



PROCEEDINGS OF THE 14th ANNUAL CONFERENCE ON WORLD WIDE WEB APPLICATIONS

7-9 November 2012
Durban
South Africa

Editors:

A. Koch
P.A. van Brakel

Publisher:

Cape Peninsula University of Technology
PO Box 652
Cape Town
8000

Proceedings published at
<http://www.zaw3.co.za>

ISBN: 978-0-620-55590-6

TO WHOM IT MAY CONCERN

The full papers were refereed by a double-blind reviewing process according to South Africa's Department of Higher Education and Training (DHET) refereeing standards. Before accepting a paper, authors were to include the corrections as stated by the peer-reviewers. Of the 72 full papers received, 64 were accepted for the Proceedings (acceptance rate: 89%).

Papers were reviewed according to the following criteria:

- Relevancy of the paper to Web-based applications
- Explanation of the research problem & investigative questions
- Quality of the literature analysis
- Appropriateness of the research method(s)
- Adequacy of the evidence (findings) presented in the paper
- Technical (e.g. language editing; reference style).

The following reviewers took part in the process of evaluating the full papers of the 14th Annual Conference on World Wide Web Applications:

Prof RA Botha
Department of Business Informatics
Nelson Mandela Metropolitan University
Port Elizabeth

Mr AA Buitendag
Department of Business Informatics
Tshwane University of Technology
Pretoria

Prof AJ Bytheway
Faculty of Informatics and Design
Cape Peninsula University of Technology
Cape Town

Mr A El-Sobky
Consultant
22 Sebwhi El-Masry Street
Nasr City, Cairo

Prof M Herselman
Meraka Institute, CSIR
Pretoria

Mr EL Howe
Institute of Development Management
Swaziland

Dr A Koch
Department of Cooperative Education
Faculty of Business
Cape Peninsula University of Technology
Cape Town

Dr DI Raitt
Editor: The Electronic Library (Emerald)
London

Mr PK Ramdeyal
Department of Information and Communication Technology
Mangosuthu University of Technology
Durban

Prof CW Rensleigh
Department of Information and Knowledge Management
University of Johannesburg
Johannesburg

Prof A Singh
Business School
University of KwaZulu-Natal
Durban

Prof JS van der Walt
Department of Business Informatics
Tshwane University of Technology
Pretoria

Prof D van Greunen
School of ICT
Nelson Mandela Metropolitan University
Port Elizabeth

Further enquiries:

Prof PA van Brakel
Conference Chair: Annual Conference on WWW Applications
Cape Town
+27 21 469 1015 (landline)
+27 82 966 0789 (mobile)

Architecture for eBook provision to South African schools

N. Dlodlo
ndlodlo@csir.co.za

J.P. Tolmay
jtolmay@csir.co.za

Meraka Institute, CSIR
Pretoria
South Africa

Abstract:

At the beginning of each year, the Department of Basic Education (DBE) in South Africa distributes textbooks to both urban and remote rural schools. The distribution machinery has not been that efficient though, resulting in some schools opening without the necessary textbooks. Distribution problems to schools has meant that some schools are using outdated books, especially now that the new curriculum and assessment policy statement (CAPS) curriculum has recently been introduced. There are ongoing discussions on how the DBE can avoid this problem. This article reports on the alternative to paper book provision in South African schools, in the form of provision of eBooks to schools. This means making available digital books that can be downloaded to the various schools to avert problems associated with distribution delays and to ensure that books that are aligned to the current curriculum are available at any point in time. Although eBooks in general have many advantages, it is the infrastructure and financing of such a project that determines the mode of eBook provision at the end of the day. Not overlooking the fact that there is a serious digital divide in South Africa, which pits the well-endowed urban schools against the poor-resourced deep rural schools, a number of recommendations are outlined in this research. The proprietary eBooks and eBook readers as provided by the established international companies are very expensive for the South African environment, and this would result in uneven access to such resources. Therefore South Africa has to come up with its own low-cost appropriate technologies to enable eBook provision to the schools. The DBE should set up its eTextbook store which comprises content by local publishers, is customised to the local environment, has the appropriate digital rights management (DRM) in place and can be easily accessed by these schools. The option is to take advantage of the current infrastructure that has been rolled out by the government in the form of projects such as computers for all schools. The problem is that this sort of infrastructure hasn't been rolled out to all schools yet, with the deep rural schools unlikely to have any such computer networks. Where there are, these school networks can be configured for eTextbook accessibility via desktop computers, laptops and mobile phones for those that cannot afford the expensive eBook readers. eTextbooks can be read on desktop computers, laptop, tablet or smart phone. Mobile access is approaching 100% in South Africa, although there is no guarantee that the phones that are in the hands of the learners support internet access and multimedia services.

