AC 2007-2585: PREPARING FOR ELECTRONIC TEXTBOOKS

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Preparing for Electronic Textbooks

Abstract

Electronic copies of books are becoming increasingly common. Examples of these include noneditable PDF files, or fully editable books based on the Wiki model[17]. Electronic books are well suited to engineering; they allow very fast updates, they are easy to access, they do not require the bulk of paper, they are easily searchable, and they allow multiple/alternate sources. So, this begs the question, why are there so few electronic books in use in higher education? In part, this is because many of the commercial books are not available electronically. Although some publishers are exploring ways to make their collections available electronically these efforts are still in their infancy.

However, a larger puzzle is in the step away from paper to purely electronic media. For example, consider the following problems. How do you write notes or slip a page into a fixed PDF file? Is the document you are viewing on your machine or on the network? Who can change the document? What happens if somebody changes a homework problem after it was assigned? Etc. Assuming that the future of the electronic book is on-line there are currently two popular models. In the Distribution model there are a small number of authors and editors who control and distribute a fixed or editable format for the book. This model most closely resembles the current publishing model. In the open model the book would be on a Wiki or Content Management System (CMS) where multiple editors and contributors could freely change it. The open model has great potential to generate excellent electronic books, but it adds some new considerations not previously encountered. The paper discusses some of the anticipated issues such as multiple versions, various notations, vandalism, and editing rights for students and faculty. In addition a set of features are proposed for the purpose of fueling discussion.

The Current Situation

Our students make extensive use of textbooks that are printed on paper. They also spend a significant amount of time carrying bags full of paper. This flies in the face of many predictions that paper would all but disappear by the millennium. Although paper has some clear benefits, it is worth asking why electronic books are not more common given laptops and other portable electronic devices.

Electronic publishing does exist but it is somewhat limited. There are an ever increasing number of free electronic books available on the internet. Most of these are in PDF format, making them easy to read and search while keeping the overall file size relatively small. Some older books are stored as scanned images, preventing searches and requiring much larger file sizes, but these are still relatively small on a modern hard drive. However, publishers are reluctant to release their mainstay titles in electronic formats for fear of the copying like that seen in the music industry.

There have been many false starts as the commercial publishers have tried to join the electronic world. Some of these include the efforts listed below. It is worth noting that most of their efforts increase the cost for the materials, do not relinquish control of content, and do not take full advantage of modern computers.

- including supplemental CDs with additional chapters, solutions, videos, software, etc.
- time limited access to on-line resources.
- electronic only books where students buy access for a semester.
- ebook readers and/or software that lock in the electronic books.
- unrestricted ebooks bundled with regular ebooks. The author recalls a bundled supplement to a controls book using Mathcad in 1995.
- on-line databases with limited printing capabilities.

For a number of reasons the free-open-source (FOS) community is growing away from the traditional publishers and starting to develop materials themselves. The most notable case is the emergence of wikipedia.org from a mere curiosity a couple of years ago, to a major competitor to the Encyclopedia Britannica[1]. Other publishers expect to confront similar situations soon from groups focused on textbooks[2,3].

The Good and Bad of Paper

Most of us appreciate the value of looking through a library to find information. Having a set of books on related topics grouped on a shelf creates knowledge proximity better than a search engine[4] could. A few minutes of flipping can give a bird's eye view of a topic, and a table of contents and index can give easy access to specific information very quickly. Moreover the books on the shelf are generally trustworthy because they have been reviewed and edited by qualified professionals.

By their very nature paper bound books have some constraints imposed by the fact that they must be edited, printed and sold within a reasonable time frame. In summary these can be listed as,

- books are prepared to address a topic - the emphasis is on 'a'
- the material in a books if often aimed at a particular knowledge level
- books must be printable within limits (length, size, features, colors, etc)
- books can be augmented with media (such as CDs)
- a textbook should cover a topic in a linear order that builds in complexity
- books are controlled by a single author with the support of highly qualified reviewers and editors
- the cost is higher if the book is more complex or has a small circulation

Ironically it is worth noting that all modern books are typeset in software and exist in an electronic form before they are every printed. It would actually be much easier, but less lucrative, if the publishers dispensed with the printing process.

