



**A Culture of
Innovation and Excellence
Powered by
Knowledge and Technology**

A Report of the Blue Ribbon Committee on Information Technology Excellence

March 31, 2011

EXECUTIVE SUMMARY

Vision

To position UC Davis at the forefront of discovery, learning and engagement, we envision a time in the near future when information technology services built upon a shared cyberinfrastructure are effectively integrated into every aspect of our academic life, and where current barriers to IT integration and use have been replaced by a widely-supported philosophy of universal access and abundance.

Grand Challenges

1. Create a top-tier cyberinfrastructure, an essential basis for research excellence and growth, as a fundamental campus priority.
2. Transform the Library into an *Academic Hub* that promotes the effective and innovative use of digital information resources in discovery and learning for the future.
3. Develop a compelling student experience that attracts outstanding students from all backgrounds and enables them to achieve their full potential for intellectual development and creativity.
4. Integrate technology services (the “community good services” described below) across the Davis and Sacramento campuses.

Building Blocks: Actions and Initiatives

1. Deliver ubiquitous wired and wireless connectivity as part of the campus cyberinfrastructure to support universal access.
2. Provide continuously increasing capacity and functionality for curation, storage and retrieval of large datasets.
3. Substantially increase access to a high performance computing infrastructure that empowers scholars in all disciplines and facilitates interdisciplinary collaboration.
4. Deliver a seamless group of distributed services focused on developing, managing, preserving and using the digital assets of UC Davis for discovery, teaching and learning.
5. Integrate IT and ongoing research on educational effectiveness to develop and enhance the best technology-assisted approaches to learning and student success.
6. Actively pursue and leverage partnerships with like-minded academic, corporate and governmental entities.
7. Create investment strategies that include all sources of funding (e.g., operational funds, loans, indirect costs and capital funds), while removing current financial barriers.
8. Combine responsibility, authority, and financial capacity in a unified high level leadership and governance structure to implement these recommendations.

The campus vision of IT excellence relies on addressing the Grand Challenges with actions associated with the building blocks mentioned above. A timely coordinated approach to planning and funding IT operations is critical. Scalable and sustainable models for assessing the success of IT planning and investments will provide a continuous cycle of renewal and anticipation for the future.

INTRODUCTION

Committee Charge

Develop a vision for the integration of IT and digital knowledge resources for the excellence of scholarship and academic life of UC Davis.

The issues addressed in this report and recommendations are not primarily technical; they are about transforming the ways we organize ourselves to support and enhance the academic mission of the University. The technology for such transformation is available. Goals and objectives discussed are not about IT strategic planning, but rather about UC Davis strategic planning for the most effective use of IT. In an era of constrained resources and limited growth, we must create incentives and provide support for our students, staff and faculty to reach their highest levels of accomplishment, individually and collectively. Providing the most advanced tools of information technology is an essential step. Growing IT resources and capitalizing on its rapidly evolving capacity to support the fundamental academic missions of research, education and engagement can enable innovation and create incentives for achieving distinction for UC Davis. Effective and reliable administrative IT support and “community good services” (IT services used widely across the campus including systems such as high speed networking, email, human resources, financial management, student services and learning management) are also essential. Substantial cost savings can be achieved through consolidating and coordinating these resources and services, reducing redundancy across the campus. These efficiency savings will increase resources available for investments enhancing achievement of the core mission and the *Vision of Excellence*.

Success will require action and change across a spectrum of needs and opportunities identified in this report. Some new investments are essential despite current budget challenges. We offer suggestions for addressing financial issues through programmatic realignment and strategic borrowing based on demonstrable potential for cost savings, more effective resource use, and increased capacity for research growth and success. Judicious investment now will prevent substantial additional costs in the future.

Principles

- A powerful and flexible cyberinfrastructure is the backbone for a successful top-tier academic research institution.
- Innovative learning communities are successful through shared information resources, ready access to information, and platforms for collaboration among internal and external stakeholders and across multiple settings and disciplines.
- Administrative functions are most effective and efficient when supported by integrated and aggregated “community good” applications and information systems—managed in a transparent manner that encourages mutual trust among campus stakeholders.
- Scalability, inside and outside of UC Davis, leverages investments, encourages collaboration and enables delivery of IT tools and resources to enhance achievement of academic excellence and the creation of new modes of discovery.
- Creative financial models may be used to continuously “recycle” financial investments, encourage innovation, and fund major capital investments.
- Continuous vetting by stakeholders is critical to measuring the effectiveness of IT investments.