Keywords: eBooks, eTextbooks, education

Introduction

Against considerable data demonstrating that education and literacy are key drivers of economic growth and that there is correlation between low literacy and high poverty levels in the developing world (2005 World Bank Development Indicators database) and that access to books can boost reading ability, the South African Department of Basic Education (DBE) is looking at the prospect of introducing eBooks to boost reading. In the process though, we must not overlook the fact that South Africa has two extremes- the well-endowed urban areas and the deep rural areas which have no infrastructure at all. What then would be the best approach to provision of eBooks to all South African schools?

A book is a medium for communicating information, where information is taken to include facts, teaching material, discursive writing and fiction. eBooks can be defined as a text in digital form, a book converted into digital form, digital reading material, a book in computer file format, an electronic file of words and images to be displayed on computer over a network, or viewed on a desktop/notebook/dedicated portable device, or read on all types of computers, or formatted for display on e-book readers (Jenkins, 2008). There is a growing range of eBook readers, that is, devices created specifically for storing and reading eBooks, each of them exploring one aspect of the paper book , that is, portability. A number of organisations have come up with their own eBook stores. An eBook store is a library of electronic books. An e-book store is a service. The owners of the eBook stores have their own standards. They have their own application programming interfaces (APIs) through which authorised subscribers can connect.

(Gibbons, et. al., 2003) suggest 7 types of e-book functionality including: the physical functionality of the device (such as readability), functionality that helps read the content (such as search and navigation tools), enhancing functionality (such as inclusion of multimedia, links to data and bulletin boards), functionality that places the content within a context (such as link to other e-content, inter-textual search ability), functionality that helps the reader “possess” the text (such as making annotations, printing) and the functionality that supports library activities (such as preserving confidentiality).

This research is structured to show the advantages and disadvantages of eBooks, introduces case studies of eTextbook provision in a number of countries including South Africa and draws lessons from their experiences. It looks at the current South African environment and recommends a South African solution to eTextbook provision. These recommendations feed into the architecture for eTextbook provision for South African schools.

Advantages and disadvantages of eBooks

eBooks have a number of advantages to both the publishers, customers and libraries. Paperless mass production of books makes it far less expensive than paper production. From one copy of an eBook, a number of copies can be obtained. Distribution of eBooks is easy. It can be via computer networks or email for download. There is no inventory when it comes to eBooks, meaning they do not bear the risk of over-supply or under-supply (Hua, 2011). There are no costs of printing, binding, inventory or distribution of eBooks and delivery is immediate – by email or download. The publishing process becomes quickest

with electronic media. It is easier to make changes and distribute via internet. The publishing cost of printing, binding, inventory, etc disappears. The electronic copies do not require physical storage space in the warehouses of publishers (Kumar, 2009). It is easier for authors to publish directly for a niche market without a publisher. Enhanced feedback can be achieved by direct contact with readers and integrated electronic feedback given by readers.

As opposed to the paper book, an eBook is portable. It offers convenient storing, since it is not bulky. It is instantly available through downloads. The reader can download a title easily, quickly and effectively, anytime and anywhere from the internet at a low price (Hua, 2011; Kumar, 2009). The reader can carry many books, even a whole library, with him using an eBook reader. The reader can dispose of an old e-book easily and without costs, as they just need to delete it from the reading device. It incorporates a range of multimedia and interactive components. Good search functions, easier navigation, an ability to cut and paste, hyperlinks to relevant web pages, sophisticated search capabilities, the ability to change text size or convert text into audio for special needs readers, functionality to underline, highlight text and make margin notes and bookmarks are such components. eBooks could help solve some challenges facing education, including an increasing student population, a changing student profile, and students' lack of funds for purchasing texts (Bennet, 2005). It provides equal access to learning materials to both campus-based and distance-learning students.

