Introduction

Intent

Technology and computing systems and their uses are constantly changing and evolving. Cal Poly is in the midst of a significant change to our administrative systems as well as our ability to integrate the university’s information systems through innovative technologies such as the portal and middleware. We are also engaged in a considerable expansion of the need for and capability to deliver a broad range of services via a secure Web services model and with the support of an e-commerce enabled, more secure and ubiquitous IT infrastructure.

This target architecture and migration planning document is intended:

• to serve as a reference and communications guide for the campus about how this will occur
• to support a change management strategy to help identify, guide and smooth a logical transition for the campus through this evolution.
• to ensure the greatest level of success for the campus in understanding and achieving a well planned, efficient and well executed plan that factors both informed technical and operational considerations.

It also seeks to identify the pathway(s) and options for how we get to a target state so a broad constituent base of Cal Poly's stakeholders can understand where we may need to go to successfully achieve desired benefits and results and how we might make wise choices in order to get there. This is the key to the "migration" which we must both understand and undertake.

Approach

This document will define a proposed target architecture upon which Cal Poly's future systems and services will operate. Determining how to most effectively utilize this architecture to meet the needs of the university’s constituents will be accomplished through a complementary campus level needs analysis. This needs analysis will begin during the Fall Quarter 2002 and continue into the Winter Quarter 2003. It will be a collaborative effort, led by ESS, AFD and ITS, to identify the key strategic needs of the university's constituents and to identify those needs which will not be addressed by existing and/or planned systems or technologies (gaps). With the gaps identified we can then begin working toward filling those gaps through additional technologies or modifications to existing or planned technologies. An overall schedule will be proposed that updates our capability to completely implement CMS, fully shed our existing legacy administrative systems, and selectively augment or complement these core systems where appropriate.

A complementary state of the infrastructure report is also being developed by ITS to define a robust and secure target architecture for the university's information technology hardware
and data warehouse-database infrastructures. These efforts are being accomplished collaboratively to ensure they build upon one another to provide a complete picture of the university's target information technology environment.

Additionally, a third ITS effort is underway to articulate both the core services needs and delivery path for the "LMS" or Learning Management Systems which are now emerging as the next essential piece of the "pyramid" of the overall ITS Strategy and design as adopted by the CSU. The final finished product from this effort will be a bit broader to cover improving the effectiveness and efficiency of the teaching and learning infrastructure, as a subset of the overall information technology infrastructure.

This Target Architecture and Migration Planning document and the State of the Infrastructure Report will be completed by Fall Quarter 2002 and the Campus Needs Analysis is projected to be completed by Winter Quarter 2003.

**Outcome**

These documents are intended to provide technical direction and focus to the campus through the coming years and to consequently drive technical business decisions (e.g. when to make further investments in legacy systems versus new technologies/systems; determining which new technologies to focus investment and training on; etc.). These documents will also help identify and prioritize what workload must be advanced, delayed or eliminated in order to support the necessary transitions (e.g. advance DegreeWorks, eliminate to greatest extent possible new local SIS modifications, etc.).

**Key Milestones**

Below are the key milestones in this "migration" effort:

- **Fall Quarter 2002**
  - ITS to draft Target Architecture & Migration Planning document, State of the Infrastructure Report, and Learning Management System's Strategy
  - Review above documents with IACC, AACC, and SC3
  - Obtain approval for above documents from IRMPPC
  - Conduct campus Needs Analysis
  - Refine migration plan documents as appropriate based on campus Needs Analysis
  - Review final documents with IACC, AACC, and SC3
  - Obtain final approval from IRMPPC

**Guiding Principles**

There are a number of guiding principles that will enable us to move through this period of significant change to reach our goal of successfully transitioning to the target environment:

- Everything we do should be focused on building the best teaching and learning environment and services support delivery structure possible
- All university organizations involved in the defined transitions must effectively and consistently communicate and work closely together
• The migration plan must be widely communicated and understood
• Campus technical standards must be collaboratively developed to guide the
  migration and then be adhered to campus-wide
• The migration plan should support and advance the university's ability to adapt to
  technological change with agility and resiliency
• Need to measure all new technology efforts and acquisitions, across campus and at
  the system level, against the migration plan to ensure they support or at a minimum
  do not counteract the defined objectives.
• ITS advisory committees (AACC, IACC, SC3) will make recommendations relative to
  resource planning and priorities and the IRMPPC will vet these recommendations.
  Where they have substantial impact on campus resources the IRMPPC will carry
  these forward to Management Staff

Technical Objectives:

The following technical objectives have been defined, and will be adhered to, to help guide
the university toward the target environment:

• The campus portal will be used as the integrative and unifying means for deploying
  all web based services and applications and information pertinent to members of the
  university community
• Cal Poly will move toward a single-sign on environment using the university's
  enterprise directory as the source for central authentication, authorization, and
  identity management
• All authentication will be done against data in the university's enterprise directory
  using LDAP authentication services when possible or other means if LDAP is not
  supported by a specific application
• Move toward role based services through the portal using a robust and CSU-
  supported middleware infrastructure
• Cal Poly will continue to build upon the Data Warehouse as central data store and
  reporting repository to support and drive business decisions
• Focus will continue on 90-8-2 applications supporting individual self-service
• Ensuring a secure environment will remain a top priority
• Cal Poly will work toward a fully 24 X 7 X 365 environment for accessibility and
  support
• Implement technologies supporting workflow and improved business processes

Target Architecture Conceptualization (End State)

Below is a conceptualization of the target environment we are moving toward. Following the
diagram is a brief explanation of the various pieces of the environment and how they work
together to provide the best computing support structure for teaching and learning possible
for the university.

Target Architecture Description

In support of anywhere, anytime access there has been, and will continue to be, a strong
and sustained movement of applications and content to the Web. To support this at Cal
Poly, we have implemented an enterprise portal (my.calpoly.edu) as the central point of
access to Web based applications and data required by faculty, staff, students, and shortly
prospective students (Fall Quarter 2002).
In the Target environment, an authorized user of Cal Poly’s Web based computing systems can use any computer with a Web browser to access the Cal Poly portal and gain secure access to those university applications and information sources for which they are authorized, based on their role at the university.

"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" which are "a set of software standards that govern the secure exchange of data and services over the Internet"[1].

Cal Poly has selected the JA-SIG's uPortal framework as the underlying structure supporting our enterprise portal. This framework, and content for this framework, is being developed collaboratively by a broad consortium of universities. Its key benefits are that it is standards based, vendor neutral, and the collaborative nature of the development provides access to a much wider pool of developers than any individual campus could provide. Many applications are now coming with their own portals, touted as enterprise portals, but these portals are so application centric that they aren't able to adequately meet all the needs of a university and our constituents. "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." [Gleason, 2002]

The first element of support for the Web Services design and the university's portal and application integration is the middleware infrastructure. This consists of the university's central directory server and facilitates the integration and security of the university's applications both within and outside of the portal. It serves as an identity management system, which allows the role-based access to applications and data through the portal. When a user logs in to the portal the middleware infrastructure authenticates the user's right to access the portal and based upon their role or "identity" presents them with the suite of applications and information to which they are entitled. Once within the portal it allows a user to move seamlessly between applications using the logon to the portal as the "single-sign on" for that user to all of their applications within the portal framework. Applications outside of the portal framework, such as workstation based client programs will also authenticate against the middleware infrastructure using the same user name and password so that students, faculty and staff will only need to remember one user name and password instead of the multiple combinations they are now required to maintain. "A strong institutional authentication and identity management system that supports single-sign-on, controls access, manages trust relationships, and protects personal privacy." [Gleason, 2002]

The diagram above depicts this interaction of students, faculty and staff logging in to the portal framework through the university's middleware infrastructure to gain access to their authorized applications and data. As you'll note this authentication process through the middleware infrastructure is the same for students, faculty and staff whether they are logging in to the portal, logging in to a desktop application outside of the portal, or using a telephone to log in to an Integrated Voice Response (IVR) enabled application.

