



UNIVERSITY of
ROCHESTER

Information Technology
Strategic Analysis
for the University of Rochester

Fiscal Years 2009-2013

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Information Technology Mission

Foster a coordinated environment where information technology is tightly aligned with the University mission.

Introduction

We are living in exponential times . . .

- *70% of 4 year-olds in the United States have used a computer.*
- *Online health information website WebMD attracts 20 million visitors per month.*
- *There are more than 2.7 billion searches performed on Google each month.*
- *98% of students arrive on campus with some type of computer. (Source: ECAR Study of Undergraduate Students and Information Technology 2007)*
- *Today, more than 90% of University of Rochester prospective students apply online. In 1997, it was 0%.*
- *The top 10 in-demand jobs in 2010 didn't exist in 2004. Universities are currently preparing students for jobs that don't exist yet. (Source: Former Secretary of Education Richard Riley)*

The modern day university exists in a digital global world where information technology (IT) has become a uniquely transformational and pervasively enabling resource. The student of the future has increased expectations for everyday use of technology. The Generation X student learned and used technology, today's Generation Y student assumes technology. Physicians, researchers, and patients are also increasingly dependent on innovative uses of information technology to achieve patient safety, quality of care, and efficiency.

Across higher education and healthcare, there is a major shift in the role of information technology—IT is no longer regarded as a tactical resource but as a strategic asset that can be leveraged to achieve transformational results.

The president's strategic planning process is articulating the future vision of the university. It has created the opportunity to strategically align IT, University-wide, with that vision. Through the collaborative effort and energy of key leaders across the University community, we have developed an information technology strategic analysis that will propel the University on its path to excellence.

Executive Summary

Overall, the information technology environment at the University of Rochester has not kept pace with University stature, talent, and needs. While there have been recent significant successes through our experimentation with a more collaborative approach, the IT environment at the University suffers from the symptoms previously observed in Advancement and Communications—the legacy effects of extreme decentralization.

Our strategic analysis is a University-wide collaborative effort to align information technology resources with the initiatives that will best support the University's overall strategic plan. The analysis is developed around the framework of three strategic goals:

Goal 1: Supporting the Mission

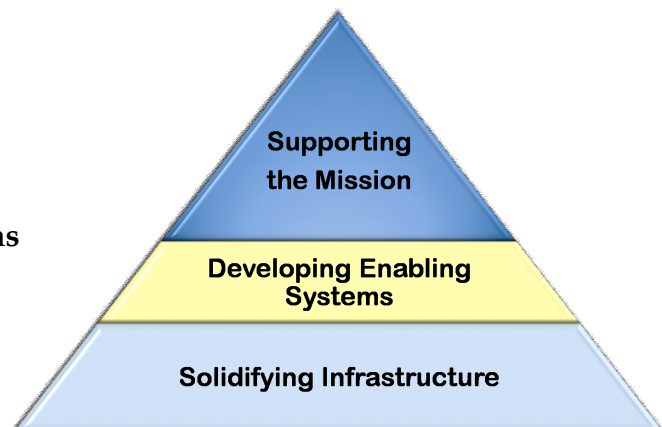
- Research
- Teaching and Learning
- Healthcare
- Performance
- Student Experience

Goal 2: Developing Enabling Systems

- Communications
- Advancement
- Administrative

Goal 3: Solidifying Infrastructure

- Coherent Electronic Identities
- Business Continuity
- Security and Compliance



Within this strategic planning framework, the following highlighted initiatives have broad impact across the University.

Supporting the Mission: Center for Computational Arts, Sciences, and Engineering

University researchers have identified significant deficiencies in our current approach to research computing. This initiative responds to a broadly supported faculty recommendation to create a University-wide research computing center to address deficiencies, support interdisciplinary synergies and discipline-specific work, as identified in the overall University plan.

Supporting the Mission: Teaching, Learning and Technology Roundtable

Opportunities are often realized through innovation and collaboration. This initiative outlines the establishment of a University-wide faculty community for envisioning how technology can enable the learning environment of the future and respond to anticipated growth.

Supporting the Mission: Electronic Medical Records

The Medical Center strategic plan has identified information technology as a strategic imperative to achieve its goals of advancing patient safety, quality of care and research opportunities. This requires implementing a modern Electronic Medical

Record (EMR), an Electronic Health Record (EHR), a clinical data warehouse (CDW), a modern web platform, and a Patient Health Record (PHR).

Developing Enabling Systems: Fix Our Web and Email Environment

Communications at the University is a Presidential priority. Overall, the legacy communications architecture is antiquated, uncoordinated, and insecure. This initiative addresses the modernization of our web environment and the future direction of our 40+ independent email systems.

Developing Enabling Systems: Administrative Systems Strategy

The University's financial and student administration is supported by legacy systems that are 20+ years old. To mitigate the risk inherent in this reality, we need to begin replacement of the financial systems and continue life support and select enhancements of the student systems. Planning for the replacement of the student systems should begin during the next five years. This initiative includes the continued expansion of our integrated reporting solution (data warehouse).

Solidifying Infrastructure: Coherent Electronic Identities

Today's modern relationship with the University is complex and comprised of many independent roles—admissions candidate, student, alumni, employee, faculty, patient, and donor, to name a few. This initiative will establish a coordinated identity for every community member. This will address the University's inability to interact with an individual in a coordinated way, improving targeted communications, supporting interdisciplinary collaborations, and strengthening development efforts.

Solidifying Infrastructure: Embracing an Institutional Security Program

Given the distributed and necessarily open nature of higher education, securing the privacy of information presents unique challenges. Expanding vulnerabilities and growing compliance requirements add to the complexity and risk. This initiative calls for the development and implementation of a comprehensive IT security program.

Historically, our IT focus and investment has been on foundational infrastructure. While necessary, this is not sufficient to support our exciting new trajectory.

Significant opportunities exist to realize programmatic benefits from coordinated investments. Information technology, strategically focused, will create opportunities for collaboration and interdisciplinary synergies that will enhance our profile as a world class research university.

The results of this analysis provide an unprecedented opportunity to assess IT from a “One University” view and examine opportunities for collaborations and efficiencies going forward. The potential initiatives highlighted above and throughout this document support three key outcomes:

- Address major legacy structural issues that have resulted from extreme decentralization
- Align IT resources and effort to best support our overall University plan
- Increase University-wide results through a major shift towards greater collaboration in our approach to IT

We need to aim higher and fully embrace a new approach to IT and support multi-year planning. The University of Rochester strategic planning effort represents a singular opportunity to realign information technology in support of the University’s missions for years to come.

Environmental Analysis

Our analysis starts with an environmental assessment of our strengths, challenges, opportunities, and threats that will influence IT planning.

Our greatest strengths are:

- Research prominence/prominent faculty and researchers
- Regional clinical economic engine
- Technology savvy and engaged student body
- Size, mobility, and speed of a private university
- Staff commitment and track record of delivering results

Our greatest challenges are:

- Legacy effects of extreme decentralization
- Ongoing support of multiple 20+ year-old systems
- Funding constraints
- Prioritization and expectation management

Our greatest opportunities are:

- “One University”—new leadership advocating for unprecedented coordination and collaboration
- Emerging interdisciplinary interests are often computationally intensive
- Knowledge breakthroughs/discoveries are being accelerated through the use of technology
- Technology as an enabler for collaborations over distance

Our greatest threats are:

- Attaining technology equivalence/competitive position with peer institutions
- Increased legislative compliance
- Increased security threats

Our strategic opportunities have been fostered by University leadership that has supported a transformational level of collaboration across the institution. The early results of pilot interdisciplinary collaborations in research computing, the student experience, coordinated communications and advancement, and business continuity support efforts have fueled deeper potential synergies and efficiencies.

GOAL 1: Supporting the Mission

The impact of information technology and its exponential evolution has transformed its application and approach in higher education and healthcare. IT has evolved from being viewed as an isolated tactical infrastructure investment to a strategically focused, mission-oriented enabler and differentiator.

Research: Computational Center for (fields of) Arts, Sciences, and Engineering

Research at the University of Rochester is a major and vital activity. High performance computing is a uniquely transformational and pervasively enabling resource. Access to powerful computational tools not only strengthens the faculty's ongoing research, but also serves as an extraordinarily effective stimulus to expand the scope and ambition of future research. Computational studies in areas as diverse as Astronomy, High Energy Physics, Economics, Political Science, and Biomechanics contribute significantly to Rochester's standing as a Tier 1 research University.

Unfortunately, our researchers are challenged by the inadequate high performance computing capabilities available to them. The historical model of facilitating research computing on an individual basis is not a feasible plan for the future. In fact, the lack of a significant high performance computing program is negatively impacting faculty recruitment and retention, with notable recent departures. Some University faculty have had to resort to computational resources at other universities to meet their needs.

The development of a University-wide approach would provide economies of scale (for systems, staff, and physical environment), share expertise, enable cross fertilization of research, and enhance opportunities for new funding. To this end, seventeen of our prominent computationally intensive faculty researchers from across the University came together two years ago and created a position paper to address significant deficiencies in our current approach to supporting research computing.

The report outlines the development of a University-wide collaborative research computing center that would leverage our new data center. The computing resource would enhance interdisciplinary synergies and discipline-specific work, provide environmental relief in terms of heating and cooling across several University locations, and free up much needed program space.

Highlighted Initiatives

- Create the Center for Computational Arts, Sciences, and Engineering:
 - Build University-wide research computing into a multi-year program and develop a long term sustainable model
 - Complete the search for the Director of the Center for Computational Arts, Sciences, and Engineering
 - Increase available computing resources through the acquisition of a large computing cluster

Research: Electronic Curriculum Vitae (ECV)

Faculty need an electronic mechanism that allows for efficient management of information regarding their appointment, discipline, publications, grants, patents, specialties, interests, and other key data for more effectively pursuing research grant opportunities. The University also needs an effective means for deriving instantaneous reports and required information gathering across our faculty body.

ECV will support faculty researchers in identifying potential collaborators for their research. In addition, ECV can prove useful for the members of our extended community seeking experts in a given field. This will assist our communication efforts in raising the stature of the institution.

We will leverage the ECV project initiated in our Medical Center and offer it to the rest of the University community to improve our current capabilities.

Highlighted Initiatives

- Broaden the ECV project to include all faculty at the University to present faculty profiles and assist faculty researchers with grant submissions and reporting

Teaching and Learning: University-wide Teaching, Learning and Technology Roundtable

The overall IT strategy in the area of teaching and learning is focused on supporting the educational activities of the faculty and students. Information technology should help enable the pedagogical approach determined by the faculty member, rather than dictate it. Student learning can be more efficiently and effectively supported through the use of technology. While technology has been employed for instructional purposes, there is potential to leverage it further.

Most faculty at the University make individual decisions on the appropriate use of technologies and media resources to support their instruction. There is a potential opportunity to exert a greater influence on technology investments and maximize synergies if these decisions are made collaboratively.

The University should follow the collaborative model used for Research Computing to create a University-wide teaching and learning technology council to facilitate thinking and recommendations for the next generation learning environment. Once created, this University-wide group should explore key teaching and learning initiatives including the expansion of the student portal and learning management system, the development of metrics, and the creation of a Faculty Innovation in Teaching program. Assessment of actual learning outcomes is a compelling need in higher education by public opinion and accrediting bodies. The existing College Teaching, Learning and Technology Roundtable is a potential prototype for examination and scaling.

Highlighted Initiatives

- Create a University-wide Teaching, Learning and Technology Roundtable
 - Establish a Faculty Innovation in Teaching program to encourage advancements in instruction and make it available to faculty at the entire University

- Develop an assessment and evaluation program for faculty in their efforts to analyze and enhance instruction. This could leverage the involvement of faculty and graduate students in the Warner School
- Build on the portal and learning management system project and increase usage by faculty and students. This could include integration of current student information systems, as well as adding new functionality

Healthcare: Electronic Medical Records (EMR) and Clinical Data Warehouse

Our Medical Center is strategically positioning itself to improve three key areas: patient safety, quality of care, and efficiency through the use of advanced Electronic Medical Records (EMRs). Medical Center leadership has identified information technology as a strategic imperative for achieving these goals.

Leveraging web technologies to provide universal and secure access to Medical Center patient care, research, and administrative systems will be a core technology requirement. Next generation EMRs will offer more than just results, review, and clinical documentation. They will function as mentors and colleagues, offering clinicians guidance and suggestions using evidence based protocols and knowledge bases at the point of care to enhance the treatment of our patients.

