

The development of DOI infrastructure: opportunities and challenges for Australia's print and publishing industries

A white paper for Copyright Agency Limited (CAL)
DOI EPICS project

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PART ONE

Opportunities and challenges for Australia's print and publishing industries

Executive summary

The advent of unique identifier infrastructure, such as that embodied by the Digital Object Identifier (DOI) system, heralds an era where the World Wide Web must now be regarded as an integral part of the infrastructure of Australia's book production industry. The implications are substantial for the education, print, publishing and other industry sectors.

The paper is divided into two parts. Part one provides a strategic overview of the opportunities and challenges associated with the development of DOI infrastructure within Australia. Part two hypothesises a particular DOI workflow within the higher education sector and highlights challenges and opportunities for the vendors of print equipment.

As in other industries disrupted by the Internet and digital technologies, the traditional understanding of book industry stakeholders is beginning to be transformed. For example, *consumers* of book products might now be better understood as *readers acting as users* of book content. Equally, traditional models used for fulfilling orders (for example, university bookshops) are being changed to the point where production is occurring close to the source of demand, that is, within or connected to bookshops themselves. There is even talk of building systemic infrastructure that would enable university librarians to define themselves as publishers of peer reviewed content.

With business models such as these already being piloted, consideration of DOI infrastructure in Australia presents an opportunity for the print, publishing and education industries to ask some fundamental questions. For example, are decision-makers within these industries adequately informed about the nature of change impacting on them? In light of such macro-changes, what type of investments should printers and pre-media companies make? Should publishers be looking more closely at logistic operations and their large warehousing investments? Should print and publishing companies change their shared value-added relationships as they respond to the changes in end user behaviour?

Is there an opportunity for the education sector to cooperate with the print and publishing industries to facilitate the development of hybrid multimedia companies for the benefit of students? Are higher education systemic infrastructure initiatives such as those being proposed by the Australian e-humanities network sufficiently cross-linked with industry expertise to ensure maximum potential and innovative outcomes? Is there sufficient expert advice available for people in these industries to make informed investment decisions in light of the demands of end user behaviour?

The fundamental argument underlying this paper is that two industry streams with quite different origins and cultures are now in the early stages of technological (and structural) convergence.

Historically, the print and publishing industries have their origins in mass manufacturing, mass marketing and the logic of minimising production costs. The profession of typesetting and typography grew up inside this world, with its focus on *document appearance and presentation mark up*. In contrast, the origins of text processing systems (and their application as part of the functionality of the World Wide Web for example) lie in the world of binary computation techniques, computer networking and the development of data management and *structural mark up* languages.

This stream of industrial practice is facilitating a different type of logic – of mass customisation, personalisation and variable print. In this new stream, published content is not necessarily treated as a product, but as an integral part of intellectual property. Copyright management spans both worlds – even though there is a significant shift in the management of rights from an *analogue* to a *digital* environment.

Australia's Copyright Agency Limited (CAL) is to be commended for its pioneering role in supporting the development of DOI infrastructure in Australia. In a grant made available under Australia's Enhanced Printing Industries Competitiveness Scheme (EPICS), CAL has undertaken an initiative titled *Making links to value for Australia's print industry using the digital object identifier*.

This is a bold project and has been part of a wider set of EPICS-sponsored projects which have harnessed the benefits of the World Wide Web and transformed the workflow of Australia's book production industry. For the benefits of this pioneering work to be fully realised, a long-term commitment will be required. This work is important because the print and publishing industries still service the majority of end users, through the printing of resources such as books and university and TAFE coursepacks. But the current business/production models are wasteful and are structured around production imperatives and not necessarily around demand imperatives.

As a result, the challenges associated with building a new type of service paradigm for end users of the book industry are substantial. New types of work business models and skills are required, particularly in the domain of workflow and metadata systems management and interoperability.

The adoption of DOI infrastructure in Australia is not just about the uptake of an agreed unique identifier system. It is also about how our text/image industries shift towards standards-based workflows. Such workflow must be designed to support the interoperability of text and data exchange across the board. At base level, this is the world of the emerging semantic web.

The EPICS scheme has emphasised that adoption of the World Wide Web as a means of supporting process automation and cost reduction objectives in book production will continue to accelerate. Parallel to this, the XML-based standards which support particular interests are only just beginning to stabilise. For example, in Australia the Online Information Exchange Standard (ONIX) is being adopted to improve data exchange between publishers and retailers. But as one particular community embraces a new standard (such as publishers embracing ONIX), they will also need to 'speak the language' of other communities such as

designers of online courses and librarians. Both these communities describe their worlds in very different ways and these descriptions are embodied in their own standards.

There are substantial challenges associated with the move from disconnected analogue workflows to comprehensive digital workflow systems.

The interoperability of content and data exchange will remain a major challenge for print and publishing industries. These are often regarded as complex matters and presently few businesses are able to embrace these issues with the proper strategic and long-term perspectives. Many businesses will thus be hesitant to commit substantial resources. Appropriate solutions will therefore need to be piloted and technology transfer strategies implemented based on the outcomes of pilot projects. The print industry has the distinct advantage of being a highly decentralised industry, so broad-based dialogue will be required to support technological solutions to improve business outcomes in both the print and publishing industries.

Four specific strategies are outlined below for consideration.

Innovation through linking end user behaviour with teaching practice

The services provided by the print and publishing industries should be better acknowledged than they currently are because end users *demand* print materials based on current reading behaviours. Of particular importance is how print/publishing workflow can be re-designed to support good teaching and learning practices and the integration of advantageous actionable identifiers. The use of tender outcome/output specifications is likely to be increasingly useful for facilitating workflow innovation. Therefore outcome/output specifications should be developed on the basis of current end user behaviour, that is, with print formats in mind.

Education and consultation campaign

There appears to be a need to consult with the Australian library sector, particularly within higher education circles. This is so the education sector will be able to specify to equipment vendors the types of functionalities required to support the interest of end users in the future. DOI infrastructure requirements might be one element of such specifications. The need to embrace standards-based workflow that encompasses the whole chain must be part of this education campaign. Such standards are likely to relate to content structuring (for example, different XML schemas and other approaches to structuring text), content rendering (print rendering, fonts and typography and electronic rendering standards) and metadata management standards encompassing B2B (such as ONIX or even the ebXML movement), cataloguing, education and digital rights standards.

Governance

If education and consultation campaigns are supported, agreement needs to be reached about how these campaigns can be implemented. At base level this would involve collaborative frameworks where DOI infrastructure should play a part.

Cross industry collaboration

The print, publishing and education industries are all enabling industries. Because information and communication technologies (ICT) are being adopted as important supply chain and productivity improvement tools across the board, what happens in the domain of standards and interoperability within the education sector is likely to have major flow-on effects in other industries, particularly in the first instance within the print and publishing industries. As a result, major innovation outcomes could be achieved by establishing alliances and cross sectoral collaborations with the education, print, publishing and graphic arts industries. Copyright management (in a digital rather than analogue environment) will be an important component of this type of collaboration.

One particular area of importance will be dialogue about the ontology systems that are integral to interoperability strategies. The importance of this dialogue is recognised in the education sector, but at this stage has been a unilateral and not a multilateral dialogue. The discussion and systematic evaluation of different approaches to interoperability (and the pros and cons of underlying approaches) is yet to happen. This re-emphasises that what happens in the education sector is likely to have major implications in other industries.

One of the objectives must be to facilitate the integration of the communications channels of the print and publishing industries with the information superhighway of the World Wide Web. In practical terms this should allow users to:

- access copyright cleared content from publishers using DOI resolution capabilities;
- know that this content is in a print ready format; and
- direct the manufacturing of book content to localised pre-media, print and finishing companies using the Internet as a supply chain tool.

The traditional ISBN infrastructure might also evolve to provide similar types of resolution services for whole books. (For example, see <http://www.isbn.org/standards/home/isbn/digitalworld.asp>)

Building supply chain capabilities to support these types of unique identifier infrastructures is a knowledge economy imperative. In this overall sense, DOI infrastructure has the potential to facilitate new ways of developing, evaluating and communicating knowledge within Australia's knowledge industries, including the education sector. By supporting the development of these types of infrastructures with a focus on end user interests, the structure of our pre-media and print communication industries will remain highly decentralised.

