The current issue and full text archive of this journal is available at
www.emeraldinsight.com/0737-8831.htm

Received 30 December 2007
Revised 11 April 2008
Accepted 26 April 2008

THEME ARTICLE

Modeling the digital content landscape in universities

Paul Conway
School of Information, University of Michigan, Ann Arbor, Michigan, USA

Abstract

Purpose – Digital content is a common denominator that underlies all discussions on scholarly communication, digital preservation, and asset management. This past decade has seen a distinctive evolution in thinking among stakeholders on how to assemble, care for, deliver, and ultimately preserve digital resources in a college and university environment. At first, institutional repositories promised both a technical infrastructure and a policy framework for the active management of scholarly publications. Now other approaches that take a broader view of digital content hold sway, the result being confusion rather than clarity about where digital content originates, who the stakeholders are, and how to establish and adjust asset management priorities. This article seeks to present a model for plotting the range of digital content that might be amenable to management as digital assets in higher education.

Design/methodology/approach – The article reviews differing perspectives on digital content, outlines a generalized model, and suggests how the model could be used for examining the distribution of campus digital assets and fostering dialog on management priorities across stakeholder communities.

Findings – A multivariate model of digital content provides a rich framework for analyzing asset management priorities in a university setting. The model should be applied and tested in a variety of university settings.

Practical implications – The model is a tool for establishing asset management priorities across campus units that produce digital content.

Originality/value – The paper offers an original model for evaluating the asset values of digital content produced or acquired in a university context.

Keywords Assets management, Digital storage, Digital libraries, Content management

Paper type Research paper

Introduction

Depending on who you ask, the idea of the Institutional Repository (IR) in higher education means anything from "innovative solution" to "irrelevant curiosity". To librarians, archivists, programmers, and the faculty who are building systems and contributing publications, an IR is, at least, a more convenient and more reliable place to hold the output of scholarly communication. (Smith, 2005). At best, advocates for a network of repositories hope to revolutionize these processes (Harnad, 1990) and, along the way, catalyze the reinvention of library collections and services (Keller *et al.*, 2003). Critics of the IR movement have their own arguments, including that the technologies and associated policy frameworks are too limited, too narrowly construed, too political,

Library Hi Tech
Vol. 26 No. 3, 2008
pp. 342-354
Emerald Group Publishing Limited
0737-8831
DOI 10.1108/07378830810903283

©Paul Conway

The author thanks Karen Markey and Soo Young Rieh at Michigan's School of Information and Tim Pyatt at Duke for their careful reading and very helpful comments on an earlier draft of this article.

or unconvincing. The vast majority of academics appears to be largely unaware of or uninterested in a suite of technologies that have too little impact on their lives as scholars or administrators (Davis and Connolly, 2007).

Against this backdrop of challenging, technology development is the near ubiquity of digital content (Lyman and Varian, 2003) on and off the university campus, significant mass digitization projects transforming library book collections (Coyle, 2006), and the inexorable shift to digitally based and tool-rich scholarship within and across disciplinary boundaries. As an all-digital academy emerges, the perspective of IR advocates and supporters is broadening to encompass the active management of digital content from a panoply of sources supporting a variety of academic purposes. This shift may be due, in part, to increased concern about the preservation challenges of digital content, in general (Waters and Garrett, 1996) or to explicit advocacy for new tools and services. Libraries and other campus organizations are initiating and championing Institutional Repositories as critical components of a very diffuse approach to stewardship on campus, as libraries themselves evolve from serving primarily as "archive" to becoming social centres for teaching and learning (Lynch *et al.*, 2007).

This article proposes one way of conceptualizing the digital content landscape in a university context. The proposed model, which the author has developed, refined, and vetted over a three-year period, is an effort to facilitate a rich cross-campus dialog on the challenges and opportunities of aggressive and effective digital asset management. The article reviews differing perspectives on digital content, outlines a generalized model, and suggests how the model could be used to examine the distribution of campus digital assets and to foster dialog on management priorities across stakeholder communities.

Evolving definitions of digital content

The concept of the IR is well described and well defined, even if not as well accepted in the academy as proponents hope. Agreement is less clear on the types of digital content included in repositories or asset management systems.

For the past 15 years, the notion of what constitutes digital content worthy of local management has expanded greatly from an initial focus on the scholarly preprint to a current view that encompasses almost any sort of digital object that can be identified and described intellectually. Initially, Harnad (1990, 2001) proposed that scholars archive their scholarly preprints as a direct challenge to the control of scholarly content by commercial publishers. Raym Crow, working under the auspices of the Association for Research Libraries' SPARC initiative[1], synthesized one of the first formal definitions of the "IR". His definition builds on but moderates Harnad's political argument while expanding the content domain slightly to encompass "intellectual product" of a university.

