The School of Computing and Information

Michigan State University


July 26, 2005

Working Group on Computing and Information


(See Appendix A for Titles and Affiliations)
The School of Computing and Information

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Executive Summary

We propose that Michigan State University establish a trans-collegial School of Computing and Information that will be chartered with pursuing an institutional vision with respect to computing and information that is both broadly inclusive and cohesive. By doing so, the University will capitalize on strategic opportunities for new levels of achievement in research, teaching, and service grounded in existing and emerging centers of excellence. The School of Computing and Information will serve as an economic engine for the State of Michigan, facilitating its transition to a 21st century knowledge-based economy. We propose to design a roadmap with milestones that will enable the School to begin operation by July 1, 2006.

The Digital Age and Michigan State University

Computing and information are revolutionizing all aspects of our world at unimaginable and unprecedented rates. Digital devices along with digital information are becoming strikingly small, arbitrarily fast, virtually free, always interconnected, and hence ubiquitous. What was once intractable and unthinkable is now becoming mundane and can be done in the palm of our hand. We stand at the dawn of the Digital Age.

The impact of the Digital Age will be pervasive, profound, and persistent. Every discipline will be affected including those in the arts, letters, business, law, sciences, and engineering. The largest impact will be in innovative interdisciplinary work based on computing and information. Such transformative research efforts will serve as springboards to “neo”-disciplinary research producing leapfrog advances in a variety of new and emerging fields. Perhaps unexpected, the most profound impacts of computing and information will be outside of the sciences and engineering. The results will forever revolutionize the world in which we live and hence the academy in which we work.

The Digital Age presents strategic opportunities for the academy in general and for Michigan State University in particular. Every aspect of our three-fold mission of teaching, research, and service will be affected. Innovative computing and information technologies present unprecedented opportunities for transcending international boundaries of time, distance, and culture. Academic institutions that strategically leverage the opportunities presented by the Digital Age are becoming and will become world leaders and thrive; those that do not risk becoming obsolete and ultimately irrelevant.
The Current National Trend

The first computer science departments were established in the early 1960’s. During the subsequent forty years, a variety of departments, programs, curricula, and degrees have sprung up around universities throughout the country all centered in some way on computing and information.

As one would expect, these new computing and information-centric programs evolved out of existing traditional programs such as mathematics and accounting. Many of these programs were often developed in a somewhat ad hoc manner with little or no central leadership or coordination and without a unified vision for the entire institution.

In recent years, a number of leading universities have undertaken strategic planning with respect to the role of computing and information in regards to their academic mission. This role was deemed to be vitally important and hence strategic to the future of the institution. As a result, these universities have founded and are founding innovative, high-level academic units with a mission and focus centered on computing and information.

While the first of such units was founded some twenty years ago, the most significant activities have been happening more recently. The now very prestigious College of Computing at Georgia Tech was founded in 1990. In the Big Ten, the University of Michigan has founded the School of Information (1996), Penn State has founded the College of Information Science and Technology (1999), and Indiana University has founded the School of Informatics (2000) and the School of Library and Information Science (2000). All told there are currently about twenty-five such units, with more being planned. A list is given below in Appendix B: “Links to Computing and Information Academic Units”.

As with many innovative endeavors, as these computing and information programs emerge and evolve, they vary from place to place. Some are library science centric while others are computer science centric. Some are virtual while others actual, and yet others are a mix. What they all have in common is a computing and information mission with a leader who reports directly to a provost.

The Challenge for Michigan State University

In February of this year, Michigan State University hosted a landmark event, *Strategic Visioning For Cyberinfrastructure, Computing, and Information*, to begin a campus-wide dialogue on the University in the Digital Age. The goals of this event were

1. to organize a broad, inclusive group of stakeholders from across the University;
2. to begin the task of casting a unified and holistic vision for computing and information at MSU for the 21st century; and
3. to identify specific next steps for realizing such a vision.

Dr. William Wulf, President of the National Academy of Engineering, launched the week with a University Distinguished Lecture and a series of meetings with campus leaders. Two days later, some ninety faculty, staff, and graduate students representing all of the colleges participated in an all-day workshop where we began the process of developing a strategic vision for computing and information at MSU. One outcome is the formation of Working Group on Computing and
Information, the group of authors of this proposal. For the complete program of Strategic Visioning For Cyberinfrastructure, Computing, and Information, see Appendix C.

In his University Distinguished Lecture, Dr. Wulf observed that the reputations of academic institutions are very resistant to change. However, there are points of inflection in history when reputations can and do change dramatically as the result of some specific catalyst. Today, the dawning of the Digital Age represents such a catalyst for universities in general and for MSU in particular.

