CHAPTER 12
COMPUTING AND COMMUNICATION SERVICES

INTRODUCTION

The University has made significant progress in computing systems. Improvements include the the quality and level of access to facilities and services as well as the policies for allocation of computing resources. The concerns expressed in this chapter are of an entirely different nature than in the past. They primarily reflect the concern that the progress made in recent years and the momentum gained will be sustained.

The computing and communication services committee was charged with reviewing the extent to which the University's computing and communication facilities and services support the goals and objectives of the institution's mission and provide the level of services needed to support the entire academic enterprise. The committee defined the communications aspect of this charge to include those communication services associated with computer network systems and services.

Work of the committee was divided into four main areas: (1) academic and research computing, (2) administrative computing, (3) public service, and (4) general computing. Data and information were gathered by interviewing several key administrators and individuals involved in computing and communications services. The committee met with selected faculty and staff; in addition to inviting their participation in the input and report forums and the self-study surveys. In addition, the committee made a fact-finding trip to Ohio State University (Exhibit 12-A and 12-B). This included a tour of the supercomputer facility at Ohio State and meetings with several computing administrators.

DEVELOPMENT OF COMPUTING SUPPORT

In 1981 the principal academic computing activity was "number crunching"—principally in the form of large-scale scientific computing and statistical analysis. The precursors of today's electronic mail environment were some experimental implementations in mathematical sciences and the Computing Center. Word processing was confined principally to the use of Script on the central system. It is worth recalling, as an indication of how far we have progressed, that in 1981 there was a University policy forbidding the purchase of "letter-quality printers" outside the Computing Center. The same thinking led to the purchase of a central "University word processing system", which was used mainly to facilitate the production of the last Self-Study Report.

The changes from the environment surrounding the last Self-Study include:

1. Decision to treat computing as a utility available on a nonrecharging basis comparable to the library,

2. Establishment of vice presidential office to strengthen and coordinate technology development on campus.

3. Development of the University's computing and communications network,

4. Separation of authorization of noncentral computing/communications purchases from the computer center,

5. Purchase of a supercomputer (through state appropriated funds) which brought about the first major improvement,

In 1990, the University further demonstrated its commitment to technology by funding a $7 million upgrade of the IBM 3090-300E supercomputer to an IBM 3090-600J. The IBM 3090 supercomputer is a statewide resource. Today, the supercomputer supports research, library, electronic mail, and adminstrative functions. The library's catalog, MEDLINE, and ERIC databases are the most recent additions to the supercomputer. The Prime computer, also recently upgraded, facilitates most of the instruction-based mainframe computing. There is a growing system of networked workstations in instructional lab settings whose staffing and maintenance will be supported by the recently approved increase in student fees.

The Center for Computational Sciences assists Computing Services with the management of supercomputer resources. Basing decisions on efficient usage, these two units work closely together to allocate computer time for research projects. Networks link the mainframe, desktop, classroom, library, the Commonwealth, and even the nation. The campus network (UKnet) is expanding rapidly. Fiber optic cable is replacing coaxial cable in the University's network backbone to provide higher speed transmission.

In addition to the traditional data and voice communications, compressed video technology also links the Lexington Campus with the Community College system. The interactive compressed video facilitates the University's distance learning and rural health care missions. Four community college links have been established as of January 1992. New sites are planned for the future.

In summary, the University has made significant technological improvements. Computing and communications technology plays an increasingly important role in the University's overall academic plan. Resources allocated to technology demonstrate a commitment to the implementation of the Information Systems Strategic Plan (Exhibits 12-C, D, E and F).

CURRENT UTILIZATION OF COMPUTING BY FACULTY AND STAFF

The University's progress during the past decade is reflected in the fact that most University employees now use computers on a regular basis. As Table 12-1 shows, more than one-third of the faculty and administrative/professional staff and more than half of the hourly staff use computers over 16 hours per week. Most employees in all categories have access to word processing and consider it important to their work. Other applications are less universal in their perceived importance and utilization, but all are used and considered important by a substantial proportion of employees in all categories. User satisfaction is fairly high in most areas of computing. Exceptions include the number of PC's available and access to administrative systems.

