The Changing Relationships between Computing Centers, Other Campus Units and University Administrations

by
J.A.N. Lee

March 1986

TR 86-18

THE CHANGING RELATIONSHIPS BETWEEN COMPUTING CENTERS, OTHER CAMPUS UNITS AND UNIVERSITY ADMINISTRATIONS.

1986 March 26

J.A.N. Lee

Department of Computer Science
Virginia Tech
Blacksburg VA 24061

[Presented at the 1986 ACM/SIGUCCS Thirteenth Annual Computer Center Management Symposium, St. Louis MO, 1986 March 26.]

I am grateful to the Program Committee of SIGUCC for inviting me to talk to you this afternoon. I remember your program chairman, John Skelton, when he was a Ph.D. candidate at the University if Denver, and I was returning to being a faculty member after ten years as Computing Center Director and Department Head. He seems to have progressed in the opposite direction. With this background and recent experiences in visiting a number of universities to review their academic programs, we lighted upon the topic of "The Changing Relationship Between the Computing Center, other Campus Units, and the Administration." I guess that classifies me as an expert -- "Ex -- a has been, and Spurt -- a drip under pressure", or as Heisenberg suggested "someone who knows some of the worst mistakes that can be made in his subject". I am hoping that what I say today will not merely be a recitation of mistakes but a suggestion of the means by which we can foster these changing relationships. While I serve (for another three months) as the Vice-President of ACM, what I say cannot represent the views of ACM on this matter. But let me give you some of my personal observations both from Virginia Tech and other institutions that I have visited recently, and from conversations with some of my colleagues in ACM.

There is a connotation in the title of this talk that there exists a "problem" to be addressed in this relationship -- just as by reading newspapers we are lead to believe that there is a "problem" with Hackers or that there is a "problem" with our technology which will prevent us from reliably implementing the objectives of the Strategic Defense Initiative. I believe that I do speak for ACM when I state that we would prefer to tackle such "problems" as "opportunities for improvement" before they overwhelm us. Such are the "tacks" taken by ACM in the cases of Computer Reliability, Hacking and "The Crisis in Computer Science".

Early last year (1985) the ACM Council published a statement on Computer Reliability which stated (in part):

> *Contrary to the myth that computer systems are infallible, in fact computer systems can and do fail. Consequently, the reliability of computer-based systems cannot be taken for granted.*

At the same we established a "Forum on Risks to be Public in Computer Systems" which is adjudicated by Peter Neumann of SRI International. In the main this consists of a Bulletin Board donated by SRI and which is accessible from Arpanet, CS Net and COMPMAIL. Discussions in the past year have covered SDI, Medical Diagnosis, intrusion into university systems, most recently the Shuttle disaster and (as a result the Philippine Elections) computerized voting. I hope that shortly we will be able to summarize some of these discussions and propose "consensus" positions on these topics.

In April 1985 a Blue Ribbon Panel composed of several sides of the hacking issue met face-to-face to discuss the "problem". The panel's report will be published in the Communications of the ACM next month - and proposes that there are "Positive Alternatives" to Hacking besides merely attempting to "mop-up" after the horse has left the stable (if you will excuse the mixed metaphor). I hope that we can implement the recommendations of the panel in the next two years.

"The Crisis in Computer Science" is multi-faceted, ranging from the lack of availability of qualified faculty (which Eric Weiss in the recent issue of "Abacus" dubbed to be an advantage to current faculty, a position with which I do not agree) to overcrowding in computer science curricula. ACM needs to provide some leadership, in cooperation with the Computer Science Board (the so-called "Snowbird Conferences"), to tackle these problems. Merely publishing reports about the "Crisis" is not sufficient. In one area ACM is pre-eminent: Education and Curriculum. We plan to build on that strength in various manners, one of which is the current Careers in Computing Project.

The Project proposes to provide information to young people about potential careers without insisting that they apply to the already overcrowded Computer Science Departments in your institutions. It is the experience of many of us that there is a large drop-out rate in freshman classes in computer science programs throughout the country. We believe that some of this is due to inadequate preparation for the curriculum emanating from an inadequate understanding of the field of computing at the secondary school level. Computer Science education is NOT learning how to play games on a computer any more than Civil Engineering education is learning how to mix

concrete! Besides providing information on what computer science is and how to prepare for a college program in that field, the Careers in Computing project will also suggest that there are equally fulfilling careers to be found in other disciplines which use computers. We hope to encourage students to enroll in other disciplines than Computer Science and to satisfy their computing "urges" by taking computer science as a area of minor study rather than becoming a major, thus reversing the project title to "Computing in Careers".

