



# PRINCETON UNIVERSITY

## IMPLEMENTING A META PORTAL STRATEGY USING SUN™ ONE

### KEY HIGHLIGHTS

#### Institution

Princeton University

#### Industry/Market

Education

#### Business Context

- Through its Partnership 2000 plan, the university has migrated to a 3-tier, distributed system for its administrative environment. Several initiatives for business applications have resulted in investments into the building blocks of the Sun ONE architecture such as portal server and directory server.
- The university is embarking upon a comprehensive Web Strategy for improved and expanded university use of the Web.
- The university is also looking to bring all its portal initiatives under a meta-portal framework.

#### Business Challenge

- A comprehensive Web architecture that can provide superior scalability, flexibility, reliability, manageability, security, and personalization.

Located in a suburban section of New Jersey, about equidistant from the cities of New York and Philadelphia, Princeton University enrolls approximately 4,600 undergraduate and 1,750 graduate students. Founded in 1746, this elite, Ivy League institution is the country's fourth oldest university.

Princeton, like other universities, is increasingly conducting its business and communicating with its students, faculty, staff and alumni through the Web. Based on this realization, the university is in the process of developing a comprehensive strategy to improve and expand the University's use of the Web.

Three major technology initiatives are taking shape at Princeton:

- A strategy to improve and expand the creativity, flexibility and innovation in the use of the Web.
- An initiative to Web-enable the client/server based administrative systems.
- A strategy to integrate the multiple stand-alone portals and aggregate typical administrative applications into a single interface.

The Web strategy builds on a prior initiative called the Partnership 2000 plan. This plan, initiated in 1997, was developed to address the Y2K problem and migrate the administrative systems from the complex main-frame environment to a three-tier, client/server model. Several initiatives—financial reporting, receivables, HR—have been proposed as part of the plan. The next phase is Web-enabling these client/server applications.

In parallel, several other campus projects have moved forward with their own Web

portal implementations. These include: a Blackboard course portal, an Alumni portal and an Oracle portal. Other portal projects are underway too, each with its own data, look-and-feel and security models. As part of the Web strategy, the university is looking to unify the portals into a single meta-portal with single sign-on capability.

With Web access to all university services, Princeton is being forced to rethink everything from brand and instructional models to systems architecture and portal strategy. The technology initiatives are aligning to drive Princeton in a technology direction that is consistent with the one envisioned by the Sun™ ONE architecture for higher education.

This case study illustrates the forces that are shaping Princeton's mission in the 21<sup>st</sup> century. The case study then illustrates how the Web Strategy is being molded to support the mission. Translating the Web strategy into a robust portal architecture is the natural next step. This sets the university on a migration path where a Services on Demand architecture will be the foundation for creating value.

The role of the various building blocks of the Sun ONE architecture in making the emerging portal architecture a reality is also presented in this case study.

Sun ONE is a platform that enables higher education to create, assemble, and deploy XML-based Web services.

Sun ONE is the acronym for Sun Open Net Environment. Sun ONE is the vision, products, services and expertise of Sun to enable the delivery of Web services today and Services on Demand tomorrow. It is Sun's Web services strategy. Web services are self-describing applications that can discover and build on DARTs. DART is the acronym for Data, Applications, Reports, and Transactions that collectively form the invaluable information assets of an organization or university. Services on Demand understand user context, traverse multiple networks, and provide a rich user experience, all in an open architecture. Sun ONE is a platform that enables higher education to create, assemble, and deploy XML-based Web services.

## Princeton's Mission & Technology Strategy

Over the past few years, Princeton, like other colleges and universities, has been buffeted by technological changes and rapid increases in economic pressures that consume its time and resources. To focus the scarce resources, the Board of Trustees outlined a plan for the university.