Table 12-1 also shows the dominant position of personal computers in the University's computing environment. The mainframe and Prime remain important at the University. Sixty

percent of the faculty, 41 percent of the professional staff, and 30 percent of the hourly staff use the mainframe or Prime at least occasionally, and larger percentages use personal computers or terminals that are connected to a larger computer. Even so, 93 percent of the faculty, 72 percent of the professional staff, and 60 percent of the hourly staff report at least occasional use of personal computers. The University has exhibited dramatic movement away from its earlier centralized approach to computing and is moving toward distributed computing.

Note that access and perceived importance are closely related. Few employees who consider an application important are unable to obtain access to it. The comparison of access to perceived importance made possible by Table 12-2 shows (focusing on gaps of five percentage points or more) that faculty do not have as much access as they desire to the Library System (a situation that has improved with the introduction of the new NOTIS system in 1992) and to imaging and graphics. Administrative and professional staff experience gaps with respect to specialized software, network access and most dramatically imaging and graphics. Hourly staff appear to have adequate access.

Table 12-1

Computer Use and Satisfaction by University Employees

	Faculty	Administration/ Professional Staff	Hourly Staff
Percent Using:*			
Personal Computers	93	72	60
Work Station	39	60	58
Mini computers	29	27	17
Mainframe/Prime	60	41	30
PC or terminal connected to larger computer	68	68	54
Use computers more than 16 hours per week	36	37	55
Satisfied with:**			
Computing Center	82	42	35
Number of PCs available	46	27	19
Service on equipment	69	78	73
Connections to local network	59	62	40
Network access, speed and software	66	61	53
Access to administrative systems	24	26	23

* Recent respondents indicating "usually" or "occasionally" using.
** Percent of respondents indicating "satisfied" or "very satisfied."

Table 12-2

Computer Access, Importance, and Utilization by University Employees

	Faculty		Administration/ Professional Staff		Hourly Staff	
Access and Importance:						
	% with Access	% # consid. Important	% with Access	% consid. Important	% with Access	% consid. Important
Word Processing	97	98	83	81	72	69
Spreadsheets & databases	72	68	66	66	47	28
Programming/Code development	39	33	42	41	25	24
Specialized software	72	75	67	72	47	49
Instruction	62	55	58	56	54	54
Network Activities	57	56	57	62	40	43
Electronic Mail	71	68	71	72	54	51
Administrative systems	38	33	39	40	34	32
Library access from office	55	63	29	31	26	22
Statistical packages	63	67	40	44	28	29
Imaging & graphics	63	68	44	53	32	29

Recommendation 12-1: Hardware should be maintained and regularly upgraded to current technology levels. To continue a high level of hardware support/service, increased salaries and additional training for the technical staff may be necessary to attract and retain personnel familiar with "cutting edge" technology.

Recommendation 12-2: A firm commitment toward the continued development of a forefront Computing Center should be made, especially in regard to a state-of-the-art large-scale computing environment.

ACADEMIC COMPUTING

The previous Self Study Report was highly critical of the academic computing environment at the University of Kentucky; however it is clear that significant progress has been made in the intervening decade. Indeed, it must be noted at the outset that there is a general feeling of satisfaction. Surveys conducted for the Self-Study showed that most faculty, staff, and students are satisfied with most aspects of computing facilities and services. The creation of distributed computing laboratories and the movement to locate computing facilities in the Library

(particularly within the proposed central library) are quite consistent with the response to the Survey. The current lab building program and the planned computing laboratory facilities in the new library would be consistent with the priorities of fully 90 percent of the community, as well as the continuation of the nonrecharged "utility" philosophy. At the same time, however, it must be recognized that the rate of increase in demands and complexity of the decisions that must be made call for the establishment of more effective, more systematic communication among those charged with administering the computing environment and the user community. While the administration rates high marks for the progress to date, there is concern that their communication links to the academic community are more anecdotal than systematic. In the past, the major computing advisory committee met irregularly, and faculty members of this committee felt that they served no real purpose.

Recommendation 12-3: The academic community, via an empowered and informed advisory committee, must be intimately involved in the strategic planning of computing services. This committee should ration resources when the need arises.

