

**North Carolina State University  
Digital Asset Management Task Force  
Report and Recommendations**

**May 5, 2006**

*As our faculty improve teaching and learning in a technology rich environment,  
they innovate....*

*As our staff develop and manage new programs and new technologies to increase  
our efficiency, they innovate....*

*We learn of a need and act on it....*

*Real leadership is about seeing a need, building a coalition and getting results.*

James L. Oblinger  
Installation Response  
NC State University  
April 20, 2005

# North Carolina State University Digital Asset Management Task Force Report and Recommendations

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## Executive Summary

NC State has asserted its commitment to **scholarship for the 21<sup>st</sup> century, innovation, and the cultivation of organizational capability** marked by outstanding efficiency and effectiveness. Consistent with this vision, its Strategic Plan, and the LITRE Quality Enhancement Plan, the university leadership should make a commitment to developing an institutional **Digital Asset Management (DAM) solution**. The benefits of such a solution would reach across all endeavors of the university by enabling collection, organization, storage, retrieval, preservation, transformation, publication, and control of valuable digital materials. For example, the system would facilitate the use of a variety of learning objects and other digital content by faculty and students, increasing pedagogical flexibility and reducing the university's reliance on traditional, high-cost textbooks.

At NC State, numerous digital assets are being created every day, and the rate at which they are being generated is increasing dramatically. These digital assets include **research data, instructional materials, and administrative and business records**, including records for which the university has legal and archival responsibilities. Digital content has become critical for day-to-day operations, and it constitutes a growing portion of the historical/archival documentation of university activities and accomplishments. **Our campus needs a strategy** for managing digital assets at the university level and providing ways for our faculty, students, and staff to manage the digital media collections created in the scope of their work. A Digital Asset Management system would help the university to call upon its intellectual capital more effectively under normal circumstances and to mitigate its risks in the event of a large-scale disaster that calls our business continuity capabilities into play.

There is a current opportunity for NC State to distinguish itself among universities, including our official peer institutions, by taking a proactive approach in this area of technological innovation, since relatively few institutions have moved beyond investigation and small-scale implementation of Digital Asset Management. Experience at NC State and elsewhere has shown that when the needs for a fundamental element of the core infrastructure become apparent and the available products are sufficiently scalable and robust, it is advantageous for the institution to move ahead quickly to develop a plan and implement an appropriately powerful and scalable solution. As time goes on, stakeholders may become increasingly invested in the short-term, legacy applications and storage schemes that they have been forced to develop in the absence of a university solution, making consensus and implementation much more difficult.

This report sets forth a vision for what a Digital Asset Management system could do for NC State and offers some possible action steps for moving forward, including a set of functional criteria applied to some of the leading software products. A Digital Asset Management solution will consist of both a **technical infrastructure** and a **network of relevant campus expertise**, guided by university policies and principles. The task force believes that the NCSU Libraries can lead and organize a successful implementation, with relevant expertise and a trusted information stewardship role on campus.

This initiative will require a **commitment from the university leadership, identification or reallocation of resources, and campus-wide participation**. The short- and long-term benefits of Digital Asset Management are worthy of this commitment -- the university can no longer afford *not* to pursue those benefits. Estimates of the resources that would be required for some possible implementation scenarios are presented in Section 4.

## Preface

Our university, like many others, is a prodigious generator of content. Textual content has been categorized and stored on our campus for decades: departments keep file copies of documents and records until it is time to send them to the University Archives; individual faculty members retain copies of their works; and publications such as books and articles by NCSU authors are collected by the library.

Slides, video, audio, and types of media have not always fared so well. Departments and units that are heavily invested in imagery have devised local systems for organizing and storing content, for example, in the Colleges of Design, Natural Resources, or Veterinary Medicine. However, in many cases, the task of sorting and cataloging content is considered secondary or is perceived to be difficult and time-consuming in the absence of well understood structures and guidelines, so that it is undertaken on rare occasions when someone has time, or not at all.

Moving to a digital realm increases the demands exponentially. This is because of the ease of transportability and reuse of digital media, and because it is, in many cases, replacing other forms of content expression. According to a College of Agriculture and Life Sciences survey, over 30 percent of incoming freshmen at NC State come equipped with a digital camera, and virtually all of today's students are heavy computer users. These students represent the future of academia and have been called "the Net Generation."<sup>1</sup> In an increasingly digital and technology-centric world, the need to manage digital media is becoming more critical each day.

It has become clear that our campus needs a strategy for not only managing the university's digital media, but also providing ways for our faculty, students, and staff to manage the digital media collections created in the scope of their work. Valuable opportunities are being lost simply because it is too difficult or costly for individuals or units to establish these repositories on their own. There is great need for a system that can enable the university community to make better use of our work, and share that work with others. We need an environment that can help to create opportunities out of work that has already been done.

Digital Asset Management (DAM) systems provide ways for users to catalog, index, and perform searches on content; but that is just the beginning. While this term encompasses a broad category of technologies, it includes such capabilities as repurposing, sharing, versioning, and archiving. In fact, these activities are all taking place already, through ephemeral workflow processes in many different contexts. But we are ill-equipped for the trend that is already in progress: the rapid and inevitable migration of our business and intellectual content to primarily digital formats.

The magnitude of the need is such that unless the university moves forward, individuals and departments will be forced to struggle with their own, smaller scale strategies for handling digital assets. This will have a significant and tangible cost in terms of scale and efficiency, and also an intangible cost in terms of opportunities lost. We simply will not know what we have, and thus, it will be lost.

## 1. Background and Problem Statement

At NC State, numerous digital assets are being created every day, and the rate at which they are being generated is increasing dramatically. A “**digital asset**” can be defined as digital content, such as an image, audio, video, text, or PDF file, plus the associated metadata (descriptive elements) that enables it to be identified. Frequently digital assets are grouped into collections, and these collections may be associated with particular projects, programs, courses/curricula, or individual faculty members’ bodies of work. Research activity that makes use of large datasets and visualization tools; online courses that feed student “portfolios;” and facilities renovation projects, with their associated architectural drawings and documents, are just a few examples. The rapid advancement and proliferation of desktop publishing tools, at one end of the continuum, and large-scale scientific data output at the other, has not been matched by the pace of application deployment for managing this enormous quantity of digital content. Much time is expended trying to locate scattered, poorly organized materials (“Was it attached to that email message back in February?”), and while this inefficiency is difficult to quantify, it has been shown to constitute a significant, embedded cost when considered across an institution.

A **Digital Asset Management System (DAMS)** is “a set of technologies that enables the collection, storage, retrieval, publication, and find-grained control over digital media.”<sup>2</sup> Digital Asset Management is sometimes referred to as Media Asset Management. The asset itself is the organizing principle underlying the functions and technical infrastructure of a DAMS, and, ideally, metadata is associated with each asset. This system can ingest digital assets, transform them into derivative/alternative formats for various uses, store and index them for search and retrieval, and manage the rights associated with those assets. (See Appendix A for a list of DAMS Functional Criteria, and Appendix D for a Metadata Overview.)

Digital Asset Management systems have been evolving rapidly over the past five years or so. They remain more common in commercial organizations than in higher education, but some universities and colleges have recognized their value and are planning or implementing enterprise-level solutions (see Appendix B for examples). **There is a current opportunity for NC State to distinguish itself among our official peer institutions** and others in this area of technological innovation, since few of them have moved beyond planning and preliminary investigation. The North Carolina Community College System (NCCCS) has recently licensed HarvestRoad Hive® for development of a Learning Object Repository (LOR), and the NCCCS is interested in collaboration with the UNC system. More details about this are provided in Section 5.

A tremendous number of potential new projects and initiatives, opportunities to use technology to preserve and share the university’s existing knowledge, and, indeed, LITRE’s ability to fully achieve its goals, are being seriously hampered by the absence of a DAM solution on campus. Units outside of Academic Affairs, such as Creative Services, while not engaged as directly in teaching and learning activities, also share this frustration and have been forced to adopt local solutions to manage and offer for reuse or resale a portion of their collection. Without a DAM solution in place, the university is missing the opportunity to take advantage of significant economies of scale and expertise, and of the effectiveness and efficiency of data access, preservation, security, and reuse that it could provide.

## 2. Digital Asset Management Task Force

The Digital Asset Management Task Force was born out of serious concerns on the part of many LITRE (Learning in a Technology-Rich Environment) study team members and others that something essential is missing in the university's information management landscape. This awareness has been building for more than 10 years, as the Libraries, the Information Technology Division (ITD), and, later, DELTA, received numerous requests and inquiries from faculty members and others struggling to manage their digital media collections. Many examples have emerged in the DELTA IDEA Grants and LITRE Grants programs designed to support faculty members as they expand their use of technology for teaching and learning. These programs have attracted numerous proposals that underscore the need for a Digital Asset Management solution that is more robust and scalable than what an individual or department can achieve alone, with titles such as, "Online e-tutorials for Maple instruction," "Building a Digital Library for the Teaching of History," or "Digital imaging to teach clinical theriogenology."

The following charge was issued by the LITRE Advisory Board to members of the Digital Asset Management Task Force in February 2005.

The LITRE Advisory Board recognizes that NC State currently has no overarching scheme for ensuring that digital materials created by faculty, students, and staff are preserved and managed for availability and use, now and in the future. The university community would benefit from a scaleable, university-wide system for digital asset management, or, at a minimum, a common architecture with articulated standards and guidelines. Ready access to an indexed collection of digital materials is of obvious value for research and instruction, as is preservation of the digital objects that play an increasingly important role in scholarly activities.

Therefore, based on a recommendation in the LITRE Quality Enhancement Plan, the LITRE Advisory Board is establishing a Digital Asset Management Task Force. This task force is charged to investigate the range of issues related to digital asset management, including existing collections, systems, and needs; architecture and standards; metadata/indexing processes; content ownership and other policies; available products/solutions; technical support; and costs (including the cost of inaction). The task force is asked to prepare a report with recommendations to the LITRE Advisory Board and the Provost during 2005 and to apprise the Board periodically of its progress.<sup>3</sup>

The task force members are listed in Appendix C. Members were identified by deans or associate deans, and by vice provosts and other key administrators, based on their knowledge, roles, and responsibilities. The task force conducted meetings throughout 2005 and early 2006, developing and then working through an outline of key issues relevant to Digital Asset Management, in accordance with its charge. Its deliberations focused on:

- the historical and current campus environment, including both technology and culture;
- the nature and diversity of existing and possible future digital collections;
- how those collections enable units and individuals to conduct daily work and accomplish their goals; and

- the desirable characteristics of a solution to replace the current, fragmented approach to managing digital assets (see Appendix A for a list of “Functional Criteria”).

