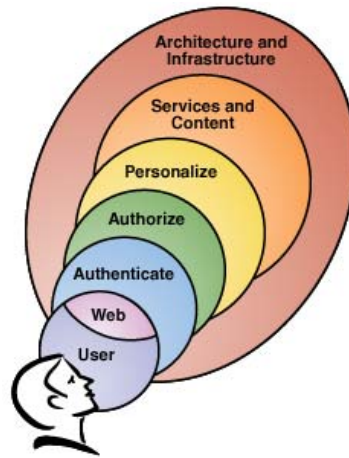


UNIVERSITY OF WASHINGTON

DRAFT INFORMATION SERVICES STRATEGY

WORKING DRAFT 3/11/02



PLEASE LET US KNOW WHAT YOU THINK ABOUT THIS REPORT

Please email comments to Ed Lightfoot, UW Chief Information Officer, (elight@cac.washington.edu)
or Cindy Brown, C&C Communications Director (cindyb@u.washington.edu)

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PREFACE

This draft *Information Services Strategy* documents current and planned information services projects at the University of Washington and explains the vision underlying these efforts. This draft report is not intended to be a strategic plan; it provides a starting point for a University-wide conversation about strategic information technology issues.

Note that some sections of this document have not been developed yet, but could be of interest.

This draft report was written in response to a review of the University Services Renewal (USER) effort that was completed in 2001 as part of an evaluation of University Initiative Fund (UIF) projects. The review praised the accomplishments of the USER project thus far, but cited the need for an overall vision and strategic context for the effort.

This draft report is a joint effort by Computing & Communications and the Office of the Executive Vice President and was developed in consultation with the Executive Vice President Planning Group.

The draft *Information Services Strategy* was presented to the Provost in December 2001, the Board of Deans on February 6, 2002, and to college departmental computing directors on February 28, 2002. During the months of March and April 2002, C&C directors are meeting with each of the deans individually to start a dialog on strategic information technology issues and how to address them.

I. INTRODUCTION

Information technology is transforming higher education, breaking down the barriers of time and place, making it possible to deliver education anytime and anywhere, tailored to the individual learner. New and emerging technologies offer the potential for colleges and universities to change almost every aspect of what they do, from the way they educate students and discover new knowledge, to the way they operate their businesses and serve their communities.

Some of these changes already can be seen at the University of Washington. Students go online to register for classes, view their grades, see simulations of complex phenomena, and research topics in libraries around the world. Faculty use tools that help them build Web sites where they post class syllabi and lecture notes, hold class discussions, and give quizzes. Employees go online to view earnings, benefits, and other personal information and to perform work such as updating payroll records or tracking grant applications. Arthritis patients find comprehensive information to help them understand and manage their condition.

While these are significant improvements, they are only the beginning of what is possible. Realizing the potential of *information technology*—the use of computing and communications systems to create, manage and process information—will take new approaches to University information

technology infrastructure and services. In addition, significant challenges related to the University's current information technology infrastructure and services need to be tackled in order for the University to move forward. Outdated administrative support systems, uneven access to computing infrastructure and services, aging wiring, and lack of training and support are some issues that need to be addressed.

Purpose of the Information Services Strategy

The purpose of this *Information Services Strategy* is to initiate a conversation about how the University of Washington can make the best use of information technology to advance its teaching, research and service missions and prepare for the future.

To start the conversation, this document offers a strategy for leveraging information technology to provide better resources and services to the University's constituents, support leading edge research and learning, improve the efficiency and effectiveness of faculty and staff, and reach constituents in new and powerful ways.

This proposal is intended to support the University in furthering its most important goals—transforming teaching and learning, increasing educational opportunity, advancing human knowledge, and solving global problems.

Planning Framework

Implementing this strategy will require both technological innovation and organizational change. This proposal outlines a framework for creating the technological and organizational environment necessary for the future, while providing the University flexibility to respond to new technological developments and institutional priorities.

This proposal suggests a single, institution-wide approach, involving all units and departments, which will enable the University to realize the full promise of emerging Internet technologies, while allowing individuals and groups within the University to adapt these new technologies to their own needs. It can be implemented incrementally, according to the availability of resources and the University's ability to absorb change.

This strategy builds upon the University's previous information technology directions and investments. The concept that underlies this strategy has been developed in consultation with constituents within the University and around the country, and it already has been recognized nationally as an innovative and valuable approach to university information services planning.

Critical Time for Planning

Now is a critical time for University information technology strategic planning. The University has the opportunity to continue as a regional and national leader in defining new directions for the use of emerging Internet-related technologies in advancing higher education. This requires making the right technological choices and investments.

This document is an initial draft that offers a starting point for a University-wide conversation about the choices ahead. It is meant to stimulate discussion within the University community about

technology directions, to contribute to a common understanding of future challenges and opportunities, and to build a consensus on how to move forward.

All ideas proposed in this document are open for discussion and change. As this initial draft is developed, input from across the University community is being sought to better define the issues and concerns and to identify solutions. The document will be revised accordingly. Once this draft is complete, this document will be evaluated continually and updated to reflect new ideas, new technologies, and new lessons learned.

Your thoughts and suggestions are needed to help determine the right information technology strategy for the University's future. Please email comments to Ed Lightfoot, Director, Information Systems, (elight@cac.washington.edu), or Cindy Brown, Project Manager, ISS project, (cindyb@u.washington.edu).

II. VISION FOR A NEW INFORMATION ORGANIZATION

“Society is undergoing a fundamental transformation from the Industrial Age to the Information Age. All people, organizations, societies, and nations are affected...This is a global phenomenon with very significant local implications...Those who realign their practices most effectively to the Information Age standards will reap substantial benefits.”

—Michael G. Dolence and Donald M. Norris
in *Transforming Higher Education*

The Challenge

Society's transition from the Industrial to the Information Age is bringing about dramatic change in peoples' needs and expectations of higher education. In response, higher education institutions are challenged to make fundamental changes in the way they operate. While it is impossible to know all the implications of the transformations underway, Dolence, Norris and others have outlined some emerging trends:

- **Demand for higher education will increase.** The amount of new knowledge and information is expanding at an accelerating rate. To keep up, people will need opportunities for learning and for re-tooling skills throughout their lifetimes.
- **Higher education will become more student-centered.** Information technology will enable students to manage almost every aspect of their academic lives, giving them instant access to their academic and financial records, housing options, course information, academic calendar, and other student services.
- **Higher education will become more personalized.** With faculty guidance, students will be able to develop their own learning programs, based upon their current level of experience and knowledge and their goals. In addition, information technology will make it possible to tailor the educational experience to each student's individual needs and learning styles.

- **Technology will transform learning.** Increasingly sophisticated simulations and communications and search tools will allow students to grapple with real-world problems, collaborate and interact with faculty and peers around the world, and will enhance their ability to be active, self-directed learners. Technology will enable the creation of learning experiences that integrate sound, video, music, and human interaction in new and exciting ways.
- **Technology radically will change the way people discover, access, and disseminate new knowledge.** Simulations of laboratory environments and sophisticated modeling will allow complex experiments to be performed anytime and anywhere and will open up new areas of exploration; communications tools will facilitate collaboration and the exchange of knowledge across the globe; and new techniques will make it easier to store, access, analyze, and visualize large sets of data.
- **Health care will become more patient-centered as information technology allows patients to take a more active role in their care.** Patients will have access to in-depth health information customized for them. New tools will facilitate communication with medical providers and enable patients to track and manage their own care.
- **Service expectations will change dramatically.** As the Internet changes the way customer service is delivered, people will expect instant, around-the-clock access to information, products, and services tailored to their individual needs and preferences. In addition, they will become accustomed to a greater degree of choice and control.
- **Competition among higher education providers will increase.** The number of institutions and corporate higher education providers will continue to expand to meet rising demand. Colleges and universities will need to be nimble and flexible to keep pace with new opportunities and changing priorities.

New technology strategies and solutions are an essential part of responding to these trends and taking advantage of the tremendous opportunities they represent. But technology is not the only answer.

Information Organization

In this twenty-first century environment, the highly departmentalized and process-driven organizational practices that evolved during the Industrial Age no longer work. A more collaborative and integrated organizational structure is needed.

What is called for is a new “information organization” focused on providing people with the resources they need to make decisions and take action. In the information organization, the institution adapts the way it does business to meet the needs of its people, and not the other way around. Organizational practices are shaped by the best way to get the job done. Processes are streamlined. Duplication of effort is eliminated. Routine tasks are minimized. The question becomes not “are we doing things right,” but “are we doing the right things?”

Technology is both driving the need for these changes and providing the ability to make them. In the Industrial Age, the technological means did not exist to create such an environment. In the Information Age, such an environment not only is possible, it is essential.

