INFORMATION TECHNOLOGY AT UC MERCED—AN OVERVIEW

Vision & Strategy

As a university being built from scratch, UC Merced has a unique opportunity to implement a coherent information technology (IT) architecture and to leverage current technologies in ways that other universities have not been able to achieve because of legacy technologies and services that have been deployed over the years in an often decentralized and uncoordinated manner. It is this opportunity that is expressed in our information technology vision statement:

> *With the aim of supporting all members of the University of California, Merced community in their efforts to realize their maximum potentials, employ the best of current and evolving technologies and practices to provide access to information and services informed by the perspective of each individual user.*

Our vision statement directly informs a number of strategies:

1. Make virtually all applications and information that an individual may need to access available via a single electronic id (UCMNetID) and password.
2. Use portal and web technologies to create a single launch point for locating applications and resources.
3. Employ identity management technology so as to recognize individuals in their different roles (student, faculty, staff, alumnus/a, …), enabling the use of a single id and a universal portal where access is automatically tailored in an evolving manner as roles change.
4. Deploy applications with security and client models that allow easy and safe access from off-campus as well as on-campus.
5. Build a robust and well-architected infrastructure based on open-standards that allows us to quickly adopt emerging technology, especially open and community source software, without having to replace existing components.
6. Use automated processes wherever possible, especially for provisioning and network management, so that service delivery occurs rapidly and accurately, while minimizing the need to fund an ever-growing IT staff as the campus builds out to its planned capacity.

IT Organization

At UC Merced, academic and administrative information technology, as well as telecommunications, is integrated into a single IT organization headed by a chief information officer (CIO). This facilitates our goal of providing services from a user-perspective rather than from a functional point of view.

The IT Department is composed of the Office of the CIO, User Services, Enterprise Applications, and Technology Infrastructure, and is currently funded at 31 FTE. Outside resources are brought in as necessary to supplement our staff while we are growing.

The Office of the CIO provides planning, project management, and financial oversight. Our Identity Management Office also reports directly to the CIO, so as to preserve its status as a campus administrative function as opposed to an IT function.

The User Services group provides desktop support, classroom support, A/V and video-conferencing support, computing laboratory management and support, as well as a walk-in help-desk (the help desk also is reachable via telephone and e-mail). In addition to the permanent staff, student employees are used to supplement the help-desk and AV/classroom support functions.

Enterprise Applications supports the web, portal, student information system, on-line job application, the collaboration and learning environment, identity management, and other applications that affect the entire campus. Although our strategy is to use vendor-supported applications when available, application integration and the development of local applications (primarily in a J2EE environment) when other solutions are unavailable is performed by this group. A dedicated team within Enterprise Applications supports our student information system. At campus opening, financial and payroll/personnel applications are being provided to us by UCLA, but the Enterprise Application group will be expanded and take over those functions when our own implementations are planned.

The Technology Infrastructure group supports the server platforms, storage technology, and most of the basic network services (directory, e-mail, calendar, DHCP, DNS, …) as well as telephone and video. Telephone service is currently provided using a Centrex facility (although we manage all of the wires and connections on campus), but we will move to our own voice-over-IP service in the future. Within the Technology Infrastructure group, the Operations Center manages the availability of voice, video, and data services, as well as the servers and the applications that run on them.

Committees

A number of committees have been established to advise and oversee various functions. Because of the small number of staff and faculty present in the early stages of opening our campus and the time-commitment for serving on multiple committees, we have tried to minimize the number of committees to those that are absolutely essential. Over time, we will add more committees and/or expand the scope of the existing ones.

The Information Technology Advisory Committee (ITAC) generates the policies governing the use of information technology. The Web Oversight Committee (WOC) oversees both usage and standards for our primary and secondary web sites. A Personal Productivity Equipment Standards Committee (PPESC) has been formed to designate standard (i.e, base funded and supported) configurations for desktop computers, lap tops, PDA’s, and other personal productivity equipment. A final, faculty committee, the Interim Planning Committee for Instructional Technology Support (IPCITS), has given guidance on choices and configuration of classroom technology and learning management software.

Infrastructure

Physical

The campus is designed with a Telecommunications building that serves as the focal point of the campus's network, telecommunications facilities, and servers. A redundant conduit system is in place that supports independent connections between the Telecom building and each other building. A substantial amount of single mode fiber, multi-mode fiber, and copper cabling is provisioned via the multiple paths; a large capacity of empty conduit is available for future expansion.

