

**The University of Colorado at Boulder
Office of the Associate Vice Chancellor for IT
Fall 2010**



During the past seven months over 200 participants engaged in the campus-wide IT plan, including 58 faculty, 65 ITS staff, 23 campus IT professionals, 56 non-IT staff, and several undergraduate and graduate students.

Through qualitative and quantitative research and committee discussions, issues were identified, action plans and timelines developed, drafts were reviewed and rewritten.

This once-every-four-years exercise provides critical input for the Office of the AVC for IT to provide a clear vision and goals for the entire IT environment at CU-Boulder.

Letter from Chancellor DiStefano

September 16, 2010

Information Technology is a vital component of the University of Colorado at Boulder's role as a research and learning institution. As we move farther into the 21st century, it is important CU-Boulder continues to view IT as integral to the success of the university's vision and mission. Flagship 2030 helps navigate this vision and in many ways IT will serve a critical role in realizing future goals, both specific and currently unimagined; however, it is also necessary to evaluate the foundation upon which future IT services and initiatives rest and operate. While this foundation is in many ways a sense of pride, it is also not without its opportunities for improvement.

The 2010 IT Strategic Plan outlines IT's past, present, and future at CU-Boulder, noting the current context in which IT services operate, building upon past achievements, capitalizing on lessons learned, and charting a clear course for tomorrow's IT efforts. The plan outlined in these pages is exciting in its forward-looking perspective and presents a promising vision of information technology's future on campus.

Phil DiStefano

Letter from Associate Vice Chancellor for IT and CIO, Larry Levine

September 18, 2010

Beginning in 1998, the University of Colorado at Boulder has responded to the Colorado Commission on Higher Education's request to develop a campus-wide IT strategic plan, soliciting the cooperation and involvement of faculty, students, and staff every four years to determine new directions for IT on campus. The 2010 strategic plan is the fourth of its kind. As in previous years, the underlying goal of the 2010 IT Strategic Plan is to enhance academic research and service missions of the campus.

The 2010 Strategic Plan provides the opportunity to align campus IT goals with additional campus-wide planning initiatives such as Flagship 2030 and its accompanying Core Initiatives. In fact, the 2010 Strategic Plan embodies the spirit of Flagship 2030 in looking to CU-Boulder's bright future as a teaching and learning institution. Specific recommendations and long and short term objectives within the plan encourage and direct tomorrow's IT efforts in accordance with this vision. Further, CU-Boulder's Core Initiatives outline priority areas for investment in fulfilling university goals and maintaining CU's presence as a leading academic institution nationally and globally. The initiatives shape the four basic areas of investigation in conducting the IT Strategic Plan including academic technology, shared resources and support, collaboration for effectiveness, and active and engaged participation across campus. In turn, these four areas yield sixteen extensive reports—the culmination of focus groups, participant surveys, and the dedicated efforts of more than 200 student, staff, and faculty participants. Research conducted prior to the construction of the sixteen reports provides strikingly similar information as the reports themselves; independent researchers note participants and contributors across campus agree on the need for enhanced engagement and participation in campus IT as well as increased collaboration and greater transparency in IT development. I am personally invigorated by these findings and the sentiment they express: a desire to actively participate in and help shape future IT directions on campus.

The 2010 IT Strategic Plan is a pointed and condensed collection of common themes, findings, and recommendations to build upon past IT efforts, direct current resources and initiatives, and plan for the future. On behalf of Information Technology Services and the University of Colorado at Boulder, I invite you to read through the following report and become an active participant in our future vision for IT on campus. Together, we can seize the moment, bring the future closer to today, and help ensure IT plays a role in CU-Boulder's continued excellence.

Larry Levine

Acknowledgements

I am deeply grateful to Chancellor Phil DiStefano, Provost Russ Moore, and Senior Vice Chancellor Ric Porreca for their steadfast support as the campus embarked on this process. Their visionary leadership in articulating the goals outlined in Flagship 2030 allowed us to have a touchstone in which to guide us through the variety of discussion and drafts, leading us to better articulate and convey how we contribute to the teaching, learning, research, and outreach mission of CU-Boulder.

Integral to this process was the 17 leads who dedicated their time and leadership in guiding the committees to tangible recommendations. The entire IT strategic planning process hinged on these individuals and we are indebted to them. They include: Michele Jackson, Keith Maskus, Doug Duncan, Russ Moore, Patricia Rankin, Clayton Lewis, Mark Knowles, Cynthia Husek, David Makowski, Diane Adams, Lewis Harvey, John Culshaw, Ron Ried, Kambiz Khalili, Chris Bell, and Steve McNally.

Working alongside the leads, were the ITS co-leads who worked behind the scenes to ensure that the committee work was moving forward within the aggressive timeline. These individuals possessed the ability to intimately understand how ITS currently operates while having the ability/fortitude to listen to significant criticism regarding ITS's shortcomings. These individuals worked alongside the leads at writing and rewriting drafts. They include: Deborah Keyek-Franssen, Michelle Clifford, Mark Werner, David Bodnar, Miah Adams, Jon Giltner, Eric Galyon, Jim Dillon, Lewis Harvey, Ken Schuetz, Herb Wilson, Dan Jones, Greg Stauffer, Larry Levine, and David Chittenden.

The committees themselves and the reviewers included a variety of faculty, students and staff – often working on several committees simultaneously. It is from these individuals that the specifics emerged—tangible recommendations regarding how to move CU-Boulder IT environment in effective new practices and services. Approximately 60 faculty, campuswide IT professionals, 10 students, 55 non-IT staff, and 65 ITS employees have been purposefully investing their time and energy to creating the report. We also thank them for engaging in this campus-wide process.

Also, two promising Ph.D. researchers provided their services to conduct countless interviews, focus groups, research, and writing skills to ground our findings. Thank you to both Lucille Sommer and Virginia Sanprie for weaving ideas and concepts together to create a cohesive report. Finally, the entire process was organized by the outstanding coordination of Becky Yeager, executive assistant to Larry Levine.

Thank you.

Marin Stanek
2010 IT Planning Director

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Executive Summary

Given the increasingly collaborative nature of technology, as well as the incremental increases in network speed and storage, new and innovative ways of contributing to the academy continue to emerge. Multidisciplinary research projects and closer partnerships with national labs are providing unprecedented research awards for CU-Boulder—providing \$454 million in fiscal year 2009-2010. Innovative classroom technology and collaborative IT tools allow for the classroom experience and experimental learning to be more robust and dynamic. Tech-savvy students arrive on campus equipped in ways unimaginable four years ago with the latest devices, applications and expectations. This is the backdrop in which the 2010 campus-wide strategic plan developed.

Beginning in February 2010, 16 committees, each comprised of approximately 8-10 faculty, students and staff—led by faculty or senior staff with support from an IT content expert—met and discussed IT issues that are in direct support of the campus mission and Flagship 2030. Areas of interest included a sharper focus on faculty and graduate student needs, development of research computing, a more holistic, campus-wide IT environment, and emphasis on service, all while maintaining vigilance around security. Each committee provided tangible action plans, which comprise the majority of this report. In conjunction, and in support of the committees, mixed-methods research occurred in the form of reviewing our peers, faculty and staff surveys, focus groups, ethnographic research, and individual interviews.

The analysis of the committee reports revealed a striking consistency of themes: a call for *transparency* through two-way communication and engaged participation, a need for *flexibility*, adaptability, and integration of a range of IT tools and services, an understanding of supporting disciplinary differences while *fostering collaborative, cooperative relationships*, and finally the need for *assessment* and evaluation to determine the effectiveness of IT tools, services and practices.

Key findings include:

- Enable the research enterprise through research computing
- Support teaching and learning through effective IT tools, spaces and support
- Enhance the student experience
- Foster efficiencies for campus staff
- Develop strong communication among stakeholders

This report is composed of an overarching summary, centered on the idea of melding the IT past and present into our IT future as well as four core chapters, which include the 16 committee reports (chapter 1: teaching and learning, chapter 2: shared resources and support, chapter 3: collaborations and partnerships, and chapter 4: governance, budget and communications). The report concludes with a variety of appendices.

IT strategic planning has occurred consistently every four years, beginning in 1998. This plan is a distinct departure in that it more fully engaged the stakeholders and partners of the campus. Faculty, students and staff participated in an unprecedented manner creating an IT blueprint that will support the campus mission.

2010 Campus-wide IT Strategic Planning Summary

A. Taking Stock: IT Today: ITS Operations & Overview

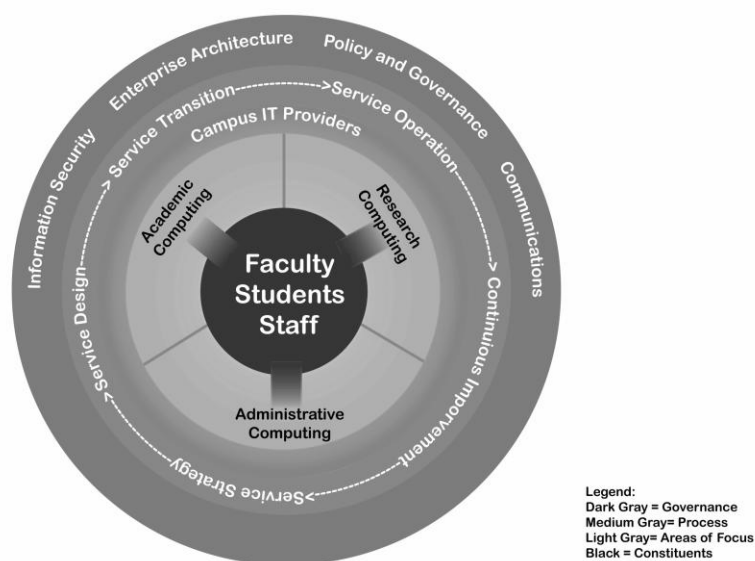
Information Technology at CU-Boulder is facilitated through a centralized organization and numerous decentralized services and offices throughout campus. Information Technology Services (ITS) operates many of the centralized IT efforts on campus—providing support for faculty, students, and staff in three primary service areas: academic computing, research computing, and administrative computing (see figure 1.1)—and works in conjunction with decentralized IT services in academic departments, university offices, and affiliated research institutions. Enterprise Resource Planning (ERP) systems are maintained by UIS (University Information Systems) for the three University of Colorado campuses which jointly govern UIS. In the fall of 2010 CU System implemented massive ERP implementations, ISIS, which is the student information system for all three CU campuses and InfoEd, a new research administrative system.

ITS is comprised of approximately 270 employees, including roughly 170 staff employees and 100 student employees. IT units across campus operate in conjunction with central ITS to provide localized, effective support. These units include the Leeds Business School, the Law School, and the School of Arts and Sciences. Other IT personnel administer specific IT tools and services within national research labs and institutes affiliated with campus. Roughly 300 computer support representatives (CSRs), who are decentralized, but come together in community IT forums three times a year, provide a link between academic, administrative, and research organizations across campus.

ITS' mission is to provide and promote an IT service and support organization, in partnership with departmental IT units, enabling the creation, management, and dissemination of information to advance the campus's teaching, learning, and research, as well as providing effective leadership and IT solutions for the campus. Figure 1.1 depicts the general operations of IT at CU-Boulder. As the diagram indicates, faculty, students, and staff receive IT services in three areas: Academic Technology, Research Computing and Administrative Computing from ITS and a range of campus IT providers. Providing services is shown as the on-going process of involving research and evaluation, service or tool design, transition to the new tool or service, operation of the tool or service, and continuous improvement (see figure 1.1). Finally, current and future initiatives are enabled and supported by policy and governance, information security, and enterprise architecture—each providing guidance and the ability for IT growth on campus.



Figure 1.1 ITS Operations on Campus



ITS Budget information

Investments in IT primarily fall under one of four categories:

- Campus programs and projects (28%)
- Academic technologies and spaces (25%)
- Support, operations, and services (including network and telephony) (42%)
- Administration & support (5%)

Most of the campus programs and projects budget is devoted to one of three primary categories:

- Research computing (28%)
- Enterprise infrastructure (IT security, storage, virtualization, messaging & calendaring, etc.) (29%)
- Program and project management (salaries and support) (27%)

These three categories account for nearly 85% of the programs and projects budget. The 2010-2011 Operating budget for ITS is \$32,256,018.

Common Good

As technology becomes increasingly important and ever-present across campus it also becomes second nature—students, faculty, and staff expect particular IT tools and services to be available to them. Such ubiquity demonstrates the tremendous role IT plays in campus life

and CU-Boulder provides a suite of Common Good IT services and productivity tools to General Funded departments in support of the university's teaching and research mission and recognition of IT's integral role in campus operations. These pooled IT services and tools are centrally paid from the highest level of the university, provided at no direct cost to the department. The current suite of IT common good services includes:

- A robust wired network (includes Internet2 and LambdaRail)
- Universally available wireless network including all campus buildings and strategic open common spaces as well as access to a campus VPN
- Faculty purchase and renewal program allowing all faculty a significant subsidy for a new computer every several years;
- Free antivirus and encryption to protect data as well as access to a variety of major software licenses
- Integrated email, calendaring, and scheduling (Exchange)
- Accessible and multi-layered IT support including both centralized and dedicated IT personnel
- Classroom and online IT training

In light of recommendations communicated through the 2010 IT Strategic Plan, additional potential common good services being pursued include: data center(s), storage/backup, phones, additional licensed software (i.e. Kronos), GigE, desktop support

B. A Look at Past IT Strategic Plans and Accomplishments

Past campus-wide IT Strategic plans have laid the foundation for many important IT resources and practices including:

1998: Establishment of the faculty computer purchase program, formation of the Distributed Academic Technology Coordinators (DATCs), creation of the 4-tiered IT support model, formation of the CIO Office and IT Council.

2002: Development of the student and faculty/staff portal, maturation of IT infrastructure (i.e. Enterprise Directory, enterprise architecture), creation of the student IT literacy/fluency effort, launch of the IT Security Office, formation of IT Infrastructure Advisory Group (ITIAG).

2006: Coordination of email environment (Exchange for faculty/staff, external email provider for students), new network funding model, campus-wide MS site licensing, maturation of security environment with departmental IT risk assessments and disaster recovery/business continuity plans.

The 2010 Strategic Plan follows this trajectory of significant achievement.

Building on Lessons Learned

It is important to note particular opportunities for growth and development.

One opportunity lies in building upon CU-Boulder's role as an innovator in collaborative, cross-disciplinary research, which makes CU-Boulder an ideal home for developing research computing across various national labs and institutes. Currently, CU-Boulder enjoys collaborative relationships with a number of research labs and institutes on campus, including

the National Center for Atmospheric Research, (NCAR) the National Snow and Ice Data Center, (NSIDC) the Laboratory for Atmospheric and Space Physics, (LASP) the Cooperative Institute for Research in Environmental Sciences, (CIRES) and the Joint Institute for Laboratory Astrophysics, (JILA). Strengthening and supporting these existing relationships as well as fostering new research development is integral to CU-Boulder's pursuit of Flagship 2030's goal of fostering research excellence.

A second opportunity exists with better utilizing technology tools, spaces, and support for transforming teaching and learning. Better coordination and collaboration with schools and colleges would realize best practices, support models, and research opportunities. Innovative ideas and leadership practices exist within Faculty Teaching Excellence Program (FTEP), Graduate Teacher Program (GTP), A&S Support for Education through Technology (ASSET), and the ITS Academic Technology Group.

A third opportunity for growth and development is web infrastructure. The last significant contribution or advancement in available web hardware and software infrastructure on campus occurred ten years ago in 2000. Improving web infrastructure services in support of communication and web content is a high priority on campus and one which can no longer be sidelined.

C. Looking Ahead: IT Tomorrow, Envisioning a Transparent and Flexible Campus-wide IT Environment that Fosters Engaged Participation

The themes found throughout the reports and detailed here in the executive report on the following pages also reflect additional areas for growth and development. The themes—transparency, collaboration, and flexibility—represent the desire to formulate more open, deliberate, and cooperative IT tools, support, and resources. Each theme occurs frequently both among and within the committee reports indicating a strong, shared sentiment of readiness to participate in the future of IT at CU-Boulder. These themes are ubiquitous throughout the committee reports and therefore send a strong message of the university's vision of IT in the coming years.

Transparency

The theme of transparency includes a strong desire, on behalf of various campus constituencies, to learn more about the processes and operations of IT on campus as those operations impact particular populations. Transparency refers to understanding current IT and ITS uses, needs, and demands and employing such an understanding in future action through rigorous and varied assessment and evaluation practices. The need for assessment is a strong reoccurring subtheme and one made explicit in specific recommendations, as indicated below. The theme of transparency documents a desire to proceed rationally and judiciously into IT and ITS decisions and view assessment as integral to doing so. Finally, transparency encompasses the need and desire for clear, accessible, widely-distributed communication regarding ITS and IT tools. Such communication is necessary not only between ITS and its constituencies but among decentralized ITS personnel and offices across campus.

Flexibility

The theme of flexibility refers to the necessity of dynamism and adaptation in addressing and supporting technology needs across campus, meeting various teaching and research demands, addressing the requirements of diverse students, faculty, and staff, and integrating a range of

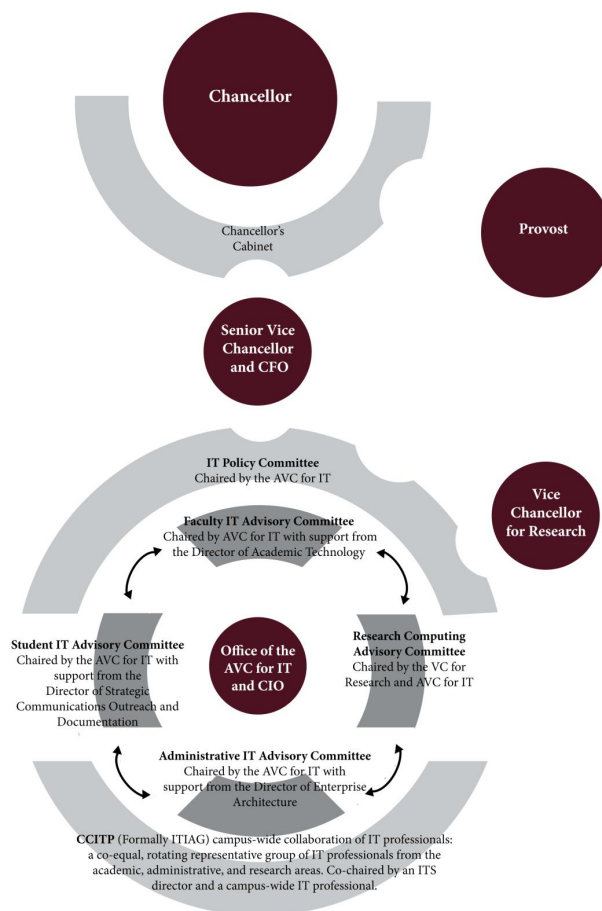
tools and services. As a theme, flexibility revolves around the overt recognition of the diversity of academic disciplines and campus populations and their varying IT needs and includes implicit reference to the value placed on academic and scholarly diversity throughout the university. While it is important to support various research and learning needs, the theme of flexibility works in tandem with the theme of engaged participation and transparency—in other words, a flexible IT environment responds to specific needs, but does so in a larger context of sharing and openness. Additionally, flexibility refers to the desire for IT tools and services to not only respond to but anticipate IT changes for campus populations and departments.

Engaged Participation

Engaged participation, as a theme, includes an expressed desire and need for increased collaboration, cooperation, and sharing across campus concerning IT tools and services. Beyond cooperation and sharing, this theme suggests ITS actively involve other university offices in decisions regarding the structure and pursuit of IT across campus, particularly when it comes to support for teachers and learners, developing research computing initiatives, partnering more closely and consistently with schools and colleges, administrative units and research institutes. In many ways this theme is an exciting and crafts a picture of a campus eager to become involved in IT operations and future development. See figure 1.3.

Shaping IT direction
through engaged participation

2010-2011 IT
Governance Diagram



D. Tomorrow's IT and Today's Priority: Recommendations of the 2010 IT Strategic Plan

Extensive independent research preceded the 2010 IT Strategic Plan and culled information from students, staff, faculty, and IT professionals about the effectiveness of IT and ITS on campus as well as concerns, challenges, and contentment with IT and ITS. The research culminated in rich data revealing campus constituencies, while content with the effectiveness of available tools, were less satisfied with the operations and processes involved in IT resource development and support. In surveys and focus groups, participants expressed the need for better communication between campus populations and ITS, a desire for more transparency and involvement concerning IT decision-making processes, and the importance of working with ITS and other groups on campus to address challenges and work toward technology-related goals. Tellingly, these themes appear within and throughout the reports comprising the 2010 Strategic Plan.

1. Enable the Research Enterprise through Research Computing

CU-Boulder is poised to become a leader in research computing development and operation because of its commitment to research, close working relationships with national research labs, including the National Center for Atmospheric Research, (NCAR) the National Snow and Ice Data Center, (NSIDC) the Laboratory for Atmospheric and Space Physics, (LASP) the Cooperative Institute for Research in Environmental Sciences, (CIRES) and the Joint Institute for Laboratory Astrophysics, (JILA).

Dedication to research computing development and deployment is a large component of fulfilling CU-Boulder's commitment to research support as articulated in the campus-wide strategic plan, Flagship 2030; not only will advancements in research computing across campus help facilitate growth and excellence in research, the open, collaborative, and flexible spirit in which such advancements are pursued will help ensure research computing resources allow for new approaches to research, scholarly, and creative work, and bolster structural support for research and creative programs across campus.

Flexibility: Create a Research Computing and Cyberinfrastructure group to develop, maintain, and promote the university's research community in a variety of research areas and disciplines.

Transparency: Develop a transparent, fair, and representative funding model and faculty oversight committee.

- Communicate to the campus community the plans of the faculty oversight committee as they pursue development of a central research-computing center and adopt relevant policies and procedures.
- Solicit additional campus input and needs assessment in establishing resource needs and an IT Infrastructure Strategic Plan in conjunction with Facilities Management.

Collaboration: Foster a shared and cooperative atmosphere around research computing tools and an environment wherein scholars and researchers may pursue a spectrum of academic and creative agendas.

- Establish a committee of faculty researchers to oversee the development of central research computing and ensure resources meet campus needs.
- Encourage and foster collaboration through research efforts integrated with national efforts and initiatives, thereby increasing opportunities for partnership between individuals, other research universities, national centers, and private industry.

- Develop increased cooperation between ITS and Facilities Management in crafting and enforcing standards and guidelines for research center program planning and building design.

2. Supporting Teaching and Learning through Effective IT Tools, Spaces and Support

Teaching and learning is fundamental to CU-Boulder's current and future success. Flagship 2030's Core Initiatives highlight a desire to further support and advance undergraduate and graduate education as well as student and faculty scholarship. In the coming decades, CU-Boulder is committed to exploring evolutions in the content and mode of teaching, increasing the number of graduate students on campus each year, and providing the resources for research excellence. As teachers and students pursue research and learning agendas, IT will continue to support their creativity, exploration, and success.

Flexibility: Ensure teaching and learning tools and services are amenable to diverse and changing needs as well as a broad community of users.

- Understand the variety in disciplinary demands and coordinate closely with departments regarding specific departmental need for teaching and learning spaces.
- Determine how learning spaces can support dynamic learning environments that respond to both student driven needs and creative faculty inspired learning environments.
- Provide support for both discipline-specific as well as widely adopted technologies.
- Explore learning management systems with more open frameworks allowing for a flexible and organic user experience.

Transparency: Fund, conduct, and publicize regular needs assessments and evaluations across campus to inform decisions about teaching and learning support services and resources.

- Invest in pilot studies to determine need and use of new technologies.
- Research effective practices for supporting teaching and learning with technology.
- Base decisions about funding and support for teaching and learning with technology in research concerning needs.
- Clearly delineate technological services available across campus and communicate those services to students, faculty, and staff.

Collaboration: Involve students and faculty in conversations concerning campus assessments and evaluations and the resulting policy and resource decisions.

- For every central adoption of a new technology service or application on campus, invest sufficient funds to ensure adequate user support.
- Create and nurture a collaborative support environment on campus.
- Promote shared, multi-functional, cross-departmental environments across campus.

3. Enhancing the Student Experience

CU-Boulder's students are exceptional, and providing them with a rich and rewarding academic and university experience is fundamental to the university's mission and goals. As IT becomes an increasingly central focus of daily life, it is important to understand how campus IT can enhance the student experience outside of the classroom. Continuing to improve the IT student experience involves attention to campus libraries, highly mobile computing, housing and dining services, and the management of student information. Together, these areas of student life can

foster a seamless IT environment for students, bolstering their academic achievements and smoothing the way for a path of collegiate success.

Flexibility: Account for a range of needs and interests among students in accessing and receiving information and utilizing tools.

- Provide training for students and faculty using joint or multi-use library learning spaces as well as training and education in integrating ITS and library supplied tools.
- Adapt multiple and dynamic strategies for communicating with students to account for communication preferences and future changes in communication technology.
- Incorporate discipline-specific portals for information made available to students regarding current faculty and student research.

Transparency: Increase communication and assessment strategies between ITS and campus resources concerned with the student experience.

- Develop more extended and frequent communication between ITS and campus offices and divisions devoted to student life. Such communication includes ITS and:
- the Libraries (concerning iTunes U, Alliance for Digital Repositories, and other current and future large projects)
- Structured communication processes with University Information Systems and campus departments.
- Regular service meetings with Housing and Dining Services to address IT processes, procedures, and future development as well as identify the opportunities and challenges involved in benefitting the student IT experience.
- Conduct assessment to understand how to best utilize space and technology resources on campus for students outside of the classroom—in library spaces, residential spaces, and other campus buildings—and align space planning with needs.

Collaboration: Work with campus divisions and offices to provide the IT resources necessary for student success and successful student services.

- Partner with the Libraries in IT-related developments within the Library Renaissance Plan.
- Improve the integration of campus-based systems with ISIS (the Integrated Student Information System).
- Work collaboratively with Housing and Dining Services to craft mutually acceptable funding models.

4. Fostering Efficiencies for Campus Staff and Realizing ROI

As IT reaches into every corner of the campus, understanding how IT may best be utilized to ensure the seamless machinations of campus life is an important concern. To best serve students, faculty, and staff, ITS is committed to reviewing and improving its service model and overall structure—a process involving a consideration of cloud computing and rich collaboration tools and how those resources may increase staff efficiency, as well as IT support services and ITS' relationship with campus customers.

Flexibility: Employ extensive knowledge of unique departmental, disciplinary, and office operations and demands in addressing staff efficiency.

- Consider development of cloud computing and rich collaboration tools from a variety of campus and disciplinary perspectives.

- Adopt an agile IT customer service model in recognition of high variation among staff members in terms of business function, available resources, and technological proficiency.
- Create new and distinct units within the ITS organization to provide specialized expertise in specific areas of need across campus such as Security, Research Computing, Academic Technology, and Classroom Support.

Transparency: Ground new developments in thorough assessment and evaluation and incorporate feedback into IT resource and policy decisions.

- Conduct needs assessment and evaluation to measure changing IT needs across campus in the areas of teaching, research, and administration and gauge those needs against the IT service model. Evaluate possibilities for achieving efficiencies through hardware or software standardizations.
- Cultivate feedback and communication throughout all components of the IT service model to better meet the needs of units and end users.
- Discuss IT service changes with campus users in a proactive manner amenable to input: create a webpage where proposed changes can be made public and users can offer policy feedback.
- Create measurable benchmarks by which to objectively evaluate, understand, and promote staff efficiency and effectiveness and in turn recognize and eliminate inefficiency and inefficacy.

Collaboration: Involve a range of voices in developing new tools and services relevant to campus staff.

- Establish an IT Policy and Oversight Board to develop new policy for ITS and coordinate policy with other IT units to meet the needs of all users; incorporate campus feedback into all Policy and Oversight Board decisions.
- Task a group to explore salient issues in cloud computing on campus such as how best to wrap cloud services, control data sent off site, mitigating risk, and meeting compliance requirements.
- With input from various campus units, craft and implement a consistent approach to developing a common collection of collaboration tools across campus.

5. Developing Strong Communication

Strong campus communication embodies many characteristics—it is circular rather than unidirectional, provides a consistent message, and is supported by an appropriate and efficient architecture. As of the summer of 2010, ten years have passed since CU-Boulder last made a significant investment in campus wide, generally available web hardware and software infrastructure in support of communication and web content. Web Communications, which operates under University Communications, manages the design, content and organization of CU-Boulder's official web site in addition to developing (for a fee) customized web sites for campus departments. Improving web infrastructure services, tools, and support—ultimately that are provided as a common good—and developing strong and inclusive communication strategies between ITS, University Communications, and campus constituencies is therefore a campus priority.

Flexibility: Adopt and deploy a web content management solution dynamic and versatile enough to address many of the technology combinations and needs throughout campus and foster a robust, multi-purpose web hosting environment.



- Create and hire positions necessary for maintaining adequate and future-looking web support.
- Establish stronger campus web support, training, and a community for university web developers and content managers to ensure infrastructure and content reflect changing needs and communication strategies.

Transparency: Determine current uses of and needs for communication technology and communication infrastructure throughout campus.

- Conduct both preliminary needs assessment and follow up evaluation regarding web content management solutions and web hosting.
- Achieve compliance with CU-System web branding standards through review of identity standards and current web content as well as initiate periodic audits of content.
- Perform periodic inventories of campus organizations maintaining IT structures to guide campus IT strategic planning and leverage IT expertise on campus.
- Evaluate use of current campus communication technologies throughout campus; partner with student-facing organizations such as Student Affairs and Housing to conduct assessments of student IT support needs and use of specific communication technologies.

Collaboration: Increase and streamline ITS communication across campus and promote unified public campus communication.

- Redesign and reorganize the current ITS website to promote simpler navigation and current usability standards.
- Implement strong cooperative ties between ITS and University Communications to combine technical expertise and critical expertise in public communications.
- Expand face-to-face ITS communication with students, faculty, and staff through enhanced training and orientation programs.
- Create and communicate a campus-wide IT mission statement in line with Flagship 2030; if necessary, alter mission statement periodically to reflect changes in technology and campus vision.

E. Conclusion

This report is the culmination of countless conversations, drafts, and rewrites that occurred among faculty, students, and staff. The outcome of their work occur in the following chapters, which are broken down by major area: chapter 1: teaching and learning, chapter 2: shared resources and support, chapter 3: collaborations and partnerships, and chapter 4: governance, budget and communications.

Each subsection follows a template in order to provide consistency with each topic area: the major issue stated, followed by a description of the background and rationale with accomplishments to date referenced. Then, each subsection develops an action plan which articulates explicit assumptions, outlines specific recommendations and provides short and long term goals, resources needed, responsible parties as well as ways to measure success and evaluate the initiatives proposed.

Chapter four, specifically the governance diagram and proposed plan of engaged participation in IT decisions, provides the “how” of how we will prioritize and evaluate the initiatives outlined in chapters one through three. Ideas and initiatives outlined in the report will be discussed within

this new governance over the course of the next several months. This plan, similar to past IT plans is meant to be a working document in spirit, in other words, a map which allows for the campus to forge ahead with new innovative ideas and practices that break down barriers and better support the campus.

Presence/Absence of Themes in Specific Recommendation Sections and Short/Long Term Objectives by Report

	Need for Flexibility	Future-Looking	Disciplinary Difference	Assessment	Communication	Transparency/Openness	Underlying Support	Voice/Involvement	Cooperation/Collaboration
1.1 Support for Teachers and Learners									
1.2 Providing Teaching & Learning Spaces									
1.3 Offering Teaching & Learning Tools									
2.1 Research Computing & Cyberinfrastructure									
2.2 Facilitating Cloud Computing									
2.3 Campus Strategy for Mobile Computing Support and Services									
2.4 Developing Rich Collaboration Tools									
2.5 Increasing Staff Effectiveness & Efficiency through Technology									
2.6 Developing Web Infrastructure									
2.7 Improving the IT Service Model									
3.1 Libraries									
3.2 ISIS Integration									
3.3 Partnering with Facilities Management: Construction & Sustainability									
3.4 Housing & Dining Services									
4.1 Engaged Governance and Budget									
4.2 Developing Strategic Communications									
Total theme occurs out of 16 reports	5	4	7	10	10	7	6	7	11

TABBED Page: Chapter 1

Chapter 1: Teaching & Learning with Academic Technology

The reports addressing Academic Technology encompass three areas: support for teachers and learners, teaching and learning spaces, and teaching and learning tools. Overall, this section of the Strategic Report emphasizes how IT and ITS on campus may best serve instructors and students by providing a wide variety of technology-related tools, support, and spaces both specific to disciplinary needs and widely shared across campus. The Academic Technology chapters also underscores the need for flexible tools and support mechanisms; assisting teaching and learning requires meeting a range of diverse needs and adopting a forward-looking perspective by anticipating the needs of future learners as well. Teaching and learning spaces, for example, must adapt to changes in learning styles and disciplinary demands.

The recommendations found in the reports concerning Academic Technology include high usability among newly adopted tools, effective support for diversity in teaching and learning, coordination of shared tools and spaces, and development of transparent processes in the selection, development, dissemination, communication, and governance surrounding teaching and learning tools, support, and spaces.

1.1 Support for Teachers and Learners

Major Issue: The growing presence of technology on campus and in the everyday lives of faculty and students presents new challenges and possibilities for providing support for teaching and learning. As the campus determines how best to move forward, a number of concerns should be considered, such as the need for: high-quality, easy-to-use tools that meet demonstrated teaching and learning needs; support for technology use that emphasizes teaching and learning; scalable and flexible support models that take into consideration needs that are different by discipline or unit and that may change over time; a better understanding of and ability to meet the support needs of students.

A. Background/Rationale

CU-Boulder faculty and students increasingly rely on technology tools and spaces for effective teaching and learning associated with face-to-face, online, and hybrid courses. In addition, students rely on those same tools and spaces for learning outside of their traditional academic programs. Effective use of technology relies on support models that address these issues while respecting disciplinary differences, and that are broadly and easily accessible to all faculty and students. Currently, that support is provided by a mix of central and decentralized units and efforts. Even as pockets of excellent support exist, the campus needs to make sure that technology support is consistently available across all units. In addition, that support must be flexible enough to meet needs that differ by discipline or with changes in pedagogical methods, understanding about learning, or technologies.

B. Accomplishments to Date

Various stakeholders across campus invest in structures to support the use of technology in teaching and learning. Investments in this support are made both centrally and locally. Examples of technology support structures with a teaching and learning focus include ASSETT, ALTEC, and iSTEM in Arts & Sciences, the Leeds School technology unit, Disability Services, and the Academic Technology unit of ITS. The campus also has a number of resources that specialize in supporting teaching and learning generally. The campus can leverage the expertise in these units to build out support that includes technology. Examples of these units include the University Libraries (which already has a significant technology focus), FTEP (Faculty Teaching Excellence Program), and GTP (Graduate Teacher Program). Overall, however, there is a lack of communication between and knowledge sharing among the many units providing this support. To ensure effective and sustainable support for teaching and learning with technology, more work needs to be done to inventory the support and services provided by and the service models in use within each of these units, and to increase communication and coordination among them.

Action Plan

A. Explicit Assumptions

The growing presence of technology on campus and in the everyday lives of faculty and students presents new challenges and possibilities for providing support for teaching &

learning. Moving forward, a number of concerns should be considered:

1. Effective support assumes the presence of stable, high-quality, functional, and easy-to-use technology-related tools and spaces (some of the campus's most critical tools do not meet this basic standard).
2. Effective support for technology in teaching and learning emphasizes support for *teaching and learning* over support for *technology*.
3. Effective support is aware of the changing needs of teachers and learners, of the ways those needs vary within different units, and adapts to those changes.
4. Students as learners have different needs than faculty. The campus must understand and meet the support needs of students.
5. The campus should leverage the expertise and knowledge of existing investments in locally- and centrally-provided support for teaching and learning with technology in ways that it does not do now.