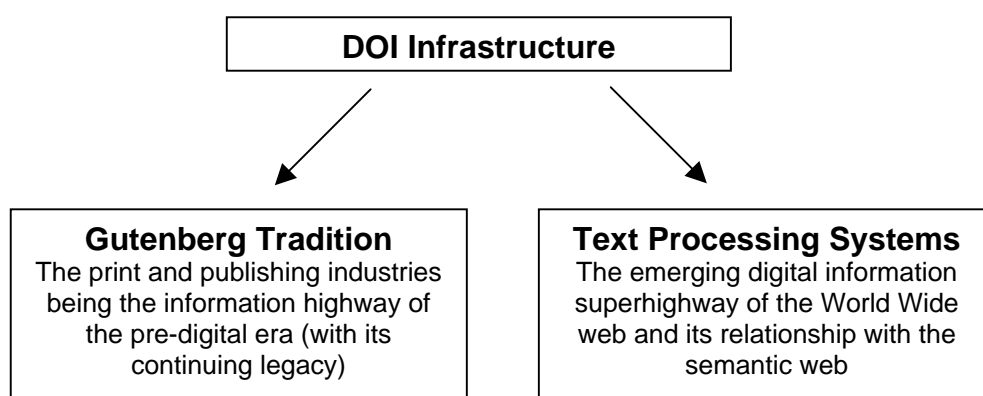
The industry context

For Australia's print industry to fully realise the commercial opportunities of new digital technologies, it is important to understand the historical and contextual forces that are currently impacting on the industry. The discussion that follows is set within the context of CAL's successful EPICS application for its project:

Making links to value for Australia's print industry using the digital object identifier (DOI)

DOI infrastructure as the confluence of two industrial streams

The DOI project in Australia, championed by CAL, provides evidence that two industry streams with separate and unique origins are now at the very early stages of convergence. These streams are described below.



The print and publishing industries have their origins in mass manufacturing, mass marketing and the logic of minimising the unit cost of production. At the heart of this is the idea of a **presentation mark up** language and associated concerns with document appearance. This is the world of *what you see is what you get*.

The profession of typesetting and typography had its origins in Gutenberg's printing press. Typesetting and typography is now a part of the domain of word processing; we have grown accustomed to using presentation mark up and we like to work with text in terms of what it looks like. The presentation of words and text is constructed not on the basis of the structure of the text but its visual representation of those structures (Cope and Kalantzis, 2003). Today, the production of new documents is digital from beginning, when pre-press houses prepare printing plates, to end. The process of developing printing plates is premised on minimum run lengths, which in turn provide the foundation for traditional print/publishing business models. When pre-press houses produce printing plates – the basis of offset printing – the plates represent the analogue manifestation of the final printed product.

In contrast, the text processing world and the World Wide-Web have their origins in the digital era. An important milestone in the formation of this world was Alan Turing's famous work in World War II. Turing built a machine to look for underlying algorithmic patterns and was able to crack the German U-boat enigma code. Interestingly, Turing's contribution used binary computation techniques to focus on the understanding of words and their meanings as contained in encrypted data. The work of Turing and others laid the foundation for modern day computing and artificial intelligence. There appears to be direct links between Turing's work at the National Physical Laboratory in the UK, the development of packet-switching technologies and subsequently ARPANET, the Internet and the World Wide Web¹.

The origins of the World Wide Web therefore lie in the use of binary computation techniques to abstract symbols from numbers and the rise of computers and computer networking. In contrast to the Gutenberg tradition and the rise of typography, the world of computer networking has led to the development of data management and **structural markup** languages. For example, it was the early work of International Business Machines (IBM) that led to the general mark up language, the precursor of standardised general mark up language (SGML). From SGML came the first markup language of the World Wide Web, hyper text markup language (HTML), followed by extensible markup language (XML).

The reason why markup languages has developed in this industrial stream is the necessity of, and benefits derived from, computer-to-computer and computer-to-machine data transfer, including text data for publishing to the World Wide Web. In contrast to mass manufacturing, the digital world and the use of the World Wide Web has the potential to service a different type of logic – that of mass customisation.

With the continuing impact of digitisation, these industrial streams are at the very early stages of convergence. In the print and publishing industries, there has been extraordinary uptake of computer-to-plate technologies. Almost all content now originates from digital sources, even though its final output might be an analogue process, e.g. offset printing. There is an increasing realisation that online publishing lacks the fundamental quality control systems that have built up inside the print and publishing industries. The scene is now set for these two worlds to become more integrated in the next several decades. The impact of this integration is likely to be substantial across a wide domain of work – including education, communications and industrial practice.

¹ See <http://www.turing.org.uk/turing/scrapbook/computer.html> for reference

A new type of infrastructure for text-based content industries

In Australia, CAL has started developing a new type of infrastructure required to address two challenges:

- The need for negotiated agreements about the adoption and use of unique identifier systems within digital text-based industries. The focus on negotiated agreements is necessary because there is a clear advantage in building infrastructure based on the principles of *interoperability*. Interoperability can only be built upon negotiated agreements around standards and the application of standards.
- The opportunity for the infrastructure to be used as part of the mechanisms for the management of rights in a digital environment.

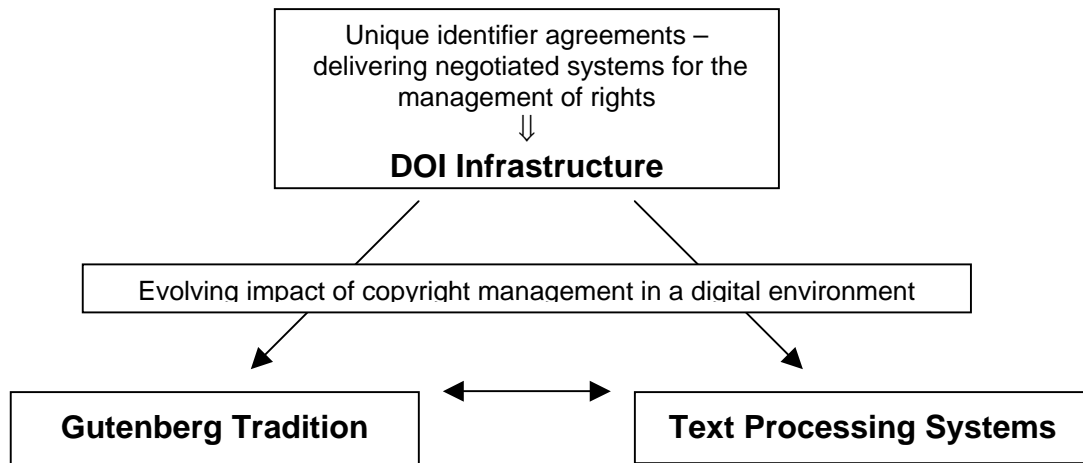
These are substantial issues. For example, unique identifier systems in a digital environment have the potential to become a cornerstone of whole-chain digital workflow management. In other words, unique identifiers such as DOIs might not only be used to identify digital products, but also to track production, including the identification of job tickets and the links from creator to user (refer to *Coordination of hub centre workflow* on page 25).

There are alternative systems and methods that can be used to address the issue of unique identifiers. As such, DOI is one type of infrastructure that can be used for the management of *rights* in a digital environment. The ISBN system also has the potential to expand to facilitate resolution and actionable services similar to DOI. The sorts of commercial opportunities described in this paper are already beginning to happen – but infrastructure, such as DOI, has the potential to glue the various elements of the value chain together.

For a country like Australia, there will be *significant* advantages in agreeing to adopt an international infrastructure within major content institutions such as the National Library of Australia, universities and the private sector. This is likely to ensure that interoperability becomes a major challenge when the book industry (and other sectors) shifts from its analogue origins to a fully-fledged digital model. It is clear that traditional analogue infrastructure in the book industry, particularly the ISBN system, must also evolve to respond to the new types of industrial practice such as zero inventory management and print-on-demand solutions.

CAL has participated in the development of the international DOI foundation for nearly eight years prior to being appointed as Australia's first DOI registration agency. CAL's participation in this forum has been built on the view that the DOI system is likely to become an important and globally negotiated infrastructure required for the good governance of text-based (and other) digital content industries. CAL and a number of other parties have identified that the need for this type of infrastructure should be considered as part of the domain of Australia's digital content management industries and more broadly, its knowledge economy infrastructure.

From the outset of CAL’s EPICS-sponsored project, it was envisaged that conversations about the application of DOI infrastructure would involve spanning the two industry streams referred to above.



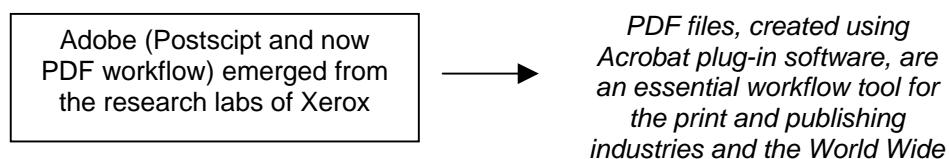
To embrace the types of commercial opportunities that are emerging through the uptake of digital technologies, it is important to understand some of the ways in which these two industrial streams are currently connected (and not connected).

Overlaps between traditional and text processing streams

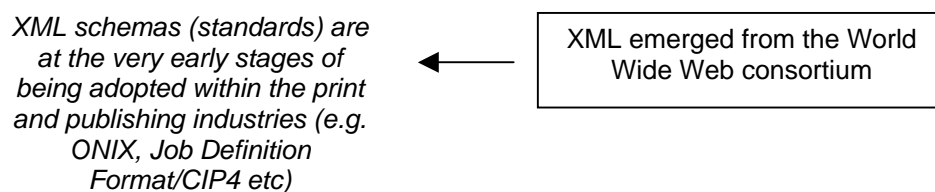
There are overlaps between the two industry streams as outlined below.