This *Information Services Strategy* is intended to serve as a blueprint for developing the kind of technological and organizational environment necessary for the University to respond effectively to the trends described above.

A Vision for the University of Washington

The vision for the University of Washington is to build an information organization that provides all of the University's constituents with the information, tools, and services they need, when and where they need them, to accomplish their goals. As part of this vision:

- **Every person (even those not affiliated with the University) will have quick and easy access to the institution's resources over the Web.** These resources will reflect the full range of activities at the University including education, research, library services, health care, sports, entertainment, and the arts.
- **Every person affiliated with the University will have a single point of entry into UW resources (through MyUW, the University's portal), and those resources will be tailored specifically for each person.** Faculty and staff will have quick and convenient access to the tools, information, and resources they need to do their jobs; students, parents, patients, alumni, and others will be able to tap into information and other resources they need to accomplish their goals.
- **Teaching, learning and discovery will be enhanced through high-speed access to information resources, communications tools, and interactive multimedia experiences.**
- **Every person will have access to the information and training they need to take full advantage of the University's resources.**

The University already has started to build toward this vision through such efforts as the University Services Renewal (USER) project, which uses Web technology to streamline support services, MyUW personal portal, which provides a single point of entry to University resources, and Catalyst, an array of online tools that helps faculty integrate technology into teaching.

While these are important accomplishments, they are only first steps. Implementing this strategy will be an enormous undertaking that likely will take many years to achieve. It will raise many challenging technological, organizational, and policy issues, some of which are addressed in the *Implementation Issues* section of this document.

In addition, there are some significant current information technology issues that will need to be resolved. For example, many offices and classrooms do not have access to the high-speed networks or state-of-the-art services that now exist at the University because of antiquated wiring, inadequate equipment, or other issues. Many key administrative support systems have outdated functionality that makes them difficult and cumbersome to use. Many people feel they are not getting the help or support they need to use information technology effectively in their work or to deal with computing problems. Some of these issues are explored further in the *Current Situation* section of this document.

Preparing for the Future

Implementing this *Information Services Strategy* and addressing these current issues will position the University to respond to the evolving needs of society in the twenty-first century. It will create the technology foundation necessary for the University to:

- **Increase opportunities for lifelong learning** by expanding distance learning programs and services over the Web and by making them more rich and dynamic.
- **Provide for student-centered learning** by allowing students to manage their academic lives over the Web and by making it possible to tailor the educational experience to each student's skills, goals, and learning styles.
- **Deepen and enrich relationships with constituents** by reaching more people in new and compelling ways.
- **Enhance learning** through next-generation communication and research tools, simulations, and other electronic learning experiences.
- **Increase efficiency and productivity** by providing faculty and staff with instant access to the information, tools, and resources they need to do their jobs.
- **Deliver better service to constituents** by providing them with quick and easy access to University resources and services over the Web.
- **Increase the University's outreach to diverse populations** by providing new communications and electronic community outreach tools. This will support the University's efforts to broaden the diversity of the undergraduate applicant pool and to recruit a more diverse faculty.
- **Become more patient-centered** by offering patients the ability to learn about and manage their own health care needs.
- **Provide collaborative learning environments** in global equity, health, environment, technology, and citizenship.
- **Enhance the discovery, access, and dissemination of new knowledge** by providing a variety of powerful tools for accessing information resources, communicating, visualizing and analyzing data, creating simulations, and conducting virtual experiments.

III. CURRENT SITUATION

This section addresses the current status of information technology at the University of Washington. It describes what services Computing & Communications (C&C) provides, the complexities of managing the University's computing environment, and major issues and concerns related to information technology at the University.

Text for this section has not been developed, but could be if there is interest. Some of the issues included below currently are addressed elsewhere in this document.

A. ISSUES AND CONCERNS

Major information technology issues and concerns include administrative support systems, client support, and communications.

ADMINISTRATIVE SUPPORT SYSTEMS

The University's core administrative support systems—including student, HR/payroll, financial, procurement, accounts payable, and budget systems—do not meet the current administrative and financial needs of the University. These systems have outdated functionality that makes them difficult and cumbersome to use. In addition, they provide only limited tools for accessing data and for producing analysis and reports. While the University Services Renewal project (USER) has successfully modernized some systems, others critically need upgrading.

CLIENT SUPPORT

Many people across the University feel that they are not receiving adequate computing support. Concerns include:

- **Insufficient support** for desktop applications, database systems, and other computing needs.
- **Lack of a central site-licensing service.**

INFRASTRUCTURE RENEWAL

Infrastructure renewal concerns include issues such as:

- **Inability to access the University's state-of-the-art information technology infrastructure and services**, due to aging wiring, inadequate equipment, or other issues.
- **Lack of resources to pay for critical computing services.** Up-front costs of new applications and services are often a deterrent to departments.

COMMUNICATIONS

There is an overall concern that C&C communication efforts are not adequately addressing the needs of the University community. This includes a need for more communication about what services C&C provides, C&C's strategic vision and plan, how priorities are set, changes in services or technology requirements, and updates on the status of projects. It also includes making more clear the role C&C plays in involving the UW community in projects such as USER and Catalyst.

B. CURRENT STATUS

This section addresses the University's current information technology environment as provided by Computing & Communications and departments and units.

COMPUTING & COMMUNICATIONS

This section describes what services C&C offers and some of the challenges involved in managing the University's computing environment.

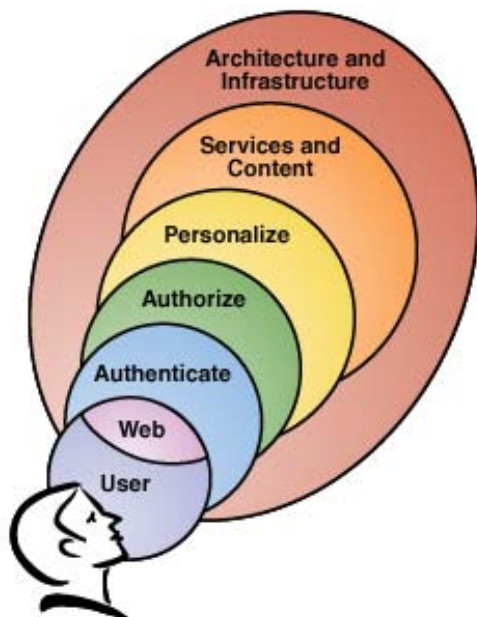
Text for this section has not been developed, but could be if there is interest.

DEPARTMENTS AND UNITS

This section describes what information technology services generally are handled by departments and units and some of the challenges they face in managing their computing environments.

Text for this section has not been developed, but could be if there is interest.

IV. CONCEPTUAL FRAMEWORK



At many institutions, an increasing number of disparate services and resources are offered over the Web, with separate entry points for students, alumni, patients, and staff. What has been missing is an integrated approach that brings all these services together and provides a unified view of the institution.

The conceptual framework introduced in this section offers such an approach. It describes the technological foundation, or *next-generation infrastructure*, necessary to deliver integrated services and resources over the Web and to enable the University to take full advantage of emerging Internet technologies.

The framework provides a simple model of this highly complex approach. It presents each component of the next-generation infrastructure step-by-step, and it explains how that component works with the others to create a seamless set of services and resources.

Rethinking University Constituents

The user is the starting point of this conceptual framework, and is its central focus. By emphasizing the user, this framework provides a useful way to rethink who the University's constituents are and how to meet their needs most effectively.

Unlike commercial enterprises with simple client-provider relationships, universities have complex sets of relationships with a wide variety of constituents.

The University of Washington community includes undergraduate students, prospective students, extension students, certificate program students, graduate and professional students, parents, alumni, faculty, donors, sports fans, medical patients and their family members, business and political leaders, medical practitioners, medical residents and post-graduates, members of the media, career planners, neighborhood and community groups, staff, administrators, prospective employees, prospective employers, researchers, and many others.

In addition, these individuals often fall into more than one category, such as alumni who are parents, staff who are students as well as medical patients, or parents who are donors as well as sports fans. To make things more complex, these relationships change over time. A high school student may take a summer course at the University, eventually become an undergraduate student, an alumnus, and a patient, and then take continuing education programs while also becoming a sports fan and a donor. The possibilities for overlapping and ever changing relationships are endless.

At the University, these people now are divided into separate categories for each of these relationships, with different departments to serve them. People have to determine which institutional divisions and locations to go to for the information and services they need. They often end up standing in lines and repeating the same information to different university staff.

Delivering Information Services

The Internet offers a unique opportunity for the University to think about its constituents more holistically and to provide them with an integrated and customized view of this institution.

Under this strategy, users can tap into the Web and instantly receive customized information, tools, and services conveniently pulled together in one place. These resources will encompass all of a user's associations with the University, and these will automatically be updated as that person's needs and relationships with the University change. In addition, users will be able to add, delete, or modify their resources to suit their individual preferences.