A preliminary examination of a set of software applications was conducted in order to gauge the possibilities among the products being marketed and mentioned in the literature, to help test and prioritize our functional criteria, and to establish that an acceptable solution does, in fact, exist. We conducted demonstrations of a few products that are currently in use on campus at the desktop or workgroup level, along with some that are being adopted by other educational institutions in North Carolina and other states. We recognize that additional technical evaluation, specifications development, and perhaps a Request for Proposals process would be required prior to making any final selection of a university solution. A partnership effort between UNC or NCSU and the NCCCS initiative, on the other hand, could take advantage of the technical infrastructure currently being developed at MCNC for hosting HarvestRoad Hive®.

Before looking more closely at NC State’s situation, it is useful to step back and conduct a brief “environmental scan” of the roles that digital assets play in higher education.

### **3. Digital Asset Management in Higher Education**

Over the past several years, Digital Asset Management has proven its value in the domain of its early adopters, which included publishers, broadcasters, record companies, film studios, and other corporations where rich media is core to their business, moving on to become a more familiar term in the university setting. Creating, storing, indexing, retrieving, and managing digital media assets across a collaborative workflow environment is a growing requirement for a wide variety of enterprises, including universities and colleges. It is recognized by information technology professionals, industry analysts, and many others within academia that today’s DAM systems can be leveraged for far-reaching benefits in virtually any type of organization. As an indication of this “critical mass” of recognition, the *Journal of Digital Asset Management* was launched in 2005 and includes articles by authors with academic as well as corporate backgrounds.<sup>4</sup>

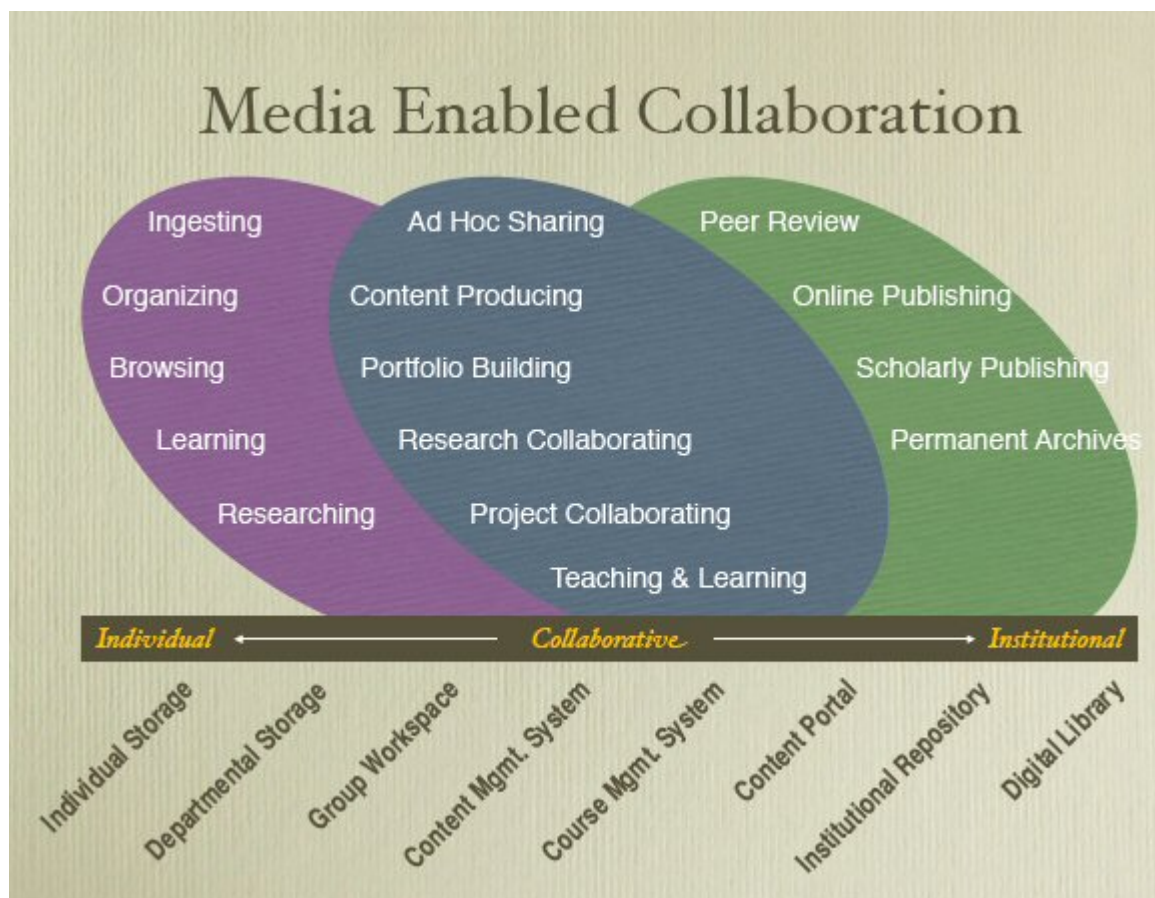
For the purposes of this report, we view the collections of an “institutional repository” or “digital library” as somewhat different in scope than the content of a DAM system, with the former defined by particular selection criteria and a focus on providing access to and preserving the authoritative versions of scholarly works for a public/community audience. The NCSU Libraries uses the DSpace repository software to manage NC State Electronic Theses and Dissertations and faculty publications. A DAMS, on the other hand, would be broader in scope and would function at multiple levels, serving both the individual and the institution, and managing multiple, “working” versions of digital files.

The flexible DAM system that we envision could be used at the desktop of a faculty member wishing to organize images, for example, selected within his/her own context of endeavor. This faculty member would use system tools to record the descriptive, contextual, technical, and functional attributes of a digital object or dataset (i.e., the metadata) at the time of its initial creation. When ready, the faculty member could copy or migrate those images, with associated metadata, to the institutional level for storage, preservation, or access purposes, perhaps deciding to share them with

either a small group or a worldwide audience. Policies and guidelines for the use of the DAM infrastructure as a university resource would be necessary and are discussed further in Section 4.

**Incentives** are critical to the success of an initiative of this magnitude, from the individual level to the institutional. From the institutional perspective, it is clear that digital assets are key to a university's competitiveness in the twenty-first century. In fact, universities could no longer function without access to an increasingly diverse array of digital information and data, both internal and external. The university is ultimately responsible for an infrastructure that both enables the creation and use of these digital assets and ensures their persistence for the required period of time.

The University of Michigan has a relatively advanced program known as "BlueStream" (<http://sitemaker.umich.edu/bluestream>) that has built upon the foundation of a DAM infrastructure to focus on "empowering media intensive work" with advanced indexing technologies for video, audio, and image content. Two of its leaders, Louis E. King and Alan McCord, have described the initial "Aha! moment", campus dialogue, and "executive interest" that led, between 2000 and 2005, to the identification of a solution, technology adoption, and the institutionalization of that solution. The processes that the university initially sought to support revolved around four themes: Archives and Collections; Research and Collaboration; Online Learning; and Public Communications. King and McCord offer the following model of "Media Enabled Collaboration", which illustrates relationships among the many activities and roles related to digital content creation and use in the university environment.<sup>5</sup>



From: King, Louis E. and Alan McCord, "A Multifaceted Approach to Digital Asset Management."

Here are some other recent observations that signal growing recognition of the value and necessity of Digital Asset Management by leaders within the academic community. First, some comments from a presentation entitled, "Managing Digital Assets in Higher Education: An Overview of Strategic Issues" by Donald J. Waters of the Andrew W. Mellon Foundation, at a 2005 forum on "Managing Digital Assets: Strategic Issues for Research Libraries:"

The development of search technologies will drive the scholarly use of massively digitized resources, but scholarly use will also shape and guide the development of particular technologies and applications for specific disciplinary pursuits. Disciplines will need to develop new and specialized methodologies—an informatics of standards and practices—to identify, mark up, and explore the large volumes of digital information with which they each need to work: economists with tabular data in government publications; literature scholars with literary texts from various genres; social historians with contemporary accounts of various aspects of social life; ethicists with case studies of ethical dilemmas; art historians with evidence about the context of artists and their art; and so on. As scholars in various fields of study develop experience with these materials, the disciplines and subdisciplines will need to develop and codify practice....

Given appropriately edited and marked up resources, and proficiency in new methodological techniques, scholars will begin to generate and report results based on research using these methods. These reports will refer systematically to digitized sources and may incorporate them in various ways. They will make increasing use of the power of the computer to illustrate and represent ideas graphically; to simulate physical, biological, and social systems; to engage the reader interactively; and to document ideas encyclopedically with data and other evidence that are portable and recombinant in ways that allow arguments to be tested, proved, and extended. Complex works with these features will be the natural descendant of the monograph and the journal article, but will fit naturally in neither category. ...

Demand will grow for deepening connections between digital library systems used for managing digital assets in various forms and combinations of licensed, digitized, and open access materials and learning management systems such as Sakai. Conversely, at least some of the content specifically created for teaching and learning will need to flow to digital library systems for long-term management and preservation.<sup>6</sup>

The urgent challenge of capturing and preserving those digital materials created by scholars but not traditionally "published" is addressed by historian Roy Rosenzweig, who observes that

While research libraries have tried to save relatively complete sets of published works, other historical sources have generally only been preserved in a highly selective and sometimes capricious fashion—what archivists call "preservation through neglect." Materials that lasted fifty or one hundred years found their way into an archive, library, or museum. Although this inexact system has resulted in many grievous losses to the historical record, it has also given us many rich collections or personal and organizational

papers and ephemera. But this "system" will not work in the digital era because preservation cannot begin twenty-five years after the fact.<sup>7</sup>

Digital Asset Management is relevant for every area of the university. This is illustrated by a closer examination of its meaning in the realms of Teaching and Learning, Research, and Extension and Engagement.

