A Course Management System Strategy for Indiana University

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Executive Summary

This report outlines a multi-year strategy for Indiana University's Course Management System. It assesses major technological trends in providing university services. In summary, the services provided by Course Management Systems, such as Indiana University's Oncourse, will evolve as an unbundled collection of web-based services alongside their near-term evolution as a single application. New interoperable standards in course content, software, and integration with publishers are imposing many transitions on Course Management Systems. This transitory time would be exactly the wrong time to invest in a packaged solution.

The findings of the report propose five recommendations with 18 specific action items.

Summary of Recommendations

1. Continue to invest in Oncourse as an IU Enterprise application rather than licensing a commercial CMS package.
2. Direct Oncourse development efforts toward Open Knowledge Initiative architecture compliance.
3. Pursue aggressive integration efforts among IU's comparative strengths in Oncourse, the OneStart Portal, and Digital Libraries.
4. Develop Oncourse as IU's lead initiative for mobile device connectivity via the OneStart Portal.
5. Aggressively pursue e-commerce opportunities that save stakeholders time and/or money

Indiana University has established research leadership positions in high performance networks, teraflop supercomputing, and has the foundation for doing so again with the Pervasive Technology Labs and other initiatives. IU's comparatively strong positions with Oncourse, the OneStart Portal, and Digital Libraries afford extraordinary control over our own destiny. They provide a foundation for demonstrating national leadership with our teaching and learning technology environment that affects the daily lives of tens of thousands of IU stakeholders.

An aggressive plan for combining these strengths – framed in the Open Knowledge Initiative collaboration with others and a plan for mobility – provide another clear path to realizing "IT leadership in absolute terms."

1 Introduction

In January of 2002, the Office of the Vice President for Information Technology and CIO commissioned an analysis of future strategic options for IU's course management system(s) (CMS). CMS, such as Blackboard™ or IU's *Oncourse*, provide a means for faculty and students to create, integrate, use, and maintain Web-based teaching and learning resources.

The timing of this analysis parallels four important external trends for universities:

1. National reports indicate a plateau in faculty adoption of instructional technologies[1].
2. Universities are unbundling their traditional functional silos to create personalized, integrated access to university functions via portal-based web services.[2]
3. The vendor market for CMS is maturing as fewer firms focus on profitability after an industry shake-out and consolidation.[3]
4. Universities are moving beyond casual exploration of multiple CMS environments towards enterprise solutions.[4]

A previous Indiana University analysis addressed CMS options and strategy in 2000. It concluded that the commercial applications did not offer sufficient benefits to buy rather than build.

2 Brief History and Current Situation

In the mid to late 1990s, many universities IT organizations, schools, and faculty engaged in extensive experimentation with a variety of vendor and home-grown course environments. Recent efforts have focused on rationalizing and scaling CMS technologies. These actions were needed to provide a common learning platform for faculty and students, rationalize training and support expenditures, and begin or accelerate integration work with existing university systems (e.g., registrar, library, etc.). This rationalization objective posed a "make or buy" decision for each university in selecting an enterprise CMS.

Indiana University chose to develop and scale up a home-grown CMS named Oncourse for the multi-campus enterprise. UITS tested and decided to adopt Oncourse as its enterprise CMS. Its major IU rollout accelerated in the fall of 1999 via funding provided by Actions 12 and 18 of the Strategic Plan. Most of the initial Oncourse code was rewritten for enterprise scalability and speed. Oncourse's capabilities have evolved each semester along with its growing integration with Registrar and Library systems. Table 1 summarizes all direct costs and IU's investment in Oncourse.

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[1] William Geoghegan, author of *What Ever Happened to Instructional Technology – Reaching Mainstream Faculty*, (IBM Academic Consulting, 1994), describes a growing chasm or gap between faculty innovators/early adopters and their colleagues who teach the majority of our classes. He concludes that "this gap is so significant in the case of instructional technology that it has so far stymied almost all efforts to bridge it….It has left us in a situation in which the early market seems to have approached saturation in its use of instructional technology, but in which mainstream adoptions are relatively few and far between" (p. 14).

[2] *Web Portals & Higher Education*, (2002). Richard N. Katz and Associates (ed). EDUCAUSE Center for Applied Research. Jossey-Bass: San Francisco.

[3] Gartner Group, Research Note: "Higher Education E-Learning Strategies Consolidate in 2002," 18 January 2002.

[4] *Ibid*

	1998-1999	1999-2000	2000-01	2001-02
Personnel/Other	$63,000	$512,000	$696,000	$669,000
Hardware/Software	$200,000	$177,000	$ 89,000	$ 81,000
Total	$263,000	$689,000	$785,000	Est. $750,000

Table 1 Oncourse Expenditures

Faculty adoption and use of Oncourse to date has been quite brisk (Figure 1) when compared with similar large state universities. There is considerable variance in the adoption rates between the core campuses and between the core and regional campuses (Figure 2). Distributed education programs, such as those in Nursing and the Kelley Direct MBA, are also using Oncourse as their CMS.