GRAND CHALLENGES

1. Create a top-tier cyberinfrastructure, an essential basis for research excellence and growth, as a fundamental campus priority.

The committee was unanimous in its belief that core to the advancement of research, scholarship, teaching, learning and the student experience is access to high quality, reliable information technology services built upon a foundation of shared high-end cyberinfrastructure. Many of the most rapidly advancing areas of disciplinary research as well as emerging interdisciplinary collaborations are fundamentally dependent on the most advanced computation, storage and networking. UC Davis must embrace information technology as a strategic necessity for the success of our academic enterprise and remove the organizational cultural barriers that have traditionally impeded its use. Such infrastructure, funding and cultural barriers were frequently cited in extensive campus consultations of this committee. They were also cited in the 2010 external review of UC Davis research by the Washington Advisory Group. The WAG noted the lack of an adequate campus research cyberinfrastructure (RCI) and emphasized that “without the RCI, (increasingly large volumes of) data generated locally is essentially ‘imprisoned’ where it is produced.”

(http://chancellor.ucdavis.edu/initiatives/blue_ribbon-research/wag_report.pdf: pages 56-59). The WAG report concisely and accurately summarizes current IT-related challenges.

An important goal is to create a campus environment in which all academic researchers have ready access to scalable, high-performance cyberinfrastructure—provided as a utility at no additional cost to the researchers. This goal will require investment in connectivity and capacity for high performance computing, as well as data storage, retrieval and curation.

We recommend an emphasis on agile, focused 12-18 month technology projects to support strategic program activities and inspire campus confidence, rather than large multi-year projects. As technological change accelerates, the campus should move quickly to adopt a culture of innovation that embraces faster prototyping and piloting of solutions. Also, subsequent implementation (and later sunseting) should rely on timelines measured in weeks and months rather than years. The developing cyberinfrastructure can itself become a more fundamental element of the research environment, providing incentives for and enhancing the capacity of faculty for grants and extramural support.

2. Transform the Library into an *Academic Hub* that promotes the effective and innovative use of digital information resources in discovery and learning for the future.

We propose an *Academic Hub* as a physical and virtual organization of shared services provided through a partnership of campus units, including the Library; the Academic Senate; the Academic Federation; Information & Educational Technology (IET); Office of Research; units within the Offices of Graduate Studies and Undergraduate Studies (e.g., the Center for Excellence in Teaching & Learning); and Disability Services for faculty, staff, and students. The Hub will plan for and execute services that support faculty, staff, and students in making effective and innovative use of information services and information resources in research, teaching, and learning. The Hub will include physical and virtual environments serving as the

academic center of the “student centered experience” of the UC Davis campus, with welcoming and comfortable facilities open 24 hours and featuring assistance for all campus users.

The Library as the academic heart of campus is the logical focal point and facilitating partner working in this enterprise with all relevant campus units. In addition to housing unique print and hard copy materials, the library space will include physical facilities, such as “incubator” cafes for informal exchanges among faculty, staff, students, and outside entrepreneurs, private group collaboration and study areas, and white-board covered walls supporting impromptu scholarly dialogues; virtual spaces including portals or gateways that are custom windows to information sources and services arrayed for instant discovery and ease of access; and technologies that aid collaborative, interdisciplinary discovery and learning efforts.

The rapidly evolving conception of a successful top-tier university library in the 21st century suggests a revised position description for the UC Davis University Librarian. With a position more closely aligned with the goals of Challenges 2 and 3, the University Librarian is an appropriate person to provide leadership for these initiatives.

3. Develop a compelling student experience that attracts outstanding students from all backgrounds and enables them to achieve their full potential for intellectual development and creativity.

The backbone of a compelling student experience is the ubiquitous network connectivity to facilitate continuous cloud access, knowledge sharing, and collaboration. We need to leverage evolving IT excellence, research expertise (e.g., in education, healthcare, cognitive science, and computer science) and commitment to student success to offer a unique student-focused experience that attracts and engages outstanding students from a wide diversity of backgrounds in California and beyond. We must anticipate the technology expectations of the students of tomorrow and consider new modes of learning and teaching. We need to bring research into the classroom, creating collaborative courses with experts from around the world, and allowing truly *global* students to experience within their courses exceptional levels of collaboration that can’t be duplicated in a single traditional classroom. At the same time, new technologies provide options to help improve time to degree and to create more flexible student learning experiences while ensuring traditional academic quality control.