Downloading eBooks means instant delivery of purchased books. Lower production costs leads to lower prices. The fact that they are not bulky to store, saves shelf space. They supplement collections in the library. They can easily be used in distance learning programmes. They increase library e-reserves. They offer the ability to update content continuously. It is a continuing challenge to keep the range of books current and relevant. There is constant need to update the collection with new resources. That can be easily done with eBooks. Paper books are expensive and bulky, as opposed to eBooks. Keeping books in digital form saves a lot of paper and the trees from which the paper is made. Libraries can support an extensive range of books with well-organised material that has good up-to-date examples.

eBooks also come with a number of disadvantages. The threat of widespread piracy threatens the healthy growth of the digital publishing industry. Unlike other open platform devices such as PCs or PDAs, the eBook platform features a rigorous copyright protection solution that securely protects the works of publishers and authors. In eBooks, the storage and transmission security is enabled through both encryption and compression. eBooks tend to have a lack of user friendliness for the interfaces. Also, students want more multimedia capabilities (Lin, 2010). There is no autonomy of the medium by which they are hosted. The dedicated eBook readers are expensive. There is a high risk in buying a technologically obsolescent eBook reader. There is a diversity of presentation styles that are appropriate to different types of books according to their content, use and intended audience. Personalisation and user customisation is the core of next generation of eBooks and eReaders (Wilson, 2002). Regulation of access by publishers restricts the number of pages that can be downloaded or printed via search software. The use of token and cookie identification technology allows far greater intrusion by the publisher into the reading habits of customers. This technology can be used to access individual identification, in order to monitor, restrict or disable access. In future, publishers and libraries could use this type of

technology to manage the digital rights of authors, giving greater flexibility to provide free, and pay-per-view access to otherwise unavailable material (Abbot, 2003)

The wide variety of software and hardware products associated with eBooks are a cause of confusion and therefore constitute a barrier to uptake (Bennet, 2005). There are significant differences between the print book and eBook physical and information supply chains. The eBook information supply chain is imperfect. Awareness of the main user groups is a major barrier to its uptake (Bennet, 2005). Many publishers are reluctant to make their publications available in eBook format because they are afraid of the effect on their revenues (Bennet, 2005). There is a lack of a common platform for eBooks. Readers tend to be attached to their analogue libraries and digital collection of books. Losing or needing to repurchase the collection if standards, devices and gadgets change is a serious issue. Not every one has computer, PDA or eReader access. Therefore public facilities should provide this. The eReaders lack durability. The high cost of the eReaders is a hindrance to eBook uptake. Availability of titles in eBook stores is limited. There are limited inventories of goods offered by any one vendor. There is a lack of standard formats among products and vendors (Rao, 2001). eBooks bought for one reader cannot be read by another device. They are device and software-dependent.

Lessons learnt from eBook initiatives in other countries

There are a number of eTextbook initiatives worldwide from which examples can be drawn. This section visits examples drawn from some eTextbook initiatives in Ghana and the USA

Ghana is a recipient of an eTextbook initiative known as WorldReader. This initiative brings eBooks specifically to people in developing countries. WorldReader's pilot study was conducted between 2010 and 2012. The purpose of the pilot study was to gauge how well students cope with eReader technology when it is made available for study. The Impact on Reading of eReaders (iREAD) pilot project provided Kindles and eBooks to students in 9 different cities and local content was created by digital conversion of 82 Ghanaian books. A number of lessons were drawn from the pilot.

One of the lessons drawn was that out-of-classroom reading is critical to the success of learners. Unfortunately the devices were fragile and broke frequently when children were allowed to take them home. This called for modifications to the devices. Protective cases had to be provided. Lights were also provided for reading at night. To reduce the numbers of eReaders required at any school, it was necessary to transition from a single user eReader model to a library model. . Amazon imposes a maximum of 6 Kindles to share the same book simultaneously. Therefore WorldReader had to negotiate with Amazon to use the books across hundreds of eReaders. Each eBook ranges from a few hundred kilobytes to several megabytes depending on the length, number of pictures, etc. When multiplied by the large number of eReaders accessing at the same time, this represents an enormous amount of data. Simultaneous access becomes difficult due to bandwidth constraints. Building an entire ecosystem around eReaders where consumers can buy eBooks using credit from scratch cards, similar to prepaid mobile phone, was devised.