Importance of Security

A fundamental part of this strategy is developing the security measures and policies necessary to protect the privacy of personal and other confidential information and to ensure the integrity of University systems and resources. Providing for security is an integral part of every computing project at the University. In addition, a Privacy Assurance and Systems Security Council has been created to establish a University-wide approach to systems security and integrity issues.

Integrated Approach

The idea of delivering customized services over the Web is not unique. Many other universities and commercial enterprises are using this approach. Typically, they focus on just one relationship: customer, student, alumnus, or sports fan. What distinguishes the University of Washington's vision is its integrated and comprehensive approach. The University's approach supports all of its constituents and recognizes the full range of their relationships with the institution, even as they change over time.

This powerful concept requires a new way of thinking, about both the Web environment and University structures and practices, but it opens up tremendous possibilities for the future.

The next sections of the *Conceptual Framework* explain, step by step, each of the major components of the next-generation infrastructure. These sections describe the University's vision for each component and how these components work together to provide customized services and resources to the user. The components are introduced in the order of steps that occur once a user logs on to the network.

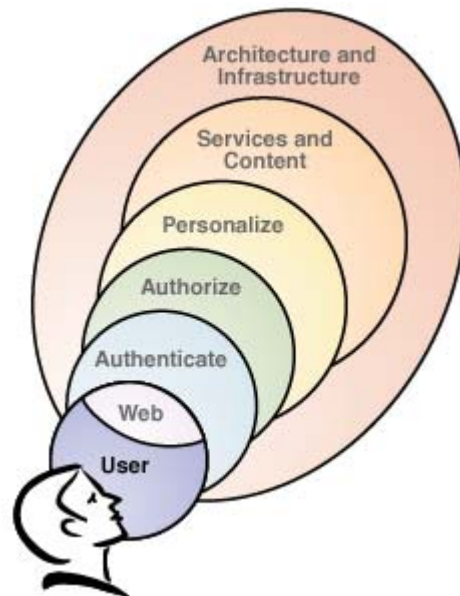
A. USER

This conceptual framework begins with the user because its primary focus is on meeting user needs.

The term *user* refers to all of the diverse and geographically dispersed people connected with the University of Washington.

The University's vision is to provide users with convenient, easy-to-use, personalized information and services over the Web.

By providing a framework that includes all of the communities that the University serves, this strategy opens up powerful new ways for the University to communicate with its constituents, reach out to diverse populations, build better connections with K-12 schools and community colleges, and enhance online learning experiences for lifelong learners.



B. WEB

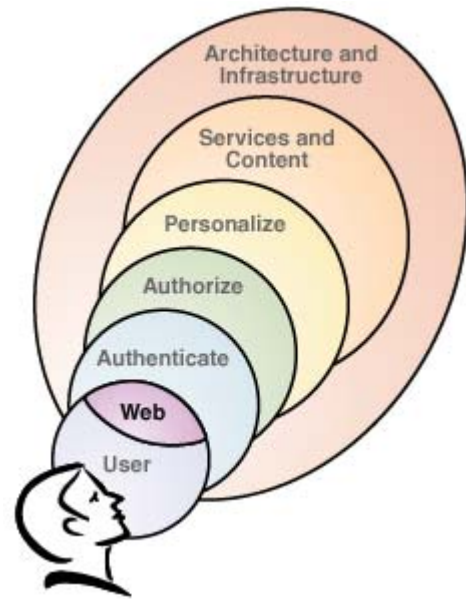
The World Wide Web is a universal lens through which to offer access to University resources. Through the Web, users can tap into the information, tools, and resources they need to accomplish their goals. The Web is the ideal environment for universal access because it works the same way for all users, no matter what computer system they have. The Web is cost-effective and easy to manage, and changes to it can be made quickly and universally.

The University's vision calls for a new way of looking at the Web. Today, most Web pages are static. They offer online versions of printed materials containing standardized information. The University's vision expands that view to include a dynamic Web environment that provides interactive resources and *customized* services, services that are tailored to the individual user.

An example of this new environment already can be seen at the University. In the past, students could go to the University's Web site for general information about a variety of topics including class registration and financial aid, but they could not register for classes or apply for financial aid.

Today, students still go to the Web for general information, but they also can access personal information. They can view their grades, student account and tuition balances, class schedules, and class assignments. In addition, they can register for classes, apply for financial aid, and complete other transactions that previously would have required filling out multiple forms and standing in lines.

Both the static and dynamic Web environments offer a valuable service, and the University's vision is to offer the best of both. The University will continue to offer general information on its official Web site, for external audiences or for anyone not interested in a customized approach. In addition, a dynamic and customized Web experience will be provided for those who want it.



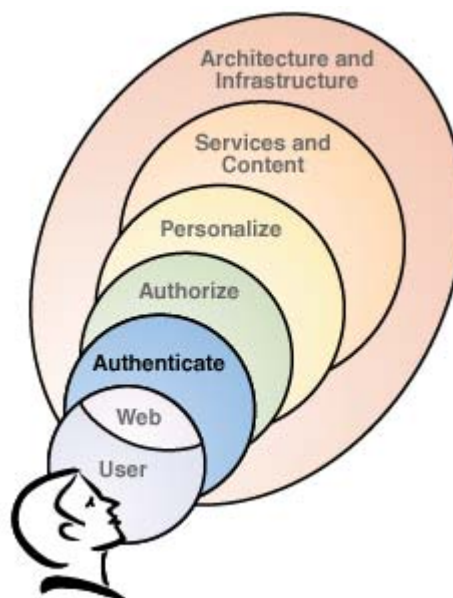
C. AUTHENTICATE

When a user wishes to establish a personalized relationship with the University, the first step is to obtain a University of Washington Network Identification (UW NetID), which serves as that person's passport to University resources.

The UW NetID is an important part of *authentication*, the process of verifying an individual's identity before allowing that person entry into a computer system. Authentication usually is accomplished with a user identification and password.

The University's vision is to establish the UW NetID as the only identification a user needs to enter the University network.

Traditionally, the University has managed the identifications of different constituent groups separately: a student was assigned a student identification (ID), an employee, an employee ID, and a patient, a patient ID. As a result, people with more than one relationship with the University have multiple identifications. In addition, every time a person's relationship with the University changes, he or she is assigned a new ID.



The UW NetID will become the only identification users need to enter the network. Users will be able to keep the same UW NetID throughout their lifetimes, even as their roles and associations with the University change. This will be more convenient for users, but, more importantly, it is a critical step in enabling the University to provide customized, integrated services and resources.

D. AUTHORIZE

After a user has logged on to the network and his or her identity has been established with a UW NetID, the next step is authorization. *Authorization* is the process used to determine what specific resources a user is permitted to access and what kinds of operations that person is allowed to perform.

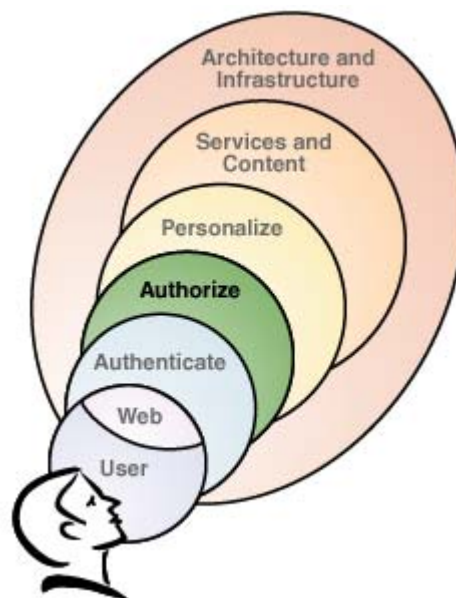
The University's vision calls for an institution-wide Web-based authorization process that provides users with quick and easy access to the resources they are permitted to use.

This new authorization process will identify a person's roles within the University, determine what resources he or she may use in association with each role, and provide access to all of those resources. (Note that users might need to take additional security steps to access highly confidential resources, such as medical records.)

In addition, the new process will allow managers to quickly and easily authorize access to University systems. By filling out a form on the Web, managers will be able to provide new employees with immediate access to the computing resources they need to do their jobs.

Appropriate authorities will be notified automatically, and the necessary audit trails and controls will be in place to ensure that only the proper authorizations are given.

Developing these new authentication and authorization processes also requires establishing the appropriate security measures to protect personal information and to assure people that the information will be used only to provide customized services for them.