In its June 2005 report “Computational Science: Ensuring America’s Competitiveness”, the President’s Information Technology Advisory Committee notes that “The most scientifically important and economically promising research frontiers in the 21st century will be conquered by those most skilled with advanced computing technologies and computational science applications.” [1]

“The universality of computational science is its intellectual strength. It is also its political weakness. Because all research domains benefit from computational science but none is solely defined by it, the discipline has historically lacked the cohesive, well-organized community of advocates found in other disciplines. As a result, the United States risks losing its leadership and opportunities to more nimble international competitors.” [5]

To this end, one of the PITAC’s principal recommendations is that “…universities must significantly change their organizational structures to promote and reward collaborative research that invigorates and advances multidisciplinary science. They must also implement new multidisciplinary structures and organizations that provide rigorous, multifaceted educational preparation for the growing ranks of computational scientists the Nation will need to remain at the forefront of scientific discovery.” [19]

Considering the current national scene and the trend of our competitors, it seems apparent that the University will indeed have a high-level computing and information-focused unit some day. If we do so now, we will be among an elite, very small group of our peers. We can leverage such leadership today as a strategic advantage for some time to come. If we follow rather than lead, our actions will likely be too little and too late.

The School of Computing and Information at Michigan State University

Universities around the country are capitalizing on the opportunities presented by computing and information in a variety of ways. To this end, we propose that Michigan State University establish a School of Computing and Information.

The School will be committed to pursuing an institutional vision with respect to computing and information that is both broadly inclusive and cohesive. By doing so, Michigan State University will capitalize on strategic opportunities for new levels of achievement in teaching, research, and service grounded in existing and emerging centers of excellence.
The mission of the School of Computing and Information will include the following:

- to provide leadership in casting and realizing a unified and holistic vision for computing and information at Michigan State University;
- to create a new culture in which interdisciplinary fields and new emerging disciplines will be nurtured and thrive;
- to develop flexible organizational structures that support the creation of innovative academic programs;
- to strengthen and grow the University’s research portfolio by ensuring competitiveness in existing research areas and by enabling competitiveness in the emerging ones; and
- to advance outreach and engagement across the missions of teaching, research, and service by leveraging innovative computing and information technologies.

The School will serve as MSU’s focal point for teaching, research, and service in computing and information, bringing together some of our most innovative and creative students and faculty to capitalize on a rare opportunity to achieve exciting new levels of excellence in teaching, research, and service.

As a result, MSU will be positioned strategically to be competitive for academic and research programs in a variety of emerging disciplines within computational sciences, humanities and social sciences technologies, and other areas. In providing a new culture and an academic home for faculty within emerging disciplines, the School will enable MSU to attract exciting research faculty, national and international students, and increased research funding.

**Computing and Information Research Programs**

A preview of the initial research activities of the School may be envisioned by visiting the Faculty of Computing and Information web site (www.ci.msu.edu), which serves as an MSU portal to a wide variety of innovative activities all emanating from the common epicenter of computing and information. (Follow the link to Research.)

With our rather limited, initial efforts, we already have identified some 87 faculty representing 28 departments from 12 colleges. While cohesive, the work is very broad and very inclusive, literally from “A” (Anthropology) to “Z” (Zoology). This computing and information centric research includes some 29 specific projects representing millions of dollars of external research funding, many of which involve international collaborations. Illustrative examples include the following. (See www.ci.msu.edu and follow the link to Research.)

- **SENS:** Software Engineering and Network Systems Laboratory (SENS);
- **MATRIX:** The Center for Human Arts, Letters, and Social Sciences OnLine;
- **Intellectual Property & Communications Law Program**;
- **M.I.N.D LABS:** Media Interface, Networking and Design Labs;
- **CEVL:** Computational Ecology and Visualization Laboratory;
- **CLODE:** Center for Leadership of the Digital Enterprise;
The School of Computing and Information

- **LON-CAPA:** Learning Online Network with Computer Assisted Personalized Approach;
- **QBMI:** Quantitative Biology & Modeling Initiative;
- **Center for Teaching & Technology;**
- **HomeNetToo Project:** Closing the Digital Divide;
- **CIERA:** Center for the Improvement in Early Reading Achievement;
- **Devolab:** The Digital Evolution Laboratory;
- **CISVAL:** Center for Integrated Study of Vision and Language; and
- **eCommerce, mCommerce, and eBusiness.**

By creating a School of Computing and Information, MSU will be building upon strength in its research portfolio. Across the colleges, computing and information research garners significant external funding and national and international recognition. Bringing these leading-edge research efforts together will enhance their individual effectiveness and MSU’s collective ability to compete for large-scale funding opportunities. Collaborative support will be provided for existing faculty to pursue grant funding with proposals that are more computing and information intensive while new joint searches and positions will bolster the faculty across the University that are in position to compete for such funding.

Most important, in addition to existing research programs, the School will position the University to be competitive for new funding arising from emerging fields and disciplines, thus strengthening and diversifying the University’s research portfolio. For example, see Appendix D: The School’s Relationship to the NIH Roadmap.

**Computing and Information Academic Programs**

The School of Computing and Information will serve as the academic home for a variety of computing and information centric programs both at the undergraduate and graduate levels. In particular, the academic goals of the School will include the following:

- Develop interdisciplinary graduate programs, undergraduate majors and graduate and undergraduate specializations that will appeal to a diverse group of students interested in the role of computing and information within and across disciplines and at all level of societal functioning—individual, group, organizational, national and global; and
- Develop interdisciplinary graduate and undergraduate concentrations that will appeal to a diverse group of students whose primary interest is in a specific discipline but who are also interested in the application of computing and information within that discipline.