Computer-to-machine interoperability



The World Wide Web as a supply chain tool



Despite these overlaps, the culture and skills bases of the print and publishing industries remain quite separate compared to the emerging industries created by the World Wide Web. Printing is a craft-based industry, defined primarily as a manufacturing industry. Publishing is an artisan-based industry, defined primarily as a creative industry. The World Wide Web is considered an IT industry, along with the related multimedia, software and hardware sectors.

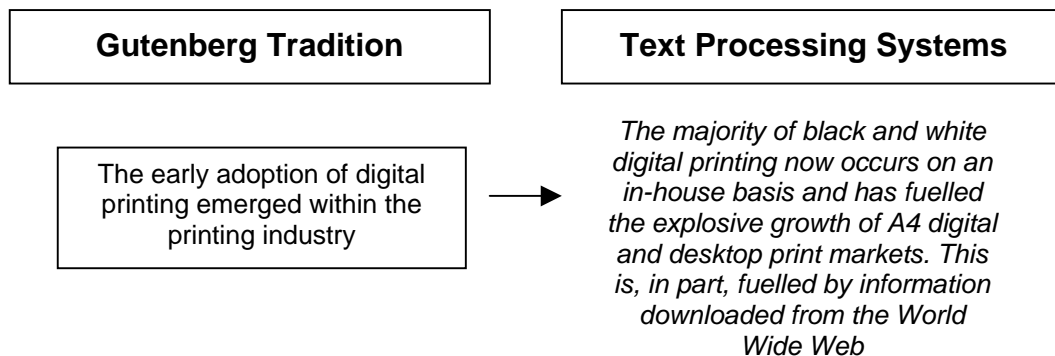
It is important to understand these divergent worlds if the opportunities arising from the adoption of digital technologies and new types of unique identifier systems (such as DOI infrastructure) are to be realised. For example, the print and finishing industries must understand the importance of metadata and interoperability of data transmission over the web. The publishing industries must also accommodate metadata management, but they further need to understand that failure to embrace new business models, based on end user behaviour, might cause their slow demise. Multimedia companies need to understand the behaviour of readers who are the product of current print-based literacy/education system. Software companies have the challenge of enabling connections between these domains of industry practice but in a way that builds value and flexibility.

Early signs of commercial realities

The early impacts of the digital revolution on the book industry are making traditional industry stakeholders nervous. Two examples follow.

The digital printing sector

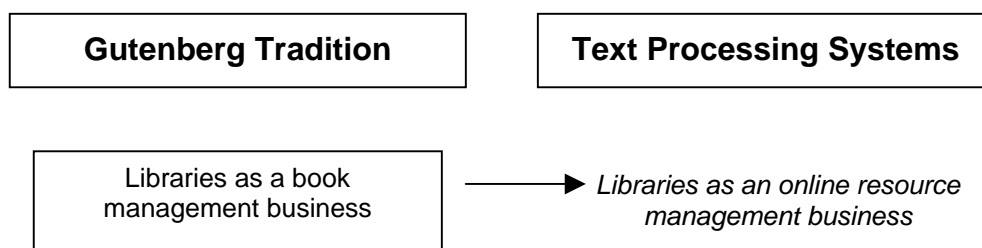
There was substantial early uptake of digital printing technologies in the commercial print market.



For those that remain in the print segment, there is now substantial market pressure for consolidation of activities.

The publishing-library sector

The recent trend by selected global publishers to secure copyright control over large amounts of content is impacting in many different ways. For example, library budgets are increasingly being spent on licensed digital content rather than purchasing traditional books. The issue of archiving has therefore arisen because users only have access to content through libraries as long as the licence fees are paid. When licence fees are not paid, access is denied. This is very different from purchasing a book and placing it on a library shelf.



THE CAL DOI pilot project

CAL's DOI project has its origins in two separate streams of inquiry. These are:

- The outcomes of previous EPICS-sponsored projects; and
- New opportunities created through the application of workflow reform for the print and publishing industries.

Previous EPICS projects

The support for the DOI project is an acknowledgement that Australia's print and publishing industries need to investigate new opportunities arising from changing requirements of users of book content and users' adoption of the Internet as a resource discovery and resource management tool.

The origins of support for the DOI project lie in two other EPICS-sponsored initiatives – the Creator to Consumer (C2C) project and the multi-channel publishing project. The C2C project was a pioneering venture established with the necessary intellectual leadership to develop a new type of book production supply chain based on the adoption and application of digital technologies.

One of the important findings of the C2C project was the realisation that books can become necessary parts of product service systems and are not best understood and measured as discrete products. For example, coursepacks are part of a product service system connected with the delivery of education services. The consumer is the student, the student is a user of text-content and pays for the use of this content as part of his or her education costs. The notion of a product service system has also highlighted that the substantial capital required for investment in new technologies is likely to emerge from related industries (i.e. from the wealth generated by the product service system) rather than from the book production industry itself.

The multi-channel publishing project (MCP) built on the pioneering work of the C2C initiative investigated the opportunities and challenges arising from digital printing within Australia's book production industry. One of the outcomes articulated by the MCP was the need for new types of infrastructure to assist users of text-content to:

- Find the content they want;
- Verify the quality of available content;
- Access the content in the appropriate formats (print or electronic) which includes acknowledging the rights of content creators and paying for the content; and
- Segment the content so users can select required sections and aggregate them into customised products.

These types of user requirements are in line with what, in principle, DOI infrastructure has the potential to deliver.

In this paper, the definition of a user is “reader” as user. The reader is everywhere and anybody: it does not follow that the focus on the reader is necessarily a focus on the customer, i.e. on the students themselves. For example, in a school the reader is as much the principal as it is the teachers, students or curriculum coordinators. New modes of work and reading are about helping everyone to access content in the format and the time required. In this sense, the process of reading does not necessarily have a product focus, for it is beyond the traditional world of publishing books. It is about creating shared contexts between creators and publishers, between creators and contributors and between commissioning editors and creators, with an underlying focus on the reader as user of content. It is about the processes of managing content as part of a product service system.

New business opportunities based on workflow reform

Growth of in-house and desktop printing

The exchange of all types of content over the Internet has fuelled substantial growth in the global desktop and in-house printing markets.

It was conceived from the outset that the DOI project would aim to facilitate integration of the printing and finishing services into Australia’s DOI infrastructure. In this way, the print and finishing sectors would be in a position to offer value-added solutions at competitive rates, thereby providing services that are not available at the present time.

Photocopying and digital printing

The photocopying market in Australian universities is estimated to be worth well over \$100 million. Negotiation of agreements and the administration and distribution of payments to rightsholders in this market is a complex business for which CAL has significant national responsibility.

The practice of scanning content for university coursepacks is further evidence that the analogue world of photocopying is slowly being turned into a content management, digital workflow and rights management business.

Global business opportunities

The aggregate value and volume of finished books which are brought into Australia is substantial. These books are currently imported on a large volume or special order (small volume) basis. There is significant potential for re-engineering the distribution mechanisms for such books by importing electronic files and printing the books locally. Other value-added services such as attaching library call numbers on these books must now be seen as a major market opportunity.

The DOI infrastructure was always conceived to have the potential to substantially increase the efficiency of establishing these customised order fulfilment systems in Australia.

The print and finishing industries and DOI infrastructure

DOI infrastructure facilitates focus on content users

Users of content are everywhere, for example, students, workers and consumers reading for pleasure. Users also include teachers and lecturers who act on behalf of students and who have control over what content is selected. The DOI system offers a user-centric approach to accessing content as outlined below.

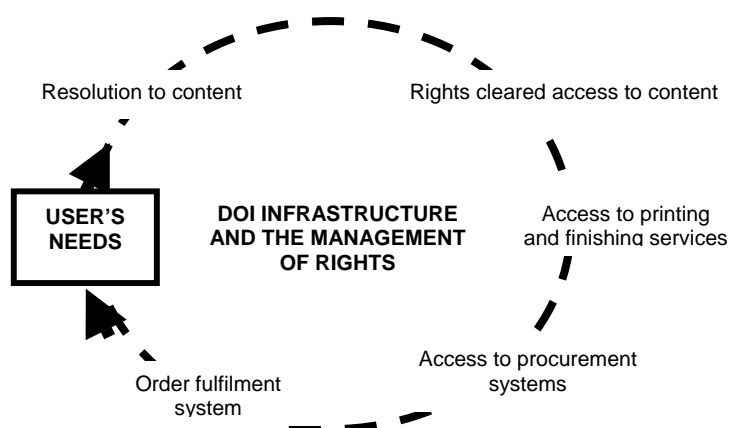


Figure 1: DOI infrastructure facilitates a focus on user needs

It is clear that using the Internet as a supply chain tool within Australia's print and publishing industries has the potential to better service the requirements of end users. Two examples follow.