The plan states the university's mission in the 21<sup>st</sup> century as follows: *Princeton strives to be both one of the leading research universities and the most outstanding undergraduate colleges in the world. As a research university, it seeks to achieve the highest levels of distinction in the discovery and transmission of knowledge and understanding, and in the education of graduate students. At the same time, Princeton aims to be distinctive among research universities in its commitment to undergraduate teaching. It seeks to provide its students with academic, extracurricular and other resources that will permit them to attain the highest possible level of achievement in undergraduate education and prepare them*

*for positions of leadership and lives of service in many fields of human endeavor.*

As Figure 1 illustrates translating the mission statement into a cohesive technology strategy is the next step. Increasingly, it is Princeton's policy to use the Web to complement existing business practices, especially when they can be done in a way that advances Princeton's values, goals, and purposes.

## Creating an Infrastructure Plan to Support Mission

By the mid-1990s, the complexity of the academic environment at Princeton had surpassed both the architecture and capacity of the IT infrastructure. In response to the changing economic and technological circumstances, Princeton committed itself to re-examining the manner in which its resources were allocated and work gets completed. Efforts got underway under the umbrella of the Planning and Data Access Group (PDAG) to establish more effective management practices and to simplify business processes. The group's report highlighted technical gaps, the operating inefficiencies they cause and the need to capture the potential of distributed technologies for the future.

The PDAG found an aging portfolio of central administrative applications characterized by redundancy of data, systems, and effort; data and systems that were isolated from each other and from users with legitimate needs for access; a high level of complexity

in which old programs, vendor packages, and modifications have been patched together; and systems that were obsolete and hard to maintain.

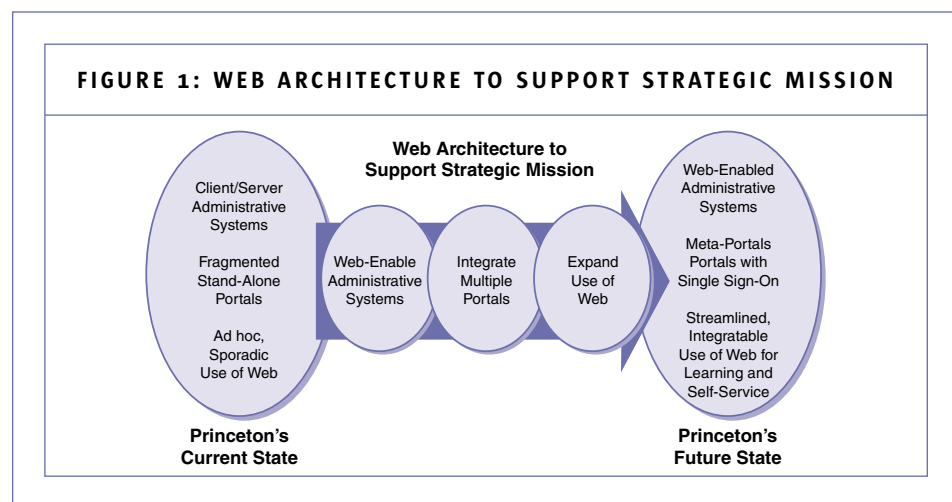
The PDAG report cast the operating challenge in stark terms: Dependent on centrally held data academic departments, as they responded to both internal and external demands for reporting and analysis, experienced the need to re-key data that was centrally stored but not available to them, lags in accessing what data was available, and obscurity caused by inconsistently defined or stored data.

PDAG recommended that Princeton revamp its systems around core functions, rather than existing administrative structures, with an eye toward simplifying operating processes at every opportunity. PDAG proposed that Princeton design and implement a rough sequencing of new systems based on priority and the technical challenges.

## Translating Plan into Action

At Princeton, the Office of Information Technology (OIT) oversees the strategic use of computing infrastructure necessary to support the University's priorities with regard to its teaching, research, and business activities. To put the strategic plan into action, the OIT embarked on a phased approach to upgrade the infrastructure and deliver on the objectives set forth in the PDAG report.