EMR enhancements will “empower the patient” through the creation of Personalized Health Records (PHRs), which could be carried with the patients in their pockets or made accessible through the Internet. PHRs will give patients easier access to their records, an ability to interact with their healthcare providers, and offer them new opportunities and approaches to maintaining their health. The desire to share medical information electronically will continue to increase, which will alleviate the concerns over the proper balance between privacy and accessibility. This will also require healthcare providers to develop improved security mechanisms to protect the confidentiality of patient information without compromising access necessary for patient care. Implementation of a broad set of EMR initiatives across enhanced information technology architecture will serve as the transformational foundation for sharing patient data across the enterprise.

This enhanced environment will support leading edge research and clinical translational sciences, by allowing patient care systems to identify patients for clinical trials and giving researchers the ability to mine clinical data to ascertain outcomes and improve quality. Secure data sharing will facilitate regional collaborations that will enhance patient care and offer new opportunities for research trials. In addition, a clinical data warehouse will be created to store data across systems that will support bench to bedside integrated research and applied health outcomes.

Highlighted Initiatives

- Replace existing acute care EMR
- Implement an interoperable EHR, linking individual EMRs into a single, unified clinical data repository

- Develop a modern web-based technology platform upon which to provide access to clinical data, enhance collaboration between colleagues and researchers and improve communications with those outside the Medical Center
- Implement a Patient Health Record (PHR)
- Replace the existing Clinical Data Warehouse with a new warehouse which supports easier end-user access capabilities
- Ensure that evidence-based resources are seamlessly integrated into the new URMC Electronic Health Record that will be implemented in 2010

Performance: TBD

Strategic Initiatives for this section are on-hold until further progress is made in the Eastman School of Music strategic plan.

Student Experience: Responding to New Expectations

This generation of students grew up with technology integrated into their lives. They don't ask for it—they expect it and assume it. We need to provide student applications and services in an easy-to-use and transparent way. IT should play a strategic enabling role in residential life, public computing, student services and athletics.

The past year has culminated in the implementation of student portals that will enable our students to integrate more of their activities into one digital environment. A focused effort over the next five years will be to incorporate additional student services such as online grading, registration, and advising, as well as online support of student social organizations (student government, Greek life, and club sports) into this new environment.

Other components of this experience include the accelerated expansion of wireless networking and technology enhancements to student spaces. One new important effort centers on implementing digital signage across the campus in classrooms and public spaces for emergency notifications, promotion information, events and other purposes that benefit current and prospective students.

Highlighted Initiatives

- Student Portal – Integrate the Campus Club Connection for student groups and organizations with the community area of the new student portal and integrate website feeds from the various event calendars
- Digital Signage – Implement digital signage across the campus for classrooms and public spaces for emergency notifications, promotion information, events and other purposes. This should be integrated with the University Event Management System.
- Enhance audio/visual technologies in student common spaces
- Enhance video services for athletics

GOAL 2: Developing Enabling Systems

Enabling systems are not what we exist to do, but what we need to do to exist. They are often the core systems upon which we build programs, efficiency, and excellence. Over the last 20 years, virtually all operational aspects of the University have expressed a desire to move, or have already moved, from paper based systems to software or technology enabled solutions. Everything from the mail we read to electronic payroll deposits to the way we manage relationships with our most significant supporters has been propelled and accelerated by enabling systems.

Communications: Re-Architecture of Existing Web and Email Environments

For most people, their first interaction with the University is through our website or via email. The current University web architecture is antiquated, with little uniformity in hardware, software, or standards. Web development itself is decentralized with no one group having expertise in all areas (programming, graphic design, usability, multimedia production) and no consistent guidelines. This increases cost, complexity, and security risk and results in varying levels of quality. Similarly, our email environment is a compilation of 40+ different mail systems for students, faculty, and staff. Such simple things as a distribution to “all faculty” are challenging in this environment.

The University must be positioned to respond to and innovate when possible in a rapidly changing communications environment. This initiative sets forth to implement a web content management system, remediate the web infrastructure and related technologies, foster a community of collaboration around the web development process, and, where appropriate, rationalize and evolve our email environments to our user community requirements.

Highlighted Initiatives

- To address existing deficiencies and vulnerabilities, develop and deploy a coordinated, modern web environment capable of scaling to ongoing University communication needs
- Establish web teams comprising staff experienced in each of the different areas of web development or centers of expertise
- To assist with developing web uniformity and simplify the update process, deploy a Content Management System that can be offered to all units across the University as recommended in the Volkmann Report
- To support emerging needs such as mass communications, targeted solicitations, as well as University-wide communication, this comprehensive strategy will thoughtfully rationalize and evolve our email environment and includes the following key activities:
 - Analyze potential opportunities to consolidate or outsource services

- Develop a capability that allows email communications with the University community by role, leveraging the proposed Coherent Electronic Identity initiative (see Solidifying Infrastructure section)
- Implement a mass email strategy that provides the capability to perform mailing list maintenance, content development, and delivery critical to both internal and external communication needs
- Provide support for the emergency notifications initiative

Advancement: Build Leading Systems to Support Strategic Objectives

We are committed to building and maintaining a robust set of systems that support a donor-centric model, broadening the base of philanthropic support for University initiatives while strengthening our relationships with alumni, volunteers, parents, friends, and patients. After successful completion of OASIS Phase I in May 2007, completion of Phases II and III are targeted for fall 2008 and entail biographic updates, gift processing, membership, planned giving, stewardship, web community, events management, and document management. OASIS sets the foundation upon which a number of specialized programs will be developed between FY09 and FY13 to support the University goals as outlined in the *Operation Advance* plan.

Highlighted Initiatives

- Complete OASIS
- Launch the Medical Donor Relations Initiative to:
 - Develop processes and systems to dramatically improve the ability to identify new medical center prospects
 - Steward/ cultivate significant donors and key prospects
- Provide Online Constituent Services
- Work with the University's identity management strategy to simplify system access for constituents and allow for seamless transitions from student to alumni, patient to donor, etc. (See Solidifying Infrastructure section, Coherent Electronic Identity initiative for details)
- Develop targeted prospect and solicitation initiatives to maximize the value of the donor pool

Administrative Systems: Initiate Replacement of Legacy Systems

Many of our core information systems were developed from manual business practices, as appropriate to our environment more than 20 years ago. Today, this gap represents significant challenges in several areas, particularly in providing real-time online services demanded in our fast-paced environment.

We need to move forward with modernization and a more unified approach to reduce complexity and process fragmentation that often prevents efficient and coordinated operations. Administrative systems are expected to provide 24/7 access to information

and services and meet expectations for high levels of performance, predictability and responsiveness.

We recommend making significant progress on integrated financial systems in the short term, with student systems replacement to follow. Interim investments will be required to maintain viability while these major efforts unfold. While these system replacements can generate operational benefits, they are very expensive and resource intensive. Because of the inherent complexities and risks, we have found these engagements have affected our peers' abilities to concurrently complete other strategic initiatives. The recommendation for immediate next steps is to initiate a detailed requirements analysis to better assess the costs, risks, and opportunities.

In parallel, we need to continue to expand our reporting solutions to alleviate pressure and support demands on legacy administrative systems. For example, the data warehouse provides access to 20 years of student information and a growing repository of finance, advancement, and other administrative data.

Highlighted Initiatives

- Begin planning and initiate replacement of our legacy financial system and incorporate supply chain and shadow financial systems as appropriate. A comprehensive enterprise-wide solution will better support the level of financial management, reporting, and compliance required
- Provide life support and available enhancements to student systems while the system replacement is being planned. These projects include, but are not limited to: online billing and payment, online registration, online course evaluations, electronic student records, student access to grades, financial information and schedules, course schedule and description replacement, online degree audit
- Develop a multi-year funding model to support technology evolution
- Continue deployment of data warehouse to enhance secure access to financials, salary, grant, and procurement data

GOAL 3: Solidifying Infrastructure

A university's foundational IT infrastructure is a necessary requirement to support mission-oriented initiatives while continuing to maintain and grow enabling systems. It is often difficult to see the tangible benefits of investments in foundational infrastructure, but our day-to-day digital survival depends on strategic commitments to this environment.

Coherent Electronic Identity: Creating a "One University" View

Today's modern University is comprised of a broad array of individuals, many of whom have multiple relationships with the University—admissions candidate, student, alumni, employee, faculty, patient, and donor, to name a few. This initiative will establish "One University" identity for every community member, regardless of the number of varied roles of an individual. Addressing the current inability to interact with an individual in the context of their overall relationship with the University, will improve targeted communications, support interdisciplinary collaborations, and strengthen development efforts. It will also address integrated access to systems and services, and provide for the timely creation and termination of access rights to University systems and services.

Highlighted Initiatives

- Establish one comprehensive University identity per individual
- Establish "One University" directory and provide University-wide and divisional access rights
- Improve the distributed workflow for granting and terminating access to University services. For example, providing email accounts as needed before the employee arrives on-site while providing a parking permit the first day of work

Data Center Environment of the Future: Supporting the University's Digital Heartbeat

Our new data center environment represents a strategic realignment in the University's approach to IT infrastructure. University leadership has sponsored a project to develop a modern data center environment that will support the evolving needs of a world class research university with a premier regional health system. It will support real-time research and academic endeavors as well as the day-to-day critical operations of a clinical enterprise. The data center strategy is a two-site solution that will support live applications at both locations.

Highlighted Initiatives

- Complete the data center environment modernization and migration to new locations

Universal Connectivity: Attaining Network Modernization

A modern network is central and essential to the success of today's great universities. An effective network interconnects and enables the University community to collaborate amongst itself and ultimately with the world. We need to maintain the modern aspects of the University network and place an active and urgent focus on areas requiring significant remediation. Wireless networks are a common everyday expectation for our students and faculty. The University needs to establish a multi-year plan to bring the University in line with our peers and support the need for targeted expansions across the University.

Highlighted Initiatives

- Accommodate the geographic growth of the University by expanding the University backbone network
- Maintain the modern aspects of the University in-building networks and place an active and urgent focus on areas that require significant remediation, with emphasis on several River Campus locations
- Set and maintain network standards, using a multi-year funding plan, to allow for predictable levels of service across the institution and to foster interdisciplinary studies, appropriate security and reliability
- Establish a multi-year wireless plan for targeted expansions across the University to meet the needs of our faculty, patients, students, and staff
- Develop a unified communications strategy to support emerging clinical needs

Information Security: Embracing an Institutional Strategy

Fundamentally, many of the proposed transformational initiatives are investments in richer communication among members of the University's extended community. Each of these information systems and technologies increases the interconnectedness and accessibility of data. For example, data about each member's relationship with the University, data that is the foundation of new knowledge, and data that guides the University's strategic planning. The confidentiality of these data is a key asset of the University.

That same interconnectedness and accessibility can be turned to purposes contrary to the University's goals, if care is not taken at every step to control and monitor access to information systems. As a priority, the University needs to complete a comprehensive policy program and invest in institution-wide security controls to keep pace, not only with the University's creative new uses of information technology, but also with the creative criminal activity that is rampant across the Internet. The challenge for IT security programs is to achieve an acceptable balance between usability and security.

Information security is most effective when it is routine, when it is built into our information systems and when it is practiced every day by our faculty, staff, students, and other workforce members.

Highlighted Initiatives

- Develop and implement a comprehensive IT policy

- Tools to administer policy
- Expand security awareness education program
- Deploy institutional systems to protect against malicious attacks
- Remediate addressable system compliance issues (SSN, etc.)

Resource Planning and Management

The Information Technology strategic analysis represents a thoughtful approach to address long standing structural issues, while also identifying initiatives that have the potential to offer broad University-wide benefit. Historically, resources have been annually planned and predominantly focused on foundational infrastructure. The intention of this exercise was to identify what is required to close the gap between our current environment and the University's stated trajectory.

This effort was community driven and developed on an accelerated timeline. It provides ranges that reflect the possible five year minimum to maximum costs beyond those already budgeted as placeholders, to allow for decision-making about prioritization. It is understood that full business plans will be developed for the select major initiatives that the University decides to pursue.

