Abstract
Based on a critical review of the current practices and market failure with regard to content supply and use, this paper proposes a new knowledge infrastructure and a content service network (CSN) that will allow consumers to conduct demand and context-driven search for granular content – in any form and format (books, journal and conference papers, theses/dissertations, web and multimedia resources) available as commercial, non-commercial, copyright and public domain content – and to download, aggregate, add value, repackage, render, and super distribute the aggregated content through a real time web-based service model. Argued that the new network will benefit content creators as well as consumers.

Keywords: Content supply chain, Publishing, Digital rights management, Intellectual property rights, Content Service Network (CSN)

Introduction
For knowledge-intensive activities, for example in education and training, consumers often use parts or sections of several books, journals, conferences, etc., such as specific chapters, articles, sections, paragraphs, tables, diagrams, and so on, and repackage the granular contents into a new content package to meet the specific needs for content for a course module in an education and training environment. Such new aggregated content packages may be used interactively by the creator for specific activities such as for teaching and training purposes, or can be distributed by the creator to a group of target users for their successive use and learning. In the current marketplace, aggregation and super distribution of content cannot be accomplished easily. The closest alternatives are printed course packs and electronic course reserves. However, none of these is appropriate for the current electronic environment and knowledge society, because the current processes of creating aggregated content packages suitable for a specific course are not only cumbersome, but are also very much restricted within the prevailing legal and commercial framework.

In today’s content market, consumers are forced to simply buy entire works, even if they want to use only a small section of the text. Taking publishing as an example, consumers must either:

- buy books and subscribe to journals and then photocopy or scan the granular elements they actually want for physical aggregation and distribution; or
- go online from one proprietary site to another and get access to the digital content in different ways, on different terms and conditions, and then attempt to repurpose and distribute extracts of content within the limits of the various different digital rights management systems and licences.

Complex and onerous statutory and commercial blanket licensing schemes have been developed to address this market failure. A contested grey economy has been built up by one section of the consumer community in response to the failure to make a legitimate market for content that meets consumers’ needs (Unchaining educational …, 2004). This paper argues that this market failure can be resolved by creating a new knowledge infrastructure which will facilitate creation of a transparent, streamlined, new content service model for a virtual supply chain that addresses consumer demands for seamless access to use and reuse of copyright and copyright free content.

Although it is not highlighted as one of the major players in a country’s overall economy, the size of the content industry and its contribution to the economy is quite significant. A somewhat old figure shows that (Eco-Libris, 2007):

- Total annual revenues of U.S. book publishers amounts to $26.8 billion (2004 figures)
Total Annual revenues of European book publishers amounts to Euro 22.3 billion (2004 figures)

Recent figures show that in the UK the publishing industry which is the second largest in Europe, has a turnover of over £18.4 billion, with its 8000 plus companies employing around 164,000 people (BERR ... 2009). A recent study show that the value-added worth of the copyright industry in Australia is approximately $100 billion which is about 10 per cent of the GDP, and the annual compound growth of the industry is 4.7 per cent compared to 3.6 per cent of GDP (Pricewaterhouse Coopers, 2008).

This is just the tip of the iceberg; taken together the entire content industry in the world is worth trillions of dollars. Yet the processes of content creation, distribution and access follow a very traditional business model. The content industry is still very much based on the product-driven model, and does not offer the flexibility of a service model for the consumer to pick and choose sections of documents, create aggregated content packages and use and redistribute them lawfully to meet the specific requirements of a given domain.

In this paper it is argued that we need a new knowledge infrastructure and a content service network (CSN) that will be complementary to traditional channels for content, and will enable users to choose information from a myriad of information channels and sources, with sufficient levels of granularity, required for their use, and produce a new information package for access and distribution through a variety of media – institutional or personal computers, handheld devices, on-demand print, and so on, within the framework of a new and easy to implement business model. The new model is currently being built and will be tested within the academic environment at the University of Technology, Sydney.

Background: related research and initiatives

Over the past few years a movement has been orchestrated by academics, librarians and researchers to ensure that scholarly literature is available free of charge to the community (Gasaway, 2004). Many universities now encourage their academic and research staff and students to publish in open archive journals and to place the works in an institutional repository in order to ensure electronic availability of faculty-produced scholarly articles and other works on their own campuses and in the wider scholarly community, the underlying notion being that “an Institutional Repository is the best way to provide Open Access to research output.” (ePrints, n.d.).