Specific possible programs are many. Illustrative examples include

- computational sciences,
- computer and information sciences,
- humanities and social sciences technology,
- environmental information technologies,
- global change analysis, and
• medical informatics.

More specifically, programs within computational sciences may include bioinformatics, computational astronomy, computational biology, computational chemistry, computational mathematics, and computational genomics.

Within computer and information sciences, along with our existing program in computer science new programs may be introduced including information science, human-computer interaction, information studies, information technology, autonomic computing, and cybersecurity.

Programs within the humanities and social sciences may be targeted for anthropology, art, music, English, history, psychology, linguistics, theater, and others.

In general, these new interdisciplinary programs will consist of an innovative and unique blend of courses from three general areas including

• new computing and information specific courses designed for a group of programs such as one set of courses designed for the computational sciences and another set of courses designed for the humanities and social sciences technologies;
• new computing and information related courses that are domain specific; and
• “traditional” domain specific courses.

An illustrative list of existing computing and information courses is given in Appendix E.

The School of Computing and Information will significantly advance undergraduate education in a number of ways including:

• by providing interdisciplinary research opportunities for undergraduates who will work with faculty and graduate students in the School;
• by providing core courses in computing and information for all undergraduates to assure that all will develop a level of competency required to be competitive in today’s job market, thereby supporting MSU’s goals in quantitative literacy;
• by actively recruiting outstanding undergraduates to MSU whose interests lie at the intersection of traditional disciplines, computing and information; and
• by promoting students’ civic engagement through experiential and service-learning.

Innovative Trans-Collegial Structure

In order to meet its trans-collegial mission in teaching, research, and service, the organization of the School will be an innovative trans-collegial structure designed to infuse and diffuse computing and information throughout all of the Colleges at MSU.

The School will serve as an academic home for faculty. The founding faculty will be from a variety of colleges and departments. Most faculty of the School will have joint appointments between various MSU Colleges and the School. For some faculty, the School may serve as their sole academic home.

Along with faculty, the School will house computing and information centric academic programs for both graduate and undergraduate students, and run these, often jointly with various Colleges. In particular, the School will develop and grow a variety of interdisciplinary programs along
The School of Computing and Information

with programs targeted towards the emerging disciplines. As all disciplines are revolutionized by computing and information, the School will provide leadership throughout the curricula across the University.

We propose that the University commit a number of faculty lines for a number of years to the School. Some of these positions will be used to recruit innovative faculty from emerging disciplines who will be housed entirely within the School. Most of these positions will be leveraged into even more positions through joint appointments with the Colleges.

The School will be led by a Dean who reports directly to the Provost. The Dean of Computing and Information will be responsible for meeting the mission of the School and sharing the vision of the School with all of its stakeholders. The Dean will collaborate closely with all of the deans and directors at MSU.

The Dean will garner external support for the School from corporations, foundations, and private individuals. In particular, a group of strategic corporate partners will be recruited and organized. We are confident that such a School will be very attractive for corporate support and private philanthropy.

The School of Computing and Information will advance MSU’s diversity mission by recruiting and retaining faculty, graduate students and undergraduates from diverse groups, including underserved racial/ethnic groups in the U.S. The interdisciplinary and applied orientation of the School will appeal to a broader segment of society than do the traditional disciplines. Women and members of underserved racial/ethnic groups, who are underrepresented in the traditional disciplines of computing, physical and natural sciences, may find the interdisciplinary and applied orientation of the School a better match to their personal and career interests and a preferable way to gain entrance into the traditional disciplines.

Economic Impact

The School of Computing and Information will be an economic engine for the State of Michigan, substantiating the Governor’s emphasis on advanced technology. The founding of the School will be viewed as innovative by MSU’s stakeholders including the Academy, alumni, government, and industry. SCI graduates will work locally and globally in existing computing and information industries—today’s Microsoft’s, Google’s, Genetech’s, and Electronic Art’s—and in organizations yet unimagined that they will initiate.

Roadmap and Milestones

We propose to design a roadmap with milestones that will enable the School to begin operation by July 1, 2006. To this end, we propose the following.

- July 2005
  - Complete initial working group white paper (i.e., this document).
  - Submit initial white paper to the Provost and VPRGS.
- August 2005
  - Meet with the Provost and VPRGS.
  - Obtain support from the senior administration.
The School of Computing and Information

- Begin work on a detailed roadmap with milestones.

- September – December 2005
  - Complete detailed roadmap with milestones.
  - Develop full proposal by
    - Consulting with internal university stakeholders including as appropriate trustees, senior administrators, deans, directors, chairpersons, faculty, staff, and students.
    - Consulting with external university stakeholders including strategic alumni, corporate partners, and foundations.
    - Hosting facilitated discussion meetings (e.g. by John Beck) with stakeholders to solicit feedback and input.
    - Consulting with external experts.
    - Visiting other institutions.
    - Complete first draft of full proposal.
  - Begin working with faculty governance.