According to the Chronicle of Higher Education there has been a drop from 8.9 to 6.1 percent of college bound seniors choosing computer programming or analyst careers, and that colleges are experiencing a reduction in computer science class enrollments. I strongly disagree with this latter statement -- what is in fact happening is that colleges are RESTRICTING enrollments to match the availablity of faculty and facilities. Class sizes are not being driven by demand any more than the topics presented are driven by employer needs. James Martin stated last year in Communications: "I was at an important facility of one of the world's largest computer manufacturers recently, and the general manager commented that he would never hire a computer science graduate." He concluded: "That's an indication of the extent to which the computer science departments are perceived to be out of date." Once again I disagree; it is merely an indication of the intransigence of the establishment to resist changes to established non-methodologies. I agree with a later statement by Martin that in some respects we are not tracking the tool development technology adequately -- but I would also argue that that is because we don't have the tools!

Being somewhat pessimistic, it is better perhaps to suggest that the Crisis in Computer Science is a plethora of intersecting, mutually deprecating, crises. One of those is the Crisis in Computing in Computer Science which involves the changing relationships between three elements of the university community:

The University Computing Center,

The Academic Community (including the Computer Science Department), and

The University Administration.

These relationships are my concern here this afternoon.

I know that some of you will not want to separate the administration and the computing center from the academic community, but permit me this distinction for the time being.

Looking back, most universities entered the world of computing in the late 1950's, clearly segmented into two major groups: those who were either building computers or acting as regional centers with fairly large systems, and those who were serving their research communities with modest machines they could afford without a great deal of university support. One company assisted the latter individualists by providing up to 60% discount on their leasing costs, thereby ensuring the growth of a generation imbued with that particular imprimatur. Those computing centers grew out of a competitive research need and were operated out of the back pockets of a group of enthusiastic faculty who were lucky enough to be on the spot and who were assured of advancement based on modern qualifications -- programs "published" in user group libraries were recognized as legitimate publications and the implementation of new systems was classified as research.

In the beginning there was an expectation of some magical effects based merely on existence of a computer on campus. In some institutions that expectation is still alive! Early in this history, it was realized that the use of computing facilities could not be restricted to those projects which brought the machines to campus, but must be shared with others, many of whom had no budget lines for computer time. It was also recognized that in order to make the best use of this investment steps must be taken in order to educate potential users. At the same time administrative computing began to move out of the tabulating machine era and into the computing center. Institutions recognized the validity of Grosch's Law: "Computing Power Increases as the Square of its Cost", not only to justify combining computational facilities, but also to justify the modification of the method of funding. Rather than attempting to recover computing costs by charging users for their actual hourly usage, the computing center was to be supported by a pre-approved budget constructed from research overhead, the diversion of computer budgets in grants directly to the computing center budget, administrative contributions and a per student academic allowance. Some colleges even

instituted a head tax for computer classes, though it is not clear whether the monies collected ever arrived at the computing center or were diverted to other uses by academic departments. I notice that some institutions have revitalized this form of support for their PC laboratories. New machines had come on the market which could perform both scientific computation as well as data processing, and it became acceptable to use a computer for non-computational activities such as text processing and office automation.

More recently we have seen another major change in the status of computing within the university with the appointment of a Vice President for Information Systems, moving the level of responsibility further towards the top of the administrative ladder, but now lumping the computing center activity with other intersecting services. This can be viewed either as giving a greater respect to the task or as moving the task one more step further way from faculty influence. One must argue that the consolidation of the functions in a single administrative unit makes sense in view of the increasing overlap between computing (in its broadest sense), communications and library facilities. This is most advantageous when we must anticipate that there is going to be a growing use of electronic publishing and storage in the next few years, accessible over communications lines to computational facilities in faculty offices, classrooms and student dormitories.

The other major change is the requirement for students to provide their own computing facilities through personal computers.