Users want bits of content

End users (including teachers or lecturers who act on behalf of students) may only have an interest in small chunks of content: these might be chapters, diagrams, or articles. CAL's DOI pilot project was built on the need to deliver coursepacks to university students.

Users would benefit from improved order fulfilment services

New types of order fulfilment systems based on local print-on-demand (such as the printing of materials purchased via Amazon.com), have the capacity to improve services for users. Firstly, delivery times could be drastically reduced by importing the file electronically and printing locally. Secondly, the expense of airfreight can largely be eliminated from the cost of this type of business activity.

Users once went to libraries to do their photocopying. Now they are increasingly able to order material over the web, select an order fulfilment outlet and then pick up the finished material at a print shop or even a bookshop.

Strategies required to service end users more effectively

Enterprise-based capabilities

Opportunities which become available through DOI infrastructure will force print and finishing enterprises to embrace new types of capabilities (see Part 2 of this paper for a more detailed discussion of these issues). At the heart of these new capabilities is the need to automate as many types of processes as possible. This will include:

- Understanding and agreeing to different types of print management information called print metadata.
- Using this metadata as a basis for establishing online ordering systems with features that automate the quotation, order entry, plant scheduling and logistics management systems.
- Aligning this production-based metadata with data fields used within enterprise resource planning (ERP) systems to achieve high levels of process automation. This is the basis of the new print industry standard called the job definition format (JDF).
- Embracing variable print and finishing capabilities for small order quantities (tailored warehousing and logistics solutions for one order through to 50+ quantities). When importing overseas titles, libraries may also require customised case binding requirements.

It is possible that in the future DOI numbers will become the basis for building job tickets – from creation of content through to the tracking of usage. In this way, DOIs have the potential to replicate bar code numbers in a digital environment to track product flows along an analogue supply chain.

To achieve these types of competencies, representatives of the chain need to articulate their supply requirements. In the case of the 'coursepack' community, CAL has worked with university lecturers, publishers, print management centres and software vendors. Agreements about the standardisation of paper sizes and digital file formats are an integral part of this endeavour. One of the objectives of CAL's DOI project has been to manage these negotiation processes.

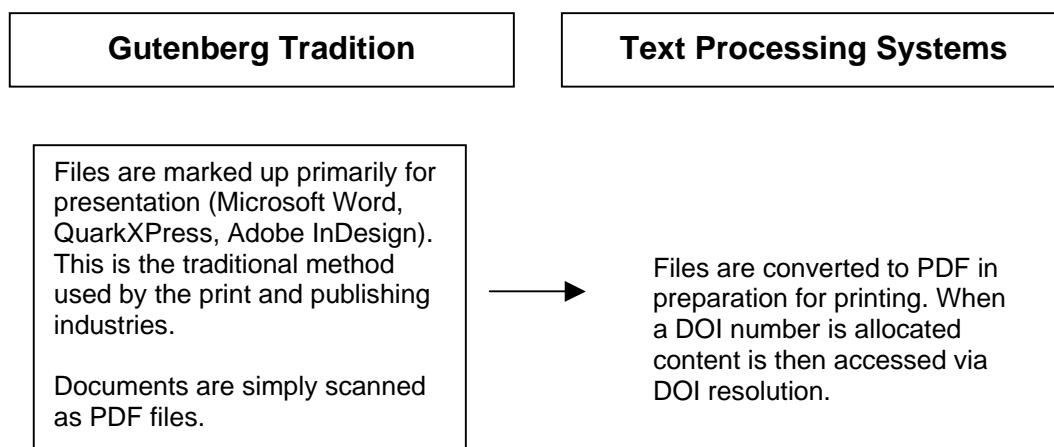
But other than these enterprise-based capabilities, experience from the EPICS scheme has shown the need to understand two different types of workflow in order to maximise opportunities associated with DOI infrastructure.

- Workflow based on content derived from traditional production environments.
- Workflow based on content derived from text-data marked up according to the structure and semantics of the content.

Current and long-term workflow considerations

To consider the issue of workflow management, it is best to return to the two different industrial streams referred to at the start of this paper. The discussion on workflow is summarised thus:

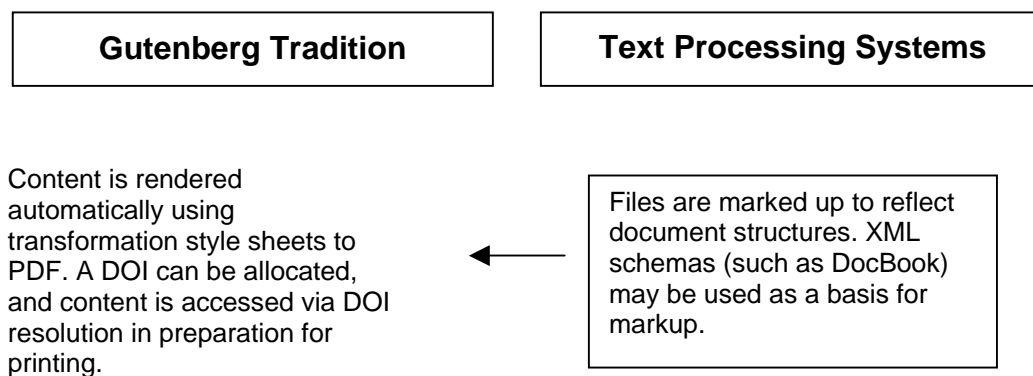
A. Traditional workflow



The problem with traditional workflow

When bits of content are disaggregated from source documents (i.e. a chapter is requested from one source) and then re-aggregated with content from multiple sources, it is not possible to render the aggregated content with the same presentation format. This can only be done by completely reworking the content within the native files. The cost of doing this is prohibitive, so the final products have different format presentations scattered through the re-aggregated content.

B. Workflow derived from structured content (XML)



The benefits of structured content

Content from multiple sources can be disaggregated and re-aggregated using structured file formats and then rendered to PDF using transformation style sheets. This ensures consistency of format presentation between documents sourced from multiple sources. Choices of paper formats or text formats become irrelevant.

The challenges of workflow based on structured content

The biggest difficulty about structured content workflow is that the process of marking up content according to its information structure requires a total redesign of the way text-based industries currently work. Parts of these workflow processes are already being pioneered in the publishing industries, but it will take some time for these to be unified in a fully automated end-to-end workflow.

Scoping of opportunities based on traditional workflow

The opportunities available based on traditional workflows can be categorised in two ways.

- Business-to-business models; and
- Business-to-consumer models.

Business to business models

Centralised and decentralised pre-media and content packaging services

In the coursepack market, the subject of CAL's EPICS project, there is a level of pre-media services, including content packaging, required.

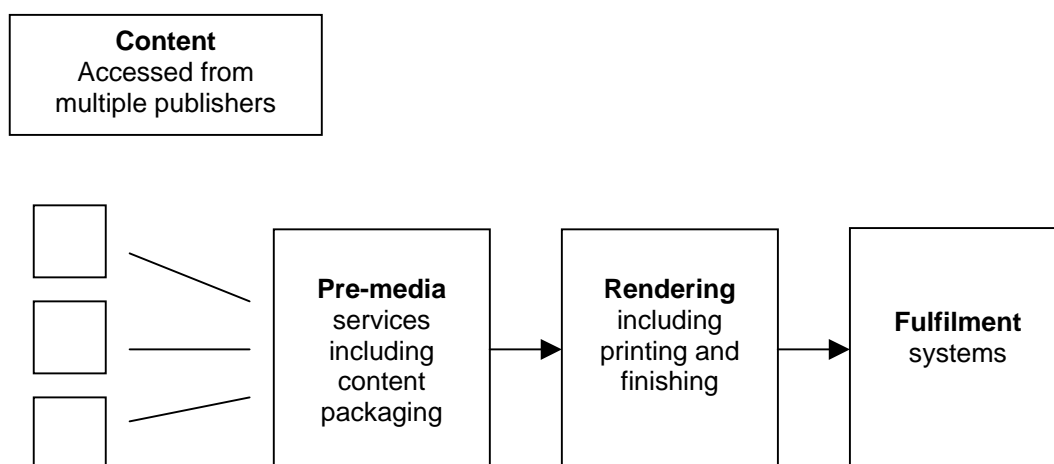


Figure 2. The role of pre-media services in content packaging

These types of services can be carried out on a highly decentralised basis, that is, inside the print rooms (or bookshops) of individual universities or TAFE colleges. The services could also be centralised based on service agreements with a number of institutions. Dispatch could be arranged through businesses such as Australia Post with 24-48 hours.

The services are defined as a business-to-business model because institutions would bill students separately for coursepack material and the cost of their education and training services. In this way, education providers and publishers would have increased certainty regarding revenue collection and distribution activities. This would also increase the ease of calculating copyright royalties compared to the current system.