New Developments

The concept of electronic publishing and distribution is not new and is destined to happen eventually. Some of the issues surrounding electronic publishing are;

- The number of electronic books available on the internet has blossomed. One of the earliest pioneers of internet publishing is Project Gutenberg that specialized in out of copyright classics[5]. More recently there have been a proliferation of books that are more recently out of print[6], or self published[7].

- A number of tools already exist for collaborative publishing. For example electronic books on the internet can use the Gnu Free Documentation License (GFDL)[8]. For example a book originally released in English[9] under this license was then translated to Dansk[10].

- Many individuals are concerned that if the publishers dominate the transition to electronic books there will be a widespread use of Digital Rights Management (DRM) protection to prevent copyright infringement. There is major design that DRM is intended to help protect content owners, it is very harmful to the rights of the general public. It is also expected to have numerous consequences for libraries[11].

- Collaborative publishing models seem to have captured the imagination and spirit of those outside the academic world. Wikipedia is an excellent example, allowing individuals (not verified experts) to contribute and edit articles. The larger community then reviews and vets the articles for accuracy and impartiality. Early concerns that the site would be overrun with vandalism and 'flame wars' have been largely unfounded.

- Previously figures and equations were stored as bit mapped images that were very difficult to edit. The Internet standards groups have been adopting new standards that allow easier editing of figures with SVG[12] and equations with MML[13].

- Content Management Systems (CMS) have been developed for cooperatively developing complex technical documents using networked environments. Some of these include Drupal[14,15]. In many ways these are more like distributed work processors, as opposed to the distributed web editors of the wiki models.

- Other computing models are emerging such as portable computing applications using flash drives. For example one that applies to this work is a portable wiki environment that includes MML and SVG editing capabilities running on a web page with AJAX - no additional software is needed on the host computer, beyond the browser[16]. Another similar software package is Doxwiki.

A Sample Vision

Technologically we are ready for electronic books in the classroom. The major barrier at this point is a proven model that others can reuse. A crude example model of use of the book in a course is outlined below.

1. Before the course the instructor identifies the text sections and depth that she/he wants to use for the standard student. An instructor could even elect to provide a set of problems to solve for the semester, and then references to course material to help the students solve the problems.
2. At the beginning of a course each student downloads the textbook master copy to their flash drive, or they configure an on-line site.
3. As the semester progresses students are guided through the book at a high level. If a particular student needs more knowledge about a particular topic they pursue the details they need by 'drilling down' in the text or on the Internet. It would also be possible to provide alternate materials for concrete vs. abstract learners.
4. Throughout the semester students make their own notations in the textbook that only they can see. They may also choose to submit suggestions or corrections to the master version. If approved the corrections will be available to other students immediately.
5. By the end of the course each student has a view of the book that is highly individualized.
6. Students can reconcile their changed book with the on-line book at any time. This would have value by allowing them to import corrections and improvements since the initial creation.

One possible use is illustrated in Figure 1. Essentially an instructor would assemble a (linear) course outline using available resources. Some of the resources would be considered core and simply copied into the course outline. Others may be left as hyper links for a variety of reasons such as copyrights, the material changes frequently, the material is review/tutorial in nature, etc. The students would then take a copy of the course outline made by the instructor and follow/modify as they see fit. It is also possible for the students and instructor to submit changes/additions to the sources, based upon their local changes. The sources may also be maintained by others outside the academic system as appropriate.

While the model presented appears to only consider free sources, it is possible for this model to be of value for commercial publishers. This is important because commercial publishers do help provide additional motivation for developing high quality books, services, and information.