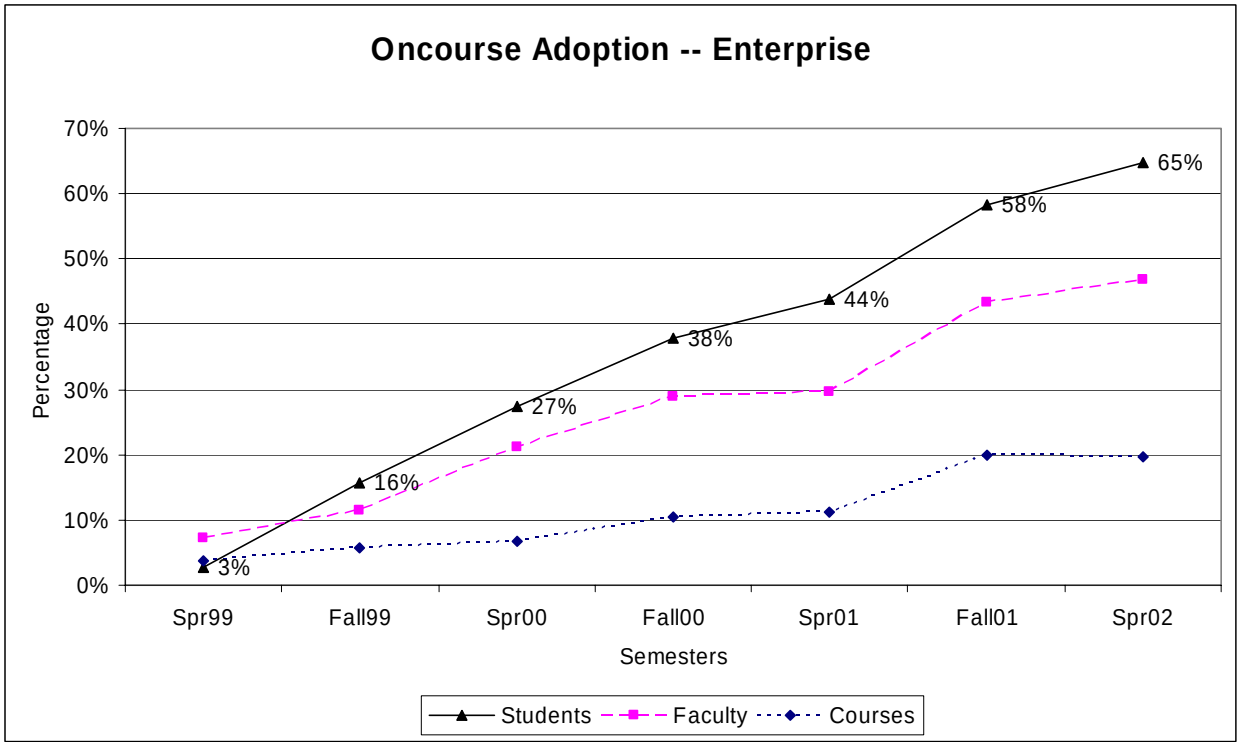

Figure 1 University-Wide Oncourse Adoption Trends as a Percentage of Students, Faculty, and Courses

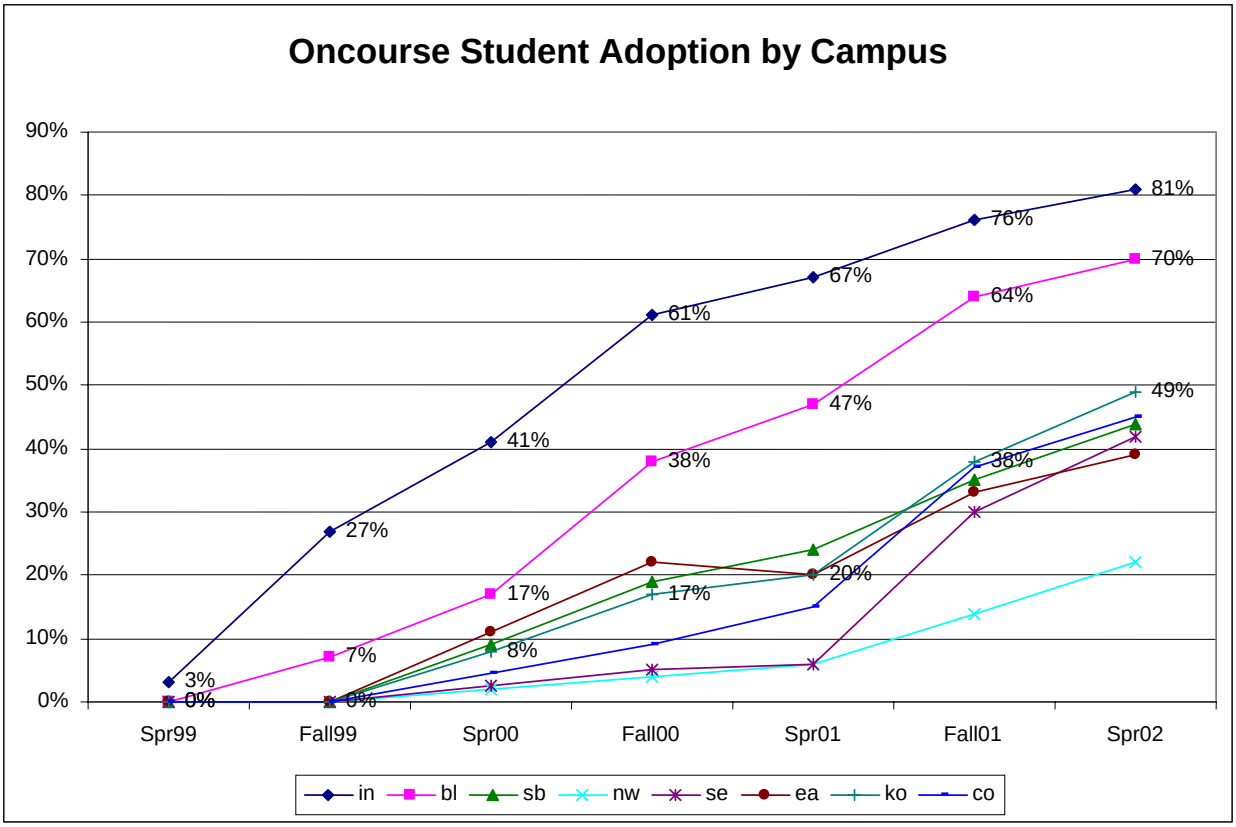

Figure 2 Earlier Campus Implementation Accelerated Higher Levels of Use[5]