Strategic Principles. These should guide campus decision-making in this area. They map roughly to the concerns above and will be used to structure the rest of this chapter.

1. **Usability is fundamental.** Any basic, centrally provided technology must work well, must be accessible, easy to use, and must meet pedagogical needs as defined by the teachers and learners themselves. The current version of CULearn (Blackboard's CE 8), for example, does not work well, is not easy to use, and fails to meet many pedagogical needs. Support that exists to compensate for low usability of tools is an inefficient use of resources.
2. **Good support is driven by faculty and student's academic needs.** Support needs vary across different disciplines and different sets of users. Decisions for how to structure and prioritize support should emerge from these needs. Support models, therefore, must be flexible and adaptable. Success should be measured primarily by meeting those needs, rather than by technology-centric factors such as adoption rates or help-center call volume.
3. **Good support scaffolds user learning.** Support models should scaffold users so that, over time, they no longer need support for a particular practice or tool. Incremental and accumulative gains are valuable and help support remain flexible and adaptable.
4. **Good support extends beyond the classroom.** The campus must support teaching and learning that takes place outside of the classroom. Traditional support emphasizes the course or classroom, which biases support toward faculty needs. Supporting students may often require something completely different. Supporting student needs is critical.
5. **Partnering is critical** Many units on campus currently provide some level of support for teaching and learning. Encouraging connections across these units can help them leverage existing resources, increasing efficiency and scalability without significant additional outlay. Partnerships can encourage pilots, local experimentation, and transdisciplinary projects. Also, through these conversations, central IT can make more informed decisions about what support gaps exist across campus and how to fill them (rather than duplicate existing resources).

B. Specific Recommendations

1. **Ensure usability of tools, systems, and spaces**
 - Adopt a set of usability guidelines centered on teaching and learning, to be applied to

any technology tool currently used or being considered for campus-wide adoption. Use the results to inform decisions about priorities for tool upgrades or replacements. Make the guidelines and resulting assessments available to the campus community.

- Replace CU Learn and improve the campus clickers/SRS tool. See chapters 1.2 and 1.3 for specific recommendations about spaces and tools.

2. **Align support with local and changing needs**

- Many local programs successfully support teaching & learning with technology. Support these local successes, Strengthen them by involving them in campus IT decision-making and policy discussions. Consider investing central resources to grow local programs.
- Fund regular needs assessments of teaching and learning needs, conducted by support staff themselves. Use methods that provide these staff with first-hand knowledge of local needs and practices, i.e., focus groups, observations, and interviews rather than surveys. Share the results.
- Fund regular evaluation and assessment of support services and resources, to better inform decisions about priorities and directions. Support change when data call for it.
- Be sure that campus IT policies and support structures allow (and even encourage) risk-taking and experimentation, e.g., support for online learning outside of CULearn, using wikis or social media. Consider reviving past or expanding present resources such as the Educational Technology House (formerly in Eaton Humanities), Academic Media Services (currently in the ATLAS Building) or grant programs (e.g., as formerly in ATLAS, and as currently in President's Teaching and learning Collaborative, ASSETT and ALTEC) that encourage experimentation and adoption of educational technologies.
- Invest in improved online learning resources and training opportunities for faculty, students, and staff.

3. **Provide better support for students**

- Create new or redesign existing support models to address the specific needs of students, recognizing this may require more cost outlay to establish new support offerings (such as hardware and software support).
- Consider student needs outside of the classroom. Re-examine any central support structure that artificially separates support (i.e., that supports *only* faculty or *only* students).
- Invest in campus learning spaces that are student centered, such as Norlin Learning Commons, Center for Community, or the UMC.
- Invest in tools that are student centered, such as eportfolios.
- Engage student government in planning, decision-making, and implementation of new support models. Pursue recommendations to create a Student Technology Advisory Board.

4. **Facilitate effective support across campus through partnering**

- Create a list of who provides teaching and learning support on campus, share the list and update it regularly. Provide mechanisms for programs to learn more about each other, and for them to partner with one another. Include programs with primary missions for supporting teaching and learning (with or without technology), such as the Libraries, FTEP, GTP, and STEM Learning Assistants program (School of Education).
- Create a grant or incentive program to support or facilitate peer-to-peer mentoring or expertise-sharing in this area.



- Involve faculty and students more directly and regularly in decision making about how to provide support. This may mean participating on advisory committees, or holding formal managerial appointments in support structures.
- Re-examine technology support models currently funded by course and instructional fees. Look for potential to restructure the support models. Current fees may have been implemented when the technology teaching & learning environment was very different. Encourage low-cost models, such as peer learning (students or faculty learning from each other).

C. Long & Short Term Objectives/Timeline

Short Term (6-12 months). Change the conversation. Demonstrate a commitment to changing existing practices as needed and building an open conversation.

1. Ensure usability of centrally provided tools, systems, and spaces

- Implement critical tool replacements (CULearn) and improvements (clickers/SRS)
- Establish structures to regularly gather and disseminate data on usability.
- Ensure accessibility (508 compliance) of new and existing tools through work with Disability Services and the Procurement Service Center. Publicize requirements and practices that lead to equal access to information and technology for students and faculty. Improve faculty training in this area.

2. Align central support with local and changing needs.

- Implement a variety of evaluation and assessment activities into central IT so that they are in a better position to understand needs (perhaps with ASSETT as a model).
- Revive initiatives that put central staff, including those who support teaching and learning *and* those with more operational responsibilities for technology implementations, in direct conversation with faculty, academic staff, and students (and them with each other). A possible starting place is the FEET (Faculty Evaluating Emerging Technologies) idea, expanded to include academic staff and students.
- Invest in pilot studies of new technologies, carried out by either central or local programs.
- Research effective practices for supporting teaching and learning with technology, including practices of peer institutions.

3. Provide better support for students

- Conduct a campus wide needs assessment and gap analysis with students to identify technology needs for learning. Share the results.
- Involve students in governance of information technology and decisions and directions resulting from that assessment and analysis.
- Evaluate centrally provided student training; change or augment with new tools and methods based on conclusions of evaluation.

4. Facilitate effective support across campus through partnering

- Begin inventory of campus units providing support, including missions, activities, expertise, availability of resources, and areas of support. Share the results.
- Convene support units in knowledge-sharing meetings, research and project presentations, and online communities. Determine effective methods for

communication and collaboration between these units. Consider ways to leverage joint resources to gain purchasing efficiencies, e.g., for software licenses.

- Involve a broad representation of campus stakeholders to oversee a cost study that investigates various means for funding campus-wide support.

Long Term (1-3 years). Create a support environment such that by 2015, CU-Boulder is recognized by students, faculty, and peer institutions as an exemplar for supporting teaching and learning with technology.

1. **For every central adoption of a new technology service or application on campus, invest sufficient funds to ensure adequate user support.** Determine on a case-by-case basis whether the investment should be in central programs, local programs, or both.
2. **Formally integrate usability into processes for adoption/upgrade of any centrally provided tool or space.** Form and disseminate usability guidelines for technology tools, systems, and spaces.
3. **Invest in teaching and learning support resources at a level equal to (or greater than) investments in spaces and tools.** The campus is understaffed with regard to personnel to support teaching and learning with technology. It is imperative that any plans for new tools and spaces include sufficient *additional* resources for *additional* teaching and learning support *staff*. And as more teaching and learning technologies are “lightweight” or “personal,” effective support requires an increase in staff, *even when the campus is not adopting a new central technology*.
4. **Create and nurture a collaborative support environment on campus.** Share results of assessment and evaluation efforts. Implement data-driven change. Ensure transparency in decisions about and funding of support for teaching and learning with technology. Eliminate artificial divisions that are based on resources, rather than on needs.
5. **Change how central support is provided by centering on identified cross-unit needs rather than separating support by discrete organizational units. Match support to needs.** The model that creates silos of support for different units is inefficient and does not leverage campus-wide opportunities. Avoid significant disparities among units with regard to support for teaching and learning. Avoid significant disparities between students and faculty support. Adopt a structure that is flexible and adaptable, so that it can change as needs change. Determining the specific structure to adopt should involve a discussion among campus stakeholders.

D. Possible Risk

No IT security risk is identified and/or associated with these recommendations.

E. Resource Allocation

1. Many of the short-term recommendations require changing the priorities of existing IT staff as well as faculty, staff and student participation. Faculty will participate as part of their service assignment. Staff may need to have workloads reassigned. Student leadership can be engaged; modest incentives generally also increase participation rate.

2. Several items are low cost (\$10,000 or less), assuming existing staff may be reassigned and student research assistants are employed.
3. Conducting assessments will be worthwhile only if the campus can respond adequately to the identified needs. An unrestricted fund would allow the campus to provide small grants or awards to respond quickly and flexibly to meet emerging needs. The use of these funds could be overseen (and perhaps awarded) by an advisory committee, furthering the involvement of campus stakeholders. Earlier intervention generally results in lower longer-term cost. The resources available should be on par with other campus-wide proposals, such as for CRCW awards or Outreach grants.
4. Investing in additional staff is the most critical component of providing effective teaching and learning support. It is also the most cost intensive, ranging from \$8,000-10,000/year for undergraduate support to \$80,000-100,000/year for professional support. The campus might call for proposals from units on campus, leveraging central funding with local funding. This would allow individual units to determine what kind of support they need, which may range from lower-cost options of student employees up to professionals. As identified in objective 7, any centrally provided resource must also fund adequate support.

F. Responsible Parties

1. Campus-wide Information Technology Advisory Committees (formed as a result of this overall strategic plan) to monitor overall implementation and ensure that progress is made toward achieving general goals.
2. Several items require the partnership and collaboration of the various units on campus that provide teaching and learning support. CIO and/or Chancellor should solicit broad initial participation.
3. The CIO and the Provost should solicit participation for a committee to review proposals for item 2, third bullet.

G. Evaluation

Evaluation of this plan is straightforward. Success can be measured by the change in perceptions and attitudes of (1) faculty, staff, and students, (2) staff of programs across campus that support teaching and learning. The recommendations of this plan aim to create an environment in which support can achieve excellence. As the technology environment changes over the next 5 years, other specific actions may emerge as equally effective. This evaluation mechanism allows the campus to remain flexible with regard to specific decisions that may be needed in the future.

A campus-wide committee with minority representation from technology-centered support units (whether central and local) should be formed. Using this plan as its guide, this committee should identify measurable indicators for assessing achieved success over time. The committee should determine a methodology for gathering and analyzing data on an annual or bi-annual basis. The committee should report the results of the study publicly to the campus. (An example of an existing committee with a similar charge is the Chancellor's Committee on Women.)

Additional Information

Table 1: Partial list of high-level units providing support for teaching and learning with technology

Name of Unit	Division	Tech Focus
Academic Technology	ITS	High
ALTEC (Anderson Language Technology Center)	Arts & Sciences	High
ASSETT (A&S Support of Education Through Technology)	Arts & Sciences	High
ATLAS	Institute	High
Continuing Education and Professional Studies	Continuing Education	Medium
Disability Services	Student Affairs	Medium
FTEP (Faculty Teaching Excellence Program)	Faculty Affairs	Medium
GTP (Graduate Teacher Program)	Graduate School	Medium
iSTEM	Transdisciplinary	High
University Libraries	Libraries	Medium-High

Table 2: Schools, Colleges, and Departments with formal Support Staff for technology

Name of Unit
Arts & Sciences
ASSETT at college level
Dean's office, for advisors
ALTEC for language departments
Chemistry
Communication
Ecological and Evolutionary Biology
Film Studies
Geology
Molecular, Cellular, and Developmental Biology
Physics
Psychology
Architecture and Planning
Business
Education
Engineering (departmental level, e.g., Computer Science)
Journalism
Law
Music
Psychology
Architecture and Planning
Business
Education
Engineering (departmental level, e.g., Computer Science)
Journalism
Law
Music

List of Accessibility and 508 Compliance Resources

National standards: www.section508.gov < <http://www.section508.gov/> >
Campus standards on accessibility: <http://www.colorado.edu/webcom/access/>
Disability Services Resources :
<http://www.colorado.edu/disabilityservices/facultyinfo.html> or
<http://www.colorado.edu/disabilityservices/handbook/handbook1.html>

1.2 Providing Teaching & Learning Spaces

Major Issue: Teaching and learning spaces on campus must be equipped with technologies that support both the diverse teaching strategies used on campus, and the unique learning styles of students in the new millennium. Flagship 2030 and the Facilities Report of the Boulder Campus Master Plan have both laid out physical space expansion goals for the future, including increasing classrooms and large lecture halls, and discussing innovative solutions to large lecture hall needs by using advanced technologies to co-locate learners. These ideas may be insufficient for meeting the needs for smaller and more specialized learning spaces. Meeting these goals will require flexibility in programs and resources to adapt to changes in technologies and teaching needs across the campus.

A. Background/Rationale

CU-Boulder is an outstanding research-intensive and comprehensive teaching university. It should have teaching and learning spaces and technologies that match those of comparable universities. Making appropriate and forward-looking investments in these areas is consistent with two core initiatives in Flagship 2030: (1) enhancing education and scholarship and (2) investing in the tools for success. [link:flagship2030/coreinitiatives](http://www.colorado.edu/masterplan/taskforces/index.html) It also will help with many key flagship initiatives [link:flagship2030/flagshipinitiatives](http://www.colorado.edu/masterplan/taskforces/index.html), including establishing more residential colleges and programs and offering all students customized and experiential learning programs. The latter initiative in particular can be enhanced with appropriate technologies for learning and distributing knowledge, as well as help distinguish an education on the Boulder campus from the growing availability of distance education. Additionally, the facilities task force report of the emerging Boulder Campus Master Plan calls for further investments in technology in existing classrooms, at least one more very large classroom with technology to transmit lectures to satellite rooms, while the east campus task force report envisions that area to be a full academic campus with teaching and learning rooms (<http://www.colorado.edu/masterplan/taskforces/index.html>). In making such improvements, planners should be aware of the considerable heterogeneity that exists in needs for spaces of varying sizes and technological capabilities.

We see a four-pronged set of issues for IT planning. First, it is important to continue to upgrade existing spaces to achieve near-universal coverage of Smart (*media equipped classroom with at least a screen, digital projector, room controller SP panel, DVD/VHS or other video playback*

Name of Unit
Arts & Sciences ASSETT at college level Dean's office, for advisors ALTEC for language departments Chemistry Communication Ecological and Evolutionary Biology Film Studies Geology Molecular, Cellular, and Developmental Biology Physics

technology, campus cable TV, sound system. The basic technologies installed evolve over time as the technologies and needs change.) or similar new technologies. This should be done at least in centrally scheduled facilities, though the need extends also to department-controlled spaces. In this regard, currently 136 of 182 centrally scheduled classrooms are Smart, while demand for such facilities grows rapidly. Second, ITS needs to work closely with campus planners and facilities management to ensure that new teaching and learning spaces are appropriately equipped. Third, as new spaces are constructed or existing spaces are renovated, attention should be paid to the heterogeneous teaching and learning needs of faculty and students soon to arrive on campus. Perhaps most significant is the increasing usage by students of IT-equipped commons rooms, such as those in libraries and RAPs, and smaller team rooms. Thus, planning of physical spaces needs to evolve to meet both changing demands for learning environments and emerging philosophies for teaching in groups. Fourth, the existing model for centralized procurement of teaching and research software is not sufficiently flexible to meet the rapidly changing needs of a number of units. A more responsive model in terms of monitoring needs and pricing for access would help support learning, particularly by undergraduate and graduate students undertaking research projects.

B. Accomplishments to Date

ITS has made significant investments in upgrading classrooms to Smart status, though the work is not complete. Technology space demands are increasing at a faster rate than the funding and resources can build them. Campus has made it a priority to fund additions of smart classrooms with temporary funding over the last 2 years. Campus has been adding facilities at a rapid pace, with a need to continue over the next 3 years to reach the goals. With these additions, we have been creating a renewal and replacement burden for the campus that will only be met with continuing funds commitments.

Large lecture hall technology models have been changing and evolving during the capital construction boom on the Boulder campus. There has been more of a focus on providing technology that is easy to use, which can operate without attendant support, and puts the tools in the hands of the instructor. Distance learning has been included as a goal in all program plans, and capabilities have been installed in most of the new construction projects in large halls or classrooms (recent ones include Leeds, ATLAS, Visual Arts). Our model for large lecture halls has evolved to meet the new demands. We need further refinement in physical room design evolution to meet changing demands on space.

All capital construction projects have been planning 100% Smart technology in classrooms they provide. This is a positive trend that helps us meet our goal of equipping more rooms with technology on campus. There are support model and long term campus renewal and replacement considerations to address with this planning.

Space design in teaching and learning computing labs and classrooms is also evolving. Students like big, open spaces to work in groups and alone, with food and ability to interact and take a break. There is still a need for quiet library style spaces as well. Community spaces for interaction are becoming more popular, with new commons style spaces packed with users well into the evening hours. As spaces are renewed on the regular cycle, they are adapting to the newly defined needs. We have installed new commons style arrangements in labs in Norlin Learning Commons, UMC, ALTEC in Hellems, Education, ATLAS, RAPs, Leeds and have more requests pending.

Students find the team rooms (*a small, enclosed technology equipped group work room with at least an LCD panel to project content, a controller, and audio reinforcement*) to be very useful for their work. All of these group study rooms are popular and heavily scheduled. We need more of these on campus.

Action Plan

A. Explicit Assumptions

"Millennial learners" and other new students will be increasingly familiar with a broad and rapidly changing array of information technologies for engaging in communication, social networking, information searches, and studying and working. Although these students are likely to arrive with laptops and mobile devices, usage patterns to date indicate that some desktop labs need to remain, with a range of technologies available. Faculty and students are likely to expect more than passive access to IT in classrooms and other learning spaces, placing an emphasis on interoperability and capacity within each space. Much of this capacity will operate through wireless means, putting a premium on consistency of signals to avoid work disruptions. Demand is growing for three types of jointly used spaces: commons areas with internet and networking access (and amenities such as food and beverages), team rooms for student collaboration, and small spaces for specific uses, such as audio or video recording, and videoconferencing.

In addressing such demands, flexibility is one key approach: we cannot predict all changes in technology and use patterns. Neither can we satisfy every possible teaching and learning demand for technology in every space, in part because these needs are sometimes in conflict. Governance is another key issue: an inclusive body needs to be charged with setting priorities, continually evaluating needs for space upgrades, and allocating scarce resources. Information is another requirement: faculty should have access to knowledge about best practices at similar universities, by broad discipline.

Accessibility Issues: The task force sees no particular issue regarding access for disabled persons other than urging facilities management to ensure such access is provided when rooms are built and renovated. Our Divisional standards documents already specify requirements around ADA accessible podiums and technology within the space.

Sustainability Issues: The task force recommends additional investments in Smart (SMT) rooms and a significant increase in the number of electrical convenience outlets in classrooms and commons rooms, which could raise long term electricity demand. Additional video and audio transmission capacity could do the same to both electrical service and network bandwidth/availability.

Specific Assumptions

- Support (face to face, online, video, etc) for all recommendations must be considered a priority.
- Ongoing funding for renewal and replacement of recommended space tools and hardware: must consider the long term implications of the implementations when approving campus projects.
- Assumption: a governance body will exist to provide high level prioritization. Should include students, IT, faculty, and administrative governance.

- Assumption is new developments that come out of the recommendations shall, everywhere possible; conform to Section 508 and campus accessibility standards.
- Flagship 2030 vision, along with Facilities Master Planning guidelines should provide the framework for IT space decisions and priorities.
- All faculty and students need access to the best space and technology to facilitate their teaching and learning styles. Best practices should be applied relative to other similar-sized research Universities.
- We cannot fully future-proof our spaces for anything that might come up in the future, nor can we satisfy every possible teaching and learning demand for technology, because they are often in direct conflict with each other.
- Spaces will be continually evaluated and revised, new priorities set by the governance body selected.
- Despite increase in student use/ownership of technology (especially laptops), some desktop labs will continue to be necessary.
- This group is not attempting to reflect the potential needs of Conference Services, an auxiliary unit that will be using some of these spaces. They have not traditionally provided financial support for the rooms they use, and oftentimes they deliver their own set of Audio Visual equipment.

B. Specific Recommendation

- A better governance system should be developed that will help set priorities for allocating resources across needs and among emerging technologies to support teaching and learning. This model should include representation from faculty and students along with technology experts.
- Continue investments to increase the number and percentage of smart classrooms of all sizes, while consulting with faculty members about whether particular rooms may be better served without Smart technology.
- Develop more spaces for collaboration among students, and between students and faculty in technology and information use. Examples include commons rooms, RAP great rooms, and team rooms that offer connectivity and workspace.
- Consider providing ample convenience outlets for all new capital construction, and also undertake a retrofitting analysis in older existing teaching and learning spaces. ITS needs to work closely with facilities management on technology choice and installation in infrastructure renovation projects.
- Due to the increasing proliferation of wireless devices operating on many frequencies and technical specifications, all new campus construction and renovation projects should take account of all wireless technologies that are likely to be present, and should adapt designs as needed to minimize interference within teaching and learning spaces. This must include consideration for wireless/mobile communication to all spaces in the building, including but not limited to radio frequencies commonly used by police/fire/life safety personnel and support staff. Addressing this problem will require extended communication during planning phases of facilities projects.
- There appear to be sharply increasing specialized audio and video needs across campus for individual and team recording of research results and creative work by both students and faculty. The campus needs to provide more small, private, and sound proofed spaces, which could be located in both academic and residential buildings.
- There is considerable variation among departments in their needs for and uses of teaching-oriented computer labs but at this time there is no consensus that such labs can be eliminated in favor of relying on student-provided laptops and devices. This heterogeneity



implies that ITS should coordinate closely with departments regarding their continued needs in this area. Greater availability and access to application software could reduce some space requirements and provide more flexible and dynamic learning spaces.

- The current IT procurement model regarding department-controlled spaces is ad hoc and needs reconsideration. Left to their own devices, the departments with more limited resources cannot invest in the technologies needed to support their teaching and learning mission. A more centralized funding model should help support provisioning of standard and emerging technologies in all classroom spaces, including departmental locations. Campus should promote more shared, multifunctional, cross-departmental environments where space is limited.
- A key function of ITS is to provide software for teaching and learning spaces. The governance body recommended above should actively work with units to understand their evolving needs for centrally purchased software and how it is delivered to student machines, computer labs and department spaces. Some effective approaches would be software Enterprise License Management (ELMs – tools such as e-academy to manage distribution and tracking of institutionally purchased software licenses), and/or keyed, virtual delivery of software and shared licensing on an enterprise level for all of campus to use.
- There is an increased demand for shared centralized server space and a shared computing canvas for teaching and learning, integrated with research. One useful example would be development of virtual spaces for students and faculty to meet and work.
- Central scheduling of classrooms and especially computer teaching labs is sometimes inefficient in terms of class sizes and time allocation. While central scheduling is important to retain flexibility, schedulers and ITS should coordinate better with departments on their needs. A task force should be commissioned with stakeholders to develop an action plan to improve space scheduling. This analysis should take into account the needs of all stakeholders, including Central/Academic scheduling, Non-Academic Scheduling (UMC), departmental facility scheduling, and ITS facility scheduling.
- Determine how spaces can support dynamic learning environments that provide more flexibility and respond to both student driven needs and creative faculty inspired learning environments. Consider implementing more models such as highly interactive virtual environments (HIVEs), peer-to-peer informal learning, clusters, individual work spaces, external work support for off campus, outside, traveling, etc.

C. Long & Short Term Objectives/Timeline

Short term: Organize an appropriate governance model to begin setting priorities and improve coordination with room schedulers and unit heads. This will be an ongoing activity. Survey or otherwise take stock of whether and how units finance technology needs in the spaces they control, along with needs for centrally purchased software. In addition:

- Address "quick win" policy and standards recommendations.
- Continue smart-classroom upgrades.
- Implement requirement for RF wireless interference analysis and additional convenience outlets into new construction standards documents.

Timeline: AY 2010-11.

Long term: Develop means by which the governance unit can interact more fully with facilities management and the Boulder Campus Planning Commission on technology investments and technical constraints in outfitting teaching and learning spaces in new buildings, RAPs, and common rooms. Investigate the need for small spaces and team rooms

equipped with audio/video technology and work with specialized units (eg, Film Studies, Music, Art & Art History, and Architecture and Planning) on their requirements.

- Begin conversation around creating funding model for all classrooms
- Create centralized storage/virtual workspace/shared canvas
- Engage scheduling task force to discuss and formulate a plan for better centralized scheduling of all teaching and learning spaces.

Timeline: ongoing from summer 2011.

D. Possible Risk

- Becoming tied into particular technologies that may become quickly outdated, a problem that is best addressed by flexibility in resources and planning and foresight by ITS and governance unit.
- Security issues regarding confidential data and records may accompany greater reliance on centralized software servers. Service cost viability will likely be a dynamic attribute of the service. Perceptions about the value of the service and the ability to adjust to market changes
- Classroom emerging technologies such as classroom capture will have security implications for the storage and publishing of the content.
- Increasing requests for 24/7 spaces to study have an impact on student safety and their need for services such as nightwalk/ride and cameras and phones in rooms.

E. Resource Allocation

The cost of these recommendations is expected to be very high.

Funding for increasing quantities of Smart classrooms, and continued support for renewal and replacement of these rooms is in excess of \$500k annually. This funding has been allocated on a temporary basis for the past two years. Continued funding of this service has been a top priority for the campus, so the funding stream is likely to continue.

Cost for supplemental power outlets within buildings is a large number that depends on many factors. This should be considered during program plan phase of construction projects for inclusion in the program plan funding requests. For campus building renovation projects such as Ketchum, this should also be a standard consideration.

Computing labs managed by ITS are funded through student fees (\$1.8M), and have a continuing funding source identified. Future planning for efforts such as software delivery to campus and student devices should be considered a component of the student fee budgeting process, with supplemental funds to support staff and faculty use requested as needed from general campus fund. Justification of these initiatives should include an analysis of central campus savings that would occur by not distributing funds to departments, but rather applying common good principles.

Modifying campus standards documentation will have minimal (less than \$5k) costs associated for professional services to develop and create the Divisional documents with campus collaboration.

There will be a significant cost associated with creation of a new, shared canvas virtual space for campus to use as a community. This is, in effect, developing a database hosting service, which requires analysis, development and some investment in hardware and software or cloud based services. This cost is expected to be approximately \$80k. It is important to note, many ITSP chapters such as developing rich collaboration tools have a similar request, so funding planning should account for the shared nature of this request.

Developing a new funding model for ALL classrooms could have a significant cost. There are approximately 500 (280 are supported by ITS) spaces on campus that are used for instructional purposes (many are not Smart rooms). Properly supporting the technology installations, and funding for renewal and replacement and additional staffing resources could be significant. We would expect a need for increasing staffing levels by 4 FTE to provide central support of these spaces in a common good model, with standard smart technologies installed. The cost for appropriate renewal support of these spaces is significant, in the \$300k-450k range if all are made smart. This need will be further developed and funding amounts honed as part of the recommendation to switch to a central funding model.

Central scheduling improvements cost would be in the \$30k-50k range, for analysis services and development of new tools or workflow processes.

F. Responsible Parties

ITS, Campus-wide Governance Group, Boulder Campus Planning Commission, Facilities Management, Central scheduling, Campus CFO, and all department stakeholders.

G. Evaluation

- Statistics of classroom equipment deliveries to spaces that are not Smart should reduce over time as upgrades are completed. This could improve resource utilization for the campus as a whole.
- Academic assessments of usage of technology in spaces. A continual evaluation of the current suite of technologies and its perceived value to the University Teaching and Learning mission.
- Cost savings analyses for providing technologies centrally or in a standards based fashion.

1.3 Offering Teaching & Learning Tools

Major Issue: While the campus needs to focus on delivering and supporting specific teaching and learning tools, the half-life of a list of promising teaching and learning tools is very short. A more lasting and strategic improvement can be made over the next four years, however, by improving processes for identifying, exploring, testing, and communicating about teaching and learning tools to be supported by campus.

A. Background/Rationale

One attribute of the world of teaching and learning tools is the rapid change and growth in the tools available to assist people in teaching and in learning. Another attribute is some support is best provided centrally while other support is best provided locally. The campus needs to consider this, as well as how best to vet teaching and learning tools through a process of selecting, testing, and evaluating tools and services by faculty and students. Many campus constituents are not included in user testing processes currently. Also, communication about support for teaching and learning tools on campus is neither uniformly received nor understood by key constituents across campus. And, there are not enough resources on campus for supporting the use of technologies.

All of this occurs amid a general milieu of concern about safety of data, FERPA considerations, copyright concerns, and concerns about storage of large data or media sets. Given this, our committee thinks there should be a comprehensive campus-level effort to provide guidance to the campus about the best tools for specific jobs, about legal considerations, and prearranged "cloud"-based tools that have been vetted by a university contract.

Our committee identified lists of teaching and learning tools that we think need to be addressed, which can be found below in section B. We identified a process for identifying those technologies, having faculty and students review them and posit uses for them; and a process that includes user testing those technologies before they are widely deployed. Visual collaboration and rich media is a recurring theme in this chapter. This is an emerging areas for growth. In addition, lecture capture tools, classroom capture tools, rich collaboration (Skype, WebEx) with shared whiteboard space, visual access to all media are all important areas to address.

B. Accomplishments to Date

Even though the campus faces declining state funding, teaching and learning technologies have been adopted at a certain level across our campus. For example, nearly every CU Boulder student has at least one class on CULearn, the campus' learning management system. However, much more thorough and deeper adoption has occurred in pockets across campus. For example in Physics, much work has been done with student response systems (clickers), with online simulations (see <http://phet.colorado.edu/index.php>), and with lecture capture systems.

Our campus has benefited from the recently completed Flagship 2030 strategic plan, which produced a number of initiatives that the campus should keep in mind as it provides support for teaching and learning tools.

Looking back to the last IT strategic plan, which was created in 2006 we can see that progress toward a number of initiatives related to teaching and learning tools was mixed. For example, very little work has been done on evolving the model of smart classroom support to account for multiple levels of user sophistication with technology and multiple pedagogical approaches. Also, the campus did not establish the Faculty Evaluating Emerging Technologies (or FEET) committee. And little work has been done to foster a culture of innovative and effective uses of technology-enhanced learning spaces.

Action Plan

C. Explicit Assumptions

Assumptions that we made about teaching and learning tools include that lists of tools are less central to this strategic plan than describing an ecology that is supportive of effective tool adoption. Also we assume the disruptive state of change in tools applied to teaching and learning situations will be able to be addressed. Further we assume that the campus will find it important to invest in the 2030 initiative as well as in tools used in support of teaching and learning over the next four years. We assume the campus will be willing to both invest in centrally supported, widely adopted technologies; as well as locally supported niche technologies. We assume that over the next four years faculty will be recognized for work they do in integrating teaching and learning tools into their curricula. And the campus will evaluate each new educational tool that will be supported. And finally, we assume that the campus should fund accessibility of any video technologies that are adopted. For example captioning of video is required when hard-of-hearing students will be viewing that video.

Assumptions about governance as well as policy and legal implications of teaching and learning tools include that the campus will be able to invest in improved methods of governance, communication, and user testing. Further, we assume that the policy and legal questions of how to respond to an environment where free and powerful tools are available outside of the campus will be addressed.

Assumptions about recommendations from the last strategic plan are that the campus will continue to work on those initiatives outlined in the 2006 planning process that were never implemented fully.

D. Specific Recommendation

This committee discussed a wide range of recommendations for improving the support for the tools used in teaching and learning. Overarching themes that emerged from our discussion were that the campus should look at support models from other universities; that technologies should be easy to use and compatible with a variety of other technologies; they should conform to standards; that we should have a "one start shopping" portal for access to technologies; and we should have a single point of help for technologies.

The campus needs to establish a formal system of governance over the support for educational technologies, programs to encourage faculty to test new tools, and a process for testing technologies and services across the board during project phases.

This committee would like to see phase-out dates for each centrally-supported technology, so that technologies that have outlived their usefulness can be retired. We would like to see faculty

course questionnaires (FCQs) incorporate some measure of educational technology use. We would also like to see the campus provide incentives for faculty to use educational technologies. More detailed recommendations follow.

Support Visual Interactivity

Because the creation, manipulation, and dissemination of video is so central to the direction teaching and learning technologies are developing; and because of the high cost of travel; technologies that employ video are likely to have a large impact on teaching on our campus. The campus should increase support for using video in learning contexts. This includes adding or enhancing services for videoconferencing, web conferencing, streaming media, downloading rich media, media capture in learning spaces (i.e. recording classroom activities, such as lectures), and video as students' scholarly work.

Part of the support for visual interactivity includes increasing existing support for advising faculty members about copyright, especially as it pertains to rich media assets. For example the campus should provide a means for giving faculty members advice on the TEACH act and Fair use. The copyright web site is a start in this direction, but providing a person who can give advice would be even better.

Support File Storage and Sharing

Because increased adoption of rich media formats are important for teaching and learning, it is very important that our faculty members and students have a much larger capacity for storing and sharing files. Any plan for a storage service needs to incorporate aggressive growth in capacity every year. This service should also provide for a variety of means of sharing files, including the ability to share files with colleagues outside of CU-Boulder. The goal in providing this service should be to make data storage be as widely used (and as useful) as email.

Support Widely-Adopted and Discipline-Specific Technologies

This committee would like to see continued central support for those technologies that are already widely adopted across campus as well as new support for technologies that have been adopted in local pockets. A number of educational technologies, perhaps the majority of them, are adopted by many disciplines. Examples include learning management systems, DVDs, blogs, wikis, etc. And this campus has attempted to provide support for some of these technologies.

More work remains on many fronts, however. For example in rich media dissemination, the campus does not have a solution for streaming media or for rich media downloading. At the time of this report, a service like iTunes U appears to have that capability and is a likely candidate for adoption. So it is important for the campus to continue to work in this area. Also more work remains in the learning management system space. We would like to see support for the *Enterprise 2.0* model for a learning management system. This model shifts the learning management system from being a stand-alone monolith to a more open framework that allows the user experience to be much more flexible and to grow organically.

While central support is important, it is just as important for the campus to provide support for technologies that are adopted by only a few disciplines. Some disciplines adopt technologies early that will later be adopted campus-wide. For example clickers were first adopted by Physics faculty, and they spread the word about them. Once enough departments adopt a technology, it may make sense for the campus to provide centralized support of this technology.

Some educational technologies seem to have a niche in particular disciplines and will likely never reach a critical mass for central support. The campus should recognize this and put resources in place to support those more local technologies. Examples include Smart Boards, which seem to be used primarily in Education.

Improve Communication about Technological Services Available Across Campus

Many campus services that provide support for tools for teaching and learning are not widely known across campus. This committee would like to see an increased effort by the campus to advertise and market these services. One-time email messages are not sufficient. Nor is a quiet post on a web page about a service. What is needed are increased resources and efforts aimed at multiple channels of communication and multiple audiences. This information should be simple and it should be pushed to faculty and students on a somewhat regular basis. ITS should provide a glossary defining what it means by various terms it uses. For example, what is ITS' definition of a smart classroom? What is ITS definition of a media capture service? The campus should assemble and widely communicate about a portfolio of supported, recommended, or used teaching and learning tools. This could include a graphical roadmap of educational technology tools and services.

Faculty members should be able to get personal tutoring on a system from resources such as Academic Technology Consultants (formerly DATCs), student assistants (for simpler requests), and possibly a lead-technical faculty member in the department. Although ITS and the Faculty Teaching Excellence Program hold workshops, it is still efficient to reach out to faculty who don't attend them.

