The Computer Aided Engineering Network

The College faced a very major challenge in building a modern computing environment for its students, faculty, and programs. Part of the problem was developing an appropriate vision for a state-of-the-art system and then financing it. But we also faced a challenge because of the very success of the University-wide Michigan Terminal System (MTS). Developed with IBM in the 1960s, this had long been one of the nation's leading time-sharing systems. Yet it was an inhouse system, adopted by few other universities, and during the 1970s it rapidly lost ground to the new generation of minicomputers such as DEC's VAX systems for science and engineering applications. By the end of the 1970s, most engineering and science departments at top research universities had acquired their own VAX systems. Yet, Michigan remained not only moored to the increasingly aging mainframe-based MTS system, but also to centrally administrated computer policies that prevented academic programs from breaking away and acquiring more advanced computing environments. In fact, every purchase of a computer had to be approved by a central committee at the University.

The Michigan Terminal System (MTS) Computer System

This was a topic of personal interest, since my own career had largely paralleled that of the digital computer. My particular area of research, nuclear energy systems (nuclear reactors, nuclear rockets, thermonuclear fusion), was not only heavily dependent upon state-of-the-art computing, but it had actually driven much of computer development. During the 1960s and 1970s I had done much of my work using Atomic Energy Commission supercomputers at AEC laboratories such as Los Alamos and Livermore. Although my research made use of the very fastest computers in the world, several of our faculty members (including Dick Phillips and Bill Powers of Aerospace Engineering) got me interested in the use of the first microcomputers such as the TRS-80 and Apple II for instructional purposes. In fact, I taught one of the very first introductory computer courses on these systems in the late 1970s. From these experiences, I was convinced that the College simply had to break away from the University's MTS system and build its own computing environment, more suited to its needs. I was convinced that the digital computer would rapidly evolve from simply a tool for scientific computation and information processing into an information technology infrastructure absolutely essential to all of our activities, from research to instruction to administration. Hence, to build a leading engineering college, we would have to become a leader in information technology. This view was shared by many members of the College.

Dan Atkins assumed the leadership for this effort, assisted by Dick Phillips, Lynn Conway and other members of the faculty. We set a rather ambitious goal: To build the most sophisticated information technology environment of any engineering college in the nation, an environment that would continually push the limits of what could be delivered in terms of power, ease of use, and reliability to our students, faculty, and staff. The system was called CAEN, the Computer Aided Engineering Network, a name that reflected its functional architecture as a sophisticated information technology network integrating the Colleges' instruction, research, and administrative activities together with both oncampus users (students, faculty, staff) and off-campus participants (industry, government, alumni). More technically, CAEN was envisioned as a distributed intelligence,

hierarchical computing system linking personal computer workstations, superminicomputers, mainframe computers, function-specific machines (CAD/CAM, simulation) and gateway machines to national networks and facilities such as supercomputer centers. The network was designed to support not only general scientific computing, but computer-aided instruction, administrative services, and access to technical and bibliographic databases.

We first had to fight a battle on State Street to allow us to break away from the University MTS system. Not surprisingly, this involved many of our old foes in the kingdom of the vice president for research, since they ran campus computing at that time. Fortunately it was easy to convince Harold Shapiro and Bill Frye that they needed to encourage more diversity in computing, and in particular, allow some units to move far out on the curve of advanced computing as pathfinders for the rest of the University. Engineering and Business Administration were given the go-ahead to build their own environments (which would eventually lead to the disappearance of MTS, although it would take almost a decade).

I have already mentioned some of our early steps to build CAEN. We first provided every member of the faculty with a personal computer (a choice of either an IBM PC or an Apple II computer). We next began to acquire several networked clusters of state-of-the-art computer workstations for research (Apollo, Sun, HP, Apple Lisas, Silicon Graphics). We faced a very major challenge in providing adequate computing resources for our students, since our large enrollments (6,000) would require a massive investment. To address this, we took two very important steps: First, as I mentioned in the previous chapter, we persuaded the University to allow us to charge students a special $100 per term computer user fee to help support their computing environment.

