Institutional Information Portal
Key to Web Application Integration

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Introduction

The institutional information portal should be treated like the "family jewels." Every college and university has two very valuable assets: identity/brand – e.g., Boston College name – and loyal constituents – e.g., alumni, students, parents, staff, prospective students. These assets need to be protected, and ownership and control of the institutional information portal should not be relinquished to an outside agency. One reason for reaching this conclusion is the desire to keep the portal free of commercialism. However, the more important reason is that the institutional information portal is a key ingredient in the strategic and technical framework to integrate applications and to customize the delivery of information to all constituents.

As we employ new advances in Internet and web technologies, the focus is going to stay on customer "self-service" but with an added dimension of "full-service." Institutional portals promise to be the user-elected point of entry that will provide all constituents with a single, personalized, web interface to all information and application resources in a secure, consistent and customizable way. The portal also promises to be the means by which multiple devices and multiple access methods can be utilized to retrieve all appropriate information resources in an integrated manner anytime, anywhere, with anything.

Figure 1 provides a conceptual overview of the architecture that will integrate and broker services to all applications and for all users and for all devices. The flexibility and scalability of the architecture is going to provide for the continuing evolution and inclusion of new types of applications, particularly e-business, e-learning and the outsourcing of internal business processes and functions on an application-by-application basis.

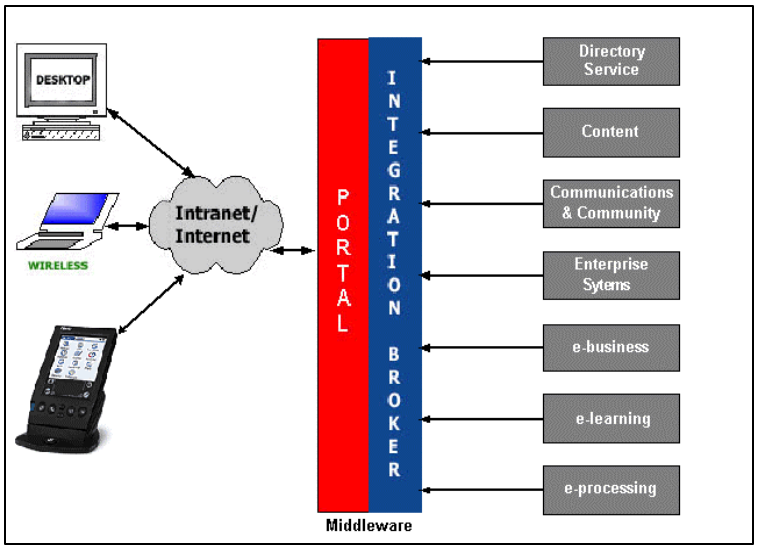

Figure 1 -- Web application integration architecture

The institutional information portal is as important to the web application integration architecture as the browser is to the client interface. The browser provides a common client and the portal provides a common framework – a framework that is based on an open architecture and available to all vendor applications to provide standard interfaces. The portal must be free and available to all constituents, just as the web browser is a free client on every desktop; there cannot be any fiscal impediments to customer participation.

The emergence of web access to all university services will force institutions to rethink everything from institutional image, to systems architecture, to new business and instructional models, to the Information Technology organization. As institutional leaders and technology experts, we need to step back, to reflect, to "think" and to take a university-wide perspective with an eye toward the future. And we need to educate at all levels of the institutional management, explaining how the institutional information portal will change the way in which all constituents will interact with Boston College and the way in which all new information systems will be designed.

Approximately twenty institutions, including Princeton, Yale, Cornell, Brown, Delaware, University of British Columbia, Columbia, Notre Dame, Holy Cross, Georgetown and Boston College, share a common vision of an open portal architecture that supports customer-centric services. These institutions, recognizing the need to protect the institutional image, to exploit the potential of the portal and to promote the use of Java technology, joined together under the sponsorship of Sun Microsystems to form the Java in Administration Special Interest Group (JA-SIG). JA-SIG members identified that the need align the interests of institutions and to share or reduce development costs. For the past year institutional volunteers have been working actively and collaboratively to create a common portal reference framework called uPortal. The uPortal cooperative effort has gained momentum and is now being sponsored and supported by an award from the Mellon Foundation.

