THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

Strategic Planning Committee for Information Technology

Final Report

May 2007

Contents

Foreword

In 2004, in his state of the university address, Chancellor James Moeser said the leading public university must lead in technology. He challenged us at UNC Chapel Hill to create and implement this vision, integrating technology into the fabric of our teaching, research, and service missions in ways that would position us to reach beyond competence to greatness.

Chancellor Moeser asked Vice Chancellor for Information Technology Dan Reed to lead a major strategic planning effort for information technology that would range from building high speed computing capacity needed for research to replacing obsolete business enterprise systems; that would redefine how computing should transform teaching and learning on and off campus as well as support the University's engagement with communities and individuals across North Carolina and around the world.

Vice Chancellor Reed appointed a Strategic Planning Committee for Information Technology in January, 2006. This committee was broadly representative of the campus community, its members including faculty and students from academic and health affairs, librarians, ITS staff, and administrators. It consisted of a Coordinating Committee and four subcommittees: Communications and Networking, Education and Learning, Research and Scholarship, and Enterprise Applications Systems. In all, more than 57 persons helped to create this plan through their valued service.

The Committee was charged with creating a strategic plan whose implementation could realize this vision. The plan should define information technology as a strategic asset in the University's overall vision and plan, and identify those opportunities where it could have a transformative impact on scholarship, education, service and outreach.

The plan should also be consistent with the overall culture of the University, encompassing the entire ecosystem of information technology on campus – ITS, college and unit IT organizations, service, departmental and research group support activities. It should reflect the need to continually update and improve technologies and their applications.

It should address a range of objectives:

- Build University-wide commitment to a shared IT vision based on a broad and inclusive process;
- Identify major IT issues facing the University;
- Identify significant obstacles and risks and recommend ways to overcome them;

- Enable communication with administrators about IT's potential to advance the mission of the University;
- Encourage coordination of University-wide IT efforts;
- Establish and communicate strategic priorities for the enhancement and use of IT for the University;
- Engage stakeholders beyond the campus including Trustees, the public and partners;
- Foster innovation and creativity by applications of IT to University challenges and opportunities.

The Strategic Planning Committee for Information Technology met from January, 2006 until April, 2007 to accomplish this charge. Its recommendations have been endorsed by its members. The Committee enthusiastically supports their implementation.

Just prior to submitting this report, we learned that Vice Chancellor Dan Reed had stepped down from this post in order to become a senior advisor to the chancellor and Executive Director of an expanded RENCI. Therefore this strategic plan has been submitted to interim CIO John Oberlin and to Provost and Executive Vice Chancellor Bernadette Gray-Little. We hope the plan will be useful as the search for a replacement CIO gets underway; and are available to discuss it as appropriate.

Carol G. Jenkins
Chair, UNC Strategic Planning Committee for Information Technology
May, 2007

Executive Summary

Technology is changing our lives on a daily basis, often in ways we don't realize or fully understand. Technology is not something we can take or leave. Technology permeates our culture. Because technological change is increasingly rapid and diffuse, our challenges are to recognize how it is affecting what we are doing now; to determine how it could help us function better; and to anticipate how we should adapt based on what is coming next.

We take these statements as 'givens'. Thus the most important recommendations in this strategic plan do not suggest what technologies to use. Today's technologies will change. Rather, they address what should change as a result of using technology more effectively, and what processes and structures are needed to ensure that we continue to make the most effective uses of technology in the future.

Strategic planning for information technology is an almost impossible task, we found, because change is so rapid and so constant. Probably the most useful recommendation we can make is to foster an environment throughout the institution that encourages continuous experimentation, assessment, and flexibility. But we also realize that the university must continue to make substantial investments in technology that are needed to serve its basic purposes reliably and accurately; investments that support operations that will persist. With those caveats, our recommendations are grounded in the reality of what is needed now; while at the same time suggesting how we can and must prepare better for the future.

The planning committee did very little primary data collection to define trends, needs or opportunities. Instead we relied on a variety of resource documents, listed in the bibliography, as springboards for discussion in the subcommittees. The committee did not conduct an internal analysis of the effectiveness of ITS or related IT service units on campus, relying on input from members of the subcommittees and others. This was not part of our original charge, nor did we feel that our timeframe allowed for it.

The planning committee did conduct a modified environmental scan to identify high level issues and trends that were considered in drafting subcommittee reports. Some of our conclusions are:

- Today's students use technology to generate and use content, create virtual communities around the globe, solve problems, provide social interaction, and more. UNC's teaching and learning strategies, facilities, and practices must change to meet these needs better. UNC needs to support its faculty as they adapt to a rapidly changing teaching/learning landscape.

- Today's students are comfortable using mobile devices anywhere, devices that converge diverse technologies. They expect access to information from any source, in any format, at their fingertips. Teaching and learning content from UNC's libraries and other instructional sources must be easily accessible and easy to manipulate.

- UNC faces pressure to reach new educational markets in North Carolina and around the globe, which technology can help address.

- Today's researchers are generating massive amounts of data, an activity that requires reliable, secure storage, as well as hardware and software tools to access and manage it better for discovery. UNC must strengthen its cyberinfrastructure to remain competitive for the best research faculty and funding, and seek opportunities for partnerships with others. UNC must develop digital curation strategies to provide stewardship for its scholarly content while meeting the demand for greater access to that content worldwide. UNC needs to strengthen support services for faculty researchers to help them harness technology effectively.

- University business enterprise systems are stretched to accommodate increasingly complex and interconnected information needs. UNC needs to replace its legacy systems with business systems that are reliable, secure, customizable, interoperable, and based on industry standards. These systems are core building blocks for an effectively functioning university. Further, UNC needs to ensure that its workforce has the training, support, and tools needed to use IT as productively as possible in a digital world.

- UNC has a proud record of achievement as the 'university of the people'. Technology is helping other universities claim similar visions to bring education, discovery, and economic benefits to communities around the globe. UNC needs to use technology productively to support its new engagement priorities, and to strengthen its leadership position.

- While UNC is becoming a digital university in these and other arenas, it has not planned strategically how to optimize and leverage its investment in its technology tools and staff while preserving its historical strengths. UNC must consider how its core decision making processes and systems both enable and obstruct the competitive position it seeks going into the future, and make adjustments where needed.

These conclusions reflect several overarching themes that are apparent in the detailed goals and recommendations that follow.

Theme: the impact of the institutional culture on our ability to effect changes in values and behavior

There are many positive aspects to the UNC culture – such as openness to collaboration; and there are negative aspects – such as a perceived resistance to examine and change governance processes, policies, and behaviors that may no longer be effective. With respect to IT, culture issues were identified by the committee as such a significant impediment that we added a goal and recommendations regarding governance that were not included in our original charge.

Theme: the importance of technology to institutional core services.

While the committee believes in the power of innovation to transform the university's impact in society, we emphasize the need to strengthen technology-enabled core services that support the university's missions. There are significant needs for improved IT core support for education, research, and business systems that are reflected in the recommendations. Effective core services are needed to lead to innovation.

Theme: the imperative to harness technology for innovation.

UNC has unparalleled opportunities to build a 21st century innovation engine that will be second to none. This is the real achievement of the Chancellor's vision and recommendations are made that call for building and using this capacity.

The Vision
Carolina 2016: Information Technology as Catalyst

Preamble

Ten years is a geological epoch on the information technology (IT) time scale. Looking back, a decade brought the web and consumer email, digital cameras and music, broadband wired and wireless networking, multifunction cell phones, WiFi, HDTV, telematics, multiplayer games, electronic education and e-commerce and advanced computational science. It also brought new challenges: email spam, identity theft, outsourcing and blurred work-life boundaries. Indisputably, IT has profoundly reshaped our daily lives, our business processes, our communication and collaboration, and our information access sociology.

We live in a world in which information technology is a catalyst reshaping our culture and our economy. In 2016 information technology will have similarly dramatic effects on Carolina. Information technology will be a catalyst capable of fundamentally transforming the way the university carries out our mission. It is imperative that Carolina defines our future vision recognizing the power of technology and its potential impact on society; and develops plans for harnessing it effectively to achieve the university's highest purposes. The challenge to Carolina will be to find ways to embrace dramatic change while continuing to uphold the values and beliefs that will help define our success in our third century of service.

Vision

Looking forward, Carolina must and will rely on IT as a strategic resource, enabling and facilitating change, in its quest to become the nation's leading public university. Carolina will educate a workforce for 2016 that will be competitive in a global society. These graduates will themselves be highly competent information users. Carolina will be a significant source of lifelong learning opportunities addressing a broad spectrum of professional and consumer needs. Technology will help make this education more accessible. Multidisciplinary education and research will be seamlessly blended. Technology will enable heightened community, state, national and global partnerships; increased economic engagement; and more nimble administrative processes, all seamlessly integrated by Carolina's information technology services. These services will empower but not intrude, and enlighten but not obscure.

As the leading public research university, by 2016 Carolina will be an international model for creatively generating and applying knowledge to benefit individuals and communities worldwide. The universe in which we will reflect, learn, innovate and serve society will have no boundaries. Carolina's scholars will achieve groundbreaking research results and multidisciplinary educational

programs through innovative uses of our large scale computing and scientific instrument platforms, our rich digital libraries and repositories, and networked teaching, learning and communications tools. Carolina will be known as a visionary, successful collaborator with many partners. IT will be the catalyst enabling this transformation.

Carolina's faculty, staff and students and those whom we serve will enjoy barrier-free communication across time and space using mobile and other media, and optimal network technologies. Carolina's flexible and robust administrative computing environment will support operational efficiencies and effective decision-making; and will be adaptable to changing institutional opportunities. But Carolina's IT will do more than help people perform rote chores more effectively; and provide value added services. It also will help them be innovative.

Such services will be a defining strength of the successful university of 2016. Talented, service oriented IT staff will need to be available anytime, anywhere, guiding our community through dramatic changes in teaching, learning, research, service and administration. They will be attracted to Carolina's collaborative work environment, vanguard technologies, and overall investment in IT as a catalyst for transformational change.

The pace of change will continue to accelerate. A decade of advances in communications and collaboration, sensors and knowledge management, modeling and discovery, electronic commerce, critical infrastructure management and sound administrative information systems will lay the groundwork to create the 21st century digital university. Our commitment to lead, together with the university's investment in IT as a strategic priority, will produce the *Weltanschauung* that is Carolina 2016.

Goals and Proposed Actions Summary

NOTE: this is a summary. The full committee reports will follow this.

Goal One: Education and Learning

Use IT to support and enhance educational programs and curricula to prepare our students to function productively in a global society throughout their lifetimes.

IT-accessible learning environments that meet teachers' and learners' needs:

- Evaluate the CCI and recommend how well it meets institutional priorities for teaching and learning. A special committee should submit its report by January 2007.

- Ensure that all classrooms are equipped to support common pedagogical approaches and have the capacity to accommodate temporary or mobile installations. ITS will produce a three-year plan and cost estimate to bring all classrooms up to a base level of support by September 2007.

Integration of teaching, research and public engagement

- Teams of key stakeholders should be convened to identify opportunities to integrate research, teaching and public engagement and recommend ways to use IT to support it by January 2008.

Improved support for effective teaching and learning methods:

- The university should invest in new designs for learning spaces that support collaboration and active learning. ITS working with others should propose how to pilot new learning space designs during 2007-2008.

- ITS working with others should establish testbeds to pilot the use of emerging instructional technologies and evaluate their effectiveness.

- Guidelines for assessing learning outcomes should be created by January 2008 and implemented for all IT-enabled instructional projects.

- The Provost's Office should develop an incentives program that supports faculty participation in strategic technology pilots; to be reviewed by faculty and ready to implement by January 2008.

Prioritization and optimization of instructional technology resources on campus:

- ITS, with broad consultation, should develop central instructional support priorities by June 2007.

- The CIO should communicate the importance of including IT expertise in key instructional improvement initiatives before summer 2007

- A team from ITS, CAS, and CTL should plan how to use IT effectively to improve gateway courses by August 2007.

- A university-wide committee should be charged to assess needs and uses for distributed learning systems, keeping in mind the capabilities of learners both on and off campus. This committee should have input into the UNC Online portal development from General Administration. A protocol should be developed before the end of 2007.

- ITS, with broad consultation, should explore the use of learning management systems that enable innovative pedagogy. Pilot an open source LMS during 2007-08.

- The Provost's Office, with broad consultation, should present a plan to improve instructional support by better integrating pedagogical and technical support organizations on campus, by September 2007.

Goal Two: Research and Scholarship

Use IT to generate and apply new knowledge that benefits individuals and communities worldwide; and that contributes to Carolina's national and global reputation for leadership in research.

IT culture and infrastructure responsive to researchers' needs:

- Conduct annual IT needs assessments in all research disciplines and use results to help prioritize services and project funding needs

- Provide additional expert IT consultants to support research teams

- Use IT to support collaborative and interdisciplinary research

- Leverage IT expertise by training researchers and students in the effective use of IT

- Provide researchers with consultant-advocates to support their effective use of IT

- Provide additional IT support for application-specific enterprises campuswide.

Improved core IT services supporting researchers' needs:

- Expand and enhance central data storage capacity

- Provide the IT expertise needed to ensure data quality, security, portability and access, drawing on expertise in departments, central IT and the libraries

- Enhance customized services for medium and high end scientific users and ensure standard core services are available for other users from central IT or other units, including the libraries.

An IT platform that supports excellence and innovation in research:

- Invest strategically in high performance computing that expands our processing power, improves data management, clarifies access to high performance computing via RENCI, supports development of software that can be shared and leveraged, provides bandwidth for collaboration, and addresses long range needs

- Attain national prominence in the use of visual and spatial resources by leveraging existing expertise in the Dept of Computer Science and other units

- Draw on the expertise of VC Dan Reed and Dean Jose-Marie Griffiths, both in national IT leadership roles, to plan and make the substantial strategic investments needed to make Carolina a national player in emerging areas such as CTSA.

Goal Three: Communications and Networking
Use IT to enable a barrier-free environment for communications and collaboration.

All content is digital

- Appoint a task force to plan and implement a process to move from paper-based to digital business processes, coordinated with the move to a new ERP system.

- Implement a policy to move from paper-based to digital methods for all official university business and communications.

Ubiquitous connectivity

- Appoint a campus task force to develop policies, procedures, and standards to achieve ubiquitous, reliable network connectivity.

- Work with commercial and non-profit data carriers to optimize connectivity to on-campus resources using public and research infrastructures.

Users are empowered to use IT effectively

- Appoint a task force to develop protocols and guidelines to help faculty and staff assess their ongoing skills and needs for IT resources, services, and training; and incorporate skills development into employee development plans. The task force also should develop mechanisms for ensuring that all employees are adequately oriented to the availability and use of the IT resources needed for effective performance.

- Host an online clearinghouse of IT information, resources and training materials for the university community.

UNC operates effectively as a digital community.

- Convene a group to adopt and develop standard technologies for enhancing and augmenting central administrative processes.

- Develop common libraries of these toolkits and provide protected test areas to develop ways to mesh seamlessly with central enterprise systems.

- Create an organic innovation marketplace to present project ideas to the UNC community.

- Provide studio quality facilities on campus for interacting with the news media and the public.

Sustainable support mechanisms are in place

- Create a task force to investigate and foster new business models for funding campus IT that can be applied to different needs ranging from standard services to leading edge initiatives.

- Seek partnerships beyond campus to leverage opportunities for collaboration.

Goal Four: Enterprise Applications Management

Use IT to provide business processes and systems that are efficient, secure, reliable, sustainable, seamless and responsive to changing institutional needs.