At this point in time, the fiber supports three independent campus data networks. The first is the standard network that supports administrative, residential, and teaching and learning needs. It provides 10/100/1000 Mbps end-user connectivity in most locations, and currently relies on 2 Gbps bandwidth between buildings. The campus is in turn connected to the state research network, CalREN (and through it to the Internet and other research networks), by two 1 Gbps connections via UC Merced-owned LEAF-grade fiber. One of these connections is direct from the campus, the other is from the Castle facility; these two locations are interconnected by our fiber. Both the inter-building connections and the CalREN connections can and will be upgraded to higher bandwidth as dictated by campus needs without the need to install additional infrastructure.

At initial deployment, the primary campus network is being used only for data, but it is engineered to also support voice and video applications. Over time, UC Merced is planning on converging all voice and video applications onto the campus network.

The second campus network is a highly-secured network that supports the building/energy management system, door access and alarm functions, security cameras, and financial applications tied to our campus card system as well as external vendor applications on campus such as ATM machines.

The third network is a campus-wide storage access network (SAN) that will allow back-end processing for servers, including back-ups, to operate at high-speed throughout the campus without interfering with or interference from general purpose usage. This network will function at gigabit speeds.

In addition to the wired network, a wireless overlay is being deployed across campus to support mobile computing. The wireless network supports 802.11 a/b/g protocols, and is secured by 802.1x PEAP authentication, based on our standard UCMNetID and password. State-of-the art management software performs such functions as detecting and neutralizing rogue access points, and automatically adjusting wireless access point gain as additional access points are deployed. Beyond today's use for data, we plan on providing voice-over IP services (VOIP) for use by emerging cell phones and other devices that support WiFi as a connectivity option. Because of that, we are creating outdoor wireless coverage by installing wireless access points in the emergency blue light phones throughout the campus.

In addition to data networks, the fiber infrastructure supports the distribution of 32 channels of television across campus. The signals are converted into traditional cable

television within each building. We are currently obtaining programming using a DBMS-based satellite system at the campus-head end, but, as we own and operate the distribution infrastructure, we are positioned to change providers and/or add locally-generated programming in the future. Also, our primary data network is robust enough to support convergence of video distribution when the time comes.

Network Services

UC Merced provides a set core network services, i.e., services of interest to at least a large subset of the campus community, but excluding applications used for a specific business function or by an academic area. These include directory services, e-mail, calendaring, document management, file storage, printing, web, portal, and virtual private networking. Access to virtually all of these services is controlled by our identity management system. Most of these services are either web-based or have secure clients that allow safe access from off-campus; for those that do not, we provide a virtual private network (VPN) facility that establishes an encrypted connection with the campus network.

The identity management system integrates data from our admissions system, student information system, payroll/personnel system, affiliates database, departmental administrators, and (in the future) alumni database to establish a unique identity for each individual, regardless of the fact that in many of these sources, he or she may appear as a different person. This is essential for supporting our single id (UCMNetID) strategy. Additionally, the identity management system establishes primary and secondary roles for each individual, which are subsequently used to control automatic provisioning (creation of an e-mail account for example) and access to the various network services. This access will evolve over time as the individual's roles change, but the UCMNetID and password will persist.

Identity management accomplishes this primarily by establishing entries in one or more electronic directories and setting appropriate fields. Our primary directory is LDAP-based, and most network services access it either directly or indirectly for authentication and authorization purposes. We also provision an Active Directory (AD) directory for the purpose of supporting Microsoft Windows-style access to printing and file services.

In tandem with the LDAP directory, identity management enables a number of other applications, including the campus card application (Cat Card, based on Diebold CS Gold) and the library circulation system (Innovative Interfaces's Millenium).

Identity management also permits our portal (My.UCMerced) to recognize an individual's role or roles and make available the appropriate content. As roles change, users will see tabs and channels appear and disappear. My.UCMerced is an implementation of uPortal and is designed to integrate content for all members of the UC Merced community, as opposed to having separate portals for students, staff, etc. This allows us to provide a single interface for individuals with multiple roles.

My.UCMerced uses both tabbed windows to separate major functions (webmail, course management, news & information, …) and channels within each window. Users can reconfigure the appearance and content of both the tabbed windows and the channels within them; however, they will only be able to see content that is designated as appropriate for their role(s).

Most of our network services run over secure socket layer (SSL), providing encryption across our internal network and/or the Internet. This includes not only portal and web-based applications, but also e-mail, directory access, and calendaring.

