MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Peer Comparison

- of -

Course/Learning Management Systems, Course Materials Life Cycle, and Related Costs

Final Report

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MIT Peer Comparison on Course /Learning Management Systems, Course Materials Life Cycle, and Related Costs

Executive Summary

Project Goal

The Massachusetts Institute of Technology (MIT) periodically surveys peer institutions to benchmark the array of options used for centrally-supporting Course/Learning Management System (C/LMS) products. A similar peer comparison was last conducted in the 1999-2000 academic year and, given the dynamic nature of C/LMS products, an updated benchmarking study was undertaken. This study covers the 2004-5 academic year and is part of a continuum of longitudinal surveys of the changing C/LMS landscape.

MIT contracted with WCET's EduTools to survey ten selected peer institutions regarding their use and support of C/LMS products and the Course Materials Life Cycle used by each institution. The data gathered in this survey is intended to benchmark these services at peer institutions and to collect information that will inform future decision-making. This report is a compilation and interpretation of the interview survey results. In reading this report, it is necessary to understand two basic definitions:

- **Course/Learning Management Systems (C/LMS)**: provides the platform for the enterprise's online learning environment by enabling the management, delivery and tracking of online and blended learning.
- **Course Materials Life Cycle**: The entire life of course materials from (a) initial design to (b) development, teaching, and technical support and (c) through publication and/or long-term archival of course content.

Course/Learning Management Systems

Institutions surveyed were asked to estimate the number of courses making "significant use" of their C/LMS. "Significant use" was defined as courses that use the C/LMS for a meaningful instructional activity and not just for administrative purposes. While this was difficult to estimate, five institutions indicated that at least two-thirds of courses met this definition. Princeton and MIT estimated that about 50% of their courses made "significant use" and three others did not wish to estimate.

While it was not one of the questions, some institutions indicated that they had experienced tremendous growth (in terms of number of courses, file space used in courses, and the number of students) in C/LMS course usage over the past few years. The University of Texas at Austin stated that for the fall 2001 semester, 354 faculty members and 20,204 students used Blackboard in 656

individual class offerings. Four years later, the fall 2005 semester saw a 414% increase in faculty participation as 1,819 faculty members used the system. The number of students accessing Blackboard increased 136% to 47,615 and course offerings increased 522% to 4,078. Similarly at MIT, the usage of Stellar, (their locally-developed C/LMS) grew from 151 courses during fall 2002 to 511 courses during spring 2006, an increase of 238%.

Peer institutions use a variety of C/LMS products: one uses an open source product, five use a commercial product, two use a community source product, two use a locally-developed product, and one uses a locally-developed product that is open source. For institutions that have not already adopted a centralized model, there is a clear trend of evolving toward one primary enterprise-wide C/LMS rather than supporting multiple products.

The most frequently anticipated future feature was better "ease of use" in doing common tasks more quickly. Many other features were identified by respondents, but the others that were most frequently mentioned to meet future needs were: more support for pedagogy needs, support from multiple mobile platforms including cell phones, and support for collaborative authoring (blogs, wikis, RSS, etc.). Several institutions are planning to add some archival features into their C/LMS.

Course Materials Life Cycle

The birth-to-death materials life cycle is foreign to the culture of most peer institutions. The institutions surveyed are still steeped in the non-electronic course materials culture. The course materials are left to the faculty and only rarely are courses archived for use or reference beyond the terms offered. DSpace has been successfully tested at MIT in pilot mode in this archiving context. Other institutions are not yet using repositories (such as DSpace and Fedora) for this purpose. Audio and video resources are provided mostly by special software or streaming servers. The costs of publishing course content are distributed and mostly opaque. None of the other institutions surveyed is doing anything similar to OCW. Outside of the institutions surveyed, examples of other open courseware projects are in China (CORE consortium), France, and Japan, as well as at the Johns Hopkins University School of Public Health (ocw.jhsph.edu), and at Tufts University (ocw.tufts.edu).

Costs

The costs of the C/LMS and course materials were not always available, as, institutions supplied no C/LMS cost data. The answers to the cost questions were almost always rough verbal estimates and not based on in-depth costs analyses by the respondents. Therefore, the costs are both unofficial and not completely comparable because of differing internal financial arrangements across institutions. One of the most surprising findings was that most of the institutions did not have a better handle on cost data and that (for many of the respondents) costs were not a principle driver in decision-making.

Based on rough verbal estimates the 2004/2005 C/LMS operating costs[1] ranged between $135,000 for Middlebury College to $1,330,000 for Berkeley with MIT at $547,550 (see Table 2). On further analysis at MIT's suggestion, it was noteworthy that there was a wide variation in the operating cost per student, this ranged from $24 per student at Yale to $152 per student at Princeton with MIT at $54 per student (see Table 3). As can be seen in Table 2 (item #17), at seven institutions the costs for supporting faculty in using C/LMS for their courses were largely opaque. Therefore, the C/LMS cost per student is a conservative estimate.

The rough verbal estimates of one-time C/LMS investments showed a similar wide range of costs from a low of $23,000 at MIT to a high of about $1,000,000 at Stanford. The eleven institutions surveyed were at different points in their C/LMS implementation in 2004/05 making it difficult to compare one-time C/LMS investments.

The annual costs of course materials (for non-C/LMS costs such as third party content) can exceed the cost of the C/LMS by millions, as is the case at Columbia for third-party course materials or at MIT for publishing OCW content. The lack of readily available costing data indicates that, for many of the institutions surveyed, money does not appear to be the critical decision-making factor in either C/LMS or Course Material Life Cycle implementations.

Implications for C/LMS and Course Materials Life Cycle at MIT

As MIT looks to the future, the survey raised some key factors to consider in decision-making.

Implications for C/LMS

All of the institutions cited the importance of maintaining the stability of the C/LMS product, integrating smoothly with other campus IT systems, and (as late adopters come on board) addressing student and faculty C/LMS usability implications when integrating those systems. Some surprise findings included anecdotal evidence that the C/LMS at some institutions is increasingly used beyond coursework (for research collaboration) and beyond graduation (to allow alumni access to college work). The biggest surprise was that, for many institutions, C/LMS costs did not appear to be the main decision-driver as compared to other factors, such as: ease of use, integration with legacy systems, and commitment to pursuing a community source (Sakai) solution. When specifically asked about key drivers: three institutions (including MIT) mentioned costs as a main driver, one called costs a "modest" driver, and the others did not even mention financial issues. In terms of organizational change for C/LMS support, three institutions envisioned no change and three

[1] C/LMS "operating costs" include licensing fees for commercial products, development costs for open or community source products, servers, technical support personnel, adapting course materials for those with disabilities, and archival costs. Respondents may not have included other related costs, such as travel and communication costs.

envisioned more centralization. Also mentioned by a few institutions were increased "community involvement" in effective C/LMS use and worries about adequate staffing to support a transition to Sakai.

Implications for Course Materials Life Cycle

Among those surveyed, MIT's OpenCourseWare makes the institution a clear leader in the mid-to-latter stages (dissemination through archive) of the Course Materials Life Cycle concept. While MIT has been instrumental in assisting other institutions (both in the United States and abroad) in implementing open content initiatives, this survey of its closest peers suggests that MIT may wish to examine the possibility of assisting these institutions in creating their own materials life cycles. In looking to the future, several institutions realize that there will be increased need to better manage course materials. Both for its own knowledge and to share with its peers, MIT may also wish to more closely track student usage of course materials.

Additional questions

The interview process revealed issues that were not covered by the survey process. These items would be good candidates for inclusion in future inquiries with peers. The questions suggested were:

- How is your institution going about getting acceptance of new systems like Sakai?
- How does your institution look at emerging trends and implement them into your system?
- How centralized is the C/LMS? …and who is responsible for management and support?
- What is the composition of project management teams for the C/LMS?
- Who are the decision makers on these issues?
- Is there any central group that maintains a financial perspective?
- Is there a specific prioritization of features for future implementation?
- What processes are used for requirements gathering and prioritizing?
- How is the institution leveraging the C/LMS with other enterprise systems?
- What was the peak one-time cost?
- What is the pattern of growth in system usage?
- Does your institution automatically create C/LMS sites for all your courses, or is the process voluntary, that is, do faculty need to request a C/LMS site for their courses?
- How much of the course content is reused from previous courses (rolled over)?

MIT Peer Comparison on Course /Learning Management Systems, Course Materials Life Cycle, and Related Costs

Final Report

Project Goal

The Massachusetts Institute of Technology (MIT) periodically surveys peer institutions to benchmark the array of options used for centrally-supporting Course/Learning Management System (C/LMS) products. A similar peer comparison was last conducted in the 1999-2000 academic year and, given the dynamic nature of C/LMS products, an updated benchmarking study was undertaken. This study is part of a continuous assessment of the changing C/LMS landscape.

MIT's C/LMS solutions are solid for the near future, but some uncertainty might arise in coming years. Stellar, an MIT-developed product, serves most of the institution's needs. This fall, Stellar will take advantage of Sakai, which is a national community[2] source C/LMS product. Sakai has now transitioned from a funded project to a subscription-based community. Meanwhile, in the commercial C/LMS market space, Blackboard (the system implemented in the most institutions) has just acquired WebCT, its closest competitor. The uncertainty of the C/LMS landscape, the number of faculty and students affected by changes in a C/LMS solution, and the magnitude of the budget supporting these systems has led MIT to continue to monitor its future options.

WCET (www.wcet.info) is a membership-based non-profit organization that advances the effective use of technology in higher education. One of WCET's activities, EduTools (www.edutools.info), conducts independent reviews of C/LMS products and consults on C/LMS selection processes. MIT contracted with WCET's EduTools to survey selected peer institutions regarding their use and support of C/LMS products and the Course Materials Life Cycle used by each institution. The data gathered in this survey is intended to benchmark these services at peer institutions and to collect information that will inform future decision-making. This report is a compilation of the survey results. It also includes comments from EduTools staff on trends, interesting insights or activities from a single institution, and implications for MIT to consider.

[2] According to the Sakai Project (www.sakaiproject.org): "The Sakai Project follows what is called the community source model, which is an extension to the already successful, economically feasible, open source movement forged by projects such as Apache, Linux, and Mozilla. Based on the goal of addressing the common and unique needs of multiple institutions, community source relies more on defined roles, responsibilities, and funded commitments by community members, than some open source development models."

Methodology

MIT project liaisons (Amitava Mitra, Phil Long, and Jeff Merriman) provided both written and verbal background information on the history, culture, and context of C/LMS implementations. They also provided detailed guidance on some sections of the final report.

The survey (Appendix A) was constructed by EduTools staff (Russell Poulin of WCET, Bruce Landon of EduTools and Douglas College, and Tom Henderson of Central Washington University) in close consultation with the MIT liaisons. Weekly phone calls were held to provide project updates and to obtain further clarifications, as needed. The survey covered the following main topics of interest:

- *Course/Learning Management Solutions.* Identified such items as: what C/LMS solution(s) are being used, what statistics exist on C/LMS usage, and how are departments using alternative solutions to replace all (or part) of their C/LMS solutions.
- *Course Materials Life Cycle.* Identified the institutionally-supported path for electronic learning materials from appearance online to archiving.
- *Related Costs.* Collect cost data on C/LMS selection, support, licensing, maintenance, integration with other systems, and improvements. Collect costs data on the maintenance and support of the Course Materials Life Cycle.

MIT selected ten peer institutions to be surveyed:

Carnegie Mellon University	Stanford University
Columbia University	University of California, Berkeley
Harvard (College of Arts and Sciences)	University of Chicago
Middlebury College	University of Texas at Austin
Princeton University	Yale University

They also selected four groups of MIT faculty and administrative personnel to be surveyed:

- MIT Operations – Those responsible for operating Stellar, DSpace, and the Library as well as those providing support.
- MIT Sloan School of Management – Those who operate, support, and use SloanSpace
- MIT Stellar Faculty Advisory Group – Faculty who serve on committees advising on Stellar functionality.
- MIT Strategic – Individuals involved in strategic planning for IT, Library, and academic technology support.

A complete list of the individuals surveyed from the peer institutions and those who comprised the MIT groups can be found in Appendix B.

Prior to administering the surveys, the survey was reviewed by a few MIT personnel who were not involved in creating the survey. After some adjustments, appointments were arranged with each institution and with the four MIT groups for interview times. The survey was sent to the respondents ahead of the 60-90 minute phone interview. These sessions were conducted by Bruce Landon, Tom Henderson, or, often, both in tandem. While the bulk of the information was collected during the interviews, some data (especially statistical numbers, costs numbers, and other background information) was sent via e-mail both before and after the interview.

Based on the EduTools CMS product comparisons web site, a project web site (http://mit.edutools.info) was created to place the question-by-question write-ups of the information provided by each respondent. The site enables side-by-side comparisons of survey interview question information for each of the participating institution and the four MIT groups.

In responding to the questions the following issues were encountered:

- In writing the survey, it was known that several of the questions included statistical or cost data that would be time-intensive to collect. Respondents were encouraged to provide their best estimates as the focus was more on judging the scope of the activities and not in compiling an exact accounting.
- Due to contractual, legal, or other conflicts, some data could not be provided. This is most prevalent in the cost data.
- The MIT student respondent was unable to participate due to several scheduling conflicts, so no direct student data was available.
- Institutional differences lead to complexities in comparing responses. For example, some institutions included integration in cost data, while others did not. Also, requirements to integrate the C/LMS with other data systems may differ significantly from institution to institution.
- Respondents were very helpful in providing local context when a question did not directly fit their situation.

After the survey, the write-up was posted to the project web site. Respondents were asked to review the write-ups to check for factual errors. All responses are listed in Appendix C and all respondents will be provided a copy of this final report. Appendix D contains short biographies of the WCET EduTools project personnel.

Definitions of Terms for the Purposes of this Survey

To assure that there was a common understanding of terms used in the survey instrument, the following definitions were provided to survey respondents:

Course/Learning Management Systems (C/LMS): provides the platform for the enterprise's online learning environment by enabling the management, delivery and tracking of online and blended learning. C/LMS systems may be (a) commercial, e.g., Blackboard, (b) open-source, e.g., Segue, (c) developed "in-house" at a particular institution, or (d) community source such as Sakai.

Course Materials Life Cycle: The entire life of course materials from (a) initial design to (b) development, teaching, and technical support and (c) through publication and/or long-term archival of course content. There is no one generally accepted course material life cycle and an institution may have several.

C/LMS "significant usage:" For "significant use of a C/LMS" we are interested in courses that use the C/LMS for a meaningful instructional activity (delivering content, holding discussions, having synchronous events, etc,) and not courses that use it just for administrative purposes only (maintaining course registration lists, posting a syllabus, posting grades). Courses that "significantly" use a C/LMS may be offered via the WWW, face-to-face, or with other technologies. We understand that you will probably need to estimate this number. The "significant usage" metric turned out to be problematic even with specific examples, because, from the C/LMS system view, there was no regular way to track how the faculty used the C/LMS in each course.

Course and Class: Course is a particular set of information or skills that is being taught with defined objectives and outcomes. For example, "History 131 - American History to the Civil War" is a course. Classes are considered to be individual instances or offerings of a course.

Summarized Responses to Each Survey Question

Section I - Course/Learning Management Systems (see definition)

1. *How many undergraduate and graduate students (headcount) were enrolled at your institution for the 2004-2005 academic year? Of those students, for the 2004-2005 academic year, how may students were enrolled in courses that made "significant use" of a C/LMS?*

The trend among institutions was to have more graduate students than undergraduates enrolled (averaged total enrolment was 16,758 students). For C/LMS usage, they estimated an average of more than 90% of all students use

one, but only an average of 69% make "significant use" of a C/LMS. Given that institutions did not have concrete numbers on "significant use," this clearly was a rough estimate that was not easily calculated by all respondents. At MIT, out of a total of 10,206 students, 6,842 enrolled in at least one subject with a Stellar site. An estimated 50% of these MIT students were using sites making significant use of Stellar. Middlebury College was quite different from the other institutions as it does not have any graduate students. Of the 2,300 graduate students at Middlebury, most had taken at least one course that made "significant use" of the C/LMS.

2. *Please name all C/LMS systems in use on your campus? Let us know which systems are commercial, locally-developed, open source, or a combination of systems. Also, when was each system first used in courses at your institution?*

The trend among institutions was to have been using a primary C/LMS for several years along with one or more niche C/LMS systems. Typically, there was a mix of locally-developed, community source, open source, and/or commercial systems. There were a couple of notable exceptions using only BlackBoard (University of Chicago and Carnegie Mellon University) and three institutions (Stanford, Yale, and Berkeley) are transitioning their primary local system into a branded Sakai community source system. MIT has been using locally-developed systems: Athena Lockers since 1994, Stellar since 2001, and Sloan Space (in the Sloan School of Management) since 2001. MIT is releasing Stellar2 this fall with Sakai components within it.

Table 1. C/LMS Systems Used by Surveyed Institutions

Institution	Primary C/LMS System	Source
MIT	Stellar 2	Locally developed
Carnegie Mellon University	BlackBoard	Commercial
Columbia University	Prometheus	Commercial
Harvard (College of Arts and Sciences)	Instructors Took Kit	Locally developed
Middlebury College	Segue	Locally developed open source
Princeton University	BlackBoard	Commercial
Stanford University	CourseWork	Locally developed open source
University of California, Berkeley	B-Space	Community source
University of Chicago	BlackBoard	Commercial
University of Texas at Austin	BlackBoard	Commercial
Yale University	Classes 2	Community source

3. *For the 2004-2005 academic year, how many courses use each C/LMS system listed in the previous question? For the 2004-2005 academic year, what is your estimate of the number of students using each system?*

BlackBoard usage ranges from all of the courses at and Carnegie Mellon University, to all students using it (but not necessarily all courses using it) at the University of Chicago, to most of the courses at University of Texas at Austin, to a tiny fraction of the courses at Stanford and Yale. The situation with the open source and locally developed C/LMS's is more diverse and changing rapidly with very high growth rates in usage. The emerging pattern is for an institution to have a clearly dominant C/LMS with rapid grow in utilization of the C/LMS along with some continuing, but not growing, niche C/LMS's. At MIT, there were 765 courses in Stellar and 120 courses in Sloan Space during 2004-05 making up roughly 50% of the courses.

In terms of number of courses, file space used in courses, and the number of students using a C/LMS in courses, all institutions experienced growth in C/LMS usage and some institutions realized tremendous increases in usage. The University of Texas at Austin exemplifies this pattern. For the fall 2001 semester, 354 faculty members and 20,204 students used Blackboard in 656 individual class offerings. Four years later, the Fall 2005 semester saw a 414% increase in faculty participation as 1,819 faculty members used the system. The number of students accessing Blackboard increased 136% to 47,615 and the number of individual course offerings increased 522% to 4,078. Similarly at MIT, the usage of Stellar, (their locally-developed C/LMS) grew from 151 courses during fall 2002 to 511 courses during spring 2006, an increase of 238%.

4. *Of the courses making "significant use" (see definition) of a C/LMS, how many courses were…*
    a. *Newly developed in the 2004/2005 academic year: _____*
    b. *Underwent major revisions (i.e., updated more than half of content, adapted to a new textbook, newly incorporated epacks, changed C/LMS or other supporting software) in the 2004/2005 academic year: _____*

Assessing "significant use" was problematic for most institutions in part because course content (and content revisions) is under the control of the faculty and statistics are not gathered by the C/LMS administrators. Some institutions make course rollover inside the C/LMS very convenient, while other institutions strategically encourage course revisions. One explanation of the pattern was that faculty initially use the C/LMS primarily for course management functions in the first couple of years and (after becoming more familiar with the system) they begin to make "significant use" of the C/LMS for content delivery and class interaction. At MIT, there were 539 new courses and 442 courses that underwent major revisions in the 2004/2005 academic year.

5. *In your C/LMS, how are you currently handling "non-text" media (video streaming, audio streaming, podcasts, simulations, virtual laboratories, image archives, etc.) What plans do you have for further handling or integrating "non text" media" with your C/LMS over the next 3 to 5 years?*

The overwhelming trend for handling non-text media is by simply having links in the C/LMS to content located on streaming servers or image repositories. Several institutions are using iTunes and there is increased planning for podcasting. Both Berkeley and Harvard are making lecture videos available to students and the University of Texas at Austin is planning to leverage their technology equipped classrooms to automatically capture the class presentation (from the LCD projector) and audio for subsequent screencasting. At Columbia, the Library has taken the lead in organizing and handling multimedia content for core curriculum courses. In other institutions there are initiatives in federated searching of image repositories and plans to make the integration of linking and rights management work better. OCW courses clearly demonstrated the appeal and feasibility of audio and video enhancements to traditional online course formats. This trend is likely to flourish at MIT when it unveils its new audio search tools that will allow audio and video streams to be searched for particular words and phrases in much the same way as how text search engines are used now.

At MIT, Stellar typically uses links to non-text media and there is some use of attachments for some resources, such as image files. Some promising developments on the horizon will lead to easier access for C/LMS non-text media. OCW provides media files via Akamai streaming servers deployed world wide. Already video is being streamed to Singapore. Additional non-text media in the future will be open "iLabs" with appropriate authentication. The future will also include the use of more authoring tools (such as LAMS) to support efficient, structured content creation. Stellar will provide a tool for managing still images including a federated search of image repositories in the fall term of 2006. There are plans for more podcasting and better integration linking out to the multimedia licensed by the Library, including audio. Future options include: more multimedia convergence within Stellar, using the Library for video streaming, and using DSpace for multimedia hosting.