> Institutional repositories represent the logical convergence of faculty-driven self-archiving initiatives, library dissatisfaction with the monopolistic effects of the traditional and still-pervasive journal publishing system, and availability of digital networks and publishing technologies (Crow, 2002).

Lynch's definition (2003) of IR is the most widely cited. He correctly establishes the IR as a set of services provided by a university to its community. He purposefully takes a broad approach to digital content, suggesting that an IR supports the management and dissemination of "digital materials created by the institution and its members".

Lynch's emphasis on locally produced content places clear boundaries on the content domain, initially eliminating from consideration content acquired from external sources to support research and teaching. Branin (2003) sees IR activities as analogous to the collection development efforts of traditional libraries. While confining IR digital content to faculty and student output, Branin equates digital content with digital information and knowledge assets, using streaming video and audio as an example of an asset management need that transcends the scholarly preprint.

Markey *et al.* (2007) conducted a census of IR activities in the USA. The MIRACLE Project's definition of IR content builds on prior work, particularly Branin and Lynch. The project limits the scope of its census population to organizations and systems that collect locally produced publications, but then investigates how universities within this population are expanding their use of IR technologies to assemble and manage over three dozen document types, including electronic theses and dissertations, learning objects, digitized images, software, and other types of content that may be deemed valuable for longer term retention.

IR to asset management

As the concept of IR stretches to accommodate an ever expanding array of formats and sources, some have begun adopting the term "digital asset management" as a broader concept capable of encompassing the active management of any form of digital content. Bicknese (2004) targets a university's electronic records as worthy of special management attention. Thomas and Rothery (2005) argue quite forcefully for accessible and more systematically managed repositories of the digital learning objects accumulated over nearly a decade in some combination of proprietary courseware systems, open source applications, and every flavor of website. Green and Gutmann (2007) add to the complex asset management picture with a pointed appeal for attention to the maintenance of research databases and other science and social science data resources either created by the university research enterprise or acquired to support it.

In digital asset management, the concept of value is a critical factor. Ross (2002), writing from the UK/European Union perspective, provides one of the earliest and most complete definitions of digital asset management applied to the higher education environment:

> Digital assets have the very unique characteristic of being both product and asset. Some digital assets exist only in digital form while others are created through the digitisation of analogue materials such as text, still images, video and audio. Content has the same value to institutions as other assets such as facilities, products and knowhow. Just as an organisation seeks to make efficient and effective use of its financial, human and natural resources, it will now wish to use its digital assets to their full potential without reducing their value.

The University of Kansas (Fyffe *et al.*, 2004) adopts an "asset management" perspective in its IR initiative, KU ScholarWorks[2]. "A digital asset is an electronic object that has value for some purpose". The KU definition explicitly places digital preservation at the core of its management approach. "To become part of the University's digital preservation program, a digital asset must support (directly or indirectly) the University's fundamental instructional, research, or public service missions". Asset management is criteria driven, focusing on three support functions: the academic mission of the university, university administrative needs, and the acquisition by license or purchase of data for continuing use.

Waters (2006) reflects deeply on the trend toward stewarding digital assets and provides the most insightful description of the challenges and opportunities of expanding the content landscape. Digital assets "are resources for research and teaching in higher education and that the aim of academic institutions in managing them is to advance knowledge and improve education". Waters offers a critique of the obsession that librarians have tended to have with escalating electronic journal pricing, and warns of the consequences of accepting a "dramatic, jump-off-the-cliff shift in the academy from owning scholarly output to effectively renting it". Waters challenges universities to invest in the necessary and significant costs of repository development, including "compelling rationales for collecting, preserving, and providing access to these kinds of scholarly output". He predicts that demand in universities "will grow for deepening connections between digital library systems used for managing digital assets in various forms and combinations of licensed, digitized, and open source materials and learning management systems". In his approach, Waters calls for an integrated and balanced approach to the wide range of digital materials that exist in various distributed forms and function fluidly as repurposeable raw material for the emerging world of cyberscholarship.

Regardless of how institutional repositories and asset management systems define the scope of content, advocates have confronted significant adoption challenges. Markey *et al.* (2007) suggests that a typical (median) operational repository contains 1,000 documents. Lynch and Lippincott (2005) find that comparing the size of repositories between institutions is at present an intractable problem but that repository tools are being positioned as general-purpose infrastructure with an increasingly wide array of digital content types. van Westrienen and Lynch (2005) report similar use-measurement challenges but an widening adoption of underlying repository technologies in thirteen industrialized nations. Walters (2006) finds a near total absence of both a broad understanding of what content is appropriate for asset management and a distinctive lack of awareness of end-user functional requirements in an asset system.