We are submitting initiatives with three scenarios of potential investment—the minimum investment required, the level of investment required for alignment with peers, and the investment to provide the University with a leadership position. This approach:

- Assists in prioritization of the many competing University strategic opportunities
- Recognizes resource constraints
- Allows for flexibility in consideration of potential for additional resource availability, as University funding grows over the next five years

Opportunities

Better Use of Existing Resources

Several opportunities exist to better utilize today's existing information technology investments:

- More University-wide coordination of technology purchasing—specifically technology training, licensing and web services to leverage economies of scale
- Better coordinated use of existing capacity; for instance, when a new initiative starts, rather than automatically buying a new server, existing capacity should be considered
- Consolidation of duplicate services and ongoing evaluation of outsourcing opportunities (for example, email)

New Funding

- As the University continues to expand our research computing capabilities and associated infrastructure, we can avail ourselves of broader granting opportunities
- Early results from utilizing a University-wide approach indicate we can better leverage key technology vendor relationships to increase financial sponsorship and student placement, advance development, and create opportunities for cooperative research initiatives. For example, a unified approach with Microsoft and IBM has resulted in significant, new results

- New indirect cost recovery opportunities could become available. One example might be research computing as it expands in the data center

Cost Allocations

Approved initiatives will be funded in various ways. Many initiatives are University-wide so costs would need to be allocated across the institution. Others are beneficiary-specific and can be recovered through rates, direct service level agreements or targeted allocations.

Assumptions

Contingencies

Contingencies for emerging technologies not yet known and for potential scope changes were not factored into this version of the financial summary.

Time Value of Money

Time value of money is not yet used. All dollars are presented in 2008 terms. This will be considered in the more detailed financial plans as they are developed.

University Growth Assumption

An overall assumption for University growth has not yet been established. Therefore, best estimate available to date was used.

Growth Impacts Technology Two Ways

- Direct: For example, many software license costs increase based on headcount
- Indirect: General growth of University faculty, staff, student and bed count add to the “hidden costs” of IT. This includes the cost of IT support staff often not considered today

Resources

Functional resource needs will need to be carefully reviewed during the detailed planning process. The majority of estimates include system implementation costs only, not functional business process and back-office changes, which may be substantial. To move forward on the new initiatives would require further study and planning to obtain firmer estimates and timelines.

Conclusions

This analysis represents a thoughtful approach by the University community to offer strategic insights that will address several existing deficiencies and align information technology resources with the initiatives that will best support the overall University Strategic Plan.

In general, the University has historically focused on multiple investments in IT infrastructure. While necessary, this is not sufficient to support the University's new trajectory and has often resulted in multiple infrastructures and systems that are not well coordinated.

As previously noted, the results of this analysis provide an unprecedented opportunity to assess IT from a "One University" view and examine opportunities for collaborations and efficiencies going forward. The potential initiatives highlighted above and throughout this document support three key outcomes:

- Address major legacy structural issues that have resulted from extreme decentralization
- Align IT resources and effort to best support our overall University plan
- Increase University-wide results through a major shift towards greater collaborations in our approach to IT

This analysis offers insight to the ongoing demand for information technology support that exceeds available University resources. Historically, distributed solutions have arisen to address the unfunded demand. A move to greater collaboration will be required to avoid adding institution-wide complexities and inefficiencies that will affect the ability to support the University's long-term direction. Information technology, strategically focused, will create opportunities for collaboration and interdisciplinary synergies that will enhance our profile as a world class research university.

As the University competes for the world's best and brightest students and faculty in an increasingly digital world, our information technology environment will need to be competitive to achieve our stated goals. The University of Rochester strategic planning effort represents a singular opportunity to realign information technology in support of the University's missions for years to come.

Information Technology . . . Propelling the University on its path to excellence.



UNIVERSITY of
ROCHESTER

University of Rochester

IT Strategic Analysis

For Fiscal Years 2009-2013

Appendices

APPENDIX I – University-wide IT Strategic Planning Committees**Information Technology Governance Council (ITGC)**

David Lewis, *Vice Provost and Chief Information Officer (chair)*

Anjan Bagchee, *Manager of Information Systems, Office for Medical Education*

Holly Crawford, *Associate Vice President for Budgets & Planning & Deputy to the Senior Vice President and Chief Financial Officer*

Tom DiPiero, *Senior Associate Dean of Humanities and Professor of Modern Languages & Culture*

Adam Frank, *Professor of Physics & Astronomy*

Dave Garcia, *Director of Information Technology, Warner School*

Susan Gibbons, *Associate Dean, Public Services & Collection Development, River Campus Libraries*

Ron Hansen, *Senior Associate Dean, Simon Graduate School of Business Administration*

Brian Harrington, *Director of Information Services, School of Nursing*

Mike King, *Associate Professor of Biomedical Engineering & Chemical Engineering*

David Krusch, *Chief Medical Information Officer and Strong Health Associate Professor of Surgery and Medical Informatics, Medical Center*

Alvin Lomibao, *Students' Association President ('09)*

Joe Meister, *Associate Vice President, University Advancement Services*

Lori Packer, *Assistant Director, Office of Communications*

Jerry Powell, *CIO of URMC/Strong Health*

Helen Smith, *Director of Technology & Media Production, Eastman School of Music*

Nancy Speck, *Assistant Dean of Institutional Research*

Doug Wylie, *University Controller*

Staff To The Council

John Barden, *Director of Applications & Architecture, University IT*

Julie Buehler, *Associate Chief Information Officer*

Eric Fredericksen, *Associate Vice Provost, University IT*

Michelle Rogers, *Assistant Director, Office of the CIO*

Samantha Singhal, *Project Manager/Business Analyst, University IT*

Supporting The Mission

RESEARCH

Eric Fredericksen, *Associate Vice Provost, University IT (chair)*

Mike King, *Associate Professor of Biomedical Engineering & Chemical Engineering (co-chair)*

Adam Frank, *Professor of Physics & Astronomy*

David Krusch, *Chief Medical Information Officer and Strong Health Associate Professor of Surgery and Medical Informatics, Medical Center*

Paul Slattery, *Dean of Research & Graduate Studies*

TEACHING AND LEARNING

Eric Fredericksen, *Associate Vice Provost, University IT (chair)*

Susan Gibbons, *Associate Dean, Public Services & Collection Development, River Campus Libraries (co-chair)*

Anjan Bagchee, *Manager of Information Systems, Office for Medical Education*

Tom DiPiero, *Senior Associate Dean of Humanities and Professor of Modern Languages & Culture*

Ron Hansen, *Senior Associate Dean, Simon Graduate School of Business Administration*

Steve Manly, *Associate Professor of Physics & Astronomy*

Julia Sollenberger, *Director, Health Science Libraries and Technologies, and Associate Professor, Community and Preventive Medicine*

HEALTHCARE

Jerry Powell, *CIO of URM/Strong Health (chair)*

Brian Harrington, *Director of Information Services, School of Nursing*

Rick Haverty, *Director of Information Systems Division, Medical Center Information Systems*

Sharon Martinez, *Director, Web Services, Medical Center*

Betty Oppenheimer, *Associate Vice President and Director of Strategic Planning, Medical Center*

Julia Sollenberger, *Director, Health Science Libraries and Technologies, and Associate Professor, Community and Preventive Medicine*

Ted Vaczy, *Director of Information Systems Division, Medical Center Information Systems*

PERFORMANCE

Helen Smith, *Director of Technology & Media Production, Eastman School of Music (chair)*

John Covach, *Chair, College Music Department*

Nigel Maister, *Artistic Director, University International Theatre*

Other members TBD

SUPPORTING THE MISSION - contd.

STUDENT EXPERIENCE

Eric Fredericksen, *Associate Vice Provost, University IT (chair)*
Anne-Marie Algier, *Associate Dean of Students*
Laurel Contomanolis, *Director of Residential Life*
Janna Gewirtz, *Vice President of the Student's Association ('09)*
George VanderZwaag, *Director of Athletics & Recreation*

Developing Enabling Systems

COMMUNICATIONS

Lori Packer, *Assistant Director, Office of Communications (chair)*
John Barden, *Director of Applications & Architecture, University IT (co-chair)*
Jon Burdick, *Dean of Admissions & Financial Aid*
Teri D'Agostino, *Associate Vice President and Director of Public Relations & Communications, Medical Center*
Kim Hughes, *Web Manager/Publisher for the College*
Sam Lopez, *Executive Director, Advancement Communications*
Dev Ravichandran, *Manager, University IT*
Kevin Wesley, *Executive Director, Alumni Relations*
Karl Withers, *Associate Vice President and Director of Marketing, Medical Center*

ADVANCEMENT

Joe Meister, *Associate Vice President, University Advancement Services (chair)*
John Barden, *Director of Applications & Architecture, University IT (co-chair)*
Joe Carney, *Director of Gallery Advancement*
Rob Gibson, *Senior Associate Vice President for Academic Development*
Sharon Martinez, *Director, Web Services, Medical Center*
Julie Myers, *OASIS Project Director, University IT*
Martha Osowski, *Director of Advancement Projects; Sr. Director of Advancement Information Services*
Glen Smiley, *Associate Vice President, Advancement, University Medical Center*
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ADMINISTRATIVE

Nancy Speck, *University Registrar and Assistant Dean of Institutional Research (chair)*
John Barden, *Director of Applications & Architecture, University IT (co-chair)*
Tim Eldred, *Manager of HRMS*
Dave Garcia, *Director of Information Technology, Warner School*
Karen Gorton, *University Bursar*
Bill Passalacqua, *Senior Associate Dean of Finance & Administration, School of Medicine & Dentistry*
John Podvin, *Registrar, Eastman School of Music*
Phil Profeta, *Corporate Director of Purchasing*

Stephen Taylor, *Senior Financial Officer for the College*
Doug Wylie, *University Controller*

Solidifying Infrastructure

IDENTITY MANAGEMENT

Kim Ritze, *Director of Security & Policy, University IT (chair)*
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Chip Nimick, *Director & HIPAA Security Officer, Medical Center Information Systems*
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BUSINESS CONTINUITY

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Rob Evangelista, *Manager, University IT*
Mike Fitch, *Manager, University IT*
Sue Graves, *Project Director, Medical Center Information Systems*
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Paul Slattery, *Dean of Research & Graduate Studies*
Ted Vaczy, *Director of Information Systems Division, Medical Center Information Systems*
Steve Zimmer, *Director of the Data Center, University IT*

SECURITY AND COMPLIANCE

Sue Graves, *Project Director, Medical Center Information Systems (chair)*

Kim Ritze, *Director of Security & Policy, University IT (co-chair)*

Chip Nimick, *Project Director & HIPAA Security Officer, Medical Center Information Systems (co-chair)*

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Resource Planning & Management (Financials)

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Julie Buehler, *Associate Chief Information Officer*

MaryAnn Capuano, *Business Center Administrator, Medical Center Finance*

Holly Crawford, *Associate Vice President for Budgets & Planning & Deputy to the Senior Vice President and Chief Financial Officer*

Alys Klingenberg, *Assistant Director, University IT Finance & Operations*

David Lindskoog, *Purchasing Manager*

Stephen Taylor, *Senior Financial Officer for the College*

APPENDIX II – Supporting the Mission: Committee Work

This section represents the full body of work developed by the IT strategic planning committees. See *Appendix II – University-wide IT Strategic Planning Committees* for a complete list of participants. The current state outlined in these sections shaped our understanding of the technology-related issues and opportunities at the University. The desired state and gap initiatives outlined by the teams have driven the outcomes of our strategic analysis and reflect the overall resource scenario ranges in *Appendix I – IT Strategic Analysis Resource Scenarios*.

Supporting the Mission

The impact of information technology and its exponential evolution has transformed its application and approach in higher education and healthcare. IT has evolved from being once viewed as an isolated, tactical infrastructure investment to a strategically focused, mission oriented enabler and differentiator.

Supporting the Mission: Research

Overview:

Research at the University of Rochester is a major and vital activity. High performance computing is a uniquely transformational and pervasively enabling resource. Access to powerful computational tools not only strengthens the faculty's ongoing research, but also serves as an extraordinarily effective stimulus to expand the scope and ambition of future research. Computational studies in areas as diverse as Astronomy, High Energy Physics, Economics, Political Science and Biomechanics contribute significantly to Rochester's standing as a Tier 1 Research University. The University's strategic planning exercise has highlighted the richness of our faculty's research efforts, and vision, in multiple domains where computing is key to the solution of major research problems. In addition, improving this foundation will create a significant positive impact on interdisciplinary collaboration, faculty recruitment and retention and it will ultimately enhance our national reputation. Many of the strategic planning initiatives campus-wide will require enhanced research computing capabilities, including three of the four new interdisciplinary initiatives proposed in the College and the Medical Center: (1) computational nano medicine, (2) medical imaging, including optical and MRI, and (3) systems biology/proteomics/genomics.