6. Please estimate the costs for each C/LMS for the 2004/2005 academic year.

The costs of the system and course materials were not always available. Complete data was provided only for Carnegie Mellon University, Columbia University, Middlebury College, Princeton University, Yale University, and University of Chicago. From the data provided, it was apparent that the annual costs of materials and library databases can exceed the cost of the C/LMS (by millions of dollars in the case of Columbia and MIT).

Table 2. Estimated C/LMS and Related Personnel Spending by Institution for FY 2004-05

Survey Question		MIT	California Berkeley	Carnegie Mellon	University of Chicago	Columbia	Harvard Arts & Sciences	Middlebury	Princeton	Stanford (1)	U of Texas Austin	Yale
--- C/LMS Systems Used ---												
1.	**Number of Students**	10,206	32,331	8,800	13,000	24,000	9,600	2,300	6,500	14,000	50,400	11,390
2.	**Primary C/LMS**	Stellar	B-space	BlackBoard	BlackBoard	Prometheus	Instructor's Toolkit	Segue	BlackBoard	CourseWork	BlackBoard	classes and classes*v2
3.	**Secondary C/LMS**	SloanSpace	BlackBoard			Lotus Domino	ICG		Whiteboard	WebCT	SpeedWay	Blackboard
3.	**Secondary C/LMS**		WebCT				ICOMMONS			BlackBoard	FirstClass	WebCT
3.	**Secondary C/LMS**									CCNET		
--- C/LMS Operating Costs ---												
6.	**2004/2005 C/LMS Costs**	$496,750	$1,300,000	$250,000	$300,000	$545,000 to $645,000	No data	$75,000	$450,000	8.25 FTE plus $61,000; Total = $886,000	No data	Software Dev et.al.= $140,000
6.1	**Estimated Annual C/LMS License Fee**	Shared community	$20,000 for WebCT/ BlackBoard (included in #6)	$100,000 (2)	Included in 6	$50,000 (5)	No data	Self Developed / open source	$100,000 (included in # 6)	Shared community	No data	BlackBoard $100,000 / WebCT $25,000
17.	**Total costs in supporting faculty in courses developed for C/LMS deployment**	opaque, primarily TAs and faculty in departments. $50,000 in Libraries for eReserves	No data	< $10,000 plus allocated amounts	$200,000	$500,000 (3)	No data	Ed Tech group $50,000(4)	3 to 5 people $500,000	Large but impossible to determine	Opaque but large	Do not know
17.1	**Notes**					60-70 FTE included in #17 & #18						

Survey Question		MIT	California Berkeley	Carnegie Mellon	University of Chicago	Columbia	Harvard Arts & Sciences	Middlebury	Princeton	Stanford (1)	U of Texas Austin	Yale
19.	**Total costs of adapting course materials for students with disabilities**	$800	$10,000	$100,000 to $150,000	"not visible"	1/2 of an FTE, about $50,000	$5,000 to $10,000	$10,000	Very little	2 FTE for an estimated $200,000	No data	$10,000
23.	**Total costs of archiving C/LMS materials**	minimal	"spinning disks" + less than $100	No data	Part of C/LMS costs (1/3 terabyte stored)	"Spinning disks", no marginal cost	"not large"	Included in Segue costs	"spinning disks" about $25,000-$50,000 / yr. --- take $37,500	"spinning disks" small	Small	Very small
ESTIMATED TOTAL C/LMS OPERATING COSTS		**$547,550**	**$1,330,000**	**$485,000**	**$500,000**	**$1,220,000**	**No data**	**$135,000**	**$987,500**	**$1,086,000**	**No data**	**$275,000**
--- One-Time C/LMS Costs ---												
7.	**Major one-time investments**	FY 2005 = $23,000	FY 2006 = $230,000	$ Included in #6	$134,000 (more in 2006)	$150,000 in 2001, $200,000 expected in 2006	No data	1/2 FTE (assume $50,000)	$400,000 to $500,000 (used $450k)	About $1,000,000 during 2004/2005 - will spend $1.05million next year	Significant $ in 2001	$80,000
TOTAL ONE-TIME C/LMS INVESTMENTS		**FY 2005 = $23,000**	**FY 2006 = $230,000**	**$ Included in #6**	**$134,000 (more in 2006)**	**$150,000 in 2001, $200,000 expected in 2006**	**No data**	**1/2 FTE (assume $50,000)**	**$400,000 to $500,000 (used $450,000)**	**About $1,000,000 during 2004/2005- will spend $1.05million next year**	**Significant $ in 2001**	**$80,000**

Survey Question		MIT	California Berkeley	Carnegie Mellon	University of Chicago	Columbia	Harvard Arts & Sciences	Middlebury	Princeton	Stanford (1)	U of Texas Austin	Yale
--- Other Course and Content Related Costs (Non-C/LMS) ---												
18.	**Personnel costs for faculty development in creating and delivering courses**	Opaque, large, TLL budget, departments	$325,000	$500,000	"not visible"	$2,500,000(3) including CTL & Schools/ Depts	No data	Ed Tech group $200,000(4)	$300,000 to $350,000 (used $325,000)	3 FTE, assume $300,000	No data	$200,000 group, peer & self study
18.1	**Notes**	OCW: 1) Dept liaison $450,000, + $60,000 2) Faculty get $3,000 per OCW course (about $5,400,000). total = $5,910,000	Does not include some major costs, e.g., TL, GSI, UE faculty dev. staff									
20.	**Total costs of third-party course materials**	LIBRARIES: $2,138,000 + 10 FTE = $3,138,000	Not available	Over $1,000,000	No way to cost - can't split costs from research	about $5 million per year	Purely instruction - $5,000 to $10,000	$10,000 + waiting for data	$50,000 plus 5 staff - Assume $550,000	Between $1,500,000 and $2,000,000	Not available	Huge but unknown
TOTAL "OTHER" COSTS		**$9,048,000 (OCW: $5,910,000 LIBRARIES: $3,138,000)**	**No data**	**Over $1,500,000**	**No way to cost - can't split costs from research**	**about $7,000,000**	**No data**	**$200,000+**	**$875,000**	**Between $1,800,000 and $2,300,000**		**$200,000 plus Huge but unknown**

(1) Stanford and others expressed several costs in terms of FTEs. This study assumes that each FTE, including benefits, costs $100,000 per year.

(2) These Universities use BlackBoard and have honored their non-disclosure agreement. Estimates of C/LMS annual license fees were made by MIT staff and reviewed by WCET authors

(3) Columbia's $3,000,000 allocated across #17 and #18 on the assumption that over 80% is likely to be faculty development

(4) Middlebury's $250,000 allocated across #17 and #18 on the assumption that over 80% is likely to be faculty development

(5) Columbia uses Prometheus and has honored its non-disclosure agreement. Estimates of C/LMS annual license fees were made by MIT staff and reviewed by WCET authors

NOTE: The answers to the cost questions were almost always rough verbal estimates and not based on in-depth costs analyses by the respondents. Therefore, the costs are both unofficial and not completely comparable because of differing internal financial arrangements across institutions.

Table 3. Estimated C/LMS Costs per Student by Major Activity as well as One-time and Related Expenses

Survey Question	MIT	California Berkeley	Carnegie Mellon	University of Chicago	Columbia	Harvard Arts & Sciences	Middlebury	Princeton	Stanford (1)	U of Texas Austin	Yale
C/LMS Operating Costs (2)	$547,550	$1,330,000	$485,000	$500,000	$1,220,000 (3)	No data	$135,000 (4)	$987,500	$1,086,000	No data	$275,000
Estimated C/LMS Operating Costs per Student	$54 (5)	$41 (5)	$55 (5)	$38	$51	No data	$59	$152	$78 (5)	No data	$24 (5)
Total One-Time Costs for C/LMS	FY 2005 = $23,000	FY '06 = $230,000	$ Included in #6 in Table 2	$134,000 (more in 2006)	$150,000 in 2001, $200,000 expected in 2006	No data	1/2 FTE Assume $50,000	$400,000 to $500,000 (used $450k)	About $1,000,000 during 2004/2005 - will spend $1.05million next year	Significant $ in 2001	$80,000
Total Other Costs	$9,048,000 (OCW: $5,910,000 LIBRARIES: $3,138,000)	No data	Over $1,500,000	No way to cost - can't split costs from research	about $7,000,000		$200,000 +	$875,000	Between $1,800,000 and $ 2,300,000		$200,000 plus Huge but unknown

(1) Stanford and others expressed several costs in terms of FTEs. This study assumes that each FTE, including benefits, costs $100,000 per year

(2) Some universities in this study use BlackBoard or Prometheus and have honored their non-disclosure agreements. Estimates of C/LMS annual license fees were made by MIT staff

(3) Columbia's $3,000,000 allocated across #17 and #18 on the assumption that over 80% is likely to be faculty development

(4) Middlebury's $250,000 allocated across #17 and #18 on the assumption that over 80% is likely to be faculty development

(5) C/LMS operating costs per student include "Total costs in supporting faculty in courses developed for C/LMS deployment", i.e., # 17 in Table 2 above. The institutions footnoted have indicated that these costs may be significant. but that they were unable to provide firm estimates

NOTE: The answers to the cost questions were almost always rough verbal estimates and not based on in-depth costs analyses by the respondents. Therefore, the costs are both unofficial and not completely comparable because of differing internal financial arrangements across institutions.

In reviewing the above tables, note that the answers to the cost questions were almost always rough verbal estimates and not based on in-depth costs analyses by the respondents. Therefore, the costs are both unofficial and not completely comparable because of differing internal financial arrangements across institutions. One of the most surprising findings was that most of the institutions did not have a better handle on cost data and that, for many of the respondents, costs were not a principle driver in decision-making.

From the data provided, one clear observation from the above estimated costs is that whether a C/LMS system is commercial or not does not seem to be the main cost factor, but rather the cost variability seems to be more associated with the degree of customization or localization that is undertaken. These cost figures seem to represent a serious escalation in cost since the early days of the out-of-the-box C/LMS.

7. Estimate the costs of major one-time investments for each C/LMS from the 2000/01 to 2004/05 academic years. Indicate the amount of that one-time investment that occurred in the 2004/2005 academic year.

The trend was to have some one-time costs, but the data were extremely variable from zero to $1,300,000. In three cases, the estimates were not easily available. The University of Chicago reported one-time costs in 2005/2006, which are significant and beyond the time period that was the focus of this question. Comparing institutions in a snapshot of time in the context of high growth in the usage of C/LMS technologies has the limitation of missing significant events that are outside of the time window used in the question. At MIT there were some one-time costs for Stellar around 2000. Since then, MIT's costs have been focused almost entirely on operating expenses.

8. Has your university conducted a cost analysis of using a C/LMS? Is it publicly accessible?

Only three institutions had conducted cost analysis of using the C/LMS and none are publicly available. Despite very rapid growth in popularity there seems to be little political desire for cost analyses and certainly not for analyses that are of public record. Academia is not well structured for conducting cost analyses, as many of the indirect costs are very difficult to allocate and are located in numerous budgets. From WCET's experience in this area, cost studies often seek to be too precise in allocating all costs and, consequently, the cost of conducting the analysis may exceed the benefits that could be gained from the cost analysis report.

MIT performed a high-level cost analysis of academic computing a few years ago. The resulting report indicated annual costs of $391,270 for in-house development. It also showed $415,000 for commercial, enterprise-level

support, though that did not include cost parameters associated with customization.

9. Are there any particular features or capabilities that you expect to add to your C/LMS systems within the next 3 to 5 years? What features or capabilities would your students like to see added?

There are a couple of general trends in the planning of future features of the C/LMS. The most widely shared trend is for refinements that make working within the C/LMS easier to do and enable tasks to be performed more quickly for both faculty and students. The second general trend is to make the C/LMS do more things to extend the breadth of functions. Future systems were expected to:

- accommodate ePortfolios.
- become more integrated with library resources on the back end.
- enable richer collaborations (in one case with voice based discussions).
- reach out to mobile devices, including cell phones on the user end of the C/LMS.

Each institution was distinctive in having unique plans for different features and capabilities, but what was clear is that the C/LMS is now part of the fabric of academic life in all of the institutions surveyed. The C/LMS products are being expected to serve the additional needs for collaboration and cooperation in academic research projects using tools that were originally designed to support student group projects in courses. Both Sakai and BlackBoard were envisioned as general purpose tools (alongside email) enabling more sophisticated academic collaboration in the future (Blogs, Wikis, RSS, and VoIP).

At MIT, there were multiple visions of the future of C/LMS features. Some respondents foresaw a future with features exhibiting a high degree of integration and broad support on a range of devices including iPods and cell phones. A key future feature will be integrated calendaring to bring together email, RSS subscriptions, blogs, and the C/LMS. Some envisioned that there would likely be a gradebook feature with better integration (like one-stop-shopping) for submitting grades with the Registrar. Others would like to see simulation, visualization, collaboration capabilities, a student evaluation tool for TA's and Faculty, better ways of keeping track of who is in the class (pictures), ePortfolios, and better integration between Stellar and OCW. Future OCW courses were envisioned to have interactive activities and more video, plus the ability within OCW to interact with communities.

There were a number of candidates for future C/LMS features related to the Library and OCW. The MIT Library related future features included: a better interface to licensed content with rights control, analysis tools in the course that would enable numerical analysis of library databases (such as census databases), the ability to facilitate the handling and annotating of digital

images, and a way to embed research library support and library expertise into the C/LMS. The OCW related features were: the ability to track information at the object-level (including copyright status), workflow ability to enable publishing at the end of the course (similar to the present Microsoft Content Management software supporting publishing), and the ability to enable a range of support levels (from self-serve to in-depth help) for faculty wanting assistance in preparing their courses for publication.

Faculty and TAs were generally more interested in seeing enhancements to file storage, the homework tool, and bulk mail features. Students were thought to be primarily interested in improving the ways in which the system organizes information. Students reportedly (there were no students interviewed in the survey) would like future features that would provide an efficient user interface integrating their calendars, registration information, C/LMS-based courses, and RSS feeds. Students reportedly would also like to enhance the bulk mail functionality and make additional improvements to the calendar so that it is more widely used by faculty and TAs. Staff envisioned a more sophisticated survey tool that could handle conditional questions and can have multiple sections (similar to the functionalities needed in a course evaluation tool).

The categorized list of all features using the edutools.info feature schema that are expected to be added by other institutions follows (the MIT categorized features are in the implications section):

Communication Tools
- Discussion Forum
  - discussion board
- Discussion Management
  - Tool for creating voice-based discussions or transactions.
- File Exchange
  - improved file management
- Online Journal/Notes
  - student-centric environment, e.g., del-icio-us or tag based environment for on-line note taking
  - editing with a thin WYSIWYG client
  - Annotation tool for text and images
- Whiteboard
  - specific pedagogic support (like voice support for language learning, virtual instrumentation)
  - embedding media (video, audio - not necessarily podcasting)
  - real time multimedia capture of the classroom presentation screen for podcasts and screencasts
  - Sophisticated support for non-text media, e.g., podcasting

Productivity Tools
- Searching Within Course
  - multimedia indexing and searching, e.g., of lecture videos

- Student Involvement Tools
  - Groupwork
    - Wiki kind of functionality
  - Community Networking
    - Sophisticated collaboration and communication with Wiki-like features and email
    - SAKAI as collaborative work tool
    - Collaboration tools (discussion, chat, mail list management)
    - Collaborative environment with access to academic materials and ability to talk about them
    - advanced collaborative tool
    - extended research collaboration
  - Student Portfolios
    - ePorfolios and ePortfolio with OSPI
- Administration Tools
  - Course Authorization
    - administrative tasks like student enrollment in course sections
    - clearer system for archiving snapshots of courses
    - administrative tools to see "how the tools are being used"
  - Registration Integration
    - to be able to see all courses
    - integration with central mainframe (SIS, Registrar, etc.)
- Course Delivery Tools
  - Test Types
    - student-based course evaluations
    - course evaluation feature
    - Assessment and assessment tools
    - locally developed language placement exams administered via assessment tools
  - Course Management
    - photo roster function
    - updates to students for new information
    - version control to "rollback content"
    - modules to let students take the roles of teachers
    - seminar enrollment
  - Online Gradebook
    - gradebook management, submissions, enhancements, and more grading functions
    - gradebook for "in-term" grade monitoring
  - Content Sharing/Reuse
    - integration with video and audio services
    - making an institutional repository out of individual repositories
    - repurpose in multiple places
    - seamless interaction with the Library
    - enable publishing outside of a course
    - repository-based system for learning objects

- seamless interaction with repositories, libraries, and museum databases
- portfolio-based content management
- Almagest for handling digital image presentations
- personalized, reusable, re-purposeable content with publishing content research portals
- digital asset management adding metadata to content modules
- blogs, and tagging and tag aggregation common in blogging tools
- content creation tools (blog, wiki, freeform) and image tools
- archiving directly in the LMS, and course data preservation

Course Templates

- support for modules
- bundling successful elements into course learning objects
- caplet-based course wizards template

Customized Look and Feel

- Sakai instance look and function like the legacy "Classes" system

Instructional Design Tools

- Virtualization
- selectable options for user interface popups
- hierarchical organization of data so any number of levels can be used and mapped to navigational layout
- additional tools to complement Sakai (such as Moodle)

Hardware/Software

Browser

- mobile device aware and embrace mobile platforms (laptops, PDA's BlackBerry's) and especially cell phones with features such as RSS
- integrate personal devices like iPods, PDA's, and cell phones as well as classroom response clickers

uncategorized features

- “57 things” on the to-do features list for the C/LMS
- More efficient integrated experience.
- dashboard to control access to tools in parallel (BlackBoard plus uPortal like)
- improvements in existing features that make them easier to use more quickly and more powerfully
- integrated online academic environment, e.g., "course shopping," course catalog, evaluation scores
- Integrated, transparent, convergence of the C/LMS with larger, academic environment

10. Many universities are now faced with developing an optimal long range deployment of C/LMS systems that minimizes costs and risks. Do you think that your institution's mixture of commercial, open-source, and in-house C/LMS systems will change in next 3 to 5 years? What role does open source play in C/LMS planning in the next 3 to 5 years?

The general tendency was to envision a mix of fewer C/LMS products in the future. This vision includes a very practical perspective that is friendly to open source options (and community source options such as Sakai), but with a preference for stability and quality assurance. The high growth in usage of current systems (such as at University of Chicago and University of Texas at Austin) has led to a user dependency that signals an end to the era of exuberant exploration of competing systems. The future will likely be more focused on meeting user demand and making the main systems ever more efficient to use.

The C/LMS future for MIT is expected to be based on a framework/platform that will make it easier to integrate tools drawn from open or community source products or from commercial systems, as well as those being developed by faculty at MIT. The vision is for convergence on a single C/LMS to bring more efficiency and shared community source development benefits. Some respondents thought that there is not adequate staffing at the Sloan School of Management to support an open source product, but the School is interested in collaborating with central IT on any of their initiatives. This would likely bring convergence in time to a single C/LMS.

Section II - Course Materials Life Cycle (see definition)

The next few questions relate to the designing, developing, and supporting courses during the 2004/2005 academic year that significantly use C/LMS systems.

11. Given that there is no monolithic course materials life cycle we are interested in the typical course materials life cycles at your institution.

From the C/LMS perspective the course materials life cycle is impossible to know because all of the development is outside of the C/LMS. There are some clues from University of Chicago, which found that about 30% of the course development happens during the preceding term and the remainder happens the week just before the course is taught. The trend is for some (if not all) of the materials from the previous offering of the course to be "rolled over" inside the C/LMS with reuse varying between 15% and 90%. The commonly estimated trend was that course materials are used and reused for up to three to 5 years.

The policies for how long the previous course materials stay easily available to faculty on the system varied from 18 months to forever. Only a few institutions perform course archiving. The student access to the course normally ends when the course ends, but has been extended in a few institutions for a limited

time (Middlebury College allows 6 months for instance). Of the survey respondents, only MIT was extending the course materials life cycle with public access via OCW, but others were considering similar plans, especially for their video lecture materials.

At MIT, each faculty member traditionally maintains all their own course materials in files or binders. For each new course preparation they would reuse and edit their own files outside of the C/LMS. There was normally little sharing of course materials from one faculty to another except in the context of departmental requirements where there may be shared course development that continues over a decade. Faculty revise 10%-20% of each course per year (at least problem sets and the syllabus) so that there is complete course materials turnover about every 5-10 years. At the end of the course, the materials remain available to the faculty in the C/LMS and faculty are likely to keep a private copy of their course materials on their desktop machine.

For MIT faculty with TA's, a common cycle is to: create content, upload to the web or Stellar, and, finally, (after being taught and refined about 3 times) the course may be reviewed and published to the world via OCW. In this cycle there are also feedback loops for refining course materials. During the Stellar part of the life cycle some course materials could be using external programs (for example: MATLAB) that dynamically generate calculated output tables. Also during the Stellar part of the life cycle there may be access to Library reserve materials that are external to Stellar. The OCW part of the course materials life cycle is not designed to link to outside programs or repositories and so arrangements have to be made for external static versions of materials to be available inside the OCW course. Then at the end of the OCW part of the cycle all the materials will to be moved into a future DSpace archive. Unfortunately, OCW updates courses infrequently, so the OCW courses can be out-of-date.

The typical cycle at the Sloan School is for faculty to develop the course outside of the system and then use SloanSpace as a repository for materials not included in the printed course packet. There is no separate archive beyond OCW.

12. If you are using a learning repository system how would you classify it - as part of your C/LMS, as a library system, or an archival system like Harvest Road, DSpace, or Fedora? How much would you estimate that it is used?