Effective institutional business systems are in place

- Assure that all administrative support systems (finance, human resources,students, email, imaging, calendaring, directory) are either embraced by the Enterprise Applications package or have the capacity to interoperate and exchange information with it

- Begin the process of evaluating and replacing core enterprise IT systems with the Student Information System as a top priority

- Support the development and acceptance of new governing principles and mechanisms for IT as identified in this plan

Goal Five: Engagement
UNC will become the best in the country at enabling and empowering the people of our state to effectively utilize advanced information technology

Recognized UNC leadership in deployment of advanced IT across the state

- Implement the recommendation in the Chancellors Task Force on Engagement that calls for a new Advanced Information Technology Initiative using the excellent resources at Carolina to help deploy IT across the state

Recognized UNC leadership in helping to make advanced IT accessible to North Carolinians

- Harness the expertise at Carolina in ITS, SILS, the libraries, schools, units and RENCI to work with the Vice Chancellor for Engagement and his advisors to improve access to advanced IT for citizens across the state

Recognized UNC leadership in equipping people and businesses in North Carolina to use advanced IT effectively

- Work with the groups and individuals above, and other partners, to help train and equip people across the state to use IT effectively.

Note: There is not an IT subcommittee report expanding on these recommendations. For more information see the Task Force on Engagement Report listed in the appendix.

Goal Six: Governance Systems
Adopt a governance structure and processes and ensure a solid infrastructure that enables IT to be used as a strategic asset of the University.

A federated governance model is developed and implemented successfully

- The CIO, with appropriate stakeholder input, should create an overall IT Governance Document that addresses the key decision domains (principles, architecture, shared services, core applications, and decision-making processes) and recommends a proposed structure.

Subcommittee Plans
Education and Learning

Teaching and learning are activities central to the University's mission, and our use of information technology should support and enhance our ability to provide high-quality education for all of the populations we serve. The modes of teaching and learning in higher education will continue to evolve, and appropriate information technologies and services should be available to support this evolution. Although the needs of and approaches to undergraduate, graduate, professional and continuing education may differ, all must be appropriately supported by the resources that the University devotes to information technology. Further, these resources should be deployed in ways that not only maintain and expand the capacity for use of the technology in ways that are already well known, but also support efforts by members of the University community to engage in innovation that enhances the educational experience and makes it available to new populations.

While this document will serve as a useful guide for IT expenditures at the University, those decisions must also be considered in the context of other strategic visions on campus, within the UNC System and at the national level.

Updating IT-Accessible Learning Environments

Access to widely-distributed and functional information technologies is a prerequisite for realizing the educational potential of IT. Properly equipping and maintaining the broad array of environments necessary to connect teachers, learners, scholars and community members will enable the institution to meet its instructional and community-based goals. This point was reinforced by the *Report of the E-Learning Task Force*, which emphasized the importance of investment in core resources to support e-learning.

To date, the major vehicle for providing universal access to IT resources for faculty and students has been the Carolina Computing Initiative (CCI). Established in 2000, the CCI was designed "to ensure that Carolina students, faculty, and staff have easy access to high-quality and affordable technology and can use it effectively." Evaluation data gathered in 2002-2003 on the CCI suggested mixed results. Laptops have proven to be very important to the academic careers of most students, even if their integration with course-related activities has been uneven. It is time to review the initiative to determine if students and faculty would be better served by an alternative approach to technology provision. Since the CCI did not have any specific goals related to pedagogy, the first step in the evaluation must be to develop such goals (particularly in reference to supporting diverse instructional approaches and learning activities). The future of the program should then be assessed, using institution-level instructional goals as a guide.

The growth of inter- and multi-disciplinary programs and approaches has blurred traditional disciplinary lines, bringing together faculty members from the College of Arts and Sciences with faculty from the professional schools in Academic and Health Affairs to create new areas of study that stimulate teachers and learners. At the same time, these new fields present complex challenges to traditional funding models and call for rethinking the arrangement of central vs. discipline-based support to meet teachers' expectations for greater consistency across teaching facilities.

To keep pace with these changes in the academy, we need to adopt a campus-wide approach to classroom design and support, insuring that each facility be equipped with IT hardware and software that supports the most common pedagogical approaches. For example, every potential teaching space should have the capacity to accommodate the use of temporary or mobile hardware and software solutions. The ITS Teaching and Learning Division should have overall responsibility for making these tools available and assisting interested faculty in making use of them in their teaching, particularly those tools that are sufficiently generic as to be useful in a variety of disciplines and pedagogical styles.

Individual schools and disciplines will have special needs not shared by the rest of the University. For example, professional schools engaged in continuing education of in-service practitioners remote from Chapel Hill have need for robust two-way audio, video, and data communication with remote sites, whether via fixed installations or mobile technologies. To the extent that such specialized needs are genuinely unique, the school or department involved should support them.

Recommendations

- A team comprised of the ITS-Advisory Committee of the Teaching and Learning and Academic Computing divisions of ITS, Student Government, and the Graduate and Professional Student Federation should undertake an evaluation of the CCI, with guidance from CTL and the Office of Institutional Research and Assessment. The evaluation should be based in part on goals for supporting diverse instructional approaches and learning activities that should be developed by CTL in collaboration with faculty members and student representatives, especially those who have made effective use of laptops and other mobile and fixed IT components.

  Implementation: The CIO and the Provost will charge CTL with leading the development of institutional priorities for supporting diverse teaching and learning activities. Those recommendations will be submitted to the Provost and CIO by July 1, 2007. The CIO will then convene a committee to assess and make recommendations on the CCI. That report will be submitted to the CIO by January 1, 2008 for further consideration.

- The ITS Teaching and Learning Division should work with units throughout the University to identify common needs and ensure that all classroom facilities are equipped to support common pedagogical approaches and have the capacity to accommodate temporary or mobile installations

  Implementation: ITS-TL will produce a three-year plan and cost estimate for bringing all campus classrooms up to a baseline level of IT support. The report will be completed by September 1, 2007 and presented to the Provost and the CIO for further action.

Integration of teaching, research and public engagement

One of the great strengths of research universities is their capability to integrate their various missions so that research and scholarly work is brought to bear on education and on engagement with the public that the institution serves. Integrating advanced research findings and methods into education requires sophisticated IT resources, many of which originated in discipline-specific context but may have wider utility as inter- or multi-disciplinary alignments expand.

Information technology should make it possible for faculty and students to easily access scientific databases, large-scale simulations, museum collections, manuscripts, images, library resources, clinical records, and other types of information for use in the classroom and in academic activities outside the classroom. The IT resources needed for integrating research into teaching are less likely to be available to students and teachers working in non-classroom settings, the community or the field. To accomplish our goals, we must broaden the availability of research and communication tools to make access between the campus and the community more transparent.

Similarly, public engagement integrated with education frequently depends upon field-based research and communication with colleagues, students and community members at remote sites. This may involve the installation of dedicated communication equipment, the use of mobile technologies such as cell phones and portable media players, or a mixture of fixed and mobile technologies.

Recommendations

- An evaluation of the opportunities to integrate research, teaching and public engagement in University programs should be undertaken by collaborative teams composed of the Deans of Undergraduate and Graduate Studies in the various schools of the University, the Office of Undergraduate Research, the APPLES Program (especially its Community-based Research Initiative), the Carolina Environmental Program, and the Vice Chancellor for Engagement, advised as necessary by the appropriate Institutional Research Board and the Vice Chancellor

for Research and Economic Development.

Implementation: A series of meetings will be convened by Provost's Office during 2007 to discuss integration opportunities. A report on recommendations generated via these meetings will be submitted to the Chancellor and Provost by January 1, 2008.

Support for effective teaching and learning methods

Information technology should support institutional initiatives to explore and adopt pedagogies that have emerged through the scholarship of teaching and learning. Faculty should be provided with guidance and support in incorporating strategies that emphasize inquiry, discovery, creativity and problem-based learning; that support higher-order thinking and active learning methods (which may include simulations, case studies, games, etc.); that leverage advances in research and involve critical judgment rather than simple acquisition and application of facts; and that promote collaborative learning and teaching.

One of the clear benefits of information technology lies in the way in which it can erase temporal and physical boundaries, and thereby facilitate communication and engagement among individuals and groups. On our own campus, technology is used daily to promote greater access to instructional materials through such resources as course management systems and the library's E-Reserves. Similarly, instructors use listservs, blogs, wikis, electronic bulletin boards and online chats to promote dialogue and knowledge creation among a variety of students, scholars, and interest groups. A number of courses use videoconferencing technology to connect and communicate with distant peers and colleagues. These examples demonstrate how investments in information technology can expand and extend the educational experience of our students, offering them access to resources around the globe. The *Report of the E-Learning Task Force* suggested that "hybrid courses in seamless classrooms" are likely to be the most effective models of e-learning in the future.

The University should build on these examples on a number of levels. All learning spaces, be they classrooms, informal collaborative spaces, labs, auditoria, or virtual learning spaces, need to be designed so that they promote collaboration and active learning. Currently, the University spends approximately $2 million dollars a year on classrooms that are configured to reinforce one-to-many teaching models and do little to promote collaboration. ITS, Facilities Planning and the Registrar should begin working with faculty and students to design and develop instructional spaces that are thoughtfully configured to promote the highest possible levels of collaboration and engagement. These spaces should incorporate technologies proven to promote and encourage active learning, such as innovative capture and projection technologies that facilitate access and participation to anyone involved in the discussion or exercise, regardless of location.

The technologies most useful for instructional use vary among disciplines, faculty members, students, and educational settings. In some disciplines the capacity for a large group of students to engage simultaneously in the solving of individual quantitative problems with instructor oversight may enhance the learning process, whereas in other disciplines the ability of a student to find a series of visual images to document the progression of events or conditions may be more valuable. Learning environments should be sufficiently flexible to accommodate multiple learning and teaching styles.

In order to further advance diversity in this area, the University must strike the proper balance between supporting popular, mature instructional technologies and those emerging technologies that might be used more widely at a later date. We must continue to pilot the use of new learning technologies, both inside and outside the classroom. We must also cultivate an improved awareness and understanding of technology services and trends that transcend higher education. Given the growing commoditization of digital devices and applications, campus-supported technologies may be less important to future educators and students.

Without a robust method for evaluating the effectiveness of various technology-enabled strategies and pedagogies, institutional investments in instructional technology are likely to under-perform. Good evaluation data must be available to inform decisions about the viability of the technology being considered and its implementation. Building on current campus efforts to assess learning outcomes, all instructional initiatives with significant IT components should adhere to a baseline assessment protocol. To this end, all new teaching and learning initiatives should include an assessment plan that would allow for an evaluation of the efficacy of the new technology after a reasonable period of time (e.g., six months) following implementation. We recommend the following general principles. First, needs assessments with identified relevant audiences should be conducted before any new services or technologies are implemented. Based on that information, ITS should develop measurable goals for the adoption of the new service or technology prior to implementation. To assure uniformity in the conduct of the evaluations, a standard evaluation form or protocol (e.g., web-based form, focus groups), should be generated and modified when needed based on the knowledge and skills students must acquire to use the services in instructional settings. To assure that appropriate cost/benefit evaluations can be made, assessments of numbers of individuals served and the types of technology issues addressed by the use of new services or technologies should be regularly provided. And, finally, to assure that all resources provided are fully utilized, assessments of knowledge of the new technology should be conducted to ensure that all university constituencies (e.g., faculty, staff, graduate students, undergraduates) are aware of where to go to obtain help with technological issues.

Each evaluation should include a judgment about the adequacy of the new service or technology for its primary purpose, areas for potential change and improvement in implementation, costs incurred, and a recommendation about the continued use of the new technology.

None of these endeavors will have a significant impact on overall student learning without the participation of our faculty. The shortage of real faculty incentives for adopting effective teaching methods has been documented in a number of campus publications over the past decade. Realizing the potential of technology-enhanced pedagogies is closely tied to the University's willingness to invest in the enhancement of instructional quality.

Recommendations

- The University should invest in new designs for learning spaces that facilitate collaboration and active learning.

  Implementation: ITS-TL, CTL, Facilities Services, the Registrar and the Associate Provost for Academic Initiatives will create a proposal for piloting new learning space designs during the 2007/2008 academic year. The proposal will be submitted to the Provost and the CIO by August 1, 2007.

- ITS-TL, working with faculty, students and IT staff from throughout the University, should establish test beds to pilot the use of emerging instructional technologies.

  Implementation: ITS-TL will coordinate efforts to identify, implement and evaluate promising classroom technologies. Reports on pilot results will be produced by ITS-TL and pilot partners and disseminated as widely as possible. Prioritization of pilot projects will be based on potential campus impact, specific campus needs and research on IT trends and development.

- A set of guidelines for assessing learning outcomes and IT implementations should be created for use in all instructional projects with significant IT components.

  Implementation: The Office of Institutional Research, in conjunction with CTL, ITS-TL and other interested parties, will recommend a set of assessment standards for IT-enabled instructional projects. The guidelines will be submitted to the Provost and CIO by January 1, 2008.

- The Provost, in consultation with the faculty and relevant instructional support organizations, should develop an incentives program that supports faculty participation in strategic technology pilots.

Implementation: The Provost's Office and the CIO will jointly develop a proposal for a faculty incentive program by September 1, 2007. The proposal will then be presented to faculty representatives for review. Those comments and recommendations will be returned to the Provost and CIO by January 1, 2008.

Prioritizing and optimizing instructional technology resources on campus

Demand for many aspects of academic technology support on campus is outstripping available resources. For example, many academic units are interested in developing interactive content, taking advantage of new online conferencing solutions, and exploring electronic portfolios and other alternative content management systems. While some initiatives may require additional investment on the part of the institution, simply advocating for larger academic technology budgets is not a realistic solution. A more prudent approach would be to begin taking a closer look at how current resources are being spent, to better integrate technology planning with institution-level instructional initiatives and to promote collaboration among campus support providers. The *Report of the E-Learning Task Force* urged that funding models for e-learning be scrutinized to assure that innovations in e-learning can be developed and, if successful, maintained.

Given resource limitations, how should instructional technology support be prioritized on campus? Most support organizations at the University strive to be as inclusive as possible, perhaps to a fault. This strategic planning process provides a framework for making difficult choices about how resources should be deployed. Decisions about expenditures on academic technology should be linked more closely with the institutional priorities and initiatives outlined in documents that strive to lay out a vision for the future of the University.

Using technology to further the University's commitment to high-quality instruction, for example, will require that more emphasis be placed on supporting high-impact outcomes like redesigned large-enrollment undergraduate "gateway" courses. In many cases, these redesigns are driven by curricular challenges like long waiting lists for popular courses, the need for more collaboration and interaction in large lecture classes, DFW/retention rates for minorities and other special student populations, curriculum enhancements like the SACS QEP, and instructional quality and consistency across course sections. Technology will likely have an important role to play in these efforts, but realizing institution-level gains in student learning is more dependent on strong leadership and creative pedagogy than technological innovation. The success of recent initiatives in gateway courses in the professional schools (e.g. Pharmacy) should be evaluated in this light in order to inform decisions taken elsewhere on campus.

Technology's role in advancing key academic objectives must ultimately be defined in the context of larger campus initiatives. Too often, the role of technology is considered after key decisions about an academic initiative have already been made. The potential of technology as a transformative agent will not be realized if it is only used to reinforce traditional instructional models and perspectives. Individuals and organizations with alternative perspectives should have a seat at the planning table from the outset. Otherwise, the tendency in most organizations, including the University, will be to adhere closely to the *status quo*.