To capitalize on these opportunities we must partner with the Academic Senate to develop best-of-breed technology-assisted approaches to learning and student success. We must also extend, support, and enhance off-campus learning experiences—including study abroad, in-service learning, online learning, internships—and expand the community of scholars, researchers and learners to people from peer universities, research entities, industries, governments, and NGOs worldwide. We will offer a distinctive set of educational, social, and professional networking opportunities to students, preparing them for a lifetime of success.

Finally, we must take an integrated approach to planning for bricks-and-mortar classrooms, hybrid learning spaces (such as the Academic Hub model proposed here), and online learning services, in close partnership with the Senate and in collaboration with our sister campuses and UCOP.

4. Integrate technology services (“community good services”) across the Davis and Sacramento campuses.

Our concept of community good services begins with the cyberinfrastructure described in Challenge 1 and extends to technology services that are commonly used across most academic, administrative and service units. These may include desktop and classroom support; email, calendaring and collaborative applications; financial and other administrative systems where development may be leveraged through collaborative open-source initiatives with other universities; network (wired and wireless) management and support; and common identity management, authorization and security systems. Savings generated by commodity sharing should be retained in the units that generate them. We then need to leverage the scale of these shared services to negotiate improved contracts and opportunities with external partners and actively continue to reduce “shadow” services and applications that mirror and inefficiently duplicate “community good” services. Campus software standards developed by IET as well as the survey results, assessments and recommendations of ADMAN (the campus Administrative Management Group) and IET can provide a framework for continuing development and expansion of this initiative.

At the end of this report we provide a website for additional information and resources developed through the consultations and research of this committee. Resources include the ADMAN survey data and recommendations and other proposals for coordinating and consolidating technology services, including a draft proposal from Administrative and Resource Management for a Multi-Media Communications unit.

BUILDING BLOCKS/ACTIONS AND INITIATIVES

1. Deliver ubiquitous wired and wireless connectivity as part of the campus cyberinfrastructure to support universal access.

Every member of the campus community should have adequate access to broadband connectivity to enable effective access to the resources of the “cloud,” maximizing opportunities for collaborative interaction and professional partnerships with colleagues on campus and throughout the world. While wireless will reach into every corner of our collaborative spaces at ever higher speeds, a state-of-the-art wired infrastructure will link together building blocks for unprecedented virtual “instruments,” bringing powerful computers, *exascale* data storage, and visual tools for insight to our researchers and their students. Connectivity is essential for the conduct of research, and is as vital as space, power and water. Limits to connectivity currently inhibit capacity for innovation, collaboration and potential for new research support and revenue generation. Providing adequate connectivity throughout the Davis and Sacramento campuses as quickly as possible will require financial investment. The network supporting campus connectivity should be managed centrally, as a fundamental community good—freeing faculty from the need for involvement in network management or server maintenance which will lower barriers to innovation and result in cost efficiencies through economies of scale.

UC Davis is fortunate to have already invested in a robust campus fiber network. Capacity for individuals to take full advantage of this network is frequently limited, however, because of inadequate in-building wiring. A current collaborative effort of IET, Administrative and Resource Management (ARM) and campus deans identified priority projects for upgrading “horizontal

wiring” in two key campus buildings. This effort should be extended rapidly to all campus buildings.

2. Provide continuously increasing capacity and functionality for curation, storage and retrieval of large datasets.

Data intensive computing is driving projections of enormous ongoing growth in data. In the humanities and social sciences, for example, the need for information storage—essential for faculty research competitiveness and success—is increasing by multiple orders of magnitude. The same is true for the sciences and engineering. The petabytes of data needed for cutting edge research in astrophysics, the terabytes of data generated by gene sequencers, and the petabytes of data generated by scientific simulations are all examples of the need for large-scale storage facilities. Shared environments are an increasingly attractive solution where high capacity networks allow access to multiple high quality providers of data storage and retrieval services. Campus-based data centers can be better used for developmental and research-focused applications. Modern, energy-efficient data centers require significant investment and careful design to be responsive to the explosive changes in scale envisioned here. We recommend the completion and implementation of a unified plan for data center management across the Davis and Sacramento campuses.

3. Substantially increase access to a high performance computing infrastructure that empowers scholars in all disciplines and facilitates interdisciplinary collaboration.