This paper will discuss the strategic role of the common portal reference framework in the institutional web architecture and will investigate the related institutional image and management issues.

What is an institutional information portal?

Institutional information portals in the commercial world are referred to as enterprise information portals and are derived from their more global counterparts (e.g., Yahoo!, Netscape) that aggregate information from disparate sources. In an academic setting the corporate stigma is removed by substituting the word institutional for enterprise. Institutional information portals are applications that provide all members of the community with a single, intuitive and personalized gateway to access and to integrate campus-specific information, stored in the campus databases and systems, with externally stored information.

The campus web site may be viewed as a collection of thousands of pages or department web sites but a portal is a collection of many applications. One of the strengths of the

portal architecture is that fully functional, server-side applications can run within a single, common user interface.

Figure 2 is an example of personal portal page. Each box, which is referred to as a channel, represents a separate application. Located on the banner of each channel are buttons that allow users to customize the content in a channel, or to minimize, expand or hide the channel.

Figure 2 – Sample portal page

Initial implementations of campus portals were restricted to specific groups (e.g., students only) and to generally available information services such as news and weather, communications (e.g., e-mail) and online communities (e.g., chat). Over the past few years colleges and universities have taken portals one step further and have begun to provide forms processing capabilities and secure access to enterprise systems (e.g., student and human resource records) and other personal information resources (e.g., calendar). Institutions are now faced with the challenge of providing expansive and integrated applications, and defining how the customer-centric designs of the portal fit with the overall architecture of the campus web environment.

The portal requirements for secure services and integration are the same as the concepts for business-to-customer (B2C) e-business applications. In a campus environment B2C could refer to business-to-constituent. As we move forward, our customers, all of our constituents, are going to expect that all information services will be accessible via the Web in a personalized and integrated form. We know generally where we need to be; it is now a matter of plotting the right course.

Institutional Web Strategy

A college or university cannot have an institutional portal strategy without a total institutional web strategy and a set of design standards. The portal is at the center of the institutional web strategy and needs to be viewed as an integral element, not just as an add-on or as a competing technology. The portal represents a change in institutional philosophy in the delivery of services and a major shift to a customer-centric design. In a portal-centric structure the customer is the “star” and content and services are structured so that all constituents will utilize the portal as their primary entry point**.**

There are three main content views of the institutional web site: hierarchical pages, audience pages and personal portal.

Figure 3 illustrates how the three views are inter-related and the vision of how different types of visitors will want to access the campus web site. The hierarchical pages accessed through the public web site (www.*collegename.*edu) will continue to be the point of entry for visitors and casual users. The audience pages will provide content that is designed for specific groups (e.g., faculty, students, alumni). Portals will be the gateway for the delivery of personal information, secure services and integrated applications.