Because prospective students are not yet official members of the university they are not yet present in the university central directory so it is not possible to authenticate them against Cal Poly's middleware infrastructure. To provide prospective students with a consistent
interface they still login to the Cal Poly portal but they are authenticated by a prospective student database maintained by the Admissions' eComs communication engine rather than the middleware infrastructure. As prospective students are matriculated, they are provided a new user name and password which are created as entries within the university's central directory. The rest of the process is transparent to these new students. The next time they login to the portal, they will be authenticated against the university's middleware infrastructure and will be provided access to the new content for which they are now authorized.

The final piece of the above diagram is the university's Oracle database infrastructure. This database infrastructure provides each system with the mechanism to collect and organize data within in a secure, robust and recoverable environment.

As referenced throughout the Target Architecture description it is founded on the principles of strong security and open standards.

**Migration Path**

This Target Architecture sand its related standards provide us with the context, focus, and direction to move forward and "migrate" efficiently. The Needs Analysis, as defined in the Introduction, will then help identify the initial "trajectory" into the Target Architecture. Though the Needs Analysis will provide the initial trajectory, Cal Poly's movement forward and migration into this Target Architecture will require continual reassessment and analysis of the environment, plan, and technology to allow ever tighter integration within the Target Architecture.

PeopleSoft provides a prime example of the need for this continual analysis and assessment. Though a single functional element within the Target Architecture, PeopleSoft also contributes to the architecture through the integration it supports. For example, PeopleSoft provides a number of self-service tools and applications, some through their portal product and some through other means. These self-service tools pull together and "serve" useful content to system users however, when deployed through the Target Architecture these self-service applications will have the capability to integrate with other technologies such as a university Imaging system or the university's data warehouse to provide even more powerful and useful functionality. The continual assessment of how tools and vertical applications can be integrated within the architecture to complement one another will allow this expanded and more powerful functionality as well as options that may produce lower overall cost of ownership.

There is also some functionality within existing or planned applications that is not yet fully mature and/or which Cal Poly may already have other solutions for, examples include PeopleSoft's Advancement and degree audit tools. Because of the integrative nature of the target architecture, Cal Poly is able to use tools such as BSR's Advance C/S tool or the DegreeWorks degree audit tool in place of PeopleSoft's modules but in concert with the remaining PeopleSoft functionality to provide the best solution possible. When our continuing assessment and analysis process then identifies that PeopleSoft or another vendor's product has matured to the point where they should replace Cal Poly's existing technologies, the system and module independence provided by the Target Architecture allow us to "unplug" the old technology and replace it with the new more integrated and robust technology. Here, again, the portal serves as the unifying element for service delivery and seamless user experience.
The data warehouse is another special "piece" of the Target Architecture that supports the integration of data from Cal Poly's systems and is a key piece of the migration forward. By combining the key data from university systems into the data warehouse we will continue to provide an ever more powerful information engine capable of aggregating the data from these multiple systems and providing the data necessary to drive university decisions.

As we move forward and address the needs and gaps identified through the Needs Analysis, as well as the new needs that arise through our continual assessment and analysis process, the Target Architecture and related standards provide a baseline of standards and guidelines to measure new applications and technologies against. All new applications and technologies will be measured against their ability to fit into the Target Architecture and to comply with the related standards and services required. This will maximize integration and overall operational effectiveness while simultaneously limiting support costs.

**Conclusion**

The three documents ITS is preparing, including this document, the "State of the Infrastructure Report" and the document outlining how to improve the teaching and learning infrastructure in combination with the campus-wide Needs Analysis will guide the campus from our current technical environment to our targeted environment, including driving the necessary business decisions.


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