Virginia Tech is proud to have been the first public institution to implement this requirement in the School of Engineering, followed this year by the Department of Computer Science and anticipated to be extended to the School of Business next year. In two years we have gone from a school which boasted of 700 dumb terminals (split roughly equally between administration and academia) to over 4000 personal computers mostly in the hands of students, thus (according to Infoworld) giving Blacksburg Virginia the highest density of computers per capita of any incorporated locality in the world. Surprisingly enough this additional cost of education to a student (approximately $3000) has not resulted in a down-turn in our applications or enrollments. For these innovations the Vice-President for Information Systems and the President have received CAUSE Recognition Awards. The President's citation stated that "Dr. Lavery has placed emphasis on the development of cost-effective computer projects in the administrative area, has promoted the installation of computer terminals at the highest levels of administration for interoffice communication and management information systems, and has encouraged faculty and staff participation in professional computer-related organizations." Unfortunately I think we have oversold him on the reasons for using computers. Let me quote you from a recent campus newspaper (not the student paper):

> *"As you may know, we received a letter from the NCAA ... Specifically the NCAA requested that we furnish squad lists for the years 1983-84 and 1984-85 in football... We'll probably develop a software package that will help the evaluation process. The NCAA will probably be interested in our approach."*

As in so many other instances we find ourselves blinded by the media rather than the message in a form of latter-day McLuhanism.

Clearly one can regard a university as a large information processing system, though perhaps without the predictability of an electronic system, and thus it should not be surprising that such importance is being attached to information systems.

From the point of view of the computer industry and the developments on the last five years, it is clear that Grosch's Law has been replaced by the Mass Production Law and that large is not necessarily better. This has lead to the conclusion that the computing needs of students can be solved by the use of PC's AND that, like slides rules (of my age) and typewriters, it is the student's responsibility to provide their own equipment. I suspect that some large computing systems in universities are not really "supercomputers" but instead are "super-editors" or "super-communicators". Perhaps this is appropriate in the age of the "Great Communicator". In any case OA will have significant effect everywhere in the university if only by taking away computer resources from teaching and research. Just as electrical power is now used to light offices and to provide air-conditioning rather than the "real work" of operating mechanical devices, so the information revolution has reached the stage where it is legitimate to put the computer to any use which will extend the capabilities of the human user.

During some research on Howard Aiken's Mark III calculator recently (charicatured on the cover of the TIME magazine 35 years before the personal computer appeared as the "Man of the Year") I found an article in which Norbert Weiner predicted that the "Information Revolution" would have a more far reaching effect than the "Industrial Revolution". He stated at that time:

> *"The great new computers are not mere mathematical tools. They are harbingers of a whole new science of communication and control (which he promptly named "cybernetics"). The machines can already work typewriters... valves, switches and all of the other control devices common in modern industry. Such development is certain. When it does come It will usher in the "second industrial revolution" which will devalue the human brain as the first industrial revolution devalued the human arm...*

HOW RIGHT HE WAS!! The article goes on to state:

> *"Many of his colleagues, while admitting he is a great mathematician, accuse him of sensationalism."*

The modern day sensationalist whom I quoted earlier, is James Martin, who stated in that same Communications article:

> *"This is not a gentle evolution but a revolution in technology. How do you manage a revolution as opposed to managing evolution? It is crime to train any new graduate today in COBOL or BASIC ... You should train them all to use the power tools (of the new industrial revolution)."*

Perhaps our problem is that we are expecting computing centers to provide the tools (or services) for this new revolution while at the same time maintaining the status quo necessary to conduct meaningful research in non-computer fields. Computing centers have enough problems today meeting the demands of the evolutionary process without taking on their shoulders the demands of a revolution.

Compounding the problems of computing center administration but reinforcing the justification for consolidation of functions are the demonstrated needs for increased off-campus access, not just because of the spread of the university's influence to larger geographical areas but also because of the home use of PC's by faculty and students. The cottage industry of computing at home grows as the cost of PC's and communications adapters decreases and parking places get more difficult to find. Like other institutions not directly involved in education, universities are beginning to recognize their wealth in terms of data held in various repositories and thus the need to provide networking, as well as distributed computing and data base access. We are not doing a good job in sharing developments and data amongst academic groups -- the concept of reusability has a very limited scope in universities. We are all aware that university budgets are limited and that without either the infusion of new money or the redistribution of existing funds very few of these goals will be achieved.

A partial solution to the dilemma of providing the appropriate machine for the job, though one which exacerbates the problem of communications, is to place the burden of acquisition of computing facilities on those who have a need. While we must expect that there is a commitment on the part of the institution to provide generic services to the whole institution, special needs can be met only by special means. Supporting this method of solution (which is clearly a case of the method of "divide and conquer") is the neat alignment of machine sizes and community needs. The pairings of mainframes and campus-wide usage, minicomputers and special subunits, microcomputers and individuals, seems to be heaven sent. But here there is a changing relationship between elements of our university communities regarding the funding of these different levels of system.