The historical model of facilitating research computing on an individual basis is not a feasible plan for the future. The development of a university-wide approach would provide economies of scale (for systems, staff, and physical environment), share expertise, enable cross fertilization of research, and enhance opportunities for new funding.

Current State

- Historically, most computational research was a very distributed activity with each individual faculty researcher completely responsible for their own environments.
- Constraints of cooling and power are limiting growth of the local computing resources. In certain cases, the lack of proper environmental conditions are causing systems to be turned off and disrupting the scientific work of the researchers.
- Continued distributed efforts are financially and operationally inefficient. That approach is also not supportive of interdisciplinary opportunities
- Computational studies already form a major part of the Universities strength in existing high profile programs of excellences such as astrophysics, physics, engineering, fusion science, planetary science and biomechanics.
- The lack of a significant high performance computing program is negatively impacting faculty recruitment and retention, with notable recent departures. Some university faculty are even attracted to use computational resources at other universities to meet their needs.
- In 2006, the University Research Computing Committee was formed and this group of leading faculty researchers developed a proposal to University leadership to improve research computing at the institution.
- Researchers use a myriad of increasingly large, complex, and disparate resources – genomic and molecular biology databases as well as online research journals – to support their study and investigation. With almost 1000 databases listed in the 2007 databases issue of *Nucleic Acids Research*, researchers struggle to keep up-to-date in their fields. There is no one site that provides a guided access portal with searchable links to a majority of these resources, and there is no support group within the university to provide guidance in their use (Galperin, M.Y., "The

Molecular Biology Database Collection: 2007 Update," 23, Database Issue, D3-D4).

- Some lab groups license particular molecular biology databases and software tools for their own use, but sharing and group purchasing is not the norm. Access by researchers to licensed content in these databases is limited/spotty, so there an opportunity to expand our existing site licensing program.

Desired State

- Create a university-wide program for Computational Arts, Sciences & Engineering.
- The national recruitment of a faculty researcher that would be the programmatic leader of this critical activity and appropriate staff support.
- The development of a physical center for consultation, training, support, and coordination of opportunities for interdisciplinary research.
- Acquisition of high performance computing resources that position the university as a national leader with an ongoing, annual plan that maintains and enhances that position.
- The permanent establishment of the University Research Computing Committee as the faculty advisory group providing oversight to this effort.
- Explore and build partnerships with others outside of the university such as corporations, government, and other academic institutions.
- Leverage the new university data center as a professionally managed home for the new high performance computing resources and take it beyond its traditional administrative computing role.
- Create and utilize innovative media and resources that promote the university as a leader in research and highlight individual faculty researcher activities and scholarship.
- Develop a sustainable financial model that maintains and enhances this computational research program.
- Create a plan for a single clinical trials data management system to unify clinical trials data management.
- Define and create a secure plan for consolidated clinical and basic science data comingled in a Clinical-Translational Data Warehouse (CTDW) to enable translational research data mining.
- Provide a bioinformatics database support service and online resource gateway to assist researchers in finding, understanding and using increasingly complex online information in molecular biology.
- Develop a sustainable program for a parallel multi-physics simulation code base that could be utilized across disciplines from astro/planetary science, to laser fusion physics to biomechanics.

Gap Initiatives

- Complete the search for the Director of the Center for Computational Arts, Sciences & Engineering which is a combination of a faculty appointment and programmatic leader and jointly sponsored by University IT, the College, and the Medical Center.
- In 2007-2008, increase available computing resources through the acquisition of a large computing cluster.
- Actively participate in state and national activities relating to high performance computing and networking.
- Build multi-year resource plan for research computing.
- Encourage the use of UR Research as a repository for faculty work and publications.
- Broaden the electronic CV project to include all faculty at the University to present faculty profile and information and assist faculty researchers with grant submissions and reporting.
- Expand the existing software site licensing to structure and manage licensing for software used for research to encourage the efficient use of these tools. Negotiate and execute institutional site licenses for bioinformatics databases and software tools and create a one-stop molecular biology web gateway. Take advantage of consortia discounts and cost-sharing opportunities. Recruit appropriate staff to manage this activity and provide training and consultation.

Supporting the Mission: Teaching & Learning

Overview:

The overall IT strategy in the area of teaching and learning is focused on supporting the educational activities of the faculty and students. Information technologies should help enable the pedagogical approach determined by the faculty member, rather than dictate the pedagogical approaches that can be used. Student learning can be more efficiently and effectively supported through the use of technology. While technology has been employed for instructional purposes, there is potential to leverage it further.

Current State

- Most faculty at the University make individual decisions on the appropriate use of technologies and media resources to support their instruction. Some faculty are currently using a service to provide streamed video and audio reserves for the students enrolled in their courses. There are a few school-wide initiatives, including the Nursing school mandate to use a common learning management system (Blackboard) for all courses and the Warner School's strong encouragement to do the same.
- Technology in the College registrar-controlled classroom spaces is largely uniform and managed by a common control system. However there are department controlled teaching spaces and public computing areas that are not managed by the Registrar's office and equipment in these places may not be standardized. This is less of a problem in the Medical Center because the Office of Education Resources (OER) is responsible for maintaining all classroom technology. There are few large-group computer classrooms on any of the campuses. The Medical Center recently purchased 108 laptops for the purpose of converting any teaching spaces (large or small group) into a computer classroom.
- Expectations of enrollment growth may be inhibited by constraints of current classroom availability. Classroom instruction might be supplemented with technology solutions, such as video conferencing and online learning, which would effectively increase our course offerings without physically adding buildings or creating additional teaching spaces.
- The student portal and common learning management system (Blackboard) is used by the College, School of Medicine & Dentistry, School of Nursing, the Eastman School and the Warner School. This will help support faculty and students involved in multi-school programs. The Simon School has started to develop their own system called Simon Exchange.
- A growth area for the Medical Center is online/distance learning, especially in the School of Nursing and for online professional training. Some faculty in the Medical Center provide webcasts of their lectures. Except in the School of Nursing, this is more for continuing professional education than for undergraduate medical education, or graduate studies.
- The current student to public computer ratio appears to be meeting the computing needs of the current student body. The student to computer ratio in the public computing spaces should be maintained as we experience the expected increase in student enrollment. This will require additional software licensing costs, as well as hardware and space needs.
- We need to consider storage and licensing needs for library systems going forward. This year we will hit the 10,000 FTE milestone causing our licensing fees to jump to the next level.
- Faculty members in the Medical Center are starting to provide their curriculum vitae electronically. The ability to look up a colleague's qualifications helps facilitate greater collaboration. The Office of the Provost is supporting further expansion of this across the University.
- There are multiple digitization projects underway at the Libraries. Current efforts include the digital art collection, public domain music scores, historical images, special collection materials, and the cataloguing of movies at the George Eastman House with the goal to eventually have them accessible and searchable through the library management system.
- We currently do not have a standard document management solution. There are multiple solutions in use at the University but they are fragmented and not resource efficient.
- There has been minimal investment in providing support for discovery and/or development of multimedia learning objects (interactive modules, animations, digital simulations) to support student learning. Faculty or students who desire to pursue multimedia projects do it without expert support. Early in 2008, Miner Library will have a public-use multimedia creation and editing station, but no multimedia developer to provide assistance in its use.
- Accessing and exporting data out of the antiquated student information student information system is difficult. Advisors are utilizing some data and Computer science and the writing program have other individual methods but they are fragmented. The situation inhibits assessment studies of student learning and discourages people from even thinking about it.

Desired State

- Create a University-wide Teaching, Learning and Technology Roundtable to facilitate thinking and recommendations for how technology could support the next generation learning environment.
- Create an 'Innovation in Teaching' program that explores new technologies that support teaching and learning. Examples might include social networking sites, virtual worlds, podcasting, personal communication devices, as well as new capabilities that are not developed yet.
- In order to provide some relief to constraints of limited physical classrooms and growing enrollment, the faculty at the University might consider selectively exploring the development of hybrid or blended courses or complete online distance learning courses where appropriate.

- Develop and provide a uniform document management system to support collaboration across departments. Also make available and support a common set of additional collaboration tools for faculty and student use across the university.
- Where appropriate, enhancements to the learning management systems should be considered. One example might be an online portfolio system that captures a range of student work over their time at the university and is available to them after they graduate. Another example could be the extension of online exams that would be proctored and auto-graded where appropriate.
- At the Medical Center, develop a Curriculum Management System that provides the following functionality: (a) answers the question “what do we teach where?” (b) creates a comprehensive, searchable set of the exact learning content for each course, (c) preserves an authoritative and comprehensive set of all curricular materials, and (d) enables sharing of learning objects.
- Expand the use of video conferencing to facilitate guest lectures and support for faculty off site. This could also lead to new collaborative academic programs with other institutions.
- The University should develop an interface between the new learning management system and the human resource system (HRMS) in order to support the recording of required staff training and compliance with security protocols (HIPAA training, nursing competencies, etc.).
- Support creation of “the competent institution” at the Medical Center. Expand the online learning system, tutorial development, multimedia capabilities and documentation systems to provide just-in-time instruction, guidance, and competency certification for all members of the Medical Center community.
- Expand the Electronic Curriculum Vitae as a tool that supports faculty and research collaboration. The future vision will support links to the grants management system, online library resources, and the UR Research repository.
- Create a collaborative space for faculty similar to the student-designed Gleason Library in Rush Rhees. This would help faculty to come together informally and share ideas and conversation and may be similar to a Faculty Club. Complement this with an “Information Commons” in the Miner Library that is similar to the Gleason Library, but designed for students, faculty and staff in the Medical Center to engage in social and intellectual networking and group study.
- Provide the ability and support for faculty and staff to conduct assessment and evaluation studies. This could include legally appropriate access to longitudinal data that may be housed in the Student Information System or other systems. This will help faculty to determine effectiveness of instruction and the curriculum, use historical data to define student trajectories through a course, and identify potentially helpful interventions and likely paths for student success. This activity should be aligned with institutional research and may even be important for accreditation efforts.

Gap Initiatives

- Carve out space on campus to support faculty collaboration. This may start in the River Campus Library with an expansion of the Educational Technology Center as well as the renovation of the Miner Library to include an “Information Commons”.
- Create the Faculty Innovation in Teaching Program and make it available to faculty at the entire University.
- Develop an assessment and evaluation program for faculty in their efforts to analyze and enhance instruction. This could leverage the involvement of faculty and graduate students in the Warner School.
- Build on the portal and learning management system project and increase usage by faculty and students. This could include integration of current student information systems as well as adding new functionality.
- Add videoconferencing capabilities on campus for faculty and students.
- Provide multimedia development and support for faculty, especially for those that elect to develop hybrid courses.
- Broaden classroom technology capabilities in departmental teaching and learning spaces.
- Efficiently enhance software licensing in the library and public areas to respond to growing needs and enrollments.
- Integrate the learning management system with the University human resource system to support the recording of required staff training and competencies.
- Develop a Curriculum Management System within the Medical Center.
- Involve faculty in the planning and implementation of a new Student Information System.

Supporting the Mission: Healthcare

Overview:

The medical center mission is to support patient care, education, research, and community service. IT initiatives need to support these mission objectives individually as well as a collective whole. The recent Clinical and Translational Science Award (CTSA) grant will emphasize the need to link research activities with clinical care and vice versa.

Over the past 18 months the medical center has invested in a new wireless and core network infrastructure designed to meet current and anticipated application demands for the next 5 years. This network will be the platform upon which the next wave of clinical and research applications can operate.

Clinical applications will move closer to the bedside in pursuit of increases in patient safety, quality of care and patient satisfaction. Knowledge-based systems will be integrated with EMR's and work with clinicians as colleagues to improve patient care. These advanced systems will create an environment that will also aid in the retention and recruitment of physicians and nurses.

New facilities will be added on-site and off-site, expanding services as well as growing our catchment area. Large clinical expansion projects such as the PRISM project will deploy advanced information technologies to create state-of-the-art patient care environments and efficient workflows with high levels of quality.