Franchising or licensing opportunities

Where the decentralisation of pre-media services is preferable (e.g. inhouse print rooms), there exists potential to franchise technology and production systems on an in-house basis or via private sector agreements. The systems would facilitate the ability to manage 'rights cleared' content using the DOI infrastructure. Such types of franchising agreements already exist in the mainstream printing industry (but are not yet part of DOI infrastructure).

These technology systems would include provisions to monitor photocopying and content usage at the institution level, thereby ensuring much higher levels of compliance with copyright management processes.

Global-local production coordination for large orders

Using the DOI resolution service, book production companies have the potential to expand their ability to import 'rights cleared' digital content from overseas for local production. In this way, global publishers are more likely to better match demand-supply equations, saving excessive over-production costs.

Business to consumer models

On-demand book production and logistics solutions

DOI infrastructure has the potential to expand opportunities in the business-to-consumer environment. Two examples follow.

A. Local manufacture of special (small quantity) orders

Anecdotal evidence provided by Australian library suppliers suggests that a market currently exists for the importation of small quantities of single books. Equally, library suppliers themselves purchase books in small but substantial volumes and currently these are fulfilled via costly global distribution networks.

DOI infrastructure has the potential to expand opportunities for these types of product lines to be printed locally and dispatched to consumers through the post. CAL is currently cooperating with Sydney University Press to pioneer this production model using the Australian Classic Works series as content for the pilot.

B. User-pays coursepack models

In situations where institutions are not prepared to centralise billing systems for payment of coursepack materials, services can be set up to deliver appropriate course content on a user-pays basis. In other words, students pay for access to content.

Long-term workflow challenges for structured content models

Coordination of hub centre workflow

DOI infrastructure might ultimately become a tool through which whole-chain workflow is coordinated. There are three types of hub centre activities that are likely to result in the digitisation of workflow.

- Content creation workflow
- Content rendering workflow
- Marketing support workflow including e-procurement

Across all these types of workflow, the need for whole-of-chain metadata transfer (and interoperability) will become increasingly evident.

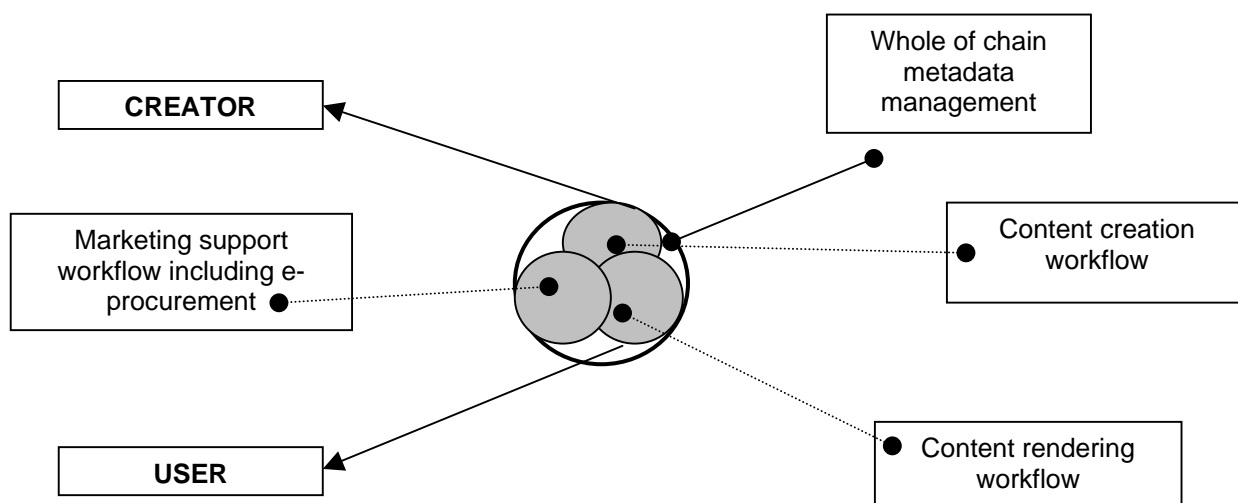


Figure 3. Workflow coordination between creators and users

This workflow model is described in more detail in the Appendix attached to this paper.

Content creation workflow

Software solutions are already emerging to support fully digitised workflow involving unpublished works, development of publishing proposals, negotiation of copyright contracts, development of drafts including peer review and other types of quality assurance mechanisms.

With the likely shift towards structured content, an opportunity also exists for the development of tools to support new ways of authoring content in a standards compliant environment (beyond what is current done in SGML). These tools might also have the potential to allocate DOIs as content is developed at the work, chapter, paragraph and diagram levels.

Content rendering workflow

The need to render all types of content to different output formats, of which print is one option, will increase. These services should be sufficiently robust to support workflow from both structured and unstructured content because the shift towards structured content workflow will not happen immediately. PDF formats are likely to remain important for some time, but other technologies such as scalable vector graphics (SVG) might also become available to overcome some of the difficulties of PDF file transmission.

Considerable work will be required to render content to different format devices. Lessons from the mobile phone market are likely to be helpful in this domain of activity.

Marketing support workflow including e-procurement

There are many elements to this type of hub centre workflow, including:

- The need to provide resource discovery metadata
- Establishment of e-catalogues
- Logistics management to support order fulfilment
- Distribution of royalties

Resource discovery

The provision of resource discovery metadata (i.e. data that populates online bookstores or library databases, etc) is an increasingly important part of providing online and print-based solutions. The purpose of providing this metadata is so users can discover resources according to their specific requirements. For example, the uploading of metadata to online retailers such as Amazon.com might become an important mechanism to market different types of new books.

E-catalogues

Once content is discovered, efforts need to be made to provide the means to make buying decisions. This is usually done through the development of online catalogues.

Logistics

Ordering systems are already being established to provide users with options regarding logistics. For example, users might want to order over the Internet and collect materials from printers located in bookshops, local print businesses or via direct mail. In the case of education institutions (schools, universities, TAFE colleges), the ability to facilitate metadata transactions between print rooms, departments responsible for copyright clearance and administration divisions (responsible for student enrolment information) is likely to be very important. It will also be important for the MIS systems of bookshops and the administration departments of universities or TAFE colleges to be compatible. This issue is very relevant to organisations such as Australia's Cooperative Bookshop chain.

Royalty distribution workflow

In the future, the print management software systems that control workflow are likely to be able to incorporate the calculation and distribution of copyright royalties. Distribution of such royalties could be done in partnership with copyright organisations such as CAL.

The coordination of hub centre workflow is likely to prove quite complex and may require solutions based on cross functional approaches to work. This might require new departments to be formed within universities. The Learning Resource Materials publishing centres that exist within many of Australia's distance education universities are likely to provide structured work models that can be used across all universities.

Whole-of-chain metadata management

With a shift towards digital workflow hub centres, the practice of metadata management will become increasingly important. Rights management metadata will be an essential part of this workflow and DOI infrastructure is likely to play an important role. But other types of metadata harvesting will also be required (including rendering, e-commerce and resource discovery metadata). This topic is addressed below.

Interfaces between workflow hub centres

The transfer of content and metadata from one hub centre to another in automated ways is likely to pose significant innovation challenges. But for an industry embracing the need for lower order run lengths, this is a challenge that has to be addressed to maintain the viability of operations.

To achieve maximum levels of process automation, new types of information architectures will need to be designed. This topic is addressed below.

Franchising of software and other types of solutions

The franchising of workflow systems (encompassing software and equipment) is emerging as a growth market in the Australian print industry. There is potential to create hybrid business models with print shops attached to bookshops or libraries. Libraries might become supply chain managers through their knowledge of metadata and interest in coordinating peer review processes (and by default becoming new models for university publishing). These types of business models are encouraging because they have the potential to reinforce the highly distributed and decentralised nature of print management service delivery across the board.

The possibility of franchising software solutions to coordinate workflow in the education sector is worthy of detailed analysis. At the moment, print rooms within universities are treated as infrastructure belonging to each individual university. But there could clearly be substantial benefits if print management solutions, particularly workflow solutions, were to be shared between

institutions because this will make better use of university assets. This issue is sufficiently significant to warrant discussion in the Australian Vice Chancellors Committee as it is the same infrastructure that is required for the management of copyright in a digital environment. There is the potential to create a distributed, trusted third party business model that might, in principle, provide sufficient certainty for publishers to access new revenue streams generated from university print rooms or trusted third-party commercial printers.

Design and implementation of new information architectures

To support the introduction of DOI infrastructure, high levels of process automation (from creator to user) will be required. New types of information architectures will need to be designed and implemented. The design elements of these architectures should take into account:

- structure of content (creator-publisher workflow);
- presentation of content (rendering workflow); and
- design of forms and data collected and managed to describe, discover and access content (resource discovery, royalty distribution and logistics workflow).