CourseSmart is an online 'retail source' operated by six of the leading textbook publishers. It includes eTextbooks from Pearson, John Wiley and Sons, Cengage Learning, McGraw

Hill Education, Bedford Freeman and Worth Publishing Group and Jones and Bartlett Publishers. They offer textbooks at half the price of the hard copy. CourseSmart Affiliates who place a link on their website to the company receive 5% of net sales on all purchases by students directed to CourseSmart from their site. The books can be downloaded to the student's computer or accessed online from any computer. Students can highlight and type notes on electronic copies of the book as well as copy small sections or print 10 pages at a time. The digital copy uses .pdf as the source format. The following lessons were concluded:

- ❖ The availability of titles is increased by bringing together a number of textbook providers.
- ❖ The fact that the .pdf format was used ensured compatibility and single standard in the textbook format from the library

Apple has launched an eTextbook application in New York City. The application works through iBook so that students will be able to access their textbooks as they do currently when reading other books on their iPads. This allows publishers and educators to produce digital textbooks from which students can learn interactively, making their learning more engaging and exciting. The following lesson can be drawn:

- ❖ The fact that the iPad eReader was used limited access to the iBook store, which in turn limits the variety of titles.

Lessons learnt from eBook initiatives in South Africa

In South Africa's Siyavula project, volunteers write maths and science textbooks for grades 10 to 12. The books can be freely copied, printed and distributed as often. They can be downloaded onto mobile phone, iPad, PC, flash drive and can be burnt onto CD, emailed around and uploaded to websites. The only restriction is to keep the book, its cover and short codes unchanged. All exercises inside the book link to a service where the learner can get more practice, see the full solutions, or test their skills development on mobile and PC. The eBooks are accessible on www.everythingscience.co.za and www.everythingmaths.co.za. It costs the government only R40 to print and distribute one of these textbooks to the schools, whereas previously the Department of Education had to pay R150 for a single book. The lessons learnt so far from this initiative are that locally-produced content is appropriate and low-cost. This local content can be licenced on an open access licence to the benefit of local schools and can be freely copied, printed and distributed

Originally known as m4Lit (mobile phones for literacy), the Yoza project is available on MXit in both South Africa and Kenya. The project explores the viability of using mobile phones to support reading and writing. It targets the youths with engaging stories that include stories from genres such as soccer issues and teen romance. The lesson learnt that can be drawn from this initiative is that South Africa can take advantage of cell phone technologies in the provision of eTextbooks

Kalahari.com is the first retailer embarking on introducing eContent widely to learners and university students. Partnering with the PETS Foundation (Programme for Educational Tablets in Schools), Kalahari.com is supporting a research project that introduces the most

effective technology into the learning experience. This project explores educational, financial, technological and logistical viability of introducing tablets, digitized texts and related technologies into the South African schools over a period of 5 years from 2012-2016. 350 eReaders are being piloted at the Vulindlela Reading Club at the St. Louis Primary School in Langa, Capetown. The lesson that has been derived so far is that:

- ❖ The tablet for eTextbook delivery must be lightweight and durable enough to stand up to the treatment of young users.
- ❖ Using tablets instead of dedicated eReaders could be the appropriate solution

Van Schaik, a textbook supplier, are adding eTextbook solutions to their offerings using Ingram's VitalSource online platform. The Vital Source reseller solution provides Van Schaik with tools to sell and deliver eTextbooks to its widespread customer base without costly infrastructure investment. The VitalSource platform is a true online/offline eBook solution, with robust iOS and Android applications complementing Mac, Windows and browser-based access. The multiplicity of access options is crucial in emerging environments like South Africa. Students enjoy the benefit of the VitalSource platform including integrated download, online and mobile content options, advance searching and annotation, note-sharing and accessibility features. The lesson that can be drawn from this is:

- ❖ An offline/online solution to eTextbook provision can resolve the issue of access/no access to the internet

Challenges to eTextbook provision for South Africa

The fact that the eBook market is characterised by proprietary ownership means that eBooks can only be accessed using particular eReaders. For example, the Barnes and Noble bookstore can only be accessed using the Nook, the Amazon bookstore can only be accessed using the Amazon Kindle, etc. Traditionally, inventories of goods offered by any single eBook vendor are limited and yet with paper books, can be purchased from random vendors. To purchase eTextbooks from these established eBook stores, South Africa has to ensure that they stock textbooks that are specific to the South African curriculum. Proprietary formats are equipped with digital rights management (DRM). This technology controls access and is used to protect copyright material and limit usage of digital material and devices (Kumar, 2009). Going around these DRM issues may prove complicated for South Africa if they are to subcontract proprietary companies to provide eTextbooks.