The University can also optimize its IT expenditures by exploring economies of scale across academic units with common goals. For example, part of the University's education mission is to expand potential to reach new constituencies across the state and beyond. Because of the expense involved (in both hardware and time), it is crucial that all decisions to purchase and implement new systems to support these initiatives be informed not only by the needs and desires of the potential users within a single unit, but also by the experience and technological capacities of other members of the University community and beyond. Since much of this activity currently originates in the professional schools spread across the campus, oversight of such decisions would best be served by a coordinating committee comprised of the central and school-based IT professionals who support these systems under the guidance of a new academic study committee.

The University must also do a better job managing its instructional content. ITS needs to strengthen central learning management system technology so that content is more easily accessible and shared among courses and audiences. Digital content should be made available within a unified learning management framework that ensures appropriate levels of access and availability to various university constituencies. This framework should provide for the seamless delivery and reuse of these learning objects regardless of whether they are intended for residential, distant, or continuing education audiences. Currently, the multitude of instructional applications proliferating across campus makes access to instructional content confusing and complicated, not to mention making reuse nearly impossible. Design standards that allow content to be more easily shared and distributed should be promoted and supported among faculty and other content creators on campus. Open-source products offer more flexibility for addressing specific institutional needs, as was also noted by the *Report of the E-Learning Task Force*.

Finally, both academic technology support and general teaching and learning support would benefit immensely from a campus culture that promoted, recognized and rewarded collaboration among various support providers. Faculty and students are interested in quality services, not who provides them. There are a number of synergies to be tapped through increased information-sharing and formal collaboration. The most successful collaborations may

require top-down coordination and resource allocation. University leaders should not shy away from such involvement when it involves important institutional priorities.

Recommendations

- Priorities for resources for instructional technology support should be driven by initiatives and projects with the highest strategic impact at the institutional and academic unit levels.

  Implementation: ITS-TL, in consultation with members of the faculty and academic unit representatives, will present the CIO and Provost with a detailed list of central instructional technology support priorities by June 1, 2007.

- Technology application and planning expertise should be represented in major campus initiatives to improve student education.

  Implementation: Before the summer of 2007, the CIO will formally communicate to the Administration and other campus leaders the importance of including IT expertise in key instructional improvement initiatives.

- A team drawn from ITS, the College of Arts and Sciences, and CTL will develop a coordinated proposal, informed by successful models elsewhere, to make effective use of IT to enhance pedagogy in "gateway" courses. The proposal will include a prioritized list of potential partners, cost estimates and a comprehensive assessment model to evaluate the impact of the IT techniques on student learning. It will draw upon evaluations of initiatives undertaken in professional schools such as Pharmacy.

  Implementation: The team, selected and charged by the Provost and CIO, will develop a proposal by August 1, 2007. The proposal will be submitted to the Provost and CIO for further consideration.

- A University-wide committee charged to assess individual and institutional needs and potential uses for distributed learning systems should be formed, with representation from practitioners engaged in such educational projects as well as administrators charged with formulating policy regarding distance education. This committee would also work to insure that the systems we adopt do not exceed the IT capabilities of the constituencies we serve in distant locations. It will also serve as the UNC-CH liaison body for decisions regarding the University of North Carolina Online portal being established by the UNC General Administration.

Implementation: This sitting committee will be selected and charged by the Provost and the CIO before the summer of 2007, with a mandate to produce an operations protocol for assessment of distributed learning systems before the end of calendar year 2007.

- ITS, in consultation with faculty, students and campus other instructional support organizations, should explore the use of learning management systems that enable flexible and innovative pedagogy.

  Implementation: ITS-TL, in cooperation with participating faculty and academic units, will pilot use of an open source learning management system for a course(s) during the 2007/2008 academic year.

- The Provost, in consultation with the CIO and other campus leaders, should develop a plan for better integrating pedagogical and technical support organizations on campus.

  Implementation: The Provost's Office will convene a series of meetings with representatives from IT and pedagogical support organizations to discuss options for improved service integration. Those recommendations, produced by September 1, 2007, will be shared with the deans and directors of participating organizations.

Research and Scholarship

Theme I: Reshape the Culture

In the past, the realm of central IT has been regarded as a culture separate and apart from the realm of academic research at UNC. That separation must end. Excellence in research sustains the university's reputation, its ability to attract talented faculty and students, and its ability to compete for funding. Because IT is fundamental to all fields of research, UNC must develop the expert staff and the cultural affinities necessary to (a) assess needs; (b) provide consultation, deploy hardware and software, and resolve technical issues; (c) support collaborative and interdisciplinary research; (d) train researchers for IT competence within their research areas and disciplines; and (e) advocate for research needs within central IT and beyond. IT staff working with researchers must work flexibly with a variety of organizational units, move easily across organizational boundaries and disciplinary cultures, respond quickly to new opportunities, and help liberate, rather than suppress, the creative energies of scholars and researchers.

A. Needs assessment: Short-term and long-term IT needs in all research disciplines should be assessed at least annually. For example, units could be asked to rank, on an IT survey, their most limiting technology constraints. The data collected will help identify potential innovations for the future, identify redundancies, and provide information to improve efficiency and cost-effectiveness across campus. To facilitate data capture, ITS should design a data-collection instrument that would specifically address these and other goals. Central and departmental IT units should then incorporate the findings into plans for providing services and projecting expenditures.

B. Expert consultation: UNC must develop IT professionals who can support research computing needs that range from consultations on data storage to software development to the installation and maintenance of high-performance computing clusters. We recommend that research units have an IT consultant who is thoroughly acculturated within a sector of the research enterprise. This consultant might directly provide some of the services required by the research teams in his or her sector but would also bring in appropriate specialists within central IT as needed. Many research units on campus already have such specialists in house. Central IT and departmental teams should work with each other to capitalize on existing expertise and share information and skills across areas as needed for specific research projects. However, not all units have staffing in these areas, and the areas of expertise within central IT also need to be broadened. We thus propose that five positions be created in University units each year for the next five years to begin to meet these needs. This initiative could begin with a pilot project, "IT Partners: A Pilot Project for UNC," which is described in Appendix ??.

C. Support collaborative and interdisciplinary research: Research focused on solving real-world problems often leads to an interdisciplinary approach to research. This is now the norm in many fields and represents a direction that many agencies funding scientific research are promoting. Examples include the interdisciplinary initiatives of the National Science Foundation and the Roadmap initiative of the National Institutes of Health. It is essential that campus IT organizations be aware of and respond to such directions, helping facilitate research scholarship across disciplines to foster innovation and collaboration. Currently, interdisciplinary research often is constrained by IT issues that arise when different systems, software, and data-management protocols must be merged or coordinated. The domain IT experts in each of collaborating areas should work together with various IT specialists as needed to resolve these issues. In geographic information systems (GIS), for instance, software changes rapidly, often within the span of one grant. Integrating data from disparate sources, which often involves a careful translation of information from one format into another and across cultural barriers, will be absolutely essential to progress in many of the sciences. In addition, interdisciplinary teams will require IT assistance and resources in the interactions necessary to collaboration: real-time communication, visualization (see III.B below), and the joint preparation of proposals and reports.

D. Train researchers: UNC has developed several successful models for providing the training necessary to help academic researchers attain technical knowledge relevant to their work. For example, the Department of Statistics offers training for student researchers and statistics consultation for research teams. The Odum Institute offers training and consultation for social scientists in a range of topics, including survey work. A similar model exists within central ITS but should be expanded to significantly increase the range of research application/programming training options. Often, students are the labor force responsible for using IT to meet the objectives of the research. Training would create a multiplier effect for IT expertise on the campus, extending the knowledge of IT specialists and consultants into the research teams. It also empowers students and provides them with job-relevant skills.

E. Advocate for research interests: Using the consultant system proposed in I.B above, each area of research would have a knowledgeable, sympathetic advocate looking out for its interests, anticipating its needs, supporting infrastructure that is already in place, and fostering communication. This will ensure the blending of cultures and the teamwork necessary to meet our goals.

F. Promote campus-wide application development and support: Some institutions have found that a small group of IT staff dedicated to maintaining on-campus code repositories and discussion forums for application-specific enterprises can greatly enhance campus-wide cooperation on open-source

application development and support. Each application group self-organizes and draws upon and actively engages non-IT staff to ensure relevance to a broad community. The IT staff provide a “home” and logistical support for the group; this function is critical because unless it is supported in this way support happens through volunteer efforts and is necessarily intermittent. This complements but is distinct from the IT consultant who seeks to advocate for a specific field; this mechanism promotes sharing of IT resources and knowledge on campus that cut across fields. Excellence in research and development in these areas will enhance Carolina’s reputation. To support this initiative, we recommend the addition of five IT staff annually for five years, dedicated to development in areas of direct interest to units on campus. These staff would develop networks of relevant campus users and developers, would manage the code repositories, and would coordinate discussion forums and disseminate information.

Theme II: Strengthen Core Services

Certain core services underlie much of the IT necessary to the research enterprise. For UNC to compete in the rapidly evolving global marketplace for knowledge, these core services must be reliable and robust.

A. Data storage, security and management: UNC must continue to expand and enhance its central data-storage capacity. Significant annual resource investments across the campus will be required to meet data storage and management needs. The current campus archival mass storage system has insufficient capacity to meet needs beyond the next three years, and archival storage is but one data-storage need. The campus should have accessible storage that is robust, scalable, easily accessible, and secure. ITS should partner with campus units to identify the full range of data-storage needs, then propose an architecture to support these needs and a funding mechanism to sustain it.

B. Data quality, portability, and accessibility: Data sets must be regarded as significant long-term resources that require careful management. Often, researchers would benefit from IT help setting up appropriate structures and metadata needed for maximum utility. Standards for the collection, management, and presentation of data change rapidly, sometimes rendering older methods obsolete. These changes are often dramatic, occurring in response to technological innovation and as a result of legislation, such as HIPAA. Researchers must have clear pathways for moving their data forward from one application to the next, ensuring integrity in the translation. In data on human subjects, safeguards for privacy and confidentiality also are crucial. There is a significant opportunity for an IT breakthrough in the problem of how to allow researchers various levels of access to human-subjects data without divulging confidential information or identifying the source through “deductive disclosure.” In each of these areas, UNC must invest in the IT expertise necessary to provide consultation and training (see IB, ID, and IF above). IT

expertise from all areas of campus, including academic departments, central IT and the libraries will be required to address this area adequately.

Recognizing the diversity of data collected and stored on campus, and understanding the rapidity with which this changes, it is unlikely that the University can or should develop detailed procedures and policies surrounding data management. Rather, relevant campus units should coordinate efforts to identify common issues and develop guidelines around these issues. These might include, for example, guidelines related to the secure storage, management, backup, migration, preservation, and retrieval of significant data sets, including research and clinical-trials data, audiovisual materials, university-created software and other intellectual property, data on collections, and other information resources of potential value for scholarship and research. Data management issues are not unique to UNC; all research universities are facing a similar set of challenges. Discussions and collaborations with other institutions should be encouraged to identify and share best practices in this area. As a goal, by 2016, data sets in this category should be fully catalogued, searchable, and accessible via a central resource. To achieve this goal, collaborative efforts will be required from many sectors of the University beyond central IT. Librarians, who are skilled in these areas, should be fully engaged in this effort, and the institutional repository (IR) now being planned for UNC could begin to address this need.

C. Custom services for medium- and high-end users: High-end scientific users (5-10 percent of faculty) will require IT consultation tailored to their needs. For the most part, these services can and should be centrally managed by ITS, and some could be provided on a fee-for-service basis. However, each major research area should be served by an IT specialist who understands the nature of the content and can work closely with the research teams, effectively leveraging the resources of central IT as needed (see I.B above).

D. Defined services: For most researchers (perhaps 90 percent), a defined set of standard services will suffice. Services in this category might include, for example, database development, central data storage and management, and others. These services could become “commodities” routinely provided by central IT and other units, such as the libraries, with a minimum of high-level expertise and oversight required. Specification and announcement of these services should occur annually, as should end-user evaluation of the services.

Theme III. Build the platform for excellence and innovation

If UNC-Chapel Hill aspires to be the leading public university, we will have to help set the nation’s research agenda and frame the questions that drive it. Inevitably, this will require computing power that is orders of magnitude greater than what we can muster today. Meanwhile, the State of North Carolina has challenged

UNC to help transform its economy from one dependent on manufacturing to one based on knowledge, engaging all sectors—education, business, and government—in the transformation. Ultimately, high-performance computing at UNC can and must be viewed in this context of service to the state. Here are just a few examples of the computing-based fields that may have relevance for North Carolina and UNC:

- Modeling and scenarios for science, social science, business, and government
- Virtual organizations for rapid, flexible problem-solving
- Integrated, predictive biology (such as the virtual-lung project under way at UNC)
- Health-care delivery
- Disaster preparedness and response
- Disaster simulation and prediction

Strategic, ongoing and substantial investments in IT, coupled with visionary thinking about our research priorities, will enable us to land the big-science projects that will propel us into the upper echelon. In today's competitive environment, research funding will tend to flow toward the locus of computing power, because that is where talented faculty members and students will choose to work. Top faculty not only attract funding and conduct groundbreaking research, they help frame the questions that shape the next wave of science and innovation. Investment is especially needed in the areas of (a) high-performance computing and (b) scientific visualization.

A. Invest strategically in high-performance computing. To compete in the arena of big science, UNC must increase its support for computing-intensive research. In areas such as structural biology, genomics, the social sciences, proteomics, and translational research (basic science applied to real-world problems), UNC has considerable strengths that are not yet fully exploited or widely recognized, largely because of IT limitations. High-end users identify six deficits on campus: (1) lack of processing power, (2) inadequate database management, (3) confusion over access to high-performance computing resources, (4) lack of software development, (5) inadequate bandwidth, and (6) lack of long-range planning. Each of these must be addressed.

1. Grow the processing power. UNC now has approximately 1600 CPUs available centrally for research computing. Because these are not adequate, some faculty attempt to buy and maintain their own CPUs. There are several potential problems associated with running a cluster for an individual researcher or team. The investigator must hire staff or use graduate students as system administrators. Departmental labs, closets, or offices where these smaller clusters may be located typically do not have sufficient cooling and environmental conditioning for the equipment. The most demanding users can require an enormous number of processors: Georgia Tech recently hired a scientist who required a start-up package of 1000 dual-processor blade nodes, almost two-thirds of the number available for all researchers at UNC. Grant funds may not provide

enough money to buy large pools of CPUs and may not provide funding for personnel to administer those systems.

In the ideal world, UNC would eliminate all CPU constraints by 2016, but this may prove impractical. Access to national or regional computing resources may remain a cost-effective option for some high-end users, and grid computing may offer advantages to others. But as UNC exploits these options, it must also expand its processing capacity if it intends to establish itself as a force in research computing and to ensure that mission-critical projects have the timely access they need. At least annually, a pan-university panel of representative high-end users should review and project processing needs, recommending to central IT a level of centrally managed processors. It is anticipated that annual University investments of at least $3M will be required to address this resource deficit.

2. Improve data management. See II.A and II.B above.

3. Clarify access to high-performance computing. Our subcommittee has reviewed several models for managing high-performance computing at major research universities. For example, the Texas Advanced Computing Center, reporting to the vice president for research at the University of Texas at Austin, supports the research enterprise with robust resources and consultation. Various other research universities have similar resources reporting to the research side or to central IT, or as part of a multi-university consortium. Recently, the Renaissance Computing Institute (RENCI) has made a number of significant investments in high-performance systems available to some investigators at UNC-Chapel Hill, Duke, and other UNC institutions. However, we have found confusion among our faculty about who may access those resources and for what purpose. We recommend that the vice chancellor for information technology and UNC administration develop a policy clarifying the roles of RENCI and central IT and developing a philosophy of resource allocation.

