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Building "Open" Frameworks for Education

The past two years have seen a dramatic upsurge in the preoccupation with "platforms" and systems for supporting course administration, class management, and online education. These systems have certainly been useful in raising the floor for faculty participation in online education. They have served primarily as engines for the masses in encouraging faculty, via relatively easy-to-use tools, to take steps (baby steps, in some cases), in using the Internet to enhance the classroom experience. This is important, and these all-in-one environments will likely continue to fill an important role for some time.

But as we move forward in a world of ever-increasing technological diversity and complexity, the current products will likely continue to grow larger and more intricate as they incorporate new features and engulf what were once distinct tools. In addition, the current online learning systems are limiting: they fail to represent the richness and dynamism of educational practice and, consequently, constrain the capabilities and services that are actually needed. We are thus learning that the educational technology systems of the future must be built from the perspective of enterprise infrastructure and must also have open frameworks as their technical substrates. An open-source, enterprise approach—with an architecture that enables and endures—is necessary for educational systems to thrive and grow.

Architecture That Enables

Educational applications and solutions have typically been localized in their orientation in that their value is realized differently in different contexts. Their development has also been inefficient and constrained because they have been able neither to leverage nor to integrate with existing enterprise systems. Our educational technology systems must be able to derive maximum value from the surrounding infrastructure.

We also must understand that the systems required to support education are mission-critical and foundational. No longer are such systems on the periphery of an institution's activity; they are becoming central, and their import may soon rival or exceed that of the various campus administrative information systems. With their need for integration and interoperability, common data definitions and standards, availability, reliability, and perhaps investment too, these enterprise systems for education have the same flavor and impact as enterprise systems for administration.

Administrative systems development now supports and encourages well-designed local ("shadow") systems through the delivery of enabling technologies and services. These enabling technologies provide central frameworks and tools to help managers of local systems make appropriate, effective, and secure use of institutional resources. Examples of such enabling systems can be found in the data warehouses and authorization (roles) directories that are becoming the norm on most campuses.

Today we are faced with a dizzying array of exciting educational technology initiatives and projects, many of which involve local development efforts that reinvent core services to build pedagogically interesting applications. In some ways these efforts might be considered educational shadow systems. As in the case of administrative systems, the educational technology systems of the future must find ways to enable and add value to these local activities.

The architecture of learning-management systems must support the development of diverse, customized tools in the support of discipline or pedagogically specific needs. These tools must link with critical resources such as the emerging digital library repositories, integrating these essential academic resources into online learning systems. Such architecture will promote both innovation and customization. It will allow various campus entities to provide resources and services to their constituents in value-added ways. For instance, professional schools often provide educational resources that are separate from and sometimes overlap with the services provided for undergraduate programs at the same institution. Furthermore, specialized approaches will likely increase as, for instance, teaching programs in engineering begin to adopt technology approaches significantly different from those used in the humanities. An enabling architecture and approach would allow an institutional entity, such as a school of medicine or school of business, to provide special academic services in value-added ways to its constituents. Why, then, impose centralized, monolithic systems?

Architecture That Endures

We must also be careful not to design the architecture too narrowly as we support diverse educational solutions. The fundamental frameworks for supporting educational applications, whether simple

or complex, must be designed for today while being open for the possibilities of tomorrow.

We cannot know what kinds of devices, operating systems, communication protocols, or other technologies will be available several years from now. Therefore it is necessary to keep today's learning systems' designs as technologically independent as possible. This way, our architecture will allow us to take advantage of the emerging technology.

The enterprise approach is one of sustainability and scalability. It calls for the development of an infrastructure that encourages a wide variety of academic applications sharing data and services via open communication protocols and open programmer application interfaces. Services include authentication, authorization, data and multimedia-document management, and workflow services, to name just a few.

The Open Knowledge Initiative (OKI)

An architecture that enables and endures is a necessary, but not sufficient, condition for a sustainable, robust educational technology system. A fertile model for distribution and business, one that complements this architecture, is also required. Such a model will enable the maintenance of the quality and intent of the original design. It will allow continued enrichment of the product suite through collective contributions from higher education and the marketplace.

One such model, currently being designed, is the Open Knowledge Initiative (OKI) (http://web.mit.edu/oki/). Funded in part by a grant from the Andrew W. Mellon Foundation, OKI aims to develop an open and extensible architecture for learning-management systems. Led by MIT, OKI is a collaborative project with Stanford University, Dartmouth College, Harvard University, North Carolina State University, the University of Michigan, the University of Pennsylvania, the University of Wisconsin–Madison, the University of Washington, and the University of Cambridge.

OKI's partner institutions are playing important roles in defining the architecture and specifying the set of fundamental Web-enabled learning components that will provide standard course-management features. If OKI stopped there, it would be of little interest, because it would merely have reproduced the functionality of existing platforms. But one of the main reasons for this initiative is that existing platforms, commercial or homegrown, are difficult or impossible to extend, either by building new educational tools on top or by linking the existing system to an institution's enterprise data services such as the registrar's databases or a digital library collection.

The OKI approach is modular. By creating several distinct modules of functionality with well-defined interfaces, OKI gains several advantages. First, this modularity allows the upgrade of a specific functional area more easily and without undue impact on the rest of the system. In addition, many applications require common sets of functionality. There is a common need for authentication, for instance, but there are many ways to provide for it, and several standards exist or are being proposed in this area. Most campuses have selected some common method for authentication, and a modular approach will allow a particular campus to modify its installation of OKI to take advantage of its local enterprise infrastructure.

Modularity brings intelligent extensibility in that it allows developers in different parts of the campus or at different institutions to share their work without having to concern themselves with local implementations of the various common services. Modularity also offers intellectual extensibility in that it allows different disciplines to create learning modules that are specific to their scholarly and teaching needs while building on the core services to provide continuity. This is perhaps the key promise of the OKI approach and supports the central idea that online educational systems should enable good pedagogy by supporting the broadest-possible range of development activity.

OKI's architecture and open source approach is designed to encourage both the partner institutions and, later, a much broader community to contribute tools and services to OKI's code-base. Whenever possible, OKI will look toward existing or proposed industry tools, open source solutions, and consortium-developed standards. Thus OKI is partnering with existing communities and movements, including the Instructional Management System (IMS) Global Learning Consortium, the work of the Advanced Distributed Learning Network (ADLNet). Like all good architecture, OKI is designed to be spare and elegant and yet provide the hooks and services that will make it a fertile environment for academic developers.

Although OKI is designed to promote the development of pedagogical applications that facilitate the management of learning content, it is not about the creation of content and course materials or the population of content repositories. That is the focus, rather, of MIT's Open Courseware Initiative (OCW) (http://web.mit.edu/ocw/), another Mellon-funded initiative. The goal of OCW is to make the course materials that are used in the teaching of virtually all of MIT's courses available on the Web, free of charge, to any user anywhere in the world. In promoting a vision of a world in which the course materials of higher education institutions are a shared global resource, OKI and OCW are complementary efforts. OKI will produce the open architecture, technical standards, and sharable software to ensure interoperability among the different platforms whereby institutions can publish course materials on the Internet. OCW will represent an immense repository of course materials that use the OKI framework and adhere to OKI standards.

Concluding Thoughts

Learning-management technology systems are emerging as the new component-based enterprise systems of higher education. Their success will require an open framework to provide an extensible infrastructure for building educational applications. Success will also require an open distribution model to fuel the support and encouragement of a vibrant development community from both education and industry.

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