The cost of hosting eBook content, maintaining platform features and providing technical support increases the cost of eBooks. Pricing models are varied from publisher to publisher and vendor to vendor if the route is subcontracting proprietary companies to provide the eTextbooks. eBook purchasing options vary and several factors must be considered before ordering. Will it be purchased as a subscription, one-time with perpetual access, or as a selection through patron-driven acquisitions? eBooks ordered as a subscription are purchased annually. If the subscription is cancelled, all access is lost. eBooks purchased with perpetual access are owned by the library, similarly to a printed book. The cost of the perpetual access eBook is usually higher than the subscription option and does not include any revisions or updates. Another option for purchase is patron-driven acquisition. In this model, the library has an agreement with the vendor, to

load records for a collection of titles into their online public access catalogue. If a given title is accessed a certain number of times, as agreed in the contract, the library purchases the title. Many publishers such as Elsevier, Wiley and Springer require that every eBook title purchased must be added to the licence through an addendum and signed by both parties (Jackson, 2011). eBook purchase is not a simple purchase as in case of print books, but continues to send annual access fees.

Connectivity should not be much of an issue if it is just a case of provision of eBooks that are of a standard nature. Download can be via the internet for those schools that have access to the internet, and offline for those that do not have access to the internet. Some South African schools, and not all, already have computer networks, through the DBE's schools computerisation project. The challenge though is not only about the cost of deployment of infrastructure to support eBooks but also the cost of maintenance of the infrastructure. Schools do not have the required technical support personnel.

Teachers without the prerequisite ICT qualifications are not properly trained to deal with and make use of new technologies that they are provided with. Providing adequate equipment and keeping them running smoothly and up-to-date is difficult. Education departments usually do not have sufficient funds to pay staff, let alone fund computer equipment. Lastly, there is the issue of integration of computers and related technology into the school curriculum, which proves an uphill task unless staff are well trained. An educator is not necessarily trained in ICT, and education-training institutions are not offering the relevant ICT training. Therefore schools need to employ ICT professionals. Unfortunately ICT professionals expect market salaries which are well above educators'.

If a South African solution is required for content production, that will go round the proprietary nature of eBooks and eBook readers, local content producers will have to be trained. Currently there is a shortage of skills in that area. South African appetite and aptitude for eContent is growing. It should extend to the education sector to increase access to content, aid learning in the classroom and also reduce the cost of learning materials over time.

The schools have a task to ensure that their stock of eBook readers are kept intact. The problem is that these eBook readers are in the hands of young, immature children., and hence there is no guarantee that they will be secure. Even security of eBook readers which can be kept within the school premises, if the threat is more outside the school premises, has to be ensured. Once any get lost, then a vicious cycle of thefts will occur, and at the end of the day there will be problems of access to the eBooks. Schools with such equipment would have to invest in expensive alarm systems and surveillance cameras. But such equipment is beyond the reach of most schools which are already underfunded. Leaving eBook readers in the hands of learners puts them at risk of being the targets of criminals, just as cell phone technologies have been. The risk of losses of eBook readers would mean that the DBE has to have a constant supply of eBook readers, and most probably as frequently as paper costs. That would mean that the intention to cut down on book provision costs to schools would be comprised, through ensuring a constant supply of these books

Not everyone has access to eBook technology. There still exists a digital divide in South Africa. Therefore we cannot subscribe an umbrella decision on provision of eBooks to all

schools. DRM refers to a system used by publishers, copyright holder and individuals to limit the use of digital content and devices after sale to protect their copyright and prevent piracy. The eBooks cannot even be shared among devices in some cases. One owning different types of readers has to purchase the same book more than once. Passive DRM and eBook watermarking as an alternative to active DRM allows sharing but the content is protected from piracy because the content can be traced back to a source device. This limits the number of times a single book can be shared. Authors and publishers are wary of digitising their works, as these are more likely to affect their profits when copyrights are violated. In storage, transmission and download pose security threats. How do we ensure that the eBook that is downloaded to a reader is only made available only to the person who is authorised to have it and cannot be copied? Currently regulation by publishers restricts the number of pages that can be downloaded via software search. Energy is required to run an eBook. Unfortunately not all schools have access to a reliable energy supply, in particular those in deep rural areas.