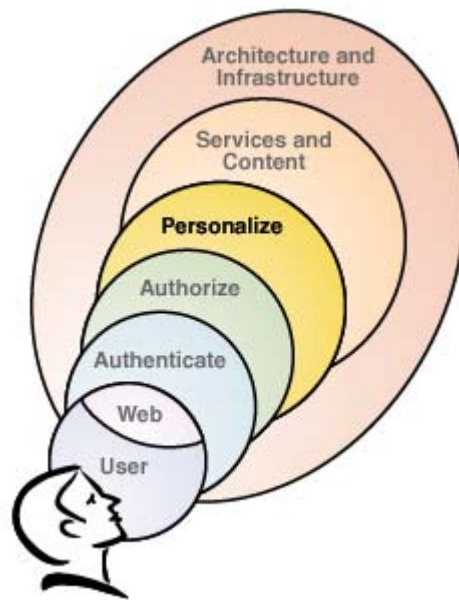


E. PERSONALIZE

Once a user has been authenticated and authorized, he or she enters MyUW, the University's personal portal. MyUW provides a single entry point to the University's resources, delivering customized information, tools, and services to each individual, based upon that person's roles and associations with the University.

The *portal* resembles a home page and performs a similar function by collecting all the most important information in one place and by serving as a jumping off point for further inquiry. But unlike a home page, a portal tailors resources for each individual, pulling together an array of information, tools, and services that reflect that person's relationships with the University and his or her individual preferences. Users can then further *personalize* their views—change the content or look—to better reflect their needs.

For example, a student's portal might be automatically customized to include a class schedule, textbook requirements, Husky card balance, important academic deadlines, links to course Web sites and important references, and information about extracurricular activities of interest to that student. The student can personalize his or her view by deleting any of those items or adding new ones.



The portal depends on authentication and authorization for its power. Once a user logs on, that individual is identified through his or her UW NetID, and the authorization system recognizes the full set of relationships he or she has with the institution. Based upon that information, the portal builds a view of the University that is customized specifically for that user.

The University's vision is for the MyUW portal to serve as the single gateway to University resources, providing information, tools, and services from every department, unit, college, and school within this institution.

To be successful, MyUW must offer compelling content and services that encourage users to log on and keep them coming back. For example, MyUW might offer patients access to personalized services that help them manage diseases such as arthritis, diabetes, or depression; it could help connect recent graduates with alumni well established in their careers; and it could provide referring physicians a way to track and monitor the progress of their patients.

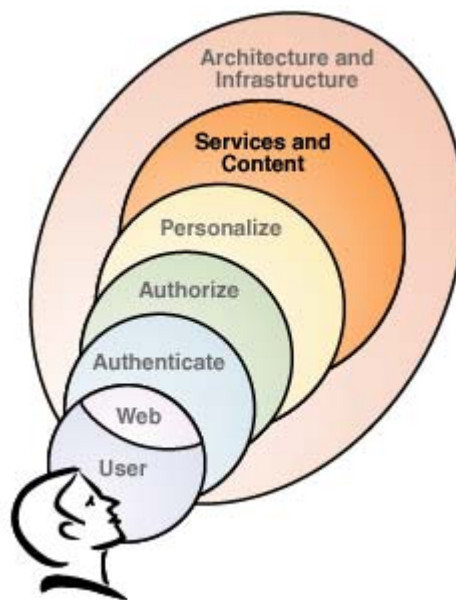
Through these and other opportunities, the University will be able to deepen relationships with constituents and build a sense of pride, ownership, and community.

F. SERVICES AND CONTENT

Once users have entered MyUW, they have access to easy-to-use, multimedia interactive information, tools, and services that have been customized just for them. The services offered through MyUW reflect the full range of activities at the University, such as teaching, learning, research, employment, support services, health care, entertainment, and the arts.

These services can be grouped under three categories:

- **Communications Tools**—tools that allow quick and easy communication between individuals and groups, such as email and discussion groups. The University’s vision is to offer a full array of multimedia communication tools that enhance person-to-person communication and build community. The University also will provide tools that allow departments and units to post material easily on MyUW.
- **Information Resources**—the full array of resources and data necessary to support the activities and operations of a major research university. The University’s vision is to provide its constituents with the information resources they need to accomplish their goals. These include information about academic, cultural, or sports events, and resources that advance knowledge, provide insight into medical conditions, and support University decision-making and operations.
- **Transaction Services**—any service that allows users to complete online transactions. The University’s goal is to provide a full range of services that enable constituents to complete all of their University transactions through MyUW. This includes buying and selling products and services, making medical appointments, paying tuition and other bills, donating money, grading quizzes, registering for classes, reserving library books, or completing administrative tasks.



Delivering these tailored services is possible because of the next-generation infrastructure that recognizes users through their UW NetIDs, identifies all of their associations with the University, and determines what resources they are permitted to use as well as their activities and interests.

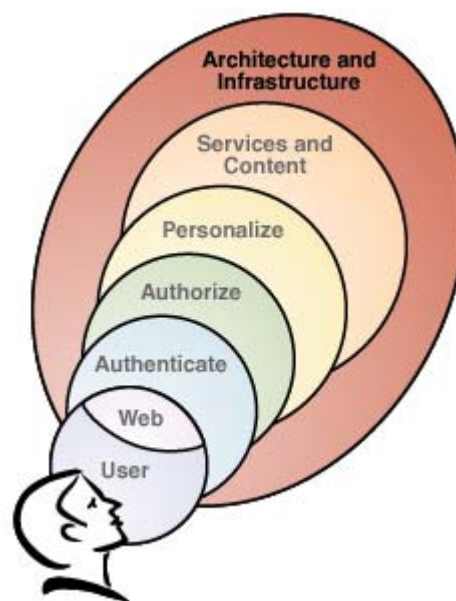
G. ARCHITECTURE AND INFRASTRUCTURE

The foundation of this conceptual framework is the technology *infrastructure*—the underlying hardware and software systems—required by other systems and applications to support the flow and processing of information. *Architecture* refers to the specific organization or structure of components or information within a computing or networking system.

The University's infrastructure supports all aspects of this institution's work, from research and scholarship to daily operations. All systems and applications rely on the infrastructure to do their jobs.

The University's goal is to provide a technical infrastructure that is fast, reliable, recoverable, and secure and that:

- Supports next-generation learning and research
- Offers anytime and anywhere access to University resources
- Improves the efficiency of University operations
- Can rapidly be recovered in the event of an emergency or disaster
- Can easily be expanded to accommodate future growth
- Is based upon the best technology that resources will allow
- Evolves to keep pace with technological advances



To accomplish this, the University will need to keep up with existing technology, participate in organizations that influence technology designs and standards, and advance the University's computing environment as new technologies emerge.

The components of the infrastructure can be grouped under three categories:

- **Computing**—the servers and software that support the multimedia, interactive, computational, informational, archival, and other computing needs of a comprehensive research University with a preeminent health care enterprise.

Computing includes Web servers and the software required to manage Web publishing, email servers and the software necessary to manage email accounts, the video servers that handle online video services, the servers and software that handle central administrative processing and transactions, and data-warehousing software and servers. Computing also encompasses all of the security, backup, and recovery systems that provide robust, recoverable, secure, and continuous operations.

The University's goal is to provide quick and reliable access to information and services while keeping critical institutional data secure and protected from accidental or malicious tampering.

- **Networking**—the hardware and software that manage communications between computer systems and other electronic devices. An important part of networking is the use of standard protocols that allow different systems and devices to communicate with one another. Networking includes the switches, routers, and software that manage the traffic flow. It also includes the design approaches, hardware, software, and support staff necessary for robust, secure, recoverable, and continuous operations.
- **Wireplant**—the physical wire and wireless radio spectrum that carry communications between computer systems or electronic devices. Wireplant includes copper, fiber, satellites, and antennae, as well as the tunnels, trays, conduits, communications closets, and other necessary physical infrastructure. It also includes providing the physical environment necessary to secure key networking and computing components.

Underlying Services

The components introduced above are only a part of what is required to provide the computing infrastructure necessary to support the University.

Behind the scenes, a host of underlying features and services are at work to ensure around-the-clock access to email, Web services, administrative systems, and other computing essentials. These hidden services are there to provide secure and continuous operations, uninterrupted by disasters, security breaches, or technical difficulties.

The following are some of the many hidden services and features provided by the C&C to ensure a high-quality infrastructure:

- **Emergency Preparedness**
 - C&C supported networks have **alternate router centers and redundant paths** so that the loss of a single router or Internet access point will not bring down the entire system. Router centers process network traffic for different parts of the University.
 - The router centers and communications closets that house electronic components have **separate power systems** to ensure continuous operations in the event of a temporary power failure.
 - The University's primary computing facility is equipped with a **diesel generator** that can operate for two weeks with its existing fuel tank capacity and indefinitely if additional diesel fuel is available. The facility handles University-wide networking, critical administrative systems, many medical centers systems, library systems, MyUW, Web hosting for the University Home page and other University Web pages, email, Catalyst tools, lab safety, and other important operations.