A Director of Academic Computing is now on the staff and will have responsibility for coordinating user services and recommending academic computing policy. Properly supported and staffed, this office together with an empowered and informed faculty advisory committee has the potential to address a major portion of the concerns listed above.

Recommendation 12-4: The Director of Academic Computing should continue to serve as an *ex officio* member of the major computer advisory committee with a responsibility to have it meet regularly with a published agenda.

The strong and successful developments of computing in scientific research is in contrast to the absence of a similar effort to promote more general academic computing. The University's *Strategic Plan* emphasizes a commitment to providing advanced academic computing capabilities in support of instruction. New instruction laboratories for faculty and students will facilitate this development.

Student computer laboratories were the first step in improving academic computing support. Public laboratory facilities are located in M.I. King Library, Health Sciences Learning Center, and the Business and Economics Building. Students staff the laboratories and provide consulting services to users. Several colleges and departments operate semipublic laboratories.

These include, Agriculture, Mathematics, Engineering, Medicine, Architecture, Human Environmental Sciences, and Education. The University's ultimate goal is 1,000 public access computers available on a 24-hour basis.

Several disciplines have implemented computer-based instruction, e.g., mathematics, English, business and economics, and business education. Besides homework-type assignments, several classes meet regularly in networked computer classrooms. Mathematics uses a classroom located in the M.I. King Library computer lab. Business Education has a classroom in Dickey Hall; and Business and Economics uses a classroom in the Business Information Center.

The Faculty Academic Computing and Technology Support (FACTS) Center was created to provide faculty with tools and assistance for implementation of classroom computer-based instruction. Current software and hardware technology are available in the FACTS Center for faculty use and exploration. The Center's staff encourages faculty members to use the center for

development of instructional projects. The Center also provides consultants and seminars as additional support services.

One-third of the faculty respondents in the Self-Study Survey indicated they used computers in their teaching. In many cases, however, the respondents indicated levels of dissatisfaction as high or higher than the satisfaction levels, suggesting several areas for needed improvement before computers will be effectively integrated into the classroom (Table 12-3). In addition, the Survey found that 44 percent of the faculty are dissatisfied with the availibility of computer laboratories for class sessions, a figure we interpret to indicate a desire for a greater number of laboratories, more conveniently placed. As noted earlier, the newly-increased student fee will provide future support.

Table 12-3

Faculty Satisfaction with Selected Aspects of Instructional Computing

Area	Satisfaction Level*	
	% Satisfied	% Dissatisfied
Availability of labs for classes	44	42
Availability of PC with large screen projection	20	61
Instruction in use of computer systems	39	47
Numbers of PC's/terminals in Instruction labs	44	49
Quality/number printers	30	43
Student access from dorms or off campus	16	32
Operating hours of student computer labs	41	34
Software available to students	45	33

*Percentages do not add to 100 because of respondents who chose to skip questions or responded "don't know".

The primary obstructions reported by the University community to instructional use of computing include: physical resources (about 50 percent), basic expertise (about 50 percent), staff assistance (about 60 percent), and available time (about 70 percent). In addition, almost half report the use would be inappropriate, particularly in the nontechnical fields, (Table 12-4). While the resources for a major effort in this direction may be currently limited, a program somewhat akin to computational sciences is needed (particularly with regard to colloquia, postdoctoral and graduate student support, etc.) but focused on the needs of the social sciences and humanities.

The principal consumer of academic computing resources (in terms of CPU cycles and disk storage) is large-scale scientific computing, called "supercomputing". Personal computers also receive widespread use on campus. The preceding section demonstrated their widespread use by faculty and staff.

Table 12-4

Importance of Various Factors in Limiting Faculty Use of Computers in Classes

Limiting Factors for Class Use:	Percent of Respondents Agreeing
Not appropriate for the class	48
Lack of funds (hardware)	55
Lack of funds (software)	57
Lack of knowledge	54
Lack of staff support	59
Lack of instructor's time	72

Maintenance is not perceived as a major area of concern by the academic users. A campus-wide coordinated approach to purchasing, installing, and servicing of PC hardware and software, as well as sufficient instruction in the use of these systems is needed to negate the necessity for individuals or small units having to do the selection, purchasing, learning, and maintenance by themselves. The surveys indicate, however, that one-third of the faculty is dissatisfied with assistance in purchasing, instruction in use, and with available consulting assistance. Another area in need of attention that should come under the purview of the Director of Academic Computing is the area of software site licenses. This, in turn, meshes with the general ideal of established, supported standards.

