe were under, this extensive review was seen as obviating the need for Kijabe to go over similar ground.

### Initial implementation of Care2X

The immediate requirement for implementation – Patient Registration and bedstate - was operational in Care2X in Kijabe by the end of January 2005. This rapid implementation was only possible because in November 2004 contact was made with three programmers from California who were prepared to donate a month of their time to support the hospital in getting Care2X up and running, at least in the Medical Records Department. Arriving in January, they had reviewed Care2X in week one, prepared a prototype in week two, implemented it in week three, debugged and trained 10 staff (on site in the Medical Records Department) in week Four.

The software has proved adaptable. For example, new fields for “Chief and subChief” needed to be added – and this was unproblematic. It has also proved to be stable, with the Linux Operating System going down once, but self-correcting itself. Some bugs were discovered but were fixed before the programmers departed. However, two reports needed to be corrected and that process has taken five months. This is because of time pressures on the programmers once they had returned to their jobs in the United States.

The initial users – the 12 medical records staff – have liked the system as it does what they want more quickly and reliably than the old Access database. Being used to a computer, their training on the new system was not time consuming. They liked the screen design and the speed of

response. The initial problems over searching have now been fixed.

However, time constraints prevented the completion of the HIV/AIDS module, and the urgent need for this has led to another package, Careware – as provided by the Futures Group – being installed.

At this stage, then, the initial implementation of Care2X has gone well. The costs to the hospital have been low since the time and travel costs of the programmers were donated, and they also brought and donated the servers on which the system runs. The terminals were already installed and maintained by the Assistant IT Manager. The software (Care2X and Linux) as FOSS does not require licence fees, nor does it require the costly software upgrades that the Access-based system needed – merely the ability to use Internet Explorer. Kijabe will put its current development into the Care2X public domain.

### Future developments

The development (and maintenance) of the Care2X system at Kijabe is predicated on being able to find and afford a programmer with web-based programming skills and who is able to use Linux and php scripting. Though remote support and development is possible in theory (and the hospital has not yet become an active player in the online Care2X FOSSFA community), in practice the programmer needs to be on site. The difficulty is that there very few Kenyans with these skills and their salary is above what the hospital can afford (\$650–900 per month). And the costs of expatriate programmers would be much higher – unless they come as full-time missionaries or as short-term volunteers (when the risks of incompatibility from different programmers developing a series of modules multiply). Nevertheless, once working, the programmer would then begin the process of integrating the hospitals' discrete information systems. There will be no interface with the existing systems, just an agreed cut-over date when each old Access database function is converted to running on the new Care2X system. Some key enhancements of Care2x will be needed before it can be rolled out on to the wards, in particular the ability to grant appropriate permissions so that ward staff cannot see data that is not pertinent to their work.

The training of staff is vital and may need to be extensive. When the system is extended to the wards, initial functions will be delegated to six unit clerks but later about 50 people will need to be trained. There will probably be a combination of formal training workshops, followed by peer learning and instruction sheets. A training database will be needed. Nevertheless, training for use of Care2X is much cheaper than a proprietary option. And the hospital is already addressing the introduction of IT training to the wards, e.g. by enabling those in charge on each ward to have an email box, in part as a way of improving computer literacy. When the ward staff are all trained, it will then become feasible to introduce results reporting.

One important strategic development will be the

relocation of much of the outpatient and HIV/AIDS clinic functions to a new location about 10 km (line of sight) away, when wireless communications to support the continued running of the Care2X module will be needed. Taken together, the integration of the existing OP, IP and departmental systems will deliver significant productivity gains (e.g. better management information about workload patterns will enable the redeployment of staff so that quality and quantity of output improves) and improve the quality of services delivered to patients.

However, there are shortcomings in Care2X which will prevent it becoming the long-term strategic solution. The US-based programmer's view was that the kernel of the product was poor and that some of the programming in the Selian version that they used as their starting point was "quirky" (reflecting perhaps the contributions of different programmers since its origination by an Indonesian nurse, Elpidio Latorilla<sup>20</sup> in 2000). Also it does not have a data dictionary or structure for clinical details that would allow longitudinal clinically-oriented research. Whilst a suitable product for the mid-term, and well able to get the hospital working more efficiently, the Care2X product may need to be replaced by another in about five years in order to incorporate these clinical research-related features. What is important to note about the experience to date is that, at this stage, the only affordable and appropriate evolutionary and locally sustainable solution for the longer term is going to have to be a better quality FOSS offering.

### Conclusions

This is work in progress, but the recommendation by Phillippe Schmidt<sup>21</sup> of UNCTAD, to the effect that in Africa it makes sense to use FOSS to start small to understand your environment, is being followed at Kijabe. The critical issue, now that the basic hardware has been provided (in effect as overseas aid – an approach that can be scaled and replicated elsewhere), is to develop local programming skills. This is a matter for Government and educational institutions. The Kenya Government is currently developing a comprehensive ICT policy and has taken adequate measures to ensure that Open Source Software is considered as a viable choice when procuring software especially for public use<sup>22</sup>. But in Kenya there is not the same depth of expertise in infrastructure or software programming that there is in Brazil, where, as David Wheeler comments<sup>23</sup>, there was a culture that was well suited to rapid uptake of OSS. Since there is no health-related FOSS programming expertise readily available onsite, and the use of FOSS to support the integration of work within such complex organizations as hospitals requires internal consistency (both in terms of software and with respect to local management arrangements which may be difficult to establish via remote programming support), there are clearly some major risks to be managed. Nevertheless, the experience at Kijabe (and the Selian Lutheran) to date suggests that FOSS model is the only affordable option. □