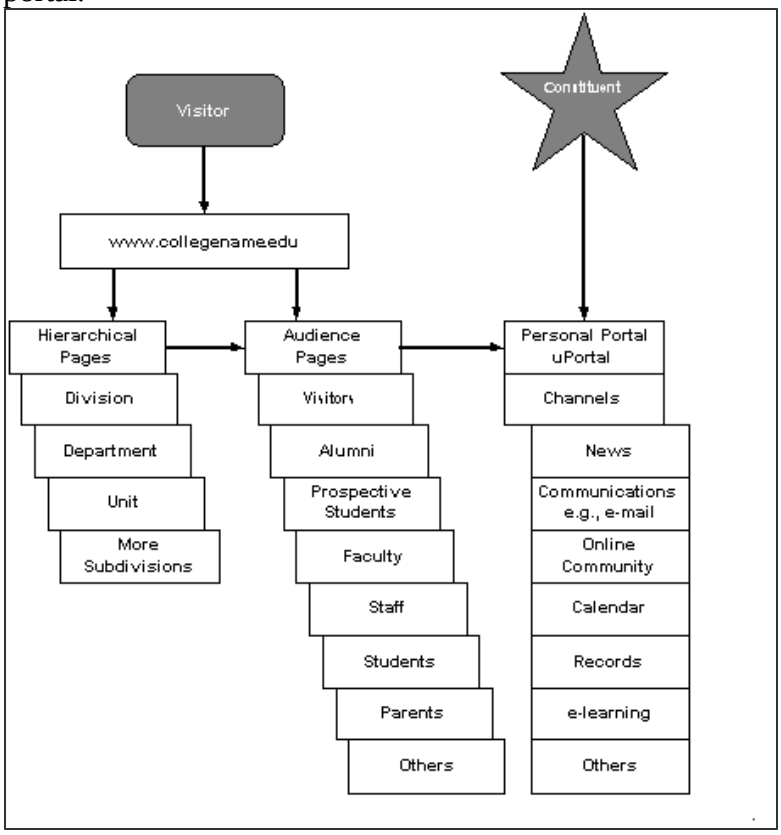

Figure 3 -- Web site overview

Hierarchical pages

In a typical institutional web site the top page or institutional home page, www.*collegename.*edu, is the public web site and the primary entry page for external visitors and the general public. The top page sits at the top of the hierarchical organization of web pages; that view is represented in a structure defined by divisions, schools, departments, units, clubs, etc. Traditionally the coding and the management of content have been decentralized with a loose linkage of all of the components of the hierarchy. Because the pages are designed to service the general public, most information is not confidential and all content is available to everyone.

The institutional web site is now a major component of the institution's mass communication, marketing, recruiting and fund raising efforts, and it is now likely that the information on the Web is reaching a larger audience than traditional print publications. For example, at Boston College we have experienced a steady and sharp increase in activity over the past year, and we now have over one million session visits per month to the public web site. The top layer pages of the official hierarchy of the university must now conform to quality and accuracy standards and have a consistent appearance and navigational structure.

Audience pages
Each external audience or constituency will have a specific, information-only audience page. For example, there will be separate audience pages for parents, faculty and students. These audience pages will all have a similar format and use the same consistent interface design and navigation scheme, but each will be composed of a mix of general information and audience-specific content. Audience pages also provide a guest view of insecure information for visitors who can't or won't authenticate. These audience pages will contain instructions and a means for logging into a personal portal (institutional information portal) in order to access personalized, customized and secure information and transactions.

Personal portal pages
The personal portal takes the concept of audience pages a couple of steps further. The first and most important architectural concept is that constituents will log into the portal to identify themselves and that every constituent will be provided with the capability of having an individual portal page. The portal presentation then consists of everything that is appropriate for the constituent's audience group plus content and services that are authorized for the individual. Content and available services are presented in a personalized and customized format based on individual profile information, access control privileges and individual preference parameters that are stored in a central directory service.

At Boston College all constituents (e.g., students, alumni, parents) will authenticate against a central directory service (LDAP) with a combination of any standard BC identifier (eagle number, social security number or username) and personal identification number (PIN). Constituents will be easily enticed to identify themselves because the portal login is standard – there will be nothing new to know or to remember, no new passwords or different passwords for every service. Individuals may belong to multiple constituent groups (e.g., staff, parent, alumnus) but they will have only one set of credentials – same ID and PIN/password and a single e-mail address.

Audience and personal portal pages provide a needed virtual facility that is not always accommodated by the institutional hierarchy. For example, there probably is not an Office of Parents in the university hierarchy but there is a need to organize and to present information and services to parents in a meaningful and unified format both as audience pages and as personal portal pages. Information presented to an authenticated parent on a personal portal page may range from parent events, to general campus news, to proxy services to access his/her daughters' student account, to capability to make contributions to the university's capital campaign.