4. Support software development. In the biomedical sciences, chemistry, and other fields, research is progressing so rapidly that off-the-shelf software is inadequate. Often, scientists can write code to perform the basic tasks they require, but they need assistance developing the user interface, scheduling, porting, and other features. In some cases, the resulting software could be made available to university researchers on the Web, enhancing the university's reputation. One example of this is software developed by the Nikolay Dokholyan team to render protein folding in real time. The most popular software packages, even those developed as open-source, would have the potential to attract corporate investment or federal funding. Revenue from external users of the software could, in some cases, be applied to its long-term support. If a

critical mass of these tools were available via a portal—as part of a highly visible biomedical "hub," for example—their cumulative value could attract widespread use and additional external funding. The basic programming necessary for such projects can and should be provided by the research teams in consultation with central IT. However, the most costly and time-consuming aspects of the projects is likely to be the graphic user interface (GUI). Programmers adept at creating these interfaces may share their expertise (see IF above) or should be available on a fee-for-service basis.

There are opportunities for partnership between the library and IT to support the technology needs of faculty and researchers in this area. In the future more librarians will have computer science degrees as well as degrees in library and information science. Teamed with applications programmers, they will help faculty create customized database structures, specialized search engines, and interfaces that match the needs of the scholar and the disciplines on which she is working.

5. Provide bandwidth for collaboration. UNC is known for its interdisciplinary research spanning disciplines, states, and nations. We should build on that reputation and enhance our capacity for collaboration. As scientific visualization (III.A), the exchange of large data sets, and real-time interactions become more significant aspects of collaboration, bandwidth will be critically important. We recommend that as part of the needs assessment (I.A) central IT identify the heaviest scientific users of bandwidth, ask them to estimate their needs, and strive to increase bandwidth accordingly.

6. Commit to long-range planning. This strategic plan should be viewed as a starting point, not the final word. Long-range planning in each critical area affecting research should be sustained.

B. Attain national prominence in the use of visual and spatial resources: In virtually all fields, researchers will render complex data sets in visual representations that will allow them to understand structures, patterns, and trends. To compete, UNC must develop greater strength in the area of visualization, including strategic areas such as geographic information systems (GIS) and the graphical modeling of biomedical processes. Despite having a Department of Computer Science known for its groundbreaking work in computer graphics, UNC lags behind other leading research universities in the area of graphic representation and visualization.

Because some of the IT resources in these areas can be applied across numerous disciplines, we recommend an investment in promoting sharing of expertise campus-wide and in central IT consultants and the hardware and software required. Central IT should conduct annual needs assessments (see I.A above) and work with academic leaders to guide investments and develop

a strategy for achieving nationally competitive capabilities in this critical new arena. While we recognize that it is not the mission of the Department of Computer Science to provide IT services on the campus (and the Department is indeed a rightful consumer of those services), the Department's expertise should be sought in the strategic decision-making needed to achieve success in this area of research.

C. Plan and invest strategically to take advantage of the nation's computing infrastructure, anticipate emerging trends, and ensure access for UNC researchers: Dan Reed, UNC's Vice Chancellor for Information Technology, and José-Marie Griffiths, Dean of the School of Information and Library Science, are members of the President's Information Technology Advisory Committee and several other leadership groups that shape IT policy and trends at the national level. In this role, these leaders have contributed to plans and reports that document, in a level of detail far beyond the scope of this strategic plan, priorities and opportunities for the nation's IT role in science and education. Some of the relevant reports are listed below. In brief, these plans describe the development of initiatives that would enable the U.S. to compete in a global knowledge economy. Access to these initiatives, computational resources, and centers of excellence is vital to the interests of UNC and its academic researchers. Without such access, many of our researchers will not succeed in the competition for contracts and grants and will have the opportunity to work at the leading edge of their disciplines. But access to these resources comes at a price. To succeed, and ensure that UNC's research programs track with the emerging "roadmap" for IT nationally, UNC may have to invest strategically in partnerships and consortia that enable access and establish Carolina as a national player in this high-stakes enterprise.

An example of such enterprises is the Clinical and Translational Science Award program (CTSA) sponsored by the National Institutes of Health. In early 2007, UNC submitted a proposal to this program that would create a comprehensive institute for melding biomedical sciences with bioinformatics, biostatistics, and other IT-intensive disciplines to break out of academic "silos" and speed the development of beneficial new treatments and technologies. The stakes for this proposal are high: if UNC is unsuccessful in this round or the next, we could become a second-tier institution in this key area of biomedical research. To support the kind of interdisciplinary, computing-intensive work envisioned in such projects, UNC must provide greater computing resources and IT staff support for interdisciplinary research teams, as described elsewhere in this plan.

We recommend that Vice Chancellor Reed, in consultation with Dean Griffiths, present a set of recommendations for securing UNC's place in the national arena, and we strongly urge support for additional resources to support the necessary investments.

1. The 2007 PITAC report to the President, **Computational Science: Ensuring America's Competitiveness**. http://www.nitrd.gov/pitac/reports/20050609_computational/computational.pdf
2. NSF Cyberinfrastructure Council, **Cyberinfrastructure Vision for 21st Century Discovery.** http://www.nsf.gov/od/oci/ci_v5.pdf
3. Computing Research Association, **Cyberinfrastructure for Education and Learning for the Future: A Vision and Research Agenda** http://www.cra.org/reports/cyberinfrastructure.pdf
4. Klingenstein et al., **Final Report: A Workshop on Effective Approaches to Campus Research Computing Cyberinfrastructure .** http://middleware.internet2.edu/crcc/docs/internet2-crcc-report-200607.html
5. NSF TeraGrid: http://www.teragrid.org/index.php
6. Open Science Grid: http://www.opensciencegrid.org/

Communications and Networking

Bits, "the DNA of information," are rapidly replacing atoms as the basic commodity of human interaction.

—Nicholas Negroponte, *Being Digital (1995)*

Universities have been both collections of atoms and ideas. Atoms rooted in the physicality of its people, its architecture, and its campus. The ideas expressed in the learning transmitted to its students and contributed to the body of human knowledge. These concepts have been intertwined together to create a special community tied to place. Information technology is adding a new dimension as bits of information that can exist anywhere at all and nowhere in particular.

The development of powerful communications and networking technologies promise to alter how we create and disseminate knowledge. These changes also promise a different degree and kind of access to knowledge and related resources. They allow the people of the globe to reach our campus and our campus to reach out to the globe with unprecedented immediacy and impact. Bringing the world to the campus and campus to the world promises to change the balance between the idea and the geographical place of our University. At such a moment, our campus should consider what that might mean and how to respond.

Rather than be swept by events and developments, the University can channel these changes to bring out the best characteristics and strengths we can offer our fellow human beings. This report offers a set of recommended goals and objectives to help our campus chart a path into the future.

Digitize Everything

Advances in business efficiency during the late 20th Century often involved moving from paper-based information systems to electronic transactions. While the investment and return on that effort required significant time, toil, and treasure—the result was a substantial increase in business productivity (Brynjolfsson 2000). As UNC faces ongoing challenges to achieve greater efficiencies with increasing pressure on administrative budgets, moving to electronic transactions will provide the necessary improvement in the efficiency of university business. Such an effort aligns with the UNC President's Advisory Committee on Efficiency and Effectiveness (PACE) to "to concentrate its resources and better support and accomplish its core missions of education, research and public service." (UNC PACE 2006)

Our campus has already made much progress in the areas of student recruitment, matriculation, registration, and contact with alumni. The same is becoming true in areas of federal support for research with the advent of www.grants.gov. Yet, many areas of campus business remain rooted in moving

paper from one place to another. Such processes are prone to error during transcription and introduce unacceptable delays.

The goal is to move UNC to become a digital campus in business processes. Such a goal mandates that all business procedures not legally required to use paper shift to electronic form and all members of UNC have access to such electronic resources. Such a goal might seem to fly in the face of the warnings of researchers and thinkers who write about the social life of paper (Gladwell 2002; Sellen 2003), but the goal here should be developing technologies that support an equal richness and convenience of business information that paper currently provides. The change should gain rather than lose efficiency (Stiroh 2002). The effort can mesh well with the Enterprise Resource Planning (ERP) effort to bring robust business applications to the campus. Nevertheless, the path to achieving the goal involves leadership from the executive suite to the desk of the administrative assistant.

Recommendations

- The Provost, with the advice of the Vice Chancellor for Information Technology, should appoint a task force composed of a senior executive sponsor and representation from faculty, business managers, administrative assistants, and information technologists. The specific objectives of the task force include:
    - Map current business procedures that use paper and determine the cost savings of shifting to electronic methods.
    - Identifying paper business documents used for transactions suitable for shifting to electronic formats.
    - Develop standards for electronic transactions and appropriate audit trails.
    - Identify training needs in the management of electronic documents and business processes.
    - Identify resources needed to encode, transmit, store, and protect non-digital information.
    - Identify mechanisms to support the seamless bridging of digitally-recorded formats to migrate data from any past format to current versions.
    - Coordinate with campus ERP efforts to take advantage of advances in business applications and business procedures undertaken.
    - Assure that the campus infrastructure of data networks and related business applications can support the adoption of electronic business documents.
    - Propose training programs and incentives for individuals and units to move to electronic forms for business documents.

- The Provost should mandate a policy that electronic methods are the standard for official communications for policy, for business issues, and information processing.

Ubiquitous Connectivity

Every member of the UNC community must connect to online resources to fulfill their roles. Whether reading email, posting information, or conducting other business electronically, every campus citizen needs ubiquitous connectivity to information resources. The bedrock of connectivity includes access to online resources everywhere, appropriate authentication and authorization to information systems, and a robust network infrastructure that can grow to meet evolving needs. As our community increasingly embraces electronic methods of business and spreading members beyond the campus, connectivity requires access to information resources from anywhere to anywhere. Such nomadic computing will empower every member with access to the information resources of the entire UNC community—regardless of location. Providing wireless and wired access to network resources everywhere on UNC property and access for off-campus users through public infrastructures is only a beginning. Information users from all sectors of the community will need single sign-on authentication and support for roles-based access to information systems. All of the above will require solid, dependable, and secure professional identity management. The end state will be standards and protocols to make access to information systems transparent for all users.

Achieving these goals begins with directory services that can fulfill the myriad needs of our community by drawing on an interrelated set of resources to create a common identity pool. It will also require participation from the full array of business units and business roles each individual on campus plays as part of the UNC community. That participation is a necessary ingredient in solving the complexities of role identity management.

Recommendations

- The Vice Chancellor for Information Technology should convene a task force to develop policies and procedures to achieve the goal of ubiquitous connectivity. Such a body will establish standards for access, authentication, and authorization including
    - A universal Onyen that all units of UNC can adopt for single sign-on functionality.
    - Standards for using Onyen authentication and access controls that will be available to all UNC information systems.
    - Standards for professional identity management.
    - Guidelines for a funding model and strategic plan to build out wireless and wired access to network resources everywhere on UNC property and support access for off campus users through public infrastructures.

- Campus leaders, particularly ITS, should work with commercial and non-profit data carriers to optimize connectivity to on-campus resources using public and research infrastructures.

Empower Users

The effective use of communications and information systems in the UNC community depends on the technology knowledge and skills of those using them. Many organizations have dropped computers on desktops and linked machines to servers without paying sufficient time and attention to the know-how of those who were expected to use them and their access to information. The lack of knowledge and dearth of skills by users often causes many programs of technology introduction to fail. The challenge stretches from the presenter who struggles to start the PowerPoint presentation to the groundskeeper who cannot update an online report for maintenance. Every department, program, and office is underpowered in the technology skills of the people working there. Yet training programs alone are not sufficient to address the challenges of rapid change in information technology or knit together the variety of communities that make up UNC.

Every member of the UNC community should have access to and be conversant with campus information and communications resources, as well as possess sufficient skills in using their personal and collective information spaces effectively. Meeting such a goal requires providing universal access to information and communications resources that help identify and address training needs from the Chancellor to the housekeeper.

Recommendations

- The Provost, with the advice of the Vice Chancellor for Information Technology, should convene a task force to achieve the following goals:
    - Develop protocols to assist every faculty member to assess their information technology needs for resources, services, and training.
    - Develop protocols to assist every manager and employee to assess the information technology needs of every staff position at UNC and include IT skills enhancement as part of the employee development plan.
    - Develop guidelines for regular evaluation of IT skills based on the above protocols to make sure the each incumbent has access to the information, training, and resources to function effectively.
    - Provide every new employee an orientation to the information technology resources required for effective performance in each position and provided opportunities for mentoring and building communities of skill.
- ITS should create and host an online clearinghouse of information, resources, and training materials for the university community. Such a

clearinghouse should provide pathways for all members of the campus to contribute to the acquisition of resources and their evaluation.

Foster the Digital Community

The campus sits at the edge of a generational change in the creation and use of knowledge (Morville 2005). The web as a platform shifts the availability of data, information, and knowledge to become a driving force in a network of participation (O'Reilly 2004). An “architecture of participation” offers a new set of capabilities that can support innovation, discovery, and dissemination in a participatory environment.

As a premier member of the research and educational community, the University should leverage high-value computing and network infrastructure tools to foster their innovation and use across the campus in fulfilling its commitment to engage the world. Achieving that goal involves taking a number of steps to knit the campus community together and extend our embrace to the larger community beyond campus. These steps include adopting standard tools for enhancing and augmenting central administrative information resources. The complexity and diversity of business needs across our campus will require flexibility in applications that serve common needs as well as support local application development capabilities. The campus should coordinate the development of common libraries of software toolkits and provide protected prototyping areas that leverage central systems and support local needs without jeopardizing existing processes or systems. To foster and guide the development of these technologies, the campus should create an online innovation marketplace where faculty, staff, and students can present project ideas for consideration by the UNC community. Inspired by the example of the open source movement and the concept that in matters of cognition (Surowiecki 2004) the many may be smarter than the few, the approach can leverage the wide array of talents and skills across the campus.

The concept of the digital community extends into increasingly rich methods for mass and interpersonal communication. As a premier institution of discovery and learning, the campus should take the necessary steps to lead in the arena of mass communication to bring its faculty and resources to inform the wider community. Fulfilling that goal will involve establishing a network of studio-quality facilities around campus for interacting with news media and the public. While having the capability to provide access is a prerequisite, the campus should also provide training for UNC leaders in interacting with information presentation technology, news services, and the public. At the other end of the spectrum is the architecture of participation in online communication that can enable drawing on the wisdom of the whole community. The campus should develop methodologies and capabilities that can leverage individual participation to common issues using shared technologies that can be knit together. By adopting standards-based technologies, we can move toward an interrelated and interconnected network of

technologies serving the common business and data needs across the UNC community.

Achieving these goals on common technologies and standards will require forging a broad agreement across the campus communities. The model of the open source and open standards movements suggests a number of approaches to discuss, decide, and reach such ambitious goals. The campus community can gain a sense of its collective wisdom in adopting the model of the Iowa Electronic Markets for drawing insight from a large number of stakeholders (Iowa 2006). The campus should create online spaces where the members of UNC can develop those agreements using the collaborative tools, such as wikis, to specify the details. Using such tools and approaches can model as well as implement methods of participation.

Recommendations

- The Provost, with the advice of the Vice Chancellor for Information Technology, should convene a broad-based group to adopt and develop standard technologies for enhancing and augmenting central administrative information resources. This coordinating group should have ongoing responsibilities in the area of enterprise systems.
- Non-ITS technology groups should work with ITS to develop common libraries of these toolkits and provide protected test areas that leverage central systems and support local needs safely. Non-ITS information technology organizations can use these tools and contexts to develop auxiliary and supplementary information systems that mesh seamlessly with central enterprise systems.
- The campus IT organizations should create an organic innovation marketplace where faculty, staff, and students can present project ideas for consideration by the UNC community.
- The University should establish studio-quality facilities around campus for interacting with news media and the public.
- UNC News Services should work with ITS and other agencies to develop training for UNC leaders in interacting with information presentation technology, news services, and the public.