It is possible to embrace these types of information architectures on an incremental basis. For example, some organisations might perceive value in addressing metadata interoperability strategies prior to dealing with reforms associated with the structuring of content. In contrast, some organisations might see merit in reforming the ways in which content is developed prior to focusing on metadata interoperability. Alternatively, organisations might see merit in completely outsourcing services to gain instant access to whole-of-chain workflow innovation techniques.

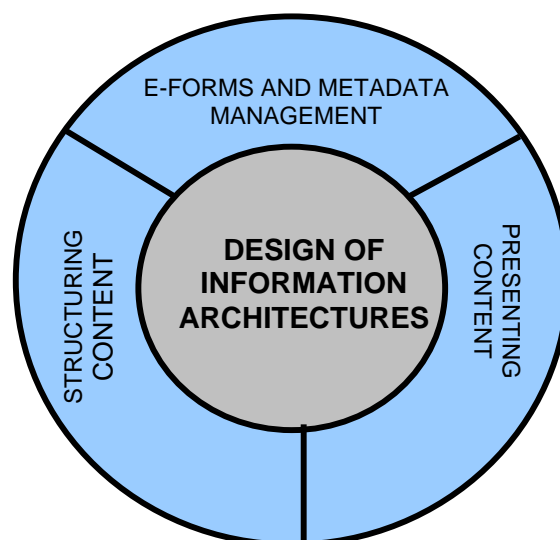


Figure 4: The design components of new information architectures to support automated workflow from creator to user

The standards that relate to these information architecture design elements are beginning to stabilise. For example, there are already XML schemas and other approaches to structuring text (but very few of these are used in Australia's book production industry). For rendering content there are already print rendering standards, e.g. the job definition format (JDF), fonts and typography and electronic rendering standards.

In the world of metadata management there are a wide range of standards encompassing B2B (such as ONIX or the ebXML movement), cataloguing, education and digital rights standards. Some of these types of standards are beginning to be understood and implemented in Australia. Further consultation with current stakeholders is needed to develop interim and evolving schemas.

To facilitate total process automation across the value chain from creator to user, there will be a need to focus on the challenge of interoperability in ways beyond what is being done in the higher education sector. The challenge of interoperability therefore needs to be designed around the current behaviour of end users. **Readers, acting as users of content, need to become the centre of everything.** In other words, dialogue about interoperability needs to be a user-centric conversation.

But this is not a straightforward conversation. It can only be done within the context of the book industry becoming integrated with the infrastructure and standards arising from the World Wide Web (and the XML schemas being negotiated within this framework such as JDF/CIP4). For example, publishers have need for specific types of data (ONIX) to support efficient e-commerce transactions. But librarians describe their worlds in completely different ways (enshrined in their library standard MARC), so ONIX compliant data is not likely to be useful to librarians. The challenge here is a semantic one. Different professions describe their worlds in different ways. For printers this means, for example, *can ONIX metadata be treated so that this same data is converted to machine-readable CIP4 compliant metadata?* This ensures that no re-keying of metadata is necessary at any point of the supply chain.

The solution to this problem is entirely dependent on the type of raw metadata originally inputted and subsequently distributed along the supply chain. This is a very difficult challenge.

Methodologies to assist with standards based interoperability are developing quite rapidly in the data processing industries. The development of the international ebXML movement (see <http://www.ebxml.org>) and the Australian national B-2-B register (see <http://www.bizdex.com.au>) provide examples of this. However, developments in the global "book" industry are less advanced probably because there are substantial challenges associated with integrating all elements of interoperability (including both the structuring and rendering of content, as well as the mapping of the metadata standards encompassing e-commerce, educational publishing including e-learning and library cataloguing). The development of the international data dictionary – iDD, is based on the ontology methodology owned by Rightscom (see <http://www.ontologyx.com/launchpr.pdf>). Ontologyx is an example of a UK based initiative that is focusing specifically on the infrastructure of text-based industries, including the book

industry. Interestingly, Australian thinking regarding the development of data dictionaries and ontologies appears to be more advanced than anywhere else because such thinking has focused on whole of chain workflow considerations, particularly the domains of structuring and rendering of content (including print) and the inclusion of many different global educational publishing and library cataloguing standards.

The author believes there is a need to systematically evaluate all types of approaches to interoperability, specifically as these relate to the integration of workflow between print-based and electronic publishing. The size of the global print market (estimated to be \$350 billion) warrants such attention.

However, any type of evaluation must focus on end user behaviour because it may well be that end users themselves require totally new approaches that have not as yet been designed or thought of.

Conclusion

The adoption in Australia of DOI infrastructure, as an agreed unique identifier standard, is likely to yield significant benefits. It offers a mechanism for ensuring principles of copyright management remain at the heart of our digital content industries. As the infrastructure becomes embedded within defined governance frameworks and is applied across a range of different industries, it will do much to ensure that access to all types of content remains cost competitive. The potential for this infrastructure to be used as a supply chain management tool across multiple industries is worthy of investigation.

However, the adoption of DOI infrastructure will not be without challenges. For example, new registration agencies are already interested in servicing Australian and other markets, which is likely to affect the ability to offer this service on an economically sustainable basis. At this stage, it is not clear that large Australian publishers will have sufficient self interest to embrace a transparent, open unique identifier infrastructure. In contrast, they may wish to retain their own supply chain systems in order to maximise the value of their content.

The willingness of publishers to embrace DOI infrastructure managed under a CAL governance framework is likely to become a crucial issue. It may well be that, over time, this type of infrastructure will be seen as an important part of the infrastructure of a transformed education and training sector. If so, rather than being championed by the interests and commercial needs of publishers, the emergence of DOI infrastructure could derive from new governance structures related to future-orientated education product service systems. Equally, there might be a need for this type of infrastructure within other knowledge industries that rely on text/image content management activities, such as the defence industries. There is a national imperative for these types of considerations to be discussed among a wide range of cultural institutions such as the National Library of Australia.

Whatever the outcome of these discussions, if the full benefits of the print and publishing industries' integration into the infrastructure of the World Wide Web are to be realised, the importance of the interoperability of digital content and metadata transmission along supply chains will require concerted attention. DOI infrastructure can provide a focus for debate about the best ways to do this. The types of XML schemas (standards) relevant to the book industry are beginning to stabilise. What will emerge will be the need to develop information architectures capable of facilitating content and data exchange across multiple standards including, for example, authoring, publishing, rendering, e-commerce, resource discovery, e-learning and library cataloguing standards.

Because of its complexity, copyright management in a digital environment has the potential to be a pivotal point of management for all content producing and consuming industries. The management of rights in a digital environment is not just a question of rights. It is also a question of how best to facilitate the uptake of standards-based workflow within print, publishing and other industries. It might also encourage sectors such as the multimedia industry to realise that the print and publishing industries still provide the bulk of content management and

order fulfilment services for users of book content in education and other sectors.

As part of the process of introducing DOI infrastructure, four strategies are suggested with respect to the print, publishing and education sectors.

Linking end user behaviour with teaching practice

At present, some monies are being channelled into developing digital learning objects through the education sector. It appears this government funding is being accessed primarily by the multimedia sectors, although end user behaviour (i.e. the student as reader) is still largely based on print/publishing rendering output services such as printed materials. As a result, the anecdotal evidence suggests that the vast majority of current teaching and learning practices rely on print-based learning paradigms, although new types of pedagogical practice are drawing on the positive use of computers and hypertext technologies. At the moment, workflow management between content published in an HTML environment versus content published for print – and the management of copyright – is still to be fully and adequately resolved.

Within this context, there is a substantial opportunity to enhance the quality of learning and teaching practices by supporting content development funding models that truly reflect trends in end user behaviour. This could be achieved through the framing of tender specifications so that they include the positive ways in which end users are currently being serviced by the print and publishing industries. But equally, like other industries, the print and publishing industries should be given the chance to reform their services based on trends in teaching and learning practice and the application of new technologies that support these practices. One way to achieve this is through tender specifications and the documentation of appropriate tender output and outcome statements. In this way, completely new hybrid print/publishing/multimedia service delivery mechanisms might be facilitated.

Education and consultation campaign

There appears to be a need to consult with the Australian library sector, particularly within higher education circles. This is so the education sector will be able to specify to equipment vendors the types of functionalities required to support the interest of end users in the future. DOI infrastructure requirements might be one element of such specifications. The need to embrace standards-based workflow that encompasses the whole chain must be part of this education campaign. Such standards are likely to relate to content structuring (for example, different XML schemas and other approaches to structuring text), content rendering (print rendering, fonts and typography and electronic rendering standards) and metadata management standards encompassing B2B (such as ONIX or even the ebXML movement), cataloguing, education and digital rights standards.