Recommendation 12-5: Existing services for selection of computing equipment and discount purchasing should continue to be expanded, enhanced, and made more user friendly.

Recommendation 12-6: The University should continue to adopt and support standard software products and negotiate site licenses for their use across campus to ensure the lowest costs and expert instructional and technical support for the campus community. Site license information should be widely disseminated.

Recommendation 12-7: Additional programs of instruction (noncredit courses) are needed for faculty, staff and students.

Recommendation 12-8: Additional support centers, with one dedicated for faculty, should be established to assist with individual computing problems and to help purchasers obtain information on and explore popular software.

The explosive growth of word processing and electronic mail has led to an increasingly sophisticated community of academic users with ever-increasing demands for service. The administration has been responsive, notably, through the further dissemination of the local area network, expansion of the IBM 3090 "supercomputer", and the development of the distributed (decentralized) microcomputer laboratories.

Measured in terms of the *number of users* and the impact on academic life, the single most important computing activity is word processing or editing. The survey suggests that almost all

faculty and about 80 percent of the students use word processing regularly, primarily on distributed systems or personal computers, followed closely by electronic mail. Further, 98 percent of faculty PC users deem this very important or somewhat important. Percentages for staff and student users are nearly as high. A campus-wide system for purchasing, licensing, instruction in use, consulting services, or maintenance of word processing software is needed. With regard to access, 83 percent of the faculty, 72 percent of graduate students, and 79 percent of undergraduates have sufficient access to computers for word processing. Six to ten percent of people in these categories need better access or help with use.

It is worth noting that the reliance on word processing means that an ever-increasing portion of the university's archives (data and text) reside on magnetic media with a very limited life expectancy. While the majority of the information need not be preserved, the absence of established document interchange and archival formats bodes poorly for that portion that should be preserved. Beyond the question of supported software, there is currently no effective means for faculty and students to ascertain which software (including upgrades) is freely available or can be purchased on advantageous terms utilizing a University license (see Recommendation 12-6 above).

There is significant use of desktop publishing throughout the campus. Other than an informal users' group, there is no coordinated development, instruction, or support available to these users. Imaging and graphics are intimate components of desktop publishing and about 70 percent of the respondents stated that imaging and graphics are very important or important with about 35 percent expressing a need for better access to computer-based imaging and graphics.

Recommendation 12-9: The *ad hoc* desktop publishing users' group should be formalized and should be supported in the purchase and use of both hardware and software.

ADMINISTRATIVE AND GENERAL COMPUTING

The following administrative systems were reviewed as part of the Self-Study: Financial Resource System (FRS), Student Information Systems (SIS), Financial Aid Management System (FAMS), Human Resource System (HRS), Payroll Personnel System, Position Control System, Students Accounts Receivable (STAR), and electronic mail. The University's Strategic Plan for Information Systems was reviewed to assess if the planning process and the actual activities were consistent and compatible. Additional information was gathered during the visit to Ohio State University.

Major issues identified included a review of the applications of administrative systems, assessment of the hardware requirements to operate these applications, and evaluation of access to the systems and information by faculty and staff. The approach taken was to identify relevant issues related to administrative computing and to request pertinent information from hourly staff, administrative and professional staff, faculty and academic administration.

Communication via electronic mail is fast, effective, and convenient. About 70 percent of the faculty and administrative staff and 50 percent of the hourly staff feel that electronic mail is very important or somewhat important in their work. From interviews with computing personnel, it was established that electronic mail usage is increasing significantly with time.

Network access is perceived to be very important to all three groups. However, the difference between the need for access and the availability of access is great with administrative/professional and hourly staff. The University should intensify its efforts to provide access to the campus computing network (the "backbone") to all groups. In particular, individual access to the "backbone" should be available from offices, dormitories, and off-site locations and should not be cost prohibitive.