A recent study shows that ‘research institutions could make surprisingly big savings if their researchers are paid to publish their articles with an open-access model rather than using the traditional subscription model. And the savings could be even bigger if they simply self-archived their work in an institutional repository’ (Open access publishing ...., 2009). Many universities are adopting a university-wide open-access policy. For example, the Massachusetts Institute of Technology (MIT) in the USA has adopted a new policy under which each faculty member grants MIT non-exclusive permission to make available his or her scholarly articles to the public in an open-access repository (MIT Agrees ...2009). Several new open source systems, and communities working around them, have appeared which allow creation of, and access to, digital information resources, with additional facilities for their preservation and sharing, e.g. Fedora (www.fedora.info), Greenstone (www.greenstone.org) and DSpace (www.dspace.org).
Two recent global developments, that will have significant influence on the access and delivery/use of digital information, are: (1) the Google and US publishers’ e-library deal (Google and US …2008) which will enable users to access and use the full texts of electronic books, and (2) Espresso Book Machine, described as an “ATM for books” by its US proprietor On Demand Books and costing about $175,000, have been installed in the US, Canada, Australia, UK and in the Bibliotheca Alexandrina in Egypt that provide new on-demand and on the spot book printing facility (DA Direct, 2008; Flood, 2009). Although it may take some time for such machines to be installed everywhere and to run in a cost-effective way, they will bring a major revolution in the book industry in that consumers will be able to print a book on the spot and thus there will be no need for printing and distribution of books physically around the world as it happens today.

The Google Book Search service is expanding rapidly in the US, and before long is expected to be available in other parts of the world (http://books.google.com/googlebooks/history.html). In addition, Google Scholar indexes peer-reviewed articles, books, theses, papers and abstracts from a wide variety of sources across many disciplines. WorldCat’s ‘Find in a library’ link (http://www.worldcat.org/) allows users to search the collections of libraries in their communities, as well as many others around the world, for both physical items and digital content.

How will the new infrastructure address the current market failure

The proposed new knowledge infrastructure will create a new supply chain for content service to replace the existing product-based model which was essentially designed to support the print world. It will address the market failure discussed earlier in this paper, in a number of ways. The novelty and innovativeness of the proposed CSN lie in the following areas:

- **New model for delivery of information on-demand with significantly reduced carbon footprint**: The CSN, will develop a new model for access to information in a much greener online and on-demand environment that will not depend on the traditional model of print production, warehouse storage, distribution, bookshop storage and delivery of printed information resources as well as the pulping of remainders and returns. It also limits the post hoc photocopying from print sources for course packs and educational materials all of which leave a significant carbon footprint. Within CSN content, in its original bundled form, or in the form of aggregated content packages, may be used digitally or may be printed on-demand, if necessary, but in either case the overall environmental impact will be much less because there will be no mass printing and storage, distribution and delivery, returns, etc. in anticipation of the market.

- **Dynamic creation of new content from existing information resources available through heterogeneous information channels and services**: The CSN will (a) create a system for dynamic creation of new content, by allowing the user to select relevant (granular) content from a variety of copyright and non-copyright information resources; (b) facilitate use of the new content interactively along with other web resources; and (c) allow distribution of the newly created content within an appropriate legal and commercial framework.

- **A new paradigm for creation and distribution of new information**: The new content service network will contribute to developing a new scholarly communications paradigm by implementing a new fluid production, distribution and access channel. Existing models for publishing are based in a market for book sales and journal subscriptions and are driven by the limitations and cost structures of print production and distribution technologies. Books and journals as artefacts are the result of the economies of scale of a print run of a printing press. They are bundles of content, e.g. articles are bundled into an issue of a journal which are static in nature. Digital distributed network technology permits a new service model which allows the content to be disaggregated and accessed in granular segments. It allows the original authors and publishers to provide a service (rather than a product) which constantly updates content in an online service model that gives the consumer access to only those granular elements that are wanted, and to re-aggregate them into a new tailored package, which in turn is easily updated. In this new model content creators and producers of content can be more responsive to demand.