As the university pauses to reassess its CMS strategy, framing the discussion is a critical first step. One approach is to carefully study existing CMS options and assess their fit to our need. A second approach is to identify the core services bundled in a CMS and to consider how they can best be delivered in an increasingly web-enabled university. Related to both of these approaches is the question of *if* or *how* a CMS contributes to

> "*…the development of information technology at IU that will enable the University to become a leader in absolute terms in its use and application. This in turn is a vital part of [President Brand's] plan that IU '... move forward to the next level until it is recognized as one of the very best of the nation's universities.'*"[6]

This report frames the discussion using the second approach.

3 Strategic Directions for Universities

Like the larger corporate world, universities have an opportunity to increase their use of digital networks for delivering services from a personalized, process view across the university rather than a silo'd, functional view. Compelling economics and service-level expectations of stakeholders will accelerate the use of web-based services.

[5] Spring 2000 data are estimates for the regional campuses. Individual campus tracking began in the Fall of 2000.
[6] "Information Technology Strategic Plan: Architecture for the 21st Century," Foreword, Indiana University, May 1998.

3.1 Web-services

Two related major trends point to strategic opportunities for planning medium-term IT investments. The first recognizes that university systems are evolving through four stages of web-enabled services (Figure 3 and Figure 4). These include:

1. Services as stand alone silos with minimal data/process integration
2. Web access bolted onto each silo
3. E-fascades providing a single web-based path to each silo
4. Portal that provides a point of data and process integration among unbundled services (Figure 4)

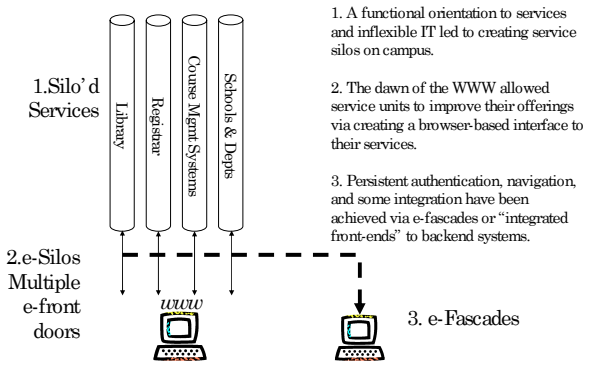

Figure 3

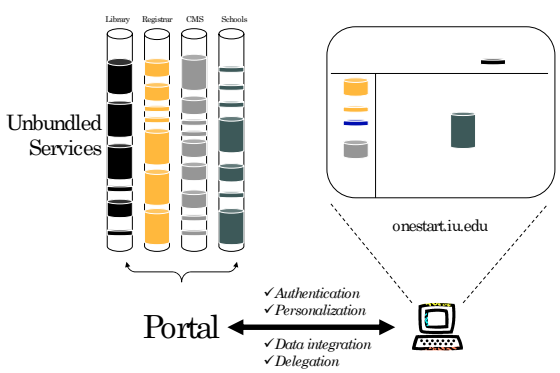

Figure 4

Personalized portals – such as IU's *Onestart.iu.edu* – provide a foundation for

- one-time login with persistent authentication across the enterprise,
- one-click access to applicable services (e.g., drop/add a course, pay bursar bill, submit homework, communicate with a professor, buy theater ticket, etc.), and
- one place where the relevant university data/information are dynamically pulled together for an individual based on his/her preferences, roles, or affiliations.

A portal provides the mechanisms for data (e.g., course schedule, fees due) and process integration (e.g., schedule room, drop course) across university services. Rising user expectations – through their personal experiences in the commercial world (my.yahoo.com or msn.com) – and economic necessity will drive universities to embrace portal-based web services.

From this evolutionary perspective, a CMS can be viewed as just another university web-based service – arguably the principal university service in fulfilling its educational mission. Most CMS products currently are in stage 2. Their longer-term integration into a process-based, data-integrated, and economically efficient portal is the natural evolutionary path for an increasingly connected campus.

3.2 Devices

The second major trend points to the post-PC era as university services are accessed by a wave of wireless devices.[7] Mobile phone handsets, PDAs, tablet PC's, and other devices will connect via GPRS, 802.11x, WAP and other network/protocol technologies. It is impractical and inefficient for individual university services to manage connectivity to the moving target of the emerging wireless world. The prudent path would argue for unbundled services connecting to the Portal, and then the Portal managing connectivity and evolution to mobile devices (Figure 3).