The overwhelming trend was for no use of learning repository systems and very limited sharing of course materials among faculty. The MERLOT repository was essentially invisible. However, many institutions were actively investigating repositories and all were using some form of linking from courses to resources external to the C/LMS that are organized in a more "topic centric" way (Library resources, streaming media, etc.) Stanford was ahead of this trend and

already using learning repositories (Fedora and Plone) as the preferred methodology for resource rights management and permanent referential links to external resource materials (that may be relocated, but the link stays constant).

At MIT, there is no Learning Object Repository in use, but there are some digital materials for courses that get reused. Examples of this include eReserves in the Library and materials from courses previously taught using Stellar. There are also files on CD's of the OCW course materials that are provided to faculty. For courses that were taught using Athena Lockers (the C/LMS that preceded Stellar) there are private course materials dating as far back as 1994.

For the Sloan School, OCW is the only form of repository used. The OCW publishing schedule is deliberately about a semester behind the current semester, so that published classes on OCW are "snapshots" in time. Starting next year DSpace will become a more visible repository option with metatagged materials from several hundred courses.

13. Are you currently using any Enterprise Content Management tools (such as, Vignette or Documentum) that enable people to collaboratively create, manage, deliver, and archive course content? Do you plan to use such a system in the next 3 to 5 years?

Enterprise Content Management tools are beginning to be used (Hannon Hill Cascade Server, Roxen, Stellent, and homegrown HyperContent), but the use is outside of the C/LMS context. Yale and Stanford have no plans in this direction, whereas Harvard is designing enterprise content management into future Course iSites. The popularity of this kind of tool may follow rather than precede the emergence of a culture of collaboration on course content development.

At MIT, there are plans for an enterprise content management tool for the MIT website, but this need seemed to have been initiated outside of the course materials development context. While there is no enterprise content management system for the C/LMS, OCW is using Microsoft Content Management System version 2002 as the software-based workflow for courses to be turned into published OCW courses. The content management issue is being investigated and there are open source alternatives, such as Alfresco, being examined for this task. In the future, the system will include an easy method to produce an archive of a course in DSpace.

14. What policies and procedures has your institution adopted regarding <u>intellectual property rights</u> for electronic course materials…for faculty ownership?

a. for student ownership?

b. for institutional ownership?

There were two approaches to the ownership of electronic course materials:

- they were owned by the faculty who created them.
- they were owned by the institution and those rights were almost always waived to faculty and student authors.

All institutions had intellectual property rights policies in place. At Yale and Berkeley, the University is the first owner. For Carnegie Mellon, Princeton, and University of Texas at Austin the instructor is the first owner. The rest of the institutions were either less definitive on this question or were presently in the process of reviewing the IP policies and did not want to forecast the outcomes of that process.

At MIT, the policy is that faculty and students own what they create. The exceptions to this may be a prior arrangement or if MIT makes a substantial contribution to content production, as in the case of producing videos. The institution owns images that are created as part of the OCW course publication process. When copies are needed, they are requested from the copy services, which manages the copyright clearance processing. Some faculty use only their own materials for their courses. OCW obtains permissions for all materials that do not belong to the faculty.

15. What policies and procedures has your institution adopted regarding acquiring and assuring proper copyright clearance for electronic course materials…

a. for course materials used for instruction?

b. for course materials that are published or archived after the course is completed?

The general trend was that there was an office or a service in the Library that was empowered to handle copyright clearance and that course materials were considered in the same way as other published materials. The response from Princeton captured the situation well: "This is a monolithic question with no monolithic answer." At MIT, faculty are responsible for any electronic documents that they post, but assistance on copyright clearance is only a phone call away. Because of the public distribution of OCW courses, only they seemed to be publishing course materials that involved additional copyright clearance processes.

16. What policies and procedures has your institution adopted regarding open access to electronic course materials?

a. for course materials used for instruction?

b. for course materials that are published or archived after the course is completed?

The most common trend was to have some provision for faculty discretion to make their materials open access. In some cases this was limited to the syllabus or materials owned by the university. The cultural support for open access varies considerably across institutions ranging from little support at University of Texas at Austin to long histories of open access at Berkeley (for video) and at MIT. The OCW public courses have served as a cultural eye-opener in many institutions showing that open access was both educationally valuable and possible. The OCW success in open access sharing and in demonstrating what high quality courses look like is a disruptive influence in institutional cultures accustomed to teaching "behind closed doors." OCW serves to raise the status of C/LMS teaching in institutions that are primarily research-focused. The question remains as to whether the publication of a "course" will join other promotion and tenure metrics (such as publishing a textbook) as a recognized faculty accomplishment. OCW establishes an online course distribution channel that rivals the textbook distribution channel. If this model is more widely adopted, it will be interesting to see how the commercial publishers respond to the challenge of university-published courses.

At MIT, open access to course materials in the C/LMS is up to faculty. For example, faculty can choose to make their Stellar site world readable, or open to the entire MIT community, or open only to those in the class, with the default being open to the MIT community. Faculty can also take materials to OCW for open access publishing. OCW is used for providing open access to the world after class materials have undergone OCW's publishing process.

17. In considering the personnel and activities that support faculty in course development (including graduate students, office staff, support from other faculty, course designers, graphic artists, course software programmers, et. al.), what is your estimate of the total cost of supplying this support in the 2004/2005 academic year?

The essence of the modal response was that support costs are very distributed and mostly opaque, but in total it would be a large number. Rough estimates ranged from $3 million at Columbia University, $500,000 at Princeton University, $200,000 at University of Chicago, to a low of $10,000 at Carnegie Mellon University where most of the support is distributed through the local departments (and not counted in the $10,000).

18. In considering the personnel and activities for faculty development in creating and delivering courses (including workshops, tutorials, peer mentoring, self-guided materials, etc.), what is your estimate of the total cost of supplying this support in the 2004/2005 academic year?

The trend was to devote a few FTE for faculty development and in a couple of the reporting cases this could not be separated from the cost of faculty support costs reported in question 17. In the institutions where faculty support was

provided, University of Chicago declared that they had no visible costs for faculty development, while for others spending ranged from $200,000 at Yale University and Columbia University, $300,000 at Stanford University, $350,000 at Princeton University and Berkeley, to $500,000 at Carnegie Mellon University. At MIT, the OCW program costs about $5,900,000 per year. This includes a stipend given to faculty at $3,000 per course and support by 5-10 departmental liaison persons which costs $450,000, a $50,000 cost associated with the Library and another $10,000 for contract graphic designers.
At MIT, the other visible cost was the Teaching & Learning Laboratory budget. For the institutions that supplied only FTE information, the conversion of 1 FTE = $100,000 was used.

19. In considering the personnel and activities for adapting course materials for students with disabilities (including website design, captioning, adaptive technologies, etc.), what is your estimate of the total cost of supplying this support in the 2004/2005 academic year?

The year trend in costs was bimodal with a "low-cost" grouping at $5,000 to $10,000 (Berkeley, Harvard, Yale, and Middlebury College) and a "higher-cost" grouping of $50,000 at Columbia University, $100-150,000 at Carnegie Mellon University, to $200,000 at Stanford University (using the conversion of 1 FTE = $100,000). There were a couple of institutions where the costs of adapting course materials for students with disabilities are opaque and essentially invisible. At MIT, there was only an $800 identifiable cost but some part of the Disabled Service budget would also be used for adapting course materials.

20. What were your estimated 2004/2005 costs (both licensing and support staff salaries and benefits) of third party course materials, e.g., copyright clearance, e-packs, article databases, simulations, etc. Please include all sources, e.g., IT, libraries, departments, etc.

This question brought to light the difficulty of separating teaching materials from research materials in research universities where more than half of the students are graduate students. The costs ranged from a low at Harvard University of $5,000 - $10,000 for "purely instructional materials" to a high of $5 million at Columbia University with the modal response being in the low millions ($1-1.5 million at Stanford University and Carnegie Mellon University). At Princeton, approximately $550,000 was devoted to digitization of audio, video, music, and texts for use in support of teaching (using the conversion of 1 FTE = $100,000). Often this cost was part of the university Library budget, which was organizationally distinct from the C/LMS organizational budget.

At MIT, the cost is $2,138,000 plus $1,000,000 for the staff costs of about 10 FTE in the Acquisitions License Service area of the Library. There is also some additional cost for copyright materials that would be associated with the Copy

Center budget and unmeasurable costs for faculty, administrative staff, and TA's.

The next questions relate to archiving course content and materials for future use and/or conversion into next generation C/LMS systems.

21. Approximately what percentage of your faculty during the 2004/2005 academic year have contributed to or downloaded content from learning repositories like MERLOT or the MIT Open Course Ware?

a. contributed to: _____
b. downloaded from: _____

The trend was for very low estimates in the 1-5% range for both contributing to and downloading from repositories. The MERLOT repository was essentially invisible and no institution reported any known use of it. Since the faculty are very independent, even if they were to use a repository, they would not go through a central gateway to do so. Therefore, the real extent of repository use is unknown. OCW was more visible, but the faculty usage is still unknown and estimated to be very low. These results are consistent with the slow growth of using learning repositories except in instances where they have strong organizational support within the institution. This type of repository and institutional support is more common with high volume "core courses".

At MIT, OCW has contributions from 73% of the faculty which is growing at 3-4% per year. There is no information about repository downloads by faculty.

22. What technologies/software do you use for long-term archival of course materials?

There is no actual library style archival of courses presently at any of the institutions except for some small experiments and a medium term in-house archival system at Harvard. The current situation is for course materials to reside on spinning-disk storage. Storage use is expanding rapidly, so a few institutions have begun planning for future archival of course materials. The declining cost of storage has likely pushed back the urgency for implementing archival systems and may, if the trend continues, be primarily a policy decision to use an archive technology.

At MIT, the Stellar C/LMS takes care of spinning disk storage. DSpace is just beginning to be used as the archive technology of choice.

23. What was your total cost of archiving C/LMS course materials for the 2004/2005 academic year?

The trend was for the marginal cost of archiving course materials to be close to zero in the range of $100 to $2,000 per year. The exception was Princeton where the total cost of archiving may be in the $25,000 to $50,000 per year range as part of the disk space for BlackBoard C/LMS. At MIT, the archiving cost in Stellar is trivial.

Section III – Strategic Focus for the Future

24. What issues will be the key drivers in your decision-making process regarding your institution's use of and selection of C/LMS systems in the next 3 to 5 years?

There were several common key drivers in the use of and selection of C/LMS systems including: ease of use, adaptability/upgradeability/openness to innovation, and cost. The commitment to community source Sakai was a key driver for Stanford, Yale, and was the only driver for Berkeley. Other less common drivers were for collaboration across organizational units, achieving efficiencies, pedagogical payoff, security, and the preference for "smooth non-disruptive progress." The following categorized list includes all key drivers mentioned by the peer institutions:

Systems Administration drivers
- a better way to understand the usage of the C/LMS
- ability to innovate, generalizable features
- adaptability, constantly interfacing to other systems, inter-operability
- stability and robustness
- service for technical problems
- support of Unicode
- upgradeability
- open-source for more control
- security

Organizational drivers
- smooth non-disruptive progress
- collaboration across organization units
- community involvement
- organization efficiency
- ease-of-use, efficiencies in developing more thorough faculty support
- portal that enables separate branding by professional schools
- commitment to Sakai
- cost of ownership

Pedagogical drivers
- assessment tools
- what drives the student experience
- student expectations
- places where the system is good for some users
- optimization of teaching and learning
- federated searching across various repositories

At MIT, one viewpoint was that, in the future, the C/LMS needs to become more of a service to faculty rather than an "online toolbox." The key drivers for change include: what features and tools are available, the ease with which new tools can be incorporated in the platform (architectural openness), leverage the enterprise systems, efficiency as a transactional platform, ease of adoption by faculty, popularity with faculty, costs vs. benefits for faculty and students, and the overall cost sustainability. Others drivers mentioned at MIT include: open software (Sakai), the ability to achieve a single C/LMS with broad adoption, cost, maintainability, and desirability of the right features for addressing the demands faculty and students to enable "making everybody happy." Another driver will be the "security" of the C/LMS.

A driver for some MIT respondents is the hope to integrate with the open publishing process throughout the materials life cycle (course development to teaching to sharing), so that at the end of the course it is quickly published. As a result, a "true life cycle management system" will emerge. Another issue is the need to replace old home grown systems with new systems that will integrate easily with the other systems on campus. In the view of many respondents, politics will not matter much.

25. How do you envision the institution's organizational structure for supporting C/LMS systems changing in the next 3 to 5 years?

The trend is for the C/LMS becoming more like an enterprise system although this is just beginning in most institutions and will likely take a long time. A few institutions are likely to stay with the same organization but anticipate more collaboration within the structure. Middlebury is still wrestling with staffing changes and issues related to supporting open source solutions. University of Chicago and MIT have just begun the process of considering the possibility of adjusting the organizational structure supporting the C/LMS systems.

At MIT, a multiple agency committee has been struck to review academic computing and is working on the issue and it is likely to be resolved before the fall. One view is that as the faculty experience becomes unified (for developing courses, teaching courses, and publishing to OCW) there will be concomitant organizational ramifications to integrate support structures as well. When the committee process is complete, the organizational structure that supports student C/LMS use and institutional cost effectiveness may become more "centralized" than the present three systems (Stellar, OCW, and Sloan Space), but not necessarily as centralized as the institutional payroll organizational structure. The present organizational support systems are not well integrated and are unable to provide answers to simple questions such as "who is teaching what?" in a timely manner. In the future, it is likely that the C/LMS will be moving out of Sloan School and faculty assistance will become more of a one-on-one service.

26. What issues will be the key drivers in your decision-making process regarding your institution's course materials life cycle in the next three to five years?

The idea of a course materials life cycle, while common at MIT, was unfamiliar at many of the institutions. Consequently, the issues that were expected to be key drivers in the institution's course materials life cycle were many and varied. The issues mentioned included faculty demand, copyright, cost (with the caveat that the cost of deciding what to save may exceed the cost of saving everything), integration with a content management system, scalable repositories, learning objects, use by distance education programs, and level of interest in ePortfolios. The vision of electronic materials is deepening into electronic curriculum at University of Chicago and the idea of publishing course materials is beginning to spread due to the effect of OCW. The complete list of key course materials life-cycle decision drivers are alphabetically listed below:

archiving
Change is happening rapidly
content management repository developments
copyright
Cost
discouraging fragile development (materials that cannot be preserved because of dependencies).
Distance Education online programs
ePortfolios
Faculty demand
Faculty turnover
getting a good set of faculty requirements and student requirements
increasing integration with the content management system
institutional bias for open access
institutional repository
intellectual property
interest in moving on to deal with electronic curriculum and implications of eReserves
learning objects
legislative pressures to teach more students (with no more physical campus space)
local efforts to opening up courses
MIT OCW, which seems to be having an impact.
open course content (OCW)is a demonstration that seems to be working and this empowers
open source content systems usage
Reality is that the cost of sorting what to save is higher than saving everything
Results of researching DSpace to support archiving and supporting research
role of the university press
scalable repositories accessible by one standard, e.g. OKI OSID.
selection of an archival system

At MIT, the key drivers are: understanding the value of OCW for faculty and students, easing the pathway to get course materials into OCW, driving the cost down, and increasing flexibility, functionality, and reusability of course materials. Another viewpoint was that the future course materials drivers will

be those situations where there are new programs, new curricula, changes in requirements, and curricula revisions. Several also felt that the "evolving" intellectual property framework will make a difference. Portability of content will be a driver from the faculty perspective, so it will need to be easier to use DSpace in the Library to get materials both in and out. Other drivers are related to enterprise developments where there is an opportunity to be hooked into other MIT systems. As the systems come to work more closely together, the colleges and support organizations will collaborate and work together more. There will be more centralization for cost control around a strategic vision of the C/LMS.

27. How do you envision the institution's organizational structure for supporting course materials life cycle activities changing in the next 3 to 5 years?

The trend was for greater involvement of the university library with the situation too vague to forecast confidently. There was a range from no change to expectations of increasing centralization. There were synergies found in code development between the C/LMS coders and the library coders at Harvard and at University of Chicago. This "collaboration" for the common good may proceed with or without changing the organizational structure. The role of university publication organizations is largely unexplored except at MIT with OCW and MIT Press. For MIT, a multiple agency committee is working on the organizational structure issue. The resulting organizational structure will have to be built up. One proposed solution is a "general contractor" type of coordinating organization that generates efficiencies for faculty. Some respondents thought that developing organizational structures with closer ties to DSpace and the Library would make it an easier conduit for course materials.

28. Have we omitted any questions that pertain to your C/LMS or Course Materials Life Cycle usage, costs, or future plans? We're especially interested in items that give us better context on the current implementation, near-term decisions, or long-term visions regarding your C/LMS or Course Materials Life Cycle.

The trend that respondents noted as missing from the survey was a focus on growth and the ramifications of being in a very rapidly growing system. For example, Stanford suggested that network security becomes increasingly difficult with additional collaboration across institutional boundaries.

Carnegie Mellon University raised the specter of a powerful identity "service" linked with the registrar that might successfully compete with the C/LMS. This suggests that much of the value of C/LMS systems is really in their authentication and authorization processes and not necessarily their course management tools.

As was noted by one respondent, after years of C/LMS usage, "we" still do not know much about what is really going on nor the pedagogical consequences. There is a hint of consequences from the experience related by Lois Brooks of Stanford that with their CourseWork (Sakai) C/LMS, the students using the system (all courses have face-to-face teaching as well) are increasing their course loads. This might suggest that "the system" has enabled the students to learn more efficiently than was previously the case without the C/LMS. If this observation proves to be reliable, then tracking "increased student productivity" would be fairly easy and could move the C/LMS technology closer to decision justifications based on pedagogical consequences that matter to students. This development would be a significant step beyond the commonly-reported ease-of-use data.

At MIT, the long term vision is that the C/LMS will help faculty to become better teachers. Presently most classes are lecture style with "chalk talk" and then students are sent home with problem sets to complete. The C/LMS could be retooled to enable more teaching methods involving active learning in the classroom and problem sets could become interactive problem sets or small virtual experiments (like iLab) integrated into the C/LMS. The C/LMS could support course/subject evaluation surveys at an early point in the course allowing faculty to make midcourse corrections based on student survey data.

One suggestion for the future surveys from MIT was that the composition of project management teams for the C/LMS was a missing aspect of this survey and that this organizational aspect seems important. Also some additional interesting questions were posed (but not answered): "Who are the decision makers on these issues?" and "Is there any central group that maintains a financial perspective?"

Implications for C/LMS development at MIT

Evidence from peer institutions clearly implies that the C/LMS is almost the equal of e-mail in becoming a defining part of the student experience. The following are key factors that are facing other institutions and are considerations for MIT in looking to the future of C/LMS implementation.

Key factor: Maintain the Stability of C/LMS product – don't change too often. The increasing importance of C/LMS usage brings with it more "pressure" from users that it be both easy to use and efficient with their valuable time. While peer institutions have taken different pathways to approach the broadening issue of usability, they all have the intention of making progress in a manner that is as smooth and non-disruptive as possible. Some have accomplished stability by staying with a familiar system, such as BlackBoard. Others are seeking to have the greater flexibility that is the promise of Sakai, but it is interesting to note that Stanford, Berkeley, and Yale

are implementing Sakai so that it emulates the C/LMS that is being replaced. MIT has a similar end goal in that they want to minimize the "disruption" to faculty, but they are following a somewhat different path. They are releasing Stellar2 for this fall and will use Sakai components within that implementation. A categorized listing of features using the edutools.info feature schema expected in the future (as identified by survey respondents) follows and is both similar and different from the aggregated list identified by the peer institutions and detailed in question 9 above:

- Communication Tools
  - File Exchange
    - enhancements to file storage
  - Internal Email
    - bulk mail and more functionality (by adding an HTML tool bar)
  - Online Journal/Notes
    - facilitating the handling and annotating digital images
- Productivity Tools
  - Calendar/Progress Review
    - improvements to calendar so that it is more widely used by faculty and TAs and by integrating it with bulk mail
    - integrated calendaring that brings together email, RSS subscriptions, blogs and the C/LMS
    - calendar-like feature to help students manage their schedules and assignment due dates
    - efficient student user interface that integrates their calendar with registration, their courses in the CMS, and RSS feeds
    - homework tool
    - Hook into the calendar system
- Student Involvement Tools
  - Community Networking
    - collaboration capabilities
    - ability within OCW to interact with communities
  - Student Portfolios
    - ePortfolios
- Administration Tools
  - Course Authorization
    - system organizing information
  - Registration Integration
    - integration (like one-stop-shopping) for submitting grades with the Registrar
    - course delivery tools
  - Test Types
    - sophisticated survey tool that can handle conditional questions and can have multiple sections
    - student evaluation tool for TA's and faculty
    - support for student course evaluations (to replace the present

- paper survey scanning system)
- Course Management
  - keeping track of who is in the class (pictures)
  - integration between Stellar and OCW
- Instructor Helpdesk
  - ability to treat faculty differentially to enable a range from self-serve style for some faculty to enabling more extensive support to TA's and faculty who want more support in preparing their course for publication
- Online Gradebook
  - gradebook feature and linking into the gradebook
- Content Sharing/Reuse
  - Library and Stellar interfaces to be more seamless and efficient
  - better interface to licensed content with rights control
  - ability to track information at the object level including copyright status
  - workflow ability to enable publishing at the end of the course
- Course Templates
  - embedding research library support and library expertise into the C/LMS
- Instructional Design Tools
  - interactive activities
  - simulation
  - visualization
  - analysis tools in the course that would enable numerical analysis of library databases like census databases

Hardware Software

- Browser
  - broad support on a range of devices including iPods and cell phones.