Common Portal Reference Framework

At an early meeting of the JA-SIG a discussion of portal strategies was characterized by one university representative as a "group therapy session." Every school seems to be facing the same issues. At many colleges and universities there are multiple independent portal projects in process. Often there is poor coordination, an absence of a standard technology architecture, and very little management insight and control. This disjointed

approach has resulted due to the lack of a clear-cut definition of a portal and technical guidance to help software vendors and their customers to build the needed portals.

The participating institutions recognized the opportunity for a common solution and have defined the following requirements for a common portal reference framework:

- Provide access to all information and services through a single graphical interface
- Support a single log-on to obtain authentication and authorization to all information resources and applications
- Provide a framework where all elements of the university (academic, administrative and community) and all business applications can be integrated
- Provide a convenient set of web-based communications services
- Provide a one-stop place to perform all business transactions
- Provide the ability to present information and access to services on an individual basis in a personalized manner
- Provide each member of the community with the ability to customize the appearance, layout and information
- Grant to the university full control and management of appearance and content
- Be vendor independent (not locked into proprietary hardware and/or software)
- Be free of commercialism
- Be available to all constituents 24 hours a day, 7 days a week
- Be flexible and able to absorb new technology advances and new applications

Using these specifications, developers from member universities worked with software developer, Interactive Business Solutions, to produce uPortal. The objective of uPortal is to provide a common framework and a set of channel standards to which application developers and commercial application vendors can write a standard, one-time only interface. The first version of uPortal, which is available at no cost to all colleges and universities, was released in July 2000, and uPortal 2.0 is scheduled for the first quarter of 2001. More information about uPortal and JA-SIG membership, conferences, and cooperative initiatives can be found at the JA-SIG web site: **http://www.ja-sig.org/**

There is universal support for the uPortal open source effort, and many institutions are waiting for uPortal 2.0 to be release for evaluation. These institutions are hopeful that uPortal will be adopted by a critical mass of institutions and that there will be a permanent support structure. uPortal is going to need a permanent organization to coordinate product development, to consult with prospective content providers, to build application connectors, to solicit code assets from vendors, to conduct quality assurance and certification tests of new releases, to provide installation and customer support services, and to market the product and the concepts. uPortal is going to need to be a stable product to be consider as the institutional information portal solution.

Alternative portal strategies

The topic of portals and application integration is “hot” on every campus and information technology planners everywhere are busy sorting through the options and devising strategies for their institutions. For the sake of discussion the portal options have been separated into the following groupings:

- Higher education portal vendors – e.g., Mascot
- Enterprise Resource Planning (ERP) vendors – e.g., Peoplesoft, SCT/Pipeline
- Higher education portal vendor with ERP affiliation – e.g., Jenzabar
- Major application vendors – e.g., Blackboard
- Portal software vendor – e.g., Plumtree, Epicentric
- Open Source – e.g., uPortal
- In-house developed – e.g., Agora (Boston College)

Higher education portal vendors

Over the past couple of years colleges and universities have been inundated with vendor proposals to provide their rendition of a campus portal at no charge to the institution. These portal vendors have created hosted portal sites that are geared to the higher education market and derive their revenue from selling advertising banners or including prominent links to sites, which in turn sell products. These vendors also have marketed their so-called "good deals" to individual units within the campus in attempt to get a foot in the door. The major marketing pitch of the vendors is that it would be too expensive for an individual institution to develop a campus portal on their own.

For smaller institutions and some institutions that are only concerned about a limited population (e.g., just students) the higher education portal option has been an attractive short-term tactic. These schools have been able to get up and running quickly with very little financial impact; however, they have surrendered control of the institutional image and constituent base. In the long run it is questionable whether any of these higher education portal companies, who are supported primarily by advertising revenue, will be able to stay in business. For larger and more diversified institutions that are seeking an enterprise solution and the integration of applications, affiliation with one of these vendors is not advised.