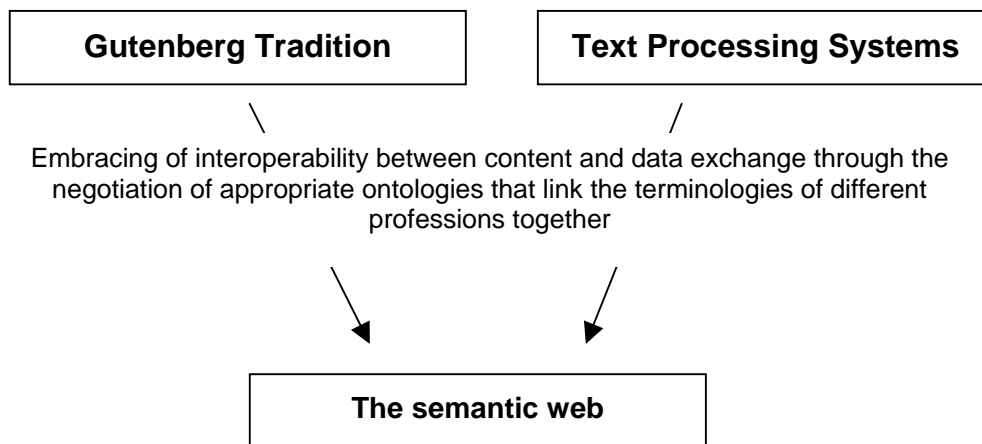
Governance

If education and consultation campaigns are supported, agreement needs to be reached about how these campaigns can be implemented. At base level this would involve collaborative frameworks where DOI infrastructure should play a part.

Cross industry collaboration

The print, publishing and education industries are all enabling industries. Because information and communication technologies (ICT) are being adopted as important supply chain and productivity improvement tools across the board, what happens in the domain of standards and interoperability within the education sector is likely to have major flow-on effects in other industries, particularly in the first instance within the print and publishing industries. As a result, major innovation outcomes could be achieved by establishing alliances and cross-sectoral collaborations with the education, print, publishing and graphic arts industries.

As conversations about such matters expand, unique identifier infrastructure should necessarily involve the adoption of appropriate ontologies that link the terminologies and discourse of different professions together. This, in fact, is about the future of the World Wide Web as it, in turn, migrates into the emerging semantic web.



The rise of the semantic web is likely to be a long and challenging journey. But the place of the book production industry must be secured early on in this journey.. Alan Turing's famous pioneering work (referred to on page [to insert]) focused on finding algorithmic patterns so that underlying words and meanings could be derived from encrypted data.

This must surely remind us all that as Gutenberg's book world continues to be integrated with computer networking, the World Wide Web and the emerging semantic web, we must not lose sight that what really matters are words, their meanings and the wisdom that can be derived from both.

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About the author

Richard Vines is a consultant to the Printing Industries Association of Australia on matters related to the Enhanced Printing Industries Competitiveness Scheme (EPICS), a Federal Government program administered by the Department of Industry, Tourism and Resources. In this role he has accessed unique insights into the day-to-day issues confronting the printing and publishing industries, including the book binding, pre-media, Internet and IT, bookselling and equipment vendor sectors that support Australia's book production industry. Richard is Director of Project Lessons, which provides consultancies for large-scale (between A\$50 million and A\$800 million) projects. He implemented a number of industry development consultancies focusing on sub-sectors within the horticultural and forest product industries for the Australian Chamber of Manufactures. From 1993 to 1998, he was Program Manager for the Monash-ANZ Centre for International Briefing, responsible for briefing global managers and their families taking up managerial and technical positions in overseas countries. From 1988 to 1992, he was a Trade Development-Public Affairs Officer for the Japan External Trade Organisation (JETRO). He was also a Board member of the Australian Dried Fruits Research and Development Council. For EPICS related matters, Richard can be contacted at: richard@printnet.com.au.

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PART TWO

Opportunities and challenges for Australia's print industry vendors

Part two of this paper identifies the opportunities that DOI offers print vendor manufacturers and other companies in related fields.

What follows is an example of a business process workflow for the purpose of definition, illustration and debate.

To support the reasoning given in other parts of this paper for the structural changes the print industry is likely to undergo in the future, currently print managers are experiencing:

- Shorter print runs. Up to 75% of print jobs are for quantities less than 5,000. (Source: Strategies for Management Commercial Print 2010).
- Shorter output times. By 2005, 33% of print jobs will be required within 24 hours. (Source: Dialog, Frank Romano, RIT, June 2001).

These trends indicate that where total print volume remains the same, the number of jobs per day is rising and the average size of the jobs is falling. These jobs also have to be delivered faster. In addition to the considerable strain on production processes, this manifests itself as a rise in administration costs and therefore a reduction in profitability.

When work becomes available through digital print-ready content identified using DOI, it will potentially further increase the number of jobs going through print shops with the associated reduction in profits. So while DOI may be seen as a benefit to the end user and others in the chain, printers will have to manage their processes better. They will have to bring their administration costs under control to make these new processes work for them.

A key technology here is JDF or CIP4 (see www.cip4.org or www.ngpppartners.org). This is the emerging print rendering standard that is likely to be adopted by the print industry in the coming years. This paper will not cover this technology except to describe it as an XML job ticket standard. It is designed to be an end-to-end aid to reduce print administration costs and give better reporting on real versus quoted costs. For the purposes of this paper, JDF techniques are assumed to be without process automation. It is difficult to see how printers can remain profitable with the ever growing volume of shorter run lengths.

Print industry vendors are well aware of these arguments and most recognise the need for these techniques and quasi-standards. Vendors see these new functionality requirements as opportunities to upgrade equipment and provide better solutions to their customers and prospects. But equally, new skills and knowledge will be required on their part so increasing automation will also be a journey for equipment vendors.

The CAL-DOI Coursepack business process workflow

The assumption behind the CAL DOI Coursepack model outlined below is that workflow is built on principles of standards compliance such as the adoption of JDF (CIP4). This model is a subsection of a wider workflow model outlined at the end of this paper and also discussed in Part 1 of this paper.

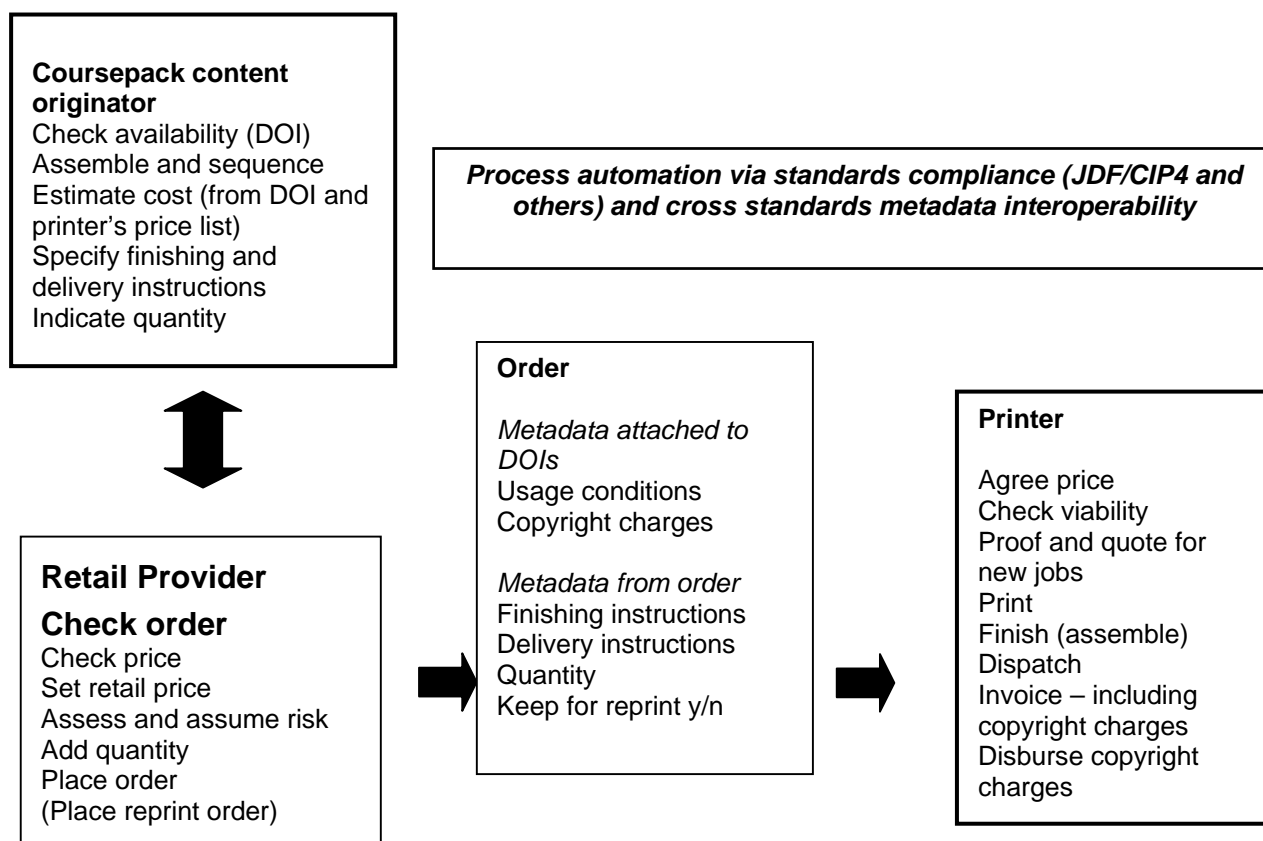


Figure 1: Example of a workflow built on the foundations of DOI infrastructure

Definitions for this model

End user / reader: not shown on the diagram, but for this model the end user is the student

Coursepack content originator: Most probably the lecturer or lecturer's assistant. The coursepack content is chosen from rights-cleared DOI content and from other sources (such as the lecturer's own material). Sequencing, finishing (such as covers, binding etc), delivery address, date required, etc would also be defined by the content originator. The total number of students could also be included but that may not be the quantity initially (or subsequently) printed. Decisions about quantity are taken by the retail provider.