If priority were placed on implementing sophisticated assessment tools (such as a survey tool that could also be used for student evaluations), then there would be the means to get appropriate feedback as the "enhancements" are made to the C/LMS system. MIT could then measure improvements in usability and efficiency to guide the process.

Key Factor: Smoothly integrate the C/LMS with other campus IT systems. While the integration of the C/LMS with other legacy core services (such as course registration and library services) has proved challenging, the institutions were unanimous in saying that they are integrating more services with the C/LMS. The challenges are both organizational and technical. Many of the systems were locally developed many years ago and (while they do the job) the technology on which they were based has now been superseded by newer technologies. This often makes interfacing with legacy systems difficult and only a stop-gap solution. The vision from OKI (the Open Knowledge Initiative)

defines the open architectural specifications for educational software that targets the interoperability requirements of MIT in terms of API's. Progress on this elegant solution to the integration issues is proceeding, but the integration task at MIT, as with other institutions, is a large one spanning several years.

Key Factor: Address the usability implications of systems integration. With the rapid increase in the usage of the C/LMS the issues related to the user experience become critically important. The students and faculty are more often on the "late adoption" end of the scale and they increasingly want one-stop shopping. Therefore, as the C/LMS integrates with other IT systems, the end result must be smooth technical integration, but also a smooth integration from a usability point-of-view. MIT's has been a user-centric approach that has emphasized front-end usability, and this approach needs to continue as back-end issues are resolved. This assumes even more importance since more than half of the faculty and students at MIT are now spending some of their time interacting with the C/LMS, and that number is growing. Some strategies to address the usability/integration issue include:

- Portal Based Integration (Yale approach) – use the portal as a user interface that integrates the C/LMS and other institutional IT systems.
- Binary Integration (Stellar approach) – use a deeply integrated architecture on the backend that supports the development of integrated front-end services and extensions with powerful tools. These processes take place in the context of semester timetables, where many processes begin when the semester begins, end when the semester ends, and few processes span more than one semester.
- Service Integration Approach---Predefined and pluggable integration that allows new modules of functionality to be brought in with minimal disruption to the environment. Service interface standards in this area, such as those provided by OKI OSIDs, address this need, and also offer the potential to create a new market for educational software. As more educational software uses the same integration technique, we move closer to a world where software can be expected to plug together. As long as the cost of integration is high, educators will have only limited access to supported software tools and systems. Solving this integration issue is a key to providing choice and flexibility.
- "Browser as Agent" approach – use the FireFox browser extended with an internal webserver and extended with scripts to preprocess multiple sites into an integrated user experience. Include multiple password management allowing legacy services (Library and the Registrar) to be integrated on the same easy-to-use web page.

There may be some synergies within the Sakai project for the first three approaches so that progress might be made quickly, but history has revealed progress to be slow. The "Browser as Agent" approach is based on new emerging open source technologies, such as MIT's Similie Project PiggyBank

extension and the GreaseMonkey extension. With a "Browser as Agent" system, it would be possible to programmatically deal with legacy interfaces from the Library, the Registrar, and OCW rendering the "results" into a single viewable page that could be saved locally in the Browser's web server. The "Browser as Agent" approach also enables for highly personalized work-a-rounds that serve the individual needs of faculty and students that can also be shared with the community. Alternatively, OKI-based service development has been underway at MIT for several years and may prove to have a very deep yet flexible set of solutions to interoperability problems. At MIT there is currently pluggable service interfaces for DSpace and other important sources of educational content (the new Stellar Image Tool is already using some of these), and projects are underway to create service-level plugs for OCW and MITSIS, MITs' Student Information System.

Key Factor: Measure C/LMS affect on student learning. Dan Updegrove from the University of Texas at Austin noted that even though universities have been using C/LMS products for several years, he felt that we collectively do not know much about what is going on pedagogically. There is a growing body of research on the learning outcomes of technology-mediated courses[3]. As these tools are now used in more than half of all classes at all but one of the institutions surveyed, more research on which C/LMS features make a sizable difference in student learning would better support this growing investment of institutional resources.

Not a Key Factor: Where are the portals? Portals have been widely-touted as a friendly route for students to have a single point of authorization giving them access to all institutional electronic resources. Since integration was cited as an important issue, it is interesting to note that implementing a portal was mentioned by only one campus. While the survey did not specifically ask about portals, it would be expected that portal development would be mentioned in discussions about C/LMS integration. Yale's development of uPortal along with Sakai was the only mention of a portal. It is interesting to note that the portal is not being implemented to solve integration issues, but is meant to emulate the previous user experience with existing systems. Given

[3] Examples of research can be found at: "No Significant Difference" web site, www.nosignificantdifference.org/; Center for Academic Transformation, www.thencat.org; and Sloan-C, www.sloan-c.org. Specific research includes:

- Comprehensive Evaluation of MyGateway Use by Faculty and Students
  Report of WS 2005 (MyGateway is a customized instance of Blackboard)
  http://www.tltgroup.org/resources/F_Eval_Cases/UMSL-CMSWinter05.htm
- e-Learning Assessment Study - University of Iowa
  http://www.uiowa.edu/~provost/elearning/assessment/index.shtml#multiple_cms
- Research Themes and Methodology - The LearningOnline Network with CAPA
  Gert Kortemeyer, 2003, http://lon-capa.org/researchthemes.html
- R. M. Wallace, Online Learning in Higher Education: a review of research on interactions among teachers and students, Education, Communication and Information, Vol 3, No. 2, 241 (2003)

the experience of other institutions, portal development will probably not be a high priority for MIT's solutions to IT integration problems.

Not a Key Factor: Money. The findings from the costing questions in the survey were both disappointing and revealing. The responses were disappointing in that some of the institutions chose not to respond and, when the institution did respond, much of the requested costing data was not available. The tendency for several of the institutions to not have critical cost data was revealing. The costs of the C/LMS did not appear to be a main decision-driver compared to other issues or institutional personnel would have had a better grasp on the cost implications.

In the process of completing this project and reflecting on the complexities of C/LMS systems and course materials life cycles some more developed ideas emerged about the costs of ownership. The following framework for the Cost of Ownership of C/LMS offers a comprehensive way to conceptualize the money issue at MIT.

Table 4. Reconceptualized Comprehensive MIT Schema for Cost Elements

1. ACQUISITION
    - Strategy, ideation, feasibility plan
    - Software acquisition (License)
    - Vendor Relationship

2. DEVELOPMENT, DEPLOYMENT & OPERATION
    - Implementation
    - Customization
    - Programming
    - Usability
    - Accessibility
    - Integration of best of breed
    - Integration with MIT infrastructure
        - SIS
        - Registrar's system
        - Data Warehouse
        - Libraries --- eReserves
        - Repositories, e.g., image repositories (Stellar image tool)
        - Card Office --- student photographs
        - Streaming media servers --- Video indexing in Stellar
    - Updates and upgrades
    - Development
    - Project Management
    - System Architecture
    - Programming
    - User Interface Design

Usability / Accessibility
Quality Assurance
Technical Documentation
Development Tools (e.g., IDE tools like Eclipse)
Integrated Tools (e.g., JIVE)
Application Support
Software maintenance (Fees)
Database administration (Oracle license, DBA)
Hosting (Hardware, Backup, Systems support, Security, Student privacy)

3. END USER SUPPORT & OUTREACH
Documentation and Training
End User Training
End User Support (Help Desk)
Maintenance
Faculty Support - Class Site Creation / Training
Outreach
Rounds
Communication
Evaluation and assessment

4. STRATEGY
Exit strategy
Risk management – Vendor bankruptcy, Merger/acquisition
Direction shift

Total Reported ANNUAL COSTS
Total Annual Costs NOT included

TOTAL One-Time Costs - Investments

Surprise Finding: Students taking more courses? Lois Brooks, Stanford University, hinted that the popularity of the C/LMS is leading students to increase their course load and take more courses per term. This might be the first easily measured "learner benefit" of using a C/LMS.

Surprise Finding: C/LMS used beyond coursework. The most interesting development in this survey is the beginning usage of the C/LMS platform to support collaboration outside of the narrow confines of the course and semester timeframes. The C/LMS interface is evolving quickly into a place to perform non-teaching academic tasks including research-related tasks or organizing collaboration with colleagues both on- and off-campus. Both Sakai and BlackBoard are seen as facilitating collaboration beyond the course and Stellar can be expected to assume a more central role in communication within

academia at MIT. Accommodating this communication role may require extending the Stellar platform to facilitate collaboration beyond the temporal confines of the semester timetable.

Other Considerations: Access student materials beyond graduation. One of the benefits of light-weight open source C/LMS solutions (such as Moodle) is that the students can take the system with them when they leave the university. One possible benefit is enabling an easier transition from student to teacher or from student to productive worker. There have been some initial explorations of using the open source C/LMS as a student portfolio in teacher education programs that seem promising (University of Kentucky). While C/LMS systems like Sakai and BlackBoard are not portable, the Browser Agent approach might be a sweet-spot middle ground between "all my files from university are on my hard drive" and "what I can find in OCW" approach.

There has been some recent progress in the area of intelligent tutors that suggests substantial gains are possible (15% - 25% performance increase in school district algebra test performance) when learning is assisted by an intelligent tutor that models and responds to the student's conceptual problem solving. Presently, intelligent tutors using the ACT-R theory of mind (John R. Anderson - http://act-r.psy.cmu.edu/) are only available for high school mathematics but the potential for just-in-time learning is profound (http://ctat.pact.cs.cmu.edu/).

To this point there is very little use of personal profile information in C/LMS implementations since these systems were conceived as being time limited – just for the length of a course. This may well be changing as BlackBoard has announced the intention to build a permanent ePortfolio system for students to use their "learning materials" beyond their university courses. This is a significant step in moving from the course-centric viewpoint to the learner-centric viewpoint (there is some interesting ACT-R research on the learner centric information foraging by Pirolli[4] that demonstrates the value of having a model that thinks like a person). Clearly, the commercial interests see the value in keeping touch with alumni beyond the course experience by offering personalized services.

C/LMS summary. MIT's current near-term C/LMS development plan is somewhat different from that of other institutions. MIT is staying with the existing Stellar user experience while incorporating the Stellar Image tool (being developed as a Sakai tool) and selected elements of Sakai, such as the Sakai Kernel Bundle and the Sakai Jforum discussion tool. Other institutions plan to combine the best features of their locally developed C/LMS and Sakai to focus on the stability of the user experience. Those institutions are either

[4] Piroli, Peter (2005). Rational Analyses of Information Foraging on the Web. *Cognitive Science 29 (2005),* 343-373.

staying with Blackboard or making the local transition to Sakai as non-disruptive as possible by emulating existing local systems.

Not surprisingly, MIT is in line with its peers on the critical issue of integrating the C/LMS to other institutional administrative and academic IT systems. It is informative that regardless of the C/LMS chosen, all institutions seem to be experiencing difficulty in implementing that integration.

The survey suggests other C/LMS issues that MIT (and other institutions) should more deeply explore in the future:

- The effects of the C/LMS features on the outcomes of student learning – locating where the added-value is found and thus identifying opportunities for additional feature related added-value for students.
- How the C/LMS can be leveraged as a tool to foster faculty-student, faculty-faculty, and researcher-researcher collaboration beyond traditional classroom use and semester timeline.

While the C/LMS development at MIT has paid much attention to a smooth transition to using the C/LMS and to usability, it may also wish to upgrade the urgency of making the front-end more integrated, e.g., with a calendar, and more efficient for both faculty users and student users. EduTools staff suggested developing the local Similie\PiggyBank project into a personal browser agent that can accomplish portal-like integration of legacy site interfaces in a highly personal way. This approach could complement the infrastructure integration initiatives already underway and would allow for individualized faculty interfaces scripted to facilitate common tasks, such as setting-up a course in Stellar or submitting grades.

The growing interest to use C/LMS-like tools both beyond the semester and beyond the original academic purposes for the software could place pressure on support, storage, and policy issues in the future. Providing a way for students to carry their work beyond the semester and beyond the institution when they graduate would be a powerful tool for students and alumni/ae. The Sakai concept already goes beyond simple teaching tools to integrating academic, service, and research work all in one space. As previously mentioned, the growth in course C/LMS usage has exploded in recent years. Adding these new demands would definitely have an impact on decision-making.

Implications for Course Materials Life Cycle at MIT

The implications of the peer institutions for the Course Materials Life Cycle at MIT are few. MIT has pioneered the beginnings of an institution-wide Course Materials Life Cycle with the OCW project and other institutions are just now beginning to consider the concept.

Key Factor: MIT is a clear leader in implementing the Course Materials Life Cycle concept. The birth-to-death materials life cycle is foreign to the culture of most peer institutions. The institutions surveyed were still mostly steeped in the non-electronic course materials culture. The course materials are left to the faculty and only rarely are courses archived for use or reference beyond the terms offered. The declining cost of online storage has made it quite feasible to keep all course material continually available. Course materials never have to be discarded and the cost of deciding what to discard is more than the cost of continuing to keep everything available on disk. This dynamic may change with the increasing use of rich media like video and audio files, but the "comfort" of knowing that nothing is lost may eventually outweigh the minimal marginal costs of additional storage. The recent development of technology for searching audio or video files for specific words and phrases will be further incentive to store materials for later review and retrieval. In follow-up discussions about this survey process, Fred Beshears, Senior Strategist for Information Technology Services at the University of California, Berkeley, shared papers[5] he has written on how his institution could develop open educational resources in a consortium with peer institutions to help control the spiraling costs of textbooks. He suggests researching the cost of developing course materials for large enrollment courses and creating a business plan to make this an on-going, self sustaining resource for the partnering institutions. With the possible exception of Berkeley, even the extensive publicizing of MIT's OpenCourseWare, institutions surveyed do not seem to be ready to follow MIT's lead on a grand scale (but Carnegie Mellon University has begun the process).

Other Consideration: Track student usage of course materials. MIT may wish to consider the implications of broadening the Course Materials Life Cycle concept to include students. If student use of materials could be tracked, then the institution and the faculty could have a localized version of Current Contents which tracks the popularity in citations of articles. The tasks for faculty in revising courses could benefit from knowing which resources students used, reused, and thought valuable enough to save in their personal learning repository (PiggyBank). The preparing of graduate students for future careers as faculty could become a natural extension of using the collaboration techniques that they learned and modeled while at MIT. This student-centric concept might be expanded to include the student and their personal browser agent (with appropriate linkages to OCW and communities at MIT) so that graduating students were both intellectually and technologically empowered by their educational experience at MIT. They would take with them not only a diploma but also a personal learning repository and their personal collection of useful open source agent tools.

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[5]Beshears, Fred (2005). The Case for Creative Commons Textbooks. *Berkeley Computing & Communications, September, 2005*. http://istpub.berkeley.edu:4201/bcc/Fall2005/opentextbook.html. Beshears, Fred (2005). Viewpoint: The Economic Case for Creative Commons Textbooks. Campus Technology, September, 2005. http://www.campus-technology.com/print.asp?ID=11891.

Course Materials Life Cycles summary. Since the concept is not present or is very narrowly implemented at other institutions, there are little in the way of serious implications for MIT from the survey results. The most interesting conversations were with MIT personnel who revealed some upcoming enhancements including: the enterprise content management system for the MIT website (new to most of the interviewees), the OCW processing of materials, the need to explore alternatives to the Microsoft Content Management System being used currently by OCW, and a new search mechanism to find words used in audio and video resources. These additions will continue to keep MIT ahead of the surveyed peers. To share its advances and to avoid being the sole institution-wide player in open content, partnering with peer institutions (as is suggested by the University of California Berkeley), and expanding OCW beyond MIT's boundaries may be an option for MIT to explore. Partnering with peers might be focused on their initial implementation of a similar system or on software development, such as a shared open source solution for a content management system supporting the course materials life cycle that can archive into DSpace. In summary, just as others have prospered from access to the OCW materials, MIT could benefit from open content from other institutions. The idea of sharing content has been anathema to most faculty. MIT has proved it can work and can continue to lead by assisting its peer institutions.

Appendix A
Survey

Course/Learning Management System and Course Materials Life-Cycle Survey

Thank you very much for participating in this survey about your institution's Course/Learning Management Systems, course materials life cycle, and what you see as your strategic focus for the future in these areas.

We will ask some questions about costs; rough estimates are perfectly acceptable. If you do not feel comfortable answering a question "off the cuff" we understand, please feel free to take some time to research an answer if you need it.

Some questions are marked with the word: Data. These are questions that require that you submit factual or estimated numbers on costs, student counts, or similar information. We will not spend much time discussing these questions, unless you feel a need to provide clarifying information. You can either provide these numbers during the interview or in a follow-up e-mail.

This survey is being conducted by the Western Cooperative for Educational Telecommunications (WCET; www.wcet.info) under contract to MIT, the Massachusetts Institute of Technology. Russell Poulin, WCET Associate Director, is the project lead - (303) 541-0305, rpoulin@wcet.info. The interviewers are Bruce Landon (604-469-3333; blandon@edutools.info) and Tom Henderson (509-963-2046; thenderson@edutools.info).

Definitions of Terms for Purposes of this Survey

Course/Learning Management Systems (C/LMS): provides the platform for the enterprise's online learning environment by enabling the management, delivery and tracking of online and blended learning. C/LMS systems may be (a) commercial, e.g., Blackboard, (b) open-source, e.g., SAKAI, or (c) developed "in-house" at a particular institution.

Course Materials Life Cycle: The entire life of course materials from (a) initial design to (b) development, teaching, and technical support and (c) through long-term archival and/or publication of course content. There is no one generally accepted course material life cycle and an institution may have several.

C/LMS "significant usage:" For "significant use of a C/LMS" we are interested in courses that use the C/LMS for a meaningful instructional activity (delivering content, holding discussions, having synchronous events, etc,) and not courses

that use it just for administrative purposes only (maintaining course registration lists, posting a syllabus, posting grades). Courses that "significantly" use a C/LMS may be offered via the WWW, face-to-face, or with other technologies. We understand that you will probably need to estimate this number.

Course and Class: Course is a particular set of information or skills that is being taught with defined objectives and outcomes. For example, "History 131 - American History to the Civil War" is a course. Classes are considered to be individual instances or offerings of a course.

Project Web Site

In support of the MIT C/LMS survey, a project site (http://mit.edutools.info) will allow you to review and comment on the interview findings. When completed, the site will enable side by side comparisons of survey interview question information for each of the participating institutions. In some cases respondents will likely replace initial rough estimates with more grounded estimates on some questions as data becomes available. In other cases respondents may wish to correct interviewer misinterpretations of their situation. The site is intended to improve data collection and provide an easy way for institutions to compare their situation with that of other institutions. A password to the web site will be provided during the interview.

Survey Questions

Section I - Course/Learning Management Systems (see definition)

1. Data How many undergraduate and graduate students (headcount) were enrolled at your institution for the 2004-2005 academic year? Of those students, for the 2004-2005 academic year, how may students were enrolled in courses that made "significant use" of a C/LMS?

2. Please name all C/LMS systems in use on your campus? Let us know which systems are commercial, locally-developed, open source, or a combination of systems. Also, when was each system first used in courses at your institution?

Product	Who developed? (commercial, locally-developed, open source, or combination)	Term first used in course?

3. Data For the 2004-2005 academic year, how many courses use each C/LMS system listed in the previous question? For the 2004-2005 academic year, what is your estimate of the number of students using each system?

Product	Number of courses?	Number of students?

4. Data Of the courses making "significant use" (see definition) of a C/LMS, how many courses were…
   a. Newly developed in the 2004/2005 academic year: _____
   b. Underwent major revisions (i.e., updated more than half of content, adapted to a new textbook, newly incorporated epacks, changed C/LMS or other supporting software) in the 2004/2005 academic year: _____

5. In your C/LMS, how are you currently handling "non-text" media (video streaming, audio streaming, podcasts, simulations, virtual laboratories, image archives, etc.) What plans do you have for further handling or integrating "non text" media" with your C/LMS over the next 3 to 5 years?

6. Data Please estimate the costs for each C/LMS for the 2004/2005 academic year.

Expense	Estimated 2004/2005 Amounts
C/LMS license fees	
Total cost to Integrate with Enterprise systems	
Training/support/help desk costs	
Maintenance fees and costs	
Software development and maintenance	
Hardware, e.g., new database servers	
Software systems, e.g., new database systems	

7. Data Estimate the costs of major one-time investments for each C/LMS from the 2000/01 to 2004/05 academic years. Indicate the amount of that one-time investment that occurred in the 2004/2005 academic year.

Expense	One-time investments since 2000	One-time investments in 2004/05
C/LMS license fees		
Total cost to Integrate with Enterprise systems		
Training/support/help desk costs		
Maintenance fees and costs		
Software development and maintenance		
Hardware, e.g., new database servers		
Software systems, e.g., new database systems		

8. Has your university conducted a cost analysis of using a C/LMS? Is it publicly accessible?

9. Are there any particular features or capabilities that you expect to add to your C/LMS systems within the next 3 to 5 years? What features or capabilities would your students like to see added?

10. Many universities are now faced with developing an optimal long range deployment of C/LMS systems that minimizes costs and risks. Do you think that your institution's mixture of commercial, open-source, and in-house C/LMS systems will change in next 3 to 5 years? What role does open source play in C/LMS planning in the next 3 to 5 years?

Section II - Course Materials Life Cycle (see definition)

The next few questions relate to the designing, developing, and supporting courses during the 2004/2005 academic year that significantly use C/LMS systems.

11. Given that there is no monolithic course materials life cycle we are interested in the typical course materials life cycles at your institution.

12. If you are using a learning repository system how would you classify it - as part of your C/LMS, as a library system, or an archival system like Harvest Road, DSpace, or Fedora? How much would you estimate that it is used?