For over ten years there have been subtle shifts in the funding of computer equipment. I can remember the time when all computing equipment was purchased and thus owned by the university. It's maintenance was also a university problem. Then researchers purchased equipment to meet their special needs and paid for the maintenance. Departments, in order to provide rudimentary office automation, purchased terminals for secretaries instead of typewriters. The cost to

the university was the cost of increased communications but this was generally covered by increased hourly rates for both CPU time and port usage. Student purchases, even though not mandated, relieved the load on classrooms, but increased their department's expenses for course access to computation. In order to meet the departmental demands for computing, and often to satisfy needs that could not be met by central system, we sold or gave spare time on machines purchased with research funds to classes and to departments for administrative use. At the same time, these units sacrifice their share in the funding of that central facility and thus double their losses. Even gifts of equipment from manufacturers could only be accepted if the overhead from research in a department could stand the cost.

With a single computation center it was easy to charge off computer time to the right account. Today there is a changing relationship between the "haves" and the "have-nots". The cost of doing business differs between administrative, research, classroom and computer science. To some extent we have returned to the situation that existed in the 1960's when there were two computing centers in an institution; one serving the administration and the other the academic community. The difference today is that the central facility has been taken over by, or has been vacated to, the business aspects of running a university. The remainder of the university must satisfy its computing needs by independent acquisitions -- independent funding and staffing. Some of this independence is due to, and the choice of, some narrowminded, elitist faculty in computer science, as much as it is due to the myoptic views of computing centers towards a single vendor.

While we tend to think of computing as hardware, the same precepts apply to the acquisition of software. Most central computing facilities are not themselves research or development establishments and thus do not require to support state-of-the-art software. In my visits to colleges recently I have been told repeatedly that all the software required to run a computer science class is available -- the FORTRAN, COBOL and Pascal compilers! Even the ubiquitous IBM PC has a programming support environment available to serious programmers together with toolkits which are reasonable facsimiles of the toolkits available in industry. Yet few computer centers provide such tools. Perhaps we should accept that a service center cannot be at the leading edge of computer science development; I don't expect such a facility to support Prolog, yet, or even Ada, but surely there should be facilities comparable to those found on most microcomputers -- spreadsheets, WYSIWYG text editors, data base systems, and graphics in a problem solving environment.

The diversity of holdings in a corporation is often a hedge against changes in the economy and fluctuations in "glamour" fields, but the diversity in computer acquisitions presents us with problems of compatibility. Networking goes a long way to solving this problem by giving access to differing systems, but most of us are actually limited to passing ASCII files from one system to another as messages rather than actually linking systems so as to achieve greater computing power. Universities have failed to support standards in our industry by

1. Not insisting on the use of standards in procurement,
2. Not following standards in their own developments,
3. Not supporting the transfer of technology to the industry through standards, and
4. Not recognizing the contribution of standards to the technology as an achievement to be rewarded.

This is paradoxical -- on the one hand universities want to run computational facilities as a reliable business operation (thus not using untried equipment) but at the same time want the freedom to experiment by not conforming to industry standards. Only recently has standards development been recognized as an element of software engineering and thus become a potential for rewardable effort; if we could now get funding for such activities, it would become legitimized even more and we could help ourselves to maintain intersystem compatibility.

There are many aspects of university computing that can be standardized but there needs to be a commitment to a product that can be maintained through an academic year to protect student's rights. Changes in either software or hardware are disastrous to courses especially when made in the middle of a session; but any change must be accompanied by training for both staff and faculty to catch up. Class preparation takes time and the modification of computing facilities (hardware or software) can have a serious impact on class activities and faculty time. Changes cannot be as-

similated by osmosis. Faculty MUST be provided with the time, materials and facilities to understand changes; even a simple change can have a profound effects on class examples, assignments and tools. At one institution I visited recently, the system maintainer did not know the semester calendar and was unaware that a recent update had occurred in the last week of the semester, thus causing havoc amongst students trying to complete final assignments.

Returning to the question of "who pays?" and the use of research computing facilities for other purposes, few funding agencies any longer support the purchase of computer equipment but will pay for time on existing systems. Agencies feel that they should treat computers as a normal part of the tool kit of a university. It is many years since we were able to purchase a typewriter through a research grant because we needed to type the final report -- the typewriter is considered to be already in place and accounted for in the overhead charged to each project. Computer terminals went that way ten years ago and except for specific research, computers are also part of that standard package. The National Science Foundation does fund some exceptional acquisitions but for the majority of computing activities it is up to the institution to provide the equipment as part of the budget.