### Teaching and Learning with Digital Assets

As noted above, faculty and students are creating and using increasing quantities of online learning content, and, with projections for continuing growth in distance and online education, this trend is likely to continue. A set of open technical specifications for interoperable learning technology objects has been developed by the IMS Global Learning Consortium and its member organizations (<http://www.imsglobal.org/>). This is an important step in enabling intelligent storage, access, sharing, and reuse of this material. Storing it within a robust DAM infrastructure, with appropriate metadata guidelines and indexing practices, is the next logical and necessary step. A DAM system would also facilitate the use of a variety of learning objects and other digital content by faculty and students, increasing pedagogical flexibility and reducing the university's reliance on traditional, high-cost textbooks.

The absence of a convenient place to "park" teaching materials such as syllabi, online learning modules, etc. results in duplication of effort from semester to semester, as well as student complaints that these materials are not readily available online where they expect them to be. The absence of a framework within which instructors could share teaching materials guarantees that little sharing occurs. The absence of online space and tools that both instructors and students can use guarantees that the university is not prepared to adopt innovative new initiatives such as student e-portfolios.

A "Learning Object Repository (LOR)" is a particular application of DAM technology that focuses on "digital educational resources that contribute to student learning or to educators' professional development,"<sup>8</sup> such as syllabi, lesson plans, tutorials, animations/simulations, images, or tests. The NCCCS is working actively to develop a LOR and is eager to collaborate with the UNC institutions. One example of a LOR is *The Orange Grove, Florida's K20 Digital Repository* (<http://lor.theorangegrove.org/>). These topics are discussed further in Section 5.

Both the DAM system and the digital library collections provided by the institution need to be interoperable with our learning management and other repository systems. Universities like NC State need to consider and plan for this **now**. McLean and Lynch write:

In essence academic institutions are only just beginning to grapple with the implications of developing the digital campus that includes the two important concepts of digital information management and e-learning management. **Central to both of these key management challenges, is the need to organize and manage the creation, flow and use of content.** In most institutions content is managed in silos that have little institutional interoperability, and as yet, the dream of aggregated reusable content remains unfulfilled. Given that this situation pertains across information management and e-learning management within the institution, a much more holistic view is required of the

functional and technical service layers required to sustain required levels of service. Part of the challenge here will be to appropriately define *institution-wide* infrastructure components and insist that all sectors within the institution share them. This includes authorization mechanisms, basic identity management, authentication, perhaps persistent identifier systems at a minimum. Library systems and learning management systems should both be prepared to employ institution-wide services here rather than to create their own.<sup>9</sup>

[Emphasis added.]

### Digital Assets in Research

Digital Asset Management is highly relevant to the research enterprise as well. In a recent article in *Nature*, "Science in an exponential world," Szalay and Gray observe that

data volumes are doubling every year in most areas of modern science.... As experiments yield more data, and analysis becomes more complex, data become increasingly difficult to document and reproduce. One might argue that complex biological experiments [for example] have always been difficult to reproduce, as there are so many variables. But we believe that with current trends it is nearly impossible to reproduce experiments. We do not have a solution for this problem, but it is important to recognize it as such, and to do what is possible to capture the workflows and to develop protocols for documenting instruments, procedures and measurements in ways that will be usable in several decades' time.<sup>10</sup>

Modern research in science, technology, and engineering relies heavily on computer modeling and simulation, data capture instrumentation, and analysis of massive datasets and databases. While these datasets may or may not reside on campus, the research value added by NC State faculty **does** reside on campus, embodied in local databases, software, and documentation. In some cases, those digital assets reside on departmental servers, but, in too many cases, only on an individual researcher's personal computer. Individuals are thus, through no fault of their own, subjecting themselves to significant risk of data loss. At the same time, the institution has no knowledge or control over whether it is meeting contractual obligations associated with sponsored research.

Recent statements by the National Science Board (NSB) and the National Science Foundation (NSF) suggest that well articulated plans to manage this deluge of data will soon be a key element in the evaluation federal grant applications. The National Science Board's 2005 report, *Long-Lived Digital Data Collections: Enabling Research and Education in the 21<sup>st</sup> Century*, recommends that

The NSF should require that research proposals for activities that will generate digital data, especially long-lived data, should state such intentions in the proposal so that peer reviewers can evaluate a proposed data management plan.<sup>11</sup>

This recommendation and the report as a whole underscore the importance of the Digital Asset Management task. A similar message is evident in recent statements emanating from another NSF initiative, the Advanced Cyberinfrastructure Program:

In addition to addressing the technological challenges inherent in the creation of a *national data framework*, NSF's data policies will be redesigned to overcome existing sociological and cultural barriers to data sharing and access. Two actions are critical. NSF will conduct an inventory of existing policies, to bring them into accord across programs and to ensure coherence. This will lead to the development of a suite of harmonized policy statements supporting data open access and usability. **NSF's actions will promote a change in culture such that the collection and deposition of all appropriate digital data and associated metadata become a matter of routine for investigators in all fields.** This change will be encouraged through an NSF-wide requirement for data management plans in all proposals. These plans will be considered in the merit review process, and will be actively monitored post-award.

At the institutional level, colleges and universities are developing approaches to digital data archiving, curation, and analysis. They are sharing best practices to develop digital libraries that collect, preserve, index and share research and education material produced by faculty and other individuals within their organizations. The technological implementations of these systems are often open-source and support interoperability among their adopters. University-based research libraries and research librarians are positioned to make significant contributions in this area, where standard mechanisms for access and maintenance of scientific digital data may be derived from existing library standards developed for print material. These efforts are particularly important to NSF as the agency considers the implications of not just making all data generated with NSF funding broadly accessible, but of also promoting the responsible organization and management of these data such that they are widely usable.<sup>12</sup>

The NSF's observation that research libraries have a special role to play in the planning and implementation of DAM initiatives has been echoed consistently in the task force discussions.

### Digital Assets in Extension and Engagement

As an engaged university, NC State's faculty, students, and staff work together with business, industry, government, other groups, and individuals to address a wide range of issues and challenges facing our state and the world. Information technology and the Internet have expanded this connectedness, creating multiple avenues for access to university knowledge, services, and research results. Access to web-based resources such as distance and lifelong learning courses, university publications, maps and geospatial datasets, and image/media collections is essential in facilitating learning and problem solving for many North Carolinians. A Digital Asset Management infrastructure would support the development of these digital resources/collections, their unmediated discovery, and productive collaboration among diverse groups and individuals.

Erskine Bowles, the new President of the University of North Carolina, points out that

we as a state and we as a University are facing what I would consider to be an *economic tsunami* heading our way. All of us have seen the enormous change that has occurred in the economy of North Carolina because of the losses in the textile, apparel, and furniture

industries. However, we haven't seen anything yet, and if we don't get more people better educated, we are going to be in no position to face up to this tsunami...<sup>13</sup>

Bowles has pledged that the University will operate more efficiently and make the most of its resources, focusing on:

- improving K-12 education throughout the state
- collaborating with the community colleges;
- expanding our distance education curricula and enrollment;
- partnering with high-growth industries and professions such as advanced manufacturing, biotechnology, and health care;
- delivering public service and research; and
- attracting and retaining "great faculty."

A Digital Asset Management approach is fully aligned with these efficiencies and goals, since it facilitates or provides multiple benefits for both the university constituency and all who have a stake in the betterment of North Carolina:

- increased productivity through reuse of digital/learning objects;
- infrastructural support for busy faculty members who are content creators;
- improved educational quality, access, and achievement, including in critical areas such as Science, Technology, Engineering, and Mathematics, where many of tomorrow's opportunities await;
- enhanced institutional capacity, at every level, to share the knowledge of the university more broadly, in support of education, government, industry, economic development; and
- opportunities to develop a "knowledge web" across multiple institutions.

#### 4. Digital Asset Management@NC State?

What is NC State University's current situation with respect to the creation, management, and use of digital content? We know that many large collections of digital assets exist, distributed across the university, with varying data structures and storage architectures, and tied to a variety of software applications. While some of these systems are functioning adequately at present, it must be emphasized that, in general, **they are not seen by anyone, including their owners or administrators, as sufficiently robust or scalable for long-term use.** Ours is not the only university in this predicament; Goodyear and Fyffe describe the common realization that these disparate collections

amount to uncurated aggregations of important and trivial information, current and superseded work, hosted on platforms with no checks for data integrity, minimal metadata for provenance, little encoding for version or access control, and no support for format migration—in short, with none of the structures and functions that together may give some assurance of ongoing accessibility and usability for digital files.<sup>14</sup>

It is not only lack of control over raw research data or instructional materials that puts the university at risk. It is also lack of control over administrative digital assets, such as those related to critical university records (including records for which the university has legal and archival responsibilities) and assets that are critical for day-to-day operations. Currently we are *losing* a tremendous quantity of valuable digital assets (business records as well as academic) and, with them, significant opportunities for advancing our mission, by not effectively capturing and preserving that which is “born digital.” Goodyear and Fyffe continue,

In the wake of Hurricane Katrina, organizations are reexamining their strategies for ensuring the continuity of their core operations. Business continuity has become a focus for higher education institutions nationwide as we watch and assist our Gulf Coast colleagues who are experiencing the very real problems of recovering from a natural disaster. For colleges and universities, these strategies must include maintaining continuity for the scholarly work of faculty and researchers. The importance of the research enterprise calls for paying significant attention to the stewardship and preservation of the institution’s digital assets, particularly those that are unique to the campus.<sup>15</sup>

There is a widespread desire to move toward a true Digital Asset Management solution, with all of the benefits it would bring. We do not need to ask, “If we build it, will they come?” A broad constituency of prospective users and stakeholders is already here, ready and waiting to work together as an “open support community” in the framework of a new system. **University funding and a university vision are required – no individual unit has the resources to solve this problem on its own.**

### Examples of Existing Collections

Here are some examples of existing digital collections at NC State. Each of these projects represents a separate investment of considerable university resources in planning, implementation, and maintenance, and, in most cases, the resulting system does not fully meet identified needs. Most, if not all, of the content creators and managers that we have surveyed are eager, and, in some cases, desperate, for a university solution.