The delivery of healthcare requires high levels of mobility. Systems and devices to support a mobile workforce through integrated and unified communications will insure the ability to access patient data anywhere and at anytime as well as expedite communications between care givers, reducing cycle times and offering an opportunity to reduce Length of Stay. Additionally, the ability to track the location of assets, care givers and patients will improve the flow of information as well as improve the workflow associated with patient care.

Enhancements to the existing Electronic Medical Records (EMRs) will continue as well as the deployment of new niche EMRs in areas such as Anesthesiology, Oncology and Intensive Care Units (ICUs). Deployment of an Electronic Health Record (EHR) will begin the process of integrating clinical data from a variety of EMR sources into a single, integrated clinical repository.

Revenue Cycle Management will be enhanced through ongoing improvements in current systems and the potential integration of financial and registration systems between Highland Hospital and Strong Memorial Hospital. These improvements will help to insure financial targets are met and revenue sharing goals with the medical center are achieved. Integration of clinical and financial data into a common repository, rather than the distinctly separate repositories of the past will enhance the ability to understand the impact of clinical events on financial position and vice versa.

Research will continue to grow in terms of annual revenues and the number of researchers engaged in research activities. Innovative Science Programs focused on Stem Cells, BioMedical Imaging, Nano Medicine, Genomics and Systems Biology along with the implementation of the CTSA will result in increased demand for high performance computing (HPC) capabilities. An increase in computational-based bio-informatics, utilizing modeling and simulation will further increase the need for high performance computing capabilities.

Tighter coupling between medical center researchers and River Campus researchers will increase the need for collaboration tools to assist with communications as well as basic research. The most effective, cost-efficient and environmentally friendly way to meet the computational needs of these various research activities is through a shared, University-wide HPC center (see Center for Computational Arts, Sciences, and Engineering in the Research section). The center will enhance our abilities to successfully compete on individual grant initiatives as well as enhancing our ability to attract world class researchers and graduate students.

Information technology will continue to be enhanced in support of the educational needs and objectives of the School of Medicine and Dentistry and the School of Nursing. Knowledge-bases in the library will continue to grow delivering more content electronically and offering new clinical decision support capabilities. Students will see an increase in the use of technology in the way their classes are managed, organized and delivered. The student portal will be enhanced to include more electronic course content. Enhancements to a University-wide learning management system will continue to lead the drive to implement technology enhancements to the learning process.

Community service will require taking medical center programs and extending them into the community. Information technology that supports the extension of the medical center programs into the community can assist in achieving this goal. Telemedicine and the Eastman Dental Center's Smile Mobiles are current examples of programs that use information technology to assist in delivery of programs to the community. Providing clinical data to the community through the Rochester Regional Health Information Organization (RHIO) and the Pediatric Immunization data base are other examples of using information technology to improve the health of the Rochester community.

Current State

- There are a variety of EMR's dedicated to supporting patient care in a particular setting. There are systems supporting acute care inpatient, ambulatory care, ED, PACS imaging and others. Each system contains some of the data that exists in the other EMR's, however no single EMR contains all data. This requires care givers to have access to multiple systems in order to have complete access to all of the data associated with a particular patient. This also requires care givers to maintain multiple userids and passwords for each system they access. The same issue applies to medical imaging, where there are multiple imaging systems and no single repository for all images.
- Communication capabilities are varied and discreet, lacking integration. Communications methods include: wired telephone, wireless telephone, cell phone, email, paging, and instant messaging. Mobile workers are required to carry a variety of devices to support each of these discreet communications technologies.
- Network infrastructure is ubiquitous on campus and off campus. Campus-based networks support high bandwidth communications. Wireless network connectivity covers virtually 100% of the campus-based locations. There are many off-site locations (approximately 70) that have reasonable network connectivity capabilities back to the main campus.
- Regionalization of our business utilizes a variety of network connectivity options that support a variety of network speeds. However longer distances and needs for higher bandwidth connections (supporting imaging as an example) can sometimes create challenges (financial and/or technical) in providing the appropriate level of service.
- Community-based physicians have access to clinical data, however it is structured in such a way as to offer them the ability to access to data for patients they are not responsible for. Security, privacy and ease of access/use all compete to create sub-optimal outcomes for each component.
- Clinical providers must initiate and perform a search in Miner Library Online to support evidence-based care decisions; time to do this is limited and patient care questions may remain unanswered. Providers can also request librarians to perform a search for them, usually completed in 24 hours. Either way, retrieving relevant and high quality information for patient-care decision-making takes considerable effort, skill, and time.
- Patients usually go to their provider or to the Internet to find health information. Those who use the Web begin at a general search engine like Google, rather than a credible health-related Website. Left to their own devices, patients and their providers must spend considerable time and effort to find relevant, understandable health information, and even then the quality of that information is questionable.
- Recently implemented a new billing/registration/ scheduling system for Strong Memorial Hospital (SMH) that is integrated with the pre-existing physician practice management system. This will enhance the ability to enhance Revenue Cycle Management and help to achieve desired operating margins. There are still two uniquely different Master Patient Indexes (MPIs) for Highland Hospital (HH) and SMH.
- Researchers have created pockets of computational capacity in support of compute intense research projects involving genomics, biostatistics, proteomics and bioinformatics. These pockets of computational capacity are sufficient for low level research initiatives and are inefficient in terms of space utilization and facility costs of power and cooling.
- Individual Principal Investigators (PIs) and/or labs are responsible for their individual IT infrastructures (with the exception of networking and email which is provided to them). They are responsible for the appropriate storage, backup and recovery of research data. Data critical to their research can reside on desktops, laptops and servers. Grant funding agencies are requiring proof of data management, including security, backup, recovery and archiving.
- Researchers collaborate internally and externally through a variety of mechanisms, though external collaboration is more challenging due to security requirements. Today, some collaboration with the River Campus occurs but there is an expectation for higher levels in the future.

Desired State

- Upgrade EMRs such that they function as colleagues/mentors and meet the Gartner EMR classification as a level 3 or greater EMR.
- Provide clinicians with a seamless EMR experience that allows for fluid movement from one EMR application to another without the need to uniquely sign-in to each system. Maintain patient context as the clinician navigates from system to system.
- Integrate multiple EMRs into a single EHR (Electronic Health Records) providing a single point of view for all clinical data that represents a particular patient.
- Provide patients with access to a PHR (Personal Health Record) which will offer them a self-managed repository of their unique patient information.
- Develop new technologies in support of voice and data communications with and between mobile care givers and at the same time reduce the number of unique communications devices (pagers, cell phones, PDAs, etc.) carried by healthcare workers.
- Enhance patient safety and quality of care through the deployment of Point-of-Care systems for medication administration and laboratory specimen collection.
- Create an integrated financial and clinical data repository, upgrading from the current data warehouse design that stores clinical and financial data in unique individual repositories.

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- Enhance patient safety and quality of care through the deployment of Point-of-Care systems for medication administration and laboratory specimen collection.
- Create an integrated financial and clinical data repository, upgrading from the current data warehouse design that stores clinical and financial data in unique individual repositories.
- A common medical record number to be used at HH and SMH which will create a single identifier to be used by all systems improving the ability to view patient data developed from visits at either institution.
- Deployment of leading edge clinical information and imaging technologies in the new PRISM expansion.
- Enhance the integration of the clinical and research enterprises in support of the CTSI.
- Continued enhancements to billing related systems to insure efficient and optimal revenue cycle management.
- Providers can quickly and easily find evidence for clinical decision-making. A “metasearch” engine is used in Miner Library Online to search with a single query the content of an expanded array of licensed evidence-based resources.
- Evidence-based resources are integrated into the medical record with direct and seamless links, alerts, and guidelines – to increase the translation of evidence into practice.
- It will be easy for patients to get the comprehensive, easy-to-understand health information they need. They will use patient bedside computer systems such as GetWell Network, as well as in-hospital patient/family libraries to access their PHR and relevant health information. With the help of librarians in providing targeted, high-quality information, providers, families, and patients will spend less time trying to find the “right” health information.

Gap Initiatives

- Replace existing acute care EMR
- Implement single sign on system possibly embedded within a new clinician web portal.
- Implement an interoperable EHR, linking individual EMRs into a single, unified clinical data repository.
- Develop a modern web-based technology platform upon which to provide access to clinical data, enhance collaboration between colleagues and researchers and improve communications with those outside the medical center.
- Implement a Patient Health Record (PHR).
- Replace the existing Clinical Data Warehouse with a new warehouse which supports easier end-user access capabilities.
- Deploy a unified communications infrastructure in support of mobile healthcare workers that supports wireless voice,

Supporting the Mission: Performance

Overview:

This section is a draft placeholder and will be developed once further details of the Eastman School's strategic plan and Eastman Theatre project are available and in particular, when further discussions with other performance departments and venues at the University have taken place.

The music profession is currently in a state of transition, and technology is now offering music education and music performance, as well as theatre, dance and other art forms, many new challenges and opportunities. There will be much to be gained through innovation and entrepreneurship, interdisciplinary collaborations and multi-art form and multimedia partnerships, and technology will enable and drive many of these developments which are new to the traditional art forms. The College Music Department, UR International Theatre, Memorial Art Gallery and other performance venues and initiatives may also inform these new directions.

While much of the required infrastructure will be based around IT, additional digital audio and video technologies will also be required. Therefore the definition of IT is expanded in this section to include resources for performance capture, production, presentation and distribution. While the applications may be very different, technologies and expertise may be shared between institutions, for example concert webcasts may be informed by work done for Athletics, video by the Medical Center and School of Nursing, radio broadcasting by Student Life, and new venues will also drive performance technologies.

Current State

- Eastman School technology is now adding more strategic and creative R&D projects to the normal day-to-day operational activities. The main drivers of this are the Eastman Theatre project, with the new building in particular providing a focus for integrated performance space technologies, the emerging Eastman strategic plan which includes interactive web initiatives, media partnerships and contemporary performance, and all forms of distance learning.
- Eastman School's IT services are part of the Technology & Media Production department, whose 11 staff support IT, web, recording, video production, classroom AV technology, student labs, online learning and Internet2 video-conferencing.
- Staff are now required to rapidly learn new skills, as they move from their traditional operational network/desktop support, audio recording and educational technology roles, into those supporting new interactive and multimedia creative projects. Finding the time for them to develop and apply these is an ongoing challenge.
- The ESM network infrastructure supports around 400 faculty, administrative, and public computers, and some of it needs to be upgraded with new cabling and switches. However, the most requested need is to incorporate wireless into public spaces, meeting rooms and classrooms.
- Collaborative and online learning applications are now becoming a more regular part of the curriculum, with Blackboard courses and the student portal increasing rapidly in popularity, along with requests for iTunesU, iPod and additional AV technology in classrooms, and a variety of other web based technologies.
- There has been an improvement in the availability of student loaner digital equipment such as recording and filming equipment, and an increase in the number of classes and training sessions for digital content production, but based on recent student feedback, this is an area which needs to expand. Similarly, there are challenges in finding suitable lab teaching spaces.
- Sibley Library has been increasing its use of technology, with an upgraded multimedia listening room and ongoing digitization projects of its archives.
- Internet2 video-conferencing has been a significant growth area with masterclasses, performances, seminars, lectures and classes being delivered via a range of technologies including Skype, codecs, DVTS (CD/DVD uncompressed quality) and Polycom. These events are often logistically complex and ideally need to be integrated more closely into the curriculum.
- The renovation of Eastman Theatre, and building of the new recital hall and rehearsal hall, will include a new recording and video production room, connecting to all performance venues. The new facilities and digital infrastructure will enable improved recordings, video production, streaming, interactive events and connectivity with the local public broadcasting station.

Supporting the Mission: Student Experience

Overview:

This generation of students grew up with technology integrated into their lives. They don't ask for it – they expect it and assume it. Information technology support and resources should be available to students as part of their relationship with the University. This should include their academic life – both in and outside of the classroom – as well as their role in the university community. IT should play a strategic enabling role in residential life, public computing, student services and athletics.

Current State**Residential Life**

- Internet, cable TV, and phone access are present in all residence halls. Today, areas in Susan B. Anthony, Gilbert, and Hoeing residence halls are equipped with wireless access. In addition, the University is expanding the campus to Riverview – with the expectation that technology services are consistent with the rest of the campus.
- From a security standpoint, access to buildings is managed using University cards with access to locked rooms managed by keys. There are a number of technology supported student spaces on campus including Wilson Commons and the new Gleason Library in Rush Rhees.
- Residential Life provides some web-based services and resources, such as an online room lottery. A new online housing system is currently being implemented.