- **A new economic model for delivery of information**: Unlike the current printed or digital model where the price of an item is fixed throughout the product life cycle (subject to discounting), this new model will be more flexible so that the price of the new content packages can be set and later adjusted depending on the market feedback and usage of the various components of the content package. This will give a better return to the creators and appropriate mechanisms may be built within the chain to adjust the price according to the nature of access, use and distribution of information. The model will have appropriate mechanisms for attribution, and obtaining permissions if necessary, for use and distribution of copyright-free Creative Commons and public domain materials.

- **A new system of value assessment in the information industry**: The new system will allow more flexibility for the user to select appropriate content for creating a new content package by
building in mechanisms which judge the quality, and therefore the value of the original information sources. For example, a lecturer may select relevant and appropriate content for use in a specific course, and for distribution among a group of students. The new value assessment system may be based on judgment of quality using a range of measurements such as journal impact factors as used by the Web of Science for journal ranking, or Page Links used in Google, frequency of access, volume of use and distribution, and so on. Within the CSN appropriate mechanisms may be built to determine the nature and frequency of use of all types of content and this will create new ways of assessing the value of the granular contents and thus of the source information products (not only journal or conference papers as is common for the Web of Science citation analysis which is an indirect way of measuring use in the first place) which can then be fed back to the content creators as business intelligence to rank their products, readjust their creation, editing and selection process, pricing models, etc.

- **A new knowledge infrastructure to support knowledge economy:** The new content service network will pave the way for creation of a new knowledge infrastructure that will have a far reaching effect on the knowledge economy.

**How the Consumers will Benefit**
The first and foremost benefit of this new model will be that it will create a dynamic market place for content where the consumers (university academics, for example) will have the rights to choose specific content, in granular or pre-packaged/bundled form, according to their choice, from a myriad of content providers. Consumers will have the freedom of picking and mixing content – in granular or pre-packaged/bundled form – and to repackage, render and re-distribute according to specific needs and contexts. They need not worry about where the content comes from, on different terms and conditions those can be used and distributed, etc. These will be handled, behind the scenes, by the system. However, consumers will be able to see, through a transparent mechanism, the price of each granular, or pre-packaged/bundled, content and thus the overall price of the aggregated content package for use and super distribution (distribution to a group of users, for example, a group of students in a class). Thus, consumers will have the freedom of preparing aggregated content packages according to the quality of content and their budget, and they will be able to add value to such aggregated content by adding their own content and/or interpretation.

The aggregated content package can be used interactively in the web environment by the consumers, both the creator of the aggregated packages and the recipient of the packages, i.e. the end users, such as university students. In other words, this will create an online market place for transaction and super distribution of content coming from a variety of channels and sources, and all the complexities of the transaction will be handled by the underlying business system.

**Benefits to the Authors and Publishers**
It may be noted that the new content service network will work only when the content creators, especially publishers, make their content available through the content service model. One may then wonder why would publishers accept this new model in place of their existing business model. The following are some features of the new network that will directly benefit publishers:

- **Significant reduction in costs and risks:** As discussed earlier in the paper, the new model will help publishers achieve significant reductions in upfront expenditure for printing of content packages (books, journals, etc.) in anticipation of markets. There will also be huge savings in costs currently incurred from storage, distribution and delivery, and even pulping of content packages. In the new model a significant amount of the content production and distribution activity can be outsourced. For example, content packages – in bundled or aggregated form – will be created and if necessary printed on-demand and on time at the consumer’s end. There will also be lower risk for the publishers since they will not have to print volumes of content packages in anticipation of the market demand.

- **A new market channel will compliment the sales and subscription channels in a demand-driven and real time market economy for content.**

- **Working in an environment-friendly way:** Based on the publishing activity in the US in 2006 it was noted that (New report ..., 2009; McIntire-Strasburg, 2008):
  - the industry’s annual carbon footprint was 12.4 million metric tons (for a total of 4.15 million books produced) or 8.85 pounds of carbon per book;
  - carbon dioxide equivalent emissions connected to paper represented over 70 per cent of the industry’s emissions.