Investment in capacity for high performance computing, evolving scientific instrumentation and visualization environments should be an important element of the overall IT strategy at UC Davis, allowing us to leverage the power of large distributed datasets. Units should be managed centrally, located relative to the accessibility of space, power and air conditioning, but made available across the University. With a high level of connectivity and high-end technological resources available to all, access to high performance computing resources could reasonably be provided on a use-based recharge basis (other universities offer successful models for this approach). These services should include flexible multi-media collaboration rooms and “hot desk” environments available to academic researchers and graduate students for high-end computing. They should include staff academic personnel and researchers and integrate with academic departments, labs, clinical departments, and organized research units. Current work of the Academic Senate’s Committee on Information Technology and the faculty-led Research Computing Subcommittee of the Campus Committee for Information Technology (CCFIT) can help establish a clear strategy for improving our research infrastructure for high-performance computing.

4. Deliver a seamless group of distributed services focused on developing, managing, preserving and using the digital assets of UC Davis for discovery, teaching and learning.

The Academic Hub will be the environment for the long term coordination and management of the vital, and increasingly valuable, academic digital assets of UC Davis. Interactive representations and reproductions of physical collections found in museums, art galleries, zoos, national parks, vineyards, agricultural fields, research labs, culinary institutes, etc. will be

showcased. These representations and reproductions are derived from “special collections” of curated and managed research and teaching databases. These databases represent massive quantities of digital data found in innumerable and often inaccessible places.

Many groups across campus engaged in health-related research are generating increasingly massive amounts of data from electronic health records, patient and animal registries, genetic and translational programs, biorepositories, multiple imaging sources and other programs. These many data sources represent an excellent example of the potential for enhancing our capacity to organize, curate and manage data from multiple disparate but interconnecting research projects—to make the data available for other researchers and to apply complicated analytical and informatics-driven tools and applications for better analysis. Most researchers now work in teams and the increasingly large data sets being developed are more appropriately managed by teams of experts working with the researchers. This type of data curation and management can best be undertaken in the Academic Hub environment, and this approach to data management will make UC Davis more attractive to faculty and external collaborators.

Expert Hub staff will help users navigate the wealth of information sources and services that the university creates or makes available. They will also support faculty, staff, and students in the discovery, creation, use, persistent management and dissemination of knowledge, as well as their integration and use of new technologies in research, teaching and learning. Hub staff will also continue to support efforts by academic researchers to address the needs for sustainable models in scholarly communication and education through publication, dissemination, and curation. A distinctive feature of the Hub’s integrative philosophy is the development—building upon the expertise and experience of current Library staff—of a pool of faculty and professional staff with skills and capacity to support the research, teaching, and community engagement vital to the myriad functions of the Hub. The close involvement of these academic *informaticists* will allow the Hub to become a home for experimentation in technology-enhanced discovery and learning that showcases the distinctive strengths of UC Davis.

5. Integrate IT and ongoing research on educational effectiveness to develop and enhance the best technology-assisted approaches to learning and student success.

Important elements for the success of this initiative include cost effective strategies for ongoing enhancement of the IT components of instructional infrastructure—laboratories classrooms, and student study and living spaces—necessitating choices about these broader investments relative to investments in the learning environments of the Academic Hub. An upgrade plan should be created in consultation with the Academic Senate to prioritize and schedule learning environment upgrades. Collaboration tools, platforms for online instruction and simulation, videoconferencing, electronic student portfolios and social networking software should be widely supported and implemented to enable faculty and students to interact with each other and with their peers around the world. The latest interactive tools and online communities bring students into closer contact with research and career opportunities in California, the U.S., and the rest of the world—including interaction with faculty, alumni, and others engaged in educational, professional, and mentoring roles. UC Davis students should be encouraged to engage directly in the development of online learning, collaboration, and community-building environments.

6. Actively pursue and leverage partnerships with like-minded academic, corporate and governmental entities.

We must continue to explore UC-wide efforts for collaborative solutions to technology, teaching and learning, research and library activities to identify opportunities for potentially significant efficiency savings and revenue generation in multiple areas of the UC enterprise. Systemwide groups including the Council of University Librarians, the IT Leadership Council, the Educational Technologies Leadership Group and other UC administrative councils have recommended collaborative initiatives for administrative computing, educational technologies and core infrastructure services. Institutionally supporting such collaborative efforts should be a high priority for UC Davis.