13. Are you currently using any Enterprise Content Management tools (such as, Vignette or Documentum) that enable people to collaboratively create, manage, deliver, and archive course content? Do you plan to use such a system in the next 3 to 5 years?

14. What policies and procedures has your institution adopted regarding *intellectual property rights* for electronic course materials…for faculty ownership?
    a. for student ownership?
    b. for institutional ownership?

15. What policies and procedures has your institution adopted regarding *acquiring and assuring proper copyright clearance* for electronic course materials…
    a. for course materials used for instruction?
    b. for course materials that are published or archived after the course is completed?

16. What policies and procedures has your institution adopted regarding *open access* to electronic course materials?
    a. for course materials used for instruction?
    b. for course materials that are published or archived after the course is completed?

17. Data In considering the personnel and activities that *support faculty in course development* (including graduate students, office staff, support from other faculty, course designers, graphic artists, course software programmers, et. al.), what is your estimate of the total cost of supplying this support in the 2004/2005 academic year?

18. Data In considering the personnel and activities for *faculty development in creating and delivering courses* (including workshops, tutorials, peer mentoring, self-guided materials, etc.), what is your estimate of the total cost of supplying this support in the 2004/2005 academic year?

19. Data In considering the personnel and activities for *adapting course materials for students with disabilities* (including website design, captioning, adaptive technologies, etc.), what is your estimate of the total cost of supplying this support in the 2004/2005 academic year?

20. Data What were your estimated 2004/2005 costs (both licensing and support staff salaries and benefits) of third party course materials, e.g., copyright clearance, e-packs, article databases, simulations, etc. Please include all sources, e.g., IT, libraries, departments, etc.

The next questions relate to archiving course content and materials for future use and/or conversion into next generation C/LMS systems.

21. Data Approximately what percentage of your faculty during the 2004/2005 academic year have contributed to or downloaded content from learning repositories like Merlot or the MIT Open Course Ware?
    a. contributed to: _____
    b. downloaded from: _____

22. What technologies/software do you use for long-term archival of course materials?

23. Data What was your total cost of archiving C/LMS course materials for the 2004/2005 academic year?

Section III – Strategic Focus for the Future

24. What issues will be the key drivers in your decision-making process regarding your institution's *use of and selection of C/LMS systems* in the next 3 to 5 years?

25. How do you envision the institution's organizational structure for supporting *C/LMS systems* changing in the next 3 to 5 years?

26. What issues will be the key drivers in your decision-making process regarding your institution's *course materials life cycle* in the next three to five years?

27. How do you envision the institution's organizational structure for supporting *course materials life cycle activities* changing in the next 3 to 5 years?

28. Have we omitted any questions that pertain to your C/LMS or Course Materials Life Cycle usage, costs, or future plans? We're especially interested in items that give us better context on the current implementation, near-term decisions, or long-term visions regarding your C/LMS or Course Materials Life Cycle.

Thank you very much. ■

Appendix B

MIT Project Liaisons & Survey Respondents

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Appendix C
Institutional Responses to Survey Questions

SECTION 1 – COURSE/LEARNING MANAGEMENT SYSTEMS	
1. How many undergraduate and graduate students (headcount) were enrolled at your institution for the 2004-2005 academic year? Of those students, for the 2004-2005 academic year, how may students were enrolled in courses that made "significant use" of a C/LMS?	
MIT Strategic	
MIT Stellar Faculty	
MIT Operations	In the fall of 2005 there were 4066 undergraduate students and 6140 graduate students, which adds up to 10,206 students including those at the Sloan School. The Data Warehouse count had 12020 students, but this included cross-registered students who were double counted, and also about 1,000 students who were only doing thesis and hence should not be counted for the purposes of Stellar. Thus, the number of students enrolled at MIT should be taken as 10,206. The significant use was hard to estimate, but about 50% of the courses would be where significant use was made of the C/LMS.
MIT Sloan School of Management	There were 100 undergraduates and 1100 graduates (650 MBA, 100 Sloan Fellows, and 100 PhD students) during the last academic year. All 175 courses (for the year) made significant use of the C/LMS using the criteria of 1 Megabyte or more of storage so all 1200 students would be in courses with significant use. The C/LMS system is also used by the Admissions Office as a communications tool during the admissions process (from acceptance to matriculation).
Carnegie Mellon University	There were 5300 undergraduate students and 3500 graduate students. Approximately 90% (7920) were in courses where there was significant use of the C/LMS.
Columbia University	There were 7,000 undergraduate students and 17,000 graduate students. About 20,000 of the 24,000 students use an C/LMS in some way in their course. It is estimated that about 16,000 students use an C/LMS in a "significant" way for instructional purposes.
Harvard (College of Arts and Sciences)	Harvard has 6,600 undergraduate students. Virtually all of these students are enrolled in a course making significant use of the C/LMS. There are approximately 3,000 graduate students of which 200 are in courses that make significant use of a C/LMS. Hundreds more make use of the C/LMS as members of the teaching staff of undergraduate courses
Middlebury College	(a) 2,300 undergraduate students, no graduate students. (b) About 850 courses are offered per academic year. For 2004/2005 there were about 350 course websites. About 1/4 of courses, at least 1/4 of students make significant use of Segue, Middlebury's main C/LMS.
Princeton University	Graduate students: 2000 Undergraduate students: 4,500 About 50% of courses make significant use of C/LMS, estimate about 75% of students.
Stanford University	There were 6500 undergraduate students and 7500 graduate students. There are 11-12k students using the C/LMS and virtually all are in courses that make significant use delivering content (in part because by design there are no eReserves for course specific content outside of the C/LMS).

University of California, Berkeley	Undergraduates: 22,880 and Graduates: 9,451, but no data available for number of students enrolled in courses that made "significant use" of a C/LMS.
University of Chicago	There are 4K undergraduates and 9K graduate students. Student significant use is not available but 68% of courses are making significant use of C/LMS (greater than 1 megabytes course size which seemed to be the pivot point for C/LMS involvement). Using this greater than 1 megabyte criterion, significant use is increasing at about 10% per year.
University of Texas at Austin	There were 37,400 undergraduates and 13,000 graduates in total. Currently there is no accurate method of determining the amount of significant use in the BlackBoard C/LMS except in general terms. UT does have plans to study the specific faculty and student use of Blackboard and its affect on learning outcomes.
Yale University	There were 5316 Undergraduate Students, 2522 Graduate Students, and 3552 Graduate Students in professional schools of Law, Medicine, and Management. Estimated that 80% of these make some use of the C/LMS system, but no further information on level of usage.
2. Please name all C/LMS systems in use on your campus? Let us know which systems are commercial, locally-developed, open source, or a combination of systems. Also, when was each system first used in courses at your institution?	
MIT Strategic	
MIT Stellar Faculty	
MIT Operations	The Stellar C/LMS was developed locally and has been in use since 2001. The Sloan Space C/LMS has been also locally developed from open source and has been in use since about 2001. There are other web accessed course support systems in use including Athena Lockers used since 1994 and also there are a number of department web sites for specific courses.
MIT Sloan School of Management	Sloan Space is the only system used and was first used in the Fall of 2000 and for all courses since Spring 2001. The system is also used by the community for communication and collaboration including program offices, research centers and groups and the 60+ Sloan student clubs.
Carnegie Mellon University	The only C/LMS is commercial BlackBoard which has been used since the Fall of 2001.
Columbia University	The primary C/LMS is Prometheus which is Open source/owned by Blackboard and has been used since December, 2001. The other C/LMS is Lotus Domino, a commercial product by IBM and it has been used for about 6 years.
Harvard (College of Arts and Sciences)	(a) Instructor's Toolkit/Faculty of Arts and Science Instructional Computing Group (ICG) 1996-2001; ICG and iCommons (Harvard Central Administration), 2002-2005.
Middlebury College	The C/LMS in use at Middlebury is Segue, which is a completely open source system. Segue was released as open source in July 2003 and went into production at Middlebury in September 2003
Princeton University	1. Blackboard, soon to be ver. 7.0 Enterprise / commercial / about 50 courses in 1998 2. "Whiteboard" / developed by the Computer Science department / approx. 1996 Note: Computer Science department is considering Moodle
Stanford University	There are four C/LMS's in use. The primary one is CourseWork which homegrown and has been used since 2001. The oldest one is the commercial WebCT C/LMS and it has been used since 1997. The BlackBoard commercial C/LMS has been used since 2002 and offers some community access. The fourth one is CCNET which is a homegrown open source C/LMS used since 2001.

University of California, Berkeley	Three systems were used in 2004-2005. WebCT and BlackBoard are commercial systems first used in 1999. Courseweb is a locally developed system which was first used in fall 2002. It provides a website for every course but has limited functionality. In addition, Course Gallery is a locally-developed, open source system for managing images, which was first used in Fall 2003.
University of Chicago	Only BlackBoard has been used since 1997.
University of Texas at Austin	They have been using commercial BlackBoard since the Fall of 2000. A customized system (Speedway) is a locally developed system used since Fall 2001 primarily by the Distance Education Center. FirstClass (a commercial system) has also been used by the College of Education from sometime prior to 2000. The decentralized nature of the university has also seen sporadic departmental C/LMS initiatives with other platforms.
Yale University	"Classes" is homegrown used from Fall of 1997 and used by about 40%. BlackBoard (pre version 6) is a commercial system being used by Medical School since Fall of 2000. BlackBoard (latest version) is a commercial system being used by Law School since Fall 2001. WebCT (campus version) is a commercial system being used by the Management School (no date). The newest system is "Classes 2" (aka Sakai) is open source system in the process of replacing "Classes" since the Fall of 2005 and is used by approximately 60% (some students use more than one system).
3. For the 2004-2005 academic year, how many courses use each C/LMS system listed in the previous question? For the 2004-2005 academic year, what is your estimate of the number of students using each system?	
MIT Strategic	
MIT Stellar Faculty	
MIT Operations	The Stellar C/LMS has 765 courses and Sloan Space has 120 courses.
MIT Sloan School of Management	In the Fall term of the 107 classes 76 use the C/LMS and 99 of 129 use it in the Spring term. Those not using Sloan Space are either MIT faculty using Stellar or PhD seminars not using any C/LMS along with a couple of faculty without TA's. There are 1100 graduate students and 95% use Sloan Space contributing to the 1200 logins each day.
Carnegie Mellon University	Blackboard is used for 1550 courses serving approximately 7920 students.
Columbia University	The main use of Prometheus is for 500 courses serving 20,000 students. Additionally it is used by Teachers College for about 3,000 courses serving 5,000 students and by the Business School for 500 courses serving 1,500 students. Lotus Domino is used by the law school for 500 courses serving 1,000 students.
Harvard (College of Arts and Sciences)	The number of courses and students for 2004/2005 C/LMS: (a) Instructors Took Kit - Significant Use: 1,365 courses. Admin only: 500 of 1,865 courses with 6,800 students (b) Course iSites: 0 courses, not yet implemented (c) ILE, Interactive Learning Environment: 2 or 3 courses, about 250 students (d) Harvard Engineering DEAS: 20 courses, about 200 students
Middlebury College	Product - Segue Segue is used for courses, collaboration, student portfolios, blogs, information sites. Segue is a general purpose content management system that includes functionality for managing courses
Princeton University	Blackboard / about 500 courses / 75% of students or about 4,875 Whiteboard / about 25 courses / approx. 100 students
Stanford University	The CourseWork C/LMS handles about 2500 courses (80% of the courses)

	for about 12k students. WebCT is more of a niche C/LMS with only 20 courses for about 240 students from the Medical School. BlackBoard has about 50 courses and about 50 students plus a number of community users involved with the School of Education. CCNET is in another niche and is used for about 100 engineering courses by about 400 students (there are more engineering courses using CourseWork than using CCNET).
University of California, Berkeley	Fall 2004 + Spring 2005 courses: WebCT Courses: 59 BlackBoard Courses: 784 CourseWeb Courses: 3,091* * For Courseweb, sites are automatically generated for each course. 3,091 of these sites were edited (e.g., a syllabus was added). No data area available for number of students. WebCT is used for a small number of very high enrollment courses.
University of Chicago	BlackBoard is used for 1600 courses with 13K students in 2004/2005. This Grows annually, current numbers indicate approximately 1900 courses/academic year.
University of Texas at Austin	BlackBoard is the primary C/LMS with 4,078 course offerings serving 47k students. Speedway and First Class serve less than 5K students.
Yale University	"Classes" system is used for about 800 courses with about 5K students. The Med School BlackBoard system is used for 100 courses with about 1100 students. The Law BlackBoard system is used for 50 course with 670 students. The Management WebCT system is use for 50 courses with about 450 students. "Classes 2" (Sakai) is used for 100 courses with 500 students in the pilot phase (with planned replacement of "Classes" in fall 2007).
4. Of the courses making "significant use" (see definition) of a C/LMS, how many courses were… a. Newly developed in the 2004/2005 academic year: _____ b. Underwent major revisions (i.e., updated more than half of content, adapted to a new textbook, newly incorporated epacks, changed C/LMS or other supporting software) in the 2004/2005 academic year: _____	
MIT Strategic	
MIT Stellar Faculty	
MIT Operations	There were 539 unique (new) courses in 2004/2005, but this estimate is subject to over counting since the identifier for the course may have changed though it is really the same course. The upper bound is 442 courses for the number of courses (over 60%) that underwent major revisions in 2004/2005.
MIT Sloan School of Management	Information about newly developed courses is unavailable. For continuing courses only about 5% copy over the old course to the new term, while the other 95% create a new course for the new term.
Carnegie Mellon University	There were about 120 newly developed courses added, but there is no way to know how many underwent major revisions revised.
Columbia University	There were about 800 newly developed courses and while there was much revision work performed on courses there is no way to measure this.
Harvard (College of Arts and Sciences)	a. 35 courses were newly developed in the 2004/2005 academic year: b. About 35 courses underwent major revisions in the 2004/2005 academic year. These are only estimates. No more concrete data is obtainable for this report.
Middlebury College	a) 19 First Year Seminars used our C/LMS in 2004/2005. These seminars can be regarded as newly developed. b) difficult to answer, though do not think there are many courses using the C/LMS that have undergone major revision…

Princeton University	Princeton "pre-builds" course sites in their C/LMS with a course description, course map, etc. Every new course at Princeton automatically has a Blackboard site created for it. The interviewees were not certain how many new courses were developed or heavily modified that made a significant use during the 2004/2005 academic year.
Stanford University	There is no data available on new courses making significant use or the number of courses that underwent major revision. The pattern of usage growth for CourseWork has been essentially exponential. In 2004 the base number of courses doubled. In 2005 the courses got 75-80 percent larger with more materials, but the most interesting development is that course class lists got longer as well which means that students were taking more courses per quarter - increasing their course load - in the context of CourseWork.
University of California, Berkeley	Courseweb does not include the tools to support "meaningful instructional activity." WebCT is heavily used by a limited number of instructors who do not significantly change the use of the site from year to year. BlackBoard has the most dynamic usage. There were 784 sites in 04-05, compared to 451 in 03-04, an increase of 333. We do not have data on which sites underwent major revisions. NOTE: All three systems will be decommissioned when Berkeley Sakai is fully implemented.
University of Chicago	About 300 are newly developed courses and about 10% of the 1600 courses underwent major revisions for a total of about 68% significant use courses. Their strategic approach is designed to encourage major revisions rather than course rollover.
University of Texas at Austin	Significant use information is not available (but highly desirable). However, the BlackBoard C/LMS has been experiencing exponential growth in both courses and files. Blackboard¨ usage has increased dramatically since its implementation. For example, in the Fall 2001 semester, 354 faculty members were using Blackboard¨ in 656 individual class offerings. The number of students accessing Blackboard¨ during this time was 20,204. Four years later, the Fall 2005 semester saw a 414% increase in faculty participation as 1,819 faculty members used the system. The number of individual course offerings increased 522% to 4,078, and the number of students accessing Blackboard¨ increased 136% to 47,615.
Yale University	N/A
5. In your C/LMS, how are you currently handling "non-text" media (video streaming, audio streaming, podcasts, simulations, virtual laboratories, image archives, etc.) What plans do you have for further handling or integrating "non text" media" with your C/LMS over the next 3 to 5 years?	
MIT Strategic	The current system basically uses link to non-test media and there is some use of attachments for things like image files. While the future of C/LMS non-test media is not known it will be characterized by easier access and there are some promising developments. The Library provides some media services through the Microsoft CMS (static system that does not include administrative systems) and OCW provides media files via AKIAMA streaming servers deployed world wide. Stellar will provide a tool for managing still images (pilot is done and it will be in the next version. The link between C/LMS and streaming video will evolve greatly. Already video is being streamed to Singapore. Future streaming models could come from a variety of sources. Additional non-text media in the future will be open "iLabs" with appropriate authentication. Also in the future will be more authoring tools like LAMS to support efficient structured

	content creation.
MIT Stellar Faculty	Some faculty do not use non-text media in their Stellar courses.
MIT Operations	MIT has an infrastructure for streaming video (Real, DV, and MPEG2) from links in a course. There also are plans for piloting the Stellar image tool with federated search of image repositories such as the Slide Library in the Fall term of 2006. There are plans for more podcasting and better integration linking out to the Library licensed multimedia including audio.
MIT Sloan School of Management	The C/LMS does not handle non-text media. The future options include: converge with Stellar, and user drives, Library for video streaming, DSpace hosting.
Carnegie Mellon University	There are only a few courses with embedded multimedia in the C/LMS. Most all courses use links out to multimedia resources.
Columbia University	Non-text media is not run inside the C/LMS. It is a strategic decision by Columbia University not to create content repositories of any kind inside the C/LMS. This is true of all content whether it is multimedia or not. The Library has taken the lead in organizing and handling multimedia content for courses. An example of this is Art History, which makes extensive use of multimedia. That course is part of Columbia University's core curriculum and the Library is charged with housing content for those core curriculum courses. Columbia University anticipates that the use of multimedia-based content will grow rapidly. At present, it is unclear which application (language arts, graduate schools, medical school with interviews of patients, etc.) will be the driving force in this growth. There will be presentation problems as a result of the size of files. The University has many .PDF files in course reserves, but these are no longer popular. Space for multimedia files could be a growing issue, but storage is also getting cheaper. Policies on storage may be needed in the future. There is currently no upper limit on storage, but one may be needed.
Harvard (College of Arts and Sciences)	The Faculty of Arts and Science is currently handling non-text media with: (a) a HELIX streaming media server for Real Media (b) Anystream Agility media archiving and repurposing - 60 faculty put lecture videos on line per term serving about 5,000 students. About 125 courses per term use streaming audio and video but not for entire lectures (c) Flash objects with PERL and JAVA CGI, (d) transitioning to Course iSites which has a tool for podcasts. FAS is currently investigating options and alternatives but will likely go into the fall using AnyStream. In 3 to 5 years Harvard will standardize on Anystream, decentralized to departments.
Middlebury College	One possible standard Middlebury may adopt for federated searching across repositories is the Open Knowledge Initiative (OKI) repository open service interface definition (OSID)
Princeton University	Princeton is looking at the Blackboard content system for general use, not specifically for use with digitized films. We currently use a RealMedia server to handle digitized film. They make an effort to automatically put links into Blackboard whenever they digitize any material (text, images, film, music), regardless of where the digitized material itself is hosted (Almagest, RealMedia, etc.) Princeton has no major changes now planned for the future.
Stanford University	The primary means of handling non-streaming media is as a file in the C/LMS or as an external URL. Media streaming is handled by a URL to external streaming servers. Audio podcasts handled by a link in