Librarians have recruited anthropologists (Foster and Gibbons, 2005), marketing specialists (Gierveld, 2006), and economists (Lavoie, 2003) in attempts to encourage adoption. Advocates appeal to scholarly responsibility (Harnad, 2001), logic (Courant, 2006), institutional efficiency (Mackie, 2004), and the preservation mandate of universities (Hitchcock *et al.*, 2007) to find effective stakeholder incentives. Davis and Connolly (2007), supplying data from Cornell, suggest that the idea of author-archiving is so disconnected from the reality of faculty life that there may be no real progress made until value-added aggregation services transcend the functional value of solitary repositories.

As university administrators expand their notions of the resource stewardship beyond the library to encompass "asset management" by a variety of campus stakeholders, major unresolved questions centre on defining the landscape of digital content appropriate for management as an asset. The growing research literature on both institutional repositories and asset management is quite loose in its definition of what digital content is appropriate for local management, where that content originates, what its administrative limits are, and, in general, how the components of an emerging all-digital content landscape fit together. What is largely missing from the literature of claims and counter claims for either IR technologies or a broader "asset management" are clear distinctions among the varieties digital content that a university creates, physically assembles, and/or provides access for its community

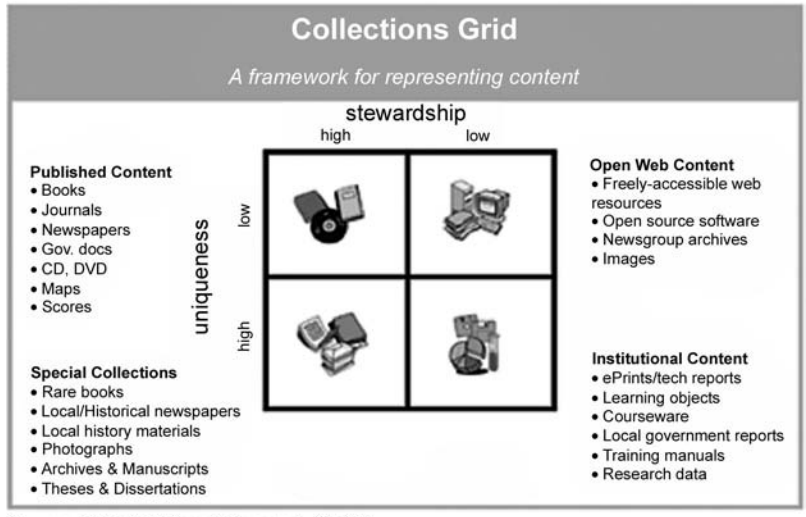
of users. The absence of a consensus framework for digital content increases the planning overhead at every university interested in capturing institutional value. As with the clichéd story of the blind men and the elephant, the obscurity of the content landscape complicates cross-campus communication and limits opportunities to develop stakeholder-driven priorities.

As the university landscape of digital content broadens beyond the realm of the scholarly preprint, it becomes increasingly necessary to model this landscape in ways that reflect the various roles and perspectives of digital content creators, stewards, and users. A comprehensive environmental scan of the digital technology landscape effecting libraries and users suggests that "too few initiatives include all the stakeholders … and there is no common view of what an IR is, what it contains, and what its governance structure should be" (OCLC, 2003). Additionally, tools are needed that foster rich dialog among campus stakeholders, on the content appropriate to manage as an asset, and on the priorities for allocating increasingly scarce resources that are competing for a plethora of technology needs. (Camp, 2007).

Digital collection models

In 2003, OCLC and Stanford University separately proposed distinctive two-dimensional collection models that envisions an evolving library environment. The first of these is the Collection Grid from OCLC (2003), which plots collections (digital and analog) in four quadrants based on the degree of stewardship required (high/low) and the extent to which uniqueness lends a distinctive character to the library and the university (high/low). As shown in Figure 1, the OCLC Collections Grid gives priority value to those special collections materials with high stewardship and uniqueness values – the very sort of materials that endow research institutions with distinctive collections identity.

On the surface, The OCLC Collections Grid's (Dempsey, 2007) embedded value system encompasses the traditional view of preservation that emphasizes long-term preservation needs over short-term user needs. (Hazen *et al.*, 1998) The Grid reflects the traditional



Source: OCLC Office of Research (2003)