The campus should also improve communication about support for accessing libraries resources and it should provide a central service for software licenses so that CU-Boulder can get better licensing rates.

Improve Processes for Selecting & Testing Technological Services Offered to Campus

When the campus rolls out technological services, there is not enough rigor around the design, selection, and user-testing of those services (including the technologies themselves at the heart of the services). Services rolled out by ITS should be user-tested more rigorously before being rolled out. This should include reaching out to other campus IT units and academic units for pilot deployments where faculty and students are studied as they use the service. Some effort should be made to establish standards for supported technologies.

The campus should re-commission the Faculty Examining Emerging Technologies (FEET) group called for in the previous strategic plan. Instead of it being a committee, however, we recommend that it be a loose network of faculty who agree to examine a technology and students and faculty who vote for technologies to be examined. The campus needs to provide people and funding to support this group.

The campus should also provide a sandbox space and virtual space for any faculty member to explore technologies they might want to adopt. As part of the agreement for using this space, the faculty member should agree to provide feedback to ITS on their impressions of the usefulness of the technologies.

Expand and Enhance Existing Support for Faculty Who Want to Use Technologies

The faculty needs even more resources for one-on-one support for using technologies. This includes more support that the Academic Technology Consultants (formerly DATCs) provide. It

also includes faculty-to-faculty and graduate student-to-graduate student mentoring in using technologies. This would imply providing more support to the FTEP and the graduate teacher program (GTP) for mentoring. Also provide support for faculty who want to go deep into learning a technology that is not traditionally supported (i.e. learning a database or programming language).

The campus should investigate the following technologies, which may have an impact on teaching and learning: augmented reality, integrated technology, mobile technologies, virtualization of applications, and three-dimensional video capture and television.

Continue to Support the Following Technologies

The committee feels that the following technologies are fruitful for ongoing support: Learning management systems, clickers, email and calendaring systems, web pages for faculty and staff, (including wikis and 'blogs), social networking applications, plagiarism detectors, projectors, labs including allowing classes to teach there, digital projectors, videoconferencing, and virtual private network connectivity to campus services.

Add Support for the Following Technologies

The campus should consider adding support for the following technologies over the next four years: streaming media; smart boards; document cameras; campus calendaring system and integration; web conferencing (for example WebEx); secure exam-taking software (for example Exam Soft); classroom lecture capture; web-based conferencing; conferencing systems to support other communities such as universities, non-profits, and businesses; web 2.0-based learning management system; improved search engine for the www.colorado.edu site; increased data storage; security options that would allow outsiders to access campus resources; mobile technologies including compatibility among mobile devices; push technologies; web content management; iTunesU; lock-down software for browser use in class; software for verifying identities and protecting identities; and wireless printing.

Long & Short Term Objectives/Timeline:

Year 1: Continue to work on the 2006 recommendations from Chapter 1 of the IT Strategic Plan — Timeline: 1 year. Continue to develop (and market) the "one start" shopping model of 5-HELP, web resources, and portal — Timeline: 1 year. Establish a process for phasing out dates for centrally supported technologies — Timeline: 1 year. Improve communication about technological services available to the campus — Timeline: 1 year.

Year 2: Improve processes for selecting and user-testing technological services to be offered to the campus — Timeline: 2 years

Year 3: Establish criteria for recognizing faculty members' use of educational technologies and implement a program to recognize them — Timeline: 3 years

Expand support for, and services in, visual interactivity, file storage and sharing, widely adopted technologies, and discipline-specific technologies — Timeline: 3 years

Year 4: Expand and enhance existing support for faculty members who want to use technologies — Timeline: finished in 4 years.

Possible Risk

This committee identified a number of risks inherent in adopting (and not adopting) the recommendations in this chapter. These include funding risks, communication risks, cultural

risks, and support risks. Our support risks are divided into analysis risks, and vendor-related risks.

Funding Risks

Funding risks include the ability of the campus to implement the suggestions described in this chapter may be negatively impacted if enrollment changes dramatically. If the campus adopts certain teaching and learning tools, there may be hidden costs (open source, service contracts, maintenance fees).

Communication Risks

Communication risks include the possibility of messages sent not being received and understood by campus constituents.

Cultural Risks

Cultural risks include unanticipated consequences from the adoption of a new teaching and learning tool. For example, adopting a learning management system may lock us into working with an ecology of third party vendors that interface with the primary LMS vendor. For example, once you are invested in the world of Blackboard, their SafeAssign tool makes sense financially, but it may not be the best tool to use. Another cultural risk is a backlash against a teaching and learning tool if it was not vetted appropriately ahead of time. A further risk is that some technologies might be used in ways that could bring harm to users. For example if Excel files are kept on unprotected hard drives, FERPA data may be exposed to people who want to steal that data.

Analysis Risks

Analysis risks include that the campus may inadequately assess campus need, and thus "miss the boat" with tools it supports. That is it may pick the wrong tool for the wrong audience or situation. Additionally, the campus may over- or underestimate the need that supported tools are envisioned to meet. Without a careful analysis of tools to be supported, the campus may end up with duplicated tools or redundant tools being supported.

Vendor-Related Risks

Vendor-related risks include that the campus may find it attractive to purchase licenses from third party vendors and then find itself not able to be as flexible with the tools provided by that vendor. The campus may settle on one or two vendors and find that those vendors have too much control over our budget outlay or services to the campus. Conversely, the campus may work with too many vendors and find that it's ability to manage relationships with vendors is strained. Vendors may discontinue support or force us on an upgrade path that isn't ideal for the campus. Finally, vendors may change direction in the services they provide, thus leaving us with fewer attractive reasons for working with them.

Resource Allocation

Cost of the project: This committee did not feel it had the knowledge of resources that would be needed to implement its recommendations.

Responsible Parties

The AVC for IT and CIO should establish a Technology Advisory Group (TAG) that reports to the CIO for the purposes of advising ITS on technology policy, investment, and support. The TAG should be comprised of faculty and staff who have both expertise and interest in using

technology. The TAG's charge should be to provide advice regarding the development and implementation of coherent, efficient policies that support both the innovative uses of technologies as well as effective dissemination and implementation of established technologies. All constituencies on campus are responsible for effective implementation of technologies to support research, teaching, and service mission of this campus. So the AVC for IT office should provide support to assist these constituencies in assessing the effectiveness of their technology support programs.

Evaluation

Evaluating the recommendations listed here is very important. A coherent approach to evaluate any technology policies, processes, or tools should consider:

- (a) the quality and appropriateness of an adopted technology,
- (b) the quality and impact of its dissemination, and the
- (c) the impact of the technology on outcomes (e.g., student learning, faculty research, work productivity, and/or service/outreach).

We encourage the campus to develop incentives as well as specific measures that promote faculty and departments to evaluate more effectively and systematically the use of technology to support student learning.

The campus should establish a function to evaluate the effectiveness of teaching and learning tools. This should be applied to tools being considered before adoption (see the recommendation from the 2006 ITSP on the Faculty Evaluating Emerging Technologies (FEET) group.

This function should also be applied to tools and services being supported currently. Findings from this function should be shared with the entire campus and should be a major source of input for the IT governance group and the various groups on campus who are involved with faculty development. Just as importantly, findings from this function should be used as input by campus-level program managers in deciding which tools and services will be retired and which ones will be launched.

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Chapter 2: Creating Mechanisms for Shared Research & Support

Chapter 2 addresses how campus IT may best serve and support the research endeavors of CU-Boulder students and faculty and encompasses specific reports addressing research computing and cyberinfrastructure, cloud computing, mobile computing support services, rich collaboration tools, increasing staff efficiency and effectiveness, web infrastructure, and improving the IT service model. The reports concerned with developing mechanisms for shared research and support provide suggestions and guidelines for ensuring IT serves the mission and vision of collaborative, forward-thinking, and competitive research at CU-Boulder. Each report makes a contribution to envisioning CU-Boulder as a world leader in pioneering research.

To that end, individual reports articulate the resources required to support research including a central data center for facilitating research computing, cloud computing applications, convergence strategies for mobile computing and appropriate support services, network infrastructure and a web hosting environment suitable for providing rich collaboration tools, and central and decentralized support services capable of efficiently addressing a spectrum of resources. Beyond identifying resources and recommended adoption and development, the reports also delineate strategic processes involved in pursuing campus research needs; needs assessment and research concerning current and future tool and resource use, resource and service oversight, and input from campus constituencies are integral components to this process.

2.1 Research Computing and Cyberinfrastructure

Major Issue:

CU-Boulder must expand IT infrastructure and services to support the success of its world-class research activities.

This “cyberinfrastructure” will consist of computational systems, high-performance data networks, extensive data storage facilities and a central data center to house research systems and will include central technical support.

This centralized model will enhance research computing activities and collaborations, allowing researchers to focus on the discovery and communication of new knowledge efficiently, securely, and cost-effectively. Adopting central IT services requires building trust between the research community and its service providers.

Oversight will be provided by an advisory board of research faculty.

A. Background/Rationale

Receiving nearly \$340 million in sponsored research funding during fiscal year 2009, CU-Boulder stands out as one of the premier public research universities in the nation. To maintain this stature, the university must recognize the role that research computing plays in modern scientific investigation and expand its information technology (IT) support for a wide range of disciplines.

Advanced research computing has become essential to the success of faculty research endeavors and as a result can directly affect faculty recruitment and retention. Researchers increasingly rely on high-performance computing for sophisticated simulation, visualization and modeling capabilities both to improve scholarly productivity and to enable discoveries that otherwise would not be possible. Funding agencies now recognize the importance of computing in successful research and tend to assess this component more rigorously when evaluating grant proposals. In addition, outstanding research increasingly requires collaboration on a national and international level, which participation in national cyberinfrastructure initiatives such as TeraGrid can greatly enhance.

“Cyberbinfrastructure,” according to EDUCAUSE, “consists of computational systems, data and information management, advanced instruments, visualization environments, and people, all linked together by software and advanced networks to improve scholarly productivity and enable knowledge breakthroughs and discoveries not otherwise possible.”

The high barriers to entry into high-performance research computing (HPRC) can significantly limit research options. Many departments do not have resources for initial hardware and software costs, on-going maintenance costs, physical and environmental space requirements, and the technical knowledge necessary just to get started. Some research areas cannot overcome these barriers, nor provide the specialized support skills, and thus may lag behind.

Today, many campus researchers address their research computing needs independently, often by way of startup packages and grants. Although these funding sources may cover upfront costs, they do not always address ongoing expenses and support. This approach leads to the

proliferation of small research computing installations which are challenging to maintain and fail to advance the development of a coherent campus-wide research computing environment.

Additionally, lack of adequate space to house computing systems and peripherals impedes the creation of viable research computing solutions, further increasing the number of small, local server farms. This distributed model is not energy efficient, strains building HVAC systems, and encroaches on valuable laboratory and office space. An estimated 40 facilities on campus use supplemental air conditioners which account for approximately 700 refrigerant tons of cooling. The true costs of such installations, borne both by the departments and the campus, are difficult to capture accurately.

Research computing produces large data sets that increase rapidly in both size and number. Effective information management must address secure storage, ownership, control, access, retrieval, transport and preservation to ensure the success of research computing initiatives.

User support for research computing is both a critical component and difficult to solve at the department level. Technical support may run the gamut from system administration to discipline-specific application support and programming. Technical consulting must be done with an understanding of the research processes and needs in specific disciplines, including the humanities and social sciences.

The researchers interviewed for this report appreciate the difficulty in providing effective and sustainable research computing at the local lab or department level. While administering systems and maintaining computing facilities detracts from their primary research activities, the absence of viable campus-wide alternatives has necessitated such involvement.

The development of a center for HPRC and cyberinfrastructure on the CU-Boulder campus offers a solution to many of these issues. Centralization could more effectively support research computing activities, improve efficiency and foster broader collaborations. A centralized support team would likely yield similar gains in efficiency and effectiveness. Improvements to the campus-wide cyberinfrastructure offers greater options for integrating research efforts with national research initiatives, thus increasing opportunities for partnerships between individuals, as well as with other research universities, national centers, and private industry.

In creating a centralized research computing model, however, the campus must address a number of outstanding questions. Researchers want to know what forms of security and access controls would be in place, how use of systems and access to a shared technical support team would be prioritized, and how control of common systems and data ownership would be addressed. Clear rules must be established and guidance provided on all these questions.

B. Accomplishments to Date

The offices of the VC for Research and the Associate VC for IT & CIO have established a budget to support a Center for Research Computing and Cyberinfrastructure, including operating funds and staffing.

The university has been awarded an NSF grant to acquire a supercomputing instrument (NSF cyberinfrastructure Track 3) to be deployed in the summer of 2010.

The university is in the process of purchasing a commercial building in the Research Park on East Campus. This building is suitable for the development of a data center to support high performance research computing.

Action Plan

C. Explicit Assumptions

The culture of researcher autonomy and self-funding requires that, to be successful, solutions must reflect voluntary participation, benefit the individual as well as the larger research community, and not diminish current ownership, control or access.

The development of central research computing resources and infrastructure will have economic advantages to the campus and to individual researchers and their departments.

The availability of central resources, including technical support, will open up new opportunities for research disciplines that have had limited access to cutting-edge computing technology.

An emphasis will be placed on developing cyberinfrastructure and support to enhance research effectiveness and efficiencies in the humanities and social sciences.

A funding model can be developed that is transparent, fair, agreeable to the funding agencies, and provides predictable costs that can be planned for.

The development of central research computing resources will serve as an intellectual “watering hole” that fosters greater cooperation and collaboration.

A central data center facility and support staff can effectively meet the diverse needs of the research community while realizing economies of scale.

The development of a central data center will enjoy broad support beyond the researchers themselves because of improvements in energy efficiency, reduced impacts to building HVAC systems, stronger security, and the ability to recover laboratory and office space on main campus.

To foster increased trust over time, the IT service provider must listen intently to the needs of researchers, preserving transparency in decision-making, and delivering on promises.

D. Specific Recommendation

1. Create a committee made up of research faculty to oversee development of central research computing resources and to provide continued oversight of the initiative to ensure that it meets the needs of campus researchers.
2. Develop a funding model to sustain centralized research computing resources that is transparent, fair, provides predictable costs, encourages integration of IT resources and is agreeable to the research community and their funding agencies.

3. Create a Center for Research Computing, HPRC, and Cyberinfrastructure to develop, maintain and promote the campus' research computing capabilities, and to support our research community in the use of these capabilities.
4. Develop capabilities to support computing-, visualization-, and simulation-heavy research in the humanities and social sciences, including the capability to analyze non-numerical types of data, including visual, textual, geographic, and audio.
5. With input from key stakeholders, establish a central research computing data center that meets the research community's unique requirements for capacity, flexibility, efficiency and security; that accommodates central and independently controlled systems; and that provides the requisite staffing to effectively perform primary support functions.
6. In order to meet the elevated demands of research, improve the reliability of the campus network and its capacity, both intra-campus and to the outside world. Mitigate competition for bandwidth with other network users through segregation and/or traffic management to achieve higher and more predictable performance.
7. Ensure that necessary archival data can be preserved in a usable form in perpetuity.
8. Provide means to further integrate research efforts with national efforts, including participation in national cyberinfrastructure initiatives such as TeraGrid, thereby increasing opportunities for partnerships between individuals, other research universities, national centers, and private industry.

E. Long & Short Term Objectives/Timeline

Short Term: Create an oversight committee made up of research faculty to help guide the development of a research computing center and the policies and procedures that will govern the use of common facilities and resources. Communicate plans and solicit additional faculty input.

Short Term: Draft a charter for a center for Research Computing, HPRC, and Cyberinfrastructure, articulating its function. Define and hire the requisite staff positions.

Short Term: Develop a funding model to sustain centralized research computing operations and communicate the details to stakeholders.

Short Term: Deploy the MRI supercomputing instrument.

Medium Term: Determine locations for new technical staff offices

Spring 2011: Increase network reliability and capacity, both internal and external. Pursue architectural and traffic management strategies to mitigate competition for bandwidth and consistently meet the needs of the research community.

Spring 2011: Renovate space and build infrastructure in a soon-to-be acquired building in the Research Park on East Campus for a data center to support research computing.

F. Possible Risk

- Lack of trust in the centralized model or in IT service provider prevents widespread adoption and participation.
- The funding model as implemented isn't sufficiently fair and cost-effective or does not garner the funds necessary to sustain this initiative.
- The benefits or attractiveness of a centralized approach have been overestimated and it is not embraced by the research community.
- The central research computing resources serve the needs of some disciplines well, but do not meet the needs of others, therefore becoming only a partial solution for the campus.
- The campus does not achieve the desired consolidation and efficiency gains because the increased data center space only adds to existing distributed data centers rather than replacing them.
- The board and IT service provider cannot formulate fair methods of providing access to computing cycles, data storage and technical support staff.
- Providing user support in a typical helpdesk fashion rather than as proactive and collaborative advanced technical consulting will diminish its effectiveness in supporting research projects.

G. Resource Allocation

Cost of the project: The cost of this project is expected to be high. This is, in effect, developing and staffing a center for research computing and cyberinfrastructure, deploying a supercomputing instrument, developing a data center to support research computing, and improving data storage, data management and networking.

Establish the funding requirements and determine how facilities and services will be supported through a mix of GF, direct and indirect cost recovery.

H. Responsible Parties

Vice Chancellor for Research, Associate Vice Chancellor for IT & CIO, Campus IT Security Office, Information Technology Services, Facilities Management, Research Building Systems, and later the Research Faculty Oversight Committee.

I. Evaluation

- Determine if the number of successful grant proposals increases.
- Determine if the number of grant proposals from underrepresented academic and research disciplines increases.
- Determine if the number of distributed/local server farms decreases, or at least stops expanding.
- Evaluate the university's energy savings due to consolidation of systems into a more energy-efficient data center.
- Evaluate the continued viability of the established funding model in terms of sustainability and perceived fairness to participants.

- Evaluate the benefits to expanding research collaboration, both internal and external to the university.
- Evaluate adoption rate of centralized services and level of satisfaction of users.
- Gauge compliance with policies governing the use and storage of sensitive data as a result of centralizing services.
- Evaluate the success and value of data management and preservation methods.

2.2 Facilitating Cloud Computing

Major Question: How can we embrace cloud computing and effectively enhance the academic, research, and service missions of the university by providing guidance and services while minimizing costs and risks?

A. Background/Rationale

Clouds by definition are fuzzy objects without clean boundaries and defining what is/is not cloud computing is not straightforward. We adopt the NIST definition of Cloud Computing¹ "Cloud Computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction." Cloud Computing is an emergent technology. It promises flexibility with access as needed and only as needed to resources. The pooling and centralization of these resources and the resultant economies of scale will provide these resources more cheaply to users than buying and staffing their own dedicated facilities. Since the cloud provider will be responsible for updating the software, new features are likely to be available more quickly and mobility is designed in because services are designed for distance use. Finally, working within a cloud should help users become more active more rapidly because they will have less to set up to get started.

The question is not if we should pursue cloud computing opportunities rather how to best take advantage of what clouds will offer. There are already significant numbers of people on campus benefitting from cloud computing and they roughly divide up into students, administrative/clerical staff, educators, and researchers. Each group has different requirements and presents different levels of security needs. The newness and the complexity of these cloud based technology systems means that many users are relatively unaware of the risks; if data stored off campus by a third party cloud is lost or private information compromised, for example, the campus may still be held liable. So, as a campus we need to understand how to take advantage of cloud computing in a way that maximizes its value and minimizes its costs.

The types of cloud that may be used can be classified by their extent, by who controls the infrastructure, and by who has access to the data. What type of cloud is used by a given application on campus will depend on issues such as how private is the data (e.g. is proprietary research or student personal data involved?), who needs access (e.g. students in a class, research collaborators across the globe), and who participates as resource providers (for example, academic libraries could share access to resources and avoid duplication). The cloud terminology used in the literature is rapidly developing and has not settled to a clear consensus. We decided that rather than provide an extensive review we would provide as an example a few specific deployment models. Again using the NIST nomenclature, these fit into four broad types:

- *Private* - these clouds are operated solely for an organization
- *Community* - these clouds are used by several organizations or support groups with shared concerns
- *Public* - these clouds are available to general public or very large organizations, and

¹ The NIST Definition of Cloud Computing - Authors Peter Mell and Tim Grance, Version 15 10-7-09. This is essentially the same as the Burton Group definition "The set of disciplines, technologies, and business models used to deliver IT capabilities (software, platforms, hardware) and an on-demand, scalable, elastic service"

- *Hybrid* - these are systems composed of two or more clouds that remain unique but share some standardization, allowing for data and application portability and the option of cloud bursting/load balancing between clouds.

We would like to stress two things. First, we are dealing with a continuum here of options rather than clear distinct classes – we are taking advantage of the NIST definitions to help clarify the different ways that clouds may be used on campus rather than to say these are the only ways clouds can be used. Even when referring to a particular deployment class there is a range of possible implementations (depending on who provides the hardware, who is in charge of authentication, where the data resides etc.) Second, this is an area where it is especially important that terms are defined before use (when we provide a case study we will include any specifics about how our group is interpreting/developing the NIST deployment models). For example, “private” could indicate to a user that access to their work is restricted to people they choose to allow access to while to technical developers it could mean that the servers and data storage devices are located on campus and under local control.

Publicly hosted cloud services, versus privately hosted cloud services (separating the service from the architecture), are already used by faculty, staff and students at the University of Colorado. Indeed, it is becoming hard to think of systems or examples of computer usage that are not likely to involve some form of implicit or explicit cloud use – very few computers are without a network connection to the web. These services are popular because they are free or low cost, available on-demand, easily scalable, elastic, and offer rapid development. The majority of these services allow for features such as; access at any time and in any location with internet access, user access controls so they can share with others online quickly, and easy collaboration with others online. The use of cloud technologies allows users to have online centralized file storage, use online digital media storage (including image, audio and video), create online group editing spaces, rapidly develop short and long term websites, manage conferences including paper submission, and review, provide online creative brainstorming and thought/idea/research organization, develop online web sites for growing and evolving bodies of knowledge (while tracking user changes to data), encourage mentorship between industry professionals and students through online professional/educational networks, and make decisions using online forums for discussion and planning.

It is likely that students will benefit significantly from using Software as a Service (SaaS) applications such as email, file storing/sharing. The services provided to the students through SaaS are likely to have limited liability and should be relatively easy to deploy with an implementation mostly transparent to the user. These services are good candidates to be deployed initially. A partial list of software and services already in use includes Dropbox, Flickr, Free SharePoint, Google Apps, Microsoft's Conference Management Tool, Mindomo, Ning, PBwiki, RegOnline, SkyDrive, Viddler, VoiceThread, Wordpress Online, and YouTube. In addition, some tools that are gaining wide acceptance around campus are also cloud based including Doodle, Google Docs, Zoho, and Zoomerang. Amazon is moving into the hardware as a service (HaaS) arena by providing client servers. As cloud computing permeates the organization as a supportive resource, private clouds will become instrumental in providing cloud resources where risk, or other limitations inhibit the use of public clouds. These private clouds may be provided virtually, by an industry provider, or may take an inner cloud approach, where the service is provided locally, but adopts a cloud service model as described by NIST.

The impact of cloud computing on research is harder to assess since many potential tools are still in a development phase and may not become readily available for the foreseeable future. One approach for research computing could be to keep the data storage on campus but to take

advantage of the computational power available in clouds. The collaborative editing of documents is already possible. Longer term there may be increased use of "Platform as a Service" clouds but here there are limitations imposed by the services provided by the vendor. For CU researchers collaborating with outside groups assurances have to be made that their collaborators will not be limited in their interactions with any cloud used by those CU researchers. These interactions could require accessing data (relatively easy to solve) or developing and using specific tools. Depending on how specialized the environment is where the tools are developed it may or may not be feasible for outside collaborators to use these tools without full access to the same environment.

Since the potential impact of cloud computing is so broad we expect that the use of cloud based resources will have a major impact on all of the Flagship 2030 goals. We anticipate that the use of virtual, cloud supported classroom spaces will directly impact our educational mission (this is already beginning to take place) and may provide new ways to support outreach to the more remote parts of our state. Since many resources will be accessible using only a computer terminal and a keyboard it will be easier to work offsite than ever before, this will make it easier to continue key functions in case of a campus closure due to weather or a major outbreak of a pandemic disease. The fact that some resources are offsite has implications for disaster recovery planning and will provide for more flexibility in work options including telecommuting that will allow us to better address work/life balance needs for staff (investing in staff) and faculty. In addition, the improved ability to collaborate across distances will help the campus research missions and the make the campus have a broader global presence and allow for new ways to impact the state and the world.

We need a strategy for a phased approach to the adoption of Cloud Computing on campus that will position us strongly in the "fast follower" category while minimizing costs and risks. We should look first to the possibilities of the cloud when developing new services or replacing obsolete software/hardware rather than initially looking at moving services that are working reliably. We need to identify the key questions that will determine if cloud computing can address a particular need and what type of cloud will be appropriate for that application. The academic environment means that the risk of independent adopters is high (sometimes termed "Shadow IT"). Rather than take a punitive/proscriptive approach we recommend that the campus central IT organization look for ways to encourage use of campus standards compliant cloud services by considering options such as easily available and/or enhanced support as well as highlighting users who have benefited from clouds that are provided to them at low cost and comply with campus standards for adoption. We would point out that the background of cloud vendors can be an indicator of their likely strengths.

Interested readers who would like more information might next go to some of the general articles that have helped shape the approach of the C⁴ team (CU Campus Cloud Computing group). In particular, "Defining Cloud Computing" – a Burton group reports by Bob Blakely, Drue Reeves, and Chris Howard, "Demystifying Cloud Computing for Higher Education" an Educause Report by Richard N. Katz, Philipp J. Goldstein, and Ronald Yanosky, and "Cloud Contracts and SLAs" from Information Week:analytics by Jonathan Feldman are good starting points.²

B. Accomplishments to Date

We have studied some potential applications of cloud computing to help clarify the benefits and potential problems. One particularly active area of current study is a pilot program to set up a

² These documents are available on the wiki at <https://itswiki.colorado.edu/display/itplan10/Home>.

private cloud to be used by participants in the Engineering Honors RAP. The purpose of the pilot is to assist in evaluating possible private cloud usage for learning and/or teaching, assist in surfacing issues surrounding private cloud deployment (specific to CU-Boulder and common to general deployment), and provide a possible model for part of the campus deployment process. This collaborative pilot includes three units; Academic Technology (Kimberly Edwards), Engineering Honors Program (Scot Douglass), and Housing and Dining Services (Alfred Roberts). We see this as an outcome representing a confluence of many agendas including flagship 2030 and believe this supports the mission of the University. The Housing IT Department will be allowing the use of infrastructure that has been provisioned for administrative users (500-700 staff members). The extended capacity used by the pilot will not impact the administrative use or mission.

The pilot project will provide virtualized applications and/or complete virtualized desktops to 50-60 Engineering Honors students. The applications available will include those specific to the needs of engineering education, *if licensing allows*. Students will be able to log in to a virtualized desktop and have ubiquitous access to applications and shared space for collaborative learning. It is a self provisioning model. All that is needed is a list of user names. Students will go to a URL such as enghonors.colorado.edu, self provision and then login to see their customized environment. We see that this model could lead to shared storage, document repository, and virtualized applications; essentially a more comprehensive application services environment. A timeline has been created that would allow the pilot to go live on August 1, 2010.

The planned support model is a mirror of those typically used for pilot projects because users are seen as beta testers for the system. Students have less difficulty with this model than the average campus user and make a good test audience. There will not be a service level agreement. Instead, there will be a general memorandum of understanding which describes what is intended for the pilot and states that there is no guarantee of service availability although the goal is for the pilot to be available 100% of the time. This pilot will help us develop a better understanding of how provisioning within the cloud works.

A key issue raised by this pilot though is how software licensing will be handled for the virtualized environment. Licenses are often attached to a machine and not a user. This specific concern is one of many legal issues which are raised by the use of clouds. We summarize the status of some key issues below and have made specific, related recommendations to address the issues raised.

Electronic Discovery and data tracking/auditing

Cloud computing vendors often transfer data among multiple servers making it more difficult to track. In the event of an audit, the ability to show how and where information has been altered and how and where it has been accessed is important to show data integrity. Also, if CU is sued or reasonably anticipates litigation, federal law requires a "litigation hold" and retention of all data relevant to the litigation. It further requires CU to produce an audit trail to demonstrate compliance with the litigation hold.

Privacy and Data Security

Unlike a traditional outsourcing relationship where customer information is often segregated on a single server, cloud computing vendors cannot segregate data. Once data is transferred from a traditional server to the cloud, CU must rely upon cloud vendors and sub-vendors (unless CU is providing its own private cloud) to protect student education records protected under FERPA

and other private data such as financial aid information protected under the Graham-Leach Bliley Act.³

Non Negotiable “Click wrap” Agreements

Cloud vendors, particularly those using “click wrap” agreements, often seek to allocate the majority of risk to the customer by limiting their liability for certain types of damages and requiring the customer to defend and indemnify the vendor if the customer’s use of the vendor’s services results in a lawsuit. Additionally, vendor agreements often specify that the law and jurisdiction of another state or country govern and the customer must agree to arbitrate any contract disputes.

Service Levels and Transition Services

In traditional data outsourcing agreements, customers and vendors often agree upon specific levels of service. Cloud vendors often establish service levels applicable to all customers because it is difficult to set different service levels for “tenants” of the same cloud.

Action Plan

A. Explicit Assumptions

The availability of Clouds means that they are being used and will increasingly be used. The campus needs to have central guidelines in place soon to help structure adoption and minimize risk. As clouds become more and more useful the types and numbers of applications on campus will grow. We anticipate that the legal situation will need continual monitoring. We foresee close interactions between campus IT professionals and members of the Office of the University Counsel to ensure that there are negotiated agreements for the use of popular cloud services that allow campus users to take advantage of these services while being in compliance with state and federal regulations. We are also assuming that the campus central IT organization will actively promote the use of services that the campus has negotiated agreements with.

We expect that any external cloud vendor we work with will adhere to the principles of universal design and ensure that accessibility requirements are met or exceeded. Similarly services provided within a cloud need to be accessible. The reactions to the difficulty of using the Kindle device if visually impaired highlight the need to make sure that any technologies adopted need to be considered from a diverse set of perspectives. However, moving towards greater centralization and/or fewer user interfaces should make it easier to monitor for and ensure compliance.

We also see benefits to cloud usage from the perspective of sustainability. Cloud resources can be sited in locations with good availability of energy from renewable sources. In addition, since resources can be adjusted to meet demand, there is less need to purchase resources based on peak demands and less concern about resources lying idle at other times. One of the criteria for selecting cloud providers can be how they deal with the recycling of obsolete equipment.

As well as providing a greener way to address IT needs, clouds can help with the provision of other sustainable practices. In the Fall of 2009, a committee including participants from CU Parking and Transportation Services and the Environmental Center engaged Zimride to provide an online ride sharing solution for students, faculty and staff. The committee evaluated several

³ There is an existing Administrative Procedure Statement (APS) giving the guidelines for data and record retention

options including operating their own web site using open source software but were able to negotiate agreeable terms with Zimride by sharing the cost with other local institutions. Zimride offers its campus edition as a cloud-based SaaS. Using Zimride had the added benefit of offering an expanded potential user pool.

B. Specific Recommendations and Overall Strategy

The adoption strategy for the campus should be a phased approach:

- Build Expertise
- Identify possible IT applications that are candidates to migrate to the cloud and prioritize
- Set clear adoption principles that include checking for alignment with campus goals
- Migrate some applications and evaluate
- Continually monitor the legal situation and rapidly changing case law

Expertise and Influence Development

The campus IT group needs to **develop a cadre of experts** on cloud computing to stay abreast of issues such as vendor relations and feedback, assessing legal implications, monitoring and influencing interoperability standards, cloud evaluation, and following and responding to usage trends. We suggest calling this group C⁴ (CU Campus Cloud Computing).

The campus should provide a crowd sourcing facility for campus cloud users/interested parties. This could include a way to rate applications (like the five star system used by trip advisor and book review sites). Membership should be drawn from a diverse range of campus communities (faculty, admin, student services, library, academic technology, site licensing....). The IT group should help seed the development of this group, but not be central to managing/operating it to encourage broad development of ideas and concepts and help ensure wide buy-in. The goal is to encourage open-thinking by making the group largely self-organizing in the hope of developing an entrepreneurial and cost efficient approach. There are likely other community needs that could be met by such a facility for other campus IT services.

Look for local outside collaborators (NIST,Google) and connectors such as L3D – lifelong learning and design.

Central IT needs to provide local infrastructure and services in ways that will facilitate cloud adoption (for example, handling identity management and endorsing a standard based approach).

Campus representatives must participate in **guiding the early development of infrastructure and standards**

Need to ensure academic needs are not ignored.

Campus representatives need to be part of *and active in* the organizations such as the Common Solutions Group (CSG) which comprises of the 25 top research universities in US, and the Open Cloud Consortium and looking for coalitions and alliances with similar interests (such as other state institutions bound by similar liability laws and other Research Intensive universities) Campus representatives at the Burton group Catalyst meetings (next - San Diego, July 2010) should include people from outside IT central – eg academic technology reps, faculty to broaden the knowledge base.

Identify Candidates for Migration

Look at each key campus IT application that is a candidate for migration and decide if the application can be moved.

We recommend that the first applications that the campus considers using cloud resources to provide should either be new to campus, required upgrades of existing systems, or replacements for systems that no longer function well. Until the campus has more experience and understands the costs/benefits of migrating to cloud services better we suggest not changing systems which are up and running well. We also recommend that applications that involve sensitive data (such as student grades or personal information) not be considered initially.

For applications that pass the initial selection and are serious candidates for migration follow the current practice of developing a roadmap that identifies what resources are required (and impact on current resources such as campus networks), how the application will be migrated, provides a reasonable estimate of internal and external costs, does a risk assessment, decides on a single or multiple vendor approach, and looks for application dependencies and interdependencies.

Provide guidance by outlining models of cloud usage that follow best practices. Since there are so many types of clouds that can be used it will not be possible to predict all possible issues that any cloud usage will involve in advance. Therefore, a few specific models of cloud usage should be studied in detail to develop an overview of the most likely issues that users will need to consider – these models should be chosen to help map out key parts of the space so that many of the other applications can easily interpolate between these models to get a quick impression of what they need to consider.

Look for applications that integrate well with existing software while recognizing the diverse nature of campus computing.

Avoid proprietary solutions.

Given the specific restrictions on contracting for cloud services that arise from the state constitution it is important that one of the aspects studied/discussed is how compliance and any other legal issues will be addressed.

Set Clear Adoption Principles

The campus should develop a standards based process for evaluating cloud providers. This should include a list of questions that all vendors must address to be considered. The process should be repeatable and rigorous and able to evaluate, assess and deploy clouds. The campus may choose to adopt or adapt a process provided by expert consultants (such as the Burton group) while ensuring that the process allows for assessing the total costs/realistic costing of cloud vendor services.

CU must ensure that all cloud vendors' security procedures comply with federal and state law and all vendors contractually commit to maintain a specific level of security. Because the State Controller's fiscal rules and the Colorado Constitution prohibit CU from agreeing to indemnify another party, to arbitrate contract disputes or to agree to be governed by foreign law, CU must

negotiate to shift risk back to vendors and to edit indemnity, arbitration and choice of law provisions to comply with state law.

CU should negotiate specific levels of service and the right to terminate a vendor services agreement or receive adequate monetary “credits” or damages when a vendor’s performance falls below standards established in an agreement. Further, CU should develop data exit strategies and should include in all services agreements a plan for locating, extracting and migrating data back to CU servers or to a different vendor. It is important to consider how to enforce these agreements if need be – that is, what tools CU can use in such a situation if it develops. As part of ensuring this, the campus will need to consider exit strategies in advance to avoid vendors feeling that CU has no alternative to continuing to work with them.