	CourseWork that links into iTunes (the C/LMS operates as a gateway similar to the way journal databases are handled). Also there is URL access to an image archive. The URL linking is made more powerful by using persistent URLs (reference URLs) that can accommodate relocating resources.
University of California, Berkeley	Currently very brief video clips can be uploaded into the CMS as an ordinary file. In Fall 2005 we launched bSpace, the Berkeley implementation of Sakai. Berkeley has an extensive Webcast/Podcast program which is publicly available. We plan to add functionality to bSpace which will enable professors to stream from within bSpace. We are also developing video interaction tools. We are actively developing Course Gallery into a comprehensive image management tool that will be part of the bSpace toolset.
University of Chicago	The present basic approach is to post media in the BlackBoard course system and the BlackBoard Content System (for the Library for eReserves and by some Departments) or as links to a QuickTime streaming server that has no rights management. Faculty want to share and version media content. The plan for enabling much more of this is to explore eDigix which is a commercial version of CLABS (from Cdigix) as an ASP solution with rights management. There is also interest in outsourcing to service providers such as iTunes U and investigating image archive options.
University of Texas at Austin	Multimedia is presently provided by central streaming servers as well as through decentralized individual college streaming servers. They are researching podcasting and plans include doing much more in the future. The Library recently licensed ArtStore which is a growing repository of 4000k images. The plan is to leverage their teaching classrooms which include an LCD projector and a document camera to enable faculty controlled automatic capturing of presented class content and audio for subsequent screencasting. With 2k faculty and 50k students this approach has some interesting potential impacts and may represent part of an institutional response to OCW.
Yale University	The handling of media varies across the systems but the main approach is to use simple urls to outside resources on separate servers. Separate servers for podcasting, streaming video (streaming.yale.edu) making heavy use of CLABS for audio and video, and iTunes U for additional audio outsourcing.
6. Please estimate the costs for each C/LMS for the 2004/2005 academic year.	
MIT Strategic	
MIT Stellar Faculty	
MIT Operations	2004-05 C/LMS costs at MIT were $496,750. This did not include travel and communication costs. Stellar is locally developed so there's no license fee.
MIT Sloan School of Management	As Sloan Space is open source the license cost is zero.
Carnegie Mellon University	It's more like $250K/year. The $250K is the approximate annual cost of all human resources that support Blackboard, updating hardware, and software costs.
Columbia University	The Prometheus license fees are unavailable due to a non-disclosure agreement. Integration cost is next to zero. The Training/Support/help desk is about $400k-$500k. The maintenance fees and costs are also unavailable due to a non-disclosure agreement. The Prometheus software development and maintenance was $100k, hardware cost was zero, and software systems costs were $45k. Cost numbers for the Lotus Domino C/LMS are very small but not readily

	available.
Harvard (College of Arts and Sciences)	Harvard declines to relay a cost estimate. It's extremely difficult to estimate at any rate, due to cross-school collaboration ventures.
Middlebury College	(a) One developer at $45,000 plus 25% benefits x 50% FTE, about $28,000. (b) Also added one commodity server, about $3,000. (c) Total estimated 2004/2005 costs are about $75,000.
Princeton University	Princeton's license fees are around $100,000 per year. 3.5 FTE staff support the C/LMS. Total 2004/2005 C/LMS costs are estimated to be between $300,000 to $500,000.
Stanford University	Because of privacy concerns staff costs are expressed as FTE rather than salary dollars. CourseWork has no license fee, total integration cost was 0.5 FTE, Training/support/helpdesk was 3 FTE, Maintenance was 2 FTE, Software development was 2.5 FTE, hardware was $30k for yearly replacement, and software systems was zero. The WebCT license is about $10k, there is zero integration, training is about 0.25 FTE, software development and maintenance was zero, and hardware was about $7.5k annually with zero for software systems. The BlackBoard license was about $3k and the other costs were about the same as for WebCT. The only cost associated with CCNET is for hardware at about $3k. This C/LMS which is not integrated was created by a graduate student and is attended to by other graduate students on an informal cooperative basis. The graduate student author is graduating so the fate of this open source system is uncertain.
University of California, Berkeley	We did not have an enterprise level CMS in 2004-2005. We paid $20,000 in licensing fees to WebCT and BlackBoard. See number 7 below for our development costs for Sakai.
University of Chicago	Total Blackboard LMS costs including license fees and user-support approach $200,000 annually. Including costs for database and systems administration adds another $100,000 annually.
University of Texas at Austin	
Yale University	Costs of license fees were Medical School BlackBoard at $40k, Low School BlackBoard at $60k, and Management School WebCT at $25k, with Classes and Classes 2 (Sakai) being free. Integration was estimated at $20k, training costs are not available, maintenance fees were $20k. The software development costs for Sakai was about $100k. There was no cost for software development or customization for the commercial products (used out of the box).
7. Estimate the costs of major one-time investments for each C/LMS from the 2000/01 to 2004/05 academic years. Indicate the amount of that one-time investment that occurred in the 2004/2005 academic year.	
MIT Strategic	
MIT Stellar Faculty	
MIT Operations	The major one-time costs were when Stellar began around 2000, and since then it's basically been operating costs. One-time investments during FY2005 were $23,000.
MIT Sloan School of Management	
Carnegie Mellon University	There have been no one-time costs for hardware because replacement costs are allocated annually.
Columbia University	For the Prometheus C/LMS there was a one time cost of $150k for the initial hardware in 2001. (There is an upcoming one time cost in 2006 of

	new Database Software of about $200k.) The Lotus Domino C/LMS one time costs are not available but thought to be very small.
Harvard (College of Arts and Sciences)	Harvard declines to relay one-time costs.
Middlebury College	1/2 FTE costs for 2004/2005 is for different person than in question 6 (ie not the original developer of the C/LMS
Princeton University	Computer servers for the C/LMS cost about $200,000. The initial C/LMS installation cost between $200,000 and $300,000 to integrate with Enterprise systems.
Stanford University	There have been and are substantial one time costs associated with developing Sakai (which when deployed will be under the brand of CourseWork). Last year there was $360k in development and next year there will be another $300k. The larger expense is for software programming which will amount to $1.5 million over the 2 years. Stanford is fully committed to Sakai because they need to do the development anyway and also need the flexibility over the code base. The task is so large that they cannot do it alone so the best hope is for collaborative development in the Sakai "community source" project. (some of the promises are coming in now -- last week there were three new alternative Sakai discussion tools to evaluate)
University of California, Berkeley	C/LMS License fees: $20,000 for non-enterprise licenses for BlackBoard and WebCT. $10,000 in Sakai membership fees (note that Sakai was NOT in production for FY 2004-05). Much of our 2004-05 costs were one time. bSpace development costs include our participation and development of Sakai functionality for the larger consortium. In 04-05 total personnel costs, including application development, training, support, systems integration, was approximately $1.3 million. This includes user support for our vendor systems (WebCT and BlackBoard). One-time costs for implementing Sakai (hardware and software) came in 2005-06. This is approximately $230,000 for server hardware and Oracle licenses.
University of Chicago	There was a one time cost of $24k to integrate with SIS and LDAP. There was also a one time cost for hardware of $110k. The survey window missed the major expenses in 2005/2006 for hardware that were part of their four year hardware renewal cycle.
University of Texas at Austin	
Yale University	Hardware costs were $80k for Sakai related hardware was the only notable one time cost.
8. Has your university conducted a cost analysis of using a C/LMS? Is it publicly accessible?	
MIT Strategic	
MIT Stellar Faculty	
MIT Operations	There was a high level costing in academic computing a few years ago and there is a report. The findings, in terms of annual costs per year were: Develop In-house of $391,270, and Commercial Enterprise Level of $415,000 though that did not include cost parameters associated with customization which were not estimated.
MIT Sloan School of Management	There has been no cost analysis. The usage growth has been exponential in the last year.
Carnegie Mellon University	There have been no C/LMS cost analyses.
Columbia University	There has been no C/LMS cost analysis done.
Harvard (College of Arts and	Yes, Harvard has conducted a cost study. C/LMS usage is increasing at double-digit growth rates.

Sciences)	
Middlebury College	(a) Yes, a summary cost analysis was conducted. (b) From the cost study in (a) total costs to maintain and develop Segue were estimated at about $75,000 a year (see #6 above). (c) Segue's significant usage is pretty constant at about 25% of all courses.
Princeton University	No on cost studies- the last they reviewed the license they talked about costs; what it would cost and why. But they haven't done comparison or "what-if" studies. They have done studies in the past on usage. The latest version of Blackboard collects much longitudinal data. They have also conducted focus group studies with faculty on features they like, don't like, etc.
Stanford University	There have not really been any cost analyses done.
University of California, Berkeley	There was a cost analysis 3 or 4 years ago but it is not publicly available.
University of Chicago	There are no cost analyses done or available. In the early years of the installation an informal costing was done which found that the cost was very small per course and since that time costing has just not been an issue.
University of Texas at Austin	No central cost analyses have been done.
Yale University	No cost analysis has been done, so none are available. The expenditure approach flows with the cultural premium for independence where there are different organizational budget lines and then independent choices are made to allocate those funds.
9. Are there any particular features or capabilities that you expect to add to your C/LMS systems within the next 3 to 5 years? What features or capabilities would your students like to see added?	
MIT Strategic	In the future the features will likely exhibit a high degree of integration and broad support on a range of devices including iPods and cell phones. A key future will be integrated calendaring that brings together email, RSS subscriptions, blogs and the C/LMS. Also there is likely a gradebook feature coming and better integration (like one-stop-shopping) for submitting grades with the Registrar along with simulation, visualization, collaboration capabilities, and a student evaluation tool for TA's and Faculty. The more pervasive change in the future will be a shifting of focus toward the student taking a lot of courses and using a calendar like feature to help them manage their schedules and assignment due dates. Students would like the Library and Stellar interfaces to be more seamless and efficient. Future OCW courses will have interactive activities and more video, plus the ability within OCW to interact with communities.
MIT Stellar Faculty	The future features included: better integration between Stellar and OCW, better way of keeping track of who is in the class (pictures) and linking into the gradebook, a hook into the calendar system, and support for student course evaluations (to replace the present paper survey scanning system which is use to evaluate 600-700 courses).
MIT Operations	Beyond ePortfolios, there were a number of candidates for future C/LMS features related to OCW and the Library. The OCW related features were: the ability to track information at the object level including copyright status, workflow ability to enable publishing at the end of the course (similar to the present Microsoft Content Management software supporting publishing), the ability to treat faculty differentially to enable a range from self-serve style for some faculty to enabling more extensive support to TA's and faculty who want more support in preparing their

	course for publication. The library related future features included providing a better interface to licensed content with rights control, analysis tools in the course that would enable numerical analysis of library databases like census databases, facilitating the handling and annotating digital images, and a way to embed research library support and library expertise into the C/LMS. Students reportedly would like future features that would help them in the context of the just-in-time environment of MIT with an efficient user interface that integrates their calendar with registration, their courses in the CMS, and RSS feeds.
MIT Sloan School of Management	Faculty and TAs are generally more interested in seeing enhancements to file storage, the homework tool and bulk mail. Students are primarily interested in improving the ways in which the system organizes information, so we have made improvements to calendar and are developing a search tool. Students would also like to enhance the bulk mail functionality (by adding an HTML tool bar) and make additional improvements to calendar so that it is more widely used by faculty and TAs and by integrating it with bulk mail, so that it is easier for students to find class information. Staff would like a more sophisticated survey tool that can handle conditional questions and can have multiple sections.
Carnegie Mellon University	While there are no new features envisioned what is envisions are improvements in existing features that make them easier to use more quickly and more powerfully.
Columbia University	The following features are on the list to be added to the C/LMS: improved file management, collaboration tools (discussion, chat, mail list management), embedding media (video, audio - not necessarily podcasting), integration with repositories, content creation tools (blog, wiki, freeform), editing with a thin WYSIWYG client. For students (and faculty) the additions desired are enhancements that make the C/LMS easier to use, seamless with the Library and seamless the other repositories.
Harvard (College of Arts and Sciences)	Harvard is adding many features with its new "Course iSites C/LMS" and has more features planned for the long-term. (a) Integrated, transparent, convergence of the C/LMS with larger, Academic environment (b) Personalized, reusable, re-purposeable content with publishing content research portals (c) Content sharing of learning objects - a repository-based system for content (d) More sophisticated support for non-text media, e.g., podcasting (e) More sophisticate collaboration and communication with Wiki-like features and email (f) Annotation tool for text and images (g) Library and museum databases (h) caplet-based course wizards template (i) gradebook management and submissions (j) student-based course evaluations (k) "student-centric" environment, e.g., del-icio-us or tag based environment for on-line note taking (l) portfolio-based content management

	STUDENTS (a) Multimedia indexing and searching, e.g., of lecture videos (b) A more integrated online academic environment, e.g., "course shopping," course catalog, evaluation scores (c) A clearer system for archiving snapshots of courses (d) A gradebook for "in-term" grade monitoring. (e) An online, collaborative environment. Access to academic materials and ability to talk about them.
Middlebury College	Middlebury is now re-writing Segue code. They hope to have a Beta ready this fall. The next release will add features needed for the next 3 to 5 years: Digital asset management built into Segue, e.g., add metadata to content modules, allow archival directly in the LMS, version control to "rollback content," Wiki kind of functionality, hierarchical organization of data so any number of levels can be used and mapped to navigational layout, add support for assessment and more grading functions, also, support for modules, they are now writing an API so people can write modules for Segue. They are exploring tagging and tag aggregation common in blogging tools. Middlebury uses Segue as a general purpose content management tool as well as a traditional C/LMS. Students, faculty, and staff create their own repositories. Middlebury wants Segue to function like an ePortfolio for students. Also, be able to make an institutional repository out of individual repositories. In addition, Middlebury has begun some evaluative work to assess whether it remains on target with the desires of its user base and whether there are compelling reasons to consider an additional or alternative C/LMS, perhaps an open source solution with broader adoption as its own capacity for dedicated development is limited.
Princeton University	Princeton has been adding tools into BlackBoard to facilitate student enrollment, e.g., administrative tasks like student enrollment in course sections, seminar enrollment, and locally developed language placement exams administered via BlackBoard's assessment tools. Princeton is waiting for the next version of BlackBoard to add some administrative modules. Other features Princeton expects to add include: 1) They have licensed WIMBA, a tool for creating voice-based discussions or transactions. > Continuing to improve their installation of Almagest for handling digital image presentations for students as well as faculty. > a Portfolio tool. > Princeton is expecting continued growth in social software like Wikis and Blogs which they are adding to BlackBoard. > Princeton also plans to add modules to let students take the roles of teachers. > Quite a few organizations and think tank sites are using BlackBoard as a collaborative tool. This is growing very fast. > Princeton is exploring SAKAI as collaborative work tool.
Stanford University	Stanford has been thinking about this for a while so the list is long with major categories for: specific pedagogic support (like voice support for language learning, virtual instrumentation), linking seamlessly with the Library resources, course data preservation (archive), ePorfolios with OSPI, embracing additional tools to compliment Sakai (such as Moodle) and extended research collaboration.
University of California, Berkeley	At the top of the list for future features was more integration with video and audio services. Other future features included the gradebook, discussion board and image tools. In a general survey students wanted

	improvements in the discussion board tool which they already liked.
University of Chicago	The growth of usage has been promoted by word of mouth and comparable to the seamless email system. The collaboration features are beginning to be used outside of courses by IT and some departments and future will have more usage by campus communities. The future features are envisioned as a dashboard to control access to tools in parallel (BlackBoard plus uPortal like). The other feature direction is policy driven to become mobile device aware and embrace mobile platforms (laptops, PDA's BlackBerry's) and especially cell phones with features such as RSS. Other future feature directions are to enable publishing outside of a course, repurpose in multiple places, and bundling successful elements into course learning objects. Virtualization is also contemplated as a future feature. Students spend an average of 12 minutes per day in the CMS. Students have requested to be able to see all courses and have an more efficient integrated experience.
University of Texas at Austin	Future features include: integration with central mainframe (SIS, Registrar, etc), administrative tools for BlackBoard to see "how the tools are being used", advanced collaborative tool, updates to students for new information, and more optional assessment tools. Additionally there are plans to integrate personal devices like iPods, PDA's, and cell phones as well as classroom response clickers. The realtime multimedia capture of the classroom presentation screen for podcasts and screencasts was also on the list of future C/LMS features.
Yale University	There is presently an active list of 57 things on the to-do list, but the main focus is to make the Sakai instance look and function like the legacy "Classes" system which was more of a simple one window web server model. Specifically, there will be a course evaluation feature added that carries forward a locally written function and a photo roster function that also carries forward previous local development. Future features will more selectable options for user interface pop-ups, gradebook enhancements, and a multitude of little things. For many of these there is a willingness to wait for someone else to build it as Sakai is built out to meet the needs of other institutions.
10. Many universities are now faced with developing an optimal long range deployment of C/LMS systems that minimizes costs and risks. Do you think that your institution's mixture of commercial, open-source, and in-house C/LMS systems will change in next 3 to 5 years? What role does open source play in C/LMS planning in the next 3 to 5 years?	
MIT Strategic	
MIT Stellar Faculty	The future mix is expected to have a heavier dose of open source displacing home grown and commercial software along with some hope for the Sakai platform to evolve.
MIT Operations	The working assumptions are that open source and open standards were the way to go, but the pragmatic mix may include some commercial tools. The vision for the future mix involves change with convergence on a single C/LMS to bring more efficiency and hopefully shared development benefits.
MIT Sloan School of Management	There will definitely be changes in the future, but exactly what is still unknown and needs to be evaluated and studied. There is not adequate staffing at the School to support an open source product, but the School is interested in collaborating with central IT on any of their initiatives. If an open source solution is supported by central IT and it has or can have the features and functionality that we need for course management, then the School is very interested in collaborating. If not, the School would consider a commercial C/LMS or external hosting of an open source or

	commercial system.
Carnegie Mellon University	While this is difficult to forecast there are no changes anticipated. They are financially supporting open source (Sakai) and might adopt it if the feature set improved on the basic course management functions.
Columbia University	The future mix may stay the same but now they have just begun looking at it form the long term perspective. In that context there may be a possible parallel C/LMS to Prometheus in the mix.
Harvard (College of Arts and Sciences)	(a) Harvard Arts & Science's (HAS) mission in the next 3 to 5 years is to maintain a low dependence on commercial components, Oracle is the exception. (b) More effectively leverage C/LMS components. HAS would also like to contribute more to open source initiatives and components. (c) HAS will evaluate commercial components, but this is not in their mission.
Middlebury College	Middlebury is committed to open source. Segue consists of open source modules and is published as open source. While Segue is locally developed, Middlebury continues to keep an eye on other solutions, but is "inclined to look at open source first."
Princeton University	Quite a bit of Princeton's development around Blackboard is open source, e.g. Almagest and Apache server. But they do not foresee changes to their C/LMS in a major way.
Stanford University	The future mix of products will likely be similar with CourseWork branded Sakai carrying more an more of the load supplemented by niche C/LMS's and other open source products.
University of California, Berkeley	Starting in the Fall term of 2006 both WebCT and BlackBoard will be dropped and only B-Space (Sakai) will be supported. This transition may be more gradual as required on a case by case basis. It is expected that the growth of new courses in the C/LMS will be nearly exponential for a few years (to a limit of about 3000 possible courses).
University of Chicago	The C/LMS was always considered an enterprise system where success was assumed and full box replication was the norm as a hot spare. The future will move it to version 7.0 and into the enterprise data center like payroll. This will integrate the C/LMS into a storage network and may tie into the central Oracle installation. The interest for Sakai has died down as development has slowed down. If Sakai becomes stable over the next 36 months it will be considered as a research tool project because it seems to triple the cost and has no quality assurance (have not yet looked into service providers like rSmart for Sakai).
University of Texas at Austin	While there are no plans to change the mix they are open to change and have test systems available including Sakai for those who are curious. The sense seemed to be that they are not ready to migrate and an alternative C/LMS would need to be much better than what they have with BlackBoard to even consider migrating.
Yale University	There is interest in have a future arrangement with low-moderate Total Cost and where the risk of vendor lock-in to cost escalation is mitigated. This focus moves toward having fewer than the present five systems and including the evolution of the local instance of Sakai as one of the future systems.

SECTION 2 – COURSE MATERIALS LIFE CYCLE	
11. Given that there is no monolithic course materials life cycle we are interested in the typical course materials life cycles at your institution.	
MIT Strategic	The traditional situation so for each faculty to maintain all their own

	course materials in files (or binders) and then for each new course preparation they would reuse and edit own files outside of the C/LMS. There is normally little sharing of course materials from one faculty to another except in the context of departmental requirements where there may be shared course development that continues over a decade. For faculty with TA's there is a more common cycle: create content (Word, PDF, Latex), upload to the web or Stellar, go to OCW (convert to PDF), and finally after being taught and refined about 3 times then it may be reviewed and published to the world. In this cycle there are also feedback loops for refining course materials. Some course materials could be MATLAB dynamically generated output (which would become static PDF's in OCW). The course materials life cycle is not designed to link to outside repositories and at the end of the OCW cycle all the materials are to be moved into a future DSpace. During the Stellar part of the life cycle there may be access to Library reserve materials.
MIT Stellar Faculty	Faculty revise 10%-20% of each course per year (at least problem sets and the syllabus) so that there is complete course materials turnover about every 5 years. At the end of the course the materials simply remain available to the faculty in the C/LMS (also faculty are likely to keep a private copy of their course materials on their desktop machine of all of their courses). The currently unfortunate situation is that OCW updates courses infrequently so that OCW courses can be a couple of years out of date.
MIT Operations	The typical basic cycle is plan, build, and teach as a feedback loop. Recent developments have added publishing in OCW and archiving to the end of the basic cycle, but these will need to be easier to do for wide spread adoption.
MIT Sloan School of Management	The typical cycle is for faculty to develop the course outside of the system and then use Sloan Space as a repository for materials not included in the printed course packet. There is no separate archive beyond OCW. There is policy about who can take classes. Classes are closed and made unavailable to students after the end of each semester, but current members are left with access to the class. Faculty can ask for students to be removed from a class at the end of a semester, though, but most do not unless the site contains sensitive information (like exams or answers). Faculty either build a new class by copying and modifying materials from a previous site or by starting anew.
Carnegie Mellon University	It is hard to say there is a typical course management life cycle since it is under the control of very independent individual faculty. The situation is fairly stable with all of the materials being created outside of the C/LMS. After being used in a course, materials are kept on the server for two years and then backed up off the server. In about 90% of the courses faculty have their materials rolled over to the next semester (the individual materials seem to be reused for up to three years).
Columbia University	Course materials are developed outside of the C/LMS and uploaded into the system. Once in the system it stays on spinning disk after the course and is available to the faculty via a self-serve menu of recent and previous courses (older than 18-24 months). It has be made easy for faculty to rollover part or all of a course and between half and three-quarters of the courses are rolled over (reusing parts of the previous edition of the course).
Harvard (College of Arts and Sciences)	*NOTE: ALL RESPONSES TO THIS AND FOLLOWING SECTIONS PERTAIN ONLY TO HARVARD ARTS & SCIENCES.* The new course platform will have the capacity to archive course

	instances so that the materials on a course Web site for a particularly instance of a course will be accessible over time. No policy has been set on the persistence of this content. Each term's course is given disk-based storage allocated on a course-by-course basis. About 85% of materials from prior terms are moved aside and only 15% are recycled. Each course has a reset button to "move aside" prior term's materials.
Middlebury College	Unless the course site's permissions are changed by the instructor, students can access the course site for as long as they are students and for up to 6 months after they graduate
Princeton University	A mixture. Everything is archived in Blackboard, partially due to a rigid curriculum. Faculty can "turn on their course" and make changes. They have years and years of archived material on Bb servers. Princeton does not presently archive materials in Almagest. Compatibility issues make archiving relatively small course modules for long periods iffy.
Stanford University	All courses are face to face or blended (C/LMS supported). The typical course materials life cycle is impossible to know in part because all of the development is outside of the C/LMS (there is no authoring tool in the C/LMS). However, the access control does define a semblance of a life cycle. After the faculty uploads the course materials (25%-30% rollover the last used materials which then can be reorganized in the C/LMS) and the course begins only the faculty and the enrolled students have access. After the course is over only the faculty has access that continues indefinitely.
University of California, Berkeley	The basic cycle is that faculty develop a course, teach it, and then either leave it in the C/LMS or take it out. Some courses are rolled over at the option of the faculty. For some coursed the cycle includes video production of the whole lecture videos (about 80 hours of video are produced every week for on demand open access).
University of Chicago	As a policy, faculty are encouraged to think fresh every quarter and never just carry over a course from quarter to quarter. It appears that about 30% of course development happens during the preceding quarter as the course is being taught and then 70% occurs in the week just before the new course starts. The cycle now seems to be stretching out and more refining of materials and reflecting on the previous term. The previous quarter course materials remain available (need a policy for how long courses stay active). In a sense there is presently no end of the cycle, except for allowing student access for one year or longer in the case of incomplete grades.
University of Texas at Austin	With 2k independent instructors there is no highly visible course materials cycle and no specific structures for this. There are a wide range of separate initiatives assisting faculty in building courses. There is the capability in BlackBoard of rolling over a course but the extent of course rollover is unknown. The university faculty culture is not known for sharing teaching materials and faculty normally have the rights to their course materials.
Yale University	The typical cycle is for faculty to create courses using the various C/LMS systems available to them and then those course materials remain available to the faculty for five years. In some individually negotiated cases, students may be allowed access beyond the term when they were in the course.
12. If you are using a learning repository system how would you classify it - as part of your C/LMS, as a library system, or an archival system like Harvest Road, DSpace, or Fedora? How much would you estimate that it is used?	