Enterprise Resource Planning (ERP) vendors

ERP vendors have entered the portal arena by offering products that integrate tightly with their ERP product offerings. These ERP vendors profess to be building products based on open standards and to be building partnerships with other content providers, but the portals are being built with proprietary tools and proprietary channel interfaces. If an institution has the full range of application systems from a particular ERP vendor, it may make sense to select the complementary portal product. This approach, of course, will lock an institution into a single proprietary vendor and establish dependency on the vendor whose primary interest is in owning the entire market, not servicing the best interests of the institution. A better long-term strategy is to employ a completely open portal and to access the enterprise systems with standard portal interfaces.

Higher education portal vendor with ERP affiliation

There is another group of vendors who are essentially the same as the ERP vendors. These vendors started out as higher education portal vendors offering community services – e-mail, chat, news -- then realized that they needed to address the customer demand for tighter linkage and access to institutional data systems. These vendors have in effect copied the SCT/Pipeline model of linking the portal with a suite of enterprise

software. With the acquisition of four enterprise system vendors -- CARS, Quodata, CMDS, and Campus America -- Jenzabar has chosen to solve the problem of gaining instant access to a customer base by attempting to meet the portal integration requirements of the users of these application systems. Institutions in this market segment can be characterized as smaller colleges, who are likely to relinquish control for ease of implementation and management.

Major application vendors

Many application vendors, particularly in the course management area, have been forced out of necessity to create or to license a portal framework to support their operating environment. These application vendors, particularly Blackboard, have positioned their product set to be the campus portal solution. Their strategy track is similar to the portal designers: each is attempting to build and to deploy an enterprise solution that will be completely web-based and will be used by everyone. Building out the institutional portal architecture from within a single application is the wrong approach. These application systems need an underlying portal component in their architecture, but the application system should not be the institutional portal unto itself.

The pressure is on the application systems vendors to integrate with the rest of the institution's information data sources and acquire basic authentication/authorization services from an institutional (enterprise) information portal. These vendors may possibly adopt open systems efforts, such as uPortal, as the application portal framework. At the very least these application vendors will need to provide compatibility between the application portal and the institutional information portal. In the future the commitment by an application systems vendor to open integration with the institutional portal architecture is likely to be a pre-condition for selection of application products.

Portal software vendor

A pure portal vendor is another alternative for colleges and universities to consider. In fact if institutions cannot wait for an acceptable production version of uPortal or the uPortal initiative is not successful, then the selection of a pure portal vendor could be a logical direction. One of the problems that we face in dealing with commercial software vendors is the proprietary nature of the products, pricing structures, lack of orientation to the higher education market and limitations on deployment. In the case of portal software that is going to be utilized by hundreds of thousands of constituents when alumni and prospective students are folded in, the commercial per-user pricing models and use restrictions could be problematic.

Open Source

There are open source projects such as Angel CMS/Portal from Cyber Learning Labs (**http://CyberLearningLabs.com/**) and Jetspeed from the Java Apache organization (**http://java.apache.org/jetspeed/site/index.html**) but uPortal is a common portal reference framework that is designed by higher education and for higher education. However, successful portals require more than framework, they need both institutional and syndicated content. Astute vendors and content providers will recognize the value of associating themselves with an open, standards-based initiative that is supported by most of the selective colleges and universities. For vendors there will be a strong inducement

to provide a single, standards-based interface to the uPortal framework, thus eliminating both vendor and institutional integration costs. At the same time, schools will be able to retain their individual identities and total control over their institutional web sites.

In-house developed

Many of the institutions have considered developing their own portal. Some have developed some portal-type services, such as secure access to student records, and are trying to build off that base. The motivation to build in-house has been driven by expediency and the uniqueness of existing file systems. Many of the institutions that are involved in the uPortal initiative fall into this category, and the opinion of the group is that it would not be wise for a single institution to absorb the expense and developer resources to create a homegrown, proprietary solution.

Boston College strategy

Many universities are in a similar position in evaluating options –wait on uPortal, or develop in-house institutional information portal, or adopt a commercial portal product? At Boston College our strategy is to continue on an interim basis to enhance our internal web services site, Agora, which has been in existence for about three years and has existing linkages to legacy applications, to look to uPortal as the long-term solution, and to aggressively support the efforts of JA-SIG. If the uPortal initiative fails to meet its goals, then we will need to consider purchasing a commercial portal product and continue to utilize Agora as an interim solution. In any case our strategy is to own the portal and never consider turning the portal over to a third party portal vendor or to build the portal out from a major application system.