- The facility also has **battery powered emergency backup** for short-term power failures or fluctuations and to ensure a smooth transition when the diesel generator is powered up.
 - The primary computing facility has many **physical security features to protect vital electronic components**. These include building access controls that allow only authorized employees to enter the facility and locked cages for extremely sensitive systems. In addition, the facility is equipped with fire and water damage-prevention systems.
 - C&C **disaster preparedness** includes emergency kits for staff. In addition, the racks that house banks of computers are bolted together and equipped with shock absorbers that allow them to rock back and forth in an earthquake instead of toppling over.
 - C&C operates **an Emergency Communications System (ECS) that provides limited telephone capacity for critical University departments during emergencies**. The system uses alternative network connections to provide service when the public telephone system is not available.
 - All **critical systems periodically are backed up to a tape robotics system** that is duplicated over a high-speed network to an alternative tape robotics facility in a different campus location. The backup data from critical systems also is trucked daily to a location in eastern Washington, out of the immediate earthquake zone.
 - The University **contracts with computer facilities in Pennsylvania and Arizona to run quarterly tests on different critical administrative systems** to ensure that the many complex components of software, hardware, and data can be reconstructed to function at the backup facility.
 - Many computer services, such as email and Web servers, use **a cluster architecture that reduces the risk associated with failure of a single system component** and allows extra capacity to be added cost effectively.
- **Security**
 - Data and applications used to run the University's business functions are protected from unauthorized access. These **critical systems can be accessed only by employees with Secure ID cards**. Each card has a numeric password that changes continuously. Currently over 3,000 users have Secure ID cards, and that number will grow as demand for protected services increases.
 - **An encrypted password is required to log on to all C&C managed systems**. This results in fewer compromised accounts on central servers and decreases the risk of security breaches.
 - C&C has taken steps to **limit access to computer systems that handle critical operations** by closing off ports and other standard access points.

- All **systems continually are upgraded with the latest security patches** to ensure that known security holes are closed.
- **Email on the central mail servers continuously is scanned for viruses.**
- University servers periodically are probed to expose any security risks.
- **Ongoing Monitoring, Maintenance, and Repair**
 - C&C runs a network operations center that continuously **monitors the entire centrally supported network** and repairs any problems that arise.
 - C&C staff **monitors all critical computing, networking, and building systems 24 hours a day, seven days a week.**

Implications for the Future

Many current trends in higher education have implications for the University's infrastructure. As the University leverages technology to advance its goals, demands on the computing infrastructure will grow. Some examples follow.

Enhancing Teaching and Learning

Over the next decade, learning will become more experiential and student centered. In order to make that transformation, a significant percentage of classrooms must be capable of supporting high-bandwidth, interactive, multimedia, and digital learning experiences. The lack of these facilities already is limiting what faculty can do in the classroom, and this problem is increasing exponentially.

Access to multimedia services, including live and on-demand television and radio content, are fundamental to the goal of "anytime and anywhere" teaching and learning. The University's goal is to sustain its leadership role in this area. This requires providing adequate radio and television spectrum and satellite facilities to support its national research information dissemination activities, such as the ResearchChannel. Examples include channel allocations on Echostar's DISH satellite network for the ResearchChannel and on UWTV.

To remain competitive in the twenty-first century, the University also must offer high-speed Internet access to global information resources from its libraries, classrooms, labs, medical centers, and public spaces.

Supporting Collaboration

In addition, the University's information technology infrastructure must be able to support a growing number of partnerships in various research, educational, and regional economic development efforts. For example, the University was instrumental in developing a statewide K-12 network that provides schools with access to global information resources. The University currently operates that network for the Washington State Department of Information Services. More recently, the University has been involved in a national initiative to provide K-12 schools with next-generation, high-speed access to information resources through Internet2.

To enable these types of partnerships, the University's technology infrastructure must be upgraded to support new methods of collaboration, not only locally, but also globally.

V. IMPLEMENTATION ISSUES

Implementing this *Information Services Strategy* and creating the technological and organization environment the University needs for the twenty-first century will be a major effort involving significant challenges. This *Implementation Issues* section addresses:

- Creating an information organization
- Future risks and challenges
- An approach to modernizing the University's core support systems
- The resource implications of implementing this strategy and supporting the University's information technology needs into the future

A. CREATING AN INFORMATION ORGANIZATION

While new technology approaches and solutions are a critical part this strategy, simply overlaying new technology on existing business practices will not create the kind of information organization this document envisions. An essential part of implementing this strategy is to rethink the University's current organizational process and structures. Organizational change must proceed hand-in-hand with new technology solutions if the University is to realize the vision of providing information, tools, and services anytime and anywhere.

The University must move away from the highly departmentalized organizational structures and cumbersome, paper-based processes that have evolved over the past century and become a more collaborative and integrated organization. This will require:

- Making information that currently is scattered among many units and departments readily accessible across departmental line
- Pulling together and coordinating services that currently are divided among departments and units in order to provide one-stop shopping for constituents
- Streamlining and simplifying organizational processes so they are easy to learn and use and offer the most direct and efficient approach to getting the job done
- Focusing not on process, but on outcomes

The User Approach

Many of these changes are underway in departments and units across the University. To enable further change, this strategy proposes building upon the successful approach used by the University Services Renewal (USER) project.

The USER project, launched in 1997 and funded through the University Initiatives Fund, focuses on improving University support services by identifying ways to streamline current business practices and then by using technology to support those changes. Under this approach, the focus is on meeting the needs of the user, not on the technology.

The USER approach starts by asking the people who work most closely with the University's systems and processes how best to improve them. It calls for broad-based involvement by members of the University community in every step of a project, from development through implementation. This involvement ensures that organizational and technological solutions meet the users' needs.

A key to making this approach work is to foster an environment where people feel free to think creatively, take risks, and challenge the status quo. USER project teams follow a set of guiding principles that promote new ways of thinking. For example, teams are encouraged not to be bound by the way things have been done in the past. In addition, the word "failure" has been stricken from the USER project vocabulary. Instead, there are "unexpected outcomes" that provide new opportunities to learn.

The USER approach is a good model for this strategy because it promotes the type of cultural change necessary to position the University for the future.

Challenges to Creating an Information Organization

Creating an information organization involves significant challenges. These include:

- **New Roles:** Restructuring business practices will involve new roles both for departments and for individual positions. Information technology will allow departments to complete more transactions without the need to go through central services. This will create new roles for both central and departmental staff. In addition, as new business practices are implemented, the responsibilities of individual positions may change. Additional training and support may be needed to support employees in their new roles.
- **Absorbing Change:** Change must occur at a pace that can be absorbed by departments and units with minimal disruption to daily operations.
- **Sustaining Change:** Encouraging and ensuring the broad-based involvement of employees throughout effected departments is essential both to initiating and sustaining organizational change.

B. RISKS AND CHALLENGES

Managing technology involves handling enormous complexity and all of its associated risks. This is especially true of systems and infrastructure that have the scope and range of those at the University of Washington. There are tremendous challenges to running systems with highly interrelated and interdependent technologies, especially when those technologies range from ones that are aging and no longer supported by their vendors to others that are still unproven and on the leading edge.

This section describes some of the challenges of managing the University's computing environment today, as well as those this institution will face in the future.

The University's Current Computing Environment

The University has over 1,200 computer servers that are managed centrally by Computing & Communications (C&C) and over 50,000 computers on the campus network. Over the past decade, the growth in demand for computing services has been exponential. Network packets, transaction volumes, the number of email messages and Web pages, time spent online, and the frequency of access to Web services all have skyrocketed.

Added to these are new technologies such as video streaming, voice over Internet, high-quality audio, and new tools for video conferencing, all of which are placing a tremendous load on the network and servers. At the same time, the University is beginning to use the Internet to reach new populations of users, including potentially hundreds of thousands of alumni and patients.

In addition, technology is in constant flux. New software fixes and security patches are being released daily, operating system upgrades occur yearly, and major software and hardware revolutions happen at least every decade. On top of this, these technologies continually are evolving, as new architectures, applications, and approaches are incorporated into them.

Keeping pace with all of this change requires constant monitoring, testing, planning, and adjustment by systems engineers throughout the University. Technological efficiency must be balanced with cost effectiveness. All of this must be accomplished in a way that minimizes interruptions to the University's existing systems and that still allows the addition of new services that the technology-savvy communities of a leading-edge research university have come to need and expect.

These are a few of the complexities the University is dealing with today. What follows is a look at some of the major challenges ahead.

Future Risks and Challenges

Funding

Securing the appropriate level of funding is the single biggest challenge to implementing this strategy and to providing the computing infrastructure and services the University needs in the twenty-first century. Maintaining the complex infrastructure necessary to support a large research university with medical centers cannot be accomplished without significant ongoing funding. The need for such a funding source is discussed in the *Resources and Priorities* section.