The OIT developed a five-year plan called Partnership 2000 that identified several



**TABLE 1: PARTNERSHIP 2000 APPLICATION INITIATIVES**

|  |
|--|
| • Receivables                              |
| • Financial Reporting                      |
| • Miscellaneous Financials                 |
| • ORPA                                     |
| • Investments                              |
| • Payroll                                  |
| • Labor Accounting                         |
| • Department Management System             |
| • Purchasing                               |
| • Human Resources Systems                  |
| • Integrated Student Information Data Base |
| • Financial Aid                            |
| • Registrar System                         |
| • Admissions                               |

application initiatives to overhaul the administrative systems (Table 1 lists the initially undertaken projects and Table 2 lists the current projects). The initiatives presumed a networked-based infrastructure tailored to the needs of distributed computing. This infrastructure included the devices and services required for application development and support, data storage and retrieval, and the provision of desktop services.

A three-tier, distributed model forms the basis for the new administrative systems today. According to David Koehler, Director of Information Systems, "The new architecture had to provide strong file and directory services, handle transaction processing, and be reliable, robust and scalable. It also had to line up with our open systems approach." Sun ONE meets each of these requirements extremely well.

Presently, with Partnership 2000, Princeton is transitioning from client-server to Web-enabled infrastructure for all administrative systems. However, after running an equivalent of a full marathon, it is not resting. It is already looking ahead. In the next phase of infrastructure build-out, it wants to lay the foundation to deliver self-service capability for students, parents, alumni, employees, faculty and staff.

## Beyond Partnership 2000: Creating a Web Strategy

With the campus community and alumni becoming avid users of the online channel, a Web Strategy is being developed to tightly integrate the Web into the daily activities of the university community (see Figure 2). Other drivers for the infrastructure revamp include rapidly changing technology, increased competition for limited resources and an infrastructure that has grown by piece-meal addition.

The success of the Web has, however, created an interesting set of issues. It is estimated that the initial university Web infrastructure in 1993 took two people one week to implement. Today, maintaining the Web infrastructure requires many people, many man-months. Web projects are getting stymied due to lack of coordination, lack of standards and lack of time.

To address these issues and move to an architected service model, a Web Strategy task force was created. The goal of this University task force is to propose a strategy for improved and expanded use of the Web as well as set policies, guidelines and an appropriate administrative structure for carrying out the strategy. The policy questions that the task force is aiming to define and address include:

- How to use the Web to support Princeton's programs of teaching and research?
- How to use the Web to support administrative activities and conduct business of the University?
- How to use the Web for internal communication? What are the implications for other forms of internal communication?
- How to use the Web for external communication (i.e., alumni and parents, potential applicants for admission and employment, members of the press, and the general public)?
- What forms of e-commerce to conduct using the Web?

The answers to these questions form the basis for the next phase of infrastructure development at Princeton. This will pave

**TABLE 2: PARTNERSHIP 2000 PROJECTS TODAY**

|   |
|---|
| • Assets and Equities                               |
| • Campus Community                                  |
| • Classroom Scheduling                              |
| • Department Charges                                |
| • DEMAND (Desktop for Department Managers)          |
| • Financial Aid                                     |
| • Grants Management                                 |
| • Housing   |
| • Operating Budget                                  |
| • STRIPES II (Alumni Relations/Fund Raising System) |
| • Student Systems                                   |
| • Undergraduate Admissions                          |

the way for the move from the current three-tier architecture to an n-tier portal architecture.

## Implementing the Web Strategy: Portals and Meta-Portals

In Princeton's current environment, resources are scattered and students and others need to visit multiple Web sites to locate the information they require. To deliver integrated access to these different constituents, a series of institutional portals are being implemented. Portals are applications that provide a single, consistent, and personalized gateway to access and integrate on and off campus information and applications. Where the campus Web site may be a collection of thousands of pages or department Web sites, a portal is a collection of many applications and services.

Why portals? It is estimated that over 42 sites exist with a 'princeton.edu' destination address. This creates inefficiency and adds to frustration. Take, for instance, grades. Since key information is not in one destination site, students would phone or visit faculty, administration and staff members with inquiries. Also, with multiple independent destination sites, there is overlap of features, an absence of a standard information architecture, poor coordination and sub-optimal use of costly programmer resources.

