Web Services in Higher Education — Hype, Reality, Opportunities

Web Services provide new opportunities for integration of disparate applications and the secure exchange of data and services over the Internet

By **Bernard W. Gleason**

Web Services are a set of software standards that govern the secure exchange of data and services over the Internet. The term can be misleading, so perhaps the best way to understand the concept is by a simple example.

Suppose a mail-order company has a partner agreement with a package delivery service. After a customer places an order over the Web, a Web Service lets the customer track the shipment's status from within the originating mail-order company's application. Web Services are the middleware glue that helps integrate these disparate and distributed applications and facilitates the timely sharing of information.

Web Services eliminate the need for an institution to discard or architecturally modify existing core business or legacy applications, or to move data and functions into a single operating environment to achieve integration. Whether an institution has invested in a large enterprise resource planning (ERP) system or elected to keep its legacy application system, new requirements and new opportunities to integrate these core systems with other business functions will result in improved efficiency for both the institution and its business partners.

John F. (Barry) Walsh, Director of Information Services at Indiana University, has likened the absence of application integration standards to an electrical system without standards. Suppose that every electrical appliance had its own voltage requirements and special plugs. We could not plug a device into a standard wall socket with certainty that it would work. That is the case with today's integration techniques, where every connection is customized, expensive to create, and expensive to maintain. As a result, real integration and interoperability of applications are minimal.

The Next Big Thing — or Hype?

Web Services is now in the hype stage — but *all* emerging technologies are hype at the outset. A parallel can be drawn with the introduction of the World Wide Web. Information technology experts to casual Web surfers recognized early on that the technology was going to shape the future — but not necessarily how and when. Over time the Web has become the preferred means to access information and services, and the Web browser has become the preferred client for all applications.

Similarly, Web Services will become an integral part of the application systems architecture for every enterprise,

including colleges and universities. "Buy versus build?" will no longer be a valid question when considering new general-purpose business applications. The strategy is becoming buy, don't build, but integrate.

Although in today's heterogeneous environments, no single application vendor can satisfy an institution's requirements, Web Services can provide a standards-based response to data interchange, integration, and interoperability challenges.

Less easy to predict than the "how" of Web Services is the "when." They are not likely to have a major impact for a few years yet, but a steady, staged adoption will occur. The following estimates the timetable:

- 2002 — The year will be dedicated to the refinement of Web Services and associated security standards. It will be a period of education and partnering. Businesses and application vendors will begin the process of adapting business models and products and will engage in the establishment of standards-based trust arrangements.
- 2003 — Web Services technology will be adopted for straightforward implementation of customer-to-business applications.
- 2004 — Web Services will support complex business-to-business functions that span multiple computing environments and require complete end-to-end processing of transactions.

Many technical issues need to be resolved and refined, but the commitment of institutions to Web Services as a strategic direction should be immediate. The first steps should be cooperative efforts with business partners to provide simple information retrieval in a trusted manner. They also should leverage the existing middleware infrastructure.

Web Services, Portals, and Trust Synergy

Web Services need to be addressed in the context of a comprehensive application systems architecture. This should include a set of complementary middleware technologies — particularly the institutional portal, central directory services and security, and trust relationships.

At the center of the application architecture lies the enterprise portal that supports a single sign-on for users and the framework for aggregating and presenting information and functionality delivered by Web Services. The individual windows within a portal presentation are referred to as channels. These channels are actually small programs. The portal framework manages the aggregation and presentation of these small programs for display in a standard way as individual windows. In essence, the portal provides a framework for building a new class of integrated applications.

In a simple scenario, the piece of information in which the user is most interested is provided by a Web service and displayed in a window in the portal. If more in-depth information is required, the user would be provided with a link to the source application and would be automatically authenticated. If a business transaction requires information from different sources, then multiple user-facing Web Services could be plugged into a standards-compliant portal framework. Theoretically, integrated applications could be created without the need for special programming skills.

Web Services also depend on a strong institutional authentication and identity management system that supports single-sign-on, controls access, manages trust relationships, and protects personal privacy.

Identity data, which is maintained in standards-based directory services, is accessed to authenticate users (faculty, students, staff) to the portal and other campus applications. For Web Services to integrate easily into the application framework and to provide convenience to users, it makes sense for business partners to accept user credentials that are maintained within the institution's directory service.

If the institutional portal creates a trust with the user and a trust with the provider of the Web service, then a trust relationship develops between the business partner and the user. This trust arrangement, referred to as transitive trust, would permit businesses to securely authenticate user identities across security boundaries and to broker services, particularly as institutions outsource more services.