- College of Agriculture and Life Sciences (CALs)  
Image Database maintained by Dr. Mary Peet, Horticulture Department  
<http://peet.hort.ncsu.edu/>  
Approximately 60 GB of content. Uses Extensis Portfolio 7.0 software on the Macintosh. Allows for only 5 concurrent users. A software upgrade is needed to improve functionality and expand the capacity, but further investment in this system would not be the optimal development strategy for the collection, particularly when compared to a university DAM solution.
- CALs Communication Services Image Showcase  
<http://216.119.109.157/content/index.cfm?fuseaction=page&filename=home.html>  
The 290-image collection makes available a handful of department’s 90-year-old image archives available for free download to members of the campus community and others. The

department, which provides fee-for-service media creation/production, is transitioning from this showcase to a new gallery temporarily at <http://carolyn.ces.ncsu.edu/gallery/gallery2/>, which currently contains 377 images. Although this gallery is growing, it represents a small fraction of the department's total image collection. If a larger campus-wide DAM system were adopted and support provided for entering images and metadata, it could help ensure that images and the history they represent are stored, indexed, protected and made available to the campus community.

- College of Design

The College of Design generates approximately 1,000 student images per year that need to be archived for both accreditation and publication purposes. In fact, one department has taken it upon themselves to explore an outside vendor-developed solution specific to their needs. The Design Library Image Collection (below) is of great importance to the teaching and research missions of the college.

- Design Library Image Collection

<http://databases.lib.ncsu.edu/design/slides/search/about.cfm>

The Design Library has over 70,000 slides covering the areas of architecture, landscape architecture, industrial design, graphic design, art and design, many of which are available in digital format (30 GB). It uses an Oracle database, with Luna Imaging® Insight® image management software available as a display interface. Access to full-sized images is restricted to NCSU students, faculty, and staff.

- College of Education Image and Video Collection

The College of Education currently maintains about two terabytes of digital video and 21 GB of photos. With the opening of the Friday Institute, the video collection is growing at an accelerated rate, approximately one terabyte per semester. In addition, accreditation standards for education have become an additional pressure: our 1,200+ students will be creating more images and video as artifacts of learning and professional practice. Storage and indexing has been a major issue for our college. At present, potential users have to request what they need and wait for it to be found and delivered. A searchable system with robust metadata is a priority. The college is very supportive of an enterprise solution to this issue.

- College of Natural Resources

<http://insidewood.lib.ncsu.edu/search/>

The InsideWood project integrates wood anatomical information from the literature, an image collection containing contributions from wood anatomists and institutions worldwide, and original observations into an Internet-accessible database useful for research and teaching. The InsideWood database contains brief descriptions of woody dicots (hardwoods) from more than 200 plant families, and is searchable by an interactive, multiple-entry key. Current storage volume is 315 GB. (Funded by two NSF grants over four years; partnership with NCSU Libraries.)

- College of Natural Resources

The Center for Earth Observation (CEO), in cooperation with the National Park Service and the United States Geological Survey, maintains a large inventory of benchmark natural

resource information for scientific and resource management purposes. Included in this data are mosaics of digital images for more than 50 National Parks. These images and data (including FGDC metadata) currently constitute 2 TB of storage space, anticipated to grow to 4 TB over the next several years. CEO is currently able to provide only minimal data organization, and access is handled manually on a case-by-case basis. CEO is in desperate need of a robust data management structure with a versatile web-based user search and download system.

- The College of Textiles maintains a digital collection of approximately 1,500 assets totaling 365 MB of file space. The collection is managed in a ColdFusion web-based application developed by the college. The metadata for each object is located in a SQL database. The application provides keyword searching and the capability for uploading and downloading of digital assets. The application is WRAPped so that only College of Textiles faculty and staff can access the system.
- College of Veterinary Medicine Image Collections  
Examples using selected images from the Poultry Catalog (17, 000 images):  
<http://www.cvm.ncsu.edu/dphp/phm/Research/pems/pems.html>,  
<http://www.cvm.ncsu.edu/dphp/phm/Service/pathquiz/pathquizmain.html>.  
CVM uses the Canto Cumulus Workgroup version, currently with five collections (catalogs) of digital objects. CVM has about 60 GB of assets, growing at 2-3 GB per year. Scalability of storage and system administration has been a major issue, since the software is not compatible with the AFS storage infrastructure supported by ITD, and Novell Netware is not stable enough. Asset reference information includes the IP number of the host machine, which has made it difficult to move the collections to larger storage environments. The college has desperately needed a more robust solution for years and is very eager for an enterprise solution, recognizing the likelihood that its content will need to be exported into that system.
- Creative Services  
[www.ncsu.edu/creative/](http://www.ncsu.edu/creative/)  
Provides fee-for-service media creation/production. Uses an in-house Extensis Portfolio server with 2,500 images on it, connected to a web version for access by clients. Most of the images are available for web use at relatively low resolution; others are provided at high resolution at a charge. Maintains "official" photos of administrators for media use. Creative Services selected the Extensis server because it can be integrated with larger database-driven systems if the university acquires a DAMS.
- Gallery of Art and Design  
<http://gad.ncsu.edu/GARTRFI/DEFAULT.ASP>  
This collection includes approximately 10,000 records with more than 60,000 associated images. Gallery staff would like to incorporate digital video content, but the current system does not support this. The software currently in use is Visual Re:discovery, a relational database system for museum, archival, and archaeological collections management. This implementation supports only two concurrent users; funding has not been available to expand the license. There is great concern about the potential for data loss under the current

circumstances, and Student Affairs would like to make the collection available on the Internet to the university community and a broader audience.

### Other Campus Stakeholders

Academic support units such as the Libraries, DELTA, and ITD are also major stakeholders in any Digital Asset Management scenario, both as system users and as sources of staff expertise/guidance for implementation and ongoing administration of a system.

The **NCSU Libraries** is prepared to include Digital Asset Management in its Compact Plan and to play a leading role in the implementation of a solution if this is supported by the university. The Libraries builds and maintains a variety of digital collections and services, with system architectures that include the DSpace repository software, Luna Imaging® Insight®, and locally developed Oracle databases. Library staff have advanced training and experience in the following areas relevant to a DAM initiative:

- supporting faculty and student use of information resources, with awareness of privacy/confidentiality issues;
- development and implementation of use policies and privilege configurations as they pertain to specific electronic resources;
- design of workflows for digital repositories; and
- design of metadata architectures and user interfaces, including usability testing.

**DELTA** would leverage NC State's investments in a DAM system to support:

- Teaching and learning, by:
  - enhancing shared knowledge through the use of learning objects within courses and across courses internally and externally to NC State;
  - allowing quick and easy access to learning objects within NC State's learning management systems, especially WebCT Vista; and
  - encouraging student reflection, critical thought, and documentation of professional growth by providing storage solutions for e-portfolio projects;
- Innovation, by offering an infrastructure for Digital Asset Management projects that come to DELTA through the IDEA grants and/or other course production processes, projects, and programs; and
- Efficiency, by replacing an aging file management system that supports DELTA's internal business processes.

**ITD** is a central university source of expertise in:

- scalable and highly reliable enterprise-level computing/networking infrastructure;
- digital multimedia, including emerging formats and standards;

- web and interface design and development; and
- providing education and training for the campus on a variety of widely used applications.

### Policies and Incentives

A Digital Asset Management system would need to accommodate both personal and university-level collections, with a workflow continuum for objects to follow based on decisions by their creators/owners within a university policy framework. Policies and guidelines need to be defined systematically, including relationships of the proposed system functions to existing university policies, rules, and regulations. Areas of particular focus include copyright/intellectual property, definition of review and quality control roles and access privileges, and compliance with FERPA and other legal restrictions. Flexible workflows need to be established that, where appropriate, define and enforce quality control and review roles, as well as individual and shared privileges. Faculty members, students, and staff must understand their roles, privileges, and responsibilities as users of the system.

Organizations that have implemented DAMS report that careful planning and preparation are critical, and that a certain amount of “cultural change” is inherent in the process and required in order to use resources effectively. Certain business practices will need to be reexamined and reengineered over time. Parallels can be drawn between this and the selection and implementation of the LMS. Obviously, determinations must also be made of where the DAM application will be hosted and how storage space will be allocated and distributed.

In addition to the range of individual and institutional incentives discussed in Section 4, one key incentive for participation in a university DAM solution would be **cross-collection search capability**, which is, of course, absent in today’s fragmented environment. To facilitate this searching, guidelines for cataloging/“tagging” of different types of assets would be developed and implemented as “templates” in the DAM system user tools. Not everything is designed or intended to be shared, but the ability to make shareable digital objects available to campus colleagues and external audiences is desirable and valuable. The University of Michigan’s Request for Proposals document describes this as follows:

Metadata flexibility is another key requirement of the University’s DAMS environment. Each discipline, application type, school, or project may require unique metadata structures. At the same time, each asset should share common metadata information established upon ingestion. This common metadata structure must result from collaboration by key University participants, especially the University Library. The ability to define and manage multiple metadata structures and associating for any digital asset is an important attribute for a successful University-wide DAMS implementation.<sup>16</sup>

**Experience at NC State and elsewhere has shown that when the needs for fundamental systems become apparent and the available products are sufficiently scalable and robust, it is beneficial for the institution to move ahead quickly to develop a plan and implement an appropriately powerful and scalable solution.** Without a DAM system, our ability to call upon our intellectual capital, now and into the future, is seriously jeopardized. A great deal of content is simply being lost or is unavailable when needed, and this is essentially by accident, not as the result of rational retention

decision processes that take into account its purpose and value. In addition, as time goes on, stakeholders may become increasingly invested in the short-term, legacy applications and storage schemes that they have been forced to develop in the absence of a university solution, making consensus on a solution much more difficult.

## Resources

What resources will be required to implement Digital Asset Management? It was beyond the task force's scope to delve into these details, but we can identify the major cost elements. For a university-hosted system, they would include:

- Personnel:
  - 1 FTE Project Manager with project management, information science, and information technology background; and
  - Technical team of 2-3 FTE for Years 1-2, with expertise in database structures and administration, standards-based development, interface design, and programming.
  
- Software Licensing: we have not identified any open-source applications that meet the functional criteria as effectively as the commercial systems available today (though "open source" does not usually mean "free"). As described in Section 5, statewide and regional pricing for one system that appears to meet many functional criteria, (HarvestRoad Hive®), has been negotiated through MiCTA. As more institutions participate in this contract, the per-FTE cost is reduced at various thresholds, such as 50,000, 100,000, and 200,000 FTE. Preliminary information indicates that the cost for an NCSU license in 2006/07 would approach \$100,000 in the first year, minus approximately 15 percent in subsequent years (depending on statewide and regional adoption of the product).