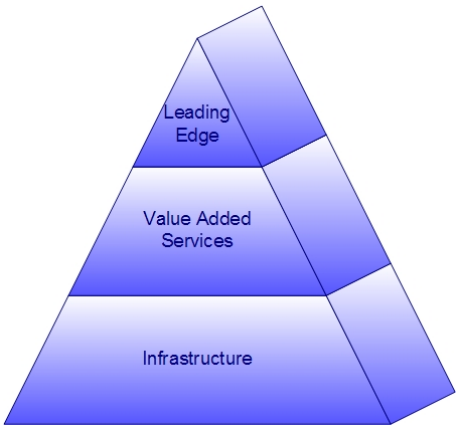
Sustainable Support

Identifying goals without identifying the means to achieve them will lead to inefficiency and ineffectiveness. The strategic role of information technology in the success of a 21st Century university seems obvious, but UNC labors under the weight of business procedures and practices rooted in the world of paper-based information resources and processing. The rise of the large-scale scientific research universities after World War II was largely fueled by federal government funding. The advent of campus information technology grew from administrative needs for data processing and opportunities in research that needed advanced

computational resources. The funding structures supporting these ends of the spectrum of use have persisted in the “black box” of IT funding and the opportunistic approach to support research computation. In between emerged information systems for educational support that never fit well in either fold. Adding a final element of confusion, information technologists have emerged as a variety of clerical worker rather than professionals in their own right.

Our success as a campus requires sustainable support for information technology. The funding methods of the past will not meet the needs of the future for the layers of infrastructure and services our campus will require. We need a broad-based business model that includes a multi-layered hybrid mix of funding resources (i.e., fee for service, strategic investments, revolving funds, and collaborative partnerships) to support levels and types of technologies and services.

Different needs require different approaches for sustainable support—especially as they change over time. The natural progression of information technology is to see the introduction of innovation as a special event requiring extraordinary support. The success of that innovation in terms of its wider adoption often requires ongoing funding, often as service delivery fees. If that success should become widespread and ubiquitous, then the technology usually becomes a commodity, available at the lowest possible cost. Commonly such commodities are available without specific per use fees. Our campus approaches to the business of information technology should recognize such a progression and take steps to leverage it.



Information technology services can be seen as a pyramid of levels of service and different funding models, each leveraging the one below. At the base are infrastructure services such as networks, email systems, or technical helpdesk resources that provide the entire community with capabilities to support business processes. These are often provided at no direct charge since metering such services may not be feasible or could deter use. At the second level are value added services that require customization or adaptation to subgroup needs such as increased security services and devices for protected health information or special services such as videoconferencing not used by the general community. Charging units within the university for these services offers a method to recoup their costs in ways that support local needs without taking resources from the base infrastructure funding. The top level offers leading edge technologies that support the most advanced technology, often in support of the research mission. Such technologies can differentiate the campus from its peers and form a part of the public perception of the institution. These

could include computing clusters for protein sequencing or developing applications for affinity networks to create communities of practice. Quite often, these leading edge efforts require special funding from research grants or reserve funds for special initiatives. Invariably, however, successful leading edge technologies migrate to lower levels of the pyramid as they become less expensive, more reliable, and more widely available. Recognizing where any specific technology resides on the pyramid helps us understand how to support it.

Approaching our information technology layers on a business basis offers a model for supporting each set of services with an appropriate model. We should provide central funding of basic infrastructure, core capabilities, and ubiquity of network and communications access because these resources do not lend themselves to metering or fee-for-service delivery models. We should, however, levy support fees for enhanced services (in communications, storage, and for specific research requirements).

These approaches will suffice for the normal business of the University, but cannot offer the resources we will need for making bold, strategic steps to move into new areas and adopt radically new innovations. For these needs, the campus should maintain a reserve of funds for strategic investment (e.g., pilot projects and services and addressing disruptive technology changes). Campus leaders from across all the affected areas will need to engage in these decisions to provide the wide array of knowledge, insight, and authority to make strategic initiatives successful. The advance of technological change will require regular reviews of these approaches to develop more efficient provision and funding support models on an ongoing basis.

The question of where to find the funds is an ongoing challenge. As a campus, we should examine old models of support and develop new models when the old ones are found lacking. These will require broadly-based task forces to look at each area of operation and ask the hard questions of where should the money come from. Nevertheless, the leadership of our University requires looking beyond our campus to find the resources we need. Reaching out to form collaborative partnerships beyond campus can leverage synergistic opportunities with for-profit and non-profit institutions. Leveraging these opportunities will require new policies to guide individual and group efforts to not only obey the law but to preserve the independence of the academy to discover and inform the wider community unfettered by commercial interests.

Recommendations

- The Provost, with the advice of the Vice Chancellor for Information Technology, should create a task force to investigate and foster new business models for funding campus information technology needs. The group should create a set of models that can be applied to different needs

from standard services (basic infrastructure, core capabilities, and network and communications access) to leading-edge initiatives. The task force should address models and areas of services such as:

  - Use fees for enhanced services (in communications, storage, and for specific research requirements).
  - Protocols for maintaining a reserve of funds for strategic investment (pilot projects and services and addressing disruptive technology changes).
  - The task force should regularly review all the above to adjust for technology change and more efficient provision and funding support.

- Campus leaders should seek collaborative partnerships beyond campus to leverage synergistic opportunities that could include public/private partnerships co-located on campus and other University property.

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Enterprise Applications Management

The effective application of information technology is of increasing importance to the many ways in which the university supports teaching, research, and administrative services. The presence of information technology is visible throughout the University. New needs are identified daily in areas where information technology can be and should be employed. New implementations are added or existing practices are altered with the help of IT and to accommodate it across all units and divisions. Simultaneously, there is a growing interest in achieving a better balance between central and distributed IT. Decentralization has brought with it increasing responsibilities for local management and self sufficiency. However, there is a sense that the growth of IT has occurred unevenly and is inadequately coordinated. Individual units are free to pursue solutions without consultation but are handicapped by a lack of resources; a lack of adequate insight, expertise, and understanding; or a lack of adequately prioritizing investments in IT. Mostly this results from efforts to just get the job done and meet service expectations or compliance issues. There is a sense that more can be done to nurture the distributed community with a clearly defined governance structure. A structure that includes …

1) achieving a balanced understanding of central IT goals;
2) building a framework for priority setting and decision making to assist unity in developing their own strategies;
3) helping individual units build upon common goals;
4) emphazsizing standards and practices employed by units in the design and implementation of their IT activities; and
5) examining policies granting external use of University administrative data and access to data through University IT resources and administrative systems;

I. Environmental Assessment:

A. Effects of the absence of a strategic approach to IT at UNC-Chapel Hill and chronic under-investment and/or mis-investment in core IT operating systems:

1. Aging and increasingly vulnerable IT systems that are essential to virtually all administrative and financial operations on the campus.

2. A patchwork of old and new systems that have evolved over time, characterized by chains of both intended and unintended interlocking data relationships that complicate and impede responses to both challenges and opportunities.

3. Technical personnel with the skill sets needed to maintain and sustain existing IT core systems are in short supply, and have limited capacity to be redeployed from one specialized system to another when the need for help arises.

4. Proliferation across campus of decentralized “shadow” IT systems, arising in large measure from needs gone unmet by campus-wide IT enterprise, and mirroring the prevailing UNC-Chapel Hill culture of distributed authority and responsibility for the University’s missions.

B. UNC-Chapel Hill confronts unaccustomed expectations and demands from key constituencies for accountability in the IT realm, prominent among which are:

1. Escalating security requirements and liabilities associated with failures, and increased regulatory complexity. UNC-Chapel Hill’s fragmented IT approach makes questionable our capacity to respond appropriately and effectively to anticipated challenges.

2. Demands for improved efficiency in the use of available financial and physical resources. UNC-Chapel Hill’s approach to its IT needs makes us vulnerable to accusations of mal-administration or excessive costs institution-wide.

3. Concerns over sustainability of our core IT operations, business continuity and disaster response capability.

C. Considerations external to the campus complicate and confound choices potentially available to UNC-Chapel Hill in devising workable and financially acceptable responses to the IT challenge:

1. Ongoing consolidation among the ranks of potential vendors for upgraded IT core systems appears to be oligopolistic in nature, with likely adverse effects on our range of available choices and our ability to negotiate favorable financial terms.

2. UNC-Chapel Hill is embedded in a complex web of State and University system business rules and practices with attendant data reporting requirements that are expected to pose serious compatibility issues for vendors’ available IT systems. Substantial adaptations and their attendant

costs and operating complexities likely will be necessary with any campus-wide IT system that might be acquired.

D. UNC-Chapel Hill will be challenged to find and establish an optimal balance between the likely need for greater central direction and control of IT policies and operations, and the heterogeneity of management styles and approaches that defines our history and traditions:

1. There is an absence of campus-wide IT system protocols that appear necessary to assure the operational integrity of a highly-distributed set of largely independent systems.

2. There is lacking presently any mechanism for assuring compliance with institution-wide IT operating policies or procurement ground rules, nor are there any financial or other consequences in place to help address decisions or actions by individual units that may lead to institutional liabilities or unjustifiable costs.

3. Any substantial policy shift toward more explicit central direction and control of IT resources and investments constitutes a challenge to the UNC-Chapel Hill "corporate culture" of distributed authority and responsibility over operations and financial resources.

4. Any substantial policy shift may also negate or conflict with technological advances that have allowed individual schools, departments or programs to become leaders among peer institutions.

E. Other intangible considerations may influence the IT choices otherwise available to UNC-Chapel Hill:

1. Resistance to change by many who perceive themselves as wedded to the maintenance and upkeep of existing legacy systems or who question their role in the decision-making process of selecting other systems.

2. Need for strong campus leadership to assess the associated risks with both action and inaction and to marshall the requisite financial and human resources to implement successfully a comprehensive upgrade of UNC-Chapel Hill's IT core systems.

3. Concern that the speed of technological change may make any large scale system obsolete before it can be fully implemented.

II. Vision of Desired Enterprise Applications at UNC-Chapel Hill:

A. Scope and functionality of IT systems:

1. There are clear, appropriate, and well-understood delegations of both responsibility and authority for IT across the campus – i.e., what components are assigned to “central IT”, and what components reside with other operating units.

2. All administrative support systems (finance, human resources, students, email, imaging, calendaring, directory) are either embraced by the Enterprise Applications package or have the capacity to interoperate and exchange information with it.

B. Technical Characteristics of IT systems:

1. The chosen technological platform is one that lends itself to upgrades in the future, to accommodate to and exploit continuing advances in the field.

2. The system(s) chosen incorporate and can accommodate evolving security measures and challenges, as well as regulatory compliance issues.

3. The system(s) chosen are judged to be reliable and sustainable.

4. The system(s) chosen process transactions as close as is possible on a “real time” basis.

5. The system(s) chosen ideally have capacity to “think” ahead of the end user’s needs – i.e., have context sensitivity.

C. IT Systems Integration:

1. IT systems allow smooth and uneventful sharing of appropriate data elements across systems, including those outside of the core package(s), i.e., are considered by users to be well-integrated one with the other.

2. Elements of needless (therefore, costly) redundancy are kept to the minimum level possible, consistent with operational requirements. Some forms of redundancy, however, may be purposefully necessary.

D. IT Systems and the Carolina culture:

1. IT systems must exhibit flexibility and fluidity, in functional, temporal, and geographic terms.

2. IT systems must accommodate as much as possible to decentralized transaction processing, subject only to necessary programmatic controls or ground rules.

3. IT systems must have the adaptability to react/respond constructively to "reasonable" unit data requirements for operations and decision support.

4. IT systems should allow for unit creativity and the development of tools that leverage central data stores, but are potentially of direct use to only a small subset of the campus.

E. IT Systems' Perceived Value:

1. At all levels of the campus people feel they have received good value for their IT investments in systems, software, and technical support – i.e., the overall Enterprise Applications are widely judged to be cost effective.

2. Both IT technical personnel and end users at all campus levels, both "central IT" and in the operating units, are well trained and have ready access to the training they need to stay current in the field.

3. Campus IT systems are "user friendly" to all users, not just to the cognoscenti/technical experts.

F. IT Systems Planning and Governance:

1. There is a process in place for serious, neutral, systematic needs assessment for IT systems, in order to mitigate campus operating units' compulsion to "do it on their own" unnecessarily. This process is flexible and

does not hinder the creative development of IT tools at the business unit level.

2. The campus commits to developing/nurturing the expertise and the mechanisms for reaching coherent decisions about new IT investments, whether at the central campus or unit level.

III. Strategic Issues and Choices:

A. Managing expectations:

1. Not everyone involved with IT is yet ready to “drink the Kool-Aid®” – i.e., there remain lots of non-believers in the need for or the feasibility of a comprehensive overhaul of Enterprise Applications.

2. There must be a general understanding that the unprecedented major investments in IT may not yield results that perfectly address everybody’s needs, or at least in certain phases of the change process.

3. Since the changes in core campus IT systems being considered will impact virtually all business units at Carolina, the campus must be advertently sensitive to and understanding of such changes’ scope and affects.

B. Need for effective IT governance:

1. The biggest single problem is seen to be the lack of an effective campus level governance mechanism for IT that is both trusted and objective.

2. There is a perceived need to “clean up”/rationalize the existing array of confusing committee structures in IT.

C. Enterprise Applications approaches:

1. A “single suite” ERP for all systems.

2. A “best of breed” ERP, with locally-developed front-end integration of individual systems obtained from different vendors.

3. “Home-grown” and departmental systems that are subject to certain campus-wide standards.

4. “Outsourcing” certain IT systems to qualified vendors.

5. Some combination of the above.

D. IT Governance Structure

1. A structure should be developed that will ensure that the opportunity for efficient, cost effective, and high quality interfaces exit to meet service expectations, achieve consensus on the way technology is engaged and used across the university. This structure should be communicated to the campus.

2. The scope of the structure should include an opportunity for all stakeholders at the executive level or their representatives to participate and include interested participants from functional and technical areas in on going development. A review of service agreements and purchasing involving systems and software that need to interface with centrally supported systems is seen as essential.

3. The governing structure should include evaluation and consultation on proposals developed in the distributed community to ensure that the university community operates with the benefit of the knowledge and expertise of central IT professionals regarding such things as proper equipment, data access, hardware, network wiring and connectivity, communications software, etc.

4. Opportunities for training and technical support should be available.

5. The structure should include policies regarding access for the university community that involve assistance with development of departmental policies, approvals, or processes as needed; ie procurement.

6. Network management policies, rights, and responsibilities should be known along with information about the locus of responsibility.

IT Governance

Overview

The UNC Chapel Hill campus presents a number of challenges in IT governance to fulfill the complexities of its mission of education, research, and service. Providing a core of consistent, reliable, and scalable resources for every area of campus life and work is a daunting task. Adding to that, the specialized needs of diverse stakeholders further complicates issues of aligning IT resources with campus goals. For example, the IT needs of an English professor in Arts & Sciences are different from the needs of an oncologist in Medicine. While both rely on email, the oncologist needs the email system to meet specified security requirements for protected health information while the English professor does not. Both are involved in the research enterprise, but they do so in very different realms with different resources needed. For these, and many other, reasons autonomy is an underlying ingredient in IT on our campus. Maintaining the right balance between reliable core services and responsive specialized services in an environment of rapidly changing needs and opportunities is the job of the chief strategist, the CIO for the institution. The CIO also must articulate clear operating principles, and uphold values that include standard business practices and transparent decision-making processes.