- January – March 2006
  - Vet full proposal by
    - Consulting with internal university stakeholders including as appropriate trustees, senior administrators, deans, directors, chairpersons, faculty, staff, and students.
    - Consulting with external university stakeholders including strategic alumni, corporate partners, and foundations.
    - Hosting facilitated discussion meetings (e.g. by John Beck) with stakeholders to solicit feedback and input.
    - Consulting with external experts.
  - Complete full proposal.
  - Continue working through faculty governance.

- April 2006
  - Complete processes of faculty governance.
  - Present final full proposal to stakeholders.
  - Present to Trustees for consideration.

- May – June, 2006
  - Finalize operational details.
  - Prepare for opening of the School.

- July 1, 2006
The School of Computing and Information

- Begin official operation of the School.
- Prepare for the 2006-2007 fiscal year.

Budget

We propose the following planning budget to be provided by the Provost and the VPRGS. A brief explanation follows.

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
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</thead>
<tbody>
<tr>
<td>Administrative Assistant</td>
<td>$75,000</td>
</tr>
<tr>
<td>Consulting</td>
<td>25,000</td>
</tr>
<tr>
<td>Hourly Student Labor</td>
<td>10,000</td>
</tr>
<tr>
<td>Travel</td>
<td>10,000</td>
</tr>
<tr>
<td>Supplies &amp; Services</td>
<td>5,000</td>
</tr>
<tr>
<td>Total</td>
<td>$125,000</td>
</tr>
</tbody>
</table>

Drafting the plan for the School will be a significant activity requiring significant amount of effort and expertise. Most important, we need a full business plan for the school that identifies and begins to cultivate external funding sources. For this reason, we propose to hire a senior level administrative assistant with grant-writing experience to assure a complete and workable plan for the School, including a sound business plan. Hourly graduate research assistance will be used to facilitate faculty efforts in crafting the proposal and research various programs and strategies at other universities. Travel support will enable visits to universities that have existing computing and information based schools and colleges as well as visits by national leaders to MSU to consult. National leaders in computing and information will be utilized as speakers and consultants in these efforts. Bill Wulf has already agreed to return to MSU and engage in the planning efforts.
Appendix A: MSU Working Group on Computing and Information

- **Burton Bargerstock**
  Director, Communication and Information Technologies, University Outreach and Engagement
- **Wolfgang Bauer**
  Professor & Chairperson, Physics and Astronomy, Natural Sciences
- **Frank Biocca**
  Ameritech Professor, Telecommunications, Information Studies and Media, Communication Arts and Sciences
- **Thomas Coon**
  Director, MSU Extension, Agriculture and Natural Resources
- **Kurt Dewhurst**
  Director, Museum, University Outreach and Engagement
- **Laura Dillon**
  Professor & Chairperson, Computer Science and Engineering, Engineering
- **Wayne Dyksen**
  Professor, Computer Science and Engineering, Engineering
- **Stuart Gage**
  University Distinguished Professor, Entomology, Natural Sciences, Agriculture and Natural Resources
- **Lynne Goldstein**
  Professor & Chairperson, Anthropology, Social Science
- **Richard Groop**
  Professor & Chairperson, Geography, Social Science
- **Linda Jackson**
  Professor, Psychology, Social Science
- **Mark Kornbluh**
  Professor & Chairperson, History, Social Science
- **Leslie Kuhn**
  Professor, Biochemistry and Molecular Biology, Co-Director Quantitative Biology and Modeling Initiative, Natural Sciences, Human Medicine, Osteopathic Medicine
- **Mark Levy**
  Professor & Chairperson, Telecommunications, Information Studies & Media, Communication Arts & Sciences
- **Edmund McGarrell**
  Professor & Director, Criminal Justice, Social Science
- **Charles Ofria**
  Assistant Professor, Computer Science and Engineering, Engineering
- **Brian Pentland**
  Professor, Accounting and Information Systems, Business
- **James Potchen**
  University Distinguished Professor & Chairperson, Radiology, Osteopathic Medicine, Human Medicine
- **Dean Rehberger**
  Associate Professor, Writing, Rhetoric, and Culture, Arts and Letters
- **Mark Sullivan**
  Associate Professor, Music, Arts and Letters
- **Peter Yu**
  Associate Professor & Director, Intellectual Property & Communications Law Program, Law
- **Michael Zaroukian**
  Associate Professor, Internal Medicine, Human Medicine
- **Yong Zhao**
  University Distinguished Professor, Education, Education
Appendix B: Links to Computing and Information Academic Units

What follows are links to academic units focused on computing and information. While rather lengthy, the list is not guaranteed to be complete. And, other institutions are making and executing plans for similar units as well. (See www.ci.msu.edu and follow the link to Resources.)

As noted above, these academic units vary from place to place. Some are library science centric while others are computer science centric. Some are virtual while others actual, and yet others are a mix. What they all have in common is a computing and information centric mission with a leader who reports to a provost.