In addition to the access issue, a significant problem is the fragmentation of the electronic mail and administrative systems. For example, five primary electronic mail systems are currently in use: Wang Office, Bitnet, UUCP, CCMail at UKLANS, and IBM Profs. Communicating across mail systems (and sometimes within a system) or readily transferring from mail to other administrative systems can be difficult.

Recommendation 12-10: **The campus computing network must be maintained across campus for the provision and seamless integration of various types of electronic mail and administrative functions, e.g., Wang, Bitnet, UUCP, etc. Increased access to the network should be available from offices, dormitories, and off-site locations and should not be cost-prohibitive for any unit or user.**

PUBLIC SERVICE

The University's *Strategic Plan* states that "The University will exert a leadership role in addressing the issues and challenges facing the Commonwealth, the Nation, and the World." The stated objective is "Leading and promoting efforts to develop a statewide communication network which is essential to link the diverse and geographically dispersed constituencies within the Commonwealth with the services and facilities available through higher education." In this aspect of the analysis, the committee collected and analyzed relevant data for the purpose of determining how well the University's computing and communications units support the achievement of this goal and make recommendations for the future. For the purposes of this report, the current "Information Systems Strategic Plan to Support University of Kentucky Goals and Objectives" document has been used as a blueprint for addressing how well computing and communications services are meeting the needs of the non-campus community of users.

University communications is moving away from the use of telephone lines to the installation of more technologically sophisticated fiber optic networks to bring the University into a state-of-the-art computing and communications environment. Soon 14 T1 (1.54 Mb) lines will link all of the community colleges with the University campus in Lexington. Dial-in ports to access the T1 lines will provide improved access to the University and the Medical Center for many users (such as agricultural extension agents and regional hospitals). The first four of these lines, linking Paducah, Owensboro, Ashland, and Hazard Community Colleges with the University, are already functioning.

Very Small Aperture Technology (VSAT) is also being used to link remote sites with the University. VSAT permits full-duplex (two-way) communication, in contrast to traditional unidirectional satellite delivery. Live interactive communication and teleconferencing are being used to support educational programming. The use of "response pads" in distant settings helps to recreate the environment of the live classroom because participants can discuss issues, take tests, ask questions, etc. Incorporation of these new technologies into all of the University outreach and educational programs requires considerable retraining for current technical staff as well as for

faculty using them. Salary scales will have to be raised to parallel those in the private sector if qualified personnel familiar with "cutting-edge" technology are to be recruited and retained. University communications appears to be building a solid technological foundation for the support of a vast array of educational, research, and administrative applications.

However, there appears to be no central coordinated effort for realizing the maximum potential of the newest communication technology. Many campus departments, the University Extension Office, and various faculty with sophisticated communication demands outside the campus all appear to work independently and without a single forum to coordinate efforts or affect policy decisions. This division of labor arose in large part because Computing and Communications Services units have been unable to add enough resource personnel to cope with the vast and changing electronic landscape. Various faculty and campus departments were therefore forced to develop their own limited expertise in needed areas. While these separate and nonintegrated developments have affected all aspects of connectedness both on- and off-campus, they particularly have impeded efforts to serve external constituents.

In most cases, groups with similar needs manage to locate one another, often through the electronic networks themselves. One example of a group that formed to meet a specific communications and computing need is the Digital Equipment users group which coordinates the university DECnet services. These groups meet on an informal basis and often redefine and expand their scope to meet other related needs (such as negotiating site licenses for software and coordinating hardware purchases). This procedure could be formalized by having Informations Systems designate a resource person to "market" each new technology and provide instruction in its use.

A committee composed of representatives from various departments with off-campus interests might serve as a mechanism for increasing utilization of new technology, monitoring use, and evaluating its effectiveness. Such a committee would help meet the objective in the strategic plan for University Information Systems calling for "leadership and direction to University-wide instructional resource services, to insure that limited equipment, production and distribution services are utilized in the most effective nonduplicative manner" (p. 7). Committees serving certain narrowly defined communications and computing interests already exist, particularly in supercomputing. If high-speed communication needs continue to grow at the present rate, however, it seems likely that competition for resources will lead to the formation of a committee with coordinating responsibilities at some time in the future.

