Leveraging the Power of Computing at KSU
Reorganization Issues for Computing and Information Sciences
and Engineering
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"Knowledge is power and the computer is the tool that amplifies that power" - Feigenbaum and McCorduck

The Real Issue

The "bottom line" is that a critical mass of faculty, facilities, and collaboration in computing and information sciences and engineering (CISE) can make significant contributions to KSU. Without this investment in a critical mass of "core" computing scientists and computational science and engineering researchers, many disciplines will be disadvantaged in their progress. Thus, any organizational structure that places priority on the development of this focus is acceptable.

Overview

While central administration is focusing on the reorganization of KSU, this memo focuses on the **real issue** facing computing sciences and engineering at KSU. It is my opinion that the real issue is one of **emphasis and focus on computing** at our University; a management structure is important only if it advances the cause of computing, and therefore many other disciplines, at KSU. This memorandum contains a rationale for funding Computing and Information Sciences and Engineering at KSU at a level commensurate with the Board of Regents Mission Statement for the University. That is, **I want to make computer science a major thrust of the University in fact, not just on paper.** I also comment on several possible organizational strategies and how they advance or retard progress in computing at KSU.

The **tangible rewards** that are possible if CIS is given a central focus within the University's strategic plans are listed below.

Source of Significant Extramural Funding
Federal funding is projected to double in the next five years in computing sciences and engineering. If CIS(E) is funded at a Top 45 level, there is the potential to generate two million dollars per year in outside funding. In order to accomplish this, we must develop a critical mass of "core" computing science expertise and an infrastructure to support the research effort.

1000 PhDs in Computational Science and Engineering by 2000
Additional faculty in computational science and engineering, specifically in parallel systems and visualization, will permit the building of research partnerships of CIS(E) faculty and computing-intensive research faculty in other disciplines to leverage the power of the computer to be more competitive for the "grand challenge" projects set forth in the High Performance Computing Initiative. It has been predicted by Dr. Eugene Wong, Associate Director of the Office of Science and Technology in the White House, that there is a need to train at least 1000 PhDs in computational science and engineering by the year 2000. "Core" computing sciences is central to the development of these applied computing degrees and the associated research projects.

Common Undergraduate Degree Requirements
An increase in the number of "core" computing science faculty is a prerequisite for CIS to meet the demands implied by the Common Undergraduate Degree Requirements. It will also permit us to extend our graduate program classrooms to a nationwide industrial clientele.

While the **cost/reward ratio** to attain these goals is not high, a significant budget increase is needed. The requisite resources to acheive these goals are minimally:

1)   six new faculty in "core" computing sciences,

2)   two new faculty which support computational science and engineering - particularly in parallel computing and visualization,

3)   a computing infrastructure which supports computing-intensive research,

4)   an organizational structure which promotes "core" computing sciences and provides mechanisms to support the integration of computing science, information systems, software engineering, computer engineering, and computational science and engineering, and

5)   competitive professorial salaries to attract senior CIS faculty.

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Possible Organizational Issues

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Disadvantaged Positions for Computing Expertise at KSU

1. Current position of CIS in the College of Arts and Sciences

For 20 years, CIS has been a profit center for A & S, receiving little support for a growing field. While we have several very good faculty, we have no critical mass and cannot compete with our peers in PhD-granting departments across the country. While we have 14 faculty members, our peers average 18 overall and the top 25 average a faculty size of 28. If we are to be competitive, we feel we must reach a faculty size of at least 22. We do not have enough faculty to support the development of computational science and engineering programs. We have no permanent funding for laboratory upkeep or upgrade, while our peers have at least $100,000 per year, some have more than $300,000 per year. We also have no possibility of improving our position unless we are given top priority within the College. Continued operation in this position is **totally unacceptable.** In actuality, there is great danger that under the current conditions our extramural funding will collapse under the weight of the numerous activities required of the limited number of good research faculty now at KSU in CIS.

2. Merging of CIS with EECE in one Department

While this may seem an appropriate solution to central administration, it will only achieve the following things:
a. It will put two dissimilar disciplines (CIS and EE) in one department; and since this unit cannot be housed in one building, it will create two disjoint "camps" within one budgeting unit.
b. It will annihilate any improvement of "core" CIS faculty. When it is time for faculty improvement and budget allocations, the senior faculty in EE would totally dominate the quality junior faculty in CIS.
c. The University of Oklahoma, probably the weakest CS program in the Big 8, is a good example of a failed collaboration between EE and CS. EE and CS are in the same department at OU.
d. The resulting nature and focus in the combined program would be the application of computing sciences to electrical engineering problems. This is far too narrow a focus for a comprehensive university such as KSU. It is essential that computing scientists collaborate with other disciplines to solve problems in computational science, and this organization would likely prohibit such outreach.

It is **totally unacceptable** to attempt this merger.