Leadership, management and responsibilities

The key to the development and implementation of a “world-class” web environment is the designation of leadership and a concentration of decision-making responsibility. Community involvement and input is essential in setting of web strategies and architectures but this is not a role for a committee. The university has to feel confident that it can place the responsibility and trust in the hands of a single, knowledgeable individual or a small, informed and dedicated group of individuals. This leadership must be capable of providing a strategic, university-wide perspective of the role of the Web, to conceptualize the entire web structure and information flow, and to possess the technical knowledge to formulate the web application integration architecture.

What will be the source of this leadership? The logical place is from within the information technology department but there is a dilemma. There is a need for two different skills for the leaders and workers. At the outset there are some intermediate-term requirements for building the required technical infrastructure, but in the long run the concentration of resources will be in the softer skills of communication, training, interface design, integrated application design, source code management and content management. In the long run the technical issues may be easier to address than the political and operational matters, and the leader needs to be someone who can reach out to the community and orchestrate the implementation of university-wide services and

innovative solutions. This leadership may come from someone who is not part of the information technology organization but who is information technology savvy.

The technical leadership must come from within the information technology department, and the creation of the web strategy and architecture must be the sole responsibility of the technical leadership. The challenges of creating the institutional web architecture can be summarized in two words: infrastructure and integration. There must be a common software infrastructure and there must be a common set of integration standards. Without a common framework and standards there will be chaos with ineffective and very expensive support costs. To meet this challenge the information technology organization needs to establish a separate unit composed of developers and innovators who are dedicated to building and implementing the required framework and software infrastructure.

The adoption of an institutional information portal strategy infers the employment of a top-down approach to design and implementation, the adherence to institutional standards, and the definition and separation of duties and responsibilities by area of expertise. For example, content is the responsibility of the departmental providers, institutional marketing and publications unit supplies identity, technical infrastructure is the responsibility of information technology professionals, and user interface and navigation is the domain of professional interface designers.

Too often staffs within the information technology area and within the departments mistakenly view themselves as web experts when they are often novices with a very limited perspective. That is particularly true with respect to the components of the interface (i.e., colors, designs, navigational structure) and application design. The situation has been exacerbated by the fact that many of people in departments have been responsible for designing and producing local web pages using their creative skills. Many have a very limited view, which often leads to expediency and a lack of conformance with institutional standards and strategies. For example, it is not logical for an institution to be implementing a portal strategy with a single sign-on standard at the same time that new applications are being introduced that require new sets of identifiers and passwords.

Web designs, portal channels and all forms of content should be centrally managed with the same discipline and commitment to standards. Institutions should consider the purchase and installation a content management system to improve the currency of content, the reusability of content on many web pages and a reduction in the need for technical skills in departments. The content management system should supplement the functionality of the portal, as opposed to the portal adapting to the content management system.

Content and services within the institutional information portal are customized and personalized by user. Therefore, the portal must be capable of dynamically displaying a personalized index of available resources on an individual basis using the same parameters and access controls that govern portal content. For example, a faculty member that is assigned to a course would have a personalized index of available processes and

procedures. The index would include entries and links to instructions for submission of a grade change and how to access transactions to process the grade change. Other constituents would never see these entries in a personal index of services and would never have access to either the instructions or the transactions.

Functionality and convenience are the most important design considerations for personal portal pages, but the interface design should still provide the highest level of consistency for the user and seamless integration with the rest of the institutional web site. There is anecdotal evidence that suggests if a portal is well designed, customers will do very little individual customization.