1. University of Michigan, School of Information
2. Penn State, School of Information Sciences and Technology
3. Indiana University, School of Informatics
4. Indiana University, School of Library and Information Science
5. University of Illinois, Graduate School of Library and Information Science
6. Georgia Tech, College of Computing
7. George Mason University, School of Information Technology and Engineering
8. UC Berkeley, School of Information Management & Systems
9. Carnegie Mellon University, School of Computer Science
10. University of Washington, The Information School
11. Cornell University, Faculty of Computing and Information Science
12. UC Irvine, Donald Bren School of Information and Computer Sciences
13. University of Utah, School of Computing
14. DePaul University, School of Computer Science, Telecommunications, and Information Systems
15. Drexel University, College of Information Science and Technology
16. New Jersey Institute of Technology, College of Computing Sciences
17. Northeastern University, College of Computer Science
18. Pace University, School of Computer Science and Information Systems
19. Radford University, College of Information Science and Technology
20. University of Pittsburgh, School of Information Sciences
21. University of North Carolina, Charlotte, College of Information Technology
22. University of South Alabama, College of Computer and Information Sciences
23. University of Texas at Dallas, Erik Jonsson School of Engineering and Computer Science
24. University of Nebraska at Omaha, College of Information Science and Technology
25. Dalhousie University, Faculty of Computer Science
26. University of St. Andrews, School of Computer Science
27. United Arab Emirates University, College of Information Technology
Strategic Visioning
For
Cyberinfrastructure, Computing, and Information

Michigan State University
Radiology Auditorium and Atrium
February 17 & 19, 2005

Sponsored by
Dr. Lou Anna K. Simon, President
Dr. John Hudzik, Acting Provost
Dr. Ian Gray, Vice President for Research and Graduate Studies
Dr. Karen Klomparens, Dean of the Graduate School
Mr. David Gift, Vice Provost For Libraries, Computing, and Technology
University Distinguished Lecture

February 17, 2005
4:00pm

Opportunities and Challenges for Universities
From Information Technology

Dr. Wm. A. Wulf

President
National Academy of Engineering
AT&T Professor of Computer Science
University Professor
University of Virginia

Abstract

Universities contribute enormously to our society; beyond education they support culture, supply the research that drives our prosperity, archive our human record, and even entertain us on Saturday afternoons. A “core competence” of universities is information— they create it with research, they warehouse it in libraries, and they retail it in both texts and classes. It is reasonable to conjecture, therefore, that further changes in the technology of information processing might affect how universities function. In fact, that has clearly already happened to some degree. Will more occur? How much? What kind? This lecture will not give answers, but rather raise some questions about what further opportunities and challenges may face universities—opportunities and challenges that might have a profound affect on them.

About Dr. Wulf

Dr. Wm. Wulf was elected President of the National Academy of Engineering (NAE) in 1997. The NAE and National Academy of Sciences operate under a congressional charter to provide advice to government on issues of science and engineering.

Dr. Wulf is on leave from the University of Virginia, where he is a University Professor. His research spans computer architecture, computer security, programming languages, and optimizing compilers. From 1988 to 1990 Dr. Wulf served as Assistant Director of the National Science Foundation. Prior to joining Virginia, Dr. Wulf founded a software company, Tartan Laboratories, based on research he did while on the faculty at Carnegie-Mellon University.

Dr. Wulf is a member of the National Academy of Engineering, a Fellow of the American Academy of Arts and Sciences, a Corresponding Member of the Academia Espanola De Ingeniera, and a Foreign Member of the Russian Academy of Sciences. He is also a Fellow of five professional societies: the ACM, the IEEE, the AAAS, the IEC and AWIS. Dr. Wulf is the author of over 100 papers and technical reports, has written three books, holds two US Patents, and has supervised over twenty-five Ph.D.’s in Computer Science.
Appendix C: Strategic Visioning for Cyberinfrastructure, Computing, and Information

University Workshop
February 19, 2005
7:30am – 4:00pm

Strategic Visioning
For
Cyberinfrastructure, Computing, and Information

7:30 am  Registration & Continental Breakfast
8:00 am  Meeting Overview
         Wayne Dyksen
8:15 am  Meeting Welcome
         Karen Klomparens & David Gift
8:30 am  Cyberinfrastructure and Epistemic Infrastructure
         John King, Dean
         School of Information, University of Michigan
9:15 am  E-Research And The Digital World: Implications For Institutional Strategy
         Clifford Lynch, Executive Director
         Coalition for Networked Information
10:00 am Break
10:30 am  Computing In The Physical Sciences
         Wolfgang Bauer, Professor & Chairperson, Physics & Astronomy
11:00 am  From Bench To Bedside:
          Using Information Technology to Transform Knowledge into Action
          Michael Zaroukian, Associate Professor, Human Medicine & Director of EMR
11:30 am  Spatial Information Technology in Geography and Beyond
          Richard Groop, Professor & Chairperson, Geography
12:00 am  Envisioning the Future of History:
          Humanities and Social Science Scholarship in the Digital Age
          Mark Lawrence Kornbluh, Professor & Chairperson, History
12:30 pm  Lunch
1:30 pm  Panel Session: Strategic Visioning for Infrastructure
        Clifford Lynch (Moderator)
        Robert Cukier, David Gift, Philip McKinley, Mark Sullivan
2:30 pm  Panel Session: Strategic Visioning for Programs
        John King (Moderator)
        Wolfgang Bauer, Karen Klomparens, Kevin Ohl, Charles Salmon
3:30 pm  Next Steps
        Wayne Dyksen & Mark Kornbluh
About These Events