The inherent difficulty in making and implementing decisions about the full range of IT needs is a key challenge identified by this planning process. Indeed, this challenge is common on large research campuses across the nation. Throughout this report we have called for new structures and processes to help set priorities, create standards and policies, and allocate resources. Without significant attention to improving IT governance at the university, the success of other recommendations in the plan may be at risk. In this section we call for the creation of a governance system that addresses five key decision domains. To put that system into action, we suggest a decision-making model and an overall structure.

Concerns

Elsewhere in this plan concerns have been expressed about how ineffective governance can impede our success in implementing new initiatives and improved services. Some of these concerns include the following:

- An imbalance between central and distributed IT that has resulted in uneven growth and poor coordination of services;
- Vulnerability to address security and regulatory requirements due to fragmented approaches;
- Inefficiencies in the use of fiscal and physical resources;
- Concern about sustainability of current services and disaster response capability;
- Absence of campus-wide IT system protocols and mechanisms to develop standards and policies, and assure compliance;

- Loyalty to legacy and vendor systems;
- Lack of systematic processes for identifying IT needs and making IT investment decisions affecting all units;
- Lack of buy-in to developing new business models for funding IT that distinguish core commodities and services from higher end uses that could be fee-based;
- Lack of effective stakeholder input to identifying IT needs for teaching and research;
- Ineffective mechanisms to share IT expertise and tools across campus units.

What is IT Governance?

According to a researcher at Gartner, "IT governance is about decision making that leads to better alignment of IT and the business."[1] When an organization's IT resources and policies do not align with its goals, then inefficiencies appear and unsatisfactory performance results. The EDUCAUSE report, "Improving IT Governance in Higher Education," also points to similarities in IT governance challenges facing major corporations and universities. It suggests that governance should cover five major decision domains:

1. The IT principles that define the role and scope of authority of IT in the institution;
2. The basic IT architecture;
3. The centrally coordinated, shared services that provide the foundation for IT;
4. The core applications across the institution; and
5. Decisions about IT priorities and investment arenas.[2]

Governance is not only who makes the decisions but how they gather and consider information about issues requiring action. It involves the process of decision making as well as the representation of the community. In other words, IT governance in a complex organization with autonomous components needs a federated system and a constitution, or governing document. A constitution should address the five decision domains defined above. It should describe a process for making decisions, how stakeholders and leaders can play their respective roles, and how the process and representation may change over time. The constitution should also specify the rights and responsibilities of every person in the University in terms of information technology. Such a document can provide the rationale to help define when and how to pursue autonomous versus "common good" IT decisions.

Steps Toward a Governance System

The EDUCAUSE Report recommends:

[1] Dallas, S. Frequently Asked Questions About IT Governance. Gartner, 26 January 2006.
[2] McCredie, J. Improving IT Governance in Higher Education, EDUCAUSE ECAR, 29 August 2006.

- Develop clear, transparent, widely communicated governance structures
- Foster true partnerships and coordination between central and local IT units
- Recognize the differences between campus-wide and local IT issues and services – while many priorities must be set centrally, decisions about how to achieve them should be made locally
- Clarify and enable the position of CIO
- Clarify IT decision-making roles and responsibilities of other campus leaders
- Simplify the campus committee structure, define clear roles, and define clear “sunsetting” provisions
- Connect analysis and technical decisions to the budget process and rationalize the funding processes for instructional, research and administrative computing
- Develop structures that produce incentives rather than prescriptions and constraints
- Ensure that the IT governance is consistent with the overall culture of the organization and its goals

Our planning committee recommends creating a system of governance for IT. We suggest a structure and a federated type of decision-making model that address many of these recommendations. We believe these are needed to achieve the goals set out in this plan. A first step towards developing a new governance model involves exploring process and representation. The model below suggests a method of making, implementing, and monitoring decisions as well as how community stakeholders can be represented. The model works equally well whether decisions involve centrally coordinated IT services or customized applications.

A Model for IT Decision Making

The process can be viewed as a cycle of input from the community stakeholders, developing an informed recommendation for action, an executive decision to marshal resources to address the issue, planning to implement the decision, doing it, and monitoring the job to see that it meets goals. Throughout the process, the role of the CIO is central in monitoring and coordinating efforts as well as providing a consistent place for input. It could follow the cycle represented in Figure 1.

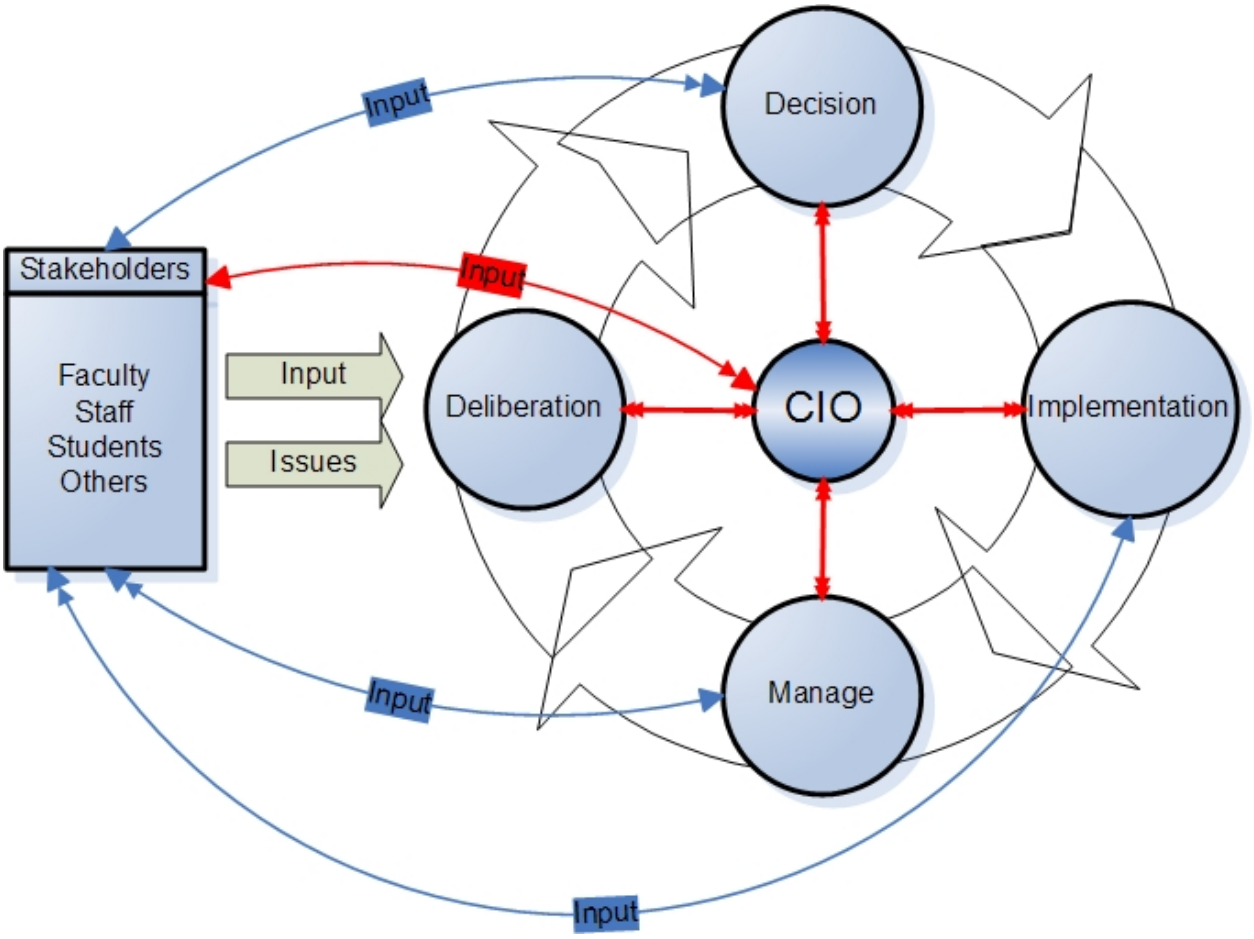

Figure 1:

In this model, each circle represents a group with responsibility for part of the process. Working from the left hand side and moving in a clockwise direction, we start with input and issues from stakeholders. They are the prime ingredient in the cycle but often their concerns need investigation and development to focus them into a policy recommendation, project proposal, or allocation decision. Turning the input of ideas, concerns, and issues from the stakeholders into a proposed action requires deliberation by an interested and informed group. The fruits of that deliberative step can be taken to campus leaders for approval or action. The campus leaders can choose to adopt, modify, or reject those recommendations—or even return them for more deliberation. If adoption or action proceeds, then the process moves into a planning step to prepare for implementation. The implementation circle can be the same or another group with responsibility for planning and executing the decision while informing and engaging the community on the process. Implementation can involve steps such as detailed project planning or developing communications messages. Once the policy or plan is in action, then a final group manages it to monitor compliance or progress to reach stated goals. If changes are needed, then the management group can restart the cycle for that issue with the deliberative body. At each step

of the cycle, the responsible group can return to the stakeholder community for more input or feedback on their step. Communications between stakeholders and functional groups can move in both directions.

The CIO serves a coordinating function in the governance system. As the responsible executive officer for campus information technology, the CIO serves to facilitate the process of moving issues along the process cycle as well as offering a method to fast-track decisions and actions as needed. The CIO is the convener of stakeholder groups as well as presenting recommended actions for decision. In the normal course of business, the CIO will carry out or delegate the carrying out of decisions in the implementation phase.

Special groups are not required for all of the decision-making, implementation, or management functions. More often than not, these should be established groups with responsibilities assigned to them by virtue of their duties, expertise, capabilities, and resources. For example, when implementing a plan for a new campus-wide service, ITS components may be the ones providing these functions. In a different way, implementing a policy may involve a wider array of campus components including school and departmental IT groups. The purpose of the cycle is to provide a consistent approach that makes it clear how stakeholder input is considered, and how decisions are made and implemented across all the areas involved. The new body proposed is the deliberative body that recommends policies and actions to the leaders. Its composition should reflect the stakeholders generally.

Representation involves who has input to the decision making process. Here a matrix structure can help assure that all key stakeholder points of view are represented. Figure 2 offers a simple way to view those inputs. The three major mission areas of the University (education, research, and service) form one axis while the roles of community members (faculty, staff, students, and “others”) form the other. “Others” can include stakeholders outside the campus such as townspeople, state leaders, peers at sister institutions, etc. A third dimension in this matrix is needed to represent specific functional areas (e.g. Telecom), applications (SIS), infrastructure (data networking), and business services (recharge centers). This structure applies generally to the model above.

Depending on the issues involved, the composition of the body may emphasize one group over the others or cut across all groups. Groups can be committees or task forces depending on the issues involved. Some issues may need a focused set of representatives (e.g., faculty members and students when discussing course management systems), whereas other issues may need broad representation (e.g., the community deciding what messaging services should be supported centrally). The matrix approach can help assure that no group is ignored.

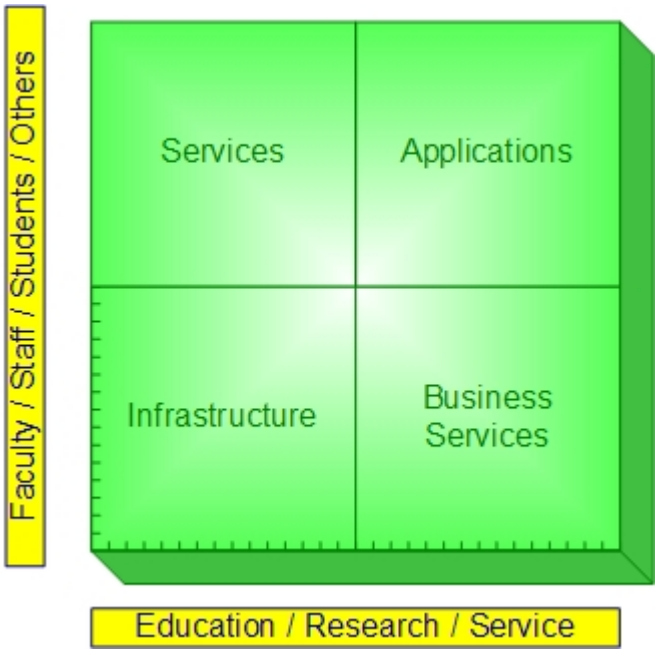

Figure 2

The proposed model allows for flexibility as well as persistence. A supra-deliberative body can persist from year to year to study and recommend decisions about long-term issues. However, it must be representative of the community as a whole and clearly understand its role. Focusing decisions in the executive suite encourages leadership buy-in as well as alignment between general campus goals and the resources available.

Case Example: SIS Development

The new PeopleSoft Student Information System just selected can serve to illustrate the proposed process of governance. ITS has followed a path analogous to the one outlined in Figure 1. The project managers involved representative groups of stakeholders from across the campus in a deliberative process to identify needs and choose a vendor for the new system. As of this writing the campus is just past the decision point in choosing PeopleSoft as the vendor for the new SIS. The next steps involve ITS conducting formal planning for implementing the new system.

One of the opportunities we now have is for the new SIS to provide a common platform that can allow for local variation to meet local needs. For example, an important aspect of a student information system is getting information from prospective students to inform admissions decisions. While the majority of the information is common across all programs and departments, a single set of centralized features cannot provide for all the local variations needed. One example of such an exception is an admissions requirement in Public Health's Department of Biostatistics that a prospective student show evidence of having

taken a calculus course. That information is only of use to that department and would make no sense in an online form for a prospective student applying to the Department of English. Therefore, the implementation process for a new SIS system should include a design feature allowing for local variation in data structures for admissions purposes. Such a design feature can be part of a list of requested features from the stakeholders whose priority can be assessed by the Project Managers in consultation with the stakeholders. This is how a federated decision-making process should work.

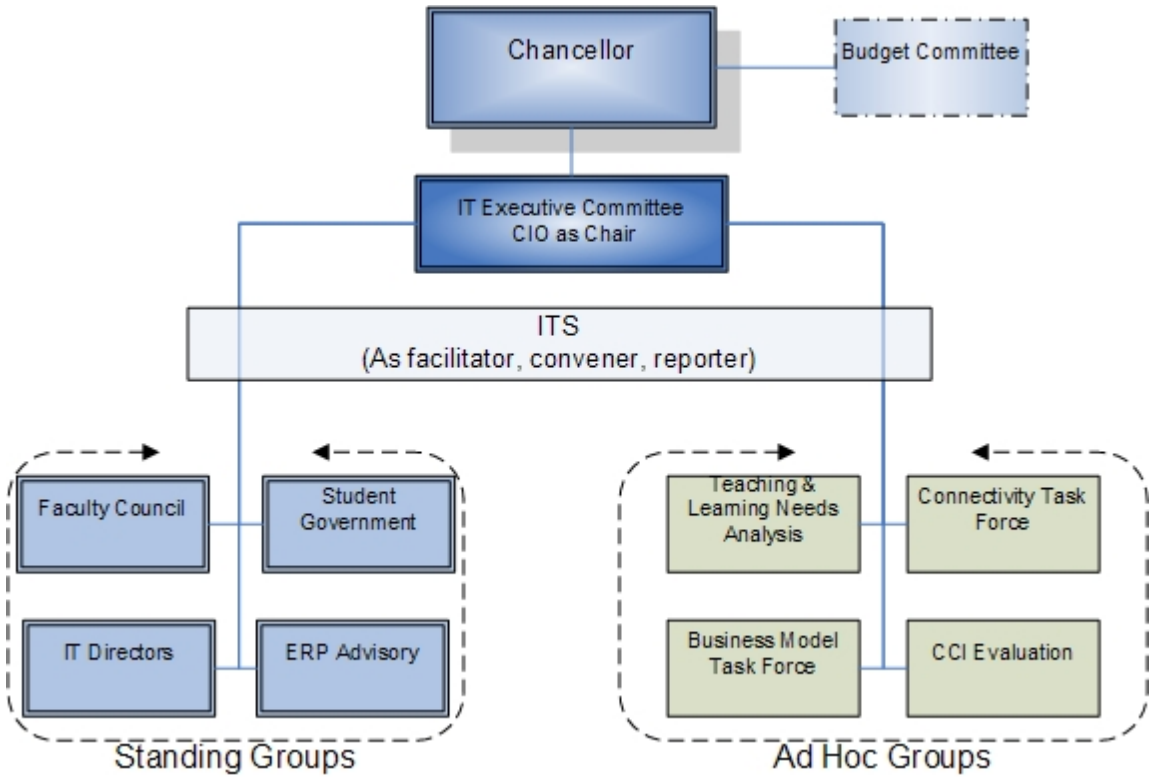

Figure 3

The Organizational Structure

Figure 3 shows a proposed organizational structure within which this federated system can work. The groups outlined suggest how stakeholders may be organized as both a set of standing groups as well ad hoc groups formed for a specified purpose. The standing groups can represent either stakeholder populations that have established roles and wider responsibilities (e.g. the Faculty Council or Student Government), standing groups with ongoing IT responsibilities (e.g. the IT Directors or CTC), and broadly representative groups formed for a specific, ongoing advisory purpose (e.g., ERP Advisory). Ad hoc groups can be formed to focus on specific issues that may arise spontaneously or come from the expressed needs of the standing groups. Both sets of groups can inform IT governance with facilitation by ITS in serving as convener and gatherer of information.