Alternatively, there are indications that we may be able to work with UNC General Administration to negotiate a memorandum of understanding with the NCCCS to participate in the Hive® installation at MCNC, at least at a pilot/start-up level, at a considerably lower cost.

- Storage and Server Infrastructure: capacity must be large enough to allow convergence of multiple data types and widespread participation by the university community. Since the data storage of managed resources can be distributed (and it is likely that some users would prefer this model), we estimate that 6-7 terabytes available centrally would be adequate for the first year or two. Cost per terabyte is approximately \$5,500, assuming an existing server infrastructure.

## **5. Initial Product Evaluation**

Digital Asset Management software products, along with digital media file formats themselves, have been evolving rapidly over the past three to five years, and there has been considerable industry consolidation. The task force conducted preliminary investigation of more than ten products and more detailed examination of seven of the products, to gain a sense of the number of potentially

viable competitors in the marketplace and the nature of the products. We recognize that a formal Request for Proposals process, with more detailed specifications, would be necessary for actual implementation of a university-hosted solution.

Our initial assessment ranks the **HarvestRoad Hive®** and **Stellent™ Digital Asset Management** products most highly. Functional Criteria worksheets completed by those vendors are attached as Appendix E. The most important functional criteria, in our view, are:

- scalability and customizability in a large, multiplatform computing environment;
- interface design and ease of use;
- flexible workflow configuration;
- accessibility; and
- interoperability with other systems, including ease of import and export of records/data and overall exit strategy.

Product Name/Vendor	Comments
HarvestRoad Hive® ( <a href="http://www.harvestroad.com/">http://www.harvestroad.com/</a> )	Meets most or all of the Functional Criteria. Standards compliance and LMS interoperability are emphasized. Has been licensed by the NC Community College System and endorsed by MiCTA.
Stellent™, Inc. Universal Content Management and Digital Asset Management ( <a href="http://www.stellent.com">www.stellent.com</a> )	Meets most of the Functional Criteria (accessibility is a potential problem). Seems to have a robust and scalable architecture (“runs within the server’s Java Virtual Machine”). LMS interoperability not highly developed.
Canto® Cumulus ( <a href="http://www.canto.com/pro/">http://www.canto.com/pro/</a> )	Workgroup version not adequate for university’s needs (in use at CVM). Enterprise version is relatively new. Some significant weaknesses/uncertainties identified.
ClearStory Systems ActiveMedia ( <a href="http://www.clearstorysystems.com/products-services/activemedia.html">http://www.clearstorysystems.com/products-services/activemedia.html</a> )	Less overall functionality than other products.
Extensis™ Portfolio ( <a href="http://www.extensis.com/en/products/">http://www.extensis.com/en/products/</a> )	University-level scalability not assured; server is Windows or Macintosh-based.
Fedora ( <a href="http://www.fedora.info">http://www.fedora.info</a> )	Open source, but difficult to install and understand the documentation. User interface and workflow configuration not mature.
Luna Imaging™ Insight™ ( <a href="http://www.lunaimaging.com/">http://www.lunaimaging.com/</a> )	In use by the NCSU Libraries to manage and display image collections in Special Collections/UniversityArchives and the Design Library. Has well developed image and multimedia indexing and viewing functions, but is not a full-fledged DAM product. Does not currently accept Word

	documents or datasets, for example.
Piction ( <a href="http://www.piction.com/">http://www.piction.com/</a> )	Small company, with most customers and presence in Australia. Emphasizes e-commerce applications (sale of digital assets).

### Recent Developments in North Carolina

Recently, the **North Carolina Community College System (NCCCS)** has contracted with **HarvestRoad Ltd.**, based in Australia, for its Hive® independent, federated digital repository system. The software will be used as a platform for a statewide Learning Object Repository and will be hosted at MCNC in Research Triangle Park. Collaboration with the UNC system in support of the engineering “2+2” and other academic programs is part of the vision for its use, and the UNC TLT Collaborative is in communication with the NCCCS about developing that collaboration. **It appears likely that UNC-GA would be supportive, perhaps financially, of an institution such as NC State wishing to move ahead quickly to implement and demonstrate a system and serve as a resource for others.**

HarvestRoad is able to demonstrate a successful implementation supporting *The Orange Grove: Florida’s K-20 Digital Repository* (<http://www.theorangegrove.org/>), and has been endorsed by MiCTA (<http://www.micta.org/>, <http://www.harvestroad.com/news/release.cfm?id=68>), an organization that administers contractual arrangements and works with its members (NC State is a member) and with vendors to develop and sustain quality, cost-saving programs. A cost model has been adopted in which the per-FTE licensing cost goes down as additional institutions across North Carolina and the southeast implement Hive®.

The **Georgia Board of Regents** has also selected Hive® for statewide implementation across multiple types of institutions, taking advantage of the MiCTA pricing. Administrators in Georgia have indicated a willingness to share information and collaborate with NC State, if desired. The Southern Regional Education Board (SREB) is planning to implement an interstate server infrastructure to federate statewide learning object repositories (<http://www.sreb.org/programs/EdTech/SCORE/index.asp>).

A committee led by members of the **Technology Committee of the UNC Faculty Assembly and the Teaching and Learning with Technology Collaborative** is planning a LOR pilot project for 2006/07 to give interested faculty and staff members the opportunity to “use a sophisticated University-wide content management system to share research, teaching, training, and other materials across all sixteen campuses.” (UNC TLT Conference program, 2006, p. 5) It is likely that the system employed for this pilot project will be HarvestRoad Hive®. Disciplinary collaboration among faculty from both the universities and community colleges could be tested and explored. A survey conducted by this committee revealed that intellectual property and access control issues figure prominently for university faculty members in the LOR context.

## 6. Recommendation

The task force strongly recommends that NC State implement a **strategic, institutional approach to Digital Asset Management**. This initiative will require a commitment to innovation from the university leadership, identification or reallocation of resources, creative and intelligent management, and campus-wide participation.

A Digital Asset Management solution will consist of both a technical infrastructure layer and a network of relevant campus expertise, guided by university policies and principles. The selection and implementation of a DAMS is needed urgently to support critical, high-impact programs and activities across the university, including but not limited to those focusing on research, teaching, and learning. This system will help the university to mitigate its risks, for example, in the event of a large-scale disaster, and will strengthen our business continuity capabilities. The benefits of this system will permeate all endeavors of the university by enabling collection, organization, storage, retrieval, preservation, transformation, publication, and control of the profusion of valuable digital materials being created.

An Implementation Team will be necessary if this initiative moves forward. The Digital Asset Management Task Force members are prepared to continue to serve, if requested, and to contribute to the implementation of a university solution that will benefit all colleges and units.

### Action Steps (not in chronological order)

- Initiate a campus discussion on Digital Asset Management that further involves stakeholders such as the colleges, Research and Graduate Studies, Extension and Engagement, Finance and Business, Facilities, Student Affairs, the Libraries, DELTA, ITD, FCTL, and others. This discussion would build awareness and gather valuable information as the project advances. There has already been broad participation in achieving the fundamental consensus that Digital Asset Management is critical for the future of the university (including participation at task force meetings by personnel from outside of Academic Affairs).
- Identify any natural linkages with current or proposed Compact Plan initiatives of various campus units. The **NCSU Libraries** is prepared to include Digital Asset Management in its Compact Plan and to play a leading role in the implementation of a solution if that is supported by the university. Compact Plan partnership codicils with other campus units related to DAM could be developed.
- Identify an Implementation Team, an Advisory Committee, and a campus-wide “expertise network” of individuals with relevant knowledge to advance and guide the project. For example, groups will need to collaborate on the development of an initial, “core” set of metadata schemas, guidelines/resources and training to create metadata describing digital objects, and a website of resources for consultation and preparation to use a DAM system.
- Consider establishing a collaborative partnership with the NCCCS and UNC GA that would allow NCSU to share in an implementation of HarvestRoad Hive® already in progress at

MCNC. This approach would allow the university to demonstrate and ramp up its use of the system at a lower cost of entry.

- If a university-hosted system or significant university-based data storage is preferred, determine the cost, time, and resources needed for software selection and acquisition, hardware infrastructure deployment, and system implementation, and identify the source(s) of those resources.
- Establish one FTE staff position as a Project Manager, ideally for 2006/07. Qualifications include knowledge of project management, information science, metadata, information/database technology, and the mission of a research university. A core technical team (2-3 FTE), or a plan to “outsource” system administration, will also be necessary for full implementation of the system.
- Improve educational quality, access, and achievement across North Carolina through collaboration with other educational organizations such as the NC Community College System, the K-12 schools, and the UNC TLT Collaborative. Collaborate as appropriate with states such as Georgia where the Board of Regents is implementing a DAMS.