In developing this report we have consulted with other distinctive universities and have discussed potential synergy associated with IT collaboration for mutual benefit. Our location is a huge asset for more aggressively exploring corporate partnerships in vital Northern California realms of information technology, healthcare, agriculture and biotechnology, as well as expanding partnerships with state government agencies and with the UC national laboratories.

7. Create investment strategies that include all sources of funding (e.g., operational funds, loans, indirect costs and capital funds), while removing current financial barriers.

An information technology strategy to drive innovation and excellence requires financial investment, with cyberinfrastructure being treated as a capital investment. Investment funding from the Office of the President could support highly worthwhile projects, such as enhancing network access, increasing storage capacity and developing “community good services.” The importance of such near-term investment in enabling scholarly innovation, creativity, and growth in research across all areas of the campus is a strong rationale for a loan proposal. Increased contract and grant funding is a value-added projected return on investment (ROI) for this approach. Investments to create a top-tier cyberinfrastructure are closely aligned with goals for strengthening and growing our research enterprise and should be coordinated and aligned with goals and investment strategy in the Office of Research. We have initiated positive consultations with Interim Vice Chancellor Nosek and Vice Chancellor-designate Lewin regarding such coordination. Other projects detailed in this report could be made available as “gift” ideas for the Campaign for UC Davis. We should seek to identify particularly innovative technology initiatives that could attract high-tech corporate partners/investors.

We need to focus technology investment in areas that provide unique value to UC Davis and minimize or eliminate redundant on-campus systems, services and information resources. This will facilitate a shift in focus—from department to campus systems and from campus-built systems to community source, multi-campus, commercial third-party or systemwide solutions—promoting acceptance of universal design, ease of use, and accessibility into all technology investments.

We recommend funding mechanisms that support maximum access and use of cyber- and computational infrastructure for research, learning, teaching and patient care for all members of the campus community. We need to eliminate recharge funding models. Services should be segmented into those where the administrative costs of recharge are high but the service is often used broadly and in similar ways. Such services could be cost recovered via a direct central allocation model. This would allow for differential distribution of cost at the Provost’s discretion with the option of units augmenting resources for a given area.

8. Combine responsibility, authority, and financial capacity in a high-level unified leadership and governance structure to implement these recommendations.

We recommend a leadership and governance structure that permits University-wide oversight and management of IT with single point accountability—to improve and simplify decision-making processes, to create incentives for greater collaboration among IT units internally and with campus stakeholders, and to ensure the implementation and oversight of the recommendations of this report.

We recommend developing a strategy for University-wide leadership, reporting to the Chancellor and Provost, with overall responsibility for the activities related to the four Grand Challenges and for engaging faculty involvement and broad campus support. The strategy assumes ongoing consultation and collaboration with the Council of Deans and Vice Chancellors to ensure consistent support for addressing report recommendations. We also propose that a senior administrator be responsible for collaborative oversight and leadership of each of the four Grand Challenges. A relatively short timeline for establishing this governance framework is recommended—to ensure quick and decisive actions to implement high priority recommendations of this report.

We need to establish a continuous process for campus IT planning and adaptation. The IT field is changing so rapidly that the recommendations of this report will require ongoing reviews and updates. We recommend that a high-level committee be appointed within two years to review progress in responding to the recommendations of this report, and to revise and update the recommendations as needed.

IMPLEMENTATION STRATEGY

There is an urgency associated with achieving the vision described at the beginning of this report. Achieving the goals of excellence for UC Davis, as one of the top public research universities in the country, requires a more effective integration of the power and capacity of information technology in our academic enterprise. The “building block” objectives of connectivity, data storage, management and retrieval, and high performance computing should be addressed immediately. These major steps summarize the implementation effort:

- The always on network—key to all building blocks—must start immediately
- Remove recharge mechanisms; invite and encourage use of the cyberinfrastructure
- Begin planning the Academic Hub
- Establish shared “community good services” including initial implementation of the data intensive and computation management facilities and an integrated data center strategy
- Create the financial basis for these changes and remove the barriers
- Establish leadership and governance for the overall effort

UC Davis has a diverse array of exceptional intellectual resources and outstanding faculty, staff and students. The campus is poised for continuing growth in academic achievement and impact. To achieve our goals and vision we must enhance and more effectively integrate IT in the discovery, learning, teaching and engagement activities of UC Davis.

APPENDIX

Records of extensive campus consultations, information from other distinctive universities and other relevant resources are in an appendix at the following website:

http://chancellor.ucdavis.edu/initiatives/information_technology

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