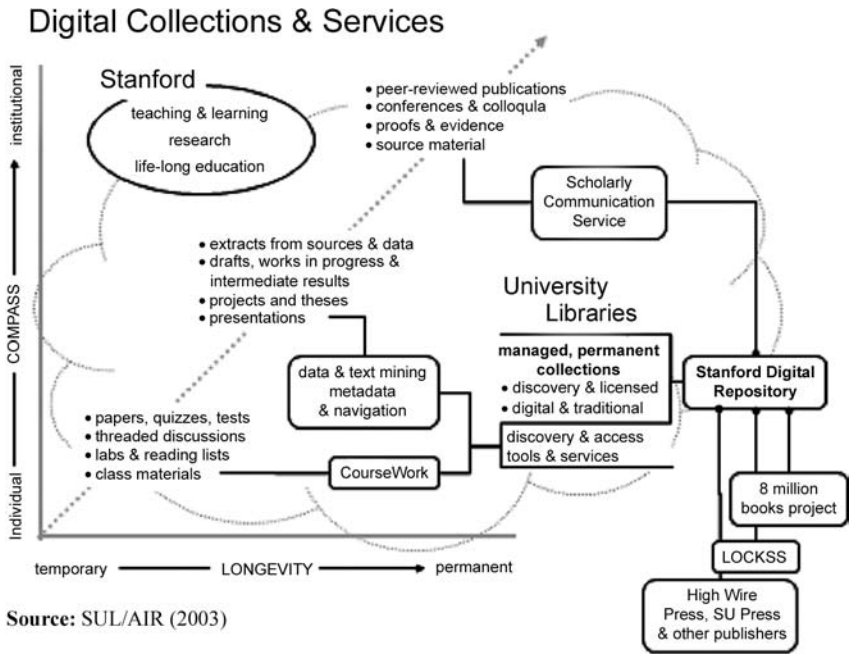
Figure 1.
OCLC collections grid, 2003

archivist's perspective that the value of unique research collections trumps redundant physical or digital collections of books and web resources. Although the Collections Grid appears to be an accurate snapshot of the collection behaviors of research libraries that are increasingly focusing their collection efforts and their university's collection dollars on digital resources, the Collections Grid may be less useful for engaging the broad array of campus stakeholders to who may not value investment in library-oriented stewardship that is not related to immediate scholarly need.

Another model from 2003 is Stanford University's portrayal of evolving digital collections and services. (Keller, 2005) It shares with the OCLC Collections Grid awareness of stewardship responsibilities ranging from short-term need to long-term preservation. The Stanford model, however, plots the second dimension in terms of the "compass direction" or the evolving orientation of digital services from individual to institutional need.

The strength of the Stanford model, represented in Figure 2, is the way it maps emerging academically oriented digital content on a suite of library digital repository and preservation services. The model explicitly presumes the library's role as campus repository but does not address the management of digital assets that fall outside the library's self-defined scope.

An alternative content landscape model is the subject of this article. The Conway model was first developed at Duke University to support campus conversations on the scope of digital library activities. The model was presented and refined at a series of workshops and symposia, including the OCLC Distinguished Seminar Series. (Conway, 2004) It was applied to the specific Duke context during a year-long exploration of digital content generated by interdisciplinary research centres and academic departments. The following sections of this article describe a more fully realized version of the Conway landscape



Source: SUL/AIR (2003)

Figure 2.
Stanford University libraries, digital collections and services, 2003

model and suggest ways that the model can support a broad planning process that involves content stakeholders across an entire campus.

Conway content landscape model

The Conway Content Landscape Model (CLM) is a multi-dimensional framework that addresses three outstanding issues with digital asset management in universities. First, the model acknowledges the broader academic mission within which digital content is created, acquired (bought and licensed), managed and preserved, and distributed and used. Second, the model provides for selection processes and priority setting exercises based on the dual perspectives of content creator/stakeholders and content user/stakeholders. Third, the model identifies four digital content property scales that provide an analytical foundation for assigning management priorities to particular classes of digital content.

At its most abstract level, seen in Figure 3, the model recognizes the information environment within which universities carry out their four-part mission to foster research, teaching, publication, and preservation (Waters, 2006). This wider environment of e-research, e-teaching, e-publishing, and e-recordkeeping is similar in structure and perspective to the digital framework that motivates the research and development activities of the UK Joint Information Systems Committee (JISC)[3].

More specifically the CLM articulates four interacting variables that together describe the core asset management challenges that universities face with digital content: property rights, structure, source and possession.

Property rights distinguishes campus digital assets based on the likelihood that the university can retain the rights to capture, store, preserve and make available digital content to its academic community. In the present environment, the rights of a university vis-a vis digital content are not a dichotomous proposition, but rather depend on a number of factors that limit options for preservation and access. Complexity is lightened in situations where a university has unambiguous rights to manage digital content.

Structure recognizes that digital objects range from tightly structured, highly relational database elements to loosely affiliated items assembled for varying purposes.