## References

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- <sup>1</sup> Diana G. Oblinger and James L. Oblinger, eds., *Educating the Net Generation* (Boulder, Colo.: EDUCAUSE, 2005), e-book, <http://www.educause.edu/educatingthenetgen>.
- <sup>2</sup> King, Louis E. and Alan McCord, "A Multifaceted Approach to Digital Asset Management," Seminar presentation at Educause Fall 2005 (Orlando, Florida).  
<http://sitemaker.umich.edu/bluestream/files/educause2005fall-print.pdf>
- <sup>3</sup> "Digital Asset Management Task Force formed," LITRE web site (2005),  
<http://litre.ncsu.edu/dfiles/dam.html>
- <sup>4</sup> *Journal of Digital Asset Management* (vol. 1, 2005- ), <http://www.palgrave-journals.com/dam/index.html>).
- <sup>5</sup> King & McCord.
- <sup>6</sup> Waters, Donald J., "Managing Digital Assets in Higher Education: An Overview of Strategic Issues" *ARL*, no. 244 (February 2006): 1-10. <http://www.arl.org/newsltr/244/assets.html>.
- <sup>7</sup> Rosenzweig, Roy, "Scarcity or Abundance? Preserving the Past in a Digital Era," *The American Historical Review* (June 2003), <http://www.historycooperative.org/journals/ahr/108.3/rosenzweig.html>
- <sup>8</sup> Griffith, Rosemary, et al., "Learning Objects in Higher Education," Academic Advanced Distributed Learning Co-Lab publication, University of Wisconsin (April 2003),  
[http://www.academiccolab.org/resources/webct\\_learningobjects.pdf](http://www.academiccolab.org/resources/webct_learningobjects.pdf)
- <sup>9</sup> McLean, Neil and Clifford Lynch, "Interoperability between Information and Learning Environments—Bridging the Gaps: A Joint White Paper on behalf of the IMS Global Learning Consortium and the Coalition for Networked Information" (Dublin, Ohio: Online Computer Library Center, 2004), [http://www.msglobal.org/digitalrepositories/CNIandIMS\\_2004.pdf](http://www.msglobal.org/digitalrepositories/CNIandIMS_2004.pdf)
- <sup>10</sup> Szalay, Alexander and Jim Gray, "Science in an exponential world," *Nature*, vol. 440 (23 March 2006): 413-414.
- <sup>11</sup> *Long-Lived Digital Data Collections: Enabling Research and Education in the 21st Century*, NSB-05-40, September 2005, <http://www.nsf.gov/pubs/2005/nsb0540/start.jsp>
- <sup>12</sup> *NSF'S Cyberinfrastructure Vision for 21st Century Discovery*, NSF Cyberinfrastructure Council, National Science Foundation, January 20, 2006, [http://www.nsf.gov/od/oci/ci\\_v5.pdf](http://www.nsf.gov/od/oci/ci_v5.pdf)
- <sup>13</sup> Erskine Bowles, "President's Report to the UNC Board of Governors," UNC General Administration Building, Chapel Hill, NC (January 13, 2006),  
<http://www.northcarolina.edu/content.php/pres/index.htm>

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<sup>14</sup> Goodyear, Marilu and Richard Fyffe, "Institutional Repositories: An Opportunity for CIO Campus Impact," *EDUCAUSE Review*, vol. 41, no. 2 (March/April 2006): 10-11.

<sup>15</sup> *Ibid.*

<sup>16</sup> *Request for Proposal: Digital Asset Management Systems and Related Services. The University of Michigan Digital Asset Management System.* Request for Proposal # C-0809-02-A, June 13, 2002, <http://sitemaker.umich.edu/bluestream/files/dams-rfp-c-0809-02-a.pdf>

## **Appendix A**

### **Digital Asset Management System Functional Criteria**

#### **Material Submission**

What file types are accepted?

What range of individual file sizes supported?

What directory structures are supported?

Does the system have the capability of receiving multiple files grouped as .zip, .tar, etc., and incorporating the files and associated metadata into storage structure?

What is the total capacity (could be distributed)?

Does it have flexible control of submission rights, i.e., submission mechanism that allows for immediate accession or prior review by a moderator?

Does it offer file conversion capabilities with process control? (upon ingest of documents and/or conversion on export)

Can the file conversion functions be turned on and off?

#### **Metadata Application**

Does it offer an end-user front-end for metadata entry? Browser-accessible?

Is the data entry interface, or any other element, platform dependent?

Does it offer curator access for editing/revising metadata (possibly separate app)?

Does it provide automated generation of some metadata - e.g., time stamp, submitter's authentication information, ...

Is it capable of handling common schemas such as Dublin Core, MARC, etc?

What are the import/export capabilities? Include XML?

Can individual assets be grouped to form collections/packages?

How easy is integration or coordination with library catalogs & other collections?

Are extensible metadata schemes supported/encouraged?

#### **Access Control**

Does it have ability to interoperate with NCSU authentication?

(e.g., specific rights for individual users, at item and collection levels)

What other rights management capabilities are supported, e.g., for licensed material?

Is there adherence to digital rights management rules?

#### **Discovery Support**

Is the metadata searchable across subcollections?

Are there search methods for metadata-contained-in-file?

Are there search methods for searching item content (such as full text or image attribute searching)?

What alerting capability is offered (e.g., trigger e-mail to curator or user when an addition or change is made to a directory or within metadata)?

Is searching fully integrated or via separate application?

Are materials accessible (ADA requirements)?  
How is asset rendered -- is there user-defined rendering?  
Is controlled vocabulary supported?

### **Distribution**

What parts of the system are browser accessible?  
What parts of the system are platform independent?  
Can viewing of certain files be limited to certain users?  
Can the system export files and groups of files, with or without associated metadata?  
Can the system export files to/via streaming and other servers?  
Does the system support integration with NCSU Learning Mgmt System(s) and other key systems (interoperability)?

### **Preservation**

Is there capability for file-type search (to allow for easy conversion from obsolete types to newer types)?  
Are there other features that facilitate preservation?  
What is the storage management system? Compatible with NCSU systems?  
Is there adequate backup capability?

### **Ongoing Management & Review**

Are there facilities for producing management reports:  
resources used  
usage statistics  
What is the capability of suspending access to file(s)?  
Does it have workflow tools for administration of submission/markup/accession?  
Are there tools for curators/moderators?

### **Other Issues**

Multiplatform/platform independence; compatible with NCSU IT infrastructure  
Users' platforms can vary

### **Business Continuity Planning**

System should be amenable to requirements of BCP, including both local and "hosted" components, if any.

### **Policy/Documentation/scope**

Conform to existing university policies such as Copyright Ownership & Computer Use  
Ability to determine and configure what material will be accepted  
Ability to determine what material will be refused (copyright or other restrictions?)  
based on technology  
based on content  
based on file types

## Appendix B

### Digital Asset Management Activities and Initiatives Examples from Other Colleges and Universities

#### Official Peer Institutions

Iowa State University

Libraries is using Luna Imaging™ Insight™, but no university DAMS.

Ohio State University

DAMS is the subject of a partnership between the Libraries and the Chief Information Officer. DAM is listed as a “critical inquiry area.” Office of Information Technology uses Stellent Content Management™, but there does not appear to be a university-wide DAM system.

<http://digitalunion.osu.edu/Research/>

Ohio State University Web Media Collective

“A group of faculty, staff and students in Humanities, Arts and Architecture working together to find cost-effective ways to make knowledge created at Ohio State available across disciplines and to audiences beyond the University.”

<http://wmc.osu.edu/>

Penn State University

Digital Media Resources Group has engaged in planning and research.

<http://its.psu.edu/dmr/dam.html>

Purdue University

The Libraries is engaged in collaboration with NSF researchers to plan for data management. Created the new position of Data Research Scientist.

Presentation by James Mullins, Dean of Libraries:

<http://www.arl.org/forum05/presentations/mullins.html>

<http://www.ala.org/ala/acrlbucket/candrlnews/caropps/march2006a/DataResearchScientist.htm>

University of Illinois – Urbana/Champaign

Documents on website refer to the University of Michigan BlueStream initiative and potential collaboration on DAM through CIC.

#### Other Institutions

Florida Distance Learning Consortium

The Florida Distance Learning Consortium consists of representatives from all 28 community colleges, 11 universities and SACS accredited private institutions. The consortium selected HarvestRoad Hive® for its Learning Object Repository, *The Orange Grove: Florida's K-20 Digital Repository*.

<http://www.theorangegrove.org/>

#### Georgia Board of Regents

The Board oversees all 35 public colleges and universities in the University System of Georgia, and has selected HarvestRoad Hive® to build a collaborative Learning Object Repository to be used in conjunction with WebCT Vista.

<http://www.usg.edu/>

#### Johns Hopkins Institutions

“The Digital Media Manager is an institutions-wide digital repository for photos, design files, PowerPoints, spreadsheets, audio, video—virtually any digital “asset” that Johns Hopkins departments need to preserve, retrieve, use and share.”

<http://www.jhu.edu/dmm/index.html>

#### North Carolina Community College System

NCCCS has contracted with **HarvestRoad Ltd.**, based in Australia, for its Hive® independent, federated digital repository system, to be used as a platform for a statewide Learning Object Repository.

<http://www.ncccs.cc.nc.us/index.asp>

#### Southern Regional Education Board (SREB)

“SCORE” stands for “Sharable Content Object Repositories for Education,” a system that places reviewed course content in databases (repositories) to which all participating states have access. The goals of SCORE are to improve teaching and learning and achieve costs savings through a multistate K-12 and higher education initiative to share digital learning course content among colleges, universities and schools in SREB states.

<http://www.sreb.org/programs/EdTech/SCORE/index.asp>

#### University of Michigan - BlueStream

“BlueStream is an online environment with powerful features for using digital video, audio, images, and documents in higher education. Built atop the UM Digital Asset Management infrastructure, BlueStream easily handles media conversion to required formats, storage, access control, and publishing - not only within BlueStream but to any web site, cTools, SiteMaker, and even iTunes.”

<http://sitemaker.umich.edu/bluestream>

#### University of Michigan Digital Library Extension Service

“Provides the foundation and the framework for educational and non-profit institutions to fully develop their digital library collections.” Offers fee-based membership, with search software and other tools.

<http://www.dlxs.org>

#### University of Texas Digital Assets Repository Project

Includes a DAMS pilot project, review of existing Digital Library Services, IT systems, and research on metadata and the Open Archival Information System (OAIS) reference model.

<http://www.lib.utexas.edu/dlp/dar/index.html>

<http://www.lib.utexas.edu/dams/index.html>

University of Washington's DigitalWell project

Focuses on "enabling access to high quality, high definition video and audio assets via Internet2 networks."

<http://www.digitalwell.org/>

**Appendix C**  
**Digital Asset Management Task Force Members, 2005/06**

Carolyn Argentati, Libraries – convener  
Mary Peet, College of Agriculture and Life Sciences  
Alan Schueler, College of Agriculture and Life Sciences  
Barbara Brenny, Design Library  
John Tector, College of Design  
Lisa Grable, College of Education  
Jonathan Ocko, College of Humanities and Social Sciences  
Heather Cheshire, College of Natural Resources  
Bill Switzer, College of Physical and Mathematical Sciences  
Mike Ferguson, College of Textiles  
David Ley, College of Veterinary Medicine  
Dan McWhorter, College of Veterinary Medicine  
Dan Tucker, College of Veterinary Medicine  
John Williams, Gallery of Art and Design  
Sharon Pitt, DELTA  
Amanda Robertson, DELTA  
Hal Meeks, Information Technology Division  
Harry Nicholas, Information Technology Division  
Saroj Primlani, Accessibility Coordinator, Information Technology Division  
Henry Schaffer, Information Technology Division

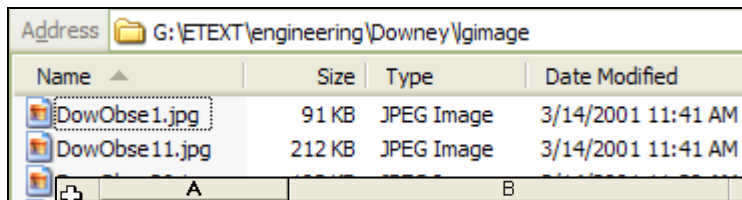
## Appendix D METADATA OVERVIEW

### Metadata

Information that describes an object or set of objects, its content, structure, lineage, restrictions, etc.