Public Computing

- The University currently has 25 computer kiosks distributed across 10 locations on the River Campus. These stations have been well received by students. In addition, there are 400 public computers available to students on the River campus. However, the demand for computing resources by students continues to increase.

Student Services

- The University currently provides students a commercial music service for downloading music and video legally.
- The Campus Club Connection currently provides web support for student organizations. While addressing the immediate need for students, it is not yet integrated with other IT services at the university.
- The new student portal currently presents academic resources for students. However, community building capabilities are now being explored to support student life outside of the classroom.
- Students currently use their student card to pay for various purchases on campus. There is a project underway to integrate this with the new student portal.
- The current student email solution provides the very basic capabilities. Many students come to campus with other email accounts and continue to use them instead of the university provided system and we expect this trend to continue.
- The Student Information System is antiquated and needs to be replaced. This is reflected in the Developing Enabling System section of this plan.
- Many student groups are relegated older, cascaded technology for their activities. For example, the group that provides first-response medical treatment (Medical Emergency Response team) had a hand-me-down laptop and no printing capabilities.

Athletics

- University Athletics has recently redesigned its web site and embraced new university graphics.
- The Athletics department was the first among its peers to provide live webcasts of sporting events. This included basic video content for football games and women's basketball games and integration with the radio broadcast.
- Coaches currently have some basic IT capabilities and video analysis tools.

Desired State**Residential Life**

- The University should explore providing mobile telecommunications options.
- Make sure that IT services are consistent as near campus and off-campus University housing increases. This should also include the collaborative student spaces across campus to provide a more effective use of the space.

- Maintain a secure and safe environment for students by managing access to all doors (buildings and rooms) managed by a unified system. The system should be able to support granting access to a particular set of individuals for a specified period of time.

Public Computing

- The University should expand the number of kiosks to 35 and the number of public computers to 450. This should also include a consistent set of applications and tools that students need as well as single sign on capabilities that integrate network access, the portal, and other NetID enabled services.
- Accelerate expansion of wireless connectivity in appropriate areas across campus.

Student Services

- The university should continue to provide to students a legal service for downloading music and videos.
- The student portal should be expanded to include support for all student community groups. Integration of announcements and calendar events should be part of this integration.
- The university should support an email environment that meets the current and future needs of our students.
- The student card system should be wireless and fully integrated with the new student portal.
- Dining services should provide online nutritional information and online food ordering capabilities.

Athletics

- Support the ongoing design and development of the Athletics web site to support recruitment and promotion.
- Provide new tools and technical capabilities for coaches to enhance their instructional support of our student athletes.
- Institutionalize the capability to provide video webcasts of sporting events. This should also include significant expansion of university services for video editing and post production.

Gap Initiatives

- **Residential Life:** Implement the new web-based housing applications and update televisions to High Definition in public areas.
- **Audio/Visual Technologies:** Provide enhanced technologies in student spaces including Wilson Commons and Susan B. Anthony, update the campus web cams, new videoconferencing capabilities, new broadcast technologies for the university television and radio stations, and additional wireless student card machines.
- **Digital Signage:** Implement digital signage across the campus on classrooms and in public spaces for emergency notifications, promotion information, events and other purposes. This should be integrated with the university Event Management System.
- **Wireless:** Roll out wireless networking access across campus to all appropriate locations. (see Foundational Infrastructure)
- **Public Computing:** Acquire and deploy new computer kiosks each year and provide a renewal and replacement cycle to keep them current. Include equipment for student groups.
- **Student Portal:** Pilot the integration of the Campus Club Connection for student groups and organizations with the community area of the new student portal and integrate web site feeds from the various event calendars.
- **Student Email:** Investigate new student email services. External options should support forwarding to and from @rochester.edu email addresses. (see Foundational Infrastructure)
- **Transportation:** Enhance the transportation systems with technology including Global Positioning System devices on buses and corresponding displays on campus so that students can see the exact location of the buses.
- **Athletics:** Support integration with the specialized athletic scoreboards (Aquatic Center, Fauver Stadium and the Palestra), provide the ability to exchange athletic game video to other institutions per league agreement, provide more data to Athletics from turn stile swipes, and continue to add IT capabilities to equipment in the Fitness area.

APPENDIX III – Developing Enabling Systems: Committee Work

This section represents the full body of work developed by the IT strategic planning committees. See Appendix II – University-wide IT Strategic Planning Committees for a complete list of participants. The current state outlined in these sections shaped our understanding of the technology-related issues and opportunities at the University. The desired state and gap initiatives outlined by the teams have driven the outcomes of our strategic analysis and reflect the overall resource scenario ranges in Appendix I – IT Strategic Analysis Resource Scenarios.

Developing Enabling Systems

Enabling systems are not the reasons we exist, but they are often the core systems upon which we build programs, efficiency, and excellence. Over the last twenty years, virtually all operational aspects of the university have expressed a desire to move, or moved, from paper based systems to software or technology enabled solutions. Everything from the mail we read to electronic payroll deposits, to the way we manage relationships with our most significant supporters has been propelled and accelerated by enabling systems.

Developing Enabling Systems: Communications

Overview:

IT must be positioned to respond to and innovate when possible in a rapidly changing communications environment.

The act of communicating with such large and disparate audiences as high school students and their parents; alumni; current students, faculty, and staff; patients and visitors; the media; and government and community leaders has always been dependent upon some form of technology. The last 15 years however, have seen a remarkable explosion in communication technology. Websites, email, instant messaging, text messaging, social networking, Web 2.0, Web 3.0: sites and business models that did not exist five years ago (Facebook, MySpace, Skype, Wordpress, iTunes, and YouTube) are now commonplace to the next generation of students and researchers. Expectations have been raised.

Current State

The Web

- Web development at the University has traditionally been decentralized, with offices springing up within University IT, University Communications, and each school and unit.
- No one organization has expertise in all the various fields surrounding Web development: programming, database administration, graphic design, writing/editing, information architecture, usability assessment, multimedia production.
- The University's Web architecture itself is antiquated, with no uniformity in hardware, software, or security standards.
- Many offices are without their own resources for developing and maintaining their Web presences, with the result that website maintenance becomes another "duty as assigned" for administrative or student staff who are not provided with proper training opportunities.
- Policies and centralizing governance groups are not enforced or are otherwise not effective. There is no one set of agreed upon minimal elements or principles regarding design, content, audience, message, or technology platforms.

Email/Notifications

- The University maintains more than 40 mail servers for students, faculty, and staff. Communicating with different groups by role (eg. all faculty, all River Campus faculty, all students, all graduate students) is a difficult process made more difficult by this dispersed email environment.
- There is at least anecdotal evidence that undergraduate students and an increasing number of faculty have their University email forwarded to external services like Gmail.
- In Fall 2007, an agreement was reached to purchase a system that will send instant text messages to people across all campuses during an emergency.

“The Future”

- New development platforms, application frameworks, programming languages, and communication models are advanced every year.
- Despite of, or perhaps because of, its decentralized nature, the University is slow to respond to these new developments, the practical upshot being that decisions about adopting or not adopting any new framework or approach are often made by default.

Desired State**The Web**

- A community of collaboration around Web development. Everyone does not necessarily have to agree to use the same platforms/technology, but everyone should be aware of what our resources are in this sphere and how to tap into them.
- Established guidelines for minimum required elements and best practices, resulting in a University Web presence that reflects our mission and strategic plans.
- An increased emphasis on websites that provide a personalized experience for the visitor, repurposing content from across University sites and allowing visitors themselves to contribute and participate in meaningful ways.
- Regular training opportunities available for staff responsible for Web development.

Email/Notifications

- A re-architected email infrastructure that supports decentralized administration, dynamic distribution lists, and access over the web.
- The ability for University administrators/faculty to send email to members of specific University segments, and for users to control how and where messages are delivered.
- A simple-to-use system for publishing, distributing, and perhaps tracking formatted emails and email campaigns.
- A plan to implement the new mass notification system for sending emergency messages via email, text messaging, phone and voice, and other methods (Web sites, my.rochester.edu) first to undergraduate students and eventually to all University constituencies (faculty, staff, parents).

“The Future”

- An “R & D” atmosphere around Web development in University IT. To ensure the University is prepared for the future, there is a need to allocate additional resources towards forward-looking efforts that may go unrealized if all our efforts involve more urgent or pressing projects.
- Maximized input from student workers and interns in this effort.

Gap Initiatives**Web Audit / “Web Teams”**

- Undertake an inventory of the entities around the University that do Web development in some capacity.
- Establish “Web Teams” comprising staff experienced in each of the different areas of Web development or “Centers of Expertise” devoted to each. Using the model of a professional design shop, the Web Teams could manage Web development projects along a client-vendor model, managing timelines, responsibilities, and costs.
- Create a Web Governance Group or Web Council comprising members of these teams or centers, who would meet regularly to discuss upcoming projects/site launches; establish guidelines for minimum required elements; and recommend and enforce best practices.
- Provide regular training opportunities on University campuses to support information providers in their Web maintenance tasks.
- Plan for the growth of the student/faculty portal, particular as a communications and notifications vehicle with possible applications for external audiences like alumni and parents.

Content Management System

- Select, purchase, and implement a content management system (CMS) that all units across the University can adopt, rather than having multiple content management systems spring up across the University.
- Train content providers on new CMS, with the goal of empowering individual site authors to maintain their sites as needed, without having to rely on University IT.

Website Re-architecture

- Acquire appropriate resources including dedicated redundant server hardware, software, and support staff so that University websites are continuously available, responsive, and capable of supporting new Web technology.

Email Re-architecture

- Analyze potential opportunities to consolidate or outsource email systems to simplify the email architecture.
- Create a list or address management system allowing email communications with University community by role, and address the infrastructure issues that make it difficult for people across multiple servers to communicate via email. (See Foundational Infrastructure – Identity Management section for details)
- Provide a system that allows students to control how and where communications are delivered. In addition to traditional University-hosted email, communications would be delivered in a variety of formats and by alternate methods such as third-party or Web-based email systems, text messages and RSS streams.

Web Audit / “Web Teams”

- Create a model where student workers under the supervision of IT managers are free to develop new Web tools that could have both mission-oriented and purely fun applications.

Developing Enabling Systems: Advancement

Overview:

Beginning in 2005, the University initiated a broad restructuring of advancement. This plan was a call for significant reengagement of our constituents to “expand University’s service and impact by engaging generations of visionary partners in the tradition of George Eastman”. This vision foundationally focuses on donor centric engagement and operational excellence. Advancement operations are viewed as critical to sustainability of the University. Supporting the life-long engagement of our constituents spanning multiple divisions and academic partners relies upon quality and consistency of information supported through numerous coordinated enabling technologies.

Current State

- University Advancement is in a state of restructuring – organizational, process, policy, and technology. Virtually all aspects of the way in which the university interacts with constituents will be altered between 2006 and 2009. This dynamic period of change is a unique opportunity to align technology to support the envisioned future state.
- Consolidation of units and integration of a donor-centric model continues to require a new way of looking at information, and exerts pressure on several sub-standard systems.
- A major system replacement was initiated in 2006 will address the central enabling system requirements for advancement. Until completed, services continue to require extensive manual effort.

Project Phases:

Phase I	Biographic Inquiry, Prospect Management, Proposal Management	Completed: May 1, 2007
Phase II	Biographic Update, Gift Processing, Membership, Planned Giving, Stewardship	Target date: July 1, 2008
Phase III	Web Community, Events Management, Document Management	Target date: Fall 2008

- As advancement programs are developing across the university, several process changes are illuminating new enabling technology needs. Many of these are high value / high return items in achieving the goals outlined in Operation Advance, the strategic plan for advancement. In some cases, technology is a prerequisite to program viability due to the complexity of communication and coordination required.
- The current offering of disjointed web sites, alumni communities, and substandard e-commerce web pages provides constituents with a less than optimal experience that does not place the university in a good light compared to the offerings of peer institutions. The future web community portion of the OASIS project only partially addresses these issues.