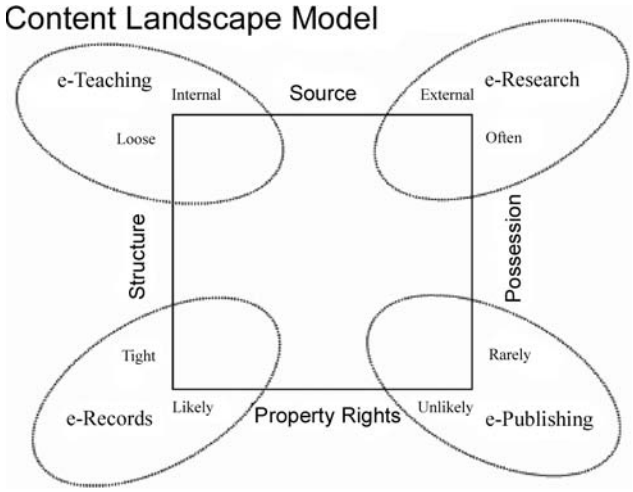


Figure 3.
The variable world of digital content

Tight structure improves the likelihood that valuable assets can be identified and managed actively; dispersed and loosely affiliated objects add complexity.

The *source* of digital assets plays a significant role in determining management priorities. Digital content that originates on a university campus (internal), either through digitization or through acquisition, may be simpler to identify and more technically capable of effective management than externally generated content. Digital content that originates locally has the value of "uniqueness" that adds distinctive character to a university, much like a library's special collections have done through the past century.

Possession as a variable of the content landscape points to the diversity of campus access models. Although some digital content of critical value to the academic mission is secured on campus-managed servers, the university rarely possesses some of the most significant digital resources in which the university has a continuing stake, particularly licensed electronic journals and books. Access is most likely through links to external data providers (journal publishers, database contractor, multimedia conglomerate) with limited or no commitment to preservation. Possession is quite often unassociated with property rights.

Populating the digital content landscape are overlapping clusters of digital content whose existence in a management framework are due to specific actions taken by the university. Some content is digitized surrogates of physical objects; some content may have been "born digitally" and may be managed to varying degrees as university records. Other digital content has been purchased or otherwise acquired by university units, ranging from libraries to academic departments, specifically to support research and learning. Yet other digital content is merely licensed for use under sometimes highly restrictive access provisions. The model assumes that nearly all digital content is accessible through a browser-based web gateway, even if the university limits access to local users as a way of dealing constructively with the present intellectual property regime.

These clusters overlap in the model to illustrate that the characteristics or functional origins of digital content on a university campus is rarely clear cut. For example, the university might retain the right to mount significant licensed resources on a local server; the university library might purchase and manage directly a significant collection of digitized artwork and may or may not deliver this asset to campus users from its own servers. Placing digital assets appropriately within the landscape is the first important step in establishing asset management priorities (Figure 4).

The Conway CLM embeds a conscious distinction between actively managed content and the wider world of digital possibilities. The dotted line in the model represents a porous, potentially two-way boundary where selection and de-selection replace random assembly and deletion as a management ethic. Atkinson (1996) defined the area inside the boundary as the "control zone" and declared unambiguously that selection adds fundamental value to scholarship. Accessibility, particularization, maintenance, certification, standardization, and coordination are all boosted "when an object of information is moved across the boundary from the open zone into the control zone". Atkinson assigned to the library and its sponsoring institution full responsibility for moving specialized scholarly publications into the control zone and maintaining them according to standards agreed on by the scholarly community.

Figure 5 provides examples of the types of digital content that a university community typically produces and plots this content on the landscape. In the domain of digitized content (upper left) live digital objects and resources usually created locally to support teaching and learning. Digitized content that is more aggressively managed, represented