To remedy the existing fragmentation of user experience, Princeton is considering moving towards one central meta-portal that would provide easy access to all key information, including course materials, student records and financial information. This is similar to projects at other institutions called “my college”.

### Evolution of The Meta Portal Concept

Initial implementations of campus portals were “information only” and restricted to: a) specific groups, such as students, b) generally available information services such as news and weather, communications, and c) online communities.

In the next phase, portals added limited interactive functionality by providing forms processing capabilities and secure access to enterprise systems and other personal information resources. Currently, the limited transaction model is being expanded to provide access to legacy applications, and the ability to retrieve all appropriate information resources in an integrated fashion anytime, anywhere, with anything, including handheld devices.

With demand for new services growing exponentially, several different departments at Princeton have initiated stand-alone Web portal projects of their own. These include a Blackboard portal for integrating course material, the DEMAND (DEpartmental MANagers Desktop) portal for integrated access to administrative applications, an Alumni portal, an Athletics Fan Only portal and an Oracle portal for accessing Oracle data.

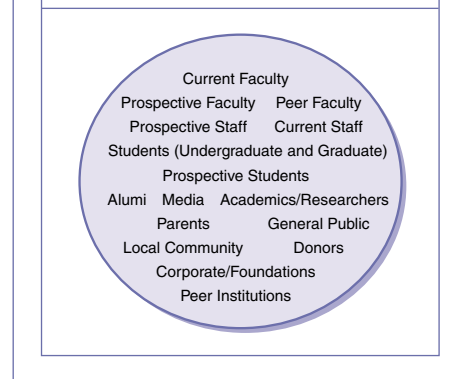
The Web Strategy task force is looking to integrate these portals to enable single sign-on and data sharing. A single sign-on is the ability of an entity to be sufficiently authenticated to gain access to all authorized, secured resources within one or more domains without additional authentication. Resources include: printers, computers, applications, files, directories, and mailboxes. These resources may be distributed throughout an enterprise on servers with heterogeneous operating environments.

### Selecting the Right Portal Approach

Selecting the right portal approach is an important issue facing university CIOs. A wrong choice can be devastating, resulting in significant wastage of time and money. Today, there are many portal approaches available. These include:

- **Affiliation with a portal service provider.** This may require the university to accept advertising in exchange for the use of the service.
- **Adopting a software vendor’s portal.** An example of this is Campus Pipeline.
- **Building a custom portal.** This utilizes commercial portal software like Sun ONE’s iPlanet Portal Server.

**FIGURE 2: TARGET AUDIENCE FOR THE WEB STRATEGY**



- **Adopting open source portal solutions.** This includes uPortal, a free, sharable university portal based on Java™ and developed by the Java in Administration Special Interest Group (JA-SIG), a consortium of universities that recognize the need for a portal solution that is designed by higher education, for higher education.

Princeton has chosen this last approach with its DEMAND project. One factor in selecting the uPortal open source portal is cost. At universities like Princeton, there isn’t a single institutional portal; rather there are lots of portals across the campus. Hence, from a cost perspective, a customized education-centric portal solu-

tion that is robust and based on open standards is very appealing.

Instead of absorbing the expense and developer resources to build a homegrown, proprietary solution, JA-SIG member institutions banded together in a collaborative development project to create uPortal, an open source portal. The effort is being supported by a grant from the Andrew W. Mellon Foundation.

### uPortal: The Open Source Higher Education Portal

Princeton is a key member of JA-SIG and, in turn, a key contributor to the uPortal effort. uPortal is specifically focused on the requirements of higher education; in contrast to commercial products that are focused on the requirements of corporations, even though they are marketed to higher education.