Advantageous Organizations for Computing and Information Sciences and Engineering

1. School or Division of Computing and Information Sciences and Engineering - CISE

This unit would contain computing science, computer engineering, management information systems, and computational science and engineering faculty. It would integrate both undergraduate and graduate degree programs in computer science, information systems, software engineering, computer engineering, management information systems, and computational science and engineering degree programs. Development of

interdisciplinary research and instructional teams would be synergistic; this unit would promote a focus on computing infrastructure for research that would serve the entire campus. The School of Information and Computing Sciences at Georgia Tech is the closest thing I have seen to this organizational structure. However, they do not integrate computer engineering and we think this is essential. This type of organizational emphasis promoted the Biology Division in its quest to become nationally known. It has been successful in the past; if KSU supports computing sciences in its growth phase, the returns will be just as dramatic as Biology.

Advantages

    a. integration of faculty research efforts across the broad spectrum of computing

    b. focus on computing at KSU, consistent with the Board of Regents statement

    c. focus on computational science and engineering and interconnections with a wide variety of disciplines which need computing to advance their research and instructional missions

    d. consistent with national trend in research support for computing science, software engineering, computer engineering, and computational science and engineering - the NSF directorate which allocates funds in this area is named CISE

    e. most natural mechanism to quickly focus on a jump to Top 45

Concerns

    a. new structures are difficult

    b. would a new unit be able to acquire enough resources for a critical mass of faculty and resources?

2. Division, School, or Department of Computing and Information Sciences and Engineering in Engineering (CISE) - not merged with EE

This would integrate the limited number of computer engineering faculty and the CIS faculty into a combined faculty of computing and information sciences and engineering (CISE). But EE faculty would not be merged with CIS faculty. It would also include increasing the number of "core" computing sciences and engineering faculty, as specified above.

Advantages

    a. strengthen undergraduate computer engineering, software engineering, and computer science - integrated curricula, better students, and more students

    b. closer connections to industry for both research in CIS and CIS graduates

    c. better fund raising through the Dean of Engineering's office

    d. more contribution to economic development

    e. more scholarships for undergraduates

    f. better support for equipment base - possibly through fee structure

    g. consistent with the national trend in support of extramural research - the NSF directorate which allocates funding in this area is called CISE, Computing and Information Sciences and Engineering

    h. computing science and computer engineering are similar disciplines

Concerns

    a. support for computational science (reaching outside the College of Engineering to collaborate with scientists on computational problems) must be a priority for the College of Engineering

    b. CISE must be top priority in the College of Engineering

    c. College of Engineering must recognize the need to build the requisite critical mass of "core" computing sciences and computational science faculty

    d. concern for emphasis on quality of research vs. development and funding in the College of Engineering

    e. must maintain BA programs in CS and IS

    f. must be able to retain all programs, including joint program with KU

    g. CISE must maintain complete control of all curricula - no imposition of traditional engineering courses

h. must have resources to provide computing courses for Common Undergraduate Degree Requirements, not a typical Engineering focus

3. Critical Mass of Computing and Information Sciences Faculty in Arts and Sciences

A plan has already been submitted which describes the potential for extramural funding if CIS is funded at a level to make us competitive with the Top 45 computing departments in the US.

Advantages
> a. large rewards in extramural funding and prestige
> b. support for computational science and engineering
> c. focus for computing within the College
> d. critical mass of "core" computer science is protected
> e. research is respected in A&S

Concerns
> a. possibly lose the software engineering part of computing, a real concern for the future of the discipline because it is about half of our discipline
> b. lack of scholarships and fellowships
> c. CIS Dept has to do fund raising, sometimes without the blessing of the College
> d. CIS must be top priority for funding in A&S or this option will not provide the proper focus - a small department cannot compete with the "big 4" departments in A&S without top priority

4. Institute for Advanced Studies in Computing and Information Sciences and Engineering

The model for this program is the Center for Advanced Computer Studies at the University of Southwestern Louisiana. In this structure, all undergraduate programs are left in their current colleges - CE in Eng., MIS in Business, and CS and IS in A&S. The Institute is created within the Division of CIS with high priority at KSU; the graduate education and research programs in computer engineering, computer science, software engineering, management information systems, and computational science and engineering are then the focus of the Institute faculty.

Advantages
> a. same advantages as School of CISE in 1. above.
> b. a very synergistic arrangement for support of graduate education and research projects
> c. a natural location for RIACT in support of computational science and engineering degree programs
> d. the same sort of "jump start" which launched the Division of Biology on its successful pursuit of extramural funding

Concerns
> a. if Institute is not in the same unit as CIS
> > - disassociation of graduate and undergraduate programs may occur
> > - undergraduate CIS programs will be de-emphasized
> > - computing at KSU is dispersed and therefore not synergistic and efficient
> b. will central KSU administration support CIS and Institute with enough resources to do its job?

Summary

The "bottom line" is that a critical mass of faculty, facilities, and collaboration in computing sciences and engineering can make significant contributions to KSU. Without this investment in a critical mass of "core" computing scientists and computational science and engineering researchers, many disciplines will be disadvantaged in their progress. Thus, any organizational structure that places priority on the development of this focus is acceptable.