CU should ensure that any cloud vendor can accommodate audit trail and litigation hold requests and do so in a timely manner.

The campus should only invest in applications that provide future portability- adopt open standards requirements to ensure transferability of applications to another provider. CU should also look for vendors of services hosted within clouds that can work in a variety of settings. The campus should encourage the use of clouds by offering efficient, financially attractive solutions for the majority of needs of campus users. The campus also needs to stay abreast of individuals’ usage of clouds by investing in internal research to identify emerging conversations and efforts. Make “Shadow IT” unattractive through marketing strategies like “float away on the CU cloud” and by helping units modify/adapt centralized solutions that are not a good fit to their needs.

Specific recommendations related to Risk Mitigation/Legal Issues

Given the specific restrictions on contracting for cloud services that arise from the state constitution look at models for addressing liability that will allow easy compliance. For example, could the equivalent of a landlord/tenant model which limits the liability of the vendors and allows the campus to insure itself against some amount of risk be developed that would satisfy the legal needs?

Task a group to look at how best to wrap cloud services to control access/encrypt data being sent off site and look at general strategies to mitigate risk.

Develop appropriate policies and enforcement mechanisms to minimize risk and ensure meet compliance requirements.

Consider looking at risk from the perspective of different campus user groups (students, faculty, administrative staff) as well as by specific applications.

Using cloud based systems may challenge current licensing models which are often linked to a particular machine rather than a particular user. Negotiations of any new licensing agreements should consider the possibility of cloud usage and incorporate this option.

C. Long & Short Term Objectives/Timeline

Immediate:

Identify critical stakeholders and develop cadre of cloud innovators and experts that interact regularly. Charge this group with developing a more detailed plan including a list of roadmap questions and evaluation criteria.

Look for possible local collaborators such as participants from NIST and Google. Look for “connectors” between efforts.

Short Term:

Develop a list of questions/guidelines to identify and prioritize candidates for migration.
Develop and evaluate the RAP prototype.

Medium Term:

Have a rigorous and reliable process for migrating applications to the cloud

D. Possible Risk

There are certain inherent risks to University data when utilizing cloud services. If the provider fails, is purchased, or changes the terms of service access to University data may be adversely impacted. Some provider agreements may not protect, or even transfer to the provider, intellectual property rights.

Those who are arranging for cloud computing service may be under the impression that they are transferring risk to the provider. However, unless the provider agreement explicitly addresses security requirements risk still remains with the campus. To both protect University data and transfer risk requires establishing a contract with the third party to appropriately articulate required protections.

We are in the infancy of this field – which providers and systems will survive through to maturity is not clear. So, in general, consideration of recoverability issues from provider failure and transportability to other providers is important. This means that attention needs to be paid to sustainability and the trade-offs involved in engineering in any dependence on a specific product or feature. CU should avoid entering into markets where arbitrage seems to be in play.

E. Resource Allocation

It is very important that the IT group and the Campus administration recognize the need for an upfront investment in cloud computing and that this investment will initially focus on allocating human resources to planning, evaluating, and developing cloud based applications. As part of this, the IT group needs to be paying attention to the skill set it needs to be hiring and developing so that the human resources allocated are able to be most effective. The likelihood is that this investment will be repaid with a good return – but the savings will not be immediate.

Given the wide range of services likely to be provided and the variation in the users of these services it is likely that there will be many models for funding these services. Once the funding requirements are established consideration will need to be given to if the service will be supported through the GF or on a cost recovery basis or by a mix of these.

The costs will be very dependent on the details of the model adopted and the application. To give some idea of the range, a ballpark cost estimate for a private dedicated cloud facility puts it in the \$1M region if there is little or no existing infrastructure present, decreasing to around \$500K if significant datacenter and networking infrastructure is already in place. At the other end of the scale providing a server and a reasonable amount (about 100GB each) of storage for around 50 users would currently cost around \$10K. Some things that will need to be considered in the cost model are licensing, the delivery infrastructure/network needs, storage requirements,

vendor support, development needs, and providing long term support. It should be noted that while cost savings may be achieved in many service elements, networking costs should be expected to rise as cloud computing nearly always place a greater burden on the network.

F. Responsible Parties

ITS Program Management Office, Legal counsel, Campus-wide Governance Group.

G. Evaluation

- Need to set up a group to discuss and develop strategies.
- Look at if the tools can be shown to actually help the units function, e.g. Does Doodle have demonstrable advantages over a central calendaring tool? Does Voicethread increase student learning?
- Develop a metric representing the ratio of campus standards based cloud computing to un-vetted services.
- Monitor number of users of key cloud services and develop measures of the adoption rate of centralized services and the level of satisfaction of downstream data users and data owners.

2.3 Campus Strategy for Mobile Computing Support and Services

Major Issue: Handheld, or “highly mobile,” communication and computing devices are currently pervasive among campus faculty, students and are already integral to students lives and campus business. CU-Boulder must plan for these devices being ubiquitous, increasingly more capable, and the assumed method of interaction with many, if not all, on-line information and collaboration services.

A. Background/Rationale

Cellular phones with cameras, texting and multimedia messaging are currently lowest denominator devices among CU-Boulder faculty, students and staff. According to the most recent statistics from Comscore (see <http://comscore.com>), nearly 30% of all cell phones are used to browse the web and this is an increasingly upward trend. It is safe to assume that within the time window of this plan all campus constituents will have increasingly powerful mobile computing devices with very capable browsers and on-device compute, graphics, and storage.

It's conceivable, if not likely, that in fewer than five years it will be expected that much of the knowledge work, communication, and collaboration that is currently done using “traditional” keyboard/mouse/screen computers be most naturally done via highly portable devices that have high speed network access whether on campus (anywhere on campus), at home, at the park, or studying abroad.

A majority of newly recruited students, staff and faculty will either have a smart phone, a phone that connects to the Internet or will have a text messaging plan. Whether this is true for all students or not, for CU to remain cutting edge, and stay a renowned, technologically advanced, university for recruitment purposes, service geared towards those that have this technology is a must.

The portability and the capabilities of these devices will lead to new approaches in teaching, learning, working, and collaborating that can't be anticipated today. However, there are many scenarios that are not only imaginable, but immediately possible and perhaps even essential in meeting the expectations of today's students, faculty and staff.

Example Scenarios

Student Administration:

- A student, using her phone, drops a course while sitting in the classroom;
- An applicant researches campus and course information at lunch using her phone;
- A student retrieves final grades on phone for mom and dad on the way home from the airport during Christmas break!

Teaching and Learning:

- Student retrieves and views recorded lecture or supplemental multimedia course materials while riding the bus,
- Students use phones in class as “clicker” response units,
- Simple and no-extra-cost point-point faculty-student communication without regard for the location.

Research:

- Field research using GPS capabilities for location finding,
- Collaboration from the field using cellular devices,
- Share licensing and infrastructure costs if multiple researchers need similar software or devices.

Emergency Communication:

- “Push” messages to devices with alerts,
- Location aware messaging to devices alerting people in a particular building of some life/health situation.

Enterprise Communication:

- Replace radio “walkie-talkie” devices with multi-function phones that can use campus or carrier networks;

Landline Replacement (or augmentation):

- Landlines phones in dorm rooms have already been removed,
- Department replaces or augments landlines by providing cell phone to staff.

Barriers to Adoption:

We have infrastructure challenges. A cell phone signal strength analysis was done for all the buildings on campus including residence halls. The results found that the residence halls have some areas with some carriers that have poor reception. Likewise it was discovered that most campus buildings have even more cell signal strength problems. Areas with poor or no signal affects both the delivery of content and communications for students and cause dangerous situations where faculty, staff, students and visitors are not able to use their most on-hand communication devices in the event of an emergency to access services or dial out for assistance.

Smart phones are not yet ubiquitous. According to the [ECAR Study of Undergraduate Students and Information Technology, 2009](#), at least 90% of undergraduates own a cell phone. Some 63% of undergraduates own Internet capable phones or plan to purchase them within the next year. However, only slightly more than half (33%) of those students use the phones for internet access. (This corresponds with the above noted Comscore data). A larger number of students (35%) do not have Internet capable phones and do not plan to purchase one in the next year. Many of those who do not access the Internet with their phones cite the cost of the phones and the cost of data plans as reasons.

On the other hand, according to the ECAR study, 9 out of 10 undergraduates use text messaging with a median frequency of “daily”. It should be noted, however, that currently unlimited data plans from major carriers typically cost only about \$10/month more than unlimited texting plans, so cost isn’t likely to continue to be a factor in whether students use their phones for Internet/web access.

Current applications are not oriented toward mobile devices. The only service specifically targeted to mobile devices is the Rave emergency notification service. Also, students waiting for technical assistance at the walk-in center in Norlin Learning Commons provide a cell phone number and are texted when it is their turn.

Most campus and university administrative applications are web-based and while many of them may display acceptably on the higher-end mobile platforms, very little thought has gone into the mobile experience. Little or no testing has been done to understand how on-line applications (like CULearn, CUConnect, CULdm, the new expense system, etc) work on the various mobile platforms.

Some of the most useful web-based functions that students, faculty and staff might like to access via a mobile device either have sophisticated workflow (examples are the shopping-cart schedule builder in the new ISIS system, and the approval processes in the new expense system) or have a purposeful look and feel designed to work optimally with traditional display/keyboard/mouse in mind. The browser capabilities, display sizes, and user input capabilities on even current state-of-the-art handheld computing devices do not allow for an acceptable end user experience with these applications.

Current university and state policy pose barriers for employees. The administrative burden that currently comes with either accounting for personal use of a university owned device, or business use of a personal owned device are burdensome and act as a disincentive for campus departments or employees to make widespread use of their capabilities as part of doing business.

B. Accomplishments to Date

Some steps have been taken by campus departments in recognizing mobile communication as a currently viable and a growing trend:

- **Wireless carrier coverage study:** As noted above, a study has been conducted to assess cell carrier signal strength in campus buildings. The conclusion is that about 50% of the indoor space on campus has weak, poor, or no service to some or all of the major national carriers (AT&T, Verizon, TMobile, Sprint/Nextel). New, LEED certified, construction is particularly disruptive to cell signals.
- **Emergency communications via SMS:** The campus very successfully uses the Rave notification service to send texts to registered phones in case of emergency or urgent need.
- **Walk in technical service center notifications via SMS:** Students can get technical support or help using their personal computers at the ITS walk-in center in the Norlin Commons. They are served on a first-come first-served basis and during busy times, students use an on-line form to sign in and provide a phone number to text when it is their turn. They then don't have to wait in line for their opportunity to get support.
- **Landline replacement in dorms:** Landline phones are not provided by default in the residence halls. Very few students request one.
- **Nextel push-to-talk phones used by Facilities Management and ITS:** Maintenance workers and other "dispatched" jobs rely on push-to-talk "walkie-talkie" functionality on Nextel phones to communicate with each other and the central dispatcher.

- **Pagers:** Many employees who once carried pagers for emergency contact now rely on text messaging to their personal phones as a replacement (so as not to carry two devices).
- **4.9Ghz Mesh Network Study by Public Safety:** The Department of Public Safety has completed a scope and cost study for implementing a campus mesh network using the 4.9Ghz band (which has been designated for public safety use by the FCC).

Action Plan

A. Explicit Assumptions

The mobile application space is immature and subject to rapidly changing capabilities and uses, evolving standards, and disparate strategies among major hardware and software vendors. Today, the most capable applications are written for specific devices with specific capabilities that are served by specific carrier networks with their own restrictions. **It is our assumption** that web browser capabilities in mobile devices will rapidly improve and adopt open standards such as HTML 5, CSS, and Javascript so that very rich and capable web-based applications that are platform and carrier independent can be deployed, avoiding the need to write for any specific platform.

A challenge for device independence will be accessibility. Some devices, notably the iPhone 3GS and new versions of Android, have accessibility features such as voice screen readers, speech to text, high contrast display settings, and extreme zoom. Nonetheless, care will be needed to ensure adequate accessibility of applications designed for mobile devices, including being sure that these applications are operable on platforms that can be used (for example) by people with motor challenges.

It is also an assumption that, while mobile devices can be an invaluable asset with respect to life/safety concerns, they also present reliability concerns. Batteries die. Signals get disrupted, networks become overloaded, and what is mobile can be dropped, broken and lost. Campus strategy must continue to provide highly reliable land-line telephone service and all safety guidelines and regulations with regard to proximity of a working phone respected.

B. Specific Recommendations

1. Expand wireless coverage on campus so that it is “ubiquitous”. This consists of both expanding the campus wireless network to outdoor areas so that a vast number of devices can use it without incurring monthly carrier data charges AND expanding in-building coverage of the major wireless vendor networks so student/faculty/staff customers of those carriers have signals in basements, stairwells, etc. (This includes evaluating installation of a distributed antenna system (DAS) within campus buildings, assessing use of university owned spectrum in the 2.5Ghz band for WiMAX coverage, and assess deploying 4.9Ghz band coverage across on campus for public safety use.)
2. Immediately start development of a basic set of CU-Boulder branded mobile apps based on the MIT Mobile Web project, within the framework of the iMobileU Initiative. Continue to maintain and enhance this over time.

Applications that should/could be part of an initial suite of applications (in no particular order):

- Campus maps and location photos
- Campus RSS news and announcements
- Bus schedules w/ nextBus tracking of available busses
- Whitepages directory search
- iTunesU
- Open seats in computing labs
- Campus event/academic calendars

Longer-term, we should explore effective uses of location aware or augmented reality applications. An example may be a simple “beacon” application that allows a student to select a building or location on a campus map and then continually points them in the correct direction until they arrive at the selected place.

3. Immediately explore expanding use of SMS text messaging to provide info beyond emergency notifications to include other categories of information pushed to phones as well as some basic information requests initiated on demand by the person sending an SMS information request.
4. Immediately adopt a “convergence” strategy for all current and future web applications that assumes applications will be accessed by mobile devices and plans appropriate changes or additions to the application interfaces.
5. Immediately explore possible changes to administrative policy or processes that make it less onerous to procure and use mobile devices when there’s no easy separation between business and personal use.
6. Establish ongoing management/oversight functions that examine:
 - Emerging technologies and service options for comprehensive wireless coverage on campus for emergency communication and other purposes.
 - Trends in student, faculty, and staff device choices, including evidence about how often services are actually used on devices of different types.

C. Long & Short Term Objectives/Timeline

Short Term (2010):

- Understand options and costs for expanding coverage in buildings.
- Assign some cross-campus resources to begin “playing with” iMobileU platform.
- Evaluate expanded Rave services.
- Draft, publish, and communicate a “guidance” document imploring those who deploy and manage application to start planning for mobile convergence.

Longer Term:

- Have a viable and funded plan for expanding cell carrier coverage into buildings;
- Have deployed an initial suit of CU-Boulder “branded” mobile applications;
- Have an active, cross-campus (cross university?) development and oversight function to facilitate continued development and planning of mobile applications;

- Have a mobile strategy documented for a specific set of key university applications (eg. Campus Solutions, CULearn, etc).

D. Possible Risks

- Possible high cost and complex logistics of providing carrier coverage to interior spaces (current estimate is approximately two million square feet to be covered @ \$1-\$2 per square foot).
- Prioritizing mobile application development as budgets decrease, resources are overloaded, and the ISIS project remains a high priority.
- BUT – there is an opportunity risk: NOT acting on these recommendations and creating a mobile presence has the risk of falling behind our peer institutions and not meeting the expectations of our students and faculty.

E. Resource Allocation

Cost of the recommendations:

As noted above, there is a potential infrastructure investment of \$2M-\$4M to provide cellular coverage within campus buildings; however, we are exploring possible ways of not incurring these costs (having vendors bear them).

If currently owned 2.5Ghz spectrum is not viable for outdoor wireless coverage for public safety use, a proposed 4.9Ghz mesh network is expected to cost \$550K.

Other costs would be in the form of deploying campus resources – an estimated team of 2-3 part-time developers - to create an initial application suite.

Indirect costs would be imposed on other campus application managers by requiring them to deploy mobile friendly versions of their applications. These costs could vary widely, as some of these applications are vendor provided and may simply start coming “out of the box” mobile ready, while others may take considerable effort to “mobilize”.

2.4 Developing Rich Collaboration Tools

Major Issue: An increasing number of collaboration technologies exist which facilitates communication, coordination, and shared content authoring for individuals working in a partnership. Collaborating through these technologies is poised to be a way of life across academia. No consistent approach exists for developing a common collection of collaboration tools across campus –if employed, a consistent approach would improve all aspects of the space including, but not limited to, cost models, support models, ubiquitous access, and robust, scalable solutions.

CU-Boulder needs to progress the adoption and development of functionally rich collaboration tools in four specific areas. 1) The campus community needs one, or more, “shared canvas” tools. 2) The campus community needs one, or more, content and media repository tools. 3) Enhancing communication using video and videoconferencing by embracing greater standardization, support, and deployment of video technologies. 4) Adopting a unified communications.

A. Background/Rationale

Shared Canvas Tools

Shared canvas tools, such as wikis and blogs, have been requested by academics, researchers, and administrative users on campus for a gamut of needs. Students, faculty, and staff rely upon external social networks, such as Facebook or LinkedIn, and external messaging and productivity tools, such as Gmail and GoogleApps, to fulfill needs unmet by CU-Boulder services. Many use cloud sources without consideration of security concerns about data, and many would like to have a campus option.

Content and Media Repository

Sharing content and media such as publications, images, audio, video, or large research data sets presents several technology problems. Solutions for sharing must accommodate broad audiences of both CU-Boulder specific and external users. As with the outsourcing of shared canvas solutions mentioned above, these localized solution may not address security, privacy, and intellectual property issues as completely as a campus solution would.

Video and Videoconferencing

A number of diverse videoconferencing facilities exist today on campus. Some are managed by departments with IT units, some built by a grant with no support structure behind it. Though many installations have occurred, CU-Boulder has not fully developed and supported a videoconferencing service model. Without a standard service model, the campus may see reduced overall value of these videoconferencing investments due to limitations in interoperability, difficulties in supporting more technologies than necessary, and an inability to aggregate equipment purchases in a way allowing for the negotiating of preferential pricing agreements with vendors.

The importance of videoconferencing will continue to rise as access to services becomes more prevalent and as needs for the services increase. Flagship 2030 identifies the development of East campus as a strategic effort that will extend for multiple years. There will be significant needs around collaboration between Main and East campus, sharing data and virtual work

spaces, and virtual transportation. Some researchers have very distinct needs for extremely high resolution communications when working with physical lab equipment or projects. Many different needs, with increasing importance over time, require attention.

Unified Communication

Unified Communications technologies attempt to combine all of the ways individuals communicate, initiate contact, leave and receive asynchronous messages, and communicate their availability and status information into a single, integrated suite of applications. These capabilities become possible through the deployment of a Unified Communications solution, though not all solutions encompass all areas. Each solution provides a unique collection of capabilities.

Unified Communication technologies integrate tightly with voice, voice messaging, electronic messaging, calendaring, and LDAP directories. Since all of these capabilities are offered as campus wide, enterprise services, achieving the majority of Unified Communication capabilities requires strategic investment in a campus wide solution. Individual colleges, schools, and departments have limited ability, and for some of the specific Unified Communication functionality, no ability, to provide these services on their own.

Relationship to Flagship 2030

The strategic plan recommendations for developing Rich Collaborative Tools (RCT) align with specific action items promoted in Flagship 2030. These include the following:

- Curriculum Enhancements
- Developing a New Research Model
- Investing in Our Staff
- Serving the State of Colorado
- Internationalize the Campus

B. Accomplishments to Date

- Reservable locations exist across campus that provide installations of videoconferencing.
- Campus, including ITS, has been researching desktop conferencing tools that can be used across campus, and tie in to the room based VTC (videoconferencing) systems.
- ITS has opened up the Learning Management System, CULearn, to CU Community uses - anyone can request shared canvas spaces and collaborate within them today.
- ITS and faculty collaborators are working on a next generation learning system, that will have sophisticated wikis, blogs, shared data space, federations and partner access, etc. This is in the works for campus rollout for Spring 2011.
- The new capital construction projects, which tend to outfit 100% of rooms with technology, are moving into a more standards-based direction around collaboration tools in the physical space - distance learning, lecture capture, videoconferencing.
- A central, “common good” Microsoft Exchange 2007 service is being deployed by ITS. Many Unified Communications technologies integrate with Microsoft Exchange.
- An iTunesU initiative and a YouTube EDU initiative are underway.

Common assumptions across all four categories of RCTs

Because there are overlapping assumptions across all three categories of RCT, they are highlighted in this section before specific assumptions about each tool is discussed in its own section.

Appropriate funding is needed for RCT; additional or new funding sources may need to be identified.

As much as possible, Universal Design should be considered and should be a feature of any product/service acquired or developed for RCT. ITAG and/or other appropriate review committees should review any campus-wide systems purchased or developed for usability, effectiveness, and section 508 accessibility compliance.

The process for selecting specific RCT technologies should include collaboration and input from campus groups such as the Boulder Faculty Assembly (BFA), Chancellor's Committee on Programmatic Access, and similar groups.

Sufficient support personnel and resources (ITS Tiered support system/5-Help) need to be provided for RCT systems.

As new tools and pedagogical techniques become more popular, new technological and human support systems will need to be developed to close the gap between the new and the existing tools.

Specific Recommendations across all four categories of RCTs

We will treat each of the four main categories of Rich Collaborative Tools in separate sections below. Common areas of concern for all four categories share the following recommendations:

1. Make sure the network infrastructure can handle the increased load of rich collaboration tools, e.g. bandwidth requirements, multi-cast requirements.
2. Develop some level of oversight for rich collaborative tools.

Surrounding issues include:

- Outsourcing tools to 3rd party vendors vs. localizing tools on campus.
- Develop redundant "back up" systems for each tool used.
- Use International Telecommunication Union definitions and other industry standard terms when writing about RCT.
- Keep an eye toward "emerging" technologies.
- All four RCT categories should account for potential emergency communication needs during implementation.
- Emphasize outreach efforts to campus affiliates prior to, during, and after any implementation.
- Reach out to different units on campus to assess their current usage and their needs surrounding the use of rich collaboration tools.
- Should address where any IP (Intellectual Property) protection plans should be reviewed and incorporated in the solutions.
- Develop governance model for this initiative.
- All four RCTs should be treated as enterprise strategies.

Possible Risk across all four categories of RCTs

Given the type of convergence, richness, and shared capabilities of the new tools adopted, educational technology support services and IT security teams will need to work more closely together to bring a wider-angled response to the heightened risks involved.

The adoption of more tools for collaboration also suggests the possibility of more hires at IT security.

Due to the very nature of RCTs, collaboration means students and researchers will share more data, so involvement from the Registrar's Office and the CU Legal Department may be necessary in order to include all FERPA considerations in tool deployment. Since the collaboration involves university owned content, questions about where the content resides and how it can be accessed also need to be raised.

Given that the definition of RCT invariably includes an abundance of video, high-resolution still images, and audio, the risk that it is not ADA compliant is also very real. Section 508 adherence is a must, which means incorporating functional performance criteria in all technology choices; therefore, an abundance of audio and video can pose an economic risk as it may require expensive 3rd party transcription, a technology that will diminish in price over time but currently is a very expensive service.

Evaluation across all four categories of RCTs

- The evaluations for all implementations should be iterative and longitudinal. Data should be derived from all end users: faculty, staff and students.
- Evaluations should be quantitative and qualitative with focus groups as one option for eliciting more qualitative data.
- Faculty Course Questionnaires would be a good means of data collection.
- Pilot programs of any new tool should include a survey, but we could repeat the evaluation later on to have a longitudinal picture of the adoption process. This would enable us to capture the change of attitudes towards the technology and perhaps even why the change occurred.
- Periodically conduct future benefit/cost and investment analysis to justify and document benefits.

B. Action Plan

Shared Canvas

Explicit Assumptions

Identification of currently existing resources would determine commonly used shared canvas technologies to inform the selection process for developing robust shared canvas tool sets. Strategic recommendations for infrastructure and robust shared canvas tool set must evolve from this effort for it to be of value.

Specific Recommendation

- Perform an in depth, campus wide assessment/audit of current shared canvas tools and resources.
- Select and implement one or more shared canvas tools as a “common good” enterprise service available to all CU-Boulder students, faculty and staff.
- Provide adequate infrastructure and scalability to support sustainable growth.
- Develop support and training for the shared canvas solution(s).

C. Long and Short Term Objectives/Timeline

Objectives:

Short term – Assess and plan for implementation and conduct a proof of concept.

Long term - Put in place the shared canvas tools to serve the community. Evaluate for effectiveness.

August/September 2010: Conduct assessment and plan implementation; report due in Fall 2010. The report should include specific recommendations including the evaluation for the implementation.

February/March 2011: A progress report detailing all accomplishments and commitments to date should be issued.

October 2011: Phase I completion date.

May 2012: Evaluation of Phase I.

January/May 2014: Overall project completed along with final evaluation.

Resource Allocation

CU-Boulder needs for RCT will likely require more than one tool. For each tool, there will be high expenditures and personnel resource commitments.

Three tools would require approximately \$150,000 to \$400,000 for the hardware and software infrastructure and 2-3 additional staff for implementing, maintaining, and supporting the tools. Exact figures depend upon the specific technologies selected.

Responsible Parties

ITS, Campus-wide Governance Group(s) ITC, CEC, etc. Organizational Unit Information
Technology support personnel

Content and media repository tools

A. Explicit Assumptions

Identification of currently existing resources would determine commonly used content and media repository tools to inform the selection process for developing robust tool sets. Strategic recommendations for infrastructure and robust content and media repository tool set must evolve from this effort for it to be of value.

There will be some repository tools that need to be local, but there may be some that can be cloud-based. The issue will be to create a set of criteria to determine which data is eligible for the cloud. By default, no data should be stored in the cloud without passing certain security requirements, especially FERPA regulations.

B. Specific Recommendation

Perform an in depth, campus-wide assessment/audit of current content and media repository tools and resources.

Select and implement one or more shared content and media management repository tools as a “common good” enterprise service available to all CU-Boulder students, faculty and staff. Provide adequate infrastructure and scalability to support sustainable growth. Develop support and training for the repository tool(s). This recommendation should be cross-referenced with content management recommendations from sections Offering Teaching and Learning Tools (1.3) and Developing Web Infrastructure Services (2.6).

C. Long and Short Term Objectives/Timeline

Objectives:

Short term – Assess and plan for implementation and conduct a proof of concept.

Long term - Put in place the content and media repository tools to serve the community.

Evaluate for effectiveness.

August/September 2010: Conduct assessment and plan implementation; report due in Fall 2010. The report should include specific recommendations including the evaluation for the implementation.

February/March 2011: A progress report detailing all accomplishments and commitments to date should be issued.

Oct 2011: Phase I completion date.

May 2012: Evaluation of Phase I.

January/May 2014: Overall project completed along with final evaluation.

Resource Allocation:

CU-Boulder needs for content and media repositories will likely require more than one tool. For each tool, there will be high expenditures and personnel resource commitments.

Two tools would require approximately \$100,000 to \$250,000 for the hardware and software infrastructure and 2-3 additional staff for implementing, maintaining, and supporting the tools. Exact figures depend upon the specific technologies selected and the total disk space required.

Responsible Parties:

ITS, Campus-wide Governance Group(s) ITC, CEC, etc. Organizational Unit Information

Technology support personnel

Video and Videoconferencing

A. Explicit Assumptions

Identification of currently existing resources would determine commonly used video and videoconferencing technologies to inform the selection process for developing robust shared canvas tool sets.

Strategic recommendations for infrastructure and robust shared canvas tool set must evolve from this effort for it to be of value.

B. Specific Recommendation

The campus should develop videoconferencing standards for software and hardware and the final choice should be based upon alignment with campus needs, reliability, cost, and ease-of-use.

- Interoperability needs to play a critical role in selecting videoconferencing standards.
- Once standards exist, CU-Boulder should work out deployment and training.
- The campus should invest in tools that connect multiple people “where they are” rather than investing in high-end, very costly “Telepresence” solutions.
- Nevertheless, the campus should remain informed about improvements in pricing for and use of “Telepresence” technology and prepare to deploy as it becomes a standard nationwide.
- The campus should consider a solution that features a combination of fixed and mobile devices.
- The campus should continue/expand CU-Boulder's relationship with CU-Denver's videoconferencing “bridge” facility and invite other CU campuses to participate in such facilities.
- The campus should consider investing in our own “MCU” or multipoint control unit.
- The campus needs to provide for video specific aspects of classroom (peer-to-peer and multi-point and multi-participant), interactive web-based conferencing and lecturing, and high-definition functionality in certain spaces on campus.

Long and Short Term Objectives/Timeline

Objectives:

Short term – Assess and plan for implementation and conduct a proof of concept.

Long term - Put in place the video and videoconferencing tools to serve the community.

Evaluate for effectiveness.

August/September 2010: Conduct assessment and plan implementation; report due in Fall 2010. The report should include specific recommendations including the evaluation for the implementation.

February/March 2011: a progress report detailing all accomplishments and commitments to date should be issued.

October 2011: Phase I completion date.

May 2012: Evaluation of Phase I.

January/May 2014: Overall project completed along with final evaluation.

C. Resource Allocation:

Videoconferencing technologies will require large investments in hardware and software infrastructure as well as personnel time for developing standards, implementing solutions, and training and supporting campus.

A needs analysis will determine how many of the VC rooms the campus should deploy. Each high quality conferencing center could be \$150,000. The more security we build into the solution, the more money it will cost.

D. Responsible Parties:

ITS, Campus-wide Governance Group(s) ITC, CEC, etc. Organizational Unit Information
Technology support personnel

Unified communications

A. Explicit Assumptions

Identification of currently existing resources would determine commonly used unified communications technologies to inform the selection process for developing robust shared canvas tool sets.

Strategic recommendations for infrastructure and robust unified communications tool set must evolve from this effort for it to be of value.

B. Specific recommendations

CU-Boulder needs to research and adopt a standard approach for a unified communications solution, negotiate licensing, and determine implementation, support, and training needs. When considering integrations with telephony versus messaging/calendaring, the campus must decide whether to emphasize enhanced call routing features or the integration of desktop productivity applications for computers.

The Unified Communications strategy must also consider and provide direction for Voice Over IP (VOIP) integration and implementations.

Provide adequate infrastructure and scalability to support sustainable growth.

Develop support and training for the Unified Communications solution.

C. Long and Short Term Objectives/Timeline

Objectives:

Short term – Assess and plan for implementation and conduct a proof of concept.

Long term - Put in place the unified communications tools to serve the community. Evaluate for effectiveness.

August/September 2010: Conduct assessment and plan implementation; report due in Fall 2010. The report should include specific recommendations including the evaluation for the implementation.

February/March 2011: A progress report detailing all accomplishments and commitments to date should be issued.

October 2011: Phase I completion date.

May 2012: Evaluation of Phase I.

January/May 2014: Overall project completed along with final evaluation.

D. Resource Allocation

Unified Communications will require a significant investment. Hardware and software solutions range from \$100,000 to \$500,000 and additional personnel would be required to implement and maintain the service.

E. Responsible Parties

ITS, Campus-wide Governance Group(s) ITC, CEC, etc. Organizational Unit Information
Technology support personnel

2.5 Increasing Staff Effectiveness and Efficiency through Technology

Major Issue: Integrating IT with business needs in a cost effective manner thus increasing staff effectiveness and efficiency. Current challenges are related to a misalignment between technology services and staff needs as each area is often independently addressed or evaluated. While we believe opportunities for quick gains in efficiency and effectiveness exist, long term success ultimately is based on a commitment to shared values, principles, and objectives that consider business needs and supporting technology in a holistic manner.

A. Background/Rationale

The past decade has been one of constant technological change that is often burdensome to staff and faculty. This change has had an impact across every spectrum of staff work, but the most notable recent changes include major budget reductions across the campus, significant enrollment increases, state and federal compliance issues on numerous issues, and the rollout of the new student information system. Campus staff must adapt to these changes, often without the benefit of sufficient resources being applied to address change consequences.

Despite formidable challenges employees have accomplished amazing feats of business productivity with minimal resources. With little likelihood of an immediate improved budget climate and the strong likelihood that the pace of change will only increase, improved operations through efficiency and effectiveness are a necessity.

Shared values, principles, and objectives are commonly considered pillars of success for large organizations. Long term success for any organization requires a common vision and a shared strategy to achieve that success. We recommend the university as well as each campus operation adopt the following principles in delivering information technology services:

- Prioritize business needs and provide supporting technology in a holistic manner.
- Develop a common understanding of what effectiveness and efficiency is.
- Promote and develop the concept of customer service excellence.
- Maximize current technology to achieve immediate efficiencies.
- Reward effective uses of technology and technological standards that promote quality, accessibility, and ease of use.

B. Accomplishments to Date

There have been significant accomplishments in managing and adapting to considerable change; however, the accomplishments that worked well when implemented often don't always keep pace with the dynamic environment. Noted accomplishments include: updated and integrated financial and human resource systems, increased support for mobile, wireless, and cross-campus communication, an increase in "common good" services including improved product licensing, increasing shared or integrated services, and highly visible security policy and communication programs.

Units on campus typically work well together to accomplish campus objectives, but there are points of friction between technology and business needs that have created disharmony. There is a growing gap between the needs of clients, business end users and IT regulatory, security, and standardization requirements. Regulations, security and standardization can place

significant additional burdens on end-users, particularly if they are imposed without first supplying resources and sufficient training, or if they require end-users to create burdensome workarounds.

The gap can be partly explained by the highly diverse needs of a tier one research university. Additionally, the pace and complexity of change has escalated such that workers must become more specialized in their own area of expertise and thus are less familiar with challenges faced by other units. Because expertise resides within both the technology arena and in business systems, linking expertise across organizations and technology support units to provide contextually appropriate solutions and services will mitigate change complexity.

Action Plan

A. Explicit Assumptions

The effectiveness of these recommendations depends on campus leadership at all levels embracing these values, principles, and objectives as central to all business decisions. Campus leadership must establish priorities, assign accountability, and create communication plans that promote collaboration, customer service, and professional development.

Significant new technological investment is not required to achieve the goals of this recommendation; however, we assume that specific individuals will be identified to assume responsibility for the report recommendations, empowered to allocate or reallocate resources, directed to form working groups, committees, or resource pools. We assume a governance forum will be established to set transparent campus priorities. Given current fiscal constraints, the objectives defined herein assume this responsibility and prioritization is necessary.

B. Specific Recommendations

1. The campus needs a better understanding of its collective present and future business needs in order to systematically build efficient technological systems and processes. Holistic business/technological planning requires anticipating, recognizing, and adjusting for inherent change. We recommend the campus create an administrative organizational structure dedicated to identifying, planning, and building efficient business processes using technology. We recommend that this unit be dedicated to business analysis, problem solving, and utilizing existing talent to improve efficiency.

The Flagship 2030 goals provide insight regarding emerging administrative needs. For example, globalization will create administrative challenges that may include the need for 24/7 access to all systems, accessibility for non-English speaking personnel, remote access, and global service centers. Although the timeline for Flagship 2030 goals is uncertain, there is a general expectation that the campus will align operations with these goals as resources and circumstances allow. These long term changes and short term challenges suggest a need for a formal business planning structure.

Often referred to as business analysis, or business process management, holistic planning requires business analysts to understand the needs of different groups, translate jargon and bridge innovative thinking and effective problem solving.

Staff members working in diverse and distributed positions can recognize and contribute towards these goals, provided there is a well managed forum for managing the communication, correlation, and integration of these ideas into concrete priorities.