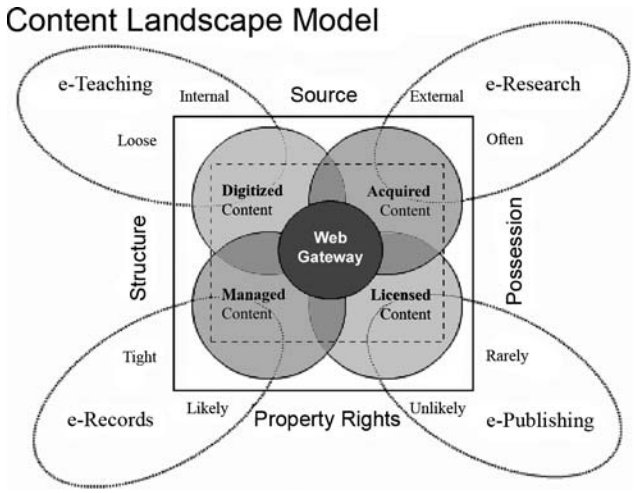


Figure 4.
Digital asset clusters on the content landscape

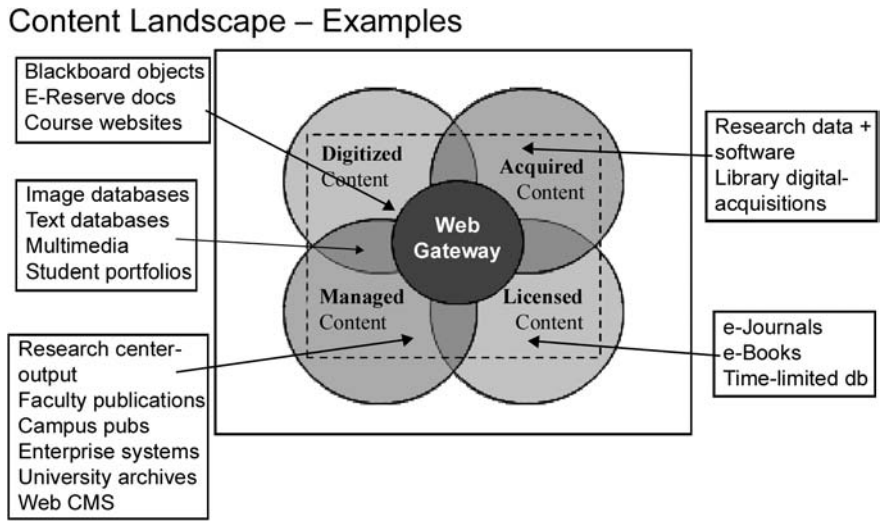


Figure 5.
Examples of digital content plotted on the landscape

by the overlapping section at centre-left, encompasses growing image and text databases, multimedia "warehouses," and portfolios of student produced content. In the more fully managed sector (bottom left) are the output of campus research centres, faculty and university publications, and the contents of enterprise systems, most especially university electronic records systems and the increasingly important web content management systems. The domain of acquired content (upper right) encompasses research data and associated software, the digital acquisitions of the library (often on portable or fugitive media) and other digital resources purchased or otherwise obtained to support the research mission of the university. Finally, the domain of licensed content (lower right) is the large and growing world of digital books and electronic journals that have become the academic lifeblood of the campus.

Uses of the model

The Conway model has been applied at Duke University as a framework for gathering and evaluating information about the scope of digital assets produced by interdisciplinary research centres and academic departments. A report on this work is in preparation. The applicability of the model to other university settings should be evaluated and reported. Additionally, the potential of the model to foster a collaborative, multi-institutional approach to asset management should be explored.

The CLM has a number of possible uses as a tool for planning and advocating campus asset management activities and commitments. The model provides a framework for identifying the most salient management characteristics of existing and emerging digital assets on campus. It is a mechanism for assembling and organizing the results of a content survey. Indeed, the four issue-dimensions of the model (property rights, structure, source, possession) could provide a useful outline of the information about clusters of digital assets that should be assembled and analyzed in a campus-wide investigation.

A common stumbling point in campus discussions is the tendency of stakeholders to view digital asset challenges through the prism of a particular administrative need. For example, the managers and designers of campus course management systems may view the management of e-learning objects to be a pressing need while remaining relatively unaware of or unconcerned about the library's electronic journal management challenge. Similarly, faculty who are struggling to deal with burgeoning collections of research data from grant funded projects may have less of an interest in the challenges of building a campus-wide digital image repository. As a visual representation of the variety of digital assets that have the potential for long term management, the content landscape model could be used as a tool for plotting the varying perspectives of campus stakeholders regarding the desirability of managing particular clusters of digital content.

In the emerging all-digital academy, the quantity and variety of assets worthy of specialized management in campus repositories could well overwhelm the resources of a university. The content landscape model has the potential to serve as a framework for establishing campus digital asset priorities through the inclusion of stakeholder perspectives and commitments. For example, a campus-wide survey of digital assets, plotted on the content landscape, might well reveal clusters of valuable content and associated stakeholders that distinguish a given university within its peer group. Alternatively, information from multiple universities plotted on the content landscape may reinforce the notion that a consortium shares deeply in value of addressing the needs of a particular type of digital asset.

Limitations of the model

The CLM does not provide adequately for some types of digital content for which campus administrators are increasingly being called upon for technical support. Specifically, collections of important digital content owned and sometimes even managed by individual faculty do not fit well in the model. Depending upon their research interests and their affinity for information technology tools, faculty possess and are continuing to assemble significant research resources on personal computers, departmental servers and other relatively unmanaged spaces.

The model also does not provide for the management as assets of the burgeoning collection of web pages either hand-coded individually or generated by dynamic database driven applications. Content delivered via a widely distributed network of

campus servers, maintained by significant numbers of support staff has proven to be largely immune to active management. Efforts to implement enterprise-wide web content management systems in higher education have generally not met expectations.