Keeping Pace with Emerging Technologies

To make smart technology decisions, evaluate emerging technologies, avoid dead-end solutions, and identify lower cost approaches, the UW must recruit and retain highly qualified staff and then give them opportunities to keep abreast of new technology developments and to influence technical directions. The University accomplishes this in a number of ways.

Computing & Communications selects its professional staff competitively from a pool of recognized technology leaders at peer research institutions and in the private sector. Staff members and other University representatives are involved in leadership roles in many key technology areas.

These include international and national committees responsible for setting technology standards and approaches for the Internet, email, security, authentication, high-speed networking, quality of service, video streaming, and high-definition television.

C&C staff members and other University representatives also provide leadership in new initiatives in networking, administrative computing, supercomputing, Internet security, and in discussions of emerging technologies, architectures, and approaches. In many cases, vendors seek partnerships with the University because of its leadership in these areas. In addition, C&C consults closely with colleagues at peer institutions on technology choices and directions.

Looking into the future, the University will need to remain involved in these national and international technology endeavors and to continue to recruit and retain a world-class staff in order to successfully manage its technology infrastructure and remain competitive with its peers.

Scalability

Designing enterprise-wide computer systems that are scalable, or that can be expanded to keep pace with rising demand, is a complex undertaking that requires many tradeoffs. C&C proposes the following approaches to ensure scalable computing in the future:

- **Invest in open Internet-based standards** that allow University systems to communicate with each other.
- **Avoid technologies that are not based on common, industry-wide standards** or that are incompatible with Internet standards, even if they are popular.
- **When possible, avoid technologies that add unnecessary complexity.** A complex highly heterogeneous computing infrastructure is more expensive and difficult to maintain than a homogeneous system, requires a broader expertise and potentially more staff to operate, and has an inherently higher risk of failure.
- **Continue the University's involvement in creating and developing national technology standards.**
- **Continuously evaluate emerging technologies, but wait on adopting them until they mature** to a point where they are stable and can be supported.

This approach has worked well for the University thus far, and C&C believes it is the best strategy for providing an infrastructure that can scale to meet future needs. However, there are tradeoffs. For example, this approach has involved saying "no" to popular technologies that do not have open standards or that add to the complexity of the system. Is this the right approach for the University in the future?

Security

Security always has been a primary concern for University computing and will be one of the greatest challenges to implementing this strategy. Several factors are converging that will require the University to increase its investment in its security infrastructure: new regulations protecting personal privacy, the growing sophistication of hackers, current global tensions, the University's growing reliance on computer systems and services, and the increasing interconnectedness of University systems.

No environment can be made to be totally secure; it is technically impossible. Human fallibility can defeat even the most expensive and technically elegant defenses. In addition, there are many risks and tradeoffs involved in engineering security into University systems. For example, it can be difficult to achieve the right balance between accessibility and security. Typically the more secure a system is, the harder it is for even authorized people to gain access to it. Such systems also often require increased management and maintenance.

The scale and complexity of the University's systems, combined with the need to make them accessible to a large and diverse constituency, makes security an increasing challenge. Although the central servers have multiple layers of security protecting core business data, the addition of many UNIX and NT servers working in conjunction with the mainframe has made security more difficult. This risk has been mitigated by the diligent application of security patches and by keeping all unnecessary functions off of these servers.

A greater challenge is ensuring the security of systems that are not centrally maintained. This will only intensify as University systems become more interconnected, meaning that a weakness in one compromises the security of the entire network.

Every day, every system on the network is bombarded continuously by automated software attempting to exploit security holes. New vulnerabilities, due in large part to the rapid evolution of software products and releases, continually are discovered. Most vendors provide patches to address these weaknesses, but the systems have to be updated with this never-ending stream of new patches.

If the systems are maintained carefully, and if the latest security patches are applied, these risks are mitigated. Unfortunately, many systems across the University do not have this type of maintenance. A number of factors make it difficult for departments to make the investments necessary to provide this level of support. However, systems that are not adequately maintained cannot be connected to the network, because of the security risks they pose. This is a significant issue because it means that not every part of the University community can take advantage of the central network and the new services that are being developed.

The University is taking important steps to deal with security issues. These include:

- **Designing for security as a basic part of developing UW enterprise systems.** C&C has a Security Infrastructure Team that focuses on the basic tools for authentication and authorization and that works with product developers to build secure products.
- **Keeping desktop and server systems updated with the most current security patches and troubleshooting machines that are attacked.** C&C and computing support staff in UW departments and colleges are working hard to keep these systems updated.
- **Offering support to departments and units in administering and maintaining servers and desktops.** This support is available either through C&C or through remote hosting services that meet security standards established by the Washington State Information Services Board.

- **Establishing a Privacy Assurance and Systems Security (PASS) Council** to address the University's strategic security, privacy, risk management, and compliance needs. The council's goal is to create a safe and compliant computing and networking environment. It provides oversight for security policies, planning, and practices.

Client Services

As the computer becomes more critical to accomplishing much of the academic and administrative work at the University, it is increasingly important that all of the components of the computing environment work securely and reliably around the clock and that people can take advantage of the many possibilities that technology offers.

Providing the user support necessary to ensure security, reliability, and functionality is a daunting task for any organization. It is particularly challenging in an environment as multifaceted and complex as the University's, with its decentralized management, disparate business and academic goals, and unevenly distributed resources.

Ideally, each computer user would receive immediate, expert support when needed—to assist in working more efficiently or in solving problems. This would be a difficult goal to achieve in even the most resource-rich organization. At the University, the responsibility for client services is shared. Computing & Communications (C&C) provides support for central networking plus a range of common services including MyUW, email, administrative applications, and Web publishing. Department, units, colleges, and schools provide support for local services such as file storage, backup, and printing and may offer other services for specialized needs.

Many constituents within the University would like to receive increased client services, both locally and centrally, and there is a need for that. However, delivering client services to such a large and diverse environment within the constraints of limited resources has involved setting priorities and making strategic choices. The following describes C&C's current support model. Is this the right approach for the future?

C&C's current support model is to:

- **Limit direct support to services that are provided centrally by C&C**, including the central University network, UW NetID account services, email, Web publishing on central servers, and installation and use of licensed statistical software such as SPSS and SAS.
- **Provide support to central units and users of core administrative and academic applications.** This primarily involves support for central business units such as Human Resources, Financial Services, Facilities Services, Student Affairs, and others.
- **Rely on departmental computing staff for local support.** Academic and administrative units at the University provide a wide range of computing and networking services to their constituencies. The breadth of these services varies widely from one department to another, depending upon the availability of resources. Some departments have a sizable staff of highly trained professionals, while others rely on graduate students or administrative staff to run their critical systems. Having support staff members who are in the same location as users and

who have a good understanding of the department's work is a great advantage when there is sufficient funding to provide adequate staff.

- **Support departmental staff in providing local services**, including answering detailed questions about the use of central networking resources and security issues.
- **Provide in-depth training programs that enable more expert use of technologies and tools.** C&C's Computer Training program provides an extensive series of courses in system administration on a cost-recovery basis. Highly qualified professionals contracted from area training firms teach these courses. In addition, C&C staff members teach classes on Web development, publishing, and accessibility.
- **Provide direct desktop support and other services under contract to specific University units.** Some University units contract with C&C to provide desktop computing and networking services and support. An example is the Nebula service, which initially provided desktop support for a small group of Provost Office staff in the mid-1990s and has grown to serve over 2,000 people. This model conceivably could serve thousands more desktops at the University, given sufficient interest.
- **Offer fee-based consulting and support services to address specific needs.** For departments needing assistance beyond the normal level of support available through C&C Client Services, C&C's Project Consulting team can respond either by using resources within C&C or contracting with outside firms. Project Consulting responds to a variety of needs including development of custom applications, security analysis and problem resolution, and system design and configuration issues. This service is available to any University department on an at-cost basis.
- **Continue to foster a customer service culture characterized by high-quality, respectful service.** Look for additional ways to respond promptly to customers even when resources limit C&C's ability to meet their needs. (Note: C&C Client Services staff members typically receive 70-100 questions per day by email. Many are answered within the hour, and the average response time is within one day. In addition, an average of 70 questions are received and handled each day over the telephone by Information Services staff.)
- **Promote ongoing communication with the University community about technological directions and changes in a variety of ways**, including through publications such as *Windows on Technology* and *UW Online Technology News* (OnTechNews), quarterly computer-support meetings, email lists and Web pages, Web developers' meetings, and online information. C&C is looking for additional ways to enhance and improve communications with the University community.

C. MODERNIZING SUPPORT SYSTEMS

The University of Washington has made substantial investments over the past 30 years in purchasing and developing core support systems that work in its highly complex environment.

These systems, which include the student database, payroll system, financial accounting systems, and budgeting system, are critical to the University's daily operations. Together, they support a

payroll of \$700 million per year; process over 500,000 transactions daily; handle student services including undergraduate admissions, registration, grade reporting, tuition billing, and financial aid; and help to manage the institution's finances and budgets.