Another objective in the strategic planning document calls for the University to provide statewide access to its resources for State and local government agencies and local school districts, including research computing and library facilities. Dial-up ports are available for off-campus users and for the community college system to access the library system's online catalog (NOTIS). Locally-mounted databases such as ERIC (education) and MEDLINE will soon allow remote users to search for periodical articles as well as library holdings. Port use will be continually monitored to determine if off-campus users experience difficulties reaching the University's computing resources. Additionally, the impact of an increasing number of off-campus users searching locally mounted library databases will be examined carefully for possible degradation of service to the campus community.

Working with Kentucky Educational Television (KET), the University has developed a no-cost system for sending files across the state called "Kentucky ICI!", originally designed as a mechanism for the Mathematics and Computer Sciences Departments to support mathematical

science teachers across the state, this system can be used for similar purposes by any segment of the University. During the demonstration phase, 13 Mb/day of new data will be parsed into about 500 areas of interest. Files can be submitted to the system by electronic mail and disseminated across the state within a few hours. To receive information and educational materials at the remote end, a user tunes a decoding device to select items of interest. Full electronic mail is also part of the system, so that remote users can actively participate in information exchange.

The strategic planning document calls for the University to work with other educational institutions, KET, and State government to develop cooperative and joint distance learning programs, utilizing University services and facilities, to ensure education and professional enrichment programs are available throughout the Commonwealth. There is a strong University cabinet-level commitment to distance learning, according to members of a newly designated committee that includes representatives from the University Extension Office, Communications Services, and many others from across campus. The installation of all T1 lines will make the most sophisticated educational technology available throughout the state. The new technology was implemented in two courses for fourteen students in the Fall of 1990, while in the Spring of 1991, the number of students increased to 149 in eight courses. Satellite delivery, transmission of compressed video via the T1 lines, and computer-based instruction were all used for the new Distance Learning Program. Clearly, the University has taken a leadership role in bringing educational programming to all areas of the Commonwealth.

While the computing and communications services have made significant progress in meeting the University's public service mission, in the future efforts should be made to coordinate statewide nonacademic use of the facilities and services available. The academic use of computers and communications services is coordinated statewide in large part through EPSCoR research clusters. (EPSCoR originated as the National Science Foundation's Experimental Program to Stimulate Competitive Research and has expanded to NASA, EPA, and DOE.) Each EPSCoR research group contains members from colleges across the state, and the state's EPSCoR program is coordinated through an office at the University and at the Kentucky Science and Technology Commission. However, nonacademic users do not have such easy access to the facilities. Ohio State University has a supercomputer users group that includes industrial users and meets bimonthly to solicit opinions and to keep this group abreast of the latest changes. When supercomputing at the University of Kentucky begins to develop a base of nonacademic industrial users, a committee of these users should be formed in Lexington as well.

Recommendation 12-11: Communications Services should develop a forum for introducing new technology and promoting its instructional applications. A committee or user group composed of representatives from various departments with off-campus interests could serve as a means of disseminating information, monitoring use, and evaluating effectiveness.

Recommendation 12-12: The remaining proposed T-1 lines should be installed at the earliest opportunity to build on the current technological foundation and broaden the University's support of both educational and the nonacademic programs throughout the state.

SUMMARY AND CONCLUSIONS

Significant progress has been made in the computing environment at the University of Kentucky in the past decade as can be evidenced by a comparison of the findings of this Committee and the report of the 1982 self-study. Indeed, it must be noted that there is a general feeling of satisfaction with the facilities and directions in computing and communications. This report clearly indicates that at this time each of the "must" statements which relate to the Criteria for Accreditation are well-satisfied. The concerns expressed in this report are of an entirely different nature from those expressed in the past. They primarily reflect concern that the promise of the progress made over the past decade be realized and direction and momentum be sustained.

Improvements are still needed in developing a "seamless" local area network for communication and administrative services and in providing for access to that network and for a forum to introduce and provide instruction concerning new technology and its application. Also, more use of site licenses of standard software is encouraged.