Welcome to the University Distinguished Lecture by Dr. Wm. Wulf and to the Michigan State University workshop *Strategic Visioning for Cyberinfrastructure, Computing, and Information*. Briefly stated, the goals of these events are: 1) to organize a broad, inclusive group of stakeholders from across the University; 2) to begin the task of casting a unified and holistic vision for computing and information at MSU for the 21st century; and 3) to identify specific next steps for realizing such a vision.

The challenge that Michigan State University faces is one shared by all universities. The digital revolution is fundamentally transforming the academy, affecting all aspects of our three-fold mission of teaching, research, and service. A host of blue-ribbon panels and reports, the most prominent of which is the NSF report on cyberinfrastructure chaired by Dan Atkins, are illustrating the depths of this transformation. In discipline after discipline across the sciences, the Atkins report demonstrates how every facet of research, publication, and teaching is being altered by computers and the digitization of data collection, analysis, storage, publication, distribution, and re-examination. Along with quantum changes to existing disciplines, computing and digitization are enabling the emergence of entirely new fields and new disciplines.

While “cyberinfrastructure” is a clumsy word, it is being used in these discussions to capture the full extent of infrastructural needs—not just more compute cycles, bigger pipes, or more sophisticated software, but also people, tools, institutional relations, and professional norms are needed to support research, teaching, outreach, and engagement in the 21st century. The challenges are enormous. They go to the core of how research is conducted and how we train researchers and structure teaching for the future. Along with these significant challenges come equally significant opportunities.

While the pace of change varies by discipline and even within disciplines, the underlying premise of this effort is that many of the challenges and opportunities posed by new technologies are similar across our University community. Certainly there are areas where common services are needed. There is much to be gained by initiating a campus-wide dialogue to explore the full implications of the digital revolution on scholarly research and teaching, and its relationship to both campus-based and general public communities.

We thank Dr. Lou Anna K. Simon, Dr. John Hudzik, Dr. Ian Gray, Dr. Karen Klomparens, and Mr. David Gift for their vision and their support, which made these strategic events possible. We also thank Dr. James Potchen for the always generous use of these beautiful facilities. And, we thank Ms. Chris Griggs for organizing yet another set of well run meetings.

Wayne Dyksen  
Professor, Computer Science and Engineering

Mark Kornbluh  
Professor and Chairperson, History
Appendix D: The School’s Relationship to the NIH Roadmap

“Roadmap initiatives will establish a series of awards that make it easier for scientists to conduct interdisciplinary research. These new awards include funding for: training of scientists in interdisciplinary strategies; creation of specialized centers to help scientists forge new and more advanced disciplines from existing ones; and initiation of forward-looking conferences to catalyze collaboration among the life and physical sciences, important areas of research that historically have had limited interaction”. NIH is also actively encouraging computational scientists to focus on biomedical problems, by supporting “the career development of investigators with quantitative scientific and engineering backgrounds outside of biology or medicine who have made a commitment to focus their research endeavors on biomedical and behavioral research (basic or clinical). Examples of quantitative scientific and technical backgrounds outside of biology or medicine considered appropriate for this award include, but are not limited to, mathematics, statistics, computer science, informatics, physics, chemistry, and engineering.” [NIH Roadmap, http://nihroadmap.nih.gov/]

New roadmap funding initiatives are in structural biology, biological pathways and networks (systems biology), and computational biology, all areas of particular strength at MSU.

Areas of roadmap funding include the following.

- Innovations in Biomedical Computational Science and Technology (PAR-03-106)
- Continued Development and Maintenance of Bioinformatics and Computational Biology Software (PA-02-141)
- NIH National Centers for Biomedical Computing (RFA-RM-04-022) and Collaborations with National Centers for Biomedical Computing (PAR-05-063)
- Predoctoral Training in Bioinformatics and Computational Biology (PAR-99-146)
- National Research Service Award Training Grants (T32; PA-02-109)
- Joint DMS/NIGMS Initiative to Support Research Grants in the Area of Mathematical Biology (NSF 02-125)
- Cheminformatics
- Innovations in Interdisciplinary Technology and Methods (Meetings)
- Interdisciplinary Research Center Planning Grants
Appendix E: Existing Computing and Information Courses

What follows is a list of existing computing and information courses at MSU. The list is intended to be illustrative and is not exhaustive.