The rationale for uPortal is open architecture, no vendor lock-in, no purchased code, follow specs to insure scalability, platform independence, and open standards (LDAP, Java, XML, JSP™ and J2EE™). It is based on a publish-and-subscribe model, in which users both provide and consume content of interest to the community and to themselves.

uPortal is consistent and complementary with other major open initiatives, such as the Internet2 Middleware Architecture Committee for Education and MIT’s OpenCourseWare. Its first version was released in July 2000. Its 2.0 Beta was released on July 27, 2001 and a performance testing was done at the Sun iForce™ center. uPortal 2.0 is scheduled to be released in early 2002.

Using its prior experience in Java and J2EE, Princeton played a significant role in the development effort. uPortal is becoming not just another application but a framework, a set of technical specifications, and software. This framework provides an iPlanet-like portal server and interfaces that permit universities to customize the portal by plugging in components in a well-defined and usable manner. Its specification provides single sign-on and defines interfaces for the content suppliers (publishers), allowing for

“We had never built any kind of Web application before and were considering an outsourcing option. But with Java and J2EE, we were able to save several millions of dollars in outsourcing.”

*Patty Gertz, Technical Manager, on ROI from building Web applications in-house*

smooth integration of external content and applications.

At Princeton, uPortal is being used as foundation to build the DEMAND portal. DEMAND aims to provide a computing environment for over 300 department managers to access and process information from a variety of sources including central administrative applications, the Princeton Web, the Princeton DataMall, and department-specific applications or resources. Ultimately, DEMAND is intended to help streamline business processes and provide an environment to orient new staff to Princeton’s administrative processes—all in one Web site.

**Transaction Portals: Services on Demand Building Blocks**

uPortal is just one component of the robust infrastructure that the magnitude and scale of Princeton’s Web Strategy demands. In fact, to build sophisticated and integrated portals with single sign-on capability, it is necessary to identify business processes that are common across the university. Also, as portal features and functionality evolve, enabling and sharing cross-university processes and capabilities becomes quite important. The Web Strategy task force has identified several common services as priority processes in order to leverage economies of scale and standardization. These include financial transactions, calendaring, updating information, survey toolkits and event management.

- **#1 Priority—Financial Transactions.** A standard method for accepting credit card transactions over the web.
- **#2 Priority—Calendaring.** An “end to end” solution for integrating event scheduling, departmental calendars, the University calendar and personal calendars is viewed as necessary. The goal is reduce the ineffi-

ciencies associated with scheduling an event/meeting and coordinating calendars.

- **#3 Priority—Bio Self Service.** The ability for students, faculty, staff, and alumni to update bio data through the Web. This includes allowing employees to update University Directory information and addresses.
- **#4 Priority—Survey ToolKit.** There are many departments/organizations on campus that use surveys to collect feedback. There are very limited tools and/or resources available to generate a survey on the Web and to collect, store and analyze the data.
- **#5 Priority—Event Management.** Many departments/organizations throughout the University plan large events—Academic Departments, the Alumni Council, Athletics, Community & State Affairs, and Student Organizations. A single tool to address the variety of event

management requirements is viewed as necessary.

These portal elements increasingly can be delivered through a “Services on Demand” strategy.

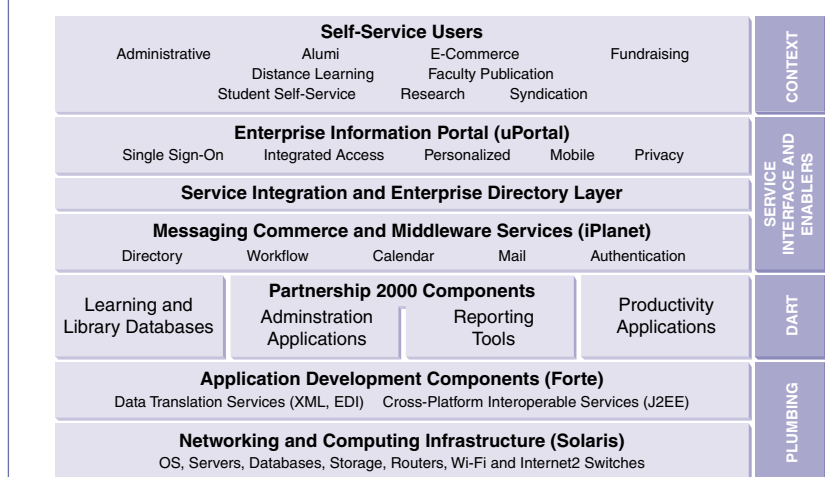
**Sun ONE: Enabling Princeton’s Future Needs**