New Service Applications

For the past 15 or so years the IT industry has experienced a steady trend toward the provision of more and more self-service functionality. The benefits have been obvious: greater customer convenience and satisfaction, along with a reduction in support costs. The Web is the preferred method of accessing information. The application integration capabilities of Web Services facilitate the creation of new integrated service applications.

Service applications are a new generation of self-service applications, but with the added dimension of full service. New applications can be stitched together from components of existing applications and modeled to create new business processes that address the needs of specific users or classes of customers in a comprehensive and composite manner. Web Services can simplify this kind of application integration by applying the same standards regardless of whether the information is accessed within the institution or with a business partner across the Internet.

Service applications, which can conform to the special needs of customers as opposed to being general-purpose, will force changes in thinking and in approaches to managing applications. For example, a new faculty member on campus might be required to perform a number of initiation tasks — sign up for employment benefits, apply for a campus ID card, acquire an e-mail account, designate beneficiaries with TIAA-CREF, specify bank routing for automatic deposit of paycheck, and so forth. Rather than forcing the faculty member to learn where and how to visit multiple offices or Web sites, the use of a service application to aggregate these multiple functions would provide convenient one-stop service.

Who designs, builds, maintains, and supports this new type of cross-functional application?

Business Integrators

Success is not merely the deployment of new technologies such as Web Services; it results when nontechnical business experts can build and maintain new service applications in an easy and inexpensive manner. Although such a scenario is distant at present, in the near term technology-savvy business integrators will collaborate with technical staff, actually component assemblers, who could build new services applications in a matter of hours rather than weeks or months.

Looking ahead to the time when the full segregation of duties is possible, information technologists will create and maintain the required technical infrastructure, and new development tools will eliminate or negate the complexities of Web Services and the need for expert programming resources.

ERP and Application Vendors, Application Service Providers

Up to now ERP vendors, application vendors, and application service providers have maintained completely stand-alone operating environments and thus require users to authenticate with different sets of credentials. Application vendors and service providers have avoided providing real-time integration points because of the lack of standards for authentication and data exchange, and the high costs of supporting customized integration.

Some ERP and application vendors have attempted to address the integration issue by positioning their application suite as the center of the universe, defining their products as the institutional portal and the central point of integration for all campus resources. Selecting an application vendor as an enterprise integration partner contradicts the premise of Web Services — deploying standards and avoiding costly proprietary solutions.

Software vendors recognize that the deployment of integration standards is cost-effective and that the additional capabilities will add value to their products. The vendors also realize that they must consider new strategies for creating and selling components and portions of their application suites. The vendors can be expected to cooperate on two fronts: first, support for single sign-on, standards-based authentication and trusted relationships with standards-compliant portals; and second, offering Web Services components that are ready for integration into standards-compliant portals.

Opportunities and Directions

Progressive deployment of Web Services will not start with the application vendors but from an unlikely source — the federal government. The incentives for the government are clear — efficiency, cost reduction, and urgency, not profit. The opportunities to use Web Services to eliminate untimely batch exchanges or to eliminate paper transmissions between institutional applications and government agencies are limitless. In response to threats of terrorism, legislation has made information sharing among government agencies, with state and local officials, and with institutions a national priority.

Despite past failures during the dot.com implosion, the netsourcing (outsourcing) of application services over the Internet will become more viable. In the future, Web Services could provide companies with the flexibility to quickly switch trading partners by unplugging the Web service from one provider and plugging in a replacement. The motivation to swap service providers would be driven by positive factors, such as competitive pricing and a broader range of services.

Extensible Mark-up Language (XML), which is the Internet standard for data interchange, lies at the heart of all aspects of Web Services. All data types (text, images, audio, video) will be mixed with data and other components, such as Web Services, to provide completeness to new service applications. These reusable components will need to be managed in an enterprise content management system based on XML.

In the short run it will not be possible to fold all internal business processes into the enterprise portal or to solve data interchange with Web Services. Also, internal systems may employ messaging mechanisms for transporting data that are superior to low-level Web Services protocols. Complementing Web Services integration should be an enterprise workflow system based on XML.

Systems software vendors will provide broad-based support for data interchange standards and will incorporate Web Services into enterprise application development environments. Service applications, which are built from multiple Web Services components, will require a structured development environment, along with easy ways to manage components and multiple inclusions. Colleges and universities will be both publishers and consumers of Web Services, and institutions will maintain directories for internal Web Services. A national organization will need to take responsibility for registration of Web Services and management of a directory for higher education.

Web Services Ahead

Web Services are an evolving and widely accepted technology and a logical step forward. No other reasonable approach exists to solving the integration of distributed applications over the Internet. Over time the capabilities of Web Services will expand and be incorporated into application architectures in ways that cannot be envisioned today. The complexities of application integration will diminish, and a new generation of service applications will emerge — applications designed and built by business integrators, not programmers. *e*

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