Finally, the CLM is a static view of the world that does not account for the flow of digital content into and from asset management systems. Further research might well match the Conway model to emerging dynamic management flow models exemplified by the consulting work of Lyon (2007) on behalf of the JISC Digital Repositories Programme.

Conclusion

Further research should also compare and contrast the strengths and weaknesses of the three models. An empirical test of the Conway Model that plots the characteristics of actual collections of digital assets across the four potentially interacting variables (rights, structure, source, possession) would help refine the relevance of the model and begin quantifying the scope of the campus digital asset management challenge.

The content landscape model proposed here may be most valuable, ultimately, for placing in a wider perspective the particular collection development priorities of a university library in relation to other stakeholders on campus. One of the biggest challenges that libraries face as they decide to begin tackling the preservation of digital information is identifying and establishing responsibility for critical clusters of digital assets, such as campus scholarly publications, for which the library is particularly well poised to preserve.

Notes

1. Association of Research Libraries, Scholarly Publishing & Academic Resources Coalition: http://www.arl.org/sparc/
2. University of Kansas. KU ScholarWorks: https://kuscholarworks.ku.edu/dspace/
3. JISC E-resources Initiative: http://www.jisk.ac.uk/

References

Atkinson, R. (1996), "Library functions, scholarly communication, and the foundation of the digital library: laying claim to the control zone", *Library Quarterly*, Vol. 66 No. 3, pp. 239-65.

Bicknese, D. (2004), "Institutional repositories and the institution's repository: what is the role of the university archives with an institution's on-line digital repository?", *Archival Issues*, Vol. 28 No. 2, pp. 81-93.

Branin, J. (2003), "Institutional repositories", in Drake, M. (Ed.), *Encyclopedia of Library and Information Science*, Taylor & Francis, Boca Raton, FL, preprint available at: https://kb.osu.edu/dspace/bitstream/1811/441/1/inst_repos.pdf

Camp, J. (2007), "Top-ten IT issues", *EDUCAUSE Review*, Vol. 42 No. 3, pp. 12-32, available at: http://www.educause.edu/apps/er/erm07/erm073.asp

Conway, P. (2004), "Institutional repositories: is there anything else to say?", OCLC Distinguished Seminar Series, October 7, OCLC, Dublin, OH, available at: www.oclc.org/research/dss/conway.htm

Courant, P. (2006), "Scholarship and academic libraries (and their kin) in the world of google", *First Monday*, Vol. 11 No. 8, p. 2, available at: www.firstmonday.org/issues/issue11_8/courant/index.html

Coyle, K. (2006), "Mass digitization of books", *Journal of Academic Librarianship*, Vol. 32 No. 6, pp. 641-5.

Crow, R. (2002), "The case for institutional repositories: a SPARC position paper", *ARL Bimonthly Report*, No. 223. available at: www.arl.org/newsltr/223/instrepo.html

Davis, P. and Connolly, M. (2007), "Institutional repositories: evaluating the reasons for non-use of Cornell University's installation of DSpace", *D-Lib Magazine*, Vol. 13 Nos 3/4, available at: www.dlib.org/dlib/march07/davis/03davis.html

Dempsey, L. (2007), *Thinking about collections*, Fiesole collection development retreat, April 12-14, Hong Kong, available at: http://digital.casalini.it/retreat/retreat_2007.html

Foster, N. and Gibbons, S. (2005), "Understanding faculty to improve content recruitment for institutional repositories", *D-Lib Magazine*, Vol. 11 No. 1, available at: www.dlib.org/dlib/january05/foster/01foster.html

Fyffe, R., Ludwig, D., Roach, M., Schulte, B. and Warner, B.F. (2004), *Preservation planning for digital information: final report of the HVC2 digital preservation task*, KU ScholarWorks, University of Kansas, Lawrence, KS, available at: https://kuscholarworks.ku.edu/dspace/handle/1808/166

Gierveld, H. (2006), "Considering a marketing and communications approach for an institutional repository", *Ariadne*, No. 49, available at: www.ariadne.ac.uk/issue49/gierveld/

Green, A. and Gutmann, M. (2007), "Building partnerships among social science researchers, institution-based repositories and domain specific data archives", *OCLC Systems and Services*, Vol. 23 No. 1, pp. 35-53, available at: http://deepblue.lib.umich.edu/handle/2027.42/41214

Harnad, S. (1990), "Scholarly skywriting and the prepublication continuum of scientific inquiry", *Psychological Science*, Vol. 1, pp. 342-3, available at: http://cogsci.soton.ac.uk/ ~ harnad/Papers/Harnad/harnad90.skywriting.html

Harnad, S. (2001), "For whom the gate tolls: how and why to free the refereed research literature online through author/institution self-archiving, now", journal (on-line/unpaginated), available at: http://cogprints.org/1639/