2. We recommend a commitment to developing and promoting a common understanding of what staff effectiveness and efficiency is. To achieve this, a dedicated and diverse administrative technology planning function must be identified to define measures, ensure clear communication and understanding, and to ensure consistent, ongoing evaluation of business effectiveness and efficiency objectives. Consistent application of effectiveness or efficiency priorities cannot be assured without meaningful measures and evaluation for all priority applications.

Today, inefficiencies are largely unrecognized and are collectively costly to the University. We have no commonly understood, measurable benchmarks to objectively evaluate effectiveness and efficiency for specific business processes. We have no mechanism for evaluating whether business processes enhance or diminish overall organizational effectiveness.

The campus must recognize shortcomings within our current systems that have inadvertently contributed toward inefficiencies. For example, the lack of an administrative structure for business planning has led to the creation of countless “shadow” systems. These systems may represent an innovative effort to make up for inadequacies in the functionality or effectiveness of enterprise systems, or an inability to adapt to the demands of those systems. In either case, the resulting systems often do not result in sufficient attention to improving enterprise systems and often demonstrate redundancy and a lack of rigorous quality assurance or adequate lifecycle support due to skill or resource barriers.

3. We recommend that the IT service environment promote and encourage a customer service orientation that better understands the needs of end users within the context of their business environment.

The fast and furious pace of technological innovation can provide distraction or obstacles for the average staff member who may not recognize the reason for change or who that change might serve. Left to their own resources, staff members may not be able to keep pace with technology opportunities, or even in distinguishing a technology’s potential value. It is important to recognize that the profile of an average staff member varies considerably in terms of business function, the resources available to them, and their technological proficiency. A customer service orientation would support end users with an appreciation for the difficulty and constraints end users experience in trying to keep pace with and understand technology. Complexity and change create inefficiencies as staff members require consistency and predictability to efficiently complete tasks. Highly diverse business needs across the campus require an agile, flexible customer service model that can address the specific needs of that business. A “one-size-fits-all” service model can compromise effectiveness and efficiency.

4. We recommend that current technology be better utilized to achieve immediate efficiencies.

The campus should promote and take advantage of existing technologies by identifying “low hanging fruit.” This committee could not measure or evaluate the extent to which current technology functionality is presently underutilized. However, across campus there are individuals who undoubtedly have first-hand knowledge and ideas worth consideration. We

believe there are two primary strategies for cultivating an environment that encourages staff members to engage in the improvement of our current systems: professional development and communication.

Targeted, accessible, and high quality training and development must become an embedded expectation that encourages staff to routinely engage in supportive professional development. Staff members should be strongly encouraged to engage in professional development opportunities outside their areas of immediate expertise. Throughout their career, staff members should be regularly and intentionally exposed to a wide range of topics that might include project management, customer service, accessibility, business processes design and management concepts, etc., in order to recognize and react to changes in the business environment and facilitate the adoption of technology.

Communication across units is the underpinning of this type of business and technology collaboration. Networking groups and consortiums can achieve cost savings through sharing best practices. There are also the intangible benefits of relationship building, developing expertise, establishing benchmarks, rapid learning, avoiding duplication of errors, and establish common ground. Groups encourage entrepreneurial partnerships.

5. We recommend that the campus promote and reward the adoption of standards based approaches for technology where it promotes accepted best practices, such as in areas like ADA accessibility. Many staff functions are repetitive and predictable, and would be well served by consistent approaches. This does not preclude the adoption of flexible and adaptive methods, but rather highlights that general staff needs may be significantly less able to adapt to unguided dynamic design elements than within other campus communities.

Meeting this requirement requires business units to identify, agree to and accept recommended standards or best practices. Business units will adopt agreed upon standards when it is delivered in ways that are easily accommodated and not difficult to comprehend. Consistent communication strategies that demonstrate the benefits of standardization and best practices for the business unit will promote rapid adoption.

For example, consider that the standards proposed for application accessibility are important due to regulatory requirement compliance; however compliance itself is often not convincing enough to encourage participation. We must demonstrate that standards improve every user's experience by creating consistency thus encouraging greater overall participation. Implementing standards that meeting regulatory compliance requirements will also increase business efficiency by removing barriers that impede users.

Consistent standards can improve workflow timeliness by promoting best practices such as key stroke consistency, information placement and help mechanisms, and predictable designs. Customer service requests will be easier to communicate and resolve because of shared approaches and expectations. Investing in standards should not be seen as a limitation, but an opportunity for key shared service areas to remove barriers for participation and improve interaction with other campus business partners.

C. Long & Short Term Objectives/Timeline

The recommendations in the preceding section are described largely as values and principles which we believe can be adopted immediately to establish a foundation from which more specific ideas and recommendations can emerge. Recognizing that budget reductions and the

implementation of ISIS will consume most resources over the next year or two, we appreciate that it is unlikely that specific recommendations involving a direct investment of funds is viable; however, we believe there is value in promoting a culture of collaboration built on strong communication channels. A nominal investment in actual dollars, a commitment by leadership to promote collaboration and communication will naturally nurture innovation and creativity thus creating considerable intangible benefits for both the short term and long term.

Within that context, we identify several specific ideas for consideration; however, we believe that within the context of a collaborative environment, other viable ideas will naturally emerge.

Short Term Objectives (within 18 months)

- Adopt customer service orientation with a high level transparency
- Establish an expectation of professional development and training for all staff. Communicate existing training and development opportunities.
- Identify key stakeholders and begin administrative planning for infrastructure to support 2030 goals. Encourage strategic thinking within ranks of business process owners and users.
- Establish communication channels to build relationships between ITS, other campus IT providers, and end users establishing consortiums and business network groups
- Encourage standardization (such as W3C standards for accessibility) and better search engine capabilities. Recognize and reward models of excellence within peer community to encourage adoption of such standards
- Improve people directory search capability (particularly important with discontinuance of printed directory)
- Promote document imaging (reduce cost, save space, accessibility of document)
- Promote a relationship with University Information Systems (UIS) that better recognizes the diverse and complex nature of the Boulder campus.

Long Term Objectives (within 24-48 months)

- Create business analyst positions to understand business needs and lead the development of appropriate information technologies to support those business needs.
- Build sustainable business, staff, and technology partnerships and networks across the campus to create efficiencies, improve systems and processes.
- Develop and establish meaningful benchmarks for gauging effective and efficient processes.
- Develop and establish training and development standards, expectations, and opportunities for business process owners and end users as well as information technology workers beyond what is currently offered. Encourage rapid adoption by improving communication and exposure.
- Invest in staff by improving current tuition benefits. Current credit and availability limitations reduce usefulness and potential development opportunities.
- Analyze and determine the best mix of centralized and decentralized services to maximize efficiencies.
- Faculty hiring is a critical business processes integral to our mission of teaching and research. Procedures and processes for hiring faculty on the Boulder campus are extensive and complex. The system is largely paper based with each academic unit maintaining their own systems. Begin development of a comprehensive faculty recruiting tool used across campus to eliminate current duplication and redundancy. Maintain common a database set from which a dashboard system can be developed to discern trends and their underlying cause in order to plan for the future. Utilize basic technologies such as electronic signatures to eliminate routing of paper documents.

- Identify high demand systems (shadow systems, local installations of enterprise level services and systems) and prioritize some for analysis and improved service delivery. Potential focus areas discussed included high-use, under-supported local business systems such as PeopleSoft Lite; enterprise licenses for event scheduling or time-keeping; and assorted customer help desks or communication and relationship management tools.

D. Possible Risk

Technology Risks:

Technologies themselves can present problems that distract focus on business solutions, or that move resources to technology support from process or personnel support.

Strategic Risks:

Internationalization poses great resource implications. Increased service windows and increasingly diverse customer base from culturally and technology dissimilar locations will make standardization and simplification even more challenging. Assumptions about timing, authority, regulatory priorities and so-on begin to add layers of complexity to the service and process questions raised here.

Resource Risks:

Reductions in central computing staff and a shift in support and tools from campus providers to central providers puts greater distance between customers and providers. Understanding local business needs and support requirements requires organizational changes which may be unsupportable with current resources.

We identify expertise needs that are not currently available or dedicated to the topics discussed, particularly in the analysis and process quality areas. Hiring and training these resources is unlikely given budget cuts and widespread need.

Environmental Risks:

Current and recent system-wide efforts to streamline business requirements and reduce training requirements appear contrary to the committee's conclusion that standardization and training are needed. Sentiments about poorly received training may disrupt or negate the positive aspects that relevant and viable business technology training could provide.

Massive system changes are just coming online. These will be a distraction from energies that could be directed towards staff efficiency and effectiveness.

Support for staff and business processes has long been located far from the individual administrative units and context of localized business process. Improving that gap during a shrinking resource cycle and with existing process inertia will be all the more challenging.

E. Resource Allocation

Nominal cost - requires a cultural shift in how we approach our business:

- Build relationships between IT providers and end users establishing consortiums and business network groups
- Promote innovation and creativity to create efficiencies, improve systems and processes, and build sustainable partnerships. Promote streamlined approaches, and the creation of partnerships to improve communication and leverage the innovative work of others.

Medium costs - requires resources for development, implementation, or training:

- Standardization of web development to improve accessibility, consistency, ease of use, and consistent customer experiences. Provide services and guidance that improves campus web infrastructure search capabilities. Provide awards or recognition for examples of excellence.
- Improve people directory search capability (particularly important with discontinuance of printed directory)
- Develop remote computing technologies and guidelines to support telecommuting and access to work materials.
- Enhance document imaging (reduce cost, save space, accessibility of document) capabilities and provide support tools (guidelines, training, user manuals, testing capabilities) to simplify adoption and acceptance of the technology.
- Develop and establish meaningful benchmarks or principles for gauging effective and efficient processes.
- Analyze the mix of centralized and decentralized staff services to ensure maximum efficiencies and remove common incremental costs and unsupported dependencies.
- Establish training and development standards, expectations, and opportunities for business process owners and end users as well as information technology workers that support improved information an efficient and effective business computing environment as described in the recommendations above.

Higher cost

- Business analyst positions to understand business needs and lead the development of appropriate information technologies, procedures, and service information to support those business needs.
- Develop a comprehensive faculty recruiting process and application used across campus.
- Invest in staff by improving current tuition benefits. Current limitations reduce usefulness and potential development.

F. Responsible Parties

Responsibilities for staff efficiency and effectiveness are rich combinations of attributes and communication channels involving various parties. Observations are provided within Appendix A to provide insight into executing the recommendations of this report. This information is in no way comprehensive.

G. Evaluation

- Campus priorities are available, transparent, and supported at all organizational levels.
- Accountability for staff efficiency, effectiveness, and service programs is explicit.
- Definitions for and evaluation of efficiency and effectiveness standards are common.
- Identifiable communication forums are established.
- Management at all levels regularly promotes collaboration through recognizable communication forums and methodologies between business and technology leaders.
- Business analysis services are identified.
- Governance priority is clear and measurably adopted.
- Staff development in priority technology areas is measured and improving.

Preliminary Observations for Matrix of Responsible Parties.

Responsible Party	Primarily Accountable To	Primary Role for achieving recommendations	Primary Implementation or Communication Strategies
Business Administration:	External constituents, funding and regulatory bodies, campus customers	Identifying direction, allocating resources, defining E/E, mission clarity	Direction, Priority
Campus IT Governance:	Business administration, faculty, research organizations, university IT governance	Determining tech priorities, aligning with admin direction, standards and policies, clarity and transparency	Priorities, Policies, and Standards, campus decisions
University Information Systems (UIS):	External constituents, campus administration(s)	Enterprise systems and services usability and E/E, relevant training and support materials, correlation between workgroups and campuses, university architecture, enterprise analysis	Campus administrative support guidance, standards, system policies, training materials and supportability materials
Information Technology Services (ITS):	Campus administration, campus IT governance, direct customers, general good service customers, contracted agreements	Guidelines, and support in defined programmatic areas, correlation of Campus technology activities, input to governance forums, campus architecture, programmatic analysis	Campus IT architecture and direction, service information and procedures, infrastructure and architectural definitions, campus IT policy, ITS training and support materials, security, forum contribution
Organizational IT:	Organizational administration, organizational customers, campus IT governance,	Campus standards and guidelines, organizational administration, awareness and development, contextual	Standards and guidelines, local technology practices, local business technical constraints and objectives,



	campus administration	analysis	training and training materials, user guides and procedures, forum contributions
Business Application Developers:	Organizational administration, organizational customers, campus IT governance, campus administration, organizational IT	Organizational administration, campus standards and guidelines, technological integration into business process	Application support materials, lifecycle documentation, procedural documentation, integration documentation
Staff Supervisors and Managers	Organizational administration, campus governance	Staff development, participation, resources, transition	Staff guidelines, opportunities, and service availability, PDQ documentation and relevance
Staff, System, and Application Users	Staff supervisors and managers, organizational administration, campus governance	Personal development, guideline and policy observance, forum contribution	Situational need, roadblocks, conflicts, local procedure and work process, workflow



2.6 Developing Web Infrastructure Services

Major Issue:

As of the summer of 2010, 10 years will have passed since CU-Boulder last made a significant investment in campus wide, generally available web hardware and software infrastructure. The lack of investment has resulted in a highly disperse web infrastructure environment. As of late February, 2010, the CU-Boulder IT Security Office had registered more than 500 distinct web servers spread across dozens of colleges, schools and departments. Many of these web servers were created due to the lack of progress on upgrading the generally available web solutions. Maintaining an extremely disperse web environment results in many inefficiencies. Consolidating around a collection of “common good” web services addresses these inefficiencies, leading to a web environment which is more cost effective, more durable, less complicated, more broadly available to anyone with web technology needs, and easier to support. In addition to inefficiencies, the extremely disperse web environment complicates CU-Boulder’s efforts to implement the University of Colorado System branding initiative. When the final details of the new visual identity standards become available, CU-Boulder will begin an effort to systematically align campus, college, school, and department web content with the new standards. CU-Boulder would greatly benefit from the development of additional web infrastructure services.

A. Background/Rationale

The CU-Boulder Web Environment

The CU-Boulder web environment includes two broad categories of service: 1) the primary WWW service, hosted by ITS, serving as a general purpose, “common good” but basic web site hosting environment, and 2) the highly distributed and localized campus wide web environment.

ITS has provided the “common good” www.colorado.edu web server environment since the earliest inception and identification of the world-wide-web as a core campus technology infrastructure need. No significant investment in improving the web server infrastructure available to campus as a whole has been made in nearly 10 years; the practices and technologies have not been significantly changed since the inception of web technologies in 1994. The age and stagnation of current central web technologies has, in large part, contributed to the second category of web environment, the collection of localized web solutions deployed by colleges, schools, and departments.

The current campus wide web environment at CU-Boulder is highly distributed and diverse. This highly diverse, highly distributed environment, though very flexible and suitable for meeting any number of business needs, results in a very inefficient use of university resources. The challenge of consolidating the CU-Boulder web environment will be finding the proper balance of a flexible enough environment to support many, but perhaps not all, of the technology combinations while still remaining sustainable.

Web Developer and Content Manager Support and Community

University Communications has developed resources for the large number of web developers and web content managers existing at CU-Boulder. The “Web Central” web site includes a description of web technologies available, resources for training and certification available, a

collection of help documents and guides, and lists the policies and standards governing web publishing at CU-Boulder. Though “Web Central” and the mailing list provide a useful collection of information, web developers and content managers would benefit from greater support and community development.

Brand Management

University Communications currently provides assistance to colleges, schools, and departments in developing their web visual identity on a for fee basis. CU-Boulder has developed guidelines for the web visual identity, but no mandatory standards and campus approved policies exist. The upcoming branding initiative of the Office of the President for the University of Colorado will require a change in this practice. The initiative will require the reevaluation and revision of the existing CU-Boulder “Web Identity Standards”, an increased need for mandating compliance with visual identity standards, and the systematic review and refurbishment of existing CU-Boulder web content to align with the new standards.

IT Strategic Plan 2006

The IT Strategic Plan of 2006 included a recommendation for implementing a web content management system and requested funding for the infrastructure and staffing for the service. Since funding never materialized, the effort stalled. The need still exists. Section 2.6.2 “Adopt and Deploy a Web Content Management Solution” renews the recommendation and request for funding.

Relationship to Flagship 2030

The strategic plan recommendations for Developing Web Infrastructure Services align with specific action items promoted in Flagship 2030. These include the following:

- Curriculum Enhancements
- Research Excellence
- Internationalizing the Campus
- Serving the State
- Investing in Our Staff
- Information Technology
- Developing a New Budget Model

B. Accomplishments to Date

- The www.colorado.edu service provides basic web capabilities, receives more than 1million web page hits per day, and contains hundreds of thousands of web page content.
- More than 500 local web servers provide numerous web applications and frameworks for a variety of college, school, and department web needs.
- University Communications provides guidance and for fee assistance for colleges, schools, and departments seeking web development and content management assistance.
- ITS and University Communications collaborated on developing a functional requirement definition for a Web Content Management solution. The initiative has never been funded and, therefore, has not progressed further.
- ITS and University Communications have collaborated on identifying emergency communications needs and developing plans for enhancing web and messaging infrastructures.
- The Office of the President for the University of Colorado has begun a CU-System wide branding and visual identity alignment initiative. Details and expectations will become available during the summer of 2010.

Action Plan

Campus Assessment and Audit of Current Web Tools and Resources

A. Explicit Assumptions

A detailed assessment of current web practices and technologies would greatly assist setting strategic directions for web infrastructure services.

B. Specific Recommendation

- Perform an in depth, campus wide assessment/audit of both current and desired web tools and resources.
- Maintain the gathered information through periodic review and reassessment.
- Summarize the results in a report.

Note: The general needs and current use assessment/audit should explore combining efforts with the IT Security Office.

C. Long & Short Term Objectives/Timeline

Short Term:

Perform audit/assessment

Long Term:

Provide one or more summary reports.

Continue periodic updating of the baseline audit/assessment.

D. Possible Risk:

Web infrastructure services may involve private or restricted data.

The audit/assessment outcome documentation may contain information which could include sensitive detailed server, service, network, and data descriptions.

E. Resource Allocation:

The majority of the cost of this project involves personnel time for conducting the audit/assessment. Hiring an additional staff member responsible for conducting and maintaining these audits would require approximately \$80,000 in ongoing funding.

Responsible Parties:

ITS, Campus-wide Governance Group(s), Organizational Unit web Information Technology support personnel, Organizational Unit web content developers

Evaluation:

- Completed audit/assessment and summary report(s).
- Impact of the audit/assessment on selecting appropriate web technology solutions for campus wide implementation.

Adopt and Deploy a Web Content Management Solution

A. Explicit Assumptions:

- Several funding requests for a Web Content Management solution have been issued but never granted. New, less expensive solutions may be available, but ongoing and one time funding will still need to be granted to proceed with this project.
- Developing work flow, delegating responsibilities for a Web Content Management solution, governance over standards, and policy/procedure development will require campus wide involvement.
- A Web Content Management solution would assist with the CU-System branding initiative.
- A Web Content Management solution supplements, but cannot immediately replace, the current www.colorado.edu service.

B. Specific Recommendation:

Select and implement a Web Content Management solution available as a “common good” enterprise service available to all CU-Boulder faculty, staff, colleges, schools and departments. Provide adequate infrastructure and scalability to support sustainable growth.

The Web Content Management solution must account for CU-System and CU-Boulder policies and guidelines for Web Visual Identity standards, ensuring section 508 accessibility requirements are met for all content, and accommodating Universal Design for all content.

C. Long & Short Term Objectives/Timeline

Short Term:

Reevaluate and refine Web Content Management functional requirements developed by University Communications and ITS.
Investigate and select a Web Content Management solution.

Long Term:

Implement the solution.
Develop policy, practice, procedure, and work flow for the service.
Migrate content from the www.colorado.edu and localized web solutions to the Web Content Management solution.

D. Possible Risk:

Some content may include sensitive information requiring greater security measures.

E. Resource Allocation:

Hardware and software infrastructure costs for a Web Content Management solution vary greatly depending upon the specific solution selected. One time infrastructure costs are expected to be within the range of \$100,000 to \$250,000. Ongoing funding for a five year renewal and replacement is expected to be within the range of \$20,000 to \$50,000. Additional staffing for operating and maintaining the service: one ITS employee for the core infrastructure and one University Communications employee for application support are required. The equivalent of two FTE's for a total of \$200,000 in ongoing funding would be needed.

F. Responsible Parties:

ITS, University Communications, Campus-wide Governance Group(s), Organizational Unit web Information Technology support personnel

Evaluation:

- Customer satisfaction and usability.
- Increased consistency and compliance with web branding standards and policy/regulatory compliance.
- The amount of web traffic (in hits and data transfer) served by the solution over time.

Create a Flexible, Robust, Multi-Purpose Web Hosting Environment

A. Explicit Assumptions:

- Sufficient funding commitments must be made in order for the Web Hosting Environment project to succeed.
- The Web Hosting Environment would accommodate many, but not all, of the needs leading colleges, schools, and departments to deploy localized web technology.
- The audit/assessment discussed in section 2.6.1 would provide highly valuable information for developing web hosting environment plans.
- A central “common good” Web Hosting Environment is expected to increase security by reducing complexity, reducing redundancy and the need to repeat security constraints across multiple solutions, and focus greater security expertise on developing a single robust solution.

B. Specific Recommendation:

- Implement a “common good” web hosting infrastructure capable of supporting a flexible, multi-purpose collection of web technologies including.
- Provide “common good” backend database structures.
- Design the solution for scalability and highly availability.
- Investigate the applicability of cloud computing resources to meet these needs.
- The Web Hosting Environment solution must account for applying CU-System and CU-Boulder policies and guidelines for Web Visual Identity standards, ensuring section 508 accessibility requirements are met for all content, and accommodating Universal Design for all content.

C. Long & Short Term Objectives/Timeline

Short Term:

Determine strategy for providing a web hosting environment and backend database solutions.
Develop deep technical proficiencies in the small subset of web technologies that will be broadly supported for CU-Boulder.
Develop shallow technical proficiency for the full collection of web technologies the web hosting environment will accommodate.

Long Term:

Implement the web hosting environment and backend database solutions.
Develop policy, practice, procedure, and work flow needs for the solution.

Migrate local college, school, and department web applications and application frameworks to the web hosting environment.

D. Possible Risk

Many localized web solutions maintain some form of sensitive data. The suitability of a shared, central web hosting environment for interacting with sensitive information will need to be carefully analyzed.

Cloud computing solutions may limit CU-Boulders ability to directly respond to service incidents and develop service enhancements.

E. Resource Allocation:

Hardware and software infrastructure costs for a Web Hosting Environment vary greatly depending upon the specific solutions supported, and whether the service is built locally or contracted to an external cloud provider. Onetime costs for developing the service are expected to be within the range of \$100,000 to \$200,000. Ongoing funding for renewal and replacement, or alternatively for ongoing contracts with external service providers, is expected to be within the range of \$20,000 to \$75,000.

Additional ITS staffing for operating and maintaining the service is required. The equivalent of one FTE for a total of \$100,000 in ongoing funding would be needed.

If both the Web Content Management Solution recommendation and this Web Hosting Environment recommendation were acted upon, it is expected that some of the deployed infrastructure could serve both purposes and potentially lower the overall cost.

F. Responsible Parties:

ITS, University Communications, Campus-wide Governance Group(s), Organizational Unit web Information Technology support personnel

G. Evaluation:

- Measurable reduction in the number of distributed web servers on the CU-Boulder network.
- Customer satisfaction and adoption rates.
- The amount of web traffic (in hits and data transfer) served by the solution.

Establish Greater Campus Web Support, Training, and Community

A. Explicit Assumptions:

Sufficient funding commitments must be made to develop robust support, training, and establishment of a community for CU-Boulder web developers and content managers. These positions are critical for supporting the proposed Web Content Management and/or Web Hosting Environment. If funding is provided for the services but not the support staffing, the value of the deployed services will be reduced.

B. Specific Recommendations:

Create and hire a position in ITS Strategic Communications, Outreach, and Documentation for a Tier 2 Web Support Coordinator. The position would combine duties similar to the ITS Tier 2 Computer Support Representative Coordinator, facilitating communication and collaboration between central and college/school/department web personnel, and ITS Escalated Support, maintaining proficiency and currency with a wide variety of web technologies to provide web service support and advising assistance. The position would also develop and promote a web developers and content management community to encourage collaboration and knowledge exchange between the many web experts on campus.

Create and hire a position in ITS for Web Escalated Support to specifically support the enterprise web services: the legacy WWW service, the recommended Web Content Management solutions, and a small subset of the additional web technologies available within the web hosting environment.

Create and hire a position for a Web Business and Functional Analyst to provide in depth consulting to colleges/schools/departments on which web technologies and solutions could best meet their needs and to provide periodic information, training, and evangelism for current and emerging web technologies. The role would also need to gain and maintain awareness of CU-Boulder visual identity policies and standards, policies and federal regulations including section 508 accessibility requirements, web development best practices and standards such as W3C, and security and privacy practices in order to assist colleges/schools/departments in understanding and meeting these needs.

All three positions must maintain close coordination with both ITS and University Communications, serving as a bridge between the primarily ITS concerns of technology specifics and content creation, editing and hosting, and the primarily University Communications concerns of content composition, structure and presentation. These positions must understand and represent all of these concerns while assisting campus with their web technology needs. They must understand and provide assistance with meeting and retaining compliance with branding and visual identity guidelines.

C. Long & Short Term Objectives/Timeline

Short Term:

Create and hire an ITS Escalated Support position for Web Technologies.

Create and hire an ITS Tier 2 Web Support Coordinator.

Begin developing a CU-Boulder web developers and content managers' community.

Long Term:

Create and hire a Web Business and Functional Analyst.

Possible Risk

None

D. Resource Allocation:

The recommended positions require hiring staff with considerable expertise:

\$100,000 for the Web Support Coordinator

\$100,000 for the Web Escalated Support position

\$100,000 for the Web Business and Functional Analyst position.

E. Responsible Parties:

ITS and University Communications

F. Evaluation:

- Development and use of a “web developers community” for CU-Boulder.
- Increased communication and collaboration between CU-Boulder web developers and content managers.
- Customer satisfaction.

Develop CU-Boulder Web Standards and Achieve Compliance

A. Explicit Assumptions

- The CU-System is currently working on branding standards for the entire university. Once developed, all campuses will be required to align their web content with the brand.
- University Communications will be responsible for understanding the new branding requirements, assuring compliance for sites directly maintained by University Communications, and assisting other web administrators at CU-Boulder with understanding how to achieve compliance.
- CU-Boulder web identity and style standards, policies, and guidelines will need to be reviewed and updated and/or supplemented.

B. Specific Recommendations:

- Review and revise CU-Boulder Web Visual Identity standards to align with the CU-System branding initiative.
- Ensure CU-Boulder web sites achieve compliance with forthcoming CU-System web branding standards.
- Deploy a web reverse proxying and caching solution that will answer for all www.colorado.edu web requests.
- Conduct periodic audits of CU-Boulder web content to ensure ongoing compliance. Explore state and/or federal grant opportunities which may provide funding for and accessibility expert and auditor for campus.

C. Long & Short Term Objectives/Timeline

Short Term:

Review CU-System branding initiative standards once released.

Form plans for achieving compliance.

Review and update relevant policies to align with the CU-System branding initiative.

Long Term:

Select and deploy a web reverse proxying and caching solution.

Update web site layouts and content to conform to the branding initiative.

Conduct ongoing audits for compliance.

D. Possible Risk:

TBD

E. Resource Allocation:

Estimated costs for a cloud based reverse proxying and caching solution is \$24,000/year. University Communications has the expertise for working towards comprehensive campus wide branding compliance, but would require backfill money to free the resources and maintain current obligations. The effort would require \$200,000 in temporary money to backfill 3 positions for three consecutive years for a total of \$600,000.

F. Responsible Parties

University Communications, ITS, Campus-wide Governance Group(s), Program Accessibility Committee, Disability Services, Organizational Unit web Information Technology support personnel, Organizational Unit web content developers

Evaluation:

Pre and post assessment of web site branding.

Establish Standard eCommerce Solutions

A. Explicit Assumptions:

Many colleges, schools, and departments have the need to accept internet payments. A few have adopted their own solutions.

Standard policies, practices, and procedures for if/when/how organization units accept internet payments would decrease the risks associated with handling credit card data and increase efficiencies for accepting the payments.

B. Specific Recommendation:

- Reevaluate and revise CU-Boulder campus policies and procedures for if, when, why, and how colleges, schools, and departments conduct online eCommerce payments.
- Evaluate and adopt one or more eCommerce solutions as standards for all CU-Boulder eCommerce: a payment portal or gateway for CU-Boulder web transactions, a campus wide agreement with one or more vendors, and/or specific shopping cart solutions.

C. Long & Short Term Objectives/Timeline

Short Term:

Review, update, and create eCommerce policies.

D. Long Term:

Adopt standard solutions for CU-Boulder eCommerce.

Meet and ensure PCI data security standard compliance.

E. Possible Risk:

eCommerce solutions must meet legal and security requirements for complying with PCI data security standards.

Specific needs for interoperability between the web application, eCommerce application, and the payment gateway are usually unique and complicated. Finding an eCommerce solution for campus must recognize those needs and be able to adapt and accommodate those needs.

F. Resource Allocation:

Cost of the project: TBD

G. Responsible Parties:

ITS: ITS Program Management, ITS Security Office, ITS Project Management, ITS Operations Office of University Controller, Office of the Treasurer of the University, Campus-wide Governance Group(s)

H. Evaluation:

- Adoption rate of eCommerce solution(s).
- Customer satisfaction.

*** Please note: There is a longer version of section 2.6 that is available upon request. Please email stanek@colorado.edu to request the full version.

2.7 Improving the IT Service Model

Major Issue: There is considerable dissatisfaction with the current model and practices of providing IT services to users on campus. Four main issues have emerged:

1. The hierarchical model of support with one point of contact does not meet the needs of many of the users, especially those with high levels of expertise;
2. Policy is set by the same people who provide support and services. Users have no clear way to influence support policies with which they disagree. The issue of policy and governance must be decoupled from the issue of providing services;
3. There is a lack of appreciation for the diversity of the customer base and for the diversity of the needs of the customer; There is a need to develop an understanding of the user's point of view in order to meet the expectations and needs of the user;
4. There is a lack of transparency (the black box approach) that destroys trust in the system

A. Background

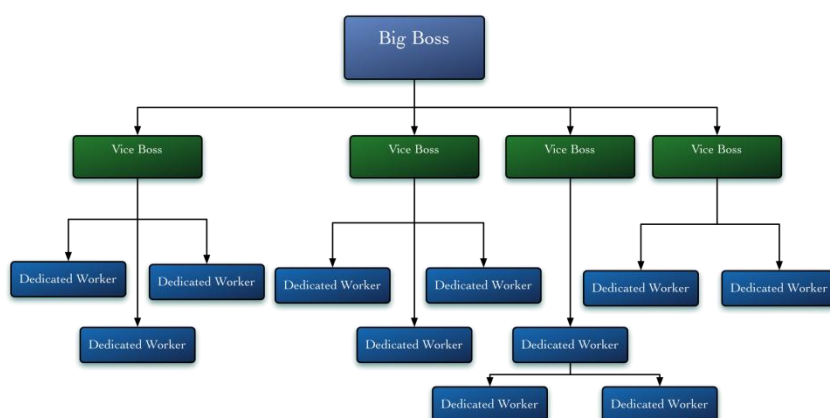
Significant portions of the campus do not have adequate IT support service because they cannot afford to purchase services offered by central ITS as it is now organized. Too much of the current "4-tier" model depends on enrolling people who are not IT support experts (e.g., the mandated Tier 2 contact people). Experts in distributed units outside of the ITS organization are expected to enter at Tier 1 rather than communicate directly with appropriate experts inside of ITS. This problem is exacerbated by the current hub (ITS) and spoke (the distributed customers) model of support because efficient and effective use is not made of the expertise of people in other units on campus.

ITS currently has a classic hierarchical structure typical of a corporation. This structure has advantages of clear lines of responsibility but suffers from inefficiency because of the isolation of the lower level people from each other.

Communication flows vertically not horizontally. Thus

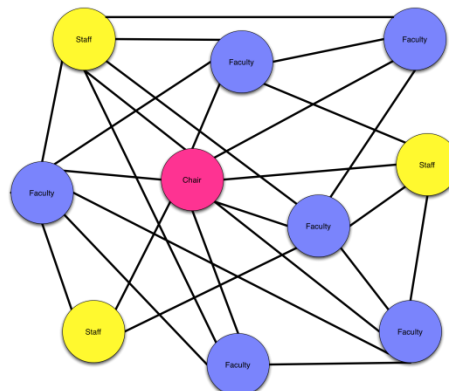
knowledge cannot be easily shared with those who might benefit most from it. Another characteristic of this structure

is that authority to make decisions is always limited by the next level up.



The organization of the organization of the four-tier support system currently in place reflects this same corporate organization structure. It is characterized by a vertical flow of information and a lack of transparency about the internal workings.

This hierarchical corporate structure stands in contrast to the functional organization of typical academic units such as departments and institutes. These units are better described as a rich interconnected network of people with very little rigid reporting structure. One consequence of this network structure is that faculty and staff are able to communicate with whomever they need to in order to collaborate and achieve their goals both within units and across units. Such a structure is relatively transparent because each individual has multiple ways of gaining information from others in the group. Such a structure is flexible because most of the connections among people are based on need to communicate (for example to carry out a research project or teach a course). When needs change, the connections change.



These very different organizational structures have led to serious mismatch of expectations, assumptions, and beliefs held by the staff of ITS about those it is mandated to serve and visa versa. This mismatch has led to an inefficient use of resources and expertise on the campus. There are many on campus, both IT professionals and others, who have a very high level of knowledge and expertise about information technology who are not employees of the ITS organization. This expertise is currently underutilized by ITS staff largely because of the rigid organization and hierarchical support model and because of a cultural attitude towards these “outsiders.”

The current support model isolates people working in central ITS from the people they are serving, both distributed IT support staff (e.g., Housing, UMC, academic departments) and actual end users. Although ITS managers might meet with administrators in different units, the staff in central IT are relatively isolated from, and are not familiar with, the nature of the research, teaching, and other work that is being done in the academic departments and other campus units. Mechanisms, procedures, and policies within central ITS discourage the ITS experts from engaging in conversations and collaborations with those outside of ITS. In addition, there needs to be more transparency in the functioning of the ITS support model. There is not sufficient collaboration among the different units and service providers nor is there enough sharing of knowledge to avoid the problems outlined here. There is not enough flexibility in support offerings, and more recognition that determining these levels should be a product of collaboration not dictation.

Finally, there are difficulties with scope—it is not clear who owns which responsibilities and services. Yet, at the same time (and because of this), there are significant relational difficulties and organizational mistrust, because the central unit (ITS) advocates to perform services located in the different units (competing for resources and budget with the very people they also promise to support). This competition for resources makes cooperation and trust more difficult.

B. Accomplishments to Date

ITS currently operates a call-in Service Center that receives approximately 60,000 calls per year. Approximately 70% of these calls do not get escalated to anyone else in ITS; ITS also operates two walk-in service centers that provide support for faculty, staff and students;

The service structure that is now in place is a hub and spoke structure. ITS is positioned at the hub and has a series of support agreements with many units on campus. These connections radiate from the hub out to the units like the spokes of a wheel.