With several investments into the building blocks of the Sun ONE architecture, Princeton is evolving around a broad vision for a comprehensive Web architecture that Sun ONE represents. Based on open Internet standards, Sun ONE offers a comprehensive, end-to-end platform that will work with the University’s existing systems and provide superior scalability, manageability, flexibility, security, and reliability.

Figure 3 shows what the Princeton Web architecture is evolving to from the various technology investments. These investments include:

- uPortal portal server for the DEMAND project. uPortal is built on Java and J2EE architecture.
- Web Server.
- Lightweight Directory Access Protocol (LDAP) directory server from iPlanet™ (then Netscape) for administrative applications.
- Java development platform and tools.

**FIGURE 3: MAPPING PRINCETON’S INVESTMENTS INTO THE SUN ONE ARCHITECTURE COMPONENTS**



Another key component is the integration server. Without integration, service delivery gets complicated. The information assets—buried in many incompatible systems, databases and applications—are of limited value unless the information can be quickly and easily accessed by all who need it to make decisions or do business in real-time.

Princeton is focusing on incremental investments that will help achieve payoff from the diverse technology assets. Sun believes that Sun ONE modular building blocks will help Princeton build integratable services within and between departments, regardless of location or platform. The Sun ONE advantage to Princeton would include increased ROI on IT assets, the ability to accelerate time to market, and the ability to recruit and retain faculty, staff and students with personalized services.

David Koehler, director of Information Systems at Princeton, explained what the University is facing: “The challenge for the teams is to think outside the box about how you make a service component instead of a piece that is going into the application. Developers want to take advantage of reusability so the next system is N percent less of the development. The goal is to be as efficient as possible.”

Clearly, Princeton is laying the foundation for future services. As the Web extends to include handheld devices, information and services can be delivered to users anywhere,

anytime. To this end, a computing model based on the “Services on Demand” vision of Sun promises even better cross-university integration, improved efficiency, and closer community and student relationships.

The Services on Demand concept is the foundation for a modular, flexible, and automated access to digital assets, including computing resources, from virtually anywhere. Clearly, this is exactly what Princeton is trying to accomplish. For Princeton, using Services on Demand will not only deliver value and productivity today, but also prepare its IT infrastructure for tomorrow.

### Key Take-Aways

Princeton University, which recently celebrated its 255th anniversary, is one of the premiere universities in the world. As an institution devoted to scholarship, teaching, learning and service, Princeton places high value on providing easy access to useful, accurate, and up-to-date information and services via the Web. It also places value on improving its use of the Web to communicate with its many audiences and conduct its business.

Princeton serves as a reference site for other higher education institutions looking to simultaneously right-size their administrative systems environments and deliver optimized service levels to their user community. The University is on a migration

path that aligns with the Services on Demand Sun ONE architecture as the foundation for its emerging Web Strategy:

- It has migrated from the old, mainframe-based environment to a distributed, client/server system, along the way adopting Java and J2EE.
- It has made significant investments in business applications, which it wants to leverage and turn into Web apps.
- It is evaluating a Web Strategy to improve and expand the university’s use of the Web.
- It is looking for a comprehensive portal framework to bring together the multiple portal initiatives under one umbrella, the meta portal.
- It has made gradual investments into the building blocks of the Sun ONE architecture, including the uPortal portal server and the iPlanet directory server.

The bottom-line: The Web is fundamentally transforming the way in which Princeton University does its work, like the rest of higher education. While still, at core, a “human” institution, the University has found in the Web and associated technologies new tools that accelerate and expand its capacities to teach and learn. Due to its open, scalable and services vision, the Sun ONE architecture will allow Princeton to accomplish its Web Strategy.

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