All of these groups can follow the process as outlined in this document for gathering stakeholder input, guiding the decision-making process, planning and implementing projects, managing the sustained service, and monitoring performance of discrete projects and programs. Some of these groups may persist from year to year and can be of an enduring nature because they relate to ongoing issues and challenges. Short-term groups should be subject to sunset provisions to keep them from persisting pass their operational lifespan. Longer-term groups can have regular change in personnel to refresh their perspectives. The groups can inform, and even be represented upon, an IT Executive Committee that reports to the Chancellor. The executive committee can include the CIO, the CFO, Provost, Vice Chancellor for Research and Economic Development, and the chairpersons of each subordinate committee.

Recommendations

Some of the pieces of a new governance system are now in place, while others need to be rethought or created. The key recommendation of this committee is to draft a governance policy, structure and operating documents that can become the new basis for making decisions about IT at Carolina. The new system should address how a campus-wide structure and core decision model such as we have proposed could coordinate with local processes. It should be clear about how, and where, resource allocation and policy decisions are made at all levels. It should address how decisions are communicated to the community of users.

Goal:

The federated governing system should be created by the CIO, in consultation with deans and key university administrators; and with input from stakeholders across the operating units of the university. It should address the key decision domains (principles, architecture, shared services, core applications, and decision making processes) and recommend a proposed governing structure, using this report as a guide.

Product:

A draft Governance Document should be presented to the Executive Vice Chancellor/Provost by the CIO by September 2007.

Appendices

APPENDIX ONE

Organizational Change Models with Direct Benefit to Individuals

The Coordinating Committee developed these scenarios to illustrate how a 'culture change' in the institution with respect to information technology could be achieved while providing direct benefit to individuals using IT. The Committee felt that these two conditions must be met in order for change to be effective.

Model One: Going Digital

Strategic Goal: All business procedures not legally mandated to use paper are electronic and all members of UNC have access to such resources.

Approach:

The path to achieving the goal of a paperless campus is to adopt open technologies and a stepwise approach. That path starts with convening a task force to move the campus to an open technology standard for document storage, retrieval, and searching. The Open Document Format (ODF) developed by OASIS offers a widely supported standard for office automation files (including support by Microsoft). The process of adoption will be most effective if the campus focuses resources on a specific goal that cuts across the entire community. We recommend a "rifle shot" project to adopt ODF for presentation files (such as MS PowerPoint) and migrate all content to that standard within one calendar year. ITS can provide facilities for online storage and indexing files by faculty and staff, initially within an authenticated environment. ITS will facilitate the migration with training and techniques for creating and translating documents into the standard. The task force will provide oversight, encourage buy-in by members of the UNC community, conduct ongoing evaluation of the process, and develop policy recommendations for issues that arise. Completing the initial project for presentation materials will help the campus master the issues involved and facilitate second- and third-year projects to adopt ODF for other standard business documents. The project will require a manager dedicated to the success of the endeavor and support services for the oversight task force.

Benefits:

Adopting and achieving compliance to the Open Document Format will help the UNC community learn how to develop and share information in electronic form. By beginning with presentation files, all segments of the community can participate in the project. Moreover, the project will create an online reservoir of presentation materials available to educational and business users across campus and beyond. The practices of developing, storing, and cataloging the files will facilitate building skills and systems in the handling of such materials in electronic form—preparing the way for successor projects dealing with other

types of materials. Achieving the goal will mark UNC as a leader in the use of electronic materials, develop skills for the digital economy and society, and move the campus closer to its goal of becoming recognized as the best public university.

APPENDIX ONE, cont.
Model 2: IT Partners -- A Pilot Project for UNC

Need

One persistent theme in our conversations with faculty members has been the need for IT experts who can work closely with academics in their efforts to strengthen teaching and research. We heard example after example of databases that lost their value for lack of IT know-how, of collaborations that floundered on problems of data sharing or communications, of teachers who avoided computer-based innovation in the classroom because they could not afford the time to master difficult hardware and software. In the view of many faculty members, this need for IT expertise far exceeds the need for greater bandwidth or computing capacity.

Goals and objectives

The proposed pilot project is based on the premise that the efforts of our faculty members generally are better invested in academic work, not in the rapidly changing realm of IT. Even so, virtually all progress in modern research and much of the innovation expected in teaching will depend on effective IT. A skilled IT partner complements and extends academic expertise, helping faculty members accomplish things they otherwise would not.

Ultimately, our goal is to enable change and improve the university's leadership position by using IT to strengthen teaching and research. Specifically, the objective of the pilot project is to test the following suppositions:

1. A pool of talented IT partners will spur innovation and help our faculty achieve a new level of success.
2. An IT partner affiliated with ITS but based in an academic unit or cluster of units will work as part of a high-performance team, effectively leveraging the broader resources of central IT.
3. As IT partners working in various academic units meet regularly with their peers in central IT, they will share their successful strategies, propagating innovation campus-wide. (Once the university has a critical mass of these IT partners, their interactions will also enable interdisciplinary collaboration by providing a forum for airing common interests and resolving differences in data management, communications, and other activities related to IT).
4. An IT partner will function primarily as a generalist and will call in specialists as needed to address IT issues beyond his or her expertise.
5. IT partners will conduct the kind of training that imparts the basic IT literacy necessary for successful academic work, increasing competence and improving communication about IT campus-wide.

6. IT partners will become advocates for teaching and research within central IT and beyond, pushing for solutions and resources that enable positive change.
7. IT partners will foster better "IT citizenship," encouraging responsible conduct on university networks, realistic expectations about IT services, and a more positive atmosphere for collaboration.

Scope of pilot: four IT employees assigned to units selected from the natural sciences, humanities/fine arts, medical sciences, and social sciences.

Duration: at least two years. This will give the IT partners time to become fully integrated into the academic work and will allow for a meaningful evaluation of the project.

Examples of activities: The range of possible activities to which IT partners could contribute is enormous. They could, for example, support research-computing needs that range from consultations on data storage to software development to the installation and maintenance of high-performance computing clusters. They would also support a wide range of needs in teaching, including contributions to the development of courseware, distance education, and collaborative learning. A few specific examples might include:

- *Implementation of an electronic class response system for large lecture classes.* Electronic response systems that allow students in the class to respond to questions posed by the instructor and have their responses recorded are available from commercial vendors. The systems can be quite useful in large classes to promote student engagement and allow the instructor to assess whether or not key concepts have been understood by the students. However, implementing such systems is not trivial, since it involves both hardware and software issues and requires customization of a generic commercial interface to suit the specific instructional needs. The dedicated assistance of an IT professional would make it much more likely that more than one faculty member would make use of such a system. Use by multiple faculty members in a department would make it more likely that the use of such systems could be spread to other departments.
- *Use of simulations.* There exist many types of simulations in the natural and social sciences that require the manipulation and visualization of large-scale databases. Allowing students to use these simulations to pose "what if" questions can be of significant educational value, but producing an appropriate user interface and making it available on an available platform can be daunting tasks. An IT partner familiar with the database and with effective visualization techniques would prove invaluable, and the user interface might be replicable for other data sets involving similar protocols.

- *Multimedia.* Many educational encounters could be enhanced by the use of images, sound or video clips, or other media. However, locating, acquiring, editing, and presenting such media in a classroom context involves a welter of programs, protocols, and platforms that take significant time to learn and implement (not to mention the fact that they change constantly). Having an IT professional available to assist with such tasks, especially if the person were well versed in the kind of materials relevant to teaching and learning in the specific discipline, would make it much more likely that faculty would use such materials.
- *Data management.* Data sets must be regarded as significant long-term resources that require careful management. Often, researchers would benefit from IT help setting up appropriate structures and metadata needed for maximum utility. Standards for the collection, management, and presentation of data change rapidly, sometimes rendering older methods obsolete. Researchers must have clear pathways for moving their data forward from one application to the next, ensuring integrity in the translation. In data on human subjects, safeguards for privacy and confidentiality also are crucial. For astronomers, the challenge is to manage the enormous stream of data flowing from telescopes. In each of these areas and more, an IT partner could provide the necessary assistance and training.
- *Visualization.* In many fields, researchers must render complex data sets in visual representations that allow them to understand structures, patterns, and trends. IT partners could help teams develop this kind of visualization, including strategic areas such as geographic information systems (GIS) and the graphical modeling of biomedical processes.
- *Software development.* Increasingly, researchers demand new software to perform complex tasks. For example, biochemists at UNC have created software that renders protein folding in real time. Software of this kind, if developed with IT expertise, will help advance the field, enhance UNC's reputation, and help the research team attract new funding.

Appointments: We propose creating EPA non-faculty positions with joint appointments in ITS and the respective academic departments. Basing each IT partner primarily in an academic unit or cluster of units will ensure that the IT partner understands the subject matter, addresses the priorities of the unit, and works successfully as part of the academic team. Requiring a joint appointment in ITS will ensure that the IT partner benefits from a fruitful exchange with peers, receives meaningful evaluations on technical performance, applies best practices and adheres to campus standards, and promotes communication. Supervision of the IT partner should be shared between the academic unit and central IT, and the IT partners should be evaluated on their ability to work effectively in both environments.

Qualifications: We recommend that the IT partners have academic credentials in the discipline in which they will be based. There is likely to be a good supply of candidates for such posts. Often, recent PhDs, postdoctoral fellows, and others find that they prefer to work in IT rather than in teaching and research. The candidates also should possess the knowledge, interpersonal skills, and aptitude necessary to work as an IT generalist, with demonstrated abilities in areas of strategic importance to the units involved. In some units, for example, the emphasis may be on database development and programming; in others, the greater need may be in instructional media or visualization.

Funding: The EPA positions envisioned would require both academic and IT credentials and must therefore be funded at the level of assistant professor or higher. While new resources almost certainly will be needed to establish these positions, several options exist for sustaining them long-term:

- *Departmental contributions:* Academic units in which an IT partner increases productivity and elevates the reputation of the department will be inclined to contribute substantially to the position.
- *Reallocation from central IT:* Some resources devoted to staff in central IT units could perhaps be reallocated into IT-partner positions. This actually could benefit central IT operations by improving communication and by increasing resources and support for IT campus-wide, reducing the central management burden.
- *Grant funding:* At present, most funding agencies generally do not allow grant funds to be used for basic IT services, which are presumed to be covered in the facilities-and-administrative charges (overhead) applied to the grant. However, an IT partner with appropriate academic credentials can contribute substantively to the work and could in some cases be paid on one or more grants.

Expected benefits: The primary benefit of the pilot project will be information about the validity of the model, as measured by evaluation. If the pilot proves successful, the model could gradually be scaled for use campus-wide. In fact, the efficiencies and benefits of this model are likely to increase as the number of IT partners on campus reaches a critical mass. On a larger scale, each IT partner and his or her respective unit would draw on the vast set of talents and skills represented among numerous IT partners, benefiting from many possible examples of successful solutions and innovations. This kind of model, which depends on a large network of subject-matter specialists linked by mutual interests, motives, methods, and goals, can foster rapid, beneficial change. Lessons learned at one node of the network are quickly diffused to the rest.

It is very difficult to predict the next wave of revolutionary change in hardware or software, or its implications for academic work. But we can predict that whatever the revolution might hold, UNC will need skilled, creative IT

professionals who can anticipate the wave, exploit its potential, and extend its benefits to the campus community. If UNC expects to achieve a position of leadership among modern research universities, we will have to invest in those talents, and deploy them in a new kind of model, one in which the IT professional is truly a part of the team.

APPENDIX TWO

Excerpted from: Chancellor's Task Force on Engagement, Final Draft Report. UNC-CH Submitted October 10, 2006.

Strategy: Make North Carolinians the best in the country at utilizing advanced information technology.

Description: Carolina has one of the finest Schools of Information of Library Science (SILS) in the nation and is blessed with extensive library holdings. The Renaissance Computing Initiative is a bold new project that will serve every corner of the state. In addition, the Computer Science Department has a world-class, highly interdisciplinary faculty, especially in the areas of computer graphics and design. These and other units at Carolina will take a leadership role in advocating for the deployment of advanced telecommunications technology across the state and equipping its people and businesses to utilize this technology through this new Advanced Information Technology Initiative.

In addition to making North Carolinians the best in the country at utilizing advanced information technology, we want to increase the number of North Carolinians who use any technology by leveraging the experience of iBiblio and SILS in developing open-source software and open content (digital libraries and archives) to develop freely available software applications and content.

These resources will work in partnership with public and corporate libraries across the state to help assure that all communities have access to useful and relevant information.

Leadership: Dean of the School of Library and Information Science; Vice Chancellor for Information Technology; University Librarian; Director of the Health Sciences Library; Dean of the School of Government; Dean of the Kenan-Flagler School of Business; Director of the Office of Economic and Community Development

Funding: State request is for $20,000,000 to increase the campus-enabled research environment through RENCI (Campus Priority 6) and $2,000,000 for an information technology support fund (Campus Priority 32).

APPENDIX THREE
Digest of Trends and Implications

This digest was produced by the Coordinating Committee for use by the subcommittees in writing their reports. It resulted from consulting and discussing many of the documents listed under Resources in this report.

Social:

User generated content becoming prevalent (blogs, wikis)
No boundaries between work and play online; impact of gaming
Generational differences in online information use (less privacy concerns etc)
Desirability of IT-enabled collaboration
New user groups now reachable by IT: partnerships in state, nation, global

Implications: need for flexibility and adaptability, risk taking. Social uses of IT will drive need for change in education and research.

Economic:

Funding is more scarce, public interest in higher ed funding and research funding is lower.
Unit costs of IT are going down but overall needs increase due to rapid advances and replacement cycles.

Implications: need to be more efficient and entrepreneurial; balance cost against benefit; leverage resources via partnerships. Impact of IT on economy =?