Desired State

- State-of-the-art operational support for Advancement, leveraging best-in-class processes and technology.
- The nation's leading fund raising organization in the practice of donor-centric fundraising.
- Business processes and technologies aligned with a strong donor centric business model.
- OASIS provides staff with easy access to information and tools needed to fulfill the objectives of the business plan.
- High quality web based products and services enhance constituent relationships across the spectrum of advancement interactions.
- A process of continuous improvement and investment ensures that the investment in technology for Advancement remains relevant as the programs and business processes being supported are enhanced.

Gap Initiatives

- Completion of OASIS.
- Medical Donor Relations Initiative
 - Develop processes and supporting systems that:
 - Dramatically improves University Advancement's ability to identify new medical center prospects by performing wealth screening based on patient demographics.
 - Support HIPAA fundraising compliance.
 - Stewards / cultivates significant donors and key prospects through a medical donor relations program that provides key constituents with amenities during visits to the URMC.
- On-line Constituent Services
 - Interim goal is to reach baseline services through completion of the Harris on-line community project.
 - Long-term goal is to develop innovative strategies that provide constituents with seamless, consistent, customer focused web products that improve the overall experience of doing business with the University.
 - Incorporate the University's identity management strategy into all products in order to:
 - Provide constituents with a single sign-on for all systems.
 - Allow seamless transitions from student to alumni, patient to donor, etc. (See Foundational Infrastructure – Identity Management section for details).
 - Redesign of Advancement web sites.
- E-commerce
 - Develop a PCI compliant, on-line giving strategy that centralizes giving or other e-commerce web pages while maintaining the graphical identity of the entity for whom the transactions are being processed.
 - Adopt strategies to drive traffic to e-commerce web pages.
- Reporting (combined with Administrative Reporting and Analytics)
 - Develop a suite of reporting tools that allow non-technical advancement staff to produce sophisticated reports that further leverage the investment in OASIS and the data warehouse.
 - The reporting portfolio will include:
 - Reports of record which will provide official financial figures that will be produced centrally.
 - A number of ad hoc reporting tools that will enable University Advancement staff to produce a wide variety of products without technical assistance.
 - Ultimately, a cycle of product and staff development will empower staff to produce increasing numbers of basic reports while freeing technical staff to work on more sophisticated reporting products.

- Mass E-mail
 - Implement a mass e-mail strategy that provides the capability to perform mailing list maintenance, content development, and delivery of e-mail to various University Advancement communities.
 - The ideal model allows list owners to perform these functions with limited technical intervention.
- Data Mining (combined with Administrative Reporting and Analytics)
 - Using both commercial and internally developed products, build predictive models that will help University Advancement better identify and solicit prospects.
 - One of the most promising of these projects would be to model patient giving (in association with the Medical Donor Relations and Major Gifts Initiative).
 - Incorporating data from constituent surveys into the data warehouse, use data mining tools become better market informed.
- Transaction Processing Automation
 - Incorporate lockboxes for high volume transaction processing operations.
 - Develop processes for automation of recurrent transactions (typically via card cards or Electronic Funds Transfer).
- Events Management
 - Reevaluate the vendor's events module versus Advancement's business requirements and determine if a more robust solution will be required.
- Intranet Portal Project
 - Develop a portal for Advancement that integrates products and services, distributes reports, and provides a repository for policy and other mission critical documents.

Developing Enabling Systems: Administrative

Overview:

Administratively focused enabling systems exist to support key processes and operations critical to the support of university administration. Today, these systems are often relied upon as the primary mechanism in facilitating complex processes. These systems store information, route workflow, administer procedures, and report data that is necessary for efficient operations and compliance activities. Be it student class registration, financial bookkeeping, presenting curricular options to prospective applicants, supporting employee selection of benefits, efficiently managing and tracking of grant dollars, or managing just-in-time material delivery critical to patient care, these systems have become the way in which the business processes of the university are managed. While in some areas we have made substantive headway in providing excellent support to the university community, we are falling behind in many areas. As the world continues to move online, our processes and the systems that support them are of increasing importance and public visibility in supporting the mission of the institution.

Current State

- Many of our current enabling information systems were developed from manually oriented business practices that were appropriate to our environment 20 years ago due to limited resources. Today, this gap represents significant challenges in several areas, particularly in providing real-time online services demanded in our fast paced environment. Students, researchers, faculty, and administrators have increasing technology expectations. Process redesigns, coupled with core system replacements, represent a significant opportunity to improve the services and operations of the university.
- Support, enhancements, data gathering, and report generation often require expertise in outdated programming and database languages. Many of our legacy systems are in very limited uses and within known support termination windows. This exposes the university to significant and increasing risk over the next 5 years as support for existing systems is terminated (financial system - FRS) and a staff support retires (for example, student systems staff). The confluence and timing of these events will have critical impact on the university's ability to conduct its business effectively.
- While a unified strategy for integrated systems architecture has been defined, and several projects continue to make progress toward this objective, substantive investments remain. Many enhancements to the legacy systems have been undertaken, but the resulting improvements are incremental. Efforts at continuing improvement are hampered by the underlying systems which will continue to result in higher ongoing costs and less effective outcomes. There are several projects which will be necessary to set the foundation for substantive progress. Until these efforts are more concretely advanced, users of multiple systems will continue to deal with fragmented interfaces and with multiple user accounts and passwords that contribute to the perception of poor service and questionable results.

Desired State

- Where feasible, the University should implement enterprise-wide systems which are centrally managed, governed through a university-wide governance structure and supported by University Information Technology. University IT should be included at the outset for all implementations, including those at the divisional level. Applications which capture core institutional data, have strict compliance or confidentiality requirements, impact large numbers of internal and external constituents and have high business and operational impacts are suggested here. Examples include student, human resources, purchasing and financial systems. A key to the success of these efforts is executive sponsorship that encourages collaboration among all units of the organization.
- A certain level of decentralization is accepted, expected and supported across the university. Given this expectation, enabling systems should be implemented recognizing the need for decentralized data stewardship and management but enhanced through centralized support. Implementations planned with this construct in mind would remove the necessity for the development of shadow systems. Clear lines of responsibility for implementation, maintenance, management and training must be established during the planning process.
- Acknowledging and including the costs for planning implementations must be part of the business process. Preliminary analyses should include costs for business process re-engineering, resource allocation and re-allocation (personnel and financial) as well as on-going costs that accrue subsequent to implementation. In addition, costs for reengineering existing systems must be included since most enabling systems intersect at many levels of operation. Resources for training and retraining, enhancements and continuous improvement must be included in these assessments. Efforts described here are likely to add significant cost to projects but assure best outcomes over the long term.
- Recent initiatives enhance and encourage the need for change. Increased collaboration and communication across all segments of the university community require new responses to old problems. Moving forward with new technologies, reducing dependence on manual processes, providing 24/7 access to information and services, as well as expectations for high levels of performance, predictability and responsiveness through enabling systems is expected.
- As the size and complexity of the university grows there is a clear need for additional tools to effectively manage information and data across divisions and units. Future developments should include records management, retrieval and report generation from enabling systems. One example is the Data Warehouse which contains student data and will soon include advancement and financial data. Report generation from this system is a specialized skill and will require trained staff to support a university-wide initiative in this area.
- As projects are envisioned there should be consideration given to other opportunities for business operations (outsourcing) rather than always creating solutions from within.

Gap Initiatives

- Accommodation for University Growth
 - Support anticipated growth in employee and student populations as well as revenue, as outlined in divisional strategic planning. Licensing cost for new software is often based on the employee headcount and/or revenue of the institution, and institutional growth has substantive implications. Expectations for high levels of system performance, web services and architecture as well as data and information storage and retrieval are universal.
- Expand to Affiliates
 - Expand enterprise wide use of solutions such as payroll management to include university affiliates where appropriate.
- Financial Replacement
 - Begin planning and initiate replacement of our legacy financial system (FRS) and incorporate supply chain and shadow financial systems as appropriate into a comprehensive enterprise wide solution to better support the level of financial management, reporting, and compliance required.
- Student Improvement and Replacement
 - Student systems (ISIS, auxiliary systems, and school-based systems where appropriate) to support student, faculty, and administrative requirements.
 - Establish and implement improvement priorities for student systems while system replacement is planned. These projects include, but are not limited to: On-line billing and payment, On-line Registration, On-line Course Evaluations, financial aid systems, electronic student records, student access to grades, financial information and schedules, etc. (using portal technology), course schedule and description replacement, on-line degree audit.
- Reporting and Analytics
 - Continue strategy of deployment of an integrated reporting solution (data warehouse) to enhance integrated reporting and minimize redundant tools.
 - Expand statistical and analytic tools to support complex data analysis.
- SSN Remediation
 - Remediate inappropriate use and take steps to guard necessary use of restricted and sensitive information (e.g. social security number and credit card data) in all systems.

APPENDIX IV – Solidifying Infrastructure: Committee Work

This section represents the full body of work developed by the IT strategic planning committees. See Appendix II – University-wide IT Strategic Planning Committees for a complete list of participants. The current state outlined in these sections shaped our understanding of the technology-related issues and opportunities at the University. The desired state and gap initiatives outlined by the teams have driven the outcomes of our strategic analysis and reflect the overall resource scenario ranges in Appendix I – IT Strategic Analysis Resource Scenarios.

Solidifying Infrastructure

A university's foundational IT infrastructure is a necessary requirement to support mission-oriented initiatives while continuing to maintain and grow enabling systems. It is often difficult to see the tangible benefits of investments in foundational infrastructure, but our day to day digital survival depends on strategic commitments to this environment.

Solidifying Infrastructure: Identity Management

Overview:

Identity Management is the ability to manage identifying and descriptive information about members of the University community, in multiple roles across the institution, and sometimes outside of the institution, as they access University content, applications, and services. Members of the University community include students, alumni, employees, contractors, parents of students and anyone who has a relationship with the University.

In an IT network, identity management software is used to automate administrative tasks, such as resetting user passwords. Enabling users to reset their own passwords can save significant money and resources, since a large percentage of help desk calls are password-related. Password synchronization enables a user to access resources across systems with a single password; a more advanced version called single sign-on enables synchronization across applications as well as systems.

In an enterprise setting, identity management is used to increase security and productivity, while decreasing cost and redundant effort.

Current State

- User identity and access data is stored in multiple directories which makes it difficult to control the distribution of information for students and employees in ways that comply with federal regulations.
- Several communications systems have been developed to improve identity contact information access and management through directory and distribution list consolidation, with varying results.
- Third Party access is not centrally tracked or managed which has a negative impact on removing access for these individuals and compliance auditing for Family Educational Rights and Privacy Act (FERPA), Health Insurance Portability and Accountability Act (HIPAA), and the Gramm-Leach-Bliley Act (GLBA).
- A unique identifier is assigned for employees and students. We need to provide a unique identifier to all members of the University community (students, alumni, parents, and contractors) to allow us to track the services used within the affiliation.
- GuestNet ID deployed to give guests a restricted identity with limited access to University services such as Internet access.