- AL 881: Teaching with Technology
- BMB 961: Computational Genomics
- BMB 961: Concepts in Protein Structure Analysis and Modeling
- BMB 961: Biomolecular Spectroscopy - Theory and Applications
- CEM 883: Computational Quantum Chemistry
- CEM 888: Computational Chemistry
- CEM 987: Biomolecular Spectroscopy - Theory and Applications
- CSE 101: Computing Concepts and Competencies
- CSE 131: Technical Computing and Problem Solving
- CSE 231: Introduction to Programming I
- CSE 232: Introduction to Programming II
- CSE 240: Informatics
- CSE 260: Discrete Structures in Computer Science
- CSE 290: Independent Study in Computer Science
- CSE 291: Selected Topics in Computer Science
- CSE 320: Computer Organization and Architecture
- CSE 331: Algorithms and Data Structures
- CSE 335: Object-oriented Software Design
- CSE 410: Operating Systems
- CSE 420: Computer Architecture
- CSE 422: Computer Networks
- CSE 425: Introduction to Computer Security (Interim New)
- CSE 429: Interdisciplinary Topics in CyberSecurity (Interim New)
- CSE 435: Software Engineering
- CSE 440: Introduction to Artificial Intelligence
- CSE 444: Information Technology Project Management
- CSE 450: Translation of Programming Languages
- CSE 452: Organization of Programming Languages
- CSE 460: Computability and Formal Language Theory
- CSE 471: Media Processing and Multimedia Computing
- CSE 472: Computer Graphics
- CSE 475: Introduction to Computational Linguistics
- CSE 480: Database Systems
- CSE 484: Information Retrieval
- CSE 490: Independent Study in Computer Science
- CSE 491: Selected Topics in Computer Science
- CSE 498: Collaborative Design
- CSE 802: Pattern Recognition and Analysis
- CSE 803: Computer Vision
- CSE 807: Computer System Performance and Measurement
- CSE 808: Modeling and Discrete Simulation
Appendix E: Existing Computing and Information Courses

- CSE 809: Algorithms and Hardware Implementation
- CSE 812: Advanced Operating Systems
- CSE 813: Advanced VLSI Design
- CSE 814: Formal Methods in Software Development
- CSE 820: Advanced Computer Architecture
- CSE 822: Parallel Processing Computer Systems
- CSE 824: Advanced Computer Networks and Communications
- CSE 825: Computer and Network Security
- CSE 835: Algorithmic Graph Theory
- CSE 841: Artificial Intelligence
- CSE 842: Natural Language Processing
- CSE 847: Machine Learning
- CSE 848: Evolutionary Computation
- CSE 860: Foundations of Computing
- CSE 867: Nature and Practice of Cognitive Science
- CSE 870: Advanced Software Engineering
- CSE 872: Advanced Computer Graphics
- CSE 875: Advanced Studies in Computational Linguistics
- CSE 880: Advanced Database Systems
- CSE 881: Data Mining
- CSE 885: Artificial Neural Networks
- CSE 902: Selected Topics in Recognition by Machine
- CSE 910: Selected Topics in Computer Networks and Distributed Systems
- CSE 912: Advanced Topics in Distributed Computing Systems
- CSE 914: Formal Methods in Software Development
- CSE 920: Selected Topics in High Performance Computer Systems
- CSE 921: Advanced Topics in Digital Circuits and Systems
- CSE 921A: Testable and Fault-tolerant Digital Systems
- CSE 921B: Embedded Architectures
- CSE 941: Selected Topics in Artificial Intelligence
- CSE 960: Selected Topics in Algorithms and Complexity
- CSE 980: Selected Topics in Database Systems
- ENT442: Biological Information Systems
- GEO 221: Introduction to Geographic Information
- GEO 324: Remote Sensing of the Environment
- GEO 419: Applications of Geographic Information System to Natural Resources
- GEO 424: Advanced Remote Sensing
- GEO 425: Geographic Information Systems
- GEO 825: Geoprocessing
- GEO 827: Digital Image Processing and Analysis
- GEO 865: Advanced Quantitative Methods in Geography
- GEO 866: Spatial Data Analysis
- ITM 309: Business Information Systems
- ITM 311: Systems Analysis and Design
Appendix E: Existing Computing and Information Courses