Another part of the changing relationship; he who holds the purse strings controls the finances. When faculty had to get outside funding to support computing, they called the piper's tune; now that funding is embedded in the university's budget (even though it can depend on faculty fund raising through grants still) and the budget makers call the tune.

The changing relationships between computing facilities and other academic units results from the change from being a research and teaching tool to being a service utility. I visited a university president who could not understand why the computer science department was so insistent that they needed a different computer than that in the central facility to support their (non-existant) research program -- even after a granting agency had turned down several research requests for the lack of proper equipment -- *"Physics manages to do most of their research on our main computer, why can't computer science?"* the president asked.

It happened before my time, and I suspect before the time of all of us here today, but similar changes in relationships must have occurred in universities previously. The day must have dawned when electricity moved out of the laboratory and into the power house, but the physicists (and later the electrical engineers) were not permitted to experiment with the on-line generators. Buildings were there before there were universities, but I doubt if Civil Engineers have been allowed to structurally test university buildings.

As I pointed out earlier, computing centers were originally managed as a research center by faculty; today we have returned to this form of management for research systems. Computing facilities, such as our Spatial Data Analysis Center or the Robotics Laboratory, are funded from research grants but are not sufficiently well endowed to support outside management, even though the magnitude of their facility is as great as some central computing systems. The dichotomy is that research centers cannot afford to be conservative and operational service centers cannot afford to be experimental.

There is a place for a university can operate computing facilities other than the central facility as turnkey services. These include administrative computing, academic computing, research support, and office automation. However attempting to run a series of centers with a single all-purpose staff does not allow for the necessary differences in philosophy. Alternatively some institutions have maintained their central facilities, but have appointed a multiplicity of Directors each responsible for representing and serving the special needs of different subunits -- academic, research and administration. Without any equipment of their own, little authority but lots of responsibility, it is not clear whether this approach will work, or merely widen the gap between subunits as budgets differ.

A third alternative is to provide an ombudsman for each competing university community within the computing center who participate in the day-to-day activities to solve problems on a more timely basis than (say) bimonthly meetings of an advisory committee. We need to get the faculty out of the business of part-time computing center management and into the business of full-time research and teaching.

The changing relationship between computing centers and other units is a function of the difference in objectives between the various units. While I am sure that no university president would admit to there being primary differences in goals in the subunits, the means for achieving those goals can tear apart a service entity such as the computing center. Administrative units need control through a Management Information System; the general user community wants reliable service in a timely manner; and the computer science and engineering community wants state-of-the-art resources. Is it possible for these subunits to work together? What priority should be attached to the computing activities of each unit? Should the computer science and engineering community be considered to be a unit of high enough priority to be counted against (say) a college or research center? Can a computing center serve all of these units or must there be a compromise so that the service provided does the least harm to the most? Is it truly possible for a computing center to serve three masters, or must one always take precedence over the others?

So where does ACM come into this picture? ACM, as still the largest computer society in the world, serving a set of disparate communities including academia, the working world, and the public, provides a broad-based environment within which we can organize meetings such as this to discuss our opportunities. Unfortunately ACM is not too swift in making succinct statements about current issues. It took us two years to make the statement that "computers can and do fail"; it has taken us seven years to produce a means by which we can change the name of the Association (while retaining the acronym)! But if you are willing to come to your own conclusions, ACM is the place where two sides of an issue can meet. We did that in the case of the Hacker issue by bringing together hackers and security conscious corporate consultants, and for once the answer was not to legalize hacking out of existence. I might well have asked the question today -- "is there a changing relationship between SIGUCC and SIGCSE?" Both grew out of ACM in the late 1960's but I don't know of the last time they met together.

ACM is supporting the activities of the Computing Sciences Accreditation Board in which the relationships between the academic program and the computing center is a fundamental criterion. There are positive alternatives to merely legalizing the relationship between computing centers and other academic units; perhaps I can suggest that it is your responsibility to investigate these alternatives, hopefully in cooperation with your fellow SIGs, under the umbrella of ACM.

I make my home close the Blue Ridge in Virginia where a gap is a place for people to meet. Let us recognize these gaps in our relationships and utilize this opportunity to meet at other times than when we need to solve problems. Lets work on these changing relationships before they become widening gaps.

Thank you.