Recommendations on providing eTextbooks to schools

It would be recommended that the DBE come up with an eBooks store of recommended textbooks. The eBook store can play the role of a library. It is important to transition from a single reader to library reader model, if the case is for the provision of books which are in short supply.. This means that the funds towards infrastructure are reduced. The only problem is that, traditionally, a library carries a whole range of books some of which are from external sources, and yet here it's only a library of recommended books. In this case a single standard in eTextbook format to enable access by all, is required. This would be formats that are not protected such as .pdf, .mobi, plain text, etc. An eBook replacement and upgrading strategy has to be put in place to avoid the glitches in eBook provision. It should be encouraged to give incentives to local authors and publishers to develop local content for these eBooks

The current school networks should be configured to enable download of eBooks from the DBE eTextbook bookstore. The store should allow simultaneous access and the availability of the required titles. Once content of the eBook has been created, the master file of the eBook can be downloaded, either offline or online to the loading station of the school to upload to eReaders. The offline / online download will be determined by whether the school has internet access or not. To ensure that only authorised schools have access to the resources, each school should have an access licence to locally-developed content

Without the necessary infrastructure, schools in less developed areas will continue to lag behind. Therefore the need to accelerate the government programme for the installation of ICTs in schools. To tackle the issue of exclusion of those schools that currently do not have computer networks, setting up a network of community based ICT centres and multiple eBook access points to complement any access would suffice. This would mean that those that would not have access to eTextbooks in their schools can take advantage of such. This can be through public access facilities such as Thusong centres, through public information terminals at post offices and libraries , internet cafes and kiosks. An alternative way to deliver content can be through digital television. Digital TV has the potential to reach 100% of the South African population since TV transmission covers the whole country. The digital TV works by pushing content to the viewers. This material can be pushed to the memory of the decoder and then downloaded to the school servers.

Instead of a total changeover from paper books to eBooks, a hybrid approach can be adopted. Schools that have the resources such as electricity and finances for technology purchase and skilled teachers can introduce eBooks. Any savings from the introduction of eBooks into such institutions can then be ploughed into those schools that do not have the infrastructure. Currently a number of rural schools do not have even the buildings to learn in. Therefore the first step should be towards the provision of paper books, before the big leap into eTextbooks.

In cases where finances are available the DBE should fund a cheap eBook reader that is robust and supports a mechanism that allows only the authorised learner to use it. The DBE can design their own format of an eBook reader and put DRM on it that can only read the school books that learners have rights of access to. It won't be worth selling to anyone else, hence security and copyright is ensured. To pass a DRM is easy, hence biometric identification of the learner can be the next source of security of the content.

The initiative should draw lessons from current South African eBooks initiatives like Siyavula before any decisions on the way forward are made.