As some system functionality has grown obsolete, the University has faced the dilemma of how best to modernize these systems. The challenge lies in finding a cost-effective option that can handle the complexity of a large research university with major medical centers.

This section gives an overview of the problems with the current support systems, some options for addressing these inadequacies, the University's strategy thus far, and the rationale behind this approach. The question is, given the risks and tradeoffs of all possible approaches, does the University's current strategy make sense for the future?

Outdated Functionality

There are three major areas of the University's support systems that are significantly outdated and are not adequately meeting the University's needs. They are:

- **User interfaces that allow people to interact with the data.** These systems have character-based, non-graphical interfaces that are difficult and cumbersome to use.
- **Ability to access and extract data.** Current systems make it difficult to access and analyze key institutional data necessary for decision-making and management.
- **Complexity.** These systems contain hundreds, and sometimes thousands, of computer programs that include business rules that ensure transactions are being processed according to University practices and state and federal regulations. Over the years, these computer programs have been heavily modified to meet new user, regulatory, and business requirements. As a result, both the computer programs and the ways they interact have grown increasingly complex and arcane. This has made it progressively more difficult for computing programmers and system managers to maintain and modify these systems and for businesses managers to understand and use them.

Build or Buy?

There has been an ongoing national debate among higher education institutions about the best approach to modernizing support systems: buying a new system, developing one in-house, or using a combination of strategies.

Many peer institutions have opted to purchase new integrated systems from major vendors, investing hundreds of millions of dollars and years of effort, with mixed results. Many of these institutions have found that while these new support systems work well in a corporate environment or in smaller educational institutions, they are not designed for the complexity of a large research university with major medical centers.

It is difficult to get these new systems to mesh with an institution's complex business practices. Many institutions have found that they either must spend substantial time and resources customizing their new systems to match their business practices, or they must change the way they do business in

order to conform to the new software. Either of these can be extremely difficult in a highly decentralized university environment. As a result, these large-scale replacement projects can be enormously expensive, with prices ranging from \$50 to \$200 million dollars, and extremely disruptive to the institution. In the end, the system still may not fully meet the institution's needs.

Given this uneven track record, other institutions have bypassed total system replacement projects in favor of other approaches, such as upgrading their current systems, enhancing their systems with new features, and buying new programs to handle specific tasks.

After carefully evaluating the options and consulting with peer institutions, the University of Washington has thus far concluded that a large replacement project is not the right approach for this institution at this time. This decision was based on the following reasons:

- **Costs can be prohibitive.**
- **Replacement has proven not to work well in the complex, highly decentralized environment of a major research university.** The University has spent years developing business rules for its support systems that ensure transactions are processed according to University policies and procedures as well as state and federal regulations. Replacing them would be extremely difficult and expensive.
- **Replacement does not fit in with the University's strategy of tailoring technology solutions to meet the needs of users.** Instead, in large replacement projects, users must often adjust their work practices to conform to the new systems.

The Situation at the University

Over the years, the University has made the investments necessary to maintain the core functionality of its support systems and to keep up with continuous changes in its business practices. As a result, many of the underlying processes still are meeting the University's business needs.

In addition, the Unisys MCP hardware and software computing platform, the environment on which these systems operate, continues to perform well. Unisys provides a high-quality, cost effective and highly secure technology platform. The vendor is moving toward standard Intel hardware to build its processors and investing in research and development so it can take advantage of new technologies. Consequently, there has been no need to replace the entire infrastructure of the University's support systems in order to upgrade inadequate functionality.

A New Look at Legacy Systems

Unfortunately, older support systems have developed an unfavorable reputation in recent years. They are often referred to as "legacy" systems, a term that has developed a negative connotation implying that these older systems primarily represent problems and costs. In reality, these systems have many positive aspects. They are a valuable source—and frequently the only reliable repository—of institutional business rules. Strategies that involve totally replacing these mature systems often overlook the valuable heritage they offer.

The University's Strategy

The University's current strategy is to preserve this valuable heritage and to leverage the investments it has made in these systems by retaining the parts that are continuing to perform while incrementally replacing the antiquated functionality.

The University approach includes:

- **Using Web-based technologies to develop user interfaces** that make it convenient and easy to view, input, and modify data over the Internet. These conversions will occur as the need and opportunity arise and as resources allow, with the goal of eventually replacing all old user interfaces.
- **Employing data warehousing techniques to provide timely, accurate, and meaningful data analysis and reports.** "Data warehousing" is the term for a series of techniques used to integrate data from multiple sources and to make the data easy to access and analyze.
- **Retaining older-generation application software in the Unisys environment,** and reorganizing and simplifying these core processes so that they more easily can be moved to a new system and/or replaced should the need arise.
- **Replacing core processes that no longer are meeting the University's business needs** by building or acquiring new systems or modules that reflect current business practices.

If certain components of these systems need to be replaced or augmented, a variety of approaches can be used. These include purchasing vendor products for University systems, buying system services from a remotely hosted service provider, or contracting with external or internal software developers to build new functionality. As new systems or services are added, it is critical that they be integrated with the University's authorization, authentication, and personalization infrastructure.

Benefits

This approach leverages the University's previous investments in its support systems, while avoiding the risk, expense, and disruption of a total replacement project that is not tailored to the institution's business practices or integrated with its authentication, authorization, and personalization infrastructure. It allows the University to determine how best to streamline its organizational practices, rather than have a vendor solution drive the process. This approach also enables the University to proceed incrementally and to control the pace of investments in new technologies and systems according to the availability of resources and the ability to absorb change.

Challenges

There are, however, challenges involved in making this approach work. The University must keep pace with new and emerging technologies, and it must make computer and infrastructure upgrades to meet the demands of new systems and services. The necessary funding and human

resources must be allocated to make this approach effective. In addition, as this strategy progresses and technology evolves, the University will need to continually evaluate its options and reassess its decisions to ensure that it is on the right path.

D. RESOURCES AND PRIORITIES

Background

Over the past decade, the University increasingly has become reliant on its computing infrastructure and services to support every aspect of its missions, from teaching, learning, and research to public service and health care. Demands for new software applications and services have been growing at a tremendous rate, and this trend likely will continue, as technology becomes a more integral part of our lives.

Yet, unlike many of our peer institutions, there has been no significant increase in operating funds for the University of Washington's computing infrastructure over the past 10 years. Funding constraints have meant that the University has had to channel its resources toward other priorities. While there have been targeted resource allocations to address specific emergency situations, these have been more than offset by general operating budget reductions mandated for Computing & Communications (C&C) in excess of \$7 million.

As a result, the University's central computing budgets today are similar to those of the mid-1980s, despite an explosion of new technologies. The arrival of the Internet and the Web has been accompanied by an unprecedented growth in both the volumes handled by the University's computing environment and in its complexity. There also has been a large increase in users' expectations.

To keep up, C&C has used every means available to leverage its limited resources. Some of these actions would have been taken anyway because they saved the University money. These include:

- Organizational consolidation and staff layoffs
- Standardizing and consolidating networking infrastructure
- Consolidating computing platforms
- Using the existing telephone wiring infrastructure for networking
- Smart technology decisions
- Automating many internal functions, such as help-desk routing, tape robotics, and system monitoring

Other actions C&C would have preferred not to take, but difficult choices had to be made in light of the resources available. These include:

- Deferring support for administrative systems in favor of infrastructure investments

- Reducing the scope of client services and support
- Saying "no" to many new projects and requests

In addition, C&C has used a combination of funding approaches and investments in technology improvements to support new projects and services, such as the activities and recent accomplishments described in this document. Taken together, these approaches constitute the defacto prioritization processes for improving the University's technology infrastructure and central support systems. They include the following:

- **University Initiative Fund (UIF) requests.** The UIF process has resulted in a number of the ongoing activities described in the *Implementation Activities* section of this document. These include employee self-service, the online payroll update (OPUS), the grant and contract improvement process, and data-warehousing efforts.

These projects were selected based upon the highest priority needs documented by a number of support system reviews conducted during the 1980s and 1990s and upon the competitive UIF process. Once projects were funded, priorities for each were established with broad input from University constituencies.

- **Self-sustaining approaches.** C&C self-sustaining groups have developed a number of University systems funded by individual University clients including the lab safety system, the temporary services system, the Nebula desktop support system, and the parking fee system.
- **Partnerships.** A number of partnerships have been established that have produced systems with long-term revenue potential, including an educational outreach administrative system, a credit card billing system, and a Web-based stores ordering and cataloging system. In addition, C&C and the Academic Medical Center have formed a partnership to share the use and cost of mainframe computing and facilities infrastructure systems.
- **Grants.** New projects have been funded with a combination of state allocations and federal and corporate grants and contracts. These include Internet2, Gigapop, cooperative library project, statewide K-20 network, and the DO-IT project.