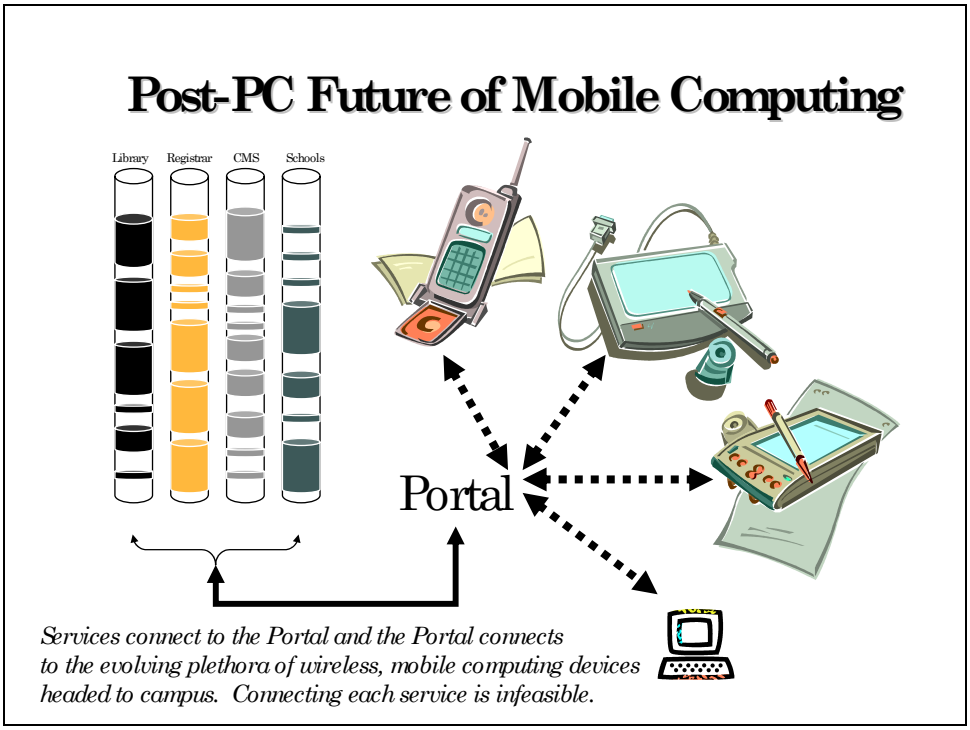

Figure 5

A coherent medium-term CMS strategy must consider how CMS investments will integrate and relate to these two major trends. A myopic focus on enhancing the CMS could lead to building another functional silo on campus that will, in time, need unbundling and integrating with personalized ports.

CMS vendors have already recognized these major trends and are working to position their products at the center of these developments.

> "'*The definition of the problem that we are trying to solve has changed,' says Matthew S. Pittinsky, chairman of Blackboard Inc. Courseware is evolving quickly he says, from a set of relatively simple tools used to enhance a professor's individual course Web Site into large-scale integrated information systems that are used for both campus-based and distance education – by an entire campus or system of campuses or a consortium of colleges. For an additional licensing fee, Blackboard, for instance, sells portal software and debit-accounting systems – both of which are compatible with the Blackboard course-management system. As the company integrates*

[7] "As American as Wireless U.", *Wired News*, 1 May 2002. American University has announced plans to become "the first fully integrated wireless university by getting rid of telephone lines and installing a wireless system to handle voice, data, and messaging. This means students will use cell phones for their primary voice communications and can surf the Web from PDAs and laptops throughout the campus, both indoors and outdoors." The system is to be active by fall 2002.

> *more functions into Blackboard, its executives anticipate signing many more '$200,000-, $300,000-, and $400,000-a-year relationships,' Mr. Pittinsky says.*"[8]

Similarly, MIT's pioneering Open Knowledge Initiative (explained in section 5.3 below) is also defining its CMS capability as a collection of unbundled services. These trends – and vendor shifts to acknowledge them as large dollar revenue streams – clearly frame the CMS strategic choice as more than a beauty contest among existing options. The next section will outlines trends in faculty use and adoption of CMS.

4 Faculty Trends

Faculty are the essential arbiters of CMS efficacy as it is their content, creativity, and pedagogical choices that give a CMS purpose. Unlike other enterprise systems that are a vehicle for standardized processes, CMS must maintain a canvas-like ability for faculty creativity while operating with mission critical reliability and change management processes. If the CMS serves faculty needs and pedagogical objectives, then its adoption is likely to accelerate. Faculty adoption is *the* critical antecedent to student use.

When addressing any voluntary system adoption, it is well established that *perceived ease of use* and *perceived usefulness* generally explain the majority of the variance between adopters and non-adopters.[9] Anecdotal experience with faculty and technologies to support learning, such as a CMS, appear to further confirm this finding. Thus, broad adoption of a CMS requires perceptions that it is useful and easy to use.

These two criteria often have vastly different meanings to the highly heterogeneous faculty at a large university. Early adopters will press for more advanced functionality while others prefer few changes to reliable, basic functions that disturb consistency between semesters. Late adopters value simplicity, clear usefulness, and ease of use in beginning to make use of a CMS. Further, it is recognized that some faculty, schools, or degree programs with specialized needs and their own resources will choose not to make use of the institutional-level CMS. Thus, an enterprise-level CMS must be able to effectively serve an increasingly segmented faculty population who have differing expectations for the CMS.

Beyond the syllabus, course schedule, roster of students, and other basic services, many faculty desire technology-supported learning modules that are unique to their discipline. Faculty innovators will continue to build or buy specialized instructional tools that serve particular course needs. Examples include simulations, visualization tools, interactive homework problem generators, etc. Some of these tools and pedagogical approaches can serve a broad set of faculty and students across disciplines, e.g., statistics tutors or sophisticated quizzing tools. Thus, a CMS should be able to link to or assimilate other instructional tools that further instructional objectives.

5 CMS Sourcing Options

At present, universities can choose to buy and implement a commercially-packaged CMS from the marketplace or to build it on their own. A third option involving an open-source to sharing CMS program code approach is emerging. Criteria regarding cost, capabilities, connectivity, and continuity frame the

[8] Olsen, F., "Getting Ready for a New Generation of Course-Management Systems," *Chronicle of Higher Education,* 21 December 2001, A25.

[9] Davis, F.D. (1989). "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology." *MIS Quarterly*, 13:3 (September), 319-340; and Venkatesh, V., Speier, C., and Morris, M.G. (in press). "User Acceptance Enablers in Individual Decision-Making About Technology: Toward an Integrated Model," *Decision Sciences*.

make-or-buy decision. This section overviews the current state of three major paths forward for CMS sourcing.