Retail provider: Could be a bookshop, the printer or even a university faculty. In Australian universities a number of models exist with a variety of charging methods from 'free' to 'production cost' to 'profit' (usually for a faculty). Whoever assumes this role assumes the risk on the production quantity; to order more if needed and to take responsibility for over-production. (Note: in this model, copyright charges are made on production quantities, not retail sale quantities.)

Order: This is assumed to be a JDF/CIP4 compliant instruction. The assumption is that the DOI will eventually hold print instructions and print conditions.

For example, any one publisher may insist that their work is preceded by their logo on a right-hand, single-sided page. They may then specify that the rest of the work must be double-sided but the first page of the work must be on a right-hand page and so on. In this example the DOIs will come with their own metadata which should/must be obeyed. As a coursepack may contain works from many publishers, the overall coursepack metadata should/must be obeyed. Decisions on conflicts should be fairly rare, but in the initial stages will have to be resolved by all concerned, sometimes referring back to the publisher to obtain a change in permissible finishing options.

Printer: The JDF/CIP4 job ticket and DOI (either listed or included) should be part of an agreed partnership with the retail provider.

There should be no surprises and the process should run with as little friction as possible. Software should eventually check the price and viability of the document (for conflicting print instructions, conflicting paper stocks, etc) and the job should flow through the print factory to completion. The invoice to the retail provider would include the copyright charges, which in this example, are assumed to be per page, per copy (this might be different for each DOI). The printer would report usage back to CAL, which would distribute royalty payment to authors/publishers using the details of the content identified by the DOI.

Printers consulted about this process see no difficulty. To them it is just another line item, and another analysis they need to provide.

"Keep for reprint" is a key process. It should be much more profitable for the printer than a newly created job but an effort must be made during the design process to take care of such work. During the 'reprint cycle' processes need to be defined to make sure the DOI print objects have not been superseded by new versions.

Requirements needed to meet this model

Printers

- Adopt and constantly refine new techniques such as JDF to bring administration costs under control.
- Form partnerships with retail providers to reduce friction during the production process. This will include the development of web-enabled ordering, and re-ordering systems and progress reporting systems. These systems must be developed in partnership with retail providers to be effective and help ongoing refinement.
- Review investment decisions on equipment to streamline job flow, job reporting and profitability analysis (JDF/CIP4).
- Institute an R&D budget to make the best use of the new techniques and advise on future investment and markets.

Print industry vendors

- Provide advice and services to help install and refine new workflows beyond marketing messages and sell new hardware. Many vendors can now bundle workflow software and many will claim a marketing advantage from their alliances. All vendors are members of the relevant JDF/CIP4 associations and all have strategies on these issues.

Administration and workflow systems vendors

- With everything becoming tighter and less forgiving, it is possible that the workflow and administration software vendors are likely to become the dominant players.
- The current hardware print industry vendors could play this role.
- These software systems can be continually refined to great effect. Print engine and other hardware refinements are limited in their effect on profitability.
- As was emphasised previously, these systems might become vehicles for major consolidation of workflow management through new franchising business arrangements.

Current print vendor business models and likely approaches to DOI

In general, all hardware print vendors are dependent on the number of devices they sell in any one year rather than other services or software they may market. For the foreseeable future, this will remain the norm.

Software and services, while profitable, are not viewed as the main game. The sale profitability of the hardware devices is a key issue for vendors. There is little point in running with very low margins in a low volume market. They will also avoid giving away services or other add-ons if they can. Although this may help sell hardware in the short term, it makes future sales and upgrades very difficult and distorts the market for current customers. As with any market there are the high price, high value-add vendors and the low price basic suppliers. The former will see DOI as an add-on to counter the cheaper competition.

From the printers' point of view, amortisation times are dropping as they realise that today's new machines are not going to be profitable for five years and should probably be replaced in three.

The number of potential machine sales to the same customer base should rise over the next few years, driven by obsolescence. The vendor's customer base should, and probably will, demand better workflow solutions and better integration to maintain and improve profitability.

The net result of this should be increasingly sophisticated workflow solutions and services to the end users for those printers that survive. In fact, sophisticated software and improving processes are necessary for survival.

As DOI reaches a critical mass, it will become one of the value-added features that vendors will claim to have special knowledge of and the tools to implement. Once that happens, it can be expected that a whole segment (e.g. higher education) would be hit by a marketing campaign to highlight this advantage. Such an action would reinforce the DOI message.

To reach critical mass, there must first be reference accounts and reference workflows to look at because theoretical business models do not work in this market.

Quotes from vendors about strategy

Fuji Xerox, Heidelberg and Océ all see DOI as an important technology to help them in their strategic initiatives, especially in the education sector. For example:

“Océ has been committed to working in the education market for many years and sees this project as being very beneficial towards supplying end users with the right information when required whilst protecting the interests of the information owners. Océ believes that by employing the structured framework of our consultancy methodology we can assist education print providers analyse their operations, define system solutions and market their print product and other services. It’s all about the customer’s total business processes, not just the printing.”

*Tim Saleeba, Marketing Manager,
Digital Document Systems, Océ-Australia Limited.*

Catalysts for vendors and printers

Print industry vendors operate in a worldwide market and as such, Australia does not count for much in terms of global sales. However, local vendors are very competitive and inventive, so most will take notice of DOI and invest time and energy to understand it and its implications.

In spite of the industry being driven by the prospect of more sales from obsolescence, the industry as a whole is expected to shrink. The number of print companies has been decreasing for some time and this trend will probably accelerate in the coming years.

The effects of this are:

1. There is considerable fear among printers about their survival. This includes in-plant printeries such as university print shops who view the future with trepidation. They believe they will not survive another cut in university spending and will be outsourced. Fear, however, is a powerful driver, and DOI may be seen by some as a lifeline for future survival – and they may be right. Print production vendors will help printers consider their choices, on the basis that they may either lose the installation completely or take a major order.
2. Print industry vendors are well aware that they are dealing with a shrinking customer base. Understandably, some are pursuing a ‘market share’ strategy to maintain their position against competition, although this normally results in price cuts. More intelligent buyers, however, will insist on value and technology.

Timelines

Looking at the higher education sector, a critical period in the production timeline is the turn of the year when course notes are put together for the start of the new semester in January/February. If DOI infrastructure was implemented in a couple of universities so they could prepare course material, they could become examples for others to follow.

As far as timing is concerned, it is suggested that the technology is rolled out to these early adopters in 2005. Installation can take place in the remaining universities in 2006. Meanwhile, other players are likely to appear, some even as competitors to in-house university printeries, others as suppliers to specialist bookshops and so on.

If the technology is simple and the content is available, it is almost certain that some printers will reinvent themselves to participate in the new workflow system. However, the processes must be faultless for the whole chain to take shape.

The key here is the building of credible sites. For universities, the 'DOI evangelists' would be academics rather than printers and their suppliers, although they would be fierce supporters. Bookshops could also become major influencers if a number of them demonstrated viable business models, and there is one determined to do so, even without DOI.

However, process automation is necessary for DOI to scale to critical mass. Without automation, DOI will be identified as a cause of failure and disruption.

Risks

Here is an assessment of the risks for the different players in the chain.

Publishers: Payment levels aside, the risk to the publisher is that which comes from commissioning work in the first instance. Others will assume production risks; in this model, it is the retail provider. From the publisher's point of view, logistics will become software logistics and storage will become software storage for works in this particular chain. These changes will fundamentally alter the business models for these works.

Coursepack content originators: No risk in this model, although there are variances when some faculties have processes designed to make money from coursepack production. They will probably have to come to an arrangement with the retail provider or assume the retail provider role themselves.

Retail providers: Assumes all the production risks; to order more if needed and to take responsibility for over-production when it occurs. (Note: in this model, copyright charges are made on production quantities, not retail sale quantities).

Printers: No risks, but they must constantly refine processes and come to terms with more automation. Manual shortcuts will not scale.

DOI workflow management model from creator to user

For discussion of this model see Coordination of hub centre workflow on page 25.