MIT Strategic	
MIT Stellar Faculty	Though not a LOR the fact and previous course materials are still available to faculty in Stellar was thought to be very helpful service.
MIT Operations	In the strict sense there is no Learning Object Repository in use, but there are some situated digital materials for courses that get reused such as eReserves in the Library. There are also files on CD's of the OCW course materials that are provided to faculty. The Athena Lockers have private course materials dating as far back as 1994. Next year DSpace will become a more visible repository option with the metatagged materials from several hundred courses.
MIT Sloan School of Management	OCW is the only form of repository used. The OCW publishing schedule is deliberately about a semester behind the current semester, so that published classes on OCW are "snapshots" in time.
Carnegie Mellon University	Carnegie Mellon University is not using a Learning Object Repository.
Columbia University	Presently they are not using a Learning Object Repository, but are actively exploring options and testing DSpace. The plan is for the future repository to be a Library type system and work seamlessly with the C/LMS.
Harvard (College of Arts and Sciences)	During 2004/2005 Harvard Arts & Sciences used a RAID array of "spinning disks." This will be updated this fall, archival is built into Course iSite. This repository system will be object-based, not course-based. The library has developed a home grown archival system but it is not for entire courses. Course iSites will have a more sophisticated system for content management as a product of the next 12-month development cycle (June 2007).
Middlebury College	Segue is now the learning repository. It is not currently adequate. The next version will be designed with metadata and version control, and "long-term thinking."
Princeton University	Princeton does not have a formal system for archiving "course-centric" materials. It is done informally inside of Blackboard, some courses date back to 1998. Princeton IS developing a formal repository for "topic centric" materials. The library is very actively exploring Fedora and DSpace.
Stanford University	The links in the C/LMS can point to repositories such as Fedora, iTunes, or Plone and this is the preferred methodology for resource rights management.
University of California, Berkeley	Presently there is no learning object repository and faculty do not noticeably download materials from any repository.
University of Chicago	The BlackBoard Content system is used by the Library for eReserves. The plan is to move forward to some "grand bit bucket" system.
University of Texas at Austin	
Yale University	While there no learning repository system at all there is ongoing investigation of options. The Library is most interested in Fedora and the wider community is interested in the potential of reusable learning objects.
13. Are you currently using any Enterprise Content Management tools (such as, Vignette or Documentum) that enable people to collaboratively create, manage, deliver, and archive course content? Do you plan to use such a system in the next 3 to 5 years?	
MIT Strategic	Currently there is no enterprise content management system in use, but

	there are plans to offer such a system. There is presently a system for video content delivery (Microsoft limited CMS) via AKAMAI cashing servers around the world that provides speedy open access for OCW. Also there are plans to harvest images from a variety of repositories and sources into the C/LMS for delivery.
MIT Stellar Faculty	
MIT Operations	While there is no enterprise content management system, OCW is using Microsoft Content Management System version 2002 as the software based workflow where course are processed and turned into published OCW courses. The issue is being investigated and there are open source alternatives mentioned such as Alfresco. In the future, the system will include an easy way (button) to produce an archive of a C/LMS course in DSpace.
MIT Sloan School of Management	There is no content system and it is not likely on the 3 - 5 year horizon
Carnegie Mellon University	Carnegie Mellon University just started using Hannon Hill Cascade Server enterprise content management system and there are no plans to it for academic work, only administrative work which includes content management of the main pages on the Carnegie Mellon University web site.
Columbia University	The HyperContent homegrown enterprise content management system is being used. It is outside of the C/LMS is positioned to be the gateway to the future repository.
Harvard (College of Arts and Sciences)	Enterprise Content Management tools are being designed into Course iSites.
Middlebury College	No - all in C/LMS. Down the line Middlebury may add Fedora into Segue but they don't see the systems as separate.
Princeton University	The system Princeton is using for the Princeton home page (and related web pages making up the main Princeton web site) is Roxen. We have licensed the Blackboard content system, which Blackboard OEMed from Xythos (we do not have a separate Xythos implementation).
Stanford University	There is no enterprise content system.
University of California, Berkeley	There is no current content management system but there has been some experimentation going on.
University of Chicago	There is no Enterprise Content Management System as it is considered too expensive.
University of Texas at Austin	They have been using the Stellent content management system for the university's public websites for two years, but the use of this system with course materials is unknown.
Yale University	No enterprise content management tools are being used and none are planned.
14. What policies and procedures has your institution adopted regarding intellectual property rights for electronic course materials…for faculty ownership? a. for student ownership? b. for institutional ownership?	
MIT Strategic	There was a process 2 years ago at MIT that resulted in a shared commitment to not locking down individual course material except when it is used for a textbook. The vision was to facilitate collaborative teaching at MIT. The ownership of student thesis intellectual property depends on the source of funding where MIT has the right to use student projects and external funders may have specific grant requirements. At this time DSpace does not host student work, but OCW publishes some student work with appropriate Creative Commons permission. In some situations graphics are redone for OCW and then MIT owns them. In

	general there are rules about work-for-hire, when significant resource assets are provided by MIT, etc. that are covered by institutional policies. Course faculty determine if the materials are to be open to the world, just MIT, or just the course.
MIT Stellar Faculty	The basic part was that faculty own what they create. When copies are needed they are requested from the copy services which take care of the copyright clearance processing. Some faculty only use their own materials for their courses.
MIT Operations	OCW obtains permissions for all materials that do not belong to the faculty. The basic policy is that faculty and students own there work unless there is some prior arrangement or the institution makes a substantial contribution as is sometimes the case with producing videos. The institution also owns images that are created as part of the OCW course publication process.
MIT Sloan School of Management	The policy is to follow MIT policies.
Carnegie Mellon University	Under the University policy faculty own their course materials and students own their work.
Columbia University	Published IP policies are well developed and disseminated to guide faculty and students.
Harvard (College of Arts and Sciences)	The interviewees passed on questions 14, 15, and 16. In general, Harvard has a very fine-grained capacity to restrict access to course materials and educational materials. Harvard also has policies and procedures in place for ownership of materials. There is an in-place log-on for course materials and library materials.
Middlebury College	Middlebury is currently thinking/revising these policies.
Princeton University	Use Princeton's "routine facilities use" policy, e.g., course materials belong to the instructor or whoever produced them. Exceptions would include course descriptions. If students' contribute content it belongs to them. An exception is "extraordinary resources" then rights are negotiated between the university and the instructor.
Stanford University	There are strict guides on intellectual property and enforced limits on access for students only while they are in the course.
University of California, Berkeley	Generally intellectual property inquiries are directed to an institutional policy link. The institution is first owner and in most all situations releases rights to the faculty or students (similarly with patents). The institutions own the course videos however enabling open access.
University of Chicago	Educational materials currently fall under blanket University IP policies. This is currently being reviewed.
University of Texas at Austin	Patents and copyright are handled differently and copyright is handled by the Library. The default position is that course materials are owned by the instructor (unless there has been substantial University investment). Student ownership is accommodated (as in the pilot testing of Turn-it-In anti plagiarism service).
Yale University	There is an overarching institutional intellectual property policy and then more specific school level policies. The policies focus on how to protect faculty rights and fair use. Students are not granted rights. The institutional rights are delineated in policy and the policy line bounding the institutional rights has been subject to negotiation in some situations.
15. What policies and procedures has your institution adopted regarding acquiring and assuring proper copyright clearance for electronic course materials… a. for course materials used for instruction? b. for course materials that are published or archived after the course is completed?	
MIT Strategic	OCW publishing is essentially similar handling of rights as is done at MIT

	Press.
MIT Stellar Faculty	Assistance on copyright clearance is only a phone call away for faculty who are responsible for the electronic documents that they post. OCW also helps in getting material cleared before publication.
MIT Operations	OCW will only reuse content with permission and the Library eReserves can only be used for fair use content. Faculty set the use rights in their courses.
MIT Sloan School of Management	Intellectual Property questions and concerns are referred to the Library and handled by the Library.
Carnegie Mellon University	There is University policy to adhere to the law with respect to copyright.
Columbia University	Published IP policies are well developed and disseminated to guide faculty and students.
Harvard (College of Arts and Sciences)	See the response to #14.
Middlebury College	The library ensures that all e-reserve material has copyright-clearance for the time period this material is available for distribution. As well, the library provides guidance to faculty regarding copyright and fair use and faculty have complete control over access to course material they publish in the C/LMS.
Princeton University	The library does copyright clearance on all e-reserve material. They are not licensed after the course is completed. Typically material is available during the semester. Some material is explicitly license and some is fair use. There are many special cases and exceptions. This is a monolithic question with no monolithic answer.
Stanford University	The Library does the copyright clearance processing.
University of California, Berkeley	In the C/LMS the faculty is required to indicate the copyright status of materials so that fair use can be managed. Recently a new position was created for a digital assets coordinator who will be responsible for cleaning the video and audio for public access and fair use access. The library handles the situation for materials in print.
University of Chicago	Copyright clearance process is under discussion.
University of Texas at Austin	The Library handles the eReserves and issues of fair use. There is no organized OCW like program, but some faculty publish course materials on departmental websites or other public sites.
Yale University	There are general policies and procedures for guidance as well as published rules of thumb and tutorial. Also specific questions can be brought to the institutional general legal counsel for advice. There has been no recent updating of historic policies.
16. What policies and procedures has your institution adopted regarding open access to electronic course materials? a. for course materials used for instruction? b. for course materials that are published or archived after the course is completed?	
MIT Strategic	MIT promotes open access most visibly with OCW.
MIT Stellar Faculty	Open access to course materials is up to faculty in the C/LMS and faculty can also take materials to OCW for open access publishing.
MIT Operations	OCW content is open access to the world. The access to Stellar class websites is controlled by faculty, who can choose to make their Stellar site world readable, or open to the entire MIT community, or open only to those in the class. The default option is that of being open to the MIT community.
MIT Sloan School of Management	The system is open to any MIT-affiliated person and faculty can choose to leave their classes open to all registered users or closed to registered

	students and allowed guests only. OCW is used for providing open access to the world after class materials have undergone their publishing process.
Carnegie Mellon University	Courses may be open access at the discretion of the faculty if all material is appropriately cleared for open dissemination.
Columbia University	Published IP policies are well developed and disseminated to guide faculty and students in fair use situations.
Harvard (College of Arts and Sciences)	See the response to #14.
Middlebury College	A new Segue site is public by default. Instructor can limit access or customize access by module. Middlebury has an electronic reserve system that conducts copyright clearance.
Princeton University	Originally when course websites were pre-built all information was open to the world. Now course websites at Princeton have a few modules open to the world and others that only students can see. The "private" modules are where faculty are asked to make copyrighted material accessible. Faculty is also told to abide by fair use policies.
Stanford University	The policy is essentially for no open access beyond the course syllabus.
University of California, Berkeley	The video access has a long history of open access and the process is evolving with the times.
University of Chicago	Access is restricted to members of the course unless specifically changed by the faculty member. Reuse of licensed or otherwise restricted materials fall under other licensing agreements.
University of Texas at Austin	There is a historic policy about access, but open access is not strongly supported by the local culture.
Yale University	There is no institutionalized approach to open access. Faculty are free to make their materials public or publish them. Course resources can be open only to the class or open to the world as in the case of fractals resources.
17. In considering the personnel and activities that support faculty in course development (including graduate students, office staff, support from other faculty, course designers, graphic artists, course software programmers, et. al.), what is your estimate of the total cost of supplying this support in the 2004/2005 academic year?	
MIT Strategic	
MIT Stellar Faculty	
MIT Operations	These costs are largely opaque, and are primarily time spent by TAs and faculty in departments. The Libraries spend $50,000(0.5 FTE) on eReserves.
MIT Sloan School of Management	Cost is zero because those kinds of support services are not provided by the Technology Services department.
Carnegie Mellon University	The central costs are under $10k, but most of the support is distributed and costs for that are not available.
Columbia University	There is extensive support from centralized Centre for Teaching and Learning and from Schools/Departments by about 60-70 FTE at a cost of approximately $3 million per year.
Harvard (College of Arts and Sciences)	Harvard declines to relay support costs.
Middlebury College	Hard to estimate. There is an Educational Technology Group which works with faculty. Four full time people staff the EdTech Group plus student assistants. A rough estimate for #17 and #18 total would be $250,000 a

	year.
Princeton University	Approximately three to five people support Blackboard. A total cost of about $500,000.
Stanford University	This is a large cost but is essentially impossible to determine.
University of California, Berkeley	The costing information is not readily available because some of the C/LMS code development is directed precisely at faculty concerns and the assistance provided by TA's, departmental assistants, etc. is very unevenly distributed and it is impossible to separate out just the support costs. The other complicating issue is that these are the early days of faculty support for a new C/LMS system.
University of Chicago	The cost of for supporting faculty in course development is estimated at $200k from the support department cost as the only proxy for the costing.
University of Texas at Austin	The supports costs are very distributed and mostly opaque, but the in total it would be a large cost number.
Yale University	No real answer on total costs. Certainly TA's, RA's, and administrative assistance have helped with course materials; but there is no breaking out of these course development costs across the institution.
18. In considering the personnel and activities for faculty development in creating and delivering courses (including workshops, tutorials, peer mentoring, self-guided materials, etc.), what is your estimate of the total cost of supplying this support in the 2004/2005 academic year?	
MIT Strategic	
MIT Stellar Faculty	
MIT Operations	At MIT, the OCW program costs about $5,900,000 per year. This includes a stipend given to faculty at $3,000 per course and support by 5-10 departmental liaison persons which costs $450,000, a $50,000 cost associated with the Library and another $10,000 for contract graphic designers. The other visible cost was the Teaching & Learning Laboratory budget.
MIT Sloan School of Management	There is no cost Technology Services because faculty development is provided by other departments, programs and areas.
Carnegie Mellon University	There is a lot of faculty development and the approximate cost is $500k per year.
Columbia University	The faculty development cost is 2 FTE (part of the $3 million figure in item 18).
Harvard (College of Arts and Sciences)	Harvard declines to relay faculty development costs.
Middlebury College	See # 17. Total estimated costs for course development and faculty development total $250,000 per year.
Princeton University	A staff of four people with a total annual budget of about $300,000 to $350,000 provide workshops, office visits, etc.
Stanford University	The faculty development cost is 3 FTE.
University of California, Berkeley	The faculty development and support budget is approximately $325,000. This does not include support provided by other units on campus (e.g., the Teaching Library, Graduate Student Instructors training group, Undergraduate Education faculty development staff).
University of Chicago	The main approach is to provide faculty development rather than "do it for them" type of support. There is generally a progress from the first year using flat file courses to the second year of more pedagogically developed courses where the help is provided case by case. There is no "visible" costing.
University of Texas at Austin	

Yale University	While there are no workshops or tutorials for faculty development there are opportunities made available at the request of faculty. There is annually about $200k worth of small group work, peer monitoring, and self-study guides utilized in faculty development in creating and delivering courses.
19. In considering the personnel and activities for adapting course materials for students with disabilities (including website design, captioning, adaptive technologies, etc.), what is your estimate of the total cost of supplying this support in the 2004/2005 academic year?	
MIT Strategic	
MIT Stellar Faculty	
MIT Operations	About $800 was spent by the ATIC Lab from some part of the Disabled Services budget. Materials are supposed to be ADA compliant before being used in Stellar.
MIT Sloan School of Management	No cost because no disabled students at all.
Carnegie Mellon University	The cost of adapting materials is distributed and is about $100k - $150k per year.
Columbia University	The cost of adapting materials for students with disabilities is small - approximately 0.5 FTE.
Harvard (College of Arts and Sciences)	Roughly $5,000 to $10,000.
Middlebury College	There is an office dedicated to ADA issues with one staff person who works with C/LMS, F2F, and other. A rough estimate would be $10,000 a year.
Princeton University	This is done on a case-by-case basis. There is very little demand, theoretically Blackboard is ADA compliant.
Stanford University	The cost of adapting materials is 2 FTE.
University of California, Berkeley	ETS receives some limited funding for captioning services for webcast and non-webcast courses. Currently this is about $10,000 per year. The Disabled Students Program provides adaptive technologies.
University of Chicago	Adapting materials is done on a case by case basis with no "visible" costing.
University of Texas at Austin	
Yale University	Less than $10k is use for adapting materials for students with disabilities per year.
20. What were your estimated 2004/2005 costs (both licensing and support staff salaries and benefits) of third party course materials, e.g., copyright clearance, e-packs, article databases, simulations, etc. Please include all sources, e.g., IT, libraries, departments, etc.	
MIT Strategic	
MIT Stellar Faculty	
MIT Operations	The cost is under the name network resources and is $2,138k (plus the staff costs of about 10 FTE in the Acquisitions License Service area of the Library) and there is some additional cost for copyright materials that would be associated with the Copy Center budget.
MIT Sloan School of Management	There would be some immeasurable costs for faculty, administrative staff and TA's.
Carnegie Mellon University	The materials costs would be over $1 million.
Columbia University	The cost of electronic materials acquisitions by the Library are about $5 million per year with about $50 of that for electronic reserves which support 250k accesses per year.
Harvard (College	Purely instruction - $5,000 to $10,000. Supported by the Faculty Support

of Arts and Sciences)	Group.
Middlebury College	Waiting for data
Princeton University	The Library also purchases CDs, and DVDs, some of which are made accessible through Blackboard (digitized), and this may cost about $50K/year. One staff member is pretty much devoted to film/video digitization. Approximately four Library staff FTEs support text and music digitization.
Stanford University	There are materials costs of between $1.5 and $2 million.
University of California, Berkeley	These services are provided by the library or by individual departments. Costs are unavailable.
University of Chicago	Presently tools are being used, but there is no way to cost this because there is no meaningful way to tell the difference between higher power teaching tools and lower power researching tools especially in the context of mostly graduate teaching at a research focused university.
University of Texas at Austin	There may be some costs associated with materials used in distance education courses, but the cost is opaque in BlackBoard.
Yale University	This is a huge cost (millions) but incalculable and is handled by the Library. There are few 10-100 epacks in use and the RIS printing shop arranges for appropriate clearance
21. Approximately what percentage of your faculty during the 2004/2005 academic year have contributed to or downloaded content from learning repositories like Merlot or the MIT Open Course Ware? a. contributed to: _____ b. downloaded from: _____	
MIT Strategic	
MIT Stellar Faculty	
MIT Operations	OCW has contributions from 73% of the faculty which is growing at 3-4% per year. There is no information about repository downloads by faculty.
MIT Sloan School of Management	There are 120 courses on OCW out of 130 courses and it is unknown how many faculty, if any, use Merlot or other repositories.
Carnegie Mellon University	We haven't done surveys about this, so I can only report from my contact with faculty. One the basis of that contact, I can say there is little interest in Merlot and some interest in OCW.
Columbia University	Both contribution to and downloading from repositories are estimated at 5%. The Merlot repository is less visible than OCW.
Harvard (College of Arts and Sciences)	(a) Contributed to: 1% or less (b) Downloaded from: 1% or less
Middlebury College	a. contributed to: none aware of b. downloaded from: not very many, has heard of a few
Princeton University	Almost none.
Stanford University	It would be a surprise if there was any contributions to repositories and only a handful have downloaded materials. For core courses there is often substantial sharing and reuse of materials by faculty.
University of California, Berkeley	There seem to be no faculty contribution to repositories and maybe 5 of 1000 faculty downloading from repositories.
University of Chicago	There is nothing through formal channels so any usage of learning repositories (even informal usage) is likely to be quite low or zero.
University of Texas at Austin	They are working on building a repository (the ArtStore service through the Library is a step in that direction) and there is some visibility of MERLOT, but the use of materials from repositories is simply not available.