5.1 Purchase a Commercial CMS

Blackboard™ and WebCT™ have emerged as the leading CMS vendors through recent industry consolidation. The debilitating deficiencies (e.g., scalability, reliability, integration with SIS) from the prior IU CMS assessment are believed to be remedied in their current versions. CyberLearning Lab's Angel™ has attracted only a few large research universities (notably Penn State) and a number of smaller colleges. Other vendors have either exited the market, been consolidated, or will likely be forced into a niche strategy. No major vendor is yet profitable, and analysts forecast that serving higher education will not be their path to profitability.[10] CyberLearningLab has achieved profitability through a focusing on a segment of the market.

Both major vendors shifted their pricing plans in recent months to focus on an FTE-based licensing arrangement. This change has resulted in much higher annual licensing fees for large-scale users with WebCT's latest Vista product "in the 'six figures' for most colleges."[11] These costs are exclusive of hardware, enterprise integration, or on-campus support costs. Interestingly, these price increases and other concerns have recently sparked a new round of inquiries for selling/licensing Oncourse to other universities.

Indiana University requested a quote from Blackboard for comparative purposes. Their quote is for $X for their basic CMS (annual, recurring licensing fee) or $X with the Community Portal capabilities (IU would need this). These costs do not include hardware, local support, administration, or integration costs. Blackboard would charge an additional fee for their "Building Blocks" tools that are required for integration with the Student Information System.

Final negotiations would likely reach some form of a discount. Conversion to Blackboard or another leading vendor would need to factor in substantial migration, re-training, and new support model costs along with considerable efforts to transition faculty users. A parallel year of operating both systems would likely be necessary for the conversion.

The essential value proposition of a vendor is to achieve economies of scale in software development, testing, maintenance, and innovation across a broad set of customers. These shared costs (plus an administration and profit margin) should create a more robust CMS in capabilities at a substantially lower cost than in-house development. The trade-off is a loss of control in the pace of development, evolution of features, and customizability to local needs. Since the software is essentially rented, no software asset is owned after the license expires.

5.2 Write Our Own CMS (Oncourse)

IU's present strategy of writing its own CMS is a mirror opposite. The university pays the entire cost of all development and support. It owns the code and has full control for customization and full

[10] *Chronicle of Higher Education*, "Course-Management Companies Are Still Seeking Elusive Profits," 23 May 2002.
[11] *Chronicle of Higher Education*, "Pricing Changes by Blackboard and WebCT Cost Some Colleges More – Much More," 19 March 2002.

responsibility for its destiny. The pace of development, evolution of features, and local customization are a fully controllable based on level of investment, management attention, and objectives.

The challenge of this approach is that the university must fund the on-going organizational capabilities for managing architectural standards, conducting systems analysis and design, coding, testing, providing administrative and governance oversight, and resolving tier 2 and 3 support issues.

In a leveraged model, these organizational capabilities already exist to serve a variety of other university needs (SIS, FIS, etc.) and are efficiently leveraged to develop the CMS. While IU does already possess these capabilities, the architectural choices for Oncourse do not provide access to these capabilities. IU currently has some leverage for Oncourse in its support mechanisms. Oncourse documentation and support documents are authored in the support centers for native integration with their systems and processes (e.g., KnowledgeBase, enterprise problem resolution, Falcon tracking and escalation).

5.3 Adopt the Open Knowledge Initiative Software and Content Standards

In January of 2001, MIT received a two-year Mellon Foundation grant to develop the Open Knowledge Initiative (OKI). The initiative involves close partnering with Stanford and participation from six other universities including the Universities of Michigan, Pennsylvania, and Wisconsin.

OKI states its primary goal as "to design and develop an open and extensible architecture for learning management systems (LMS)."[12] Their use of LMS is the same as the more broadly used term of CMS. The first architectural specifications document was released as a draft in March of 2002 (Figure 6).[13] OKI states that it does not intend to compete in the CMS market place. It has defined its objective as influencing that market place via its layered, extensible architectural framework. Both MIT and Stanford will build CMS implementations for their own needs based on OKI specifications.

[12] "What is OKI?" OKI White Paper, 15 January 2002, http://web.mit.edu/oki/library/what_is_OKI.pdf
[13] "OKI Architecture Overview," OKI White Paper, 22 March 2002, http://web.mit.edu/oki/library/ArchitecturalOverview.pdf