Our e-mail service is IMAP4 (currently Sun Messaging Server). Sending e-mail requires authentication just as accessing e-mail does. As IMAP is a standards-based service, a wide variety of clients can be used with it, including Eudora, Microsoft Outlook, Macintosh Mail, and Thunderbird. We also make a web-based mail client available, integrated into our portal with single sign-on. A virus identification and removal tool, and also a SPAM tagger, are integrated into the mail server.

Our calendar service is Oracle Calendar. The current state of calendar standards does not permit the same freedom of choice of clients as for e-mail. However we support native clients for Windows, Macintosh, and Linux, as well as a web client, and integration with Microsoft Outlook.

Rather than rely of departmental file servers, we have implemented a campus-wide file storage facility (UCMSTOR for faculty and staff, UCMBOBCAT for students), based on network storage appliances. Windows, Macintosh, LINUX and other UNIX-based systems can store and access files on an individual or shared-folder basis. Off-campus accessibility is possible via our VPN service.

For faculty and staff requiring file storage with document management functionality, we have deployed Xerox's Docushare system (UCMSHARE). Features include indexing, searching, versioning, abstracting, etc. Access to specific folders and documents can be controlled on a group and/or individual basis by the document creators and authorized managers. Although primarily designed as a web service to allow universal access, a Windows client is also available.

Digital signage

To provide a network service in a somewhat different category than the others, we have deployed a number of flat-panel displays around campus (currently in Library and Dining areas) that, driven by a set of products from Starbak, can be used as electronic signs able to display content from a wide variety of sources, including electronic documents (Word, PowerPoint, …), slide shows, streaming video, television, etc. Control of the programming can be delegated to different groups for the screens in their physical areas.

Residential Services

Network

Each bed is provisioned with a 10/100 Mbps Ethernet connection to the campus network. Additional ports are provided in the common rooms of our suite-style housing. Wireless access is also provided in the residences, student activity building, and dining hall.

Telephone

For those students who wish to install traditional landline telephone service, we provide a telephone jack in each room. Actual service is provided by SBC, but we own and manage the wiring infrastructure between the Telecom Building and the jacks in the rooms.

Cable TV

Each bedroom and common room is equipped with a cable TV outlet. Costs are built into the housing fee, and the standard 32 channels are available everywhere. In addition to entertainment and local broadcast (Fresno) channels, the current channel line-up includes CNN and Fox news, CSPAN, UCTV, the History channel, the Discovery channel, The Learning Channel, and G4 Tech TV.

The Den, a recreational room in the student commons building adjacent to the residences (Valley Terraces), is equipped with a large-screen TV and a larger suite of satellite-provided channels independent of the campus distribution system. The dining hall, Valley Dining Commons, has two wall-mounted LCDs that can be used to display television programming, digital signage, or local programming (DVDs).

Computer areas

Valley Terraces contains a small drop-in computer lab for students, as well as a study area that allows 7 students at a time to connect their personal laptops to power and Ethernet. Wireless networking is also provided in these areas. A student help desk is staffed in the evening.

Student Services

Administrative

Virtually all student administrative services, starting from one's application for admission, are available online. Course descriptions are available in the web edition of the course catalog, via the registration application, and in the Sakai collaboration and learning environment. Registration and grade retrieval functions are web-based, and are provided by our Sungard/SCT Student Information System (SIS), but integrated into our identity management process, so that the same UCMNetID and password used for network services is used here. Online billing and payment are also integrated into this application.

From an internal IT perspective, SIS supports admissions, registration, financial aid, transcripts, and all of the usual functions that a student information system typically provides. It is also currently being used for recruitment. Student housing is handled by two other applications: the StarRez application for on-campus housing is integrated into the portal, while a local application allowing landlords to list off-campus housing runs on

its own web site. The off-campus application also provides the ability to search for potential roommates.

Information Technology

Once accepted for admissions, students are automatically given ucmnetid@ucmerced.edu e-mail accounts (the UCMNetIDs are assigned and used earlier as part of the admissions process). As scheduled by the Registrar, they will appear in the online directory and be able to register for courses.

It is expected that most students will use the webmail client integrated into the portal, but they use the same e-mail system as everyone else and can install any client that supports IMAP4/SSL. Students also have access to central file storage (intended primarily for computer laboratory assignments and as a drop-box for electronic materials located using Library computers), wireless networking and our VPN service. UCMCROPS, an implementation of Sakai, provides functionality related to courses (see Teaching and Learning).

Information Technology support for students is provided through online documentation as well as by the Student Help Desk. Currently, the Student Help Desk is integrated with our general help desk (open 8 AM – 6 PM, both walk-in and via telephone and e-mail), but supplemented with two evening walk-in help desks staffed by students, one in the student housing complex, and the other in the Library.