Integrated applications

New integrated web applications will cut across department lines and will aggregate and present information and services from multiple sources within a common user interface. Customer interaction and presentation should be based on processes, and all of the required information and transaction capabilities for a particular process should be ordered and delivered in a complex, integrated design that provides end-to-end fulfillment in a single application. For example, in the past the student registration process has been restricted by the data and business logic of the student record system. On the Web and in the portal infrastructure the student will have convenient access to an expanded set of information and services that are aggregated from many sources (e.g., course catalog, course management, bookstore, finance, financial aid, degree audits, advisement, wait listing, etc.).

Figure 4 provides a sample illustration of how all necessary resources could be made available to a student during registration. The example also demonstrates how the portal functionality and channels could be incorporated into an application to create an application portal within the institutional information portal.

Figure 4 -- Portal within the portal

In the student registration example above, the techniques that would be employed are similar to any e-commerce application. The student searches catalogs, checks inventory, puts selected items (courses) into a shopping cart, determines when the process is complete and possibly makes financial settlement.

Some applications will be distributed across multiple platforms with some processing outsourced over the Internet. Access to secure services will not always be executed by logging into the portal but all applications will utilize the functionality of the portal and integration infrastructure for authentication. The sequence of screens below depicts an

alumnus entering the Alumni Association audience page in order to gain secure access to the alumni online community services that are hosted at a remote location.

Figure 5 displays how the alumnus can select Online Community from the Alumni audience page.

Figure 5 -- Audience page

In Figure 6 illustrates the required log in procedure and authentication against the same LDAP directory service that is utilized in the institutional information portal

Figure 6 -- Directory service log on

Figure 7 displays the results after authentication by Boston College. The alumnus is actually connected to a secure service that is hosted by an off-campus application service provider (ASP).

Figure 7 -- Hosted service

The sequence of screens also demonstrates how the institutional identity has been applied across three computing environments to provide the customer with a high-quality appearance and a consistent navigation structure of a single application. This same model and logic could be utilized for other applications. For example, an institution could integrate an internal purchasing and budget control system with a business-to business, e-procurement service over the network in a similar manner. The possibilities are endless with vendor cooperation and the proper institutional integration infrastructure in place.

Closing Comments

How do we alert and educate the members of the administration and the university community about the importance and potential of the institutional information portal? How do we gain assurances from the university that institutional web and portal strategies will be adopted and embraced and standards will be enforced? How do we get the highest levels of management focused on a set of inter-related strategies that are too technical for most executives to understand but are critical to the central communications functions and future operations of the university?

Top management is focused on three things: how will the institutional web and portal strategies enhance the institutional image and the educational experience, how will customer service be improved, and how will new efficiencies translate into lower costs? We need to frame issues in non-technical terms and appeal to the basic instincts of all good decision-makers; instincts like intuition, commonsense and the urge to be the best. Executives will understand and endorse clean and professional presentation formats, consistent navigational concepts, quality and integrated content, and customer-centric designs. They also will support techniques such as single sign-on because they will comprehend the inherent savings and convenience to customers by eliminating the need to maintain a multitude of usernames and passwords.

Executives expect a comprehensive and visionary approach to solving major institutional issues. The traditional role of all senior managers in the university is to set and nurture long-term goals and strategies. These strategies include areas such as long-range fiscal planning, enrollment management, campus buildings master planning, and athletic programs. The web strategy has a similar impact and needs to be categorized and prioritized as another major institutional strategy. Standards for web design, protection of the institutional identity and image and better ways to service our external and internal customers are now institutional priorities. Information technology is now challenged with the task of implementing an institutional information portal framework and creating the required software infrastructure to support integration of all applications and information.

Enterprise resource planning (ERP) and application systems vendors are also being challenged to provide standards-based interfaces and to integrate their products into a common portal framework. It is in the best interest of institutions and vendors to have a single set of open standards, and over the next year ERP and application vendors will incorporate an open portal framework (most likely uPortal) into their product and integration architectures. The portal will emerge as the key to web integration and the primary institutional interface to all information and applications.

The ideas, personal opinions, strategies and directions in this paper are being offered because sharing ideas is the key to building consensus on campus within the business and technical units, within the greater higher education community and with business partners.