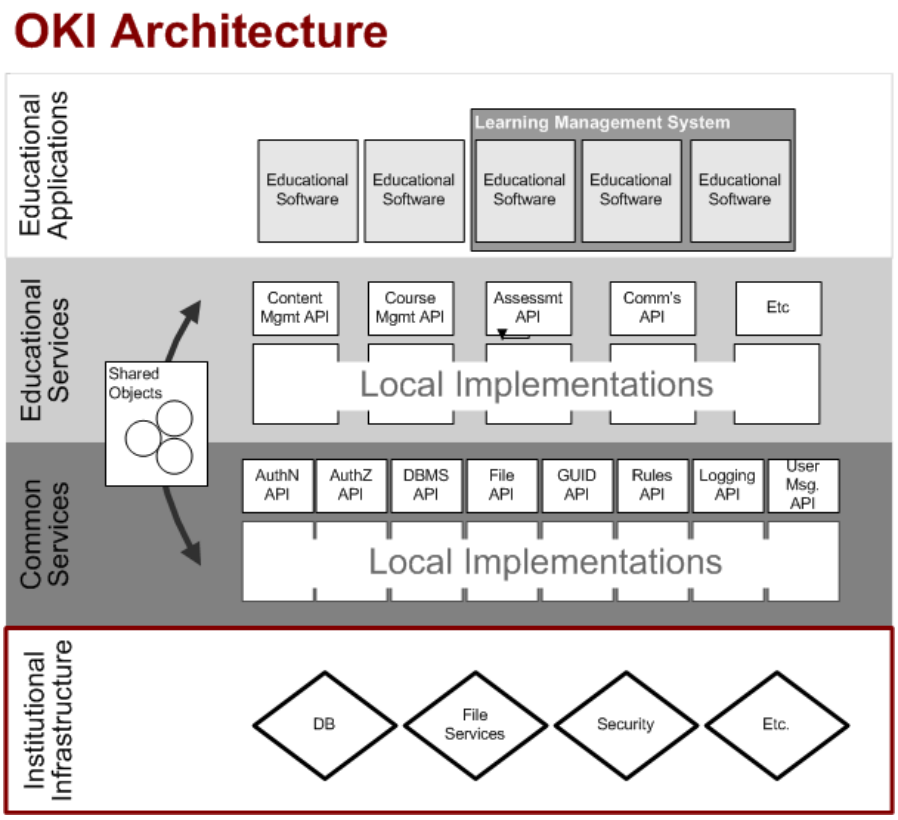

Figure 6 Extensible OKI Architecture - The "Learning Management System" is the same as a Course Management System.

Partners will contribute additional educational tools in an open-sourced implementation of the architecture. Java 1.3 has been specified as the initial API and implementation language with a future objective of creating other API language bindings.

The OKI approach offers a hybrid path between the buy commercial and build options. Its economic efficiencies rely on code-sharing via open source and common standards to achieve the virtual economies of scale available to a commercial vendor. The pace of development, evolution of features, and local customization remain fully controllable based on the level of investment, management attention, and objectives.

While OKI boasts respectable progress towards its ambitious goals, an enterprise-scale production CMS appears unlikely before 2004 in the best-case scenario. Thus, OKI software implementation is not a viable CMS option for IU in the near term.

Additionally, other groups have proposed international standards for course content to support interoperability independent of the CMS software.[14] These groups include the IMS Global Learning Consortium Inc. and the Academic Advanced Distributed Learning Co-Lab (Dept. of Defense initiative)[15]. The Sharable Content Object Reference Model (SCORM) is already in release 1.3 production use. These groups have declared their intent to work together with the OKI on global,

[14] *Chronicle of Higher Education*, "Mixing and Matching Distance-Education Software," 24 May 2002.
[15] http://www.imsproject.org/ http://www.wiadlcolab.org/

interoperable standards for both technology and content.[16] The commercial vendors have declared their support for content standards, but most observers question their commitment to a strategy that reduces switching costs between products. Oncourse has currently planned development work towards SCORM and IMS compliance for summer 2003.

6 Recent CMS Decisions at Peer Institutions

The CIC's spring 2002 survey[17] reports on twelve institutions. This data along with phone interviews with other universities reveals few consistent themes in emerging CMS strategy. Some large institutions have committed to a vendor strategy with Blackboard, WebCT, or Angel (Penn State). Some are migrating away from non-viable vendors (such as Lotus) or home grown systems have never reached critical mass. Many are engaged in tactical efforts that largely deal with their current legacy situation. There is much interest and talk about OKI efforts, but near-term action towards OKI is only now emerging.

Eight CIC respondents list future release plans citing only one CMS while four plan support for multiple CMS (most cite legacy reasons for this). The University of Illinois (Urbana) plans continued use of four CMS including both Blackboard and WebCT. Washington U. has developed a broad collection of popular, home-grown teaching tools, but it is only now beginning to bundle them in a CMS framework.

The U. of Michigan has committed to a one year migration from their custom, Domino-based tool towards the OKI framework. Their internal study revealed no economic benefit from implementing a vendor solution over rewriting their own CMS into OKI. In sum, there is no clear direction other than those who have specified a vendor and are spending to build integration to their local environment.

7 Discussion

The charter for a CMS strategy assessment for Indiana University during the spring of 2002 was well timed. Clarity and consensus is emerging regarding the shape of the next generation of web-based campus services including CMS. Committed answers to the following four questions will provide clarity in choosing a CMS strategy.

7.1 Development Capability as an Option?

1. Does IU have sufficient scale, scope, and skill to even have the economically-viable option of developing and innovating with its own CMS?

   Position: Yes. IU has an economically-viable development capability and scale.

Universities that answer "no" to question 1 by default must choose from vendor solutions. Unless they intend to create a development shop or wait for the promise of OKI, their path is necessarily a beauty contest among commercial CMS solutions. They will likely pursue a tighter relationship with a major vendor by licensing its CMS, Portal, and other back office systems (some of these integrated solutions are promised via vendor strategic alliances, e.g., Blackboard/WebCT and PeopleSoft).

[16] "MIT Open Knowledge Initiative, ADL Co-Laboratory, and IMS Cooperate to Advance Learning Technology," http://www.adlnet.org/index.cfm?fuseaction=newsstory&newsid=46, 11 July 2001.
[17] http://telr.osu.edu/surveys/cic-lms/report.cfm

IU – with over 100,000 students and faculty on eight campuses (plus distributed learners) – has large scale and scope. The existence and 60,000+ user base of Oncourse and the in-house Financial Information System demonstrate IU's existing capability to build enterprise-scale systems. The Office of the Vice President of IT & CIO, however, has established a systems philosophy of buying packaged software rather than building when a viable option is available. Packaged CMS software is readily available. Thus, the university's answers to other questions arbitrate if the CMS strategy should remain a highly visible exception to the university's systems philosophy.

7.2 Commodity Service or Innovation Platform?

2. Should IU position its CMS as a commodity IT service or as an evolving platform for faculty innovation?

   Position: IU should choose to position the CMS as a platform for faculty innovation.