- ITM 412: Marketing Technology & E-Commerce
- ITM 414: Enterprise Systems
- ITM 444: Information Technology Project
- ITM 821: Enterprise Database Systems
- ITM 823: Advanced Enterprise Database System
- ITM 824: Digital Bus Models & Processes
- ITM 825: Object Oriented Business Information Systems
- ITM 826: Enterprise Information Systems
- ITM 911: Doctoral Seminar in Information Systems
- ITM 912: IT Transactional Perspectives
- MIC 433: Microbial Genomics
- MUS 441: Introduction to Computer Music
- MUS 442: Advanced Computer Music Projects
- MUS 882: Digital Music Systems
- MUS 883: Independent Projects in Computer Music
- MUS 890: Composing and Programming
- MUS 882: Digital Music Systems
- MUS 883: Independent Projects in Computer Music
- MUS 883: Independent Projects in Computer Music
- MUS 890: Composing and Programming
- MUS 890: Computer Music Literature
- PHY 102: Physics Computations I
- PHY 201: Physics Computations II
- PHY 301: Physics Computations III
- PHY 480: Computational Physics
- PHY 832: Molecular Dynamics Simulations
- PSY 200: Cognitive Psychology
- PSY 209: Brain and Behavior
- PSY 255: Industrial and Organizational Psychology
- PSY 295: Data Analysis in Psychological Research
- PSY 395: Research Design and Measurement in Psychological Research
- PSY 401: Memory and Skill
- PSY 402: Sensation and Perception
- PSY 403: Laboratory in Cognitive Psychology
- PSY 409: Psychobiology of the Life Span
- PSY 410: Neurobiology of Learning and Memory
- PSY 413: Laboratory in Behavioral Neuroscience
- PSY 441: Interpersonal Behavior and Groups
- PSY 442: Stereotypes, Prejudice, and Discrimination
- PSY 455: Organizational Research Techniques
- PSY 463: Introduction to Cognitive Science
- PSY 801: Sensation and Perception
- PSY 802: Basic Cognitive Processes
- PSY 803: Higher Order Cognitive Processes
- PSY 804: Molecular and Developmental Neurobiology
- PSY 806: Advanced Neuroscience Techniques Laboratory
- PSY 809: Developmental Psychobiology
- PSY 811: Advanced Behavioral Neuroscience
Appendix E: Existing Computing and Information Courses

- PSY 814: Psycholinguistics
- PSY 815: Quantitative Research Design and Analysis in Psychology
- PSY 837: Social Cognition
- PSY 839: Systems Neuroscience
- PSY 840: Group Processes
- PSY 851: Neuropsychology
- PSY 852A: Neuropsychological Assessment
- PSY 852B: Neuropsychological Assessment Laboratory
- PSY 860: Industrial and Organizational Psychology
- PSY 862: Organizational Psychology and Behavior
- PSY 863: Seminar in Cognitive Science
- PSY 864: Personnel Selection
- PSY 865: Research Methods in Applied Psychology
- PSY 867: Nature and Practice of Cognitive Science
- PSY 926: Scientific and Professional Ethics
- PSY 953: Social Systems: Theory, Research, and Intervention Across the Life Span
- PSY 954: Cognitive-Behavioral Theory, Research, and Intervention Across the Life Span
- PSY 961: Training and Organizational Development
- PSY 962: Work Motivation and Job Satisfaction
- STT890: Statistics in Genetics
- STT890: Statistical Analysis of Gene Expression Data
- TC100: The Information Society
- TC 200: History and Economics of Telecommunication
- TC 201: Introduction to Telecommunication Technology
- TC 240: Introduction to Digital Media Arts
- TC 241: Principles of Interactive Media
- TC 310: Basic Telecommunication Policy
- TC 339: Digital Games and Society
- TC 342: Basic Video Design and Production
- TC 346: Basic Interactive Media Design
- TC 361: Data Communication
- TC 375: New Media, Old Media
- TC 391: Special Topics in Telecommunication
- TC 410: Advanced Telecommunication Policy
- TC 444: Information Technology Project Management
- TC 445: Digital Game Design
- TC 446: Advanced Interactive Media Design
- TC 447: Three Dimensional Graphics Design(W)
- TC 448: Special Topics in Digital Media Arts and Technology
- TC 452: Telecommunication and Information Industries
- TC 455: 3D Game and Simulation Design (W)
- TC 456: Multichannel and Broadband Telecommunication(W)
- TC 458: Telecommunication Management
- TC 462A: Wireless Networks and Applications
Appendix E: Existing Computing and Information Courses

- TC 462B: Teleconferencing and Computer Supported Cooperative Work
- TC 462C: Introduction to Electronic Commerce
- TC 463: Network Design and Implementation I
- TC 464: Network Security
- TC 465: Network Design and Implementation II
- TC 476: Telecommunication Research Methods
- TC 491: Special Topics in Telecommunication
- TC 493: Telecommunication Internship
- TC 498: Collaborative Game Design
- TC 802: Research Methods in Telecommunication
- TC 820: Introduction to Theory in Telecommunication, Information, Society
- TC 840: Foundations of Digital Media Arts and Technology
- TC 841: Design Research for Digital Media Arts and Technology
- TC 842: Design and Development of Media Projects
- TC 843: Digital Media Project
- TC 848: Special Topics in Digital Media Arts and Technology
- TC 850: Telecommunication and Information Policy
- TC 852: Economic Structure of Telecommunication Industries
- TC 853: Information Technology and Organizations
- TC 861: Information Networks and Technologies
- TC 862: Information Networks and Electronic Commerce
- TC 872: Telecommunication and National Development
- TC 877: Comparative and International Telecommunication
- TC 891: Special Topics in Telecommunication
- TC 893: Telecommunication Internship
- WRA 210: Introduction to Web Authoring
- WRA 415: Digital Rhetoric
- WRA 417: Multimedia Writing
- WRA 410: Advanced Web Authoring
- WRA 420: Advanced Technical Writing