Research:

Cross disciplinary and multi-site research is appealing in sciences, less so in humanities
Research is generating massive amounts of data requiring management and archiving
Scholarly publishing under pressure

Implications: promote new solutions for sharing access to distributed IT e.g. grids; promote collaboration among Triangle campuses and beyond; campus needs to build cyberinfrastructure capacity that includes storage capacity, processing power, and services; campus should protect its knowledge bases; NC economic development is affected

Education:

Virtual classrooms becoming commonplace, drive for e-learning linked to good outcomes, outreach, and improved value to community

Push from GA for greater e-learning to improve ed. access; UNC's position focuses on improving Distance Ed. in prof schools; strong commitment to improving on site learning environment for undergrads.

Implications: UNC pioneered with CCI but impact and support not pervasive – need to catch up; need to model successful e-learning at undergrad level, support innovation in prof schools where underway, and decide if we are interested in educational outreach to new markets. Infrastructure investment needed for all.

Technology:

Revolution underway bringing software closer to point of use, will trigger dramatic changes in all areas.
Digital rights management will be a big issue – to authorize users, protect ownership; although more SW will be open source
Mobile technologies will grow in use, capabililties and popularity
Massive data storage and high speed processing capability are becoming more affordable and more needed
Social networking tools – Facebook, etc. are popular
And more…

Implications: UNC needs new models to harness its own creative output better; engage innovators; and be more responsive to needs at state and other levels

Information:

With growth of digital content, need better ways to organize, preserve, and structure data so it can be used and shared
Google is changing how we get and use information
Scholarly communications models are changing
Libraries' roles are changing in a digital world, focus on better organization, persistent access, etc

Implications: Collaboration is needed for digital content management, on and off campus; standards are needed; infrastructure investment is needed; fundamental changes are occurring in scholarly communication that affect teaching and research; and access to knowledge resources

Enterprise Processes:

Overlapping missions among units like libraries, bookstores, presses
Disparate domains recognize need for their business systems to interconnect
Customers want a seamless experience

Implications: UNC systems are in critical need of replacement, need to see as opportunity to improve how things work; huge infrastructure investment needed

APPENDIX FOUR
Selected Resources Consulted

External Reports:

1. Environmental Scan: Pattern Recognition (2003). OCLC, 2003. (www.oclc.org/membership/escan/toc.htm)
2. The Horizon Report. 2007 edition. A collaboration between The New Media Consortium and the EDUCAUSE Learning Initiative. Posted February 15, 2007, by NMC (www.nmc.org/horizon/2007/report)

EDUCAUSE Reports: www.educause.edu + profile id

1. Educating the Net Generation. Ed. by Diana G. Oblinger and James L. Oblinger. c2005 (www.educause.edu/educatingthenetgen)
2. Envisioning a Transformed University. Educause Report by James J. Duderstadt, Wm. A. Wulf, and Robert Zemsky. 2006 (ID:CSD4557)
3. IT and the Changing Face of Research in Higher Education. By Stephen L. Daigle and Brian Voss. CFAR. July 2006 (ID: ERB0603)
4. IT Engagement in Research: a Baseline Study. By Harvey Blustain et al. CFAR. July 2006 (ID: ERS0605)
5. 7 Things You Should Know About Grid Computing. By the Educause Learning Initiative. 2006 (ID: EL17010)
6. Top IT Issues in Higher Education; Results from 2005 Educause Current Issues Survey. (www.educause.edu/2005SurveyResources/6323)

UNC Reports:

1. Chancellor's Task Force on Engagement Report, October 2006
2. ITS in Review 2006. UNC Information Technology Services, University of North Carolina at Chapel Hill, 2007
3. Report of the Distance Education Task Force, February 2007
4. Report on Expanding Access to Higher Education Through State-Funded Distance Education Programs. Presented to UNC Board of Governors, May 2006
5. UNC Information Technology Services. Enterprise Resource Planning (http://its.unc.edu/erp)
6. The UNC Board of Governors Long Range Plan 2004-2009.

Selected IT Plans from Other Institutions:

1. University of California-Berkeley (http://technology.berkeley.edu/)
2. Duke University (http://www.oit.duke.edu/itac/stratplan/report/)
3. Indiana University (http://www.indiana.edu/~ovpit/strategic/)
4. University of Michigan (http://www.umich.edu/~pog/inforev2/)
5. Penn State University (http://www.cis.psu.edu/mvg/)
6. Purdue University (http://www.itap.purdue.edu/strategic_plan/ITStrategicPlan_final.pdf)

7. Ohio State University (http://cio.osu.edu/planit/future.html)
8. University of Texas (http://www.utexas.edu/its/about/strategic/)
9. University of Virginia (http://www.itc.virginia.edu/org/stratplan/)

Additional resources useful to the committee are listed at the end of the Committee Charter; and at the end of subcommittee reports.

APPENDIX FIVE
Charter, Charge and Roster
Strategic Planning Committee for Information Technology

Daniel A. Reed
Vice Chancellor for Information Technology and CIO

January 2006

Planning Committee Mission and Vision

The mission of the Strategic Planning Committee for Information Technology is to develop a vision for the use of IT at the University of North Carolina at Chapel Hill. This broad and empowering vision should articulate a technical environment that supports, and also enables, the transformation of teaching, learning, research and service, through the application of computers, telecommunications, digital information resources, and instructional tools. This vision should be consistent with, and supportive of, the university's vision and strategic goal to become the leading public university in the United States.

This desire was articulated clearly by Chancellor Moeser in his 2004 state of the university address, when he remarked,

> *I have also asked Vice Chancellor Reed to lead a major strategic planning effort for information technology, encompassing everything from high-speed computing to what we know will be necessary major investments in administrative computing to replace systems that are increasingly obsolete. We have not fully tapped leading-edge information technology as an intellectual lever to help advance the University's mission. And we have not yet fully realized the potential of the Carolina Computing Initiative. This will be a major effort. The leading public university must lead in technology.*

This committee is charged with defining a strategic plan whose implementation can realize this vision, both by making IT a key element of the University's vision and plan, but also by identifying those opportunities where IT can have a transformative impact on scholarship, education, service and outreach, as well as engaging and supporting the citizens of North Carolina.

Such a plan recognizes IT as a strategic asset, essential for learning, teaching, research and community outreach, and one that is vital to the operation of the University. The plan must not only be consistent with the University's goals, it must also establish a process that is consistent with the overall culture of the University and that is responsive to the need for continually updated technology and evolving processes. The plan must also examine the entire ecosystem of

information technology, ranging from Information Technology Services (ITS), through college IT organizations and other IT service groups, to departmental and research group support activities.

Strategic Planning Committee Objectives

- Build a University-wide commitment to a shared strategic IT vision based on a broad and inclusive process that informs stakeholders about both opportunities and constraints

- Identify or assist with articulating major IT issues facing the University

- Identify significant obstacles and risks to the attainment of the goals and make realistic recommendations for overcoming them

- Enable necessary communication with Deans, Directors and other administrators about the potential of IT to advance the University's mission

- Encourage coordination of University-wide technology efforts to increase efficiency, minimize service duplication and maximize benefits

- Establish and communicate strategic priorities for the enhancement and use of technology to the University community

- Engage and build relationships with stakeholders beyond those on campus, including the Trustees, the public and collaborative partners

- Foster innovation and creativity via application of information technology to University challenges and opportunities

General Guidelines

- The process must be inclusive, seeking input from faculty, staff, students and administrators, at many organizational levels

- IT priorities, resource needs and process changes must be considered within a broad institutional context, and recommendations must be formulated accordingly.

- The plan should identify a set of strategic directions, each of which is then concretely defined by a set of objectives and, if appropriate, possible implementation tactics.

- The directions and recommendations should be clear and achievable, without describing implementation approaches or details, enabling the plan to remain vibrant and useful for at least five years.

Timeline and Process

Creation of the strategic plan for IT must be both inclusive and timely. To be successful, the plan must reflect the input and opinions of all University stakeholders: faculty, staff, students, and administrators. However, given the rapidity with which IT capabilities and technologies change and the age and stability of our administrative computing infrastructure, we must also move quickly to implement the action items that emerge from the collaborative planning process. ***The committee should aim to complete and submit an initial draft of the strategic plan for information technology to Vice-Chancellor Reed by June 30, 2006.***

Rather than a one-time exercise, we expect the initial plan to continue to evolve, as a living document, in response to regular updates. It will be distributed widely and refinements and updates will be solicited and welcomed from the Carolina community.

Throughout the planning process, the Office of the CIO will facilitate and support committee meetings by assisting with scheduling, note taking, and report drafting. The staff and management of Information Technology Services will also support the committee by completing analyses and collecting data as requested by the committee.

Committee Structure and Membership

Reflecting the deep integration and impact of information technology on University processes and objectives, the committee membership must be broadly inclusive but also sufficiently small to be nimble and responsive. Moreover, the range of IT issues is very broad, ranging from enterprise applications through research computing to educational technology; no single individual is likely to be equally knowledgeable in all of these areas.

To balance these conflicting goals, the strategic planning committee will consist of a high-level coordinating committee and a set of four technical committees: Education and Learning, Research and Scholarship, Communications and Networking, and Enterprise Applications. The chair of each technical committee will also serve as a member of the coordinating committee. In addition, the coordinating committee and committee chairs may appoint and guide *ad hoc* workgroups composed of staff, faculty and/or administrators to conduct specialized analyses and activities.

Coordinating Committee

The Coordinating committee will chart the high-level direction of the strategic planning committee, ensuring that the technical committees collectively examine the full range of IT issues with minimal overlap and duplicated effort. The committee will also be responsible for integrating technical committee insights and producing the final planning document.

Carol Jenkins, *Chair,* Coordinating Committee
Margaret Dardess, Provost's Office.
Shelly Earp, Lineberger Comprehensive Cancer Center
Jose-Marie Griffiths, School of Information and Library Science
Nancy Suttenfield, Finance and Administration; replaced by David Perry
Judith Wegner, Chair, Faculty Council
Todd Gamblin, GPSF Student representative
Colin Hicks, Student representative

Neil Caudle, *Committee Chair*, Research and Scholarship Committee
David Potenziani *Committee Chair*, Communications and Networking Committee
Laurie McNeil, *Committee Chair*, Education and Learning Committee
David Perry, *Committee Chair,* Enterprise Applications Committee

ITS Attendees
Dan Reed, Vice Chancellor for IT and CIO
Robyn East, Associate Vice Chancellor for IT and Deputy CIO

Education and Learning Committee
The Education and Learning committee will examine all aspects of the use of information technology in education, including but not limited to novel educational approaches, distance and continuing education, educational IT infrastructure, the Carolina Computing Initiative (CCI), pedagogical assistance, classroom support, and staff and faculty training and enrichment.

Laurie McNeil *(chair),* Department of Physics and Astronomy
Linda Carl, Friday Center for Continuing Education
James Johnson, Kenan-Flagler Business School
Christopher Jones, Department of Mathematics
Steven Melamut, Law Library

James Noblitt, Department of Romance Languages and Literatures
Lisa Norberg, Library
Abigail Panter, Department of Psychology/Academy of Distinguished Teaching Scholars
Iola Peed-Neal, Center for Teaching and Learning
Carol Tresolini, Office of the Provost

ITS Attendees
Priscilla Alden, ITS User Support and Engagement
Charles Green, ITS Teaching and Learning

Research and Scholarship Committee
The Research and Scholarship committee will consider all aspects of the use of information technology in research and scholarship, including but not limited to high-performance computing, digital data management, scholarly publication and

curation, information security and privacy, research software support, research computing infrastructure, and collaboration facilities and techniques.

Neil Caudle (*chair),* Office of the Vice Chancellor for Research and Economic Development
Barbara Entwisle, Carolina Population Center
Joel Kingsolver, Department of Biology
Sarah Michalak, University Libraries
Gary Marchionini, SILS
Gene Orringer, School of Medicine
Lee Pedersen, Department of Chemistry
Harvey Seim, Department of Marine Sciences
Todd Taylor, Department of English

ITS Attendees
Ruth Marinshaw, ITS Research Computing
Steve Cornelison, ITS Enterprise Data Management

Communications and Networking Committee
The Communications and Networking committee will consider all aspects of digital communication, including but not limited to next generation telephony, wireless networking, local, state, national and international networking, web content processes, information sharing and content management, and usability and access.

David Potenziani (*chair*), School of Public Health
James Alty, Facilities Services
Alan Blatecky, Renaissance Computing Institute
Kevin Jeffay, Department of Computer Science
Paul Jones, School of Library and Information Science
Lisa Katz, News Services
John Kichak, UNC Health Care
James Kessler, Disability Services
James Porto, FITAC and School of Public Health

ITS Attendees
John Streck, ITS Telecommunications and Networking
Audrey Ward, ITS Communications

Enterprise Applications Committee
The Enterprise Applications committee will consider all aspects of mission-critical University applications, including but not limited to financial, student, personnel, alumni, e-mail and communication applications, as well as institutional data management.

David Perry *(chair)*, Office of the Dean, School of Medicine; replaced by Elmira Mangum
Vincent Amoroso, Office of Scholarships and Student Aid
Laurie Charest, Human Resources
Fletcher Fairey, Office of University Counsel
Andrew John, Office of Vice-Chancellor for Research and Economic Development
Elmira Mangum, Office of the Provost
Tammy McHale, Office of the Dean, College of Arts and Science
Roger Patterson, Office of the Vice Chancellor for Finance
Brian Payst, Division of Student Affairs
Alice Poehls, Registrar
Jean Vickery, Office of the Vice-Chancellor for Advancement
Lynn Williford, Institutional Research

ITS Attendees
Stephanie Szakal, ITS Enterprise Applications
Jeanne Smythe, IT Security and Policy

Exemplar Questions

1. How can information technology help Carolina achieve its strategic goal of becoming the best public university in the United States?

2. Given continuing economic dislocation, how and should Carolina extend its continuing and just in time educational reach across North Carolina?

3. With the explosive growth of "born digital" data, what strategies should Carolina pursue to establish a leadership role in digital data management?

4. How can computing technology foster innovative approaches to classroom, small group and independent education? What role should the Carolina Computing Initiative (CCI) play?

5. Enterprise Resource Planning (ERP), though necessitated by the age and obsolescence of Carolina's administrative systems, will be a complex balance between adapting current practices and modifying software to accommodate Carolina's needs.

Selected Reference Materials

National Documents

1. *Cyber Security: A Crisis of Prioritization*, President's Information Technology Advisory Committee,www.nitrd.gov/pitac/reports/20050301_cybersecurity/cybersecurity.pdf, February 2005

2. *Computational Science: Ensuring America's Competitiveness*, President's Information Technology Advisory Committee,

www.nitrd.gov/pitac/reports/20050609_computational/computational.pdf, June 2005

3. Facilitating Interdisciplinary Research, Committee on Science, Engineering, and Public Policy (COSEPUP), www.nap.edu/openbook/0309094356/html, 2004

North Carolina Documents

4. *Academic Plan,* UNC Chapel Hill, www.unc.edu/provost/news/aca_planOct03.pdf, July 2003

5. *Scholarly Communications in a Digital World*, UNC Chapel Hill, www.unc.edu/scholcomdig, January 2005

6. *Information Resources Reports and Publications,* University of North Carolina, Office of the President, www.northcarolina.edu/content.php/ir/reports/reports.htm

7. *State of North Carolina Information Technology Services*, www.its.state.nc.us

Other University Strategic IT Plans

8. *Information Technology Strategic Plan: Architecture for the 21st Century*, Indiana University, www.indiana.edu/~ovpit/strategic, May 1998

9. *Information Technology Strategic Plan*, Purdue University, www.itap.purdue.edu/strategic_plan/ITStrategicPlan_final.pdf, September 2002

10. *ITS Strategic Plan*, University of Texas, www.utexas.edu/its/about/strategic, February 2005

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