Architecture for eTextbook provision to South African schools

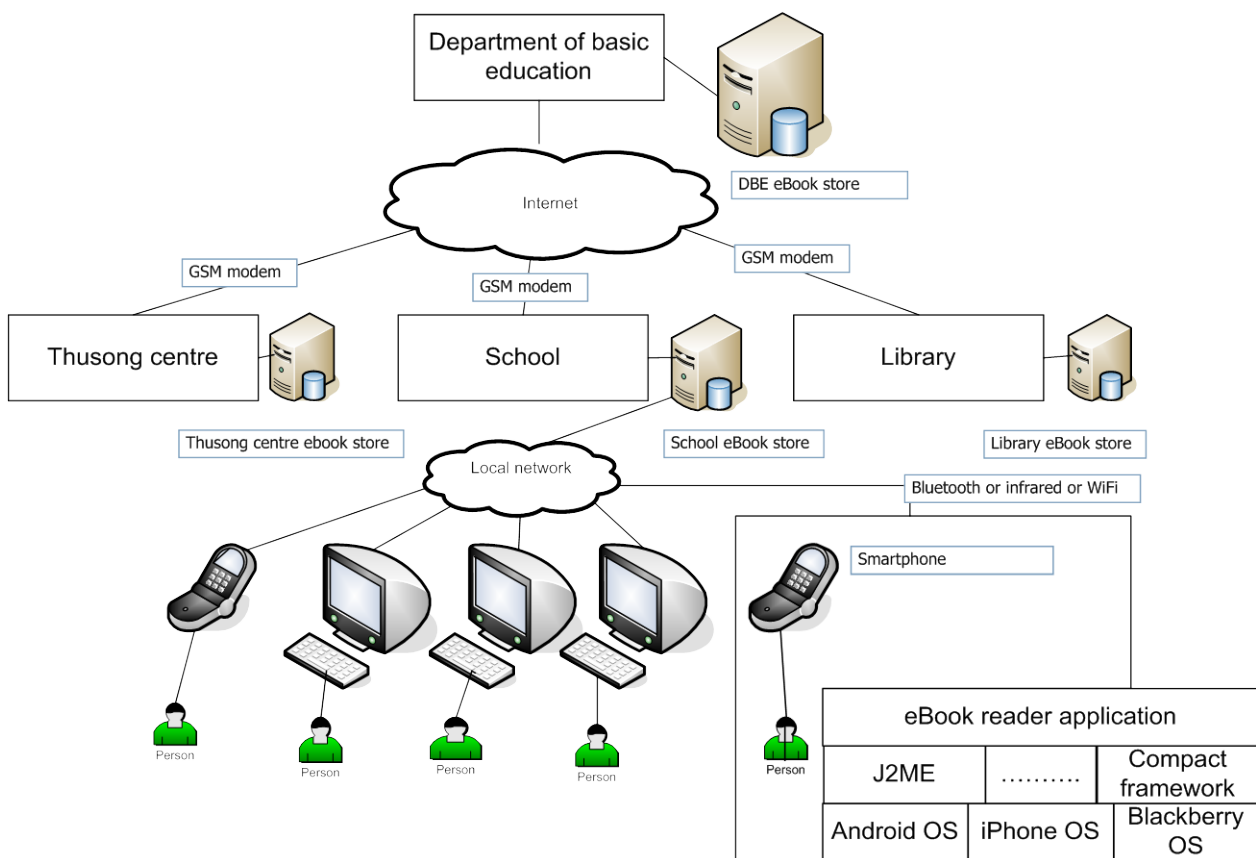
The DBE can set up its own local eBook store on a DBE cloud platform. The eBook store should contain recommended books on the South African schools curriculum. Schools, libraries and public facilities such as the Thusong centres, and kiosks download these eBooks onto their servers via GSM networks. Since this download occurs once a year or in case there have been any updates at the DBE book store, the costs to these schools is minimal. The eTextbook download system works online and offline. Schools with internet connectivity download the textbooks directly from the DBE onto their servers. The advantage of the once-a-year download is that on occasions that the school's connectivity is down, the education content is still accessible to the learners. Also, some schools do not yet have internet connectivity and hence flash disks can be physically transported to these schools for the download. This cuts down on transport costs as compared to moving paper books. When learners access through the public centres, they register for the service as they would in any book libraries. They can also access these public resource centres via Bluetooth, infrared or Wifi. The idea is so that the learners avoid using the GSM network for access as that would require that they pay for the download to the commercial cell phone service provider.

Let's take the example of a school as shown in Figure 1. The learners can access the school eTextbook servers via a smartphone or the web browser. These schools have networks in place under the government computer rollout programme. The smartphone can connect to the school server via Bluetooth, infrared or WiFi.