Type	Use	Example types of data
<b>Descriptive</b>	Describes or identifies the object	<ul style="list-style-type: none"> <li>• authors</li> <li>• titles</li> <li>• subjects</li> <li>• relationships (ispartof/haspart)</li> </ul>
<b>Administrative</b>	Provides information for managing the object	<ul style="list-style-type: none"> <li>• object location</li> <li>• rights management</li> <li>• version control</li> </ul>
<b>Structural</b>	Maps how the parts of the object relate	<ul style="list-style-type: none"> <li>• page order</li> <li>• sections</li> <li>• image sequence</li> </ul>
<b>Technical/Preservation</b>	Documents file format(s) and software/hardware used in object creation and how to manage them for long-term availability	<ul style="list-style-type: none"> <li>• file format</li> <li>• scanning resolution</li> <li>• checksum</li> <li>• migration path</li> </ul>
<b>Functional/Behavioral</b>	Outlines how an object interoperates with external services and software	<ul style="list-style-type: none"> <li>• online data viewer</li> <li>• programming libraries</li> </ul>

### Metadata Snippets:



	A	B	C	D	E	F
	Originating Number	Assignee	Assignee Location	Application Date	Issue Date	CCL Codes
2	3932519	Hoffmann-La Roche Inc.	Nutley, NJ	10/16/1973	1/13/1976	568/315, 549
3	3932456	Richardson-Merrell Inc.	Wilton, CT	6/16/1969	1/13/1976	548/441, 514
4	3932542	Great Lakes Chemical Corporation	West Lafayette, IN	8/26/1974	1/13/1976	570/206, 502
				/1971	1/13/1976	540/226, 540
				/1974	1/13/1976	544/221

```

<meta name="Author" content="Andrew Daviel">
<meta name="Generator" content="vi">
<meta name="Copyright" content="Copyright 1997 Vancouver Webpages">
<meta name="Publisher" content="Vancouver Webpages">
  
```

```

<?xml version="1.0" encoding="ISO-8859-1"?>
<?xml-stylesheet type="text/xsl" href="ingr_classic.xsl">
<metadata>
<idinfo>
<citation>
<citeinfo>
<origin>U.S. Department of Commerce
U.S. Census Bureau
Geography Division</origin>
<pubdate>2001</pubdate>
<title>TIGER/Line Files, Census 2000</title>
<edition>Census 2000</edition>
<serinfo>
<sername>TIGER/Line Files</sername>
<issue>Version (MMYY) represents the month and year
file created</issue>
</serinfo>
</pubinfo>
<pubplace>Washington, DC</pubplace>
<publish>U.S. Department of Commerce
U.S. Census Bureau
Geography Division</publish>
</pubinfo>
  
```

```

contributor.advisor John M. Essigmann.
contributor.author Bradley, Lisa Jolene Naser, 1957-
date.accessioned 2005-04-01T16:33:54Z
date.available 2005-04-01T16:33:54Z
date.copyright 1991
date.issued 1991
identifier.uri http://hdl.handle.net/1721.1/13956
description Thesis (Ph. D.)--Massachusetts Institut
  
```

## METADATA OVERVIEW - continued

### Metadata Issues

- **Complexity** – Cost vs. Benefit
  - Unstructured
    - Documentation
    - Comment Tags
  - Simple structures allow for flexibility and ease of creation.
    - HTML Meta tags
    - Dublin Core
    - VRA Core
  - Complex structures reflect homogeneity, intricate needs and uses, and high cost of creation.
    - MARC
    - LOM
    - FGDC
    - METS
- **Markup Standards** – Assessing your needs and metadata uses
  - One Size fits all:
    - Dublin Core
    - MARC
    - METS
  - Content/Use specific:
    - VRA Core
    - LOM
- **Encoding Standards** – Best Practices
  - Free-form
  - Semi-structured
  - Structured
    - Declan MacManus | MacManus, Declan | McManus DP
    - 6 August, 1973 | 8/6/1973 |19730806
    - Raleigh | Raleigh, NC | USA-NC-Wake-Raleigh
- **Metadata Management** – Where does it go?
  - In the object
    - Web-page
    - .TIFF
  - Around the object (e.g. METS)
  - In a directory with the object
  - In a collection of metadata files
  - In a database
  - In a repository/DAM with the object

### Usual Suspects:

Standard	URL
Dublin Core – Qualified	<a href="http://dublincore.org/documents/dces/">http://dublincore.org/documents/dces/</a>
VRA Core	<a href="http://www.vraweb.org/vracore3.htm">http://www.vraweb.org/vracore3.htm</a>
LOM	<a href="http://ltsc.ieee.org/wg12/20020612-Final-LOM-Draft.html">http://ltsc.ieee.org/wg12/20020612-Final-LOM-Draft.html</a>
MARC	<a href="http://www.loc.gov/marc">http://www.loc.gov/marc</a>
METS	<a href="http://www.loc.gov/standards/mets/">http://www.loc.gov/standards/mets/</a>

- James Jackson Sanborn, Assistant Head, Digital Library Initiatives & Metadata Architect, NCSU Libraries

## Appendix E

<b>Digital Asset Management Task Force</b>	
<b>Functional Criteria - HarvestRoad Hive®</b>	<b>Response</b>
<b>Material Submission</b>	
What file types are accepted?	Any type files. Hive stores all content in its native format.
What range of individual file sizes supported?	Out of the box, Hive supports unlimited file sizes. Hive, does however, allow administrators to set file size quotas.
What directory structures are supported?	Hive allows you to define your own directory /category /taxonomy structure. This includes sub-directories.
Does the system have the capability of receiving multiple files grouped as .zip, .tar, etc., and incorporating the files and associated metadata into storage structure?	Yes. With respect to zip files, Hive can disassemble (unpack) and store the items contained in the zip file individual. Any associated metadata can be imported into the system during the content migration stage, or at any other time.
What is the total capacity (could be distributed)?	Unlimited. System allows for distributed environments.
Does it have flexible control of submission rights, i.e., submission mechanism that allows for immediate accession or prior review by a moderator?	Yes, Hive is based on permissions, workflow, and if desired copyright.
Does it offer file conversion capabilities with process control? (upon ingest of documents and/or conversion on export)	Yes. This would be handled by the built-in Workflow engine. You can define an unlimited workflow process.
Can the file conversion functions be turned on and off?	Yes, Hive has process control capabilities via the workflow engine. Hive can support content conversion via the workflows and/or manual process or a script depending on the type of content.
	Yes, this is typically script based.
<b>Metadata Application</b>	
Does it offer an end-user front-end for metadata entry? Browser-accessible?	Yes. Using the Hive templates, metadata submission can be done via any web browser.
Is the data entry interface, or any other element, platform dependent?	No. It is web based and supported by any browser.
Does it offer curator access for editing/revising metadata (possibly separate app)?	It can, by extending the templates.
Does it provide automated generation of some metadata - e.g., time stamp, submitter's authentication information, ...	It can. This information is stored and used by the reporting function. It is possible to tap into this information and preload metadata.
Is it capable of handling common schemas such as Dublin Core, MARC, etc?	Yes. Hive allows the user to apply any schema. It also supports mapping between schemas.
What are the import/export capabilities? Include XML?	In terms of importing, Hive supports any format, including XML. For export, Hive allows exporting in the native format.
Can individual assets be grouped to form collections/packages?	Yes.
How easy is integration or coordination with library catalogs & other collections?	Hive has a tool Reading List Management Server (RLMS) which integrates into any library system by way of Mark system.

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Are extensible metadata schemes supported/encouraged?	Supported yes. Hive allows to define your schema.
<b>Access Control</b>	
Does it have ability to interoperate with NCSU Kerberos-based authentication?	Yes. We recommend HLDAP. But can use other authentication means. Hive has a completely open Java based API.
Is there capability for policy-determined access control, permissions & process rules (e.g., specific rights for individual users, at item and collection levels)	Yes. Hive has very extensive user /group / and role based rights, along with the workflow and copyright engine.
What other rights management capabilities are supported, e.g., for licensed material	Copyright
Is there adherence to digital rights management rules?	Can be enforced via the permissions and copyright components.
<b>Discovery Support</b>	
Is the metadata searchable across subcollections?	Yes. And also across distributed environments.
Are there search methods for metadata-contained-in-file?	Yes. Hive provides both general search and element specific (advanced) searching. Both metadata and file content is indexed and fully searchable.
Are there search methods for searching item content (such as full text or image attribute searching)?	Yes. Hive provides both general search and element specific (advanced) searching. Both metadata and file content is indexed and fully searchable.
What alerting capability is offered (e.g., trigger e-mail to curator or user when an addition or change is made to a directory or within metadata)?	Email notification. What triggers this would be defined by system administrator.
Is searching fully integrated or via separate application?	Fully integrated.
Are materials accessible (ADA requirements)?	??
How is asset rendered -- is there user-defined rendering?	??
Is controlled vocabulary supported?	Yes
<b>Distribution</b>	
What parts of the system are browser accessible?	All
What parts of the system are platform independent?	The hive application can reside on Solaris, Linux, Mac. The database component runs on SQL Server, Oracle, and MySQL.
Can viewing of certain files be limited to certain users?	Yes. Through the permissions settings.
Can the system export files and groups of files, with or without associated metadata?	Yes. Through the permissions settings.
Can the system export files to/via streaming and other servers?	Yes. Through the permissions settings.
Does the system support integration with NCSU Learning Mgmt System(s) (WebCT other key systems (interoperability)?	Yes. Supported LMS/LCMSs include, but not limited to, WebCT, BlackBoard, Plateau, Angle, Moodle, Sakai, Avilar. We are in the process of integrating with Desire2Learn and Campus Cruiser.
Is there a mechanism for charging for download/delivery (e-commerce, fee-for-service)?	Using the copyright and auditing information, you can integrate with a commerce engine (Papal). This would require custom integration.
<b>Preservation</b>	