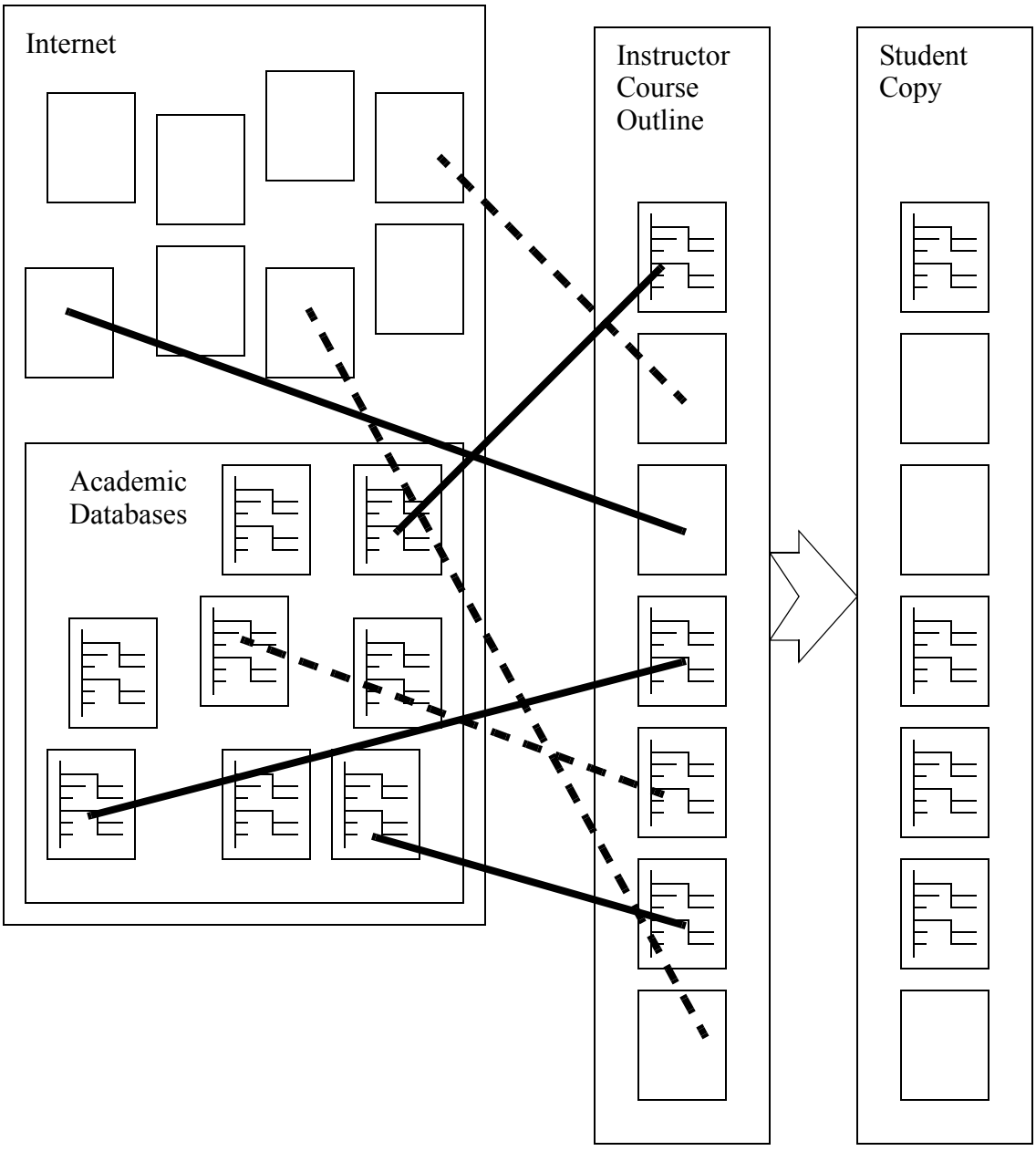

Figure 1 - An example Course Software Model

Issues to be Resolved

There are a number of issues as classified below.

Essential

- Identify software that requires little or no client end installation/maintenance.
- Allow dynamic on-line editing of equation (MML or Latex) and image formats (SVG) in documents.
- Establish permissions/policies for public and course based book editing.
- A clear model to emphasize the value for instructors is critical to the adoption of the model.
- The model should allow non-linearity including linking to other documents and media types.
- Allow the material to be constructed in alternate ways so that it is not driven by the body of the writing.

Nice to Have

- Identify ways to allow portable electronic books that vary from the master copy, but refer back to it.
- Explore unique technologies that allow locally hosted Wiki's (or CMSs) such as doxwiki, dokuwiki, tiddlywiki.
- A policy that encourages the uniformity of notations and formats without forcing a monoculture to develop.
- Use of tools such as writely to support collaborative work.
- Develop a commercial model for publishing to reward authors, editors, and distributors.
- Concurrent development software may provide a tool for resolving parallel changes in the book. One such system long in use for software is the Concurrent Version System (CVS).

The Next Step

The author is progressing to develop identify and test software to implement the electronic textbooks. It is hoped that others would be able to provide helpful input to steer this process.

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