We have to write an eBook reader software for each of the different smartphones since each smartphone supports a different operating system. Writing an eBook reader is complicated. Different eBook readers will read different eBooks since eBooks are stored in different formats. These operating systems range from Android, Blackberry, Windows, etc. Each operating system requires its own eBook reader. Some of the eBook reader softwares will be written using, for example, J2ME for Android, the Compact Framework

for Windows, etc. The J2ME, for example, sits on the eBook reader. The eBook reader sits on the smartphone, and accesses the DBE store. The eBook reader needs an HTTP client or “ftp” component that connects to the eBook store to download eBook files from the eBook store. The smartphone has a GPRS connection to ‘ftp’ the file. The books could also be in .pdf format so that we can use .pdf readers to read content if the eBooks are .pdf. Smartphones mostly have standard .pdf readers. Besides the smartphone a web browser can be utilised to connect to the eBook store. All smartphones have a browser. The school networks as well have browsers. For security purposes the eBook store, whether on the local school server or on the DBE server can have password protection, so that only authorised users can access. Either way, there is no need for security because once books have been downloaded onto a smartphone they can be transferred from one phone to the next.

Figure 1: The architecture for eTextbook provision



We cannot send the eTextbooks to the learners through SMS. The phone has only so much memory. We can also provide a service through MXit and other social networks such as Google Talk, Viber, etc. to connect to the e-book store. Unfortunately connecting through social networks costs money for the data connection and traffic for downloading the files. Through the MXit API we can write a plug-in application to connect to the eBook store. Kids could then use MXit to read our book store. We develop an e-book store service where learners' accounts and lists of books and which part of the book the learner is reading from are kept. The learners can access the eBook store, download the material and read off-line.

Conclusions

The paper is on an architecture for eTextbook service provision to South African schools. The research says that there can be no uniform decision on the mode of delivery of eTextbooks to South African schools because whilst some schools have the required ICT infrastructure, others don't. The research proposes that the DBE set up its own eTextbook database, which the schools can download from onto their networks for learners' access. These school databases can then be accessed through smartphones or web browsers. South Africa has a 100% cell phone coverage. Alternatively for those schools that do not have any ICT infrastructure, access can be made through public facilities such as Thusong centres, public libraries and kiosks. The smartphone and web browser still applies in these public facilities as well. In the worst case scenarios, the learners can access the DBE library directly through their phones, at a cost though, since they have to go through the GSM network and pay the commercial service providers.

References **Re-do according to the format specs provided!**

Abbot, W., Kelly, K., Sooner or later! – Have e-books turned the page?, Bond University, Australia **Date?**

Armstrong, C., **(no comma, add date)** Books in a virtual world: the evolution of the e-book and its lexicon, Journal of librarianship and information science, Vol. 40, No. 193, pp. 193-206, 2008.

Bennet, L., Landoni, M., **2005** E-books in academic libraries, The Electronic Library, Vol. 23, No. 1, pp. 9-16, **2005**

Gibbons, S., Peters, T.A., Bryan, R., E-book functionality: what libraries and their patrons want and expect from electronics books, LITA Guide, No. 10, LITA, Chicago, IL, 2003

Hua, G., Cheng, T.C.E., Wang, S., Electronic books: to "E" or not to "E"? A strategic analysis of distribution channel choices of publishers, International journal of production economics, Vol. 129, pp. 338-346, 2011

iRead Progress Report/Student training Eastern Region, Ghana, November 29 to December 3, 2010. www.worldreader.org

Jenkins, A., What is inhibiting the proliferation of e-books in the academic library, Scrool, Vol. 1, no. 1, 2008

Kumar, S., Agarwal, D. K., Lijhara, S.K., Tapkir, S., E-books: readers, librarians and publishers perspective, ICAL 2009 – Visio and roles of the future academic libraries, pp. 124-129

Landoni, M., electronic books, in Feather, J. and Sturges, P. (eds), Routledge international encyclopaedia of information and library science, 2nd ed, Routledge, London, pp. 168-171, 2003.

Lin, Chiun-Sin., Tzeng, Gwo-Hshiang., Chin, Yang-Chieh, Chang, Chiao-Chen, Recommendation sources on the intention to use e-books in academic digital libraries, The Electronic Library, Vol. 28, No. 6, pp. 844-857, 2010.

Rao, S.S., Familiarisation of electronic books, The electronic Library, Vol. 19, No. 4, pp 247-256, 2001

Wilson, R., Landoni, M., Gibb, F., A user-centred approach to e-book design, The lectronic library, vol. 20., No. 4., pp. 322-330, 2002