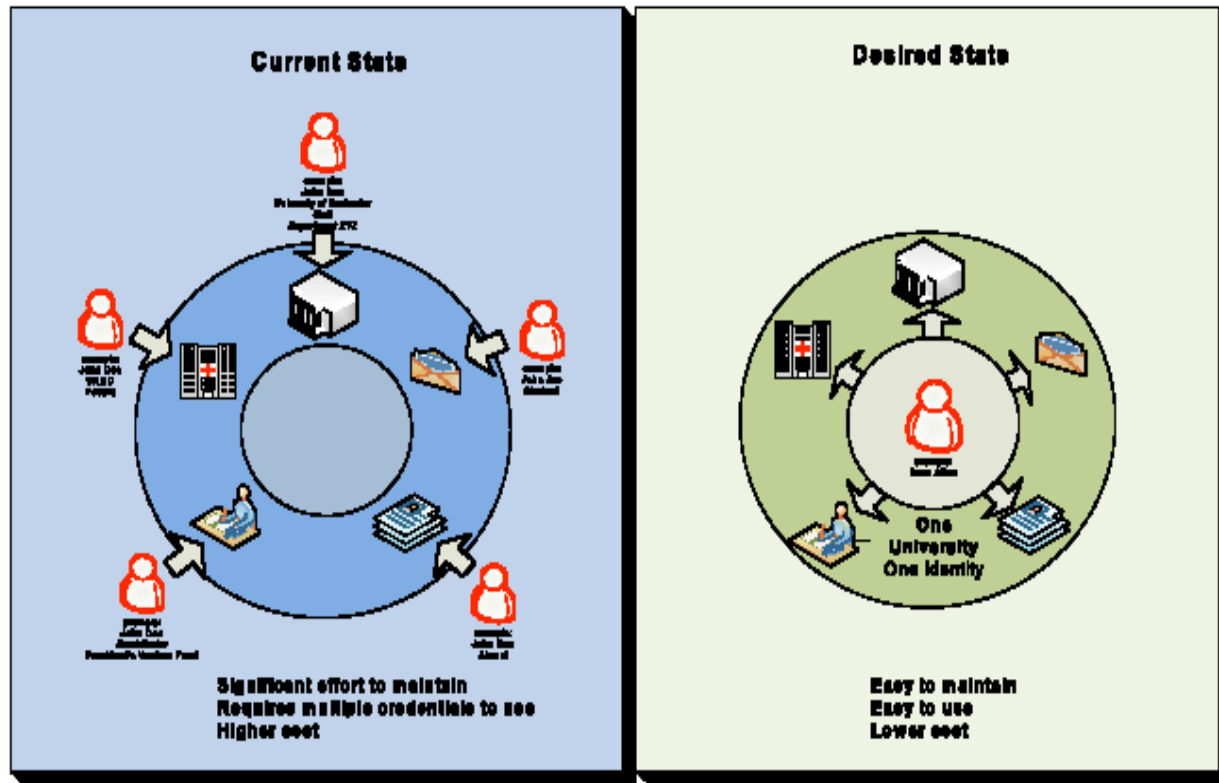
Desired State

- Maintain the relationships with a University community member for the entire lifecycle from student through alumni (Advancement).
- Recognize each person as one identity regardless of their current point of contact with the University.
- Create a speedier and more customer-friendly process for setting up information services access for new community members (students, employees, guest faculty, alumni, etc.).

- Comply with regulations (HIPAA, GLBA) surrounding account management. For example, removing access for terminated employees within a compliant timeframe.
- Allow more granular service entitlement—providing new email accounts five days before the employee arrives on-site while providing parking access the first day of work.
- Participate in trusted identity federations (higher education, government, commercial) to provide University community members with easy access to outside information services and allow members of other institutions appropriate access to University information services.

Gap Initiatives

- Highly sponsored, institution-wide initiative to develop a comprehensive classification scheme for all University roles (e.g., definition of deans, directors, department heads, etc.).
- Recognizing each community member by establishing one University identity per person.
- Leverage enterprise identity information through unified view. This would allow searches for all colleagues across the University via last name, for example.
- User friendly and more granular service entitlements to provide better service for students, faculty, and other university community members. For example, providing new email accounts five days before the employee arrives on-site while providing parking access the first day of work.
- Coordination from one point will allow for required buy-in and support for a cross-organizational solution to set standards or naming conventions so they are consistent and resolve conflicts. For example - if there is a John Smith who is faculty member and another who is an administrator, who gets the email address John.Smith@rochester.edu.



Solidifying Infrastructure: Business Continuity

Overview:

Continuity of business services is assumed by those engaged in academic, medical, performance, and research pursuits at the University of Rochester as well as their community partners. Institutional requirements include a modern and secure data center, un-tethered, ubiquitous connectivity, and efficient effective support resources.

As our community widens its geographic reach, service offerings are increasingly reliant on technology. Mobility, ease-of-use, and availability have redefined point-of-care health services, academic tools, and the continuum of services available to users. Healthcare clinical staff are working increasingly across hospitals, clinics, research facilities, private practices, and further reaching locations. As the University continues to grow and new opportunities present themselves, services must be scalable, flexible and reliable.

Interdisciplinary research and community-based learning opportunities that extend the classroom experience require skilled resources that work broadly and effectively across disciplines and spatial constraints to expand collaborations beyond the university's physical boundaries.

As we look to the future, new opportunities using global video-based communications can closely couple the researcher to the graduate student or fellow working in the physical lab or in the field as well as better support connectivity between the University and alumni community. Successful management and planned growth of infrastructure resources positions the University to best meet the new community needs, allows for new grant opportunities, and influences our ability to recruit the best faculty, students, and staff.

Current State

- Our new data center environment represents a strategic re-alignment in the University's approach to IT infrastructure. University leadership has sponsored a project to develop a modern data center environment that will support the evolving needs of a world class research university with a premier regional health system. It will support research and academic endeavors as well as the day to day critical operations of a clinical enterprise. The data center strategy is a two-site solution that will support live applications at both locations. A plan has been developed and site work has begun.
- The major geographic locations of the University of Rochester, including sites like the Eastman School of Music (looking northward) and the Cardio Vascular Research Institute (looking southward) are connected together via an extensive 63-mile fiber optic network. The network provides capacity to support the University's missions.
- The University's in-building networks are in various conditions, which create issues as our community works on more shared services and interdisciplinary efforts across geographic locations. Some networks have reached their limits of capacity. The Medical Center campus is in the process of a network upgrade that will be finished in early 2008. The River Campus is reviewing investment options by building to strive to reach an acceptable base level of connectivity.
- Management of collaborative services such as email is highly decentralized. Today, providing service requires significant effort and hand-offs across multiple organizations. Given that our infrastructure was built on a history of extreme decentralization, user resolution tasks that would typically take a matter of minutes, such as an email attachment that is corrupt when it reaches the user, can take multiple resources hours to complete. User tolerance for downtime is declining as reliance on the services grows.
- Although wireless has been expanded to new locations, the University of Rochester is still lagging in coverage. Touring admissions candidates often ask about wireless service and it is difficult to explain the lag in comparison with peers.
- Individuals are carrying more communication devices than ever before; some community members carry as many as five devices to meet their daily needs or job duties. The number of devices adds to cost, creates device confusion for the community member and adds to the complexity of directories and support services. Mobile, transitory, consolidated, encrypted and secure services are growing needs across the University.
- The University has many technology help desks, each providing support on targeted technology areas. It can be confusing and frustrating for faculty, staff, and students to navigate to the appropriate service provider to meet their needs. In addition, University-wide technology training needs are currently addressed at a department level, resulting in involvement of many vendors, high administrative costs, inefficiencies and varying levels of quality.

Desired State

- To satisfy the University's demand for infrastructure that supports core academic and administrative requirements, a world class research initiative and continued growth of technology in support of health care, the University launched the Data Center of the Future initiative with the capacity expected to support continued growth of services through 2015. The data center strategy is a two-site solution that will support live applications at both locations.
- A modern network that interconnects and enables the University community to collaborate amongst itself and ultimately with the world. Students, faculty and staff should have access to services and applications from any place at any time and in the quantity and quality required to deliver the service or support the University missions. Networks must be highly available, reliable, and secure.
- Faculty, students, and staff should be able to use multi-purpose devices to be able to communicate as needed anytime, from anywhere. Communication services and collaborative tools will allow constituents to work, learn, develop and share technologies and services in more flexible, effective and efficient ways.
- Wireless service is a common everyday expectation for our students and faculty. Coverage and service levels should continuously be reviewed and augmented to attract the best in new admissions and remain competitive with our peers.
- Investments must be made to provide better technology training for faculty, staff and students. In addition, more collaboration is needed to improve University-wide technology support and better use of training dollars.

Gap Initiatives

- Complete the data center environment of the future as planned to build out the primary and secondary locations to support the evolving needs of the University community and allow for adequate recovery in the event of a disaster.
- Leverage and expand the university-wide network backbone to support University growth, provide adequate bandwidth and better control costs.
- Maintain the modern aspects of the University in-building networks and place an active and urgent focus on areas that require significant remediation. Network standards should be set and maintained using a multi-year funding plan to allow for predictable levels of service across the institution and to foster interdisciplinary studies, appropriate security and reliability.
- Establish a multi-year wireless plan for targeted expansions across the University to meet the needs of our faculty, students and staff.
- A strategy and action plan needs to be developed for University-wide, simplified, communications infrastructure. This will allow for a more planned and deliberate rollout of all forms of communication and message-management services.
- Evaluate processes related to institution-wide technology support and offer more coordinated training opportunities to individuals across the University to improve efficiency and effectiveness.

Solidifying Infrastructure: Security & Compliance

Overview:

Fundamentally, many of the proposed transformational initiatives are investments in richer communication among members of the University's extended community. Each of these information systems and technologies increases the interconnectedness and accessibility of data – data about the each member's relationship with the University; data that are the foundation of new knowledge; data that guide the University's strategic planning. The confidentiality of these data is a key asset of the University.

That same interconnectedness and accessibility can be turned to purposes contrary to the University's goals, if care is not taken at every step to control and monitor access to the University's information systems. Information security investments at the University must keep pace, not only with the University's creative new uses of information technology, but also with the creative criminal activity that is rampant across the Internet.

Information security is most effective when it is routine, when it is built in to our information systems and when it is practiced every day by our faculty, staff, students, and other workforce members. The steps outlined below improve the default security posture of our information systems and improve the ability of the systems' users to make secure choices. We need to advance on both of these fronts in order to support the confidentiality, integrity, and availability of the information systems envisioned in the transformational initiatives

Current State

- A first issue of a University IT policy was completed December 2006 which encompasses access to personal communications and appropriate use of networks and systems. This policy can be

found at http://www.rochester.edu/its/ITpolicy/documents/INFORMATION_TECHNOLOGY_POLICY.pdf.

- Encryption software is currently being rolled out at the Medical Center and high risk administrative areas, and plans are underway to implement encryption in the rest of the University. Encryption will prevent the risk of exposure of private or patient data being accessed if a device is stolen from the University.
- Documentation of policy training and compliance is a manual process today and there are no assurances that the policies are read and understood.
- In today's University network environment, anyone can connect any computer to the network, whether or not it is properly secured. Common examples of computers not secured are personally owned devices (of workforce members and students) and institutionally owned computers in areas without IT support staff. This large quantity of computers is vulnerable to hackers and other malicious code, threatening the availability of all of our computers and the confidentiality of our data.
- Historical openness of University networks is inadequate to protect University systems and data from the Internet threats of today.
- A recent data security campaign was launched to further educate University faculty, staff and graduate students.

Desired State

- Security awareness exercises to educate community members and improve knowledge of security policies and best practices. Examples of this include how to handle social engineering calls from an unlisted number to community members asking for their password, physical access testing to buildings and data centers, etc.
- Automated presentation of policy training materials and documentation of training compliance to provide assurances that the policies are read and understood.
- Enforcement of secure configuration of computers to reduce the threat that one infected computer can take down an entire network of thousands of users.
- Improve proactive network security monitoring and notification to prevent malicious activity in its initial stages.
- Blocking all malicious content in email, web browsing and peer-to-peer file sharing.
- Increased segmentation of our networks to limit the propagation of malicious software across our internal networks similarly isolate internet facing systems from other internal networks.

Gap Initiatives

- Expand security awareness education program to be administered and tracked as part of the University Information Security Program.
- Deploy a targeted electronic policy training management tool.
- Deploy improved network based technology to enforce registration and secure configuration of devices connecting to University networks.
- Deploy intrusion prevention software to all devices connected to the University network.
- Deploy content filtering for malicious software contained in common media such as email, web browsing and document sharing.
- Raise the quality of information systems security configuration, monitoring, and auditing needed to ensure operational reliability and preservation of institutional reputation.

APPENDIX V – Glossary of Terms

CMS	Content Management System
CTDW	Clinical Translational Data Warehouse
CTLTR	College Teaching, Learning and Technology Roundtable
CTSA	Clinical and Translational Science Award
CV	Curriculum vitae
EDC	Eastman Dental Center
EHR	Electronic Health Record
EMR	Electronic Medical Record
FERPA	Family Educational Rights and Privacy Act
FTE	Full-time equivalent
FRS	Financial Records System
GLBA	Gramm-Leach-Bliley Act
HH	Highland Hospital
HIPAA	Health Insurance Portability and Accountability Act
HPC	High Performance Computing
IT	Information Technology
ISIS	Integrated Student Information System
MC	Medical Center
MPI	Master Patient Index
NIH	National Institutes of Health
OASIS	Office of Advancement Strategic Information System
OER	Office of Education Resources
PACS	Picture Archive and Communications Systems
RHIO	Regional Health Information Organization
SMD	School of Medicine and Dentistry
SMH	Strong Memorial Hospital
SON	School of Nursing
UR	University of Rochester