Leveraging limited resources and finding alternative funding sources has resulted in many positive outcomes, including:

- A uniform approach to networking
- A strong infrastructure
- The ability to acquire and retain excellent staff
- Several new innovative information services projects as described in the *Implementation Activities* section of this document
- A low-cost and innovative strategic approach to building the infrastructure and information services necessary for the future

- An approach to planning next-generation infrastructure that is widely praised by our peers

However, these funding approaches no longer are sufficient to sustain the University's computing environment. They alone cannot adequately address the need to do the deferred maintenance on the administrative support applications, keep up with the growing demands on the computing infrastructure from UIF-funded initiatives and other new services, address security issues, and upgrade the networking infrastructure after decades of using the telephone wireplant.

The University now needs to look at its approach to ongoing funding and to develop a strategy that will allow the vision outlined in this document to be realized and position this institution to remain competitive in the future.

Toward a New Approach to Funding

Any new funding approach should recognize that the University's technology environment is made up of two separate parts that should be handled differently. They are:

- **Infrastructure:** All of the components that are shared by the entire community and that represent a common good for the institution.
- **Specific Services:** Existing systems, software applications, or new projects that provide specific services to individual University constituencies.

The Infrastructure

The infrastructure is critical to accomplishing the University's combined missions of learning, teaching, research, community service, and health care. **This infrastructure needs ongoing, sustainable funding in order to support the University into the future.**

The infrastructure encompasses:

- Components of the next-generation infrastructure described in the *Conceptual Framework*—Web, authentication, authorization, personalization, content and services, and architecture and infrastructure (including computing, networking, and wireplant).
- Critical support services, including:
 - Student systems that manage the centrally supported services, such as admissions, registration, financial aid, grades, and billing
 - Financial systems that manage the budgeting and accounting functions of the institution
 - Procurement systems that manage the purchasing of goods and services
 - Payroll and human resources systems that manage employee payroll, services, and benefits

- Equipment necessary to support these operations, systems, and functions.
- Staff (both management and technical) necessary to develop, enhance, support, and maintain these operations, systems, and functions.
- Physical space required to house this staff and its support equipment.

Specific Services

Services for individual University constituent groups should be evaluated according to specific criteria and funded accordingly. In the past, these services have been prioritized through the combination of approaches described above including the UIF and other grant proposal processes, the availability of funding from individual departments for self-sustaining projects, and the formation of partnerships. As the University evaluates its information technology options, what is the appropriate mechanism for setting priorities in the future?

VI. IMPLICATIONS

The next-generation infrastructure proposed in this report is intended to enable the University of Washington to realize the full potential of the Internet and related technologies and to position this institution as a leader in the emerging world of e-business, e-learning, and e-health.

A. IMPLICATIONS FOR DEPARTMENTS AND UNITS

Achieving this strategy will require an institution-wide effort, with implications for every department, unit, college, and school. It will involve making important strategic decisions about technology directions, including a commitment to a standard, institution-wide approach to key infrastructure components. It will entail a high level of coordination and cooperation among departments and units across the University.

Lessons from the Past

More than a decade ago, the University faced a similar strategic decision in determining its approach to networking. At that time, different departments within the University were using their own local networks and could not share email or other electronic communications. The University decided to establish an institution-wide networking approach that would allow the exchange of electronic communication across campus and around the world.

Although many were opposed to this move at the time, it became clear that there were substantial benefits to this approach. This decision positioned the University to become a national leader in networking technology, and it enabled the type of collaboration within the University and with national peers that has been critical to the University's success.

Meeting Today's Challenge

Today, an analogous situation is arising as colleges and universities across the country grapple with how best to leverage Internet and other related technologies. Institutions are offering more and more services over the Internet. They are creating separate portals for students, employees, alumni, and other constituency groups. They are establishing disparate authorization and authentication networks, each requiring separate identifications and passwords. The result is a confusing array of disconnected services that presents a fragmented view of an institution and can lead to inefficiencies and frustration.

The University again is poised to take a regional and national leadership role in defining new directions for these emerging technologies. Once again, this requires the University to consider a strategic decision to invest in an institution-wide approach. This approach will enable the University to create an integrated system of services and resources, with one authorization and authentication system, one portal, and one strong, unified institutional identity on the Web.

Many departments and units within the University already are working together on such an approach, including the Office of the Executive Vice President, Educational Outreach, the Medical Center Information System, the University of Washington Alumni Association, Computing & Communications, and the Student Access and Computing Group (SACG, formerly UWired). However, realizing the full potential of this approach depends upon attracting a high level of participation from departments and units throughout the University.

Guidelines for University Departments and Units

In order to take advantage of the technology components that are being developed as part of the next-generation infrastructure, departments, units, colleges, and schools should follow the guidelines included below. These guidelines are not intended to limit, in any way, the options of departments, units, colleges, or schools to purchase systems from vendors, to build systems internally, to employ contractors, to acquire services from C&C, or to use any combination of these approaches.

These guidelines are meant to ensure that any new systems that are developed will integrate with the next-generation infrastructure. There have been several instances where vendors have been willing to modify or enhance their systems to be compatible with the next-generation infrastructure, and they understand that this increasingly is a requirement for doing business with the public sector, as well as private enterprises.

The guidelines are to develop systems that:

- Use standard TCP/IP Internet networking technologies.
- Are based on Internet email standards including SMTP and IMAP.
- Are based on standard Web-based interfaces and use standard Web browsers (as opposed to proprietary client software that requires specialized software to be loaded and supported on each desktop).
- Take advantage of UW NetID authentication and standard University Web-based authentication software to avoid multiple passwords and logins for users as they navigate between systems. (This eventually will position UW NetID users to

become members of the Eduperson Internet2 community, allowing cross-institutional authentication as well.)

- Take advantage of the University authorization system that currently is being developed. This system allows Web-based maintenance of roles and access authorizations, and it enables the use of University-wide workflow and electronic forms software.
- Take advantage of the personalized environment provided by MyUW by publishing information and services (or links to information and services) in MyUW and by using MyUW standards-based publication approaches.
- Take advantage of other e-commerce facilities such as standard e-form and workflow routing software currently being tested and deployed for a number of University-wide applications.
- Follow the basic standards for computing environments that are required to take advantage of MyUW and other new services. A list of these minimum requirements can be viewed on the Web at <http://www.washington.edu/computing/hardware/>

In addition, University departments, units, colleges, and schools should:

- Review the list of projects and activities included in the *Implementation Activities* section of this document to see if any of those projects support their needs and to avoid duplication of effort.
- Consider how to take advantage of the MyUW portal as an outreach tool that can help foster relationships with constituents. One way to build relationships is to offer constituents access to MyUW. In order to this, departments, units, colleges, and schools will need to work with C&C to establish procedures for providing UW NetIDs to their constituents.
- Keep track of future technology offerings and improvements that may support their future needs by periodically reviewing the list of projects and activities included in Appendix I of this document, *Implementation Activities*, and eventually updated on the *Implementation Activities* section of the Web version of this document. Another helpful resource is the Technology Directions for Network Computing Web page, at <http://www.washington.edu/computing/directions/>
- Get involved in USER task groups and projects. These projects are creating the support services environments for the future, and broad based participation is important to ensure they meet users' needs.

Security Considerations

When making decisions about new systems and services, departments and colleges also should consider the implications of an increasingly threatening security environment. It is costly to maintain servers and desktop systems so that the latest system software security patches and security policies are in place. However, there are even greater costs involved if these systems are not kept current,

including loss of access to servers and research data and risks for all the systems sharing the same network, such as denial of access, intrusions, and theft of data.

There are now services that offer professional support in administering and maintaining servers and desktops. These services pass the risks to a core of professionals and provide economies of scale. They are available either through C&C or through remote hosting services that meet security standards established by the Washington State Information Services Board. These alternatives should be considered as new systems are planned and as approaches to old systems are reconsidered.

B. IMPLICATIONS FOR COMPUTING & COMUNICATIONS

This section describes the implications of implementing this strategy for Computing & Communications.

Text for this section has not been developed, but could be if there is interest.

VII. NEXT STEPS – A UNIVERSITY-WIDE CONVERSATION

Many technology conversations have been taking place around the University on a formal and informal basis. The introduction of this *Information Services Strategy* is intended to facilitate more formal discussion and planning University-wide. This document is not intended to present the definitive answer, but rather to provide a starting point for discussion; to ask many questions and to propose solutions.

Over the next months, we hope that more detailed conversations can lead to a better collective understanding of future challenges and opportunities. We hope these conversations will inspire new ideas about what is possible. We hope they will give rise to innovative approaches that will help all of us make the most of new and emerging technologies and will contribute to advancing the University's most important goals.