Yale University	Less than 1% of faculty contributed to learning object repositories. Perhaps less than 5% of faculty are even aware of Merlot. OCW is more visible but the only likely repository use would be when it is tied to a grant requirement.
22. What technologies/software do you use for long-term archival of course materials?	
MIT Strategic	
MIT Stellar Faculty	Presently, the Stellar C/LMS takes care of it.
MIT Operations	DSpace is just beginning to supplement the technologies of simple spinning disk and CD's for storage of materials in individual courses.
MIT Sloan School of Management	The course management system is backed up daily, but classes are not formally archived to a separate server or database.
Carnegie Mellon University	Presently there is no archiving, but they are looking into archiving systems and sorting out the multiple meanings of "archiving."
Columbia University	Presently everything is on spinning disk, but an archival system is on the planning horizon.
Harvard (College of Arts and Sciences)	Currently using RAID-based disk systems. Overwriting most class materials from term-to-term. For the medium term Harvard Arts & Sciences will use software-based, in-house, archival that is part of the Course iSites C/LMS. Long-term options are being discussed.
Middlebury College	Segue (their current C/LMS) will be a tool that students, faculty, or staff can use for personal use, course use, or an institutional repository.
Princeton University	Done mainly in Blackboard.
Stanford University	The present situation will be replaced a dedicated repository supporting bit level preservation and separate metadata.
University of California, Berkeley	There is significant use of spinning disks and also DVD's (in the Library) and CD's plus some digital video on tapes.
University of Chicago	Spinning disks are the technology of choice. Retrieval of a individual course's materials is via a simple local web form the retrieves a whole course. There has been some planning to limit how much is live to just two years in the future.
University of Texas at Austin	There is no archive other than the live server presently, but the issues are under discussion. Two alternatives are being discussed: a repository and alternatively making faculty responsible for their files.
Yale University	The brute force technology of spinning disks.
23. What was your total cost of archiving C/LMS course materials for the 2004/2005 academic year?	
MIT Strategic	
MIT Stellar Faculty	The cost appears to be trivial (near zero).
MIT Operations	There might be some cost of disk space for old courses in Stellar.
MIT Sloan School of Management	Faculty get $3000 per OCW course which is minor compared to the salary dollars of the 5-10 OCW departmental liaison persons.
Carnegie Mellon University	
Columbia University	
Harvard (College of Arts and Sciences)	Currently not large.
Middlebury College	Part of the cost the Segue C/LMS
Princeton University	Course archiving costs at Princeton include the cost of ongoing disk space for running Blackboard. The total cost is maybe $25000 to $50,000 per

	year.
Stanford University	Only the marginal cost of a terabyte of storage.
University of California, Berkeley	Beyond the cost of spinning disks the costs are under $100.
University of Chicago	The cost is difficult to separate out but presently there is 1/3 terabyte of course materials available on spinning disks.
University of Texas at Austin	Zero archiving cost presently except that courses are not deleted so there is marginal storage cost.
Yale University	Essentially the cost is the disk cost and the course materials part of that cost is inseparable in the present situation. What is clear however, is that disk usage is growing at 30% per year as faculty such as those in history of art have begun to use storage intensive applications like PowerPoint with high resolution images.

SECTION 3 – STRATEGIC FOCUS FOR THE FUTURE	
24. What issues will be the key drivers in your decision-making process regarding your institution's use of and selection of C/LMS systems in the next 3 to 5 years?	
MIT Strategic	In the future the C/LMS needs to become more of a service or services to faculty than thought of as an online toolbox. The key drivers for change include: what features and tools are available, the ease with which new tools can be incorporated in the platform (architectural openness), leveraging the enterprise systems, efficiency as a transactional platform, ease of adoption by faculty (popularity with faculty), transition cost (costs vs. benefits for faculty and students), and overall cost sustainability. The Total Cost of Ownership will be hopefully mitigated by open standards that change the cost slope to be downward. Another driver is the hope to integrate with open publishing from teaching to sharing. Ideally these processes would happen in parallel so that at the end of the course it is published.
MIT Stellar Faculty	The C/LMS issue drivers are: open software (Sakai), the ability to achieve a common standard -- single CMS with broad adoption, cost, maintainability, and desirability of the right features for addressing the demands faculty and students. Other issues that will help drive the decision is the need to replace old homegrown systems with new systems that will integrate easily with the other systems on campus. Politics will not matter much.
MIT Operations	The C/LMS drivers are: costs (leveraging investments), faculty acceptance/adoption, the hope for a happily integrated family of technologies, the hope that the OCW process will be sustainable and that a "true life cycle management system" will emerge.
MIT Sloan School of Management	There are many decision drivers including: the ability to support platform with existing staff of 2.25 persons plus outsourcing of 20 hours per month (manual effort as Sloan Space is not integrated with enterprise services), Stellar progress in enterprise integration, Sakai (Stellar 2), cost, "making everybody happy", and the ability to add new features. Also another driver will be the "security" of the C/LMS.
Carnegie Mellon University	The C/LMS decision drivers are: improved features for managing a course (quicker, more powerful, less clunky), and effective collaboration support.
Columbia University	The C/LMS decision drivers are: cost of ownership, support, and upgradeability.

Harvard (College of Arts and Sciences)	Yes to all drivers mentioned by the interviewer. The interviewees specifically mentioned: (a) Costs, (b) Organization efficiency, (c) Collaboration across organization units, (d) Efficiencies in developing more thorough faculty support, (e) Optimization of teaching and learning, (f) Student expectations and what drives the student experience.
Middlebury College	Primary considerations to-date and in the future are: > overall usefulness, > usability, > simplicity (especially in features), e.g., fewer but smarter, > generalizeable features, > systems inter-operability (OKI OSID), > federated searching across various repositories. Middlebury doesn't expect everything to be centralized. Middlebury has a preference for open-source for more control.
Princeton University	Key issues driving Princeton's C/LMS decisions include: 1st: stability and robustness 2nd: ease of use 3rd: adaptability, constantly interfacing Blackboard to other systems, 4th: specific features, e.g., support of Unicode or assessment tools.
Stanford University	The C/LMS drivers are the commitment to Sakai, security, and the ability to innovate.
University of California, Berkeley	The only driver now is the commitment to B-Space (Sakai).
University of Chicago	One of the main issues that will drive the decision-making will be community involvement. The C/LMS is now seen as part of the ecosystem and further integration will involve town hall type discussions to move forward. Additional driving issues will be K-12 and further integration of research involvement. The issue of portal that enables separate branding by professional schools will also be a driver.
University of Texas at Austin	Measurable impact on teaching and learning outcomes, scalability, reliability, features, ease of use for both faculty and students, ability to integrate with university legacy systems, extensibility and customizability.
Yale University	The main driver is the full commitment to Sakai as a way to avoid vendor lock-in and commercial limitations. Integration is easier with the full code base rather than just with an API and it allows the code to be tweaked locally without the risks of commercial updates breaking the local modifications. Total Cost is a modest driver and there is no loyalty to commercial solutions. There is a driver for consolidating on good solutions at reasonable cost but not yet ready for that leap. The political drivers are always there. There is a type of driver in the form of 10 year shadow of the way things were in the past that drives for smooth non-disruptive progress.
25. How do you envision the institution's organizational structure for supporting C/LMS systems changing in the next 3 to 5 years?	
MIT Strategic	No idea yet about future organizational structure but a multiple agency committee has been struck and is working on the issue and it is likely to be resolved before the Fall. One view is that as the faculty experience becomes unified for the course situation and for OCW there will be concomitant organizational ramifications integrating supporting structures as well. When the committee process is complete the

	organizational structure that supports C/LMS simplicity for the student and cost effectiveness for the institution may well turn out to be more "centralized" than the present three systems (Stellar, OCW, and SloanSpace) but not necessarily as centralized as institutional payroll organizational structure.
MIT Stellar Faculty	The supporting organization will become a bit more centralized around a common platform (central organization and central support) with big departments still having a person work with the central organization. The present organizational support systems are not well integrated and unable to provide answers to simple questions such as "who is teaching what?" in a timely manner. The Stellar C/LMS may be the best candidate for locating current data related to teaching such as course faculty, TA's, students, dates, etc.
MIT Operations	As the systems come to work more closely together the organizations will collaborate and work together more. There will be more centralization for cost control and around a strategic vision of the C/LMS.
MIT Sloan School of Management	In the future it is likely that the C/LMS will be moving out of Sloan School and that the assistance to faculty will move closer to faculty with more involvement in assisting faculty one on one.
Carnegie Mellon University	The previous model had both faculty and technical support in a single organization. We have now moved technical support into the central computing organization, which is distinct from the organization that supports faculty use of Blackboard.
Columbia University	There is likely to be increasing centralized support structure and more systematic adoption at the school level through the University.
Harvard (College of Arts and Sciences)	More collaborative development. For example, the Faculty and Arts and Sciences and the Engineering school will work more closely with Central Administration. The core development of the C/LMS will move into core central administration.
Middlebury College	Staffing changes are a big issue. Hopes that the institution realizes that Middlebury is committed to open-source but that support is an issue. For example, there are no licenses but a larger commitment to staff. "Getting the college to think in terms of staff."
Princeton University	Blackboard is now supported by academic systems at Princeton. The C/LMS is becoming much more like an enterprise system. Units may emerge that provide enterprise support.
Stanford University	The C/LMS supporting structure will likely stay the same.
University of California, Berkeley	Since there was a restructuring about 3 years ago there are no further changes anticipated in the next 3 - 5 years. There is more likely to be a shift in emphasis to more focus on teaching and learning with the Library remaining good friends with the C/LMS and media groups.
University of Chicago	There is the beginning of change organization in the formation of a START (Support for Technology and Applications in Research and Teaching) group. More community groups will become technologically facilitated to increase their effectiveness.
University of Texas at Austin	The present supporting organizational structure involves central supports, College/School supports, and departmental supports and will not change in the next 3 to 5 years.
Yale University	There will be more and more enterprise systems that move the infrastructure more to the backend from the frontline and middle level IT groups. There is presently one FTE for the move to Sakai transition.

26. What issues will be the key drivers in your decision-making process regarding your institution's course materials life cycle in the next three to five years?	
MIT Strategic	The key drivers are: the value of OCW for faculty and students, easing the pathway to get course materials into OCW, driving the cost down, increasing flexibility, functionality and reusability of course materials. As course materials become available there will be a focus on the ability to get the "size of the chunks correct."
MIT Stellar Faculty	Until OCW this issue was not visible and certainly not a faculty issue. The future course materials drivers will be those situations where there are new programs, new curricula, changes in requirements, and curricula revision. The basic faculty situation with respect to course materials is likely to remain much the same.
MIT Operations	Same drivers as question 24 and 25 with the added background that the "evolving" intellectual property framework will make a difference: The C/LMS drivers are: cost, faculty acceptance/adoption (predicated on a more efficient and much easier to use system), hope that the OCW process will be sustainable, and a "true life cycle management system." As the systems come to work more closely together the organizations will collaborate and work together more. There will be more centralization for cost control and around a strategic vision of the C/LMS.
MIT Sloan School of Management	Portability of content will be a driver from the faculty perspective so that it is easier to use DSpace in the Library to get materials both in and out. Other drivers are related to enterprise developments where there is an opportunity to be hooked in to other MIT systems.
Carnegie Mellon University	The first order driver is getting a good set of faculty requirements and student requirements. Form the preliminary information gathering the students seem oblivious to the long term storage issues, but there may be interest in some sort of ePortfolio. Faculty have not been visibly interested in ePortfolios.
Columbia University	The course materials life cycle drivers include: the selection of an archival system, increasing integration with the content management system, discouraging fragile development (materials that cannot be preserved because they are browser dependent for instance).
Harvard (College of Arts and Sciences)	Faculty demand.
Middlebury College	Want all course materials to be in robust, scalable repositories hopefully accessible by one standard, e.g. OKI OSID.
Princeton University	Princeton is very actively researching DSpace to support archiving and supporting research. The library is using Fedora. Open source content systems usage will likely grow and as they are adopted they will be linked to Blackboard.
Stanford University	The observation of copyright will be a driver into the future. The other reality is that the cost of sorting what to save is higher than saving everything (given the declines cost of storage this will continue).
University of California, Berkeley	There is a strong institutional bias for open access from the institutional mission statement. Another driver is that change is happening rapidly. Also the developments in the area of content management repository will also be a driver whether it grows into the C/LMS or takes some other form.
University of Chicago	As the idea of electronic course materials has worked its way thought the university there is now some interest in moving on to deal with electronic curriculum and implications of eReserves. There is a deepening vision electronic materials will be a decision driver in the future. Some drivers will be around issues of intellectual property raised

	in discussions and issues of archiving. Other drivers will be issues around learning objects and the role of University of Chicago Press. The issue of faculty turnover is also likely to be a driver.
University of Texas at Austin	Faculty input is a primary driver. Faculty have asked that courses remain active at least 2 years so that they can copy the materials to a new course as needed. If UT had a learning repository that would be suitable for storing archived materials, that could change the course materials life cycle. The Distance Education online programs will probably be a driver for structuring a course materials life cycle at least to meet their own needs (where some course changes are responsive to outside government changes for instance). The other driver is the MIT OCW, which is seeming to have impact. The dream of open course content is now a demonstration that seems to be working and this empowers local efforts to opening up courses.
Yale University	There will be cost drivers in this area around the issues of an institutional repository. There has been mild interest in ePortfolios.
27. How do you envision the institution's organizational structure for supporting course materials life cycle activities changing in the next 3 to 5 years?	
MIT Strategic	No idea yet about future organizational structure but a multiple agency committee has been struck and is working on the issue. There is no real organizational structure now and it will have to be built up with one possibility similar to a "general contractor" type of coordinating organization that generates efficiencies for faculty.
MIT Stellar Faculty	MIT does not seem to have a course materials support structure presently other than some ad hoc developments. OCW seems more of a type of publication than a structure supporting course materials, but because courses need to be updated in OCW over time this could be seen as a variety of support structure. In fact many faculty have come to rely on Stellar and OCW as and entitlement that helps them with their courses. However, OCW needs to update more often (a button in Stellar) to better support student shopping and linkage with the course calendar.
MIT Operations	Not much change is anticipated in OCW, but the other aspects are going through a process of review currently.
MIT Sloan School of Management	Developing organizational structures with closer ties to DSpace and the Library to make it an easier conduit for course materials.
Carnegie Mellon University	Carnegie Mellon University is starting the process of changing the course materials support structure among the major organizations involved.
Columbia University	There is likely to be increasing centralized support structure and more systematic adoption at the school level through the University.
Harvard (College of Arts and Sciences)	More code development between librarians and the C/LMS code writers stationed in Central Administration. Starting this fall, 85% to 95% of courses will be standardized on "Course iSites." This will improve the collaboration with the library systems. Course iSites will be better able to create rich learning objects worth archiving.
Middlebury College	See #25. Envision life-cycle activities to be built into Segue, their C/LMS. Middlebury hopes to have increased staff time and knowledge to support open-source, standard compliance, accessibility.
Princeton University	More resources will likely be committed, e.g., integration of library services may take place along with a university-wide approach to the course material life cycle. Digital media centers may appear and Princeton will see more teams working on not only content and pedagogy, but also archival.
Stanford University	The course materials support structure is likely to stay the same with a

	few tweaks.
University of California, Berkeley	It is expected that there will be no change in the support structure in the next 3 to 5 years.
University of Chicago	This will shift even more activities inside the Library since location of the START group inside of the Library has proven fruitful. Thus far the notion of Citrix using VMware virtual machines for storing and replicating course software tools including databases has added value to archiving along with issues about licensing old software versions.
University of Texas at Austin	If there is movement toward open access and the creation of more content (as seems likely with the class presentation capture plans) then things will have to change and there will have to be a organizational support structure built to support course materials life cycle activities.
Yale University	The situation is too vague at this juncture. It will depend on the mix of repository versus Library versus portable local options.
28. Have we omitted any questions that pertain to your C/LMS or Course Materials Life Cycle usage, costs, or future plans? We're especially interested in items that give us better context on the current implementation, near-term decisions, or long-term visions regarding your C/LMS or Course Materials Life Cycle.	
MIT Strategic	
MIT Stellar Faculty	The long term vision is that the C/LMS will be helping faculty to become better teachers. Presently most classes are lecture style with "chalk talk" and then students are sent home with problem sets to do. Maybe the C/LMS can be retooled to enable more teaching methods involving active learning in the classroom and maybe problem sets can become interactive problem sets or small virtual experiments (like iLab) integrated into the C/LMS. Maybe the C/LMS could support course evaluation surveys at early in the course allowing faculty to make midcourse corrections based on student survey data.
MIT Operations	The composition of project management teams for the C/LMS was a missing aspect of this survey and that organizational aspect seems important. Some additional interesting questions were posed (but not answered): Who are the decision makers on these issues? Is there any central group that maintains a financial perspective?
MIT Sloan School of Management	Nothing extra, but an explanation about how Sloan Space came to be and its historic relationship with .LRN and open ACS.
Carnegie Mellon University	The question that was not raised directly was whether the C/LMS was centralized or not. If there were a powerful identity "service" coordinating the Registrar permissions and a repository capable of multiple data views would there be much left for the course management system to do?
Columbia University	
Harvard (College of Arts and Sciences)	
Middlebury College	Prefers the term "curricular technology." Middlebury is researching what is happening outside of academia. Instead of a C/LMS they would rather have a content management system modeled on trends outside of academia. When students graduate they will have some understanding how to work with these emerging technologies. Questions on how your institution looks at emerging trends and implements into their system
Princeton University	
Stanford University	One of the rapidly growing concerns is security, both in terms of legal requirements to protect privacy and the exponentially growing cost (about half of the network cost). The security situation becomes much more complex when collaboration involves multiple institutions and

	discrete access requirements.
University of California, Berkeley	The suggestion was that it would be interesting to ask how folks are going about getting acceptance of new systems like Sakai. The approach at Berkeley was to promote collaboration using B-Space (Sakai) as an early step in the process. The survey seemed to have missed the issue of video convergence and video usage (they found that the average access use time was 10 minutes and that students were both course shopping using the videos and also using videos from more than the current term when studying). The other reuse of video was to repackage as the greatest hits based on usage statistics to further promote the open access mission. (promised a link to a study by Diane Hurley(sp) on a Mellon grant that explored the "true cost" of Chem 1A)
University of Chicago	The growth of C/LMS is quite telling and this survey mostly missed this perspective. Both faculty expertise with the technologies is evolving quickly, general usage growth is nearly exponential so that a one year snapshot is a quite limiting view. All of this has been in the context of IT staffing decreases (restructuring of the Digital Media Lab) at University of Chicago so that growth versus staffing trends seem to have shifted.
University of Texas at Austin	The structure of the questions bespeaks of those who have been offering online degree programs and courses on a larger scale than UTexas at Austin. There maybe some really interesting secondary audiences for these questions. The sharing of OCW is welcomed and also the seeing how this is accomplished. The focus on strategy and resource allocation are especially interesting in the context of after 6 years with BlackBoard the pedagogical processes are still opaque due to the limitations of the administrative capabilities of the LMS.
Yale University	The Yale approach is quite different than the MIT approach to integration of systems. They are actively exploring uPortal to develop integration at the level of the user interface between the SIS, IT, Library, and Administrative systems. They are also unlikely to have a "super system" but rather an large array of services tied together at the level of the portal. The individual services will likely include a mix of local systems, open source, and commercial services that are seamlessly integrated in the user interface. The vision is to not be a code builder of software systems but rather to be mixing resources to cater to the special needs of the users of the system by integrating available code from open source and services from commercial service providers (with a careful attention to avoid lock-in situations with uncontrollable costs). Another aspect of the vision seems to be that all this technology involvement should really be background not foreground at Yale (more and more a part of the backend infrastructure out of sight but working smoothly whenever needed, so smoothly that technology training is rarely needed).

Appendix D
WCET EduTools Project Personnel

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Bruce Landon is a member of the faculty of Douglas College in British Columbia and a senior advisor with WCET. He earned his doctorate in experimental social psychology from Rutgers University and began teaching at Douglas College in 1976. He teaches courses in introductory psychology, social psychology, research methods in psychology, data analysis in psychology, and cognitive psychology. Landon developed the landonline website in 1997 for the Centre for Curriculum, Technology and Transfer to assist in the province-wide selection of a common course management system. In 2002, through an arrangement with WCET, the web traffic was redirected to the www.edutools.info site

Tom Henderson
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Tom Henderson has over fifteen years of experience in private industry as a CPA, a financial manager/acquisitions analyst for a Fortune 500 company, and as a consultant. He has over six years of experience in higher education assessment. His education includes a B.S. in Accounting from the University of Idaho, 1975, an MBA in Finance from the University of Washington, 1981, and a Ph.D. from the Individual Interdisciplinary Degree Program at Washington State University in 1999. His first experience applying Activity-based Costing to higher education was with the Flashlight Cost Model in the mid 1990's. He has since worked with the Technology Costing Methodology, the TCM/mini-Bridge cost simulation model, and various ABC studies for specific scenarios. Henderson is currently the Director of Testing and Assessment at Central Washington University.

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Russell Poulin is the Associate Director of WCET (www.wcet.info) – a membership-based cooperative dedicated to advancing the effective use of technology in higher education. WCET is a unit of the Western Interstate Commission for Higher Education. Russ organizes the information sharing activities among WCET's members and directs EduTools.info, which provides independent reviews of educational software and courses. He also co-directs the Northwest Educational Outreach Network, which uses distance education to expand the reach of programs not available in every WICHE state. Russ also heads the Technology Costing Methodology project, consults on distance education planning projects, and serves on the editorial board of *Innovate*.