## References

- <sup>1</sup> <http://www.care2x.com/>
- <sup>2</sup> Open Source: Open for Business. The Leading Edge Forum (CSC) 2004. <http://www.csc.com/features/2004/48.shtml>
- <sup>3</sup> Why Open Source Software David A. Wheeler [http://www.dwheeler.com/oss\\_fs\\_why.html](http://www.dwheeler.com/oss_fs_why.html)
- <sup>4</sup> How to Evaluate Open Source Software David A. Wheeler [http://www.dwheeler.com/oss\\_fs\\_eval.html](http://www.dwheeler.com/oss_fs_eval.html)
- <sup>5</sup> <http://flossproject.org/>
- <sup>6</sup> Open Source Software: Perspectives for Development. InfoDev/World Bank Dec 2003 [http://www.infodiv.org/files/837\\_file\\_Open\\_Source\\_Software.pdf](http://www.infodiv.org/files/837_file_Open_Source_Software.pdf).
- <sup>7</sup> Open Source Software and Low Cost Computing. CATIA Nov 2003 [www.catia.ws/Documents/Indexpage/Inceptionreport.pdf](http://www.catia.ws/Documents/Indexpage/Inceptionreport.pdf)
- <sup>8</sup> Free and Open Source Software Foundation for Africa <http://www.fossfa.net/tiki-index.php>
- <sup>9</sup> <http://bridges.org/FOSS/>
- <sup>10</sup> care2x - FOSS hospital management [http://www.fossfa.net/tiki-view\\_forum\\_thread.php?forumId=1&comments\\_parentId=3](http://www.fossfa.net/tiki-view_forum_thread.php?forumId=1&comments_parentId=3) For the evaluation of FOSS solutions for the health care sector, we have installed a FOSS hospital management system on FOSSEFA. The software is called care2x and implements a broad range of hospital information services, from Patient registration and admission to prescription and pharmacy management to an online cafeteria menu list. The idea of this installation is to evaluate if Care2x co could be recommended for use in the African health sector
- <sup>11</sup> FOSS Adoption Around the World [http://www.tbs-sct.gc.ca/lap-paf/oss-ll/foss-ll/foss-ll07\\_e.asp](http://www.tbs-sct.gc.ca/lap-paf/oss-ll/foss-ll/foss-ll07_e.asp)
- <sup>12</sup> Office of the e-envoy. Leading the drive to get the UK online. UK online,. <http://www.e-envoy.gov.uk/Home/Homepage/fs/en>.
- <sup>13</sup> Choosing Open Source: A guide for civil society organizations. Mark Surman and Jason Diceman Jan 06 2004 <http://www.commonsc.ca/articles/fulltext.shtml?x=335>
- <sup>14</sup> Orders received by the departments from outpatients are costed, the patient takes the bill and pays it at the cashier before returning to the department with the receipt that then enables delivery of the service.
- <sup>15</sup> <http://www.futuregroup.com/index.cfm>
- <sup>16</sup> <http://www.state.gov/s/gac/tl/or/c11652.htm>
- <sup>17</sup> Other options that Dr Niemi looked at were rejected because, for example:
  - A MoH Access database was made for District Medical Officers to collect data from health institutions and there were no plans to make it usable at hospital level.
  - The programme in one Oracle-based offering would only cost \$1,000, but given license fees and implementation charges (at \$250 per day) the estimated \$40,000 per site was unaffordable.
  - Another "really nice" programme had software costing \$35,000, but the total quota of implementation for one hospital was over \$100,000, with a charge of \$400 for one day consultation.
  - The same big American company as reviewed by Kijabe sent a quote where "I had to ask where are the dots between zeroes!! The implementation for one hospital was over US\$ 1,000,000 and on top of that we would have paid flight tickets from South Africa and accommodation in a four star hotel".
  - A quote from a Kenyan company, which has a programme under development, had software at \$80,000 and would charge US\$ 200 for one consultation day.
  - There are hundreds of programmes available in Europe, America, South Africa, India and many other countries. The main problem with them is the high price and difficulty to get support.
- <sup>18</sup> See Care2X website <http://www.care2x.com/>
- <sup>19</sup> Personal Communication
- <sup>20</sup> <http://www.care2x.com/ela.php>
- <sup>21</sup> [http://r0.unctad.org/ecommerce/event\\_docs/fossem/schmidt.pdf](http://r0.unctad.org/ecommerce/event_docs/fossem/schmidt.pdf)
- <sup>22</sup> [http://www.fossfa.net/tiki-read\\_article.php?articleId=154#Kenya](http://www.fossfa.net/tiki-read_article.php?articleId=154#Kenya)
- <sup>23</sup> <http://www.dwheeler.com/essays/fisl2005.html> Company employees in Brazil have traditionally swapped code with each other between companies and the government has encouraged agencies to share their code with other agencies. After all, when you're not made of money, it makes sense to reuse code, and it's perfectly legal to give it away if you developed it... especially when there is a cultural expectation that you will get some back later. These informal arrangements turned out to be similar in spirit to OSS/FS, but typically were one-on-one arrangements. With OSS/FS, all they had to do was to attach a small standard licence clause, and suddenly they could work with not just with someone they knew, but with an entire global network of people. This also translates really easily into an export business for Brazil.