If the CMS is positioned as a commodity IT service for reliably presenting a syllabus, schedule, roster, and conducting interactive quizzing, discussions, etc., then the CMS strategy should select an economically-efficient, reliable, and scalable option that does not pay a premium for new development and innovation. If extensible CMS services are an essential building block for faculty innovation, then the university should choose to spend a premium for the system development or new packaged software releases that advance CMS capabilities.

In its present form, Oncourse offers little differentiation as a commodity CMS service and has some deficiencies when compared commercial offerings (e.g., user interface, multiple windows, chat, etc.). Our actions to-date have not flowed from a committed answer to this question, and frankly, there has been no capacity for making choices. Oncourse's first three years were consumed by rewriting the inherited code, converting it to ASP, scaling up to meet accelerating demand, remediating feature deficiencies, and slowly evolving the feature set.

A CMS is the principle IT mechanism for connecting the faculty and students. IT leadership in absolute terms requires IU's commitment to providing the faculty an extensible platform for innovation in teaching and learning. This narrows the criteria for choosing a CMS, but leaves open the buy or build question as extensible CMS software is accessible through either path.

7.3 Pace, Features, Local Integration?

3. To what extent does IU value ultimate control over the pace of development, evolution of features, and local integration of its CMS – especially if viewed as a collection of unbundled services?

   Position: IU should value control in prioritizing and aggressively integrating its CMS with other university resources.

This question places the CMS strategy in the larger context of the university's technology vision and strategy for achieving that vision. Three current initiatives provide some context. Oncourse will soon integrate student photographs from their campus ID cards, incorporate assessment for learning measurement through the national Flashlight instrument, and enhance connectivity to the resources in IU's digital library.

These three examples all illustrate immediate opportunities related to pace, features, and local integration of a CMS with the priorities and other resources of the university. Implementation of packaged software largely limits the university's degrees of freedom in prioritizing and implementing CMS capabilities. The commercial vendors will, by necessity, construct their offerings to serve the broader market. In the best case, they will follow the negotiated, middle ground guidance from a broadly-based user advisory board. Thus, if a means to "IT leadership in absolute terms" necessitates control over the pace, features, and integration of IU's CMS with other resources, then IU should value a CMS strategy that ensures control.

7.4 Keeping Pace

4. Can a homegrown CMS ensure connectivity to evolving electronic resources (e.g., textbook publishers, quizzing tools, simulations, etc.) that are designed for leading commercial vendors?

   Position: IU must maintain CMS connectivity to market place teaching and learning resources.

Question three presented opportunities for controlling the pace, features, and integration of the CMS. The mirror side of this is keeping pace with the evolution of the marketplace. Textbook publishers and other software vendors have already started offering learning resources that connect to the leading vendors' CMS products. This trend may accelerate, and faculty will require that their favorite learning resources connect to IU's CMS and the faculty's work to be portable via SCORM or other content definition specifications. Thus, a CMS strategy that retains the privilege of control also confers the responsibility of keeping pace with an evolving industry of teaching and learning resources from a multitude of providers.

The recommendations that follow build on these questions and positions.

8 Recommendations and Proposed Actions

The following recommendations set forth a path for remediating current Oncourse issues and creating an innovative set of personalized web services for students and faculty. The recommendations and their associated actions aim to achieve decisive leadership in CMS services.

Recommendation 1: Continue to invest in Oncourse as an IU Enterprise application rather than licensing a commercial CMS package.

Strategically, if CMS do in fact become unbundled collections of layered services that integrate and connect via personalized portals, this is exactly the wrong time to give up control and move to a packaged solution. Additionally, Oncourse has earned considerable buy in and trust from a large number of faculty. Even early adopters and innovators often place a syllabus link in Oncourse to their hand-crafted websites. Transitioning to a commercial CMS package offers only probabilistic value from additional features relative to the 100% certain pain of migrating the faculty and support services.

Oncourse governance needs to mature similarly to other enterprise applications. This involves engaging stakeholders through purposeful and timely mechanisms.

Action 1: *Immediately implement the new Teaching and Learning Systems Steering Committee structure with its Development Priorities and Policies Subcommittees for guiding Oncourse investments.*

Oncourse's underlying technologies are currently outside of IU's architectural standards for enterprise systems. All other enterprise systems and development skills are based on J2EE, Oracle, Unix, and RS/6000 hosting. Oncourse sits alone in Microsoft ASP, SQL Server, Windows 2000, and Dell hardware. It is thus isolated from economies of scale in training, support, development tools, staff rotation, career path, etc. from other UIS enterprise applications. As an unbundled CMS becomes more integrated with SIS, library, the Portal, and other services, it is imprudent to pursue further investment in an isolated set of tools and staff for an enterprise application. Additionally, Oncourse hardware will be facing major equipment replacement costs in the 2003-04 budget.

> **Action 2:** *Plan and fund a migration of Oncourse into IU's Enterprise Architectural Standards.*
>
> **Action 3:** *Unbundle Oncourse as a collection of services. Maintain its coherence as a single application, but open its services to integration with other campus services and the OneStart Portal.*

Recommendation 2: Direct Oncourse development efforts toward Open Knowledge Initiative architecture compliance.

Both Blackboard and WebCT have signaled some interest in the OKI architecture, and other universities are steering near- and medium-term development efforts towards building OKI-compliant tools. IU should enter discussions with the MIT OKI team to assess the feasibility of developing OKI architectural compliance within Oncourse.