## Appendix E

Is there capability for file-type search (to allow for easy conversion from obsolete types to newer types)?	Yes. Hive supports versioning, which can be searched across.
Are there other features that facilitate preservation?	Hive supports content preservation by using the Hive Super Cache which places content in distributed servers and uses replication.
What is the storage management system? Compatible with NCSU systems?	All content / objects are stored in native format in a flat file structure. Yes
Is there adequate backup capability?	You define the level of backup, mirroring, etc...
<b>Ongoing Management &amp; Review</b>	
Are there facilities for producing management reports: resources used	Yes
usage statistics	
What is the capability of suspending access to file(s)?	Full ability to control who has access, when they have it, and for how long.
Does it have workflow tools for administration of submission/markup/accession?	Hive has a workflow engine.
Are there tools for curators/moderators?	Hive is independent of any authoring tools. Curator / moderators and other reviewers can have specific reviews via the system workflows and the Reload Editor tool can be used to daggrate and reassemble content packages.
<b>Other Issues</b>	
Multiplatform/platform independence	Web accessible. Supports most browsers including IE, Firebox, Netscape, Safari
Users' platforms can vary	Not a problem.
<b>Business Continuity Planning</b>	
System should be amenable to requirements of Businss Continuity Plan, including both local and "hosted" components, if any.	Hive supports redundant servers that can be distributed via the Hive Super Cache, replication can also be setup to copy data from one datacenter to another via Unix OS.
<b>Policy/Documentation/scope</b>	
Ability to configure system functions according to university policies	Yes, via Hive workflows that can support any number of steps and reviews.
Defines what material will be accepted/restricted (copyright or other restrictions?)	Yes
based on technology	Yes
based on content (copyright, pornography, ...)	Yes
based on file types (HTML, XML, ...)	Yes

## Appendix E

<b>Digital Asset Management Task Force</b>	
<b>Functional Criteria -- Stellent™ Digital Asset Management</b>	<b>Comments</b>
<b>Material Submission</b>	
What file types are accepted?	Stellent allows you to store and manage (apply Library Services) to virtually any file format. Stellent also has the ability to convert more than 360 file formats to alternate versions, and allows you to specify Rendition Sets to different types or categories of content.
What range of individual file sizes supported?	Stellent uses a file system-based repository that is extremely scalable by simply adding disk capacity; there is no file size limit for individual files.
What directory structures are supported?	Stellent allows you to maintain a fully-flexible folder structure that is virtual, and not dictated by actual content storage.
Does the system have the capability of receiving multiple files grouped as .zip, .tar, etc., and incorporating the files and associated metadata into storage structure?	Yes, Stellent can accept multiple file contribution, and store/manage the individual components.
What is the total capacity (could be distributed)?	Stellent places no limit on number of assets; and is extremely scalable to store millions of items.
Does it have flexible control of submission rights, i.e., submission mechanism that allows for immediate accession or prior review by a moderator?	Yes, Stellent uses a Roles-based security model to control viewing and editing; as well as a robust workflow engine to facilitate review and approval processes prior to release.
Does it offer file conversion capabilities with process control? (upon ingest of documents and/or conversion on export)	Yes, file conversion is available, both upon ingest or request.
Can the file conversion functions be turned on and off?	Yes, conversions can be configured (turned on/off, or customized) per asset category.
<b>Metadata Application</b>	
Does it offer an end-user front-end for metadata entry? Browser-accessible?	Yes, Stellent uses a browser-based interface that allows the end user to upload content, as well as specify metadata for categorization.
Is the data entry interface, or any other element, platform dependent?	No, the UI is browser-based, using virtually any industry standard web browser.
Does it offer curator access for editing/revising metadata (possibly separate app)?	Yes, the browser-based UI allows authorized users to edit content and metadata, as well as participate in workflow processes.
Does it provide automated generation of some metadata - e.g., time stamp, submitter's authentication information, ...	Yes, Stellent streamlines the capturing of standard metadata values like author, date, etc., as well as making it very easy to apply additional metadata.
Is it capable of handling common schemas such as Dublin Core, MARC, etc?	Yes, many Stellent customers have used its granular metadata model to comply with Dublin Core and various other metadata standards.
What are the import/export capabilities? Include XML?	Stellent's asset repository is openly accessible over standard web protocols, as well as through industry standard API's, including XML.
Can individual assets be grouped to form collections/packages?	Yes, Stellent provides a Content Basket (shopping cart) to allow the end user to assemble groupings of content for delivery.
How easy is integration or coordination with library catalogs & other collections?	Integration is typically very straightforward and easy by relating attributes within such systems to Stellent's metadata model.
Are extensible metadata schemes supported/encouraged?	Yes, Stellent places no limit on the extensibility of its metadata model, as well as supporting a schema that makes appropriate metadata available based upon type of content and/or other criteria.

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<b>Access Control</b>	
Does it have ability to interoperate with NCSU authentication?	Yes, Stellent has integrated with many customer's existing authentication schemes, as well as provide its own security directory.
Is there capability for policy-determined access control, permissions & process rules? (e.g., specific rights for individual users, at item and collection levels)	Yes, using the Roles-based security model described above. Security is available down to both the folder and object level.
What other rights management capabilities are supported, e.g., for licensed material?	Stellent can employ additional rights-related metadata/security information to restrict content access and editing.
Is there adherence to digital rights management rules?	Yes, Stellent includes functionality to support such rules, and the UI is dynamic and delivers content based upon defined access.
<b>Discovery Support</b>	
Is the metadata searchable across subcollections?	Yes, metadata searches can be narrow (i.e. folder), or system-wide; returning all results to which the user has access.
Are there search methods for metadata-contained-in-file?	This metadata in the file and be extracted upon import and input into Stellent's metadata tags for searchability (customization).
Are there search methods for searching item content (such as full text or image attribute searching)?	Yes, content (assets) in Stellent are searchable based upon any combination of full-text and/or any metadata attributes.
What alerting capability is offered (e.g., trigger e-mail to curator or user when an addition or change is made to a directory or within metadata)?	Stellent can use email notification to provide such alerting, either as part of a workflow (for review and approval) or a subscription to content (for notification only)
Is searching fully integrated or via separate application?	Stellent's search capability is fully-integrated and functional out of the box
Are materials accessible (ADA requirements)?	Yes, Stellent's web based interface can be configured to support accessibility (Section 508), as well as the system can automatically create accessible renditions of assets upon ingest.
How is asset rendered -- is there user-defined rendering?	Asset rendering can be both user-defined, and/or administratively defined, based upon the customer's requirements.
Is controlled vocabulary supported?	Yes, Stellent allows pre-defined vocabularies to ensure proper metadata assignment
<b>Distribution</b>	
What parts of the system are browser accessible?	All end user and administrative functionality is available through a standard, Java-enabled web browser. The browser-based UI is platform independent, and the server side application runs within the server's Java Virtual Machine (JVM).
What parts of the system are platform independent?	Yes, using the object level security, making it available only to designated role:
Can viewing of certain files be limited to certain users?	Yes, Stellent has a built-in archiving/export utility, that can include metadata or no
Can the system export files and groups of files, with or without associated metadata?	Yes, this is supported by Stellent being a web-accessible system over HTTP
Can the system export files to/via streaming and other servers?	Yes, Stellent integrates with many operational systems through standard API integration, usually making Stellent an object repository available to the other system(s).
Does the system support integration with NCSU Learning Mgmt System(s) and other key systems (interoperability)?	This is feasible with some moderate customization, and possibly 3rd party integrator
Is there a mechanism for charging for download/delivery (e-commerce, fee-for-service)?	
<b>Preservation</b>	
Is there capability for file-type search (to allow for easy conversion from obsolete types to newer types)?	Yes, using Stellent's industry leading conversion technology and rendition sets

## Appendix E

Are there other features that facilitate preservation?	Yes, Stellent can use additional metadata (such as Release/Expiration date) to automate this lifecycle.
What is the storage management system? Compatible with NCSU systems?	Storage is standard disk (local or remotely attached); therefore, should be compatible with existing systems.
Is there adequate backup capability?	Yes, Stellent's archiving utility also facilitates the system backup process
<b>Ongoing Management &amp; Review</b>	
Are there facilities for producing management reports:	Yes, Stellent includes many out of the box reports around users, activities, objects, workflows, etc. Additionally, because it uses a standard RDBMS, custom reports can be generated with standard 3rd party tools like Crystal Reports.
resources used	Stellent runs as a service which can be monitored by many 3rd party application monitoring tools for running state and resource usage.
usage statistics	Yes, Stellent includes a tracking module to gather and report content usage
What is the capability of suspending access to file(s)?	This is simply a matter of editing its security assignment to cease access
Does it have workflow tools for administration of submission/markup/accession?	Yes, Stellent has a robust workflow tool, allowing comprehensive review, approval, rejection, editing, and release of content. Serial/Parallel processes, variable decision logic, external processes, timeouts/escalations, are all supported.
Are there tools for curators/moderators?	Yes, as part of the standard web UI
<b>Other Issues</b>	
Multiplatform/platform independence	Stellent is a Java-based application that runs within the server's JVM, making it platform independent (Windows, Unix, & Linux)
What is "platform acceptable to NCSU"? Must the server side match?	???
Users' platforms can vary	Does not matter, assuming a standard Java-enabled web browser
<b>Business Continuity Planning</b>	
System should be amenable to requirements of BCP, including both local and "hosted" components, if any.	As a web-based application, Stellent supports all industry standard fault tolerance approaches for continuous uptime (load-balancing, clustering, etc.)
<b>Policy/Documentation/scope</b>	
Conform to existing univ policies such as Copyright Ownership & Computer Use	Yes, this can be supported using the extensible metadata model and security functionality
What material will be accepted?	Material can be reviewed for acceptance/rejection using the built in workflow functionality
What material will be refused? (copyright or other restrictions?)	Using the configurable workflow functionality, content can be accepted/rejected based upon any metadata or file criteria, including the specific attributes mentioned below.
based on technology	see above.
based on content (copyright, pornography, ...)	see above.
based on file types (HTML, XML, ...)	see above.