This generated $1.5 million each year that we then could use to buy (or even debt-finance) computer equipment. We made absolutely certain that every penny of these fees (along with significant contributions from the College) went entirely to equip numerous student computing clusters around the College that would be restricted solely for the use of engineering students. To provide a vivid demonstration of just what the students were getting for their fees, we converted two large lecture rooms on the first floor of the Chrysler Center into a gigantic computer cluster, equipped with over 100 of the new Apple Lisa workstations. This was quite a sight—probably the largest collection of Apple Lisas that ever existed—and it really impressed the students.[1] We adopted the philosophy that these were the students' computers, without any constraints on how they could use them. Similar computer clusters were built around the College.[2]

The Apple Lisa Lab in the Chrysler Center

The second element of our plan for students involved developing a mechanism to help them purchase their own personal computers, since we realized that the College would never have sufficient assets to equip all 6,000 students. We explored the possibility of negotiating very deep discounts (60% or more off list price) with key vendors such as Apple and IBM. They were quite willing to do this, but the principal hangup was with the University, nervous that the local computer stores might complain to the state legislature that we were undercutting their business. After considerable effort, we finally managed to convince Shapiro and Brinkerhoff that the leading universities would be achieving massive deployment of personal computers to students through such bulk discounts, and that Michigan would rapidly fall behind if we did not do the same. Since I suspected that the impact on local retailers would be very positive from the secondary hardware and software sales stimulated by the student

program, we negotiated a separate agreement with them to sell their wares when the students picked up their computers through the University. Since the first major deliveries occurred early in the fall, we began to call these events the Fall Computer Kickoff Sale. It was quite a hit with the students, particularly when new systems such as the Macintosh appeared. The number of University students acquiring their own computers began to rise rapidly, stimulating both the College and the University to install appropriate networking capability in the residence halls and University buildings. (The Fall Computer Kickoff Sales continue to this day.)

The final step in bringing CAEN to the level of sophistication we had envisioned was made possible by a $2 million gift from General Motors that allowed us to acquire over 350 high-end computer workstations, connected with high speed networks, to serve the advanced needs of students and faculty. Our philosophy was simple: We were determined to stay always at the cutting edge, but with a very strong service focus. We sought to remove all constraints on computing, with no limit whatsoever on student and faculty use. We went with a multivendor environment, moving with whatever technology was most powerful.

Needless to say, these were highly controversial issues in the early 1980s, particularly at the University of Michigan. But as a result, by the mid-1980s the College could boast one of the most sophisticated computing

The launch of the Computer Aided Engineering Network (with Bill Poduska of Apollo Computers and Steve Jobs of Apple Computer)

environments of any University in the world, a fact of major importance to recruiting outstanding faculty and students.

Completion of the North Campus Move

As we discussed in the previous chapter, all of the key steps necessary to complete the long-sought (and endured) move of the College to the North Campus were in place by mid-1983. We needed only to finish the construction of the massive Engineering Building I (now the Electrical Engineering and Computer Science Building), and this would occur in spring of 1996.[3]

Of course, although the move of all of our faculty, students, and programs was complete, there was still more to do to improve the quality of the North Campus environment. We invested heavily in building an instructional center (library, computer center, instructional television) in the unfinished basement of the Dow Building (with only a minor setback when the underground facility for the HVAC equipment collapsed from faulty materials and design midway through the project). Chuck Vest pushed for more student facilities, including a small vending/study area next to the EECS Building (we all called it Chuck's Bar and Grill although it was later named as a memorial to one of our young faculty, Jonathan Laitone, who was lost in a climbing accident on Mt. Ranier my first year as dean). A connector laboratory was built between the Dow and G.G. Brown Laboratories for bioengineering, a major addition was built for the North Campus Commons (later named the Pierpont Commons), and the Space Physics Research Laboratory was doubled and then tripled in size.

The Dow-GGBL Connector