A recent interview revealed that ‘the UK alone publishes around 200,000 book titles per year. If each of them had a print run of 1,000, that would be 200,000,000 books to be shipped around the world – without even considering all the journals, newspapers and magazines’ (Green Publishing, 2009). It was further revealed that ‘24 trees are required to make one tonne of paper. In addition, 1.5 tonnes of coal are required to produce the electricity for one tonne of paper and this is
responsible for emitting around five tonnes of carbon dioxide’ (Green Publishing...2009). The new model will help publishers reduce their carbon footprint significantly by making their content available online, and leaving the printing part of their business largely to the consumers who may or may not print the content. There will also be savings in carbon footprint that is currently caused in the content industry by travel, transportation and storage, distribution, delivery and pulping of unsold books and journals. Further research will reveal the exact savings in carbon footprint that can be achieved through this model.

- **Working in a much more responsive and open market**: Publishers will not have to work completely on the basis of an anticipatory business model. Instead, they can operate in a demand-driven market economy where their products will be in a virtual market place which is directly accessible to the consumers.

- **Working in a more transparent and regulated marketplace**: Because of the various frictions in the current product-based content supply chain, consumers are often reluctant to make the maximum use of content available in the market. Some of these are due to the difficulties associated with discovery and access, while others are due to the bureaucracy and hurdles associated with making use of the content especially when super distribution is concerned. The new model will alleviate all these problems and hide all the complexities of downloading, aggregation, super distribution, etc., and thus both the publisher and consumer groups will connect smoothly and in a transparent way. This will increase the use of content significantly and thus will benefit everyone in the content supply chain.

- **More returns from the same business**: The new network, through its model of open market economy, will help publishers get more returns from the same business. Such returns will come in a number of ways, such as through savings in the production and distribution costs (discussed in 1 above); more sales resulting from a frictionless, demand-driven and real time transaction model; payments for granular content based on the volume and frequency of use, super distribution, etc.

- **This new model, through various control and monitoring techniques, will ensure lawful use of content, and thus there will be less chances of content piracy and grey market economy.**

- **Within CSN, amortization of infrastructure cost among all creators/publishers and stake holders will reduce content and transaction costs benefiting everyone in the content supply chain.**

**Summary and Conclusion**

The new network will create a one-stop shop for fee-based as well as Creative Commons and open archives content of virtually any form and format. It will create a new knowledge infrastructure to support the creation and operation of a virtual content market place where anyone can access, select, download, aggregate, use and super distribute content of any form and format produced by virtually any creator or publisher anywhere in the world irrespective of their size and affiliation as long as they wish to make their content available through the network. This does not mean that the reputation of content creators and publishers is not important. However, the new knowledge infrastructure will create a level playing field thereby ensuring that small content creators and publishers have the same opportunity to make their product available through the virtual content market place.

Thus, it is envisaged that the CSN will create a social infrastructure for content creation and use. By making appropriate use of the ICT and web technologies and building a suitable e-commerce model for the virtual content supply chain, it will create an environment where virtually every content creator and every consumer will have the equal opportunity to benefit, be it in the creation or in the use of content, for every action and every decision in every walk of life. Thus the ultimate power with regard to content creation and use will rest with the general public – content creators and users – as opposed to a specific industry or business in the content supply chain.

The new CSN and the resulting knowledge infrastructure will benefit the global community in a number of ways:

- The new knowledge infrastructure will help every country achieve several priority goals, for example, promoting an innovation culture and economy by developing a new content creation and distribution infrastructure, a key factor in innovation.

- The new model will contribute to a new knowledge economy. It can be used as a sustainable model for the higher education sector to facilitate campus-based as well as distance/off-campus learning, and it can also be used for dynamic knowledge creation and delivery in any specific domain – business, science and technology, medicine, etc.

- The new content service network, for the first time, will create an environment for learning, where students and teachers can dynamically create content and use it interactively at an individual level, as well as in a shared environment, if so desired. The model, which is currently being built within a university environment may be used in any educational or other institution in any country.

- The new network will bring a paradigm shift in the information world that facilitates creation of new
knowledge from existing publishers and suppliers, digital libraries and information services as well as lowering barriers to entry for new actors.

- The new knowledge infrastructure can be adopted by creators and publishers world-wide for on-demand creation and delivery of content from existing sources in their publication portfolios including currently out-of-print content.
- It will also lower the barriers to entry and create a level playing field for creators and content producers, thereby empowering the relatively small content providers to compete on the basis of the quality of their content.

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References