Teaching and Learning

Software

UC Merced was a founding member of the Sakai Educational Partners Program (SEPP) and the first campus to have gone into production with Sakai as its sole collaboration and learning environment (incorporating functions found in traditional learning management systems). Sakai is integrated into our campus portal with single sign-on on the user side, and integrated with our student information system for class rosters and for enabling faculty to submit grades. All courses are automatically provisioned into Sakai. Our strategy is to provide functionality such as grade submission uniquely through Sakai, rather than through vendor-provided web or portal services so that faculty see a consistent platform. We are also exploiting Sakai's collaboration features, primarily in support of research projects.

Sakai is a community-source product, developed by a partnership including the Massachusetts Institute of Technology, Stanford University, Indiana University, and the University of Michigan, as well as the Open Knowledge Initiative and the uPortal consortium. It represents the efforts of a group of leaders in course management software to develop a common application and framework that will better meet the needs of higher education than do current commercial products. A high level of interest by other institutions led to the creation of SEPP, which now numbers over 80 members. As the initial production versions of Sakai have been released, and initial funding from the Mellon and Hewitt foundations draws to a close, the project is being re-organized as the

Sakai Foundation, which will oversee product development and relations with the Educational Partners and Commercial Affiliates.

We plan to increase the functionality available in Sakai as new releases, components, and other software that runs in the Sakai framework become available. We especially are looking at OSPI, a well-known open-source electronic portfolio application that has been re-tooled to run in the Sakai framework. Our expectation based on community response so far is that other significant applications will be either developed or re-tooled to run in the Sakai framework.

Discipline-specific applications are made available for scheduled courses in the instructional computer labs by faculty request, and currently include ArcGIS, Atajo, Eclipse/GILD, EcoBeaker, GaussianViewW, Gaussian 03W, GCG Wisconsin Package, MatLab, SPSS, STATA, STELLA, and Visual Studio.

Facilities

Classrooms

A standardized approach has been used to design technology in classrooms and video conference rooms across campus to provide a consistent user experience to faculty and others using the facilities. Three standard design levels have been defined: Display, Capture, and Video Conferencing. Each design level builds on top of the previous, adding additional functionality; all rooms are designed with the infrastructure in place (conduit, power, wall backings, etc.) to be upgraded to whatever level is needed.

Display level rooms support the projection of computer-based information (PowerPoint, etc.) as well as other input (DVD, VHS, document camera). Screens may be traditional or electronic (LCD, plasma, …). Whiteboards may be traditional or "smart" electronic white boards.

Capture level rooms permit the recording (audio and/or video) of lectures, with the primary intent of making the content available as streaming files to students as part of the Sakai course site.

Video conferencing rooms provide the full level of equipment to support interaction with other sites; i.e., real-time exchange of audio and video and the ability to initiate calls.

The control equipment that manages facilities within full-function rooms is scenario-based, i.e., if an instructor were to select "PowerPoint Presentation", the screen would be lowered, shades would be lowered, the lights would be dimmed, the projector would be turned on, and the computer video output connection to the projector would be enabled.

Computer laboratories

Several computer labs are available for instructional and drop-in use. In addition, the Library allows students and faculty to check out lap top computers for use within the Library (which has ubiquitous wireless and plug-in Ethernet ports for internal and Internet information access).

Administrative Support
IT supports end-users directly through the Help Desk and Desktop Support groups. In addition to provisioning computers, IT provisions and supports telephones, cell phones, and PDAs. Through the Identity Management Office, and using our automated identity management system, newly arriving faculty and staff are added to the electronic directory and provided e-mail, calendar, and document management accounts. Their views are set up in the portal, and they are flagged as eligible to use central file storage, wireless networking, printers, and VPN facilities.

IT also supports a number of vendor-supplied departmental applications, including Housing, Advancement, Facilities Management, and Campus Card. While IT does not have application expertise in these applications, it assists in the configuration, procurement, installation, maintenance, back-ups, and trouble-shooting from the hardware layer to the database layer. These servers are housed in the Telecom building along with the servers used by IT.

Research Support
Given the small number of faculty at the inception of the campus, and the lack of communities of interest for special facilities, IT support for research is currently limited primarily to providing extensive connectivity and network services, and consultation to research faculty. The enterprise file system is used heavily by some research groups. In the future, it is likely that IT will assist in creating and managing facilities such as grid computer clusters and visualization labs.