ITS personnel are highly motivated and competent information technology professionals. The problems that we have identified do not reflect on the people, but rather on the organization and structure of how ITS interacts with the many different units on the campus that they are to serve. It is this organization that we recommend changing;

Action Plan

A. Explicit Assumptions On Which This Plan Is Based.

We need to separate governance from the provider providing the technology. Governance represents the business aspect and is concerned with establishing policy. Technology provides services. Establish a policy/ oversight board that reports to the CIO. This board coordinates policy of ITS and other IT units so that the needs of all users are met. As a general principle, this board would not be made up of the same people who are providing services. The chair of this board should not be the same person who is running ITS services.

We agree that the mission of the university is to achieve excellence in education and research. ITS' own mission should be to support the mission of the university. The role of staff is to help units within the University carry out the mission and achieve the goal of excellence. The University mission is our central, shared focus. The functioning of the University requires high degree of flexibility and adaptability, because practices and needs vary widely across different disciplines and units (one size does not fit all).

We agree that every unit is to be supported at a level that meets their basic needs. A support model should not depend on a unit's ability to pay in order to achieve this basic level of support. A call center in and of itself is not a sufficient level of support. Similarly, the more that the support staff understands and is familiar with the particular work that is being done by those they support (faculty, staff, students), the better able they are to support those user. Quality support depends on familiarity with the end user and his/her work.

There must be a recognition of and respect for the "expertise across campus" and of the importance of area or content knowledge (that needed expertise cannot be centralized). All support staff on campus must actively work to establish trust among them, particularly when the relationship requires one unit to be dependent on the services provided by central ITS. There must be a respect for boundaries of existing support groups, and a recognition of support staff across units as peers.

Support staff in distributed units must accept that elevated access (i.e. the ability to bypass parts of the work flow) also means certain elevated responsibilities relating to troubleshooting and correctly identifying a problem. Managing these expectations and privileges will be a challenge for everyone involved.

There must be transparency in the system, especially in how to prioritize resources, cost-modeling, and decision-making. More transparency is needed about what services are provided by support units and how they are provided. It must be easy to track the status of reported problems through the system.

Scaling must be part of the logic, including a shared understanding of how to prioritize services (for example, not every need can be the highest priority). The goal of our recommendations is to unfold ITS to make it more transparent and to align it with the mission of the faculty and staff.

B. Specific Recommendations

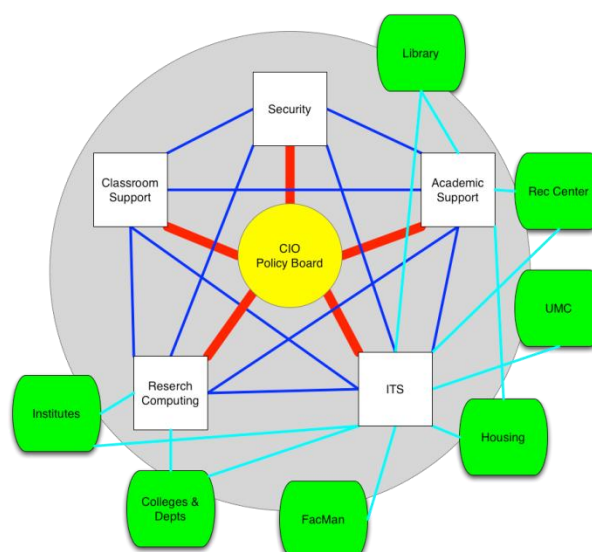
1. Reduce the mission of current ITS organization to focus on what it does well—to emphasize its strengths in providing IT infrastructure technology. To make a break with the past, the name of the new unit should be changed to reflect this new focused mission (e.g., ITI—IT Infrastructure).

The three core services should be:

- Developing and maintaining the campus networks and servers
- Supplying central support for campus users (help desk and higher level support)
- Developing and maintaining central computing spaces to house server and other specialized computing equipment

2. Create new and separate units out of the current ITS organization to provide specialized expertise (e.g., Security, Research Computing, Academic Technology, Classroom support) in specific areas needed by the campus. These units, like the new, reduced ITI, would implement policies set by the IT Policy board established in recommendation 3;

3. Establish an IT Policy and Oversight Board that reports to the CIO. This board will develop policy for ITS and coordinate policy with other IT units so that the needs of all users are met; The board will strive to make the campus IT community more cohesive and to reduce conflicts. The chair of the board would not be the director of the new ITI (or the other units, see number 3) to avoid conflicts of interest. The function of the board is to set policy, not to deal with daily operational issues. The membership of the board should be drawn from the campus administration, faculty and staff;



4. Develop mechanisms to **significantly increase and sustain** involvement, communication, coordination, and collaboration among all relevant units on campus to leverage distributed expertise. Ownership of the mechanisms needs to be shared, rather than controlled by one central unit. Develop mechanisms for discussions of non-urgent issues on a regular basis.

5. Establish a different working relationship between the different service providers, especially between a central IT service provider and the different levels of end users (including support staff). Develop a rotation system in which key ITI personnel serve in appropriate units and other IT (e.g., Housing) personnel serve in ITI.

6. Develop ways to prioritize for 24/7 escalated service; develop a model of how some levels of service could be provided;

7. Develop mechanisms for staff or units to request more coverage of service than they currently have.

C. Short and Long Term Objectives

1. Immediate Objectives

- Establish a policy board as recommended in 1 above.
- Begin an assessment of the needs of the diverse pool of users on campus with the aim of gathering information about the specific nature of the work (teaching, research, administrative support) within units. Needs change and should be frequently assessed. The results should be communicated to relevant support staff, and mechanisms should be established for those support staff to follow up by themselves communicating to users and unit support staff.
- Begin evaluation of options to provide some form of 24/7 help service by phone or email for the most important services such as network . Develop reasonable guidelines for what is an appropriate after hours service call. Leverage Tier 2/support staff as a resource to help extend service beyond business day (e.g., local staff could filter the service requests so that central IT staff might simply be "on call.")
- End the practice of making pronouncements of infrastructural changes, especially in situations where substantial number of users will be affected. Create a web page where these proposed changes can be made public and where policy input can be given. Detailed technical information about changes to services provided, including new services, should be available to end users who are relying on those services. Keep the campus informed of project schedules.
- Rethink the way SupportWorks is used in order to increase its utility to all units on campus. Open access to the system to non-ITI support staff—make it an campus resource rather than an ITI resource. The object is to use support resources more efficiently because local staff could handle some of the case load, and could also add their knowledge. A shared web portal could be another option. At the very least, there should be a way for support staff in units to communicate with each other and back to central ITI with regard to applications, services, hardware, etc., especially if the unit is deploying services that may have an effect on central services.
- Provide more open access to elevated support levels and ITI experts.
- Place online information that would be useful for support staff across campus to know, and make it accessible to support staff across campus. Limit or end the practice of holding information as a central resource. For example, make available more information on campus software site licenses, along with details regarding the terms of use (End User License Agreement - EULA) and contact information, for the license holder and vendor.

2. Short-Term Objectives

- One of the objectives of the needs assessment (from #1 above), should be to identify potentials to offer standard hardware or software configurations, or to link units that have similar hardware/software needs. In other words, to assist the campus with achieving efficiencies through standardization. (However, this does not mean to try to fit all uses within a standard.)
- Rethink the model and the process for software licensing. Re-assess who should own the process (need a model that is flexible and has variation, for times when more efficient for a non-ITI unit to lead).

- Rethink the cost models for support services, e.g., rather than linking positions to computers supported, link them to actual work performed. Look for potentials to reduce marginal cost for each user supported.
- Institute campus conversations and involvement about what services different units find are most valuable for customer support *and* which set of that support common to all. Rather than having "effective customer support" defined primarily by central ITI, the decisions about what central resources the campus should invest in (e.g., what email service, web services, network services, security services) should be made by the IT Policy Board with effective input from the whole campus.
- Consider a funding model that involves a sliding pay scale for central services (i.e., to subsidize units with lower budgets).
- Coordinate procedures for academic units to cooperate with technology support staff with regard to reporting needs that need fixing, and develop ways to coordinate among support staff and central ITI to determine who is responsible for the need.

3. Long-Term Objectives

- Rethink campus relationships between support staff. Create a system that increases communication among relevant people in different units across campus.
- Accountability -- develop outcomes based assessment not only for specific services, but for system/structural elements as well. (i.e., to assess decisions made about how to do things). And provide mechanism to feed these back into the system to improve it.
- Continue discussions involving faculty, staff, and students all together to determine reasonable expectations for minimum level of support. Do not depend on central IT to make that decision in isolation. Build feedback – communication–into the system so that it can better meet the needs of units and end users, while maintaining openness and transparency.

D. Possible Risks

Any organizational change poses risks that the new organization structure will not achieve its goals and that the net impact on the campus will not be positive. We believe, however, that the current situation is far from optimal in terms of supporting the academic mission of the university. Since we are not recommending elimination of functionality and services but a reorganization of how they are achieved, we believe that the risks of implementing the recommendations are very low. The potential benefit is an increase in user satisfaction across campus and a higher level of support for the university mission.

E. Resource Allocation

For the most part these recommendations are resource neutral. The recommended changes are largely organizational and structural in nature. They will result in a better use of existing resources because personnel will focus on doing what they do best and will not be operating outside the bounds of their expertise.

The two exceptions are the recommendation that some form of 24/7 help be made available and the expansion of the SupportWorks license. The current ITS administration has made one preliminary estimate of the cost of these additional services using an outside vendor, but this committee has not done an in-depth analysis the estimate nor evaluated the costs and benefits of providing the help service internally or externally. How much these recommended changes

would cost depends on the specific implementation chosen. This choice of how to implement the recommendations should be made by the CIO and the Policy Board. The CIO would then include this cost as part of the budget request process.

F. Responsible Parties

Policy will be set by the campus administration, specifically by the Chief Information Officer/Associate Vice Chancellor with the guidance of the policy board.

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Chapter 3: Strengthening Collaboration Efforts

With roughly 29,000 undergraduate students, 85 majors at the bachelor's level, 70 at the master's level, and 50 at the doctoral level, CU-Boulder serves a large and academically diverse student population. Strengthening collaboration efforts on campus is a means of identifying how to best serve this population, as well as faculty and staff, through increased cooperation among a range of divisions and offices on campus. In particular, chapter 3 considers how IT and ITS may best collaborate with University Libraries, University Information Systems, Facilities Management, and Housing and Dining Services. As technology continues to merge seamlessly with all facets of daily campus life, it is essential to identify and capitalize on opportunities for campus services to work together and provide students, faculty, and staff with a rewarding and supportive campus environment. Such efforts not only require attention to present collaborative efforts, but demand consideration of how ITS may collaborate with an array of campus divisions to best serve campus constituencies in the future as well.

Specific recommendations within the reports detail how ITS may: work with campus libraries to maximize effectiveness of information resources and library space, introduce and usher in the Integrated Student Information System (ISIS), liaise with Facilities Management to address energy consumption and heighten user mobility, and in conjunction with Housing and Dining Services, satisfy the major IT needs of students. These recommendations detail plans for enhanced communication between various campus divisions and ITS as well as the development of oversight committees.

3.1 Libraries

Major Issue: In the information age, the relationship between libraries and IT is indistinguishable to many. Campus libraries rely on a robust IT infrastructure and campus IT relies on libraries to provide access to a wide variety of electronic content. This committee will consider the various intersections between libraries and IT including provision of a broad range of content as well as services and spaces. The committee will define a strategic vision for future campus collaborations to meet the needs of students, faculty, and staff.

A. Background/Rationale

Across higher education, close relationships between libraries and IT units make possible the provision of one of the most critical and fundamental services on any campus: access to library content by faculty, students, and staff. While most university libraries, including CU-Boulder's, manage much of their own technology internally, including online catalogues, data storage, and the like, partnerships between libraries and central IT units will become increasingly important over the next several years. In understanding needs that neither libraries nor IT can provide separately, campuses will need to address how best to facilitate partnerships between those two units.

Current issues facing CU-Boulder's University Libraries and ITS:

- How to collaborate to ameliorate space crunches, in part by assessing and programming space in concert;
- How to collaborate on middleware solutions to make access to content easier, more secure, and more proactive (e.g., by pushing relevant content based on roles and affiliations);
- How to jointly provide and provide support for use of IT tools to access the Libraries' resources; and
- Determining respective roles of the Libraries and IT in data curation and management, including infrastructure development, service, and support.

This chapter focuses on three main areas that require joint Libraries-IT work to support the academic mission of the University: spaces, services and support, and infrastructure.

Accomplishments to Date

The University Libraries, which runs an internal information technology unit, and ITS have enjoyed a fruitful strategic partnership over the past several years. Monthly meetings at the director and assistant director level have ensured consistent communication about joint projects (e.g., the Norlin Learning Commons, the Alliance for Digital Repositories, iTunes U) and ITS projects with significant Libraries' impact (e.g., campus Exchange, password requirements). Although communications and relationships at the strategic level are strong, because the number of joint projects will increase during the next few years and because solid communications and relationships at the operational level are only recently formed through cooperative work on the Norlin Commons the continued strengthening of communications and relationships at all levels is imperative.

Action Plan

Explicit Assumptions

Spaces

The draft campus master plan makes several recommendations about the Libraries. Recommendation #3 is to “Establish more multi-use areas, commons spaces, interactive connections, and study spaces within libraries.” Goal one under “Client-Centered Focus” of the draft updated Libraries’ Strategic Plan calls for the Libraries to “base collections, services, programs, and policies on best research practices and leading technologies.” Goal two under “Library as Destination” calls for the Libraries to “enhance our physical spaces to support campus teaching, learning, and research and to facilitate both individual and collaborative learning and research.” IT is both a necessary and natural partner in any activities designed to meet these goals. Any joint activities should work in concert with the draft master plan and the Libraries’ Strategic Plan.

Services and Support

The campus must invest in resources to support the training of students and faculty that use jointly provided spaces (e.g., Learning Commons) and services (e.g., iTunes U, streaming services, ADR, etc.), as well as joint communications about those services, with the goal of enabling a culture that supports open access to all University resources.

Infrastructure

To facilitate access to University resources, the campus must facilitate collaborative work in the area of identity management, VPN, storage, and delivery.

Accessibility Issues: All joint services and support must meet minimum 508 guidelines to ensure that all faculty, students, and staff have access to University Libraries resources.

Sustainability Issues: The creation of new, jointly designed learning spaces will need to be guided by sustainability goals that limit the power and resources needed for desktops, laptops, and other technologies.

D. Specific Recommendations

Spaces

- The Libraries and IT should partner appropriately on the Norlin Renaissance plan.
- We should use space efficiently, taking every opportunity to look at available space and use it wisely. This should factor into any upgrades/remodels affecting current facilities in Norlin and the branches.
- The Libraries and IT have a shared interest in a robust infrastructure (e.g., networking, Libraries’ IT, IdM, Lab Management, etc.) that enables us to manage space wisely.
- We need to understand how both undergraduate and graduate students use and want to use space and align our categorization of spaces with those needs. This is especially critical as open lab environments are converted to other purposes. Although students still need access to specialized applications, space for labs is shrinking. With the main campus fully built-out, student voices may not be adequately represented in the discussions around this issue. One possible tool is to survey students about their needs and thoroughly analyze any data we have about use of IT resources and use of spaces within the Libraries. Again, goals under client-centered focus and the library as destination are relevant to this discussion.
- We need to understand how faculty and other patrons use and want to use space and technology resources and align our space planning with those needs.

- Since the Main Campus is at capacity, it seems natural to assume that East Campus will take on a larger role in the life of the Boulder Campus. How this will play out remains unclear. A case in point: while a small space in the biotechnology building currently under construction has been designated as a drop-in spot for consultation with the Libraries and/or IT, how staff use this space has not been worked out.
- As the campus moves forward with the East Campus, the Libraries and IT need to understand both the short and long-term directions and plan accordingly. The Libraries and IT should have ongoing conversations on this issue.

Services and Support

- Many IT-related projects that are pending must be concluded, including iTunes U (public and private instances) and the Alliance Digital Repository (ADR). There is a need for improved communication between the Libraries and ITS on large projects such as these. This could include a central point of contact that could communicate updates, take ownership of the project, and ensure that the project is moving along at an appropriate speed.
- We must actively assess user needs and expectations, as well as changing patterns of scholarly communication (what is the target of this research?) in order to continually improve library services. Methods might include observations, interviews, and focus groups targeting students and/or faculty.
- Continued research on other institutions
- Observations, interviews, and focus groups targeting students and/or faculty
- Faculty and students need to be more informed of copyright and fair use policies, as well as open access and scholarly communications and dissemination. Find, create, and implement easy and effective ways to push information about these and other library resources out to faculty and students.
- The Libraries' website and its relationship to CU's website requires continuous improvement, including the addition of video tutorials to help users understand what the Libraries have to offer, and how to use library resources. The Libraries' website and all interfaces also need to be compatible with mobile devices, most importantly the search tool.

Infrastructure

- One card for photocopying, printing, and scanning that can be replenished using credit cards (one for CU affiliates, one for non-CU users).
- Host a conversation about the future of reserves.
- Consider one-stop shopping, single sign-on for course-specific content, and collaboration around that content, e.g.:** A portal at which students can get their course-specific Library reserve information. See <http://www.lib.rochester.edu/index.cfm?page=courses><http://www.lib.rochester.edu/index.cfm?page=courses>
- A way for students to access course-specific reserve information from within CULearn courses.
- Online group data and document collaboration for students
- Long-term access to institutional assets (retirees, graduates, etc.)
- Advanced Videoconferencing Technologies/electronic collaborative environments, such as Access Grid, to facilitate at-a-distance collaboration that is as easy as picking up the phone (<http://www.accessgrid.org><http://www.accessgrid.org>)
- Discipline-specific portals of information made available to students, based on their major, courseload, or by choosing areas/keywords; tailored "My Libraries" function in CUConnect or CULearn.



- The Libraries and ITS need to collaborate on future faculty and student research on technology, such as hyper-text media, archaeological media, gaming, etc.
- Content management system to maintain and enhance the Libraries' web presence
- Campus-wide support for research-related productivity tools, e.g. bibliographic management software.
- User education or training integrating both ITS-supplied and Libraries-supplied tools to enhance student learning

Long & Short-Term Objectives/Timeline

Short Term: Libraries and IT to continue collaborations on issues with pressing deadlines such as iTunes U replacement, campus audio/video streaming services, and the ADR (or other) digital repository platform. Now through Fall 2011.

Long Term: Build on established collaborations by enhancing services to include features such as single-sign-on or dynamically including information about library resources into courses in the new learning management system platform. Design and build future phases of the Norlin Renaissance Plan as well as work together on other campus facilities projects where the library and IT intersect. Fall 2011 onward.

- Development of a performance and usage metrics program to monitor and evaluate existing and proposed library and IT integrated services.
- Review of other related ITSP initiatives, including “Offering Teaching and Learning Tools”, “Providing Teaching and Learning Spaces”, “Developing Rich Collaboration Tools”, and “Improving the IT Service Model,” which have varying levels of overlap and common objectives and potential shared resource pools. This will allow for integration and coordination of plans and objectives.

Possible Risk

It is possible that future campus funding levels could compromise our ability to complete these projects in a timely fashion.

Resource Allocation

As appropriate, the Libraries and ITS should collaborate on seeking funding for ongoing and special projects from Academic Affairs and Campus Administration.

Responsible Parties

The Dean of Libraries along with the associate deans and the Associate Vice Chancellor for Information Technology and Chief Information Officer along with the assistant directors are responsible for delegating sections of this plan.

3.2 ISIS Integration

Major Issue: The introduction of the Integrated Student Information System (ISIS) suite of tools and supporting technologies represents a significant disruptive technology event that replaces aging systems, provides modern technologies and data structures, provides additional enterprise tools, and represents an opportunity to greatly improve the administrative services required to support university students. This change and the opportunities it provides come at a time of deep resource limitation felt at a state and national level. The challenge for this strategic planning cycle is to recognize and identify priority investments that create an agile, participative data application environment supporting key student services, while enhancing students' educational experience and enabling campus objectives amidst the turmoil of change and economic constraint.

A. Background/Rationale

ISIS is the emerging Integrated Student Information System for the university. It includes Oracle Peoplesoft's Campus Solutions, Constituent Relationship Management (CRM system), Master Data Management, the enterprise portal for services, and a new student data warehouse and related enterprise class data reporting system. It also includes an integrated document management system, a degree audit system, and underlying software systems for integration and workflow. This system represents a transition to Oracle enterprise products for human resource, accounting, and student information purposes.

ISIS is managed by University Information Systems for all campuses and academic units of the university. The ISIS systems are the culmination of a large, multi-year project to replace the legacy Student Information System that served the campus for more than two decades. The admissions modules of ISIS went live in the Fall 2009, with full implementation scheduled through 2010.

On the Boulder campus, there are at least 50 campus application systems and likely many more that extract data from or feed data to ISIS. These systems vary in size and complexity. Examples include learning management systems, Library catalog and resource systems, Housing and Buff OneCard systems, Parking Management, International Education systems for study abroad students and international students on campus, Student Advising in Arts & Sciences, several interfaces to federal systems to meet federal reporting requirements, and many more in academic and administrative units. These systems are supported by Computer Support Representatives (CSR's) who are departmental personnel and departmental IT system managers. These departmental systems help departments meet their mission responsibilities using traditional extract and load technologies that are not often secure or timely. ISIS presents opportunities to improve and modernize the integration of campus systems.

In the next two years, the university will face extraordinary budget pressure to both be more efficient and to look for revenue other than from State appropriations. This implies that improved business processes and increasing staff efficiency are important contributors to improved student services. Faculty, and other important constituents of the university including parents, alumni, high school counselors, international education, 3rd party counselors, potential transfer students, are also impacted. The university will find itself in an even more competitive environment for recruiting the kinds of students needed to meet its mission and goals. The university will also have to adapt and fine-tune student processes and data assets that have been in place for many years.

The Campus Flagship 2030 strategic plan has a number of academic and business drivers that ISIS must meet along with the integration of campus systems. A few highlights are given here that are pertinent to ISIS and ISIS integration

- Increase uniformity in administrative processes among campus units where efficiencies can be gained or services improved
- Increase graduate student recruiting and retention
- Support new kinds of graduate level master and certificate programs
- Support students at distant, or enrolled in other, collaborating universities
- Increase international student recruiting , retention, and study abroad opportunities
- Enhance revenue
- Increase efficiencies of staff, their access to, and use of, computing technologies
- Support new kinds of educational programs and offerings through new, innovative housing models

A. Explicit Assumptions

1. The campus will largely react to changes introduced by the ISIS project for the next year or two. Strategic execution and thinking will be limited as the campus develops new processes and learns to effectively utilize ISIS tools. Much of the tactical deployment of strategic objectives is thus more likely to be seen in years 3 and 4 of this planning cycle.
2. The university has invested in and will rely heavily on Oracle PeopleSoft to provide rich features and services that enable university priorities and direction.
3. The university will stay current with Oracle's changing technology and upgrades. This maintains a viable system but requires appropriate levels of staffing and attention.
4. The university will adopt business and IT practices that support the efficient application of software upgrades, patches, and releases. This includes adapting business process and staff training to conform to vendor distribution cycles and an investment in software testing and quality assurance processes to manage the impact of software change.
5. The university will continue the central tenet of the ISIS project to minimize customizations to the systems. Minimizing customizations maximizes the integration contribution of the system and accommodates frequent upgrade cycles. This does not preclude supportive extensions, but suggests a strong value proposition is necessary and that process modification is an equally viable consideration.
6. The university will continue to make an investment sending staff to the Higher Education User Group for PeopleSoft products, and other important user associations and events. Active participation by university personnel will influence product improvements that are important to CU and keep key personnel well informed of upcoming changes.
7. New integration methods will allow for a high degree of reuse of data services. The university will use standard, canonical data services, supplied by Oracle, facilitated through "middle-ware", or developed by the university. "Standard data services" describes common, well-defined collections of data readily available for use by other systems.
8. Departmental systems will conform to the university and Oracle standards for integration and will commonly use Web based, service oriented approaches.
9. In the late 2011 to 2012 timeframe, the university will start to expand use of the ISIS systems, especially CRM for student retention and other strategic areas.
10. The demand for integrated workflow between systems will continue and even increase.
11. Pressure arising from the need for more cost savings will encourage more use of central systems.

12. The need for agile, quick responses to specific needs of departments will continue. The innovative, entrepreneurial nature of departments will continue. Easily accessible technology services, such as cloud computing, will offer opportunities for departments to be innovative service providers.
13. Data and identity protection will continue to be a vital requirement for the university. Management of access to data will continue to be a policy and procedural issue.
14. Effective identity management will continue to be a critical need, driving certain IT initiatives. University-wide identity management is a necessary component for effective ISIS integration. Most services and techniques depend on an accurate and transparent understanding of persons and their relationship to the university and/or campus.
15. IT Governance (decision making) will mature and support the need for cross-department coordination of IT development and support. IT Governance will provide a forum to make optimal decisions related to acquisition or development of departmental systems. IT Governance will improve service relations between departments and central IT units.

B. Specific Recommendations:

1. Pursue Technology Initiatives To Achieve Effective ISIS Utilization and Resource Efficiencies
 - A. Maximize value from the investment in the ISIS Project. Take advantage of ISIS integration and the investments made in ISIS to meet campus business needs. Examples to consider include:
 - 1) Expand the use of the CRM system from student recruiting to student retention.
 - 2) Use the CRM system for other business needs that require better communication, service, and follow through with constituent groups.
 - 3) Utilize the new document management system more broadly.
 - 4) Develop the workflow software and integration software for campus and departmental business needs.
 - B. Implement automated workflow with the capabilities of the new workflow software and related products.
 - C. Provide for “real-time” and event-driven services.
 - D. Invest in skills and cooperative development models to foster effective use of ISIS technologies and data in central and departmental technology organizations. Develop business process analysis, modeling, and design competencies.
 - E. Encourage the development of additional features and services to meet business needs. Define, publish, and support development architecture and effective life-cycle management for ISIS technologies.
2. Make Meaningful Data Available Through Data Services Standards and Approaches
 - A. Move toward developing a set of standard web and data services that combine data from ISIS and other source data systems.
 - B. Produce data models and information architecture to support integration efforts
 - C. Participate in a robust identity management methodology and master data practices to provide reliable, up-to-date, accurate records of persons and their relationship to the University. This is an essential enabler for many ISIS technology objectives and an integrated systems environment.
 - D. Minimize duplication of effort and provide uniform data accessibility while providing abstraction from the component technologies and their dynamic changes by utilizing Web Services approaches and standards. Standard services can reduce interface



duplication, promote consistent and predictable integration, and provide a stable buffer between campus systems and ISIS change cycles.

E. Advance privacy and protection of data while pursuing these data initiatives

3. Establish Service and Governance Initiatives To Provide Direction, Clarity, and Opportunity

1. Consider and investigate opportunities to replace campus systems (such as fsaAtlas or Apply Yourself) where ISIS provides sufficiently similar functionality. Utilizing ISIS functionality provides cleaner integration, eliminates redundant license fees, and reduces data duplication and exchange.
2. Establish clear decision making forums and utilize the new IT governance processes to help manage and clarify priorities while directing funding towards optimal campus investments.
 - 1) Create an approach for defining and developing optimal web services and data services. This includes a governance process that supports co-development and an “architecture of participation” that enables solutions and defines responsibilities and expectations for all providers.
 - 2) As part of IT governance, create a data governance process to support better utilization of all ISIS related data assets.
3. Develop a service model that encourages co-development of new services that takes advantage of the distinctive capabilities of personnel from UIS, ITS, and campus departments.
 - 1) Improve information, documentation, and training for campus department IT staff.
 - 2) Clarify responsibilities so that campus departments can easily identify contextual contacts for ISIS information.
 - 3) Provide an “application manager” for each of the major application areas of ISIS. This person will have in-depth knowledge of the application and can help departments determine the best way to use the application to meet business needs or integrate with the departmental system.
 - 4) Provide additional campus contextual documentation and training for the ISIS system.
 - 5) Keep departments informed of upcoming changes in the new software releases for ISIS.
 - 6) Establish a registry or catalogue of services and departmental applications with ISIS interfaces or integration. Encourage departments to select existing university or campus solutions before purchasing potentially redundant application systems. This will help identify existing integrations and interfaces, minimize duplication of effort and data, and promote effective service deployment.
 - 7) Develop a process that allows departments and providers to develop enterprise quality business solutions that can be used by other departments and organizations and become part of the campus portfolio of services.
 - 8) Establish a structured communication process between departments, ITS, and UIS.
 - 9) Encourage cooperative and positive collaboration to meet departmental needs.
 - 10) Adapt service delivery environments to a rapidly changing, dynamic social technology expectation
 - 11) Increase service windows and support for international services (language, cultural, legal environment considerations)
4. Encourage primary reliance on university wide reporting tools and the data warehouse for data reporting purposes.

- 1) Develop supportive training and utilize key providers (such as Registrar services and Institutional Research offices) when possible to eliminate redundancy, provide expertise and consistency, and assure a level of data integrity.
- 2) Support methodologies to integrate and make campus or departmental data sources more widely available through these tools.

C. Short/Long-term Objectives

1. The university must strengthen the initiation and development of relationships with prospective students, enrolled students, and graduating students as well as family members, alumni, and community members. Effective, positive relationships between the university's wide ranging constituents and administrative services will help meet recruiting goals, improve retention, and improve the overall experience of students. ISIS systems will help the university meet these goals, particularly by extending the use of integrated elements such as the CRM system and data warehouse. Real-time integration between ISIS and campus systems improves service and information quality.
2. The way the university uses technology for communicating and interacting with students must be flexible and must be extensible to take into account ever changing communication technologies. The newer generation of students will be much more agile with how they use communication. Their expectations will be higher that the university can match the way that they communicate with their peers and others. This can be said in another way – the university must offer multiple channels of communication so that we can ask students “how do you want to communicate with us”; not tell students you must use these channels.
3. The university needs a much better way to support all students in a responsive and efficient manner, such as students experiencing academic or personal difficulties (students of concern) and for a multitude of student retention goals. Identifying and supporting such students requires a comprehensive view of student information, including academic performance, administrative support, and extra-curricular activities. To support objectives of organizations such as the Division of Student Affairs to facilitate immediate assistance without excessive “assistance shopping”, heavy reliance on strong integration and comprehensive information availability is necessary. “No wrong door” processes are better supported by technology (such as the ISIS CRM functionality) when the processes and data are supported through standardized, integrated methods.
4. Improve the integration of campus-based systems with ISIS. Reduce the cost of maintaining interfaces while improving the integration with more real-time data and event driven processing, improving data integrity, and reducing security risk.
5. Develop a useful and well understood IT architecture for integration. This architecture can provide a small collection of standard data services that are well documented, and that can be used by departments to develop additional, innovative services to support specific business needs. The use of defined methods and processes will take better advantage of distributed campus IT skills and will assist in developing the IT community into a self-sustaining and robust set of expertise. University IT organizations, with product support from Oracle, can define an enabling IT architecture for building innovative extensions to ISIS. Architecturally compliant solutions can in turn become university-wide solutions, not merely local point-solutions.



6. Comprehend and pursue an understanding of the impact of increased internationalization on data and services. Expanded support windows, additional customer concerns (agents, cultures, regulatory environments, language barriers), and increased clarity in communications are necessary across all integrated services.

D. Possible Risk

Technology Risks:

- The campus may not invest sufficiently in staff, support, and procedural considerations to utilize the ISIS tools effectively or efficiently. Campus training, support, and procedural guidance may lag behind the massive technological innovation ISIS represents.
- There is a high dependency on a single market provider (Oracle) for the majority of university enterprise data and administrative systems. Change processes, disruptive events for the provider, and variation in planning horizons could impact university priorities and services.
- Technological viability is increasingly short as innovation, integration, scale, and complexity of data systems are likewise rapidly increasing. These forces will likely create difficult choices due to economic and resource limitations.
- New event and request driven integration may pose immediate security and privacy concerns.

Strategic Risks:

- Increasing internationalization introduces new procedural and technical strains on student data processes. Service and support windows must increase to support Flagship 2030 goals, greatly impacting the support costs and availability costs for providing data. Legal and jurisdictional issues increase external mandates and demands on data, as do cultural and communication barriers. These factors impact support requirements and costs at a time of massive technology change and poor economic condition.
- Adaptation to technological change requires investment in employee and customer development. In recent years, campus and university staff have found increasing development and training requirements challenging and intrusive to their core activities. Conflict in this area may produce less effective application of ISIS tools towards campus priorities. This is both an environmental and Flagship 2030 strategic risk.

Resource Risks:

- Resource constraints are tight given national economic and state funding externalities. An increasing dependency on technology and increased service window will be challenging in the current economic environment.
- The complexity of the new highly integrated systems creates a skills barrier for participation. The flexibility presented will demand skilled resources many individual departments do not currently have and cannot afford to pursue without reallocation of existing resources.

Environmental Risks:

- Organizational, process, and workflow design may not adapt as quickly as technology change requires, reducing effectiveness of the technological investment.
- The intense focus brought to the ISIS implementation and enterprise development environment may be difficult to maintain during the years immediately following initial implementation. This could interfere with opportunities to put tools with limited or targeted scope in ISIS (such as CRM and Document Imaging Tools) into more pervasive use as recommended.

5. Resource Allocation

1. No additional enterprise level technology investments of a significant nature currently appear necessary to achieve the stated recommendations and objectives of this report.
2. Much of the additional cost of ISIS integration comes in the development of services, standards, methods, training, and procedure. The actual allocation for this may be possible in large part to a “reallocation” of departmental resources that are freed up due to ISIS capabilities. Otherwise achieving the service windows needed and the process integration implied represents a significant investment in skilled human resources. Implications include the following considerations:
 - a. Accommodating a shift in service away from simple departmental tools to enterprise architectural approaches represents a reallocation priority. New and robust technology will require new investments and constrain out-of-date and less serviceable approaches. Funding and skills allocation challenges follow.
 - b. Smaller departments and more isolated organizations with integration needs may require representative technical services more than in the past due to the integration and additional complexity of the new system and its underlying data structures.
 - c. Target service windows are multiplicative, not additive, to service resource requirements. Support that could be managed by one or two persons will require as many as five or more skilled support staff as service windows increasingly approach 24 hour, 7 day requirements.
3. Development and integration technologies will require shared resources with high availability or additional investment by those organizations that choose to pursue their own integrations. The development environment, tools, and techniques are markedly different than in the previous data environment. This may represent a cost burden such organizations are unaccustomed or unprepared to accept.
4. The recommendations of this report cannot provide the intended efficiencies or effective processes without due investment in process, roles, and skills. Technology alone is insufficient to create efficiency or effective solutions.

6. Responsible Parties

- ISIS vendors, Oracle, other business partners
- Shared data repository custodians at the department level
- Central system-wide IT, UIS
- Campus-wide IT providers and service organizations (ITS)
- Owner, Stewards, Custodians, and end-user consumers
- Business line or functional process parties impacted by, dependent on, or providing to ISIS

7. Evaluation

How will we know that we are successful?

- Campus departments have a well defined process for requesting and receiving ISIS support and services.
- Computer Support Representatives (CSRs) express satisfaction in being well informed about ISIS and changes to ISIS.