Hazen, D., Horrell, J. and Merrill-Oldham, J. (1998), "Selecting research collections for digitization", Council on Library and Information Resources, Washington, DC, available at: www.clir.org/pubs/abstract/pub74.html

Hitchcock, S., Brody, T., Hey, J.M.N. and Carr, L. (2007), "Digital preservation service provider models for institutional repositories: towards distributed services", *D-Lib Magazine*, Vol. 13 Nos 5/6, available at: www.dlib.org/dlib/may07/hitchcock/05hitchcock.html

Keller, M. (2005), "Institutional repositories: strategic considerations", Presentation available at: www.ala.org/ala/acrl/aboutacrl/acrlsections/universitylib/CurrentTopicsKeller.ppt

Keller, M., Reich, V. and Herkovic, A. (2003), "What is a library anymore, anyway?", *First Monday*, Vol. 8 No. 5, available at: www.firstmonday.org/issues/issue8_5/keller/index.html

Lavoie, B. (2003), "The incentives to preserve digital materials: roles, scenarios, and economic decision-making", OCLC, Dublin, OH, available at: www.oclc.org/research/projects/digipres/incentives-dp.pdf

Lyman, P. and Varian, H. (2003), "How much information 2003?", School of Information Management and Systems, University of California, Berkeley, CA, available at: www.sims.berkeley.edu/how-much-info-2003

Lynch, C. (2003), "Institutional repositories: essential infrastructure for scholarship in the digital age", *ARL Bimonthly Report*, No. 226, available at: www.arl.org/newsltr/226/ir.html

Lynch, C. and Lippincott, J. (2005), "Institutional repository development in the United States as of early 2005", *D-Lib Magazine*, Vol. 11 No. 9.

Lynch, B. *et al.* (2007), "Attitudes of presidents and provosts on the university library", *College & Research Libraries*, Vol. 68 No. 3, pp. 213-27, available at: www.ala.org/ala/acrl/acrlpubs/crljournal/backissues2007a/crlmay07/crlmay7.cfm

Lyon, L. (2007), "Dealing with data: roles, rights, responsibilities and relationships (consultancy report)", *JISC Digital Repositories Programme*, available at: www.jisc.ac.uk/whatwedo/programmes/programme_digital_repositories/project_dealing_with_data.aspx

OCLC (2003), "Pattern recognition: a report to the OCLC membership", OCLC, Dublin, OH, available at: www.oclc.org/reports/escan/default.htm

Mackie, M. (2004), "Filling institutional repositories: practical strategies from the DAEDALUS project", *Ariadne*, No. 39, available at: www.ariadne.ac.uk/issue39/mackie/

Markey, K. *et al.* (2007), "Census of institutional repositories in the United States: MIRACLE project research findings", Council on Library and Information Resources, Washington, DC, available at: www.clir.org/pubs/abstract/pub140abst.html

Ross, S. (2002), "Position paper on DAMS for the heritage sector", Digital Asset Management Systems for the Cultural and Scientific Heritage Sector, DigiCult Thematic Issue No. 2, available at: www.digicult.info/downloads/html/1039519224/1039519224.html

Smith, M. (2005), "Exploring variety in digital collections and the implications for digital preservation", *Library Trends*, Vol. 54 No. 1, pp. 6-15.

Thomas, A. and Rothery, A. (2005), "Online repositories for learning materials: the user perspective", *Ariadne*, No. 45, available at: www.ariadne.ac.uk/issue45/thomas-rothery/

van Westrienen, G. and Lynch, C. (2005), "Academic institutional repositories: deployment status in 13 NATIONS AS OF Mid 2005", *D-Lib Magazine*, Vol. 11 No. 9, available at: www.dlib.org/dlib/september05/westrienen/09westrienen.html

Walters, T. (2006), "Strategies and frameworks for institutional repositories and the new support infrastructure for scholarly communications", *D-Lib Magazine*, Vol. 12 No. 10, available at: www.dlib.org/dlib/october06/walters/10walters.html

Waters, D. (2006), "Managing digital assets in higher education: an overview of strategic issues", *ARL Bimonthly Report*, Vol. 244, pp. 1-10, available at: www.arl.org/bm ~ doc/arlbr244assets.pdf

Waters, D. and Garrett, J. (1996), "Preserving digital information: report of the task force on archiving of digital information", Commission on Preservation and Access, Washington, DC, available at: www.rlg.org/ArchTF

Corresponding author
Paul Conway can be contacted at: pconway@umich.edu

To purchase reprints of this article please e-mail: **reprints@emeraldinsight.com**
Or visit our web site for further details: **www.emeraldinsight.com/reprints**