> **Action 4:** *Conduct an exploratory meeting with the MIT OKI team for due diligence regarding Oncourse strategy and contribution to OKI (June 2002).*

If due diligence does confirm OKI as the right direction for Oncourse developments, this could position IU to contribute to and adopt tools from OKI member institutions. Since OKI's preliminary development direction is Java-based, this would also align very well with Action 2:.

Given that IU owns the code to a production system supporting 65,000 users, it could be an opportunity for Indiana to become a major OKI partner. Assuming feasibility and desirability of an OKI trajectory, the following action items would define an evolutionary path forward.

> **Action 5:** *Achieve OKI architectural compliance by 2004. Beginning with the Spring 2003 release (fall work), all new feature development is steered towards OKI compliance. Remediation of existing code will be planned for an evolutionary revision.*

Recommendation 3: Pursue aggressive integration efforts among IU's comparative strengths in Oncourse, the OneStart Portal, and Digital Libraries.

IU is extremely well positioned – relative to its academic peers – to innovate and lead through building on our existing strengths in Oncourse, the OneStart Portal, and Digital Libraries. Aggressive pursuit of integrating these capabilities will enable IU to innovate in creating customized, web-services for a variety of computing devices. These services will facilitate faculty and user experiences of access to personalized, integrated information.

> **Action 6:** *Increase funding for Oncourse innovation and integration towards a process-based set of campus services (e.g., buying textbooks – perhaps by auction, dynamic*

personal calendars from role-based data sources – syllabi, athletics, student organizations, Exchange, etc.)

Action 7: *Aggressively pursue grant funding opportunities for OKI and digital library tool development.*

Action 8: *Establish an integration taskforce to accelerate Oncourse connectivity to electronic subscription services and the Digital Library.*

Action 9: *Accelerate dialogues with faculty and staff to prioritize integration efforts.*

Action 10: *Create Oncourse tools (OKI compliant) to help faculty integrate library resources into their courses (e.g., a drag-n-drop interface between a navigating Digital Libraries and placing library resources in an Oncourse Assignment).*

Recommendation 4: Develop Oncourse as IU's lead initiative for mobile device connectivity via the OneStart Portal.

This recommendation builds on Action 6:. The signals are becoming clearer that wireless mobility will soon be a common part of student and faculty life. Devices will take many forms (handhelds, phones, tablets) and use various networking technologies (802.11x, 2.5G/GPRS, WAP). UITS needs to engage preemptive efforts to purposefully steer wireless development on campus. Abdication of this role will likely lead to a fragmented set of services that will proliferate security concerns and invoke future retrofitting costs.

Consistent with the view of Figure 5, Oncourse and the OneStart Portal provide an excellent target for innovation. Mobility services from Oncourse through the portal provide a great place for pilot projects that could provide UITS learning and valuable user services.

Action 11: *Appoint formal UITS responsibility for mobility strategy.*

Action 12: *Develop and fund a series of targeted pilot projects towards Oncourse/OneStart mobility for the 2002-03 academic year.*

Action 13: *Engage other campus units in mobility pilot project development and experimentation (e.g., Pervasive Technology Labs, Kelley School's Technology Studio, Informatics, IUPUI Engineering) to leverage student talent and expertise as target users.*

Recommendation 5: Aggressively pursue e-commerce opportunities that save stakeholders time and/or money.

The availability of personalized data, workflow, and network connections to the outside world provide rich opportunities for saving time and money. There are many preliminary discussions and ideas floating around with no formal process for vetting, funding, and implementing the more promising ones.

Action 14: *Establish a formal process for vetting, funding, and deploying CMS-related e-commerce innovation.*

This process would create a business case discipline for new e-commerce initiatives. It would also clarify appropriate funding sources and approaches for different types of projects. These could include state-funded development, "pass-the-hat" to take up a collection among interested stakeholders, or a venture capital approach with a charge-back recovery mechanism for use.

For example, the current approach to textbook procurement for students is highly inefficient for all stakeholders. A CMS – combined with portal and e-commerce capabilities – could present each student with a table of required/recommended books as rows and real-time "bids" from suppliers as columns. These bids could include the university bookstore, Amazon, local vendors, etc. The student could click on one vendor to buy the specially-priced bundle or pick and choose individual books as needed. The books could be delivered or arranged for pickup. Transaction fees from these providers could offset system development and maintenance costs.

As the form factor of portable devices continues to improve (e.g., tablet PC, digital book readers, etc.), electronic textbooks will find their place in academe. Again, the CMS, portal, and e-commerce offer economically-promising mechanisms for completely rethinking how students and publishers buy and sell materials.

Active experimentation is essential towards identifying winning and high value solutions. Capacity is needed for purposeful experimentation with the CMS and OneStart.

> **Action 15:** *Accelerate the university's capability to build, pilot test, and deploy promising CMS-related e-commerce solutions.*

9 Summary and Conclusion

A university's Course Management System is arguably the largest single service directly used by students and faculty. Its role is to further the very core of the teaching and learning mission. Indiana University's Oncourse has served the institution well, but many extensions and transitions will be required to keep pace with needs and opportunities. Oncourse is presently under-funded to keep pace with these requirements and opportunities.

This analysis document presents the first step in outlining a vision and incremental path towards its realization. If OVPIT leadership concurs with these recommendations, then more diligence will be required to put specific costs and timeframes with each action item.

Indiana University has established research leadership positions in high performance networks, teraflop supercomputing, and has the foundation for doing so again with the Pervasive Technology Labs and other initiatives. Our comparatively strong positions with Oncourse, the OneStart Portal, and Digital Libraries afford us extraordinary control over our own destiny in creating the leading teaching and learning technology environment for Indiana University's students and faculty. The recommendations and action items presented here provide the basis for next steps in the evolution of IU's enterprise-scale technologies to support teaching and learning.