- Innovative development of new services still occurs but using a well-conceived architecture for extending the services of ISIS. Services can be built relatively quickly using standard data services approaches.
- UIS supports a small number of standard services instead of many custom services that are expensive to maintain and support.
- The campus has adopted a common, comprehensive relationship management approach. This approach supports a system for collecting and monitoring student activities, and provides much better communication and follow-through with students.
- Campus departments will have access to an up-to-date registry (catalog) of services and applications. Decisions to acquire new third-party systems are based on a careful evaluation of available CU services prior to new acquisitions.
- The Registrar will have an up-to-date inventory of all systems on campus that contain student data.
- The protection and privacy of student data continues to be a top-level priority and is well understood by all departments. Policies will be clear, up-to-date, and followed.
- The university is using a common, comprehensive identity management system to support security policies and procedures, as well as providing a common, trustworthy source of data for personal identity and affiliations.
- Departmental systems that were built for data reporting purposes will be reduced and replaced by effective use of the new university-wide data reporting tools and data warehouse.
- The Registrar's office (and other central IT units, including Institutional Research) provides a standard set of queries and reports that provide a high-degree of reliable and accurate student and trend data.
- The central data warehouse architecture meets greater than 90% of all campus reporting needs.
- Campus recruiting goals are achieved utilizing ISIS data systems.
- Retention processes are defined and ISIS data will demonstrate measurable positive achievement of retention goals.
- Services or service prototypes exist supporting the latest social computing or technology devices.
- "Student of Concern" processes depend heavily on ISIS data and integration services.
- Total cost of data access for departments is measurably less due to ISIS data services.
- The defined integration architecture is also the architecture of choice for campus developers.
- Upgrade schedules, testing requirements, quality and training standards for the development of ISIS integrations are defined and available to all potential providers.



3.3 Partnering with Facilities Management: Construction & Sustainability

Major Issues: As the use of technology in higher education continues to mature, proper infrastructure planning, development and management becomes increasingly critical to delivering the quality experience that our students, faculty and staff expect. User mobility, expanding use of video, cloud computing, growth in research computing and physical development of the campus represent a number of factors that drive the need for IT planning. In addition, procurement, use and management of technology on campus have a significant impact on sustainability, from energy consumption to electronics end-of-life management issues.

A. Background/Rationale

The Boulder campus is undergoing unprecedented growth in facilities, as evidenced by the number and size of projects that are under construction or being planned (e.g. as of March 31, 2010, construction is underway on the 302,318 square foot Center for Community; a 127,724 square foot, 500-bed residence hall at Williams Village; a 281,800 square foot Systems Biotechnology facility in the Research Park; and a 50,565 square foot facility to consolidate the Institute for Behavioral Sciences in Grand View). Additionally, final planning for a high performance computing facility is underway on East campus. Beyond these large projects, there continue to be hundreds of small renovation projects underway. Although these projects vary from renovating a lab for a new professor to constructing a world-class bioscience research center to providing housing for students, there is a common thread that runs throughout virtually all of these projects – the need for information technology.

The Colorado Commission on Higher Education requires that a Facilities Master Plan be developed and approved every ten years to provide a roadmap for physical development of the campus. The current Master Plan was approved in 2001, and it is currently in the process of being updated. Although the Facilities Master Plan provides a roadmap for developing the physical campus environment, it does not specifically address the infrastructure that must be provided to accommodate demand for IT services and telephony.

As our reliance on technology increases and it becomes more ubiquitous, expectations of students, faculty and staff will undoubtedly continue to increase. Our students and workforce are becoming increasingly mobile and expect to be able to access applications and data from virtually anywhere, placing new demands on wireless infrastructure. Shifts in application architecture are occurring, such as cloud computing; demand for video applications is growing in academic and administrative settings, placing an increased burden on the network backbone; and extended building hours and an increasing need to electronically schedule and control labs and meeting spaces are requiring improved tools for managing and monitoring access to space. These are just a small number of trends that are currently impacting technology infrastructure, facilities and service delivery.

The campus does not have comprehensive standards or guidelines that outline the space allowances that should be provided in order to accommodate computing labs, servers and other technology-based infrastructure. As technology continues to evolve and the campus grows, space allocated to IT programs and the sustainability impacts will become increasingly important.

Significant space is used to house servers or data centers. Rough estimates suggest that the campus has at least 40 data centers and many other spaces where servers are housed. The campus recently articulated its objective to transition to a more centralized data-center approach for managing significant technology-related resources. Based on information from the Facilities Master Plan, along with more detailed IT-related programmatic information, the campus has an opportunity to adopt a phased or modular approach for data center development and expansion, optimizing the campus' capital investment and cost of operations.

A significant amount of space is also used to house computing labs. With mobile computing devices widespread, opportunities may exist to improve the utilization of lab space by reducing the number of desktops and increasing the amount of space that supports students with their own laptops with available power data access. Demand for lab space continues to be high in areas that require large or specialized applications, such as Engineering, Environmental Design and Business. Virtualization technologies and cloud computing options may influence this demand in the coming years.

Data center consolidation has the potential to not only improve the efficient use of space, but it also provides a significant opportunity to reduce energy consumption. Data centers are known to be energy hogs, with approximately 40 percent of the cost of operations directly related to energy. Accordingly, they serve a key role in addressing the campus' sustainability and carbon neutrality goals. Consolidation would result in the elimination of specialized cooling units that are oftentimes inefficient and take advantage of large-scale, high-efficiency equipment and modern space and HVAC design that capitalizes on the heat generated by the equipment as a heating source for other parts of the building or even separate buildings. It would also enable the campus to expand the use of virtualization technologies, which more efficiently utilizes hardware capacity, reducing the number of servers and energy consumption.

The volume of electronics equipment purchased by the university presents challenges. The campus has a well-recognized electronics-recycling program to ensure an environmentally appropriate outcome for the surplus equipment; however, some IT staff on campus have expressed an interest in being able to exchange equipment directly with other departments prior to officially declaring a piece of equipment surplus. This practice has the potential to extend the life of some equipment, reducing surplus volume and saving the university money. In addition, there is currently very little involvement of vendors in reclaiming their electronics equipment at end-of-life. Opportunities may exist to leverage our purchasing volume to require support on the part of the vendor for addressing recycling or reuse of electronics.

B. Accomplishments to Date

- Facilities Management recently partnered with ITS to successfully renovate the Marine Street Computing Center. As a result of the project, energy consumption has been reduced, the space is more functional, additional capacity has been obtained and building occupants are more comfortable.
- Facilities Management and ITS continue to work on plans to finalize development of a high performance computing center at the CINC facility as well as other potential options for developing a centralized data center for campus research and administrative computing.
- ITS is running a pilot of virtualization desktop infrastructure with thin clients with a vendor partner. The outcome will be an assessment of the benefits of VDI technology, and any cost or other beneficial savings it may provide to the campus.

- A baseline has been developed detailing current energy use by computer model and lab that is potentially applicable to departments across campus.

Action Plan

A. Explicit Assumptions

These recommendations assume that the campus continues to support the data center consolidation concept. They also assume that campus sustainability programs remain a high priority. Many of the recommendations outlined in this chapter are intended to support the President's Climate Commitment and the Governor's Executive Order Greening State Government.

B. Specific Recommendations

1. Develop an IT infrastructure master plan that would help ensure that core infrastructure, such as the network backbone, telephony capabilities, wireless infrastructure, space, etc., are sufficient to accommodate the demands anticipated in the Facilities Master Plan as well as ongoing changes in the use and management of technology. Additionally, in order to ensure that the Facilities Master Plan serves as an effective baseline, make sure that strong IT representation is achieved in developing the Facilities Master Plan.
2. To successfully meet campus demands for services, Facilities Management and ITS must collaborate to improve the understanding of the impact that changes in IT modality and trends have on facilities. This understanding, combined with a clearly articulated campus IT strategy, will facilitate development of effective standards and guidelines that result in facilities and other infrastructure that will accommodate the campus' needs today and in the future. In order to accomplish this, campus governance should designate roles and responsibilities in Facilities Management and ITS to develop, communicate and enforce standards and guidelines as well as collaborate in regard to program planning and building design. Increased collaboration will help ensure proper consideration and accommodation for communications infrastructure, power, cooling, physical security and space. In addition, IT participation on the Boulder Campus Planning Commission may also be considered in order to heighten awareness of IT issues on the Commission.
3. IT facilities and infrastructure should adhere to the vision and associated standards for campus IT. All standards, whether they define space allowances or specific technologies, should be consistently applied regardless of who manages the resources. For example, classroom IT equipment standards that are applied to centrally scheduled classrooms are not consistently followed for departmentally-controlled and funded classrooms, causing some support issues for ITS. In addition, incentives should be developed to encourage significant change, such as data center consolidation.
4. Define and inventory data centers, and implement a program for an energy conservation/sustainability review of all existing facilities in collaboration with data center owners, ITS and Facilities Management.
5. Enhance the annual review program for computer labs to validate whether the labs meet programmatic needs based on the changing mobility requirements of students, options for

delivering specialized or complex applications (e.g. virtualization or thin-client technologies), among other factors. In addition validate that sound sustainability practices are being followed in the management of lab equipment.

6. To support end-of-life management of electronics, investigate development of an intra-campus online exchange, whereby staff from across campus could post surplus items for direct transfer to other departments prior to declaring the equipment surplus.
7. Work closely with the Procurement Service Center in conjunction with their strategic sourcing efforts to place responsibility for reuse or recycling of electronics on vendors, when possible.
8. Increase coordination among ITS, Facilities Management and other campus IT organizations regarding infrastructure related to backup power to reduce duplication of efforts and costs.

C. Long & Short Term Objectives/Timeline

Short-Term:

1. Develop IT Infrastructure Strategic Plan to support the campus Facilities Master Plan; (2) designation of roles and responsibilities in Facilities Management and ITS by campus governance to increase understanding and collaboration on issues impacting facilities; (3) develop standards that articulate the campus' vision for management of technology; (4) review and update lab oversight process to ensure effectiveness and include sustainability; (5) enhance electronics end-of-life management; (6) survey, identify and begin sustainability audits of data centers; (7) begin uniform and consistent enforcement of standards; (8) and, improve coordination of backup-up power infrastructure management.

Long-Term:

2. Reduction of energy consumption through consolidation or efficiency improvements of data centers; (2) evolve standards, balancing changing needs and technology with long-term sustainability.

D. Possible Risks

The recommendations outlined in section B present a number of risks. In general, however, they can be categorized as business risks as opposed to technology or security risks. In other words, failure to successfully execute the recommendations could result in an inability to deliver the quality or range of services desired by the campus community.

Adoption of new standards or strict adherence to existing standards could potentially negatively impact the cost of new construction or renovation projects.

E. Resource Allocation

The recommendations outlined above may require the addition of a new planner position in ITS or Facilities Management. If required, the overall cost would likely be in the range of \$80,000 to \$100,000, including salary and benefits. Although there would be an ongoing, operational

component to the position, at least a portion of the funding could be recovered from project recharge.

Funding is currently available through Xcel Energy rebates as well as Department of Energy and Governor's Energy Office grants for energy conservation projects. These one-time funding opportunities should be pursued to address deficiencies in existing data centers or development of consolidated centers.

F. Responsible Parties

ITS; Facilities Management; Campus Administration; Procurement Service Center

G. Evaluation

- Review the reduction in number of data centers on campus compared to the baseline.
- Monitor consumption of electricity, steam and chilled water in facilities housing data centers.
- Monitor the volume of electronic equipment that is directly transferred between departments.
- Monitor the volume of electronic equipment that is returned to vendors at the end of equipments' useful life.
- Adherence to standards or guidelines.
- Successful completion of a campus IT infrastructure master plan.

3.4 Housing and Dining Services

Major Issues: 1: How can the relationship between HDS and ITS be enhanced? 2: How might we improve IT involvement in the enhancement/expansion of Residential Colleges (from planning initiatives to implementation)? 3: Major Issue 3: What are the major IT needs or initiatives for HDS and its customers?

A. Background/Rationale

HDS and ITS have provided shared critical services to students living in the residence halls most notably for telephony and networking. The desire to increase residential academic programs will increase the joint reliance on an effective relationship between HDS and ITS. Past friction areas point to differing sets of business drivers and principles within the two departments. As such, to enhance the relationship HDS and ITS leadership will identify and communicate a shared set of principles that guide the relationship. Through a shared set of principles both departments will have a shared understanding of business needs and how those align with Campus goals. Based on a shared understanding both departments will jointly seek solutions to meet business needs, jointly seek to make the most effective and efficient use of technology in a financially responsible manner for both departments to meet business needs, and collaborate on new technology.

Campus governance, HDS, and ITS need to be clear and open about funding models and IT costs. For example, there exists a perception that ITS network funding model can not be changed since it was mandated from the CFO whereas HDS sees the network funding model inequitable and out of sync with other institutions. Hence, HDS is asking ITS for an alternative solution that is less costly for both HDS and ITS. The lack of clarity results in the potential for conflict or harm to the relationship. It also results in the potential for conflict or poor decisions. Specific funding issues that must be resolved include the network funding model and educational technology for Residential Academic Programs (RAPs).

As the campus moves forward with Residential Colleges funding, policies and standards will need to be addressed. Questions regarding funding and oversight for RAP classrooms will need to be resolved through campus leadership. Since the same faculty and students will be using academic technology inside and outside of the Residential Colleges, common solutions and processes should be in place. Failing to do so will be both inefficient and confusing to HDS and ITS customers.

ITS and HDS have a jointly vested interest in providing fast and reliable network service to student residents that does not adversely impact academics and research. Additionally, ITS and HDS have a vested interest in providing open and up-to-date information about network performance and service issues.

Students find it difficult to get good reception in some areas of the residence halls and many other residential areas (i.e. Family Housing or Bear Creek Apartments) on campus. Additionally, students would find improved IT support within the residence halls highly desirable.

Residence halls security relies on CCure locks on all external doors. Students need access to their residence hall buildings 24/7. As such, all units supporting card access systems (HDS - Buff OneCard, Housing Facilities Management, and ITS) need to ensure that systems are available. There exists a perception among students that Buff OneCard needs to be made more

durable so that students do not have access issues after hours or have to purchase new cards. However, data indicates that the cards are highly durable and this information needs to be better communicated with the residence hall students. This same need for better communication can be identified for other ITS or HDS services.

Future issues such as smartcard technology have been proposed by RTD and other campus areas and will require analysis and coordination of campus areas involved. There is a need to meet and discuss such possible card changes, costs, and benefits. Additionally, the new ISIS system is requiring changes to interfaces for all systems accessing or uploading SIS data. Such changes will impact all other downstream IT related systems.

Action Plan

A. Explicit Assumptions

Housing and Dining services will be represented in some form as part of the developing governance structure (e.g., as a member of an administrative computing committee)

B. Specific Recommendation

1. Establish a set of core principles to guide the relationship and business decisions, for example:
 - We understand that both organizations have a set of core competencies which are recognized by both organizations
 - Clearly defined business needs will drive business, service and technical decisions
 - IT investments will seek to make the most effective and efficient use of resources throughout the life-cycle of the service
2. HDS and ITS will work to identify administrative computing services or technologies that can be shared or pooled so as to gain efficiencies. An example, is Kronos which while not used by all employees is used by departments to support business needs.
3. The creation of a monthly program or service review meeting with HDS and ITS to discuss challenges related to services to enhance communications. Key issues are, academic technology, smart classrooms, networking, telecom/phone, security, smartcards, ISIS interfaces, digital signage, emergency notification, web development, e-commerce, cell signal strength planning, IT processes and procedures development and establishment of standards and policies. Additionally, a quarterly leadership meeting with the CIO and HDS executive director, and their direct reports, should be established. The purpose of the meetings will be to review tactical and strategic plans as well as challenges and opportunities in the HDS/ITS relationship. Such a meeting could potentially mirror discussions ITS currently has with external partners. Lastly, active participation by HDS in campus IT governance will help to ensure that policies, strategic plans, and business needs are addressed early on.
4. Campus governance, HDS, and ITS need to continue to work collaboratively to develop mutually acceptable funding models that are well understood and transparent.
5. Active participation by HDS in campus IT governance discussed in section 4.1 will help to surface the needs for IT resources (e.g., bandwidth) required by Residential Colleges and student residents. By surfacing such needs, potential IT governance support can be garnered for joint identification and funding solutions that would address what are currently competing interests.

6. It must be recognized that wireless networking is considered a necessary infrastructure component to support residential academic computing. As such new wireless technologies (e.g., 802.1n) can no longer be considered an augmentation to existing wired network service.
7. Cell phone reception needs to improve especially given the increased reliance on cell phones for both personal and emergency communications. A plan needs to be developed to improved this infrastructure with milestones and deadlines.
8. An effort to evaluate the feasibility of replicating the walk-in service center at Norlin Commons in additional locations closer to students (C4C or Williams Village) or courier service for warranty work through the Bookstore.
9. Buff OneCard has an established advisory group whose relationship with broader IT governance should be understood and formalized. Buff OneCard should share processes of their services and interface connections with campus groups. A process needs to be developed for coordination of Buff OneCard systems processes that impact campus departments. For example, should the campus move from magnetic stripe cards to smart cards it would require coordination between HDS, ITS, PDPS, and Facilities Management. Such a process would also address service issues such as network availability requirements for card access systems.
10. HDS and ITS need to formalize the process for identifying new academic technology equipped classrooms, determining funding, and support requirements.

C. Long & Short Term Objectives/Timeline

- Residence Halls network bandwidth service level agreement - 1 to 2 years
- Establish common principles and regular service review meetings - 1 year
- Communicate and share Buff OneCard roadmap - 1 year.
- Develop strategy for cell phone coverage on campus - 1 to 3 years.
- Develop strategy for improved walkin IT support for personally owned equipment within the residence halls - 1 to 3 years.

D. Possible Risk

E. Resource Allocation

Cost of the project: Recommendations for additional collaboration, such a regular leadership meetings, do not represent additional direct cost to the University. Other items in the recommendation section will need to be evaluated to determine the cost and sources of funding.

F. Responsible Parties

Campus leadership, Campus IT Governance, CIO, HDS Executive Director

G. Evaluation

Potential evaluation criteria include:

- Student satisfaction survey
- Cost savings
- Number of jointly commissioned and completed projects

TABBED Page: Chapter 4

Chapter 4: Participating in IT Governance

The final chapter of the IT Strategic Report concerns engaged participation in governance and budget, as well as communications and consists of two reports: Redefining Governance and Developing Strategic Communications. Each report focuses on how IT and ITS may best serve campus constituencies and details significant enhancements to an understanding of how IT governance and communication may be conceptualized on campus.

Recommendations involve envisioning and implementing IT advisory committees as well as a campus-wide virtual organization composed of ITS and distributed IT providers to offer a more effective fit between an ITS-provided core infrastructure and a variety of distributed services. In tandem with this recommendation is overt recognition of the expense associated with IT and the need for systematic processes surrounding IT funding. In turn, effectively communicating with students, faculty, and staff is integral to IT governance. Recommendations for developing strategic communications include crafting and distributing a campus IT and ITS mission, redesigning how IT and ITS information is constructed and disseminated, and stronger collaboration between university communications and ITS. Viewing communication as a continuous feedback loop rather than a one-way linear model is an important aspect of establishing open and reciprocal channels of information and in turn, providing an environment wherein IT development may flourish.

4.1 Redefining Governance and Fiscal Responsibility: From Services Offered to Services Shared

Governance: How can the Office of the Associate Vice Chancellor for IT develop appropriate advisory structures that include faculty, students and staff that effectively shape IT direction through engaged participation to better support the core activities of teaching, learning and research?

Additionally, how can the AVC for IT define in theoretical and actionable terms the idea of fiscal responsibility and budget transparency through engaged participation of the advisory committees? How can the IT committees draw in other recommendations that derive from other committees to create a campus-wide dialogue regarding IT fiscal responsibility?

A. Background/Rationale

This subchapter provides a roadmap to engage all areas at CU-Boulder to select, prioritize, coordinate, budget, measure, and judge IT services, at the level of one specific area, and for all of CU-Boulder.

IT is a strategic service and resource necessary to the support of research, teaching, outreach, and administration. IT services have developed across the campus in a distributed manner, typical and appropriate to an R1 institution. To maximize the quality, quantity, and cost-effectiveness of IT services, governance – advisory and decision-making processes – is needed to coordinate and optimize IT assets across distributed service providers. An IT governance model that engages the campus can form a campus-wide virtual IT organization composed of ITS and distributed IT providers that is guided by, and is responsive to, all campus constituencies. A virtual IT organization can provide a continuum of services, from core infrastructure provided primarily by ITS, to domain-specific IT providers who will then be better able to serve IT needs unique to their areas. No one area at CU-Boulder independently provides all of its IT service and resources. It follows that each area, to maximize its IT services and resources and minimize its costs, must coordinate how it fulfills its IT needs with other areas and with ITS. Further, the more an area can depend on ITS for core services and resources, the fewer core services and resources an area has to provide for itself, freeing resources for IT needs specific to an area, or for non-IT needs; therefore, the campus has an inherent interest in IT governance and finance.

Effective IT governance requires systematic campus-wide advisory input from faculty, students and staff within a decision-making model. The model must be able to distill and prioritize IT projects and directions that support the strategic directions set forth by campus leadership. Governance and fiscal responsibility are sides of the same coin. The governance model, informed by fiscal realities, must identify and, endorse or decline funding for initiatives, projects, and services. Committees within the governance model must be aware of the many-faceted aspects of distributed and centralized IT on campus and how those aspects interdependently form one large-scale IT environment. This new structure needs support from all campus constituencies, including the chancellor and senior leadership.

B. History and Accomplishments to Date

IT at CU Boulder evolved from four groups. Three formed ITS: Telecom (telephony and physical networking); Computing and Network Services (core and administrative development and services); and Academic Media Services (instructional IT and media services). One developed alongside ITS: distributed IT service providers within the research, administrative and academic areas. A rift and lack of coordination between ITS (the first three groups) and distributed IT service providers (the fourth group) is apparent. ITS offers campus-wide IT services and resources, but generally has not engaged or interactively communicated with other campus IT providers.

For the past few years ITS has operated under the Four Tier support model in which Tier 1 provides broad, self-help communications (the ITS web, end-user support documents, technical information, etc.), Tier 2 provides an outreach component composed of non-ITS staff known as Computer Support Representatives (or CSR's) who provide local IT support functions partly coordinated by ITS, Tier 3 provides ITS support employees, some positioned in academic and administrative departments, and Tier 4 – ITS staff who provide escalated IT support. In addition to about 150 ITS employees, by rough count, there are about 250-300 “IT” staff, who comprise mainly IT professionals, but range from doctoral level scientists to departmental assistants also assigned an IT support role. The primary communication conduit from ITS to campus-wide IT professionals (primarily a one-way channel) is the CSR/Tier 2 community.

The campus recognized the need to develop a senior position overseeing IT functions and created the position of “associate vice provost for academic and campus technology.” This position is now reconstituted as “associate vice chancellor for IT and CIO.” The former AVP formed IT Council, comprised of senior-level administrative staff, faculty, and students. IT Council met monthly during the academic calendar from 1999 to 2005, having eventually degenerated to little faculty participation and interaction. The 2002 campus-wide strategic plan recommended that three additional advisory boards be developed: the IT Infrastructure Advisory Group (ITIAG), the Faculty Advisory Committee for Educational and Information Technology (FACE-IT) and a student advisory committee. ITIAG is still in operation. FACE-IT met for a year and no longer exists. The student advisory committee never developed. ITIAG comprises IT professionals from the schools and colleges as well as the research institutes, academic departments and ITS. ITIAG has met monthly since 2002 to influence technical direction, shape policy, and provide a campus-wide technical perspective.

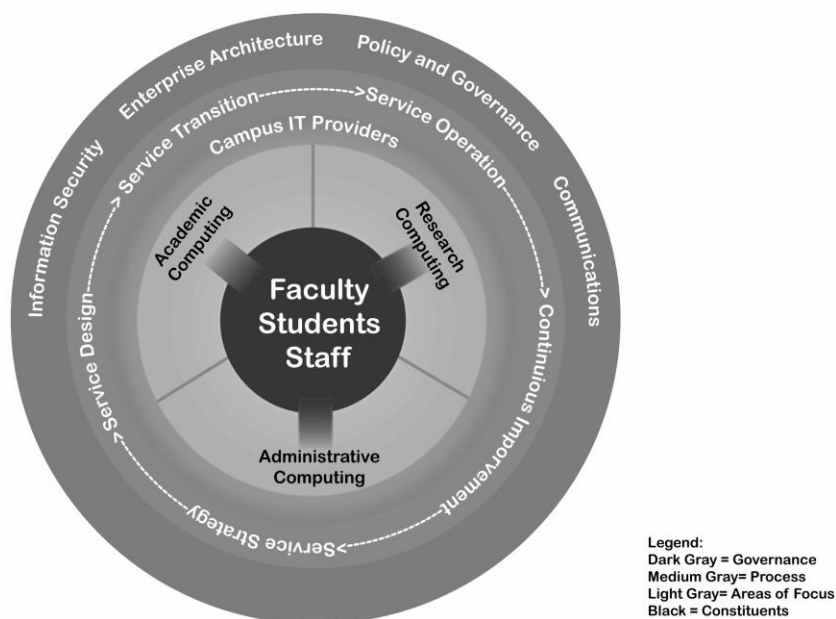
C. A New Model

Building on past success, lessons learned, and best practices from public and private sectors, the office of the AVC for IT and CIO recently developed a new, integrated model of campus-wide IT focus (academic computing, research computing, and administrative computing), support and process (service strategy, design, transition, and operation, and, continuous improvement) and governance principles (policy and governance, communication, enterprise architecture, and information security).

The diagram below, “Conceptual IT Environment,” shows that the faculty, students, and staff are at the core, or the heart of the IT environment. Close to the constituencies are the three areas of focus in which all IT services and support fall: academic technology, research computing, and administrative computing. The next concentric circle—the campus IT providers—represents all

IT providers who support these three focus areas utilizing a collection of campus resources in a variety of ways. The following circle represents how these IT services and support are created, adopted, managed, and assessed using the most widely accepted approach to IT service management, ITIL, which provides a cohesive set of best practices for IT—strategy, design, transition, operations, and continuous improvement provide the structure to effectively plan and execute IT projects and programs. The outermost circle represents the boundaries, or criteria in which to create structure and order in developing and maintaining campus IT. IT security, enterprise architecture and policy are all critical elements that must be considered to ensure a healthy, functioning IT environment.

Conceptual IT Environment



D. Action Plan

Specific Recommendations

The Governance committee considered the question: how can campus-wide IT directions and projects identified in the rest of the strategic planning process be endorsed and supported over the coming years? We considered existing and past IT advisory councils and groups, the BFA, the soon-to-be advent of a research computing faculty advisory group, existing IT governance structures across the campus in various schools, colleges, and administrative areas, and the

overall governance structure of CU-Boulder. The chair and co-chair also reviewed the ideas in an EDUCAUSE publication with the committee.⁴

Three principles emerged. 1) IT services and resources are necessary to all functions at CU Boulder. 2) How IT is to be conducted requires advisory committee input from all areas of the campus – faculty, students, and staff. Such committees will allow for campus-wide consideration of IT strategies and priorities. 3) An executive committee is necessary to communicate and help shape major projects and directions into recommended decisions and funding needs that can be supported and authorized by the Chancellor, his executive team, and the faculty leadership. (Area specific IT service providers would remain responsible to their existing management, and would participate alongside ITS to help shape and participate in campus-wide IT directions, specific projects, and policies.)

The next diagram, “Shaping IT direction through engaged participation and shared services” depicts a structure to implement these three principles, basically, a campus-wide advisory layer and an executive group tied to the Chancellor’s Cabinet. The structure will also maintain ties with the BFA through joint members, and with various academic groups such as the Council of Deans, the Chair’s Breakfast, and various meetings of Associate Deans and Associate Vice Chancellors.

Specifically:

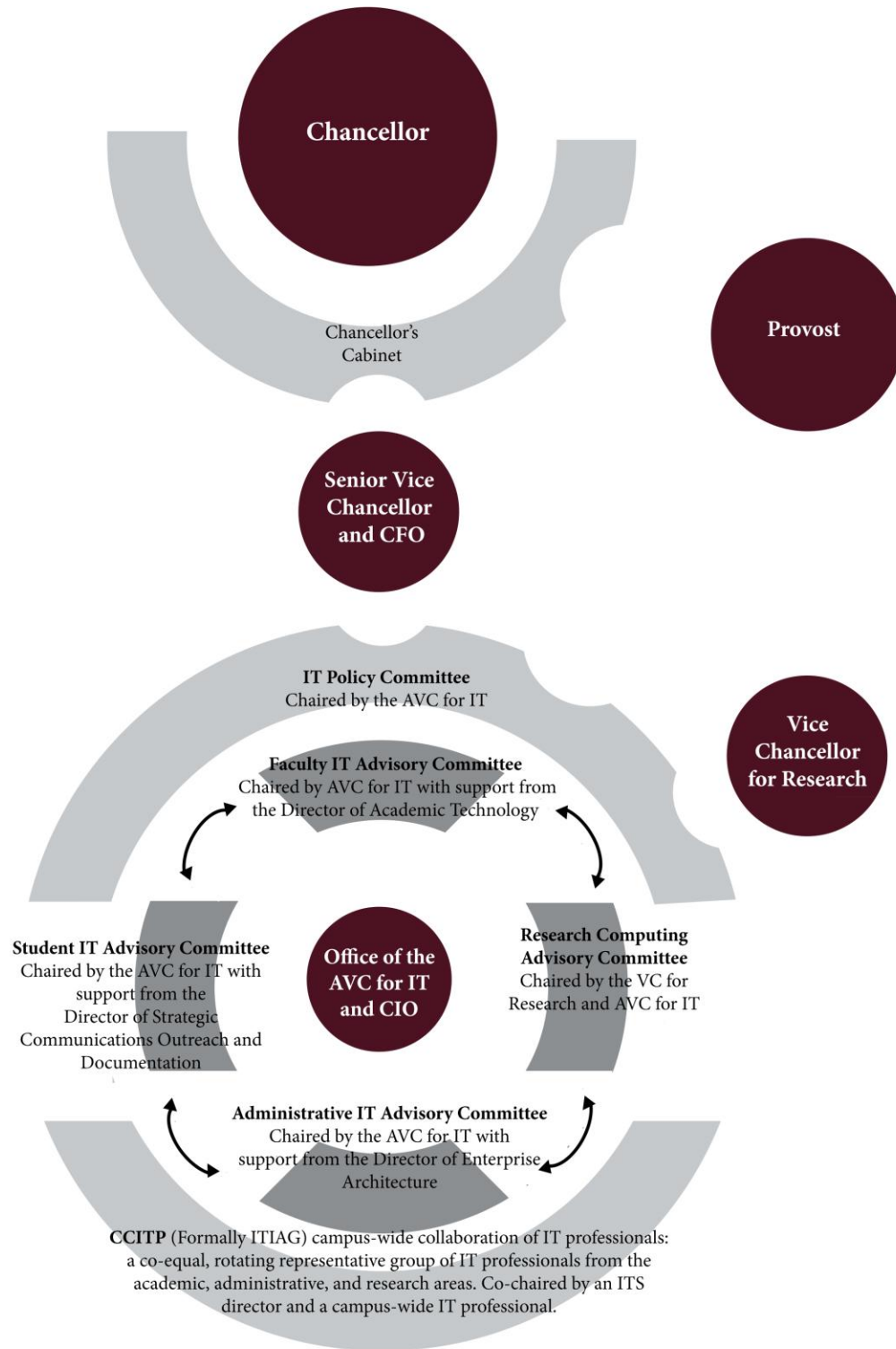
- Recommendation 1: Create the suggested governance structure.
- Recommendation 2: Use the suggested structure as an integrative approach to develop IT strategies and associated funding requests, and as an intake mechanism for requests from individuals, other committees, and group entities for IT strategies and projects, and their associated funding requests.

⁴ Chapter 2: Building an Effective Governance and Decision-Making Structure for Information Technology, James I. Penrod. In Organizing and Managing Information Resources on Your Campus, Polley Ann McClure, Editor. A Publication of EDUCAUSE, Copyright 2003 Jossey-Bass Inc. Published by Jossey-Bass, A Wiley Company.

- Recommendation 2a: Develop campus-wide communication methods for individuals, other committees, and group entities to provide input into the new governance structure (see section 4.2: Developing Strategic Communications).
- Recommendation 3: Develop a review process to measure the effectiveness of the advisory boards (process to be determined).

Shaping IT direction through engaged participation

2010-2011 IT
Governance Diagram



Description of the Committees:

Executive IT Policy Committee – This committee (name subject to change) will comprise of five members, at the associate dean level or higher. Each of the following offices will nominate one member; final decision will be determined by the Chancellor: Provost, VC for Budget & Finance, VC for Administration, VC for Student Affairs, and University Counsel. Each member initially will serve either 2-3 years to create a mixed rotation schedule. This committee will be chaired by AVC for IT/CIO, supported by Director of Strategic Communications, Outreach and Technology. This small group of senior leadership will review and “own” strategy, policies, and directions developed by the four advisory committees. Initially, this group will meet quarterly with the potential of twice per year with select members with the Chancellor’s Cabinet (see schedule chart at end of the report). Additionally, this committee will apprise CEC regarding campus-wide IT issues as requested by the CEC.

Faculty IT Advisory Committee – This committee will have approximately 15 members: three nominated from A&S, one member from each of the other Schools and Colleges in addition to the chair of the BFA Administrative Services and Technology committee and possibly two at-large BFA members, nominations determined by Deans for Schools colleges, BFA for BFA members. Each member initially will serve either 2-3 years to create a mixed rotation schedule. This committee will be chaired by AVCIT/CIO, supported by the Director of Academic Technology. This influential and representative group of faculty may develop additional subgroups (e.g. Faculty Evaluating Educational Technology, or FEET) as necessary. This committee will meet every other month (September through May). This group ensures that IT services and support enhance learning, teaching, and research; meet instructional and research needs of faculty and instructors; and are coordinated across academic and service units. Members will provide advice and help evaluate issues associated with: the deployment of new technology services and spaces; the evaluation of the effectiveness of technology in teaching and learning; the support of academic technologies. Additionally, this committee will apprise CEC regarding academic technology issues as requested by the CEC.

Administrative IT Advisory Committee – This committee will also have approximately 15 members from administrative areas and administrative support from at least A&S and Engineering, Continuing Education, and UIS. The various administrative areas: Enrollment Services, Human Resources, A&S Administration, Engineering Administration, Faculty Affairs, Housing & Dining Services, UIS, Continuing Education, Institutional Research, Public Health and Safety. Nominations determined by the head of each administrative area. Members should be appointed by the department head/chair, participation should be part of the job duties of the role, and should be on-going according to role (not served terms). In many cases, the member should be the department head (HR, Registrar, Faculty Affairs, Housing & Dining Services) – not the senior IT person. This committee will be chaired by AVC for IT/CIO, supported by the Director of IT Service Engineering. The three main functions of the committee:

- Provide “business owner” direction to central IT services where active concerns have impacts across multiple business areas (such as identity management practices)
- Provide campus input to be brought to UIS governance
- Develop and recommend policy related to how campus IT assets (systems and data) are to be deployed and managed to meet campus administrative needs.

Student IT Advisory Committee – This committee will seek to have seven consistent members, four from undergraduates, including one representative from University of Colorado Student Government (UCSG) as well as three graduate students, includes one representative from UGGS. Nominations determined by UCSU and UGGS. Given the difficulty in getting



student representation, the term limit is five years for this committee, which makes it possible to have a student member sit on this committee for that length of time. This committee will be chaired by AVC for IT/CIO, supported by the Director of Strategic Communications, Outreach and Documentation and will meet three times a year. This committee advises the AVCIT/CIO on student IT strategic, priority, and policy matters. Additionally, this committee could apprise the CEC on IT issues as they relate to the student experience as requested by the CEC.

Faculty Research Computing Advisory Committee – This committee is yet to be formed, name is subject to change. This committee will be chaired by the Director of Research Computing who will report to VCR in collaboration with AVCIT/CIO and instantiated and charged by the Provost. This committee will provide oversight for the development and management of a campus-wide collaborative research-computing environment. This committee is a singularly focused group reporting to the VCR. Frequency of meetings has not yet been determined.

Campus-wide Collaboration of IT Professional/Partners (formerly ITIAG, new name subject to change) – This group will be composed of approximately 20 members from the schools and colleges, research institutes, and administrative departments, including auxiliaries (each area has approximately five representatives with four additional ITS employees serving). This cross-representative group will have members rotate on a 3-4 year cycle depending on the schedule (see appendix A for the schools and colleges, research institutes and administrative departments).

This group of IT professionals would replace both ITIAG and the Tier 2/CSR Advisory Board. This group is co-chaired by an ITS representative and campus IT professional and meets monthly. (Note – various subsets of members of the CCITP group would advise and consult with the four advisory committees on both an ad-hoc and regular basis, e.g., Security and/or Enterprise Architecture.

Proposed Meeting Schedule	Exec Policy Committee	Faculty	Admin	Research Computing	Student	CCITP (ITIAG)
January		X		?	X	X
February	X		X			X
March		X				X
April			X	?	X	X
May	X	X?				X
June			X			X
July						
August	X		X			X
September		X			X	X



October		X	?	X
November	X	X		X
December				

E. Fiscal Responsibility:

Linking the advisory committees to a flexible, yet systematic process of funding enhances the transparency surrounding IT initiatives, programs and services. The budget committee, as part of this IT strategic planning process, led by Steve McNally and David Chittenden, recommends integrating systematic conversations regarding funding priorities into the advisory committees' agendas.

Integrating the consideration of IT strategies and directions with funding: These examples would not necessarily occur in a prescribed order, and would iterate across five major aspects of the proposed governance model:

1. Campus members at large, individuals, other committees, other entities, who forward requests, questions, complaints, and criticism to the advisory committees and to individual members of the advisory committees;
2. The advisory committees (including the CCITP);
3. The IT Executive Committee;
4. Other campus committees; and
5. Chancellor's Cabinet/senior leadership.

The consideration of IT strategies, directions, and funding must also recognize the budget cycle of:

- May/June final approval of budget for next FY by Regents;
- Close of the previous FY;
- Early fall budget census, which helps determine the overall budget for the FY that will follow the current FY;
- Circa late-fall considerations for the upcoming FY, whether it will be a growth or a retraction year; and the late spring end-process in which the budget for the following FY is finalized May/June, ultimately, with the Regents.

Proposed Budget Cycle Conversation:

1. Summer/ongoing. Beginning in summer, as much as is possible for committees to meet, and continuing into the new academic year, the advisory committees, likely picking up themes and matters from the previous year, consider whether elements of the IT environment need to be maintained as-is, discontinued, decreased, increased, and whether new elements need to be developed.
2. Post fall budget census. The AVC for IT provides an early distillation and reviews this ongoing development of possible initiatives with various senior officers, including the SVC/CFO, the Provost, and various associate (vice) provosts and chancellors for their input and as a "heads-up."

3. Ongoing process. The CCITP and other technical venues around campus, in collaboration with ITS program managers, through their work, will posit changes to existing or new IT initiatives. Ultimately the AVC for IT will hear about these new initiatives in a variety of ways, will bring them to the advisory committees, and will bring advisory committee considerations to the CCITP. (There will also be cross-memberships among the advisory committees, the CCITP, and the BFA.)
4. Late winter/early spring. Based on their considerations to date, the advisory committees and the Executive Committee discuss a distillation of possible strategic IT initiatives for the upcoming budget cycle. These initiatives will derive from the ongoing momentum of the governance committees, ongoing assessments of the performance of the IT environment, and the ongoing evolution of technology. Again, as feasible, the AVC for IT provides further distillation and reviews this ongoing development of initiatives with various senior officers, including the SVC/CFO, the Provost, and various associate (vice) provosts and chancellors for their input and as a “heads-up.”
5. Spring and/or ongoing. The SVC/CFO in conjunction with the Provost and Chancellor’s Cabinet, reacting to proposed IT directions, begin the effort of determining possible new projects and funding levels as well as identifying from a senior leadership perspective areas that should be discontinued and/or areas where efficiencies can be realized.
6. Spring. The AVC for IT and the Executive Committee, based on input from senior leadership, provide some high-level parameters for the advisory committees, the CCITP, and ITS regarding funding parameters to be applied in support of IT directions identified by the ongoing governance process.
- 7a. Ongoing. Culminating for spring use by the advisory committees and executive committee discussions will continue. Projects and formal funding requests may then be initiated in a variety of ways, most commonly: a) through program direction statements from ITS program directors; b) with endorsement from the CCITP; c) presented as recommended program directions to be vetted, depending on the domain of the statement, by one or more of the advisory committees. Standard formats will be developed which includes high-level project description and funding requests.
- 7b. The direction statement and standardized funding requests will be discussed and reviewed by the various committees, with the final product being a prioritized list of funding requests that is given to the Executive Committee. It will be the responsibility of the AVC for IT/CIO to prepare the prioritized list and support the presentations to the advisory committees.
8. The Executive Committee will finalize the funding priorities and present the information to the Provost and the Chancellors’ Cabinet.

The funding process is meant to be iterative, dynamic—with requests being generated from the bottom up and expectations and funding levels being communicated down from the highest levels of the university. The focal point is the Office of the AVC for IT who, through engaged IT participation from the faculty, students, and staff, create requests that provide the broadest IT perspective. Additionally, it is the responsibility of the Office of the AVC for IT to critically examine the entire campus-wide IT budget, providing recommendations that will gain efficiencies and savings.

Conclusion:

Implementation of this governance process will result in visible, campus-wide, participatory, and ongoing process for faculty, students, staff, and senior leadership to engage together in shaping the nature and directions of the CU-Boulder IT environment, both in terms of services and spending.



Attachment A:Schools & Colleges:

Arts & Sciences
 Architecture & Planning
 Business
 Education
 Engineering
 Graduate School
 Journalism
 Law
 Libraries
 Continuing Education

Research Institutes:

ATLAS—Alliance for Technology, Learning & Society
 Center for Humanities and the Arts
 CIRES—Cooperative Institute for Research in Environmental Sciences
 Energy Initiative
 IBG—Institute for Behavioral Genetics
 ICS—Institute of Cognitive Science
 INSTAAR—Institute of Arctic and Alpine Research
 JILA
 LASP—Laboratory for Atmospheric and Space Physics
 University of Colorado Museum of Natural History
 Institute of Behavioral Sciences

Administrative Units:

Bookstore & Imaging Services
 Budget & Finance
 Enrollment Management
 Environmental Health and Safety
 Facilities Management
 Housing and Dining Services
 Human Resources
 ITS
 Public Safety, Parking & Transportation
 Recreation Center
 UMC

Attachment B

Sample of Meeting Agendas

Each committee will need to establish a baseline of common knowledge/understanding of the IT issues the committee will encounter. Largely, this will be accomplished at the discretion of the AVC for IT by bringing in IT experts to speak on a particular topic. To launch the structure, all committees will review the campus-wide IT strategic plan.

Draft Agenda for Executive Policy Committee

- **August 2010:** skip because this committee will build from the work of the other committees
- **November 2010:** kick-off orientation with utilizing the campus-wide IT strategic plan as foundation
- **February 2011:** policy review—Computing & Network Resources, Security Policies
- **May 2011:** review of proposed budget considerations

Draft Agenda for Faculty Advisory Committee

- **September 2010:** Introduction to the academic technology committee; technologies available; spaces available; support available; organization of IT organization and services on campus
- **November 2010:** Rolling out the new Learning Management System: timeline, needs, migration of courses, review of draft C&NR policy
- **January 2011:** Prioritizing LMS functions and Security policies
- **March 2011:** review of proposed budget considerations
- **May 2011:** classrooms (centrally- and departmentally-scheduled); labs; instructional computer spaces, review of evaluation and assessment metrics specific to teachers and learners

Draft Agenda for Administrative Advisory Committee

- **August 2010:** kick-off orientation with utilizing the campus-wide IT strategic plan as foundation and definition of POI/university roles
- **October 2010:** review of cloud computing, mobile computing and possibly ISIS implantation also, review of draft C&NR policy
- **February 2011:** review of support for teachers and learners and Security policies
- **April 2011:** review of proposed budget considerations
- **June 2011:** review of evaluation and assessment metrics specific to teachers and learners



4.2 Developing Strategic Communications

Major Issue: As users of technology faculty, staff and students need to stay informed of changes to IT services on our campus. These constituencies also need a way to join in the conversation about the future of IT services. IT communication should not be viewed as a one-way conversation between ITS and its customers but rather should be an inclusive loop. In the end, the conversation about IT services should make all parties more successful consumers and providers of IT services.

A. Background/Rationale

IT communication on the CU-Boulder campus is mainly driven by Information Technology Services and is largely one-way. ITS provides documentation and service information on a website that is dated and difficult to navigate. Other ITS communication vehicles include a once-a-semester newsletter to faculty and staff, an IT security awareness campaign, and an orientation program called ITS Quick Start. ITS also makes use of campus communication channels such as E-memos, Buff Bulletins, and Inside CU to communicate service changes.

ITS established the Tier 2 program in 2001 to better connect with the IT needs of departments, schools and colleges across campus. While the program has been successful in leveraging Tier 2 Computer Support Representatives (CSRs) to relay information from ITS to their respective departments, CSRs have been underutilized as a feedback mechanism to ITS. Some CSRs are IT professionals while others may have little or no IT background. This leads to difficulties utilizing CSRs as IT points of contact within campus units.

Another factor that contributes to the lack of feedback to ITS is the lack of IT governance structures on the campus. Our campus has both a strong central IT organization and strong campus IT but lacks the governance and communication structure to support the two. A dynamic communication structure needs to accommodate both central IT and decentralized IT needs.

Our campus needs to evaluate current IT communication strategies and identify new communication processes and vehicles that will successfully engage all campus constituents in dialogue about IT services and support and their future on our campus.

B. Accomplishments to Date – Efforts to Improve Communication

- The following communication vehicles and support structures have been created to better inform the campus of IT initiatives and service changes:
- Tier 2 organization and the IT Support Community Event, Tech Talks & Forums
- ITS Quick Start for students
- Oneonone newsletter for faculty and staff
- Security awareness campaigns
- ITS website
- 5-HELP Service

Action Plan

A. Explicit Assumptions



The term "campus IT" is considered to be all people who perform some sort of IT work on the CU Boulder campus, including people outside of ITS.

For item "Campus IT Mission," we assume that a body of constituents will be available to garner input for creation of a campus-wide IT mission. This body will most likely be formed out of the IT Governance committee as part of the overall strategic planning process.

The term "The committee" in this chapter refers to the IT Strategic Plan's Strategic Communications Committee.

B. Specific Recommendations

1. Define and Communicate the Mission of IT

Problem: The committee recognizes the perception on campus that there is a lack of IT strategic direction. Currently there are no clearly communicated IT governance structures and IT organizations are largely autonomous with few standards. There is no common campuswide understanding of how to fulfill the mission of supporting faculty, staff and student computing and communication needs or requirements as set by university leadership. ITS does have a mission statement but is insufficient to describe the mission of the organizations that fall outside of ITS' domain or services.

Recommendation: Campus IT, in conjunction with faculty, staff, students, and the Associate Vice Chancellor of IT, perform the following tasks:

- Create a campus-wide IT mission statement, ensuring the mission is up-to-date with the most recent campus vision (currently Flagship 2030), and
- Communicate the campus-wide IT mission through appropriate campus channels to appropriate campus IT constituents.
- Also ITS leadership should perform the following tasks:
- Review and revise the ITS mission statement to ensure the mission is up-to-date with the campus-wide mission, and
- Communicate the revised ITS mission through the appropriate campus channels to appropriate campus IT constituents.

2. Campus IT Roles and Responsibilities Inventory

Problem: A significant gap exists in the understanding of the breadth and depth of campus IT service, support and expertise currently provided by different organizations on campus. This gap in understanding means incorrect assumptions could be (and most likely are) made about departmental expertise and communication needs.

Recommendation: The Associate Vice Chancellor of IT should commission a periodic inventory of campus organizations that maintain IT structures (including ITS) to guide campus IT strategic planning and leverage IT expertise on our campus. This inventory should be used to help the sharing of IT expertise between departments. Specifically, the inventory should identify the following:

- People performing IT activities on campus and the organizational requirement they fulfill. This includes all roles from the IT professional responsible for system administration of hardware, software and security to the administrative assistant with no technical expertise who was elected to update the department website,

- Assets (hardware/software) managed within campus organizations (outside of ITS) and the requirements they fulfill,
- Services which organizations provide using internal resources,
- Services which organizations rely on ITS to provide and maintain as either a common-good or purchased service,
- Services which organizations rely on other campus organizations to provide and maintain, and
- Services which organizations purchase from outside vendors.
- For more specifics and examples on the inventory collection, please see Appendix A.

3. Expand Face-to-Face Communication

Problem: Face-to-face communication with faculty, staff and students about IT issues is underutilized. Additionally the committee recognizes as new faculty, staff and students arrive at the university, not all new people have access to or are pointed to the pertinent information to effectively access campus IT services shortly after their arrival. An extensive amount of information is available online and through phone help, but this information may not be disseminated appropriately and can overwhelm users.

Recommendation: ITS, being in the best position to begin this dialogue, should expand the existing ITS Quick Start orientation program and departmental support meetings to:

- Include all faculty, staff, undergraduate and graduate students,
- Provide faculty, staff, and students with vital services in the first 48 hours on campus,
- Host "in person" events to connect new faculty, staff, and students with IT resources, documentation and providers on campus,
- Engage campus organizations with frequent open support meetings, narrowly focused on a specific department or organization, to interact with organizational personnel, faculty, staff, and students.

4. Evaluation of Campus Communication Technologies

Problem: The committee recognizes that the campus utilizes many different technologies such as email, mailing lists, and wikis to disseminate information to the campus for various topics or events. The volume of information sent to campus personnel is large and widely varied, and new technologies could exist that may better facilitate targeted communication.

Recommendation: ITS Communications, being in the best position to begin this dialogue, perform the following:

- Evaluate technologies and processes that will allow individuals to participate in IT dialogue or notifications at the level they determine appropriate, and
- Make recommendations to ITS leadership and campus IT regarding common-good services that would improve campus communication.
- For more specifics and examples on the types of technologies and processes to evaluate, please see Appendix B.

5. Evaluation of Student Support Process and Systems

Problem: Students often adopt new technology trends more rapidly than other campus constituents, leading to difficulties for inflexible support organizations.

Recommendation: The committee suggests that ITS partner with student-facing organizations

(Student Affairs, Orientation, Alumni Affairs, Housing, etc) to conduct an assessment of student IT support needs (including preferred methods of seeking support). The committee suggests that the results of such an assessment be made available to all campus organizations expressing interest, and be used by ITS as the basis for a program to educate ITS staff, faculty, and graduate students regarding student support preferences and any complimentary programs available.

6. Restructuring of the Tier 2 Computing Support Representative (CSR) Program

Problem: The Tier 2 CSR program, while effective in building a campuswide network to help inform departments of IT service changes, lacks campuswide recognition and standardization of roles and responsibilities. CSRs are in a prime position to represent departmental IT needs to ITS leadership for the purpose of strategic planning but are not formally recognized as such. Also, the current lack of uniform definition regarding the required skills of a CSR means that IT support is non-uniform across campus institutions.

Recommendation: ITS and the campus must formalize the role of the Tier 2 CSR program and those that serve in the role of CSR. The committee recommends that this include:

- Investigate changing the name and mission to provide IT professionals outside of ITS with a more meaningful and appropriate identity within the campus community.
- Develop a formal structural framework, including keeping minutes of Tier 2 Advisory Board meetings, development of a Tier 2/CSR website and creation of a formal process to fill board positions.
- Implement a Tier 2 mentoring program to help new CSRs rapidly become proficient in campus/ITS specific process and culture.
- Retool the CSR certification program to be more campus oriented and include information regarding campus services such as: website hosting, network management, software licensing, etc.
- A process and transparency needs to exist to allow CSRs to directly engage the appropriate ITS subject expert to resolve service and support issues.
- The committee suggests that ITS leadership, working with the ITS Tier 2 Liaison, investigate building a formal process by which the Tier 2 Advisory Board can make proposals directly to ITS leadership (or Campus IT leadership).
- ITS, working with representatives from the Colleges, departments, and campus constituents, identify guidelines that provide for CSRs to have a certain baseline of IT skills.
- Explore methods for departments to pool resources to appoint a shared CSR in instances where the department need is below levels that would provide for the hiring of qualified staff.
- For more information, please see Appendix A.

7. Stronger Collaboration Between University Communications & ITS

Problem: Communication between campus organizations and external entities is often non-uniform and varies depending on the parties involved. Few enterprise-level communication tools exist on campus and those that do exist are dated and inefficient. Many departments are forced to turn to third-party solutions and there is very little uniformity on campus.

Recommendation: Committee would direct ITS to partner with (and provide strong support for) University Communications in order to provide technical expertise and critical leadership in enhancing public communications. This partnership will likely require strong support from Campus IT. Examples of areas ITS could provide support are:

- Develop effective, consistent, and easily managed departmental, college, faculty, and university web sites.
- With input from faculty, staff, and students, build scalable infrastructure to support outreach efforts (educational and research oriented) that can be easily accessed by specific public and private constituencies.
- Development of flexible web "conversation" tools for students, faculty, staff, and members of the community.

8. ITS Website Reorganization and Redesign

Problem: The current ITS website is difficult to use and poorly organized for the role it has grown to play in supporting campus IT.

Recommendation: The committee recommends that ITS undertake a redesign of the website with the following goals:

- Strive to incorporate modern usability standards.
- Enable simpler navigation.
- Examine methods of providing solution based information.
- Examine role based portal technologies as possible replacements.
- Provide greater dynamic content to advise users of outages or current conditions.

C. Long & Short Term Objectives/Timeline

The target completion times of the above recommendations are listed here.

Immediate:

Define and Communicate Campus IT Mission
Define and Communicate ITS mission

Short Term (3-6 months):

Expand ITS Quick Start to include faculty, staff and graduate students - Could target for Fall 2010 or Spring 2011.

Host "in person" events to connect new faculty, staff, and students with IT resources, documentation and providers on campus.

Long Term (1-2 years):

Establish recurring schedule for Campus IT Roles and Responsibilities Inventory - Highest priority after defining the campus IT mission.

Redesign of the ITS Website.

Evaluation of Campus Communication Technologies

Evaluation of Departmental/Organizational Support Meetings

Evaluation of Student Support Process and Systems

Restructuring of the Tier 2 computing Support Representative (CSR) Program

Create a uniform definition of the Tier 2 CSR Representative

Stronger Collaboration between University Communications and ITS

D. Possible Risk

The Campus IT Roles and Responsibilities Inventory would help assure that campus IT personnel are meeting campus IT policies related to security and private data.

E. Resource Allocation

The Campus IT Roles and Responsibilities Inventory may require additional or reallocated staffing. It will also impact all department personnel as they take time to participate in the inventory.

Expanding IT Quickstart will require additional or reallocated funds and time.

External communication tool development and implementation of new public communication technologies will require additional or reallocated funds.

F. Responsible Parties

There is not just one responsible party. These recommendations must be accomplished through campus coordination. How that will be done is contingent on specifics of implementing the above recommendations, as well as responsibilities resulting from the definition of the Campus IT Mission.

G. Evaluation

The ultimate goal of this chapter is not easily measureable as it concerns communication between humans. A general evaluation of the main goal may be accomplished by answering the primary issue addressed in this chapter: Are campus users of technology part of an inclusive communication loop involving ITS, faculty, staff, and students? This broad question can be partially answered by evaluating the committee's ample specific recommendations through answering the following questions:

- Has the *Campus* IT Mission been established and communicated within 6 months of adoption of Strategic Plan?
- Has the *ITS* Mission been established and communicated within 6 months of adoption of Strategic Plan?
- Has the *Campus IT Roles and Responsibilities Inventory* been implemented within 6 months of adoption of Strategic Plan?
- Has the IT Quickstart program been expanded by Spring 2011.
- Has the ITS Website been redesigned and deployed within 6 months of adoption of Strategic Plan?
- Does the *Campus IT Roles and Responsibilities Inventory* have a periodic schedule for renewal and updates?
- Has there been an evaluation of Campus Communication Technologies performed within two years of adoption of the Strategic Plan?
- Has there been an evaluation of Departmental/Organizational Support Meetings within two years of adoption of the Strategic Plan?
- Has there been an evaluation of Student Support Process and Systems within two years of adoption of the Strategic Plan?
- Has the Tier 2 computing Support Representative (CSR) Program been restructured within two years of adoption of the Strategic Plan?

- Has two-way communication between ITS and Tier 2 Representatives increased within two years of adoption of the Strategic Plan?
- Has a new clear definition of the Tier 2 CSR representative been written and communicated within two years of adoption of the Strategic Plan?
- Is there stronger collaboration between University Communications and ITS within two years of adoption of the Strategic Plan?



Attachment A - Campus IT Roles and Responsibilities Inventory Suggestions

The following are suggestions for acquiring the necessary information for the recommendation of Campus IT Roles and Responsibilities Inventory. This is not an exhaustive list of what should be asked, but is tailored to communication-related items. While this inventory is occurring, it would be useful to ask questions related to all IT activities to drive decision making and planning for all ITS projects. Some questions that have arisen from discussion have motivated the need to do the inventory, such as:

How many departments are duplicating services already provided by ITS, and why?

What percentage of people listed as responsible for IT in their organization (such as desktop support, email support, etc) are non-technical people (either not trained or no background)?

What percentage of IT faculty/staff/students surveyed/interviewed know that 5-HELP exists and is available to them?

How many people use the website to obtain IT information versus calling people around campus?

There are many useful data points to be considered from such an inventory to identify both strategic communication channels as well as information that could be used for other strategic purposes for the campus. The following is a list of initial IT roles that are identified to exist, and more than one role is typically applied to a single person:

Server administrator

hardware monitoring/replacement

Service administrator

email

web manager/webmaster

dns

custom room reservation

user authentication

Desktop administrator (hardware)

hardware monitoring/replacement

Desktop administrator (software and support)

backups

interface with campus AD (user authentication)

pslite

MS office

email client

other software

Software management (Updates, imaging, security, etc.)

Network administrator

hardware

configuration

wiring

network liason with ITS

Content administrator

website

email list (subscription management and/or sending out email to lists)

ITS contact person

security notifications from Dan Jones et. al.

Tier2 notifications

IT support community notifications

General IT Coordinator

Position requires information and notifications from all systems IT services (UIS, HR, ITS, others?)

Each of these roles will need targeted communication depending on the kind of setup of systems. For example, if a server is configured to authenticate to the campus Kerberos server, the person responsible for that server will need communications from ITS whenever that authentication service will be changed or be under maintenance, etc. These dependencies must be identified and the appropriate communication channels must be developed to meet the communication needs for these roles.

Another example is that if an Office Administrator is responsible for updating the department website and he/she uses ITS web hosting, she will need communications from ITS regarding service downtimes, changes, or upgrades. However, if an Office Administrator from another department uses off-campus web hosting or a solution within the department, he/she does not need to be on the ITS communication channel for the web hosting.

What is critically important is that all questions in the inventory be asked of all campus IT personnel in order to garner stable and defensible statistics for planning and decision making processes.

A sampling of questions to the main IT support person is listed here. These are by no means exhaustive, but hopefully will give guidance:

How many people (in terms of FTE) who are not employed by ITS provide IT support in your dept/office? (Can be partial numbers, i.e. 1.5 FTE)

What roles does each person play (refer to roles above)?

Do you or your support personnel have formal training outside of ITS?

Have you or your support personnel been trained through ITS-supported training modules?

Do some or all faculty support their own computing?

If yes, how many servers/desktops (listed separately) does each manage?

Is management shared by your IT personnel and the faculty?

If yes, what support roles are filled by IT personnel and what roles are filled by the faculty?

Do you know what IT policies exist?

Do you know where to find information about IT policy?

How does ITS communicate to you regarding new projects, updates on existing projects, or status of critical services on which you depend?

Do you always receive communication about all the services on which you depend from ITS?

How would you like to receive communication from ITS about services, projects, or changes?

How do you or your personnel obtain information on campus services (website, initial hiring materials, co-workers, word of mouth, etc)?

Are you able to reach out for help from other campus IT personnel (even those outside of ITS) regarding non-standard problems that may not be documented?

Do you attend IT support events?

Why do you go?

Are they useful?

How could they be changed?

Ideally, other administrative staff would also be interviewed to understand the perception of IT services, availability, and also to understand the needs of the general faculty, staff and students as they experience on a day-to-day basis.

Attachment B - Evaluation of Campus Communications Technologies Suggestions

The following are suggestions of different technologies that may be used to more effectively communicate to all campus individuals, including faculty, staff and students. This list is not exhaustive, but may be used to guide decisions.

Currently communication to campus personnel occurs over email via Administrative E-memos from many different groups, Buff Bulletins, and group-specific email lists. The volume of information is vast, and varied, and tends to overwhelm individuals to the point where important messages are ignored. An idea is to deploy a system with 'channels' or an equivalent feature that allows people to elect what communication they wish to receive. Some communication will be mandatory, such as emergency notifications from the campus about events or weather. A sample of technologies that could be pursued to give targeted communication include RSS feeds and email list subscriptions.

Other technologies for user support exist that are already being prototyped by the libraries such as live chat. This allows a user to receive almost immediate help from someone who is able to assist with their specific problem, and could be deployed to multiple departments within ITS (and outside). An example would be if a user had an email issue beyond standard password and access issues, they could request a chat which would be directed to the email escalated support person within ITS to answer the person directly, avoiding a potential long wait from calling 5-Help.

Appendix A

May 2010 ITP Committee List

Chapter 1: Academic Technology

- 1.1 **Support for Teachers & Learners** (Michele Jackson & Deb Keyek-Franssen)
Members: Amanda McAndrew, Julian Kinsman, Laura Border-GTP, William Colgan-grad student, Mark Knowles-ALTEC, Mary Ann Shea-FTEP, Will Medlin-Chem & Bio, Geoff Rubenstein-Cont Ed., Ed Rivers-English, John Falconer-Chem & Bio, Caroline Sinkinson-Libraries
Reviewers: David Underwood, Mark Werner, Mary Ann O'Meara, Joel Frahm-JILA, Hunter Ewen-grad student, Michelle Clifford, Jill Lester, Gary Schut-LASP, Lisa Severy-Student Affairs, Marshall Walker—UGGS VP
- 1.2 **Providing Teaching and Learning Spaces** (Keith Maskus & Michelle Clifford)
Members: Duncan McBogg, Jeff Greene, Grant Matheny-ASSETT, Jack Maness-Libraries, Harry Koutsis, Paula Bland-Housing, Tom Higginbotham-Tri-Ex, Howard Kramer-Disability
Reviewers: Julian Kinsman, Guido Ceyssens, Stephen Butler, Mark Werner, Eric Sherrill, Clemith Houston
- 1.3 **Offering Teaching and Learning Tools** (Doug Duncan & Mark Werner)
Members: Jennie Whitcomb-Education, Mary Ann O'Meara, Michelle Clifford, Joanna Weidler-Lewis-CE, Peter Schneider-Arch & Planning, Elizabeth Barton, Scott Kohla-Leeds, Kevin Kluck-Student, Bette Sellers-Andersen-Student Affairs, Jim Love-undergraduate, Matt Benjamin-Fiske
Reviewers: Deb Keyek-Franssen, Clemith Houston, Caroline Sinkinson, Kerry Havens, Stephen Butler

Chapter 2: Shared Resources & Support

- 2.1 **Creating Research Computing & Cyberinfrastructure** (Russ Moore & Dave Bodnar)
Members: Henry Tufo-CS, Orrie Gartner, Mike Carter, Paul Beale-Physics, Graham Mountain-CIRES, Marty Dunn-Mechanical Engineering, Marie Banich-Cog Science, Gary Schut-LASP, Dave Gallaher, Larry Levine, Chad Stoffel-INSTAAR, Rob Knight-Chem/Biochem, Mark Winokur-English
Reviewers: Bruce Fast, Matt Yoder, David Wood, Matthew Woitaszek-NCAR, Michael Oberg-NCAR, Dan Timmons-MCDB
- 2.2 **Facilitating Cloud Computing** (Tricia Rankin & Miah Adams)
Members: Kimberly Edwards-DATC, Chris Bell-Law, David Ratchford-CASA, Jason Forbes-Ucomm, Al Roberts-Housing, Becki Currey-Legal Counsel, Alex Viaggio
Reviewers: Mike Matthies, David Wood, Michelle Clifford Dan Jones, Mike Carter, JC Polanycia, Ilene Mesnard, Eduardo Luiggi
- 2.3 **Providing Mobile Computing Strategy & Service Offerings** (Clayton Lewis & Jon Giltner)
Members: Dmitriy Pantyukhin-CIRES, David Lewis-A&S, Chris Neves-Public Safety, John Roberts-CSR, Sean Myers, Daniel Schaefer, Robert Dixon, Aren Hansen-Student, Michael Marino
Reviewers: Mike Matthies, Dan Myer, Mark Gammon-DATC, Ray Baum, David Wood, JC Polanycia Jeff Lipton, Craig Hurter, Jason Henley, Dirk Grundwald

- 2.4 **Developing Rich Collaboration Tools** (Mark Knowles & Eric Galyon)
Members: Dan Timmons-MCDB, Eric Denbraber-Housing, Teri Hoyer-CIRES, Bill Franz-EBIO, Michelle Clifford, Rochelle Scott, Duncan McBogg, Howard Kramer-Disability Services, Shayn Smith-Career Services
Reviewers: Daniel Schaefer-DATC, Anudas Schmidt-Library, Tyler Schoenke, Clemith Houston
- 2.5 **Increasing Staff Effectiveness & Efficiency with Technology** (Cynthia Husek & Jim Dillon)
Members: Mark Detterick-Leeds, Stephanie Morris-CS, Burton Fox, Sean Myers, Dave Lewis-A&S, Ridawn Cummings-Leeds, Deanna Knowles-Cont Ed, Catherine Stager-Kilcommons-Disability Services, Jean Thomson-Bursar, Robin Bryant-Admin, Michele Van Pelt-Wardenburg, Elaine Hernandez-Provost Office
Reviewers: Julian Kinsman, Craig Hurter, Jim Rosenthal-Student Affairs
- 2.6 **Developing Web Infrastructure Services** (Diane Adams & Eric Galyon)
Members: Dan Timmons-MCDB, Teri Hoyer-CIRES, Rex Headd-Law, Erik Jasiak-LASP, Rochelle Scott, JC Polanycia, Steve Bailey, Vijay Patel-Housing, Joe Kuster-Human Resources, Will Kubie-UComm, Alex Viaggio
Reviewers: Joe Tinucci, University Treasurer, Mike Matthies, Kerry Havens, Lynn Schaper, Jim Rosenthal-Student Affairs
- 2.7 **Improving the IT Service Model** (Lew Harvey & Ken Schuetz)
Members: Dave Kohnke-Leeds, Matt Bernick-CIRES, Jim Curry-Applied Math, Michele Jackson-Comm, Jonathan Moore-FacMan, Patrice Thoresen-Housing, Gary Schut-LASP, Victor Lombardo-UMC, Tim Leal-Libraries, Mike Matthies
Reviewers: Herb Wilson, Lisa Deutchman, Clemith Houston, Joe Gibson, Kimberly Edwards-DATC, Chris Neves-Public Safety, Dave Lewis A&S

Chapter 3: Collaboration Efforts

- 3.1 **Libraries** (John Culshaw & Deb Keyek-Franssen)
Members: Robert Linz-Law, Julian Kinsman, Jina Waikomoto, Peggy Jobe, Erica Brandon, Thea Lindquist, Tom Zeiler (History and RAP director), Rani Machoi
Reviewers: Holley Long, , Tom Lange-Public Safety, Donna Patee, Clemith Houston, Laura Gapinski, Hess-Museum, Paul Gordon-Comparative Literature, Steven Bruns-Music
- 3.2 **ISIS Integration** (Dave Makowski & Jim Dillon)
Members: Deb Coffin-Dean of Students, Kari Branjord-ISIS project, Dave Lewis-A&S, Corey Wahl-Registrars, Ken Kucera-Housing, LeCarla Gilmere, Miah Adams, Jason Armbruster-UIS, Ryan Chreist-Admissions, Kim Kreutzer-International Education, Lisa Severy-Student Affairs
Reviewers: Larry Drees-Housing, Kerry Havens, Jim Rosenthal
- 3.3 **Partnering with Facilities Management: Sustainability & Construction** (Ron Ried & Herb Wilson)
Members: Rob Schubert-CIRES, Chris Neves-Public Safety, Moe Tabrizi-Facilities, JoAnn Zelasko-Engineering, Tom Tozier-Imaging Services, Craig Hurter, Jane Folger, Sandy Johnson-Facilities, Wayne Northcutt-Planning
Reviewers: Dave Normann, Dave Bodnar, Michelle Clifford, Chris Evans, Bill Franz-EBIO, Kristin Eply-VC Admin Office, Paul Leef-Campus IT-Architect
- 3.4 **Housing & Dining Services** (Kambiz Khalili & Dan Jones)
Members: Robert Dixon-HDS, Chris Lewis-RAP, Deb Cook-HDS, Tom Lange-public safety, Al Roberts, Herb Wilson, Dave Bodnar, Chase Prieve-Student, George Moore
Reviewers: Jon Giltner, Tim Cowan, Donna Pattee, Chris Evans

Chapter 4: Governance & Budget Transparency

4.1 **Redefining Governance** (Susan Beatty & Larry Levine)

Members: Jon Giltner, Jim Williams-Libraries, Joe Rosse-BFA, Chris Bell-Law, Chris Shenk-CS, Deb Keyek-Franssen, Larry Hill-Staff Council, Darna Dufour-A&S, Preston Cumming-UGGS

Reviewers: Mark Sondergard-Libraries, Victor Lombardo-UMS, Brad McKendry-Public Safety, Jim Dillon, Dan Jones, Dave Norman, Laura Border-GTP, Barbara Battenfield-Geo, Jim Currey-Math

4.2 **Developing Strategic Communications** (Chris Bell & Greg Stauffer)

Members: Karen Lund-Anthropology, Matt Groeninger-LASP, Mark Gammon, Donna Pattee, Bill Franz (EBIO), Chris Schenk-CS, Brendan Kretzschmar – Student, Laima Gaigalas – Music, Merrill Lessley-Theatre & Dance, Randi Viola-ATLAS

Reviewers: Jen Gray, Marin Stanek, Rochelle Scott, Lisa Severy-Student Affairs, Dave Beckham-Registrars, Daniel Schaefer-Journalism,

4.3 **IT Spend/Budget Transparency** (Steve McNally & David Chittenden)

Members: Elaine Hernandez, Kathryn Bryn Samuelson-Business, Darna Dufour-A&S, Herb Wilson, Patty McDonald-Ed, Dennis Russell-Law, JoAnn Zelasko-Engineering, Beth Kroger-JILA

Reviewers: Cynthia Husek, Bill Kaempfer, Frank Bruno, Randi Viola-ATLAS, Erika Smith, Irene Hillson, Miah Adams.

Appendix B

Peer Institutions

1. Iowa State University
2. Pennsylvania State University—Main Campus
3. Purdue University—Main Campus
4. Rutgers University—New Brunswick
5. University of Arizona
6. University of California—Berkeley
7. University of California—Davis
8. University of Illinois at Urbana-Champaign
9. University of Iowa
10. University of Kansas
11. University of North Carolina at Chapel Hill
12. University of Texas at Austin
13. University of Virginia—Main Campus
14. University of Wisconsin—Madison
15. Colorado State University

All of the institutions on this list are classified as extensive research institutions (Carnegie classification) and are similar in terms of size and FTE (as reported by CU's Office of Planning, Budget and Analysis in their 2008 IPEDS Report). All are also AAU members (with the exception of CSU).