VISION '99

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Prepared by
the Office of the Associate Vice President
Computing and Information Technology
State University of New York at Buffalo
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Preface

"There is nothing wrong with change if it is in the right direction."

Winston Churchill

Information Technology (IT) already plays a part in much that happens at our university. Every indication is that its presence and influence will significantly increase in the next decade. To make the best use of its potential and to effectively manage its challenges, we must plan. This document is the product of a planning effort conducted by the Associate Vice President for Computing and Information Technology (CIT) and his senior staff. It is meant to stimulate discussion. We hope to start a dialogue which will guide us into the future. If you study or work at the University at Buffalo, we encourage your participation.

VISION '99 begins with our speculation about the future, looking ahead to 1999. We try to describe how IT will be part of the overall environment of the University; the ways in which student and faculty life will be affected; and the changes coming to the work of administrators and staff. Our focus is on the people we serve. We then move on to a discussion of some broad issues regarding shared responsibility we think are important to all of this, then to a proposed action plan and a resource plan based on the action plan.

While preparing VISION '99, we have been guided by the University's mission and by recent statements of the President and the Provost which set the course for the future. IT is only useful and important to the extent that it serves the goals of the University and meets the needs of its students and faculty. Without effective use of IT those goals cannot be achieved, those needs cannot be satisfied. Our intent is to plan for success.
The Vision in Brief
The Vision in Brief

Effective deployment and use of information technology (IT) is an essential element of the University's capacity to fulfill its mission and realize the vision for its future articulated by the President, the Provost, and others. IT is, increasingly, integral to the creation and sharing of knowledge, the vitality of the classroom experience, the conduct of business, and the facility of communications in general.

IT services and resources at the University have in the past been primarily acquired and provided by Computing and Information Technology (CIT) and its predecessor organizations. Until the late 1980's, steadily mounting demand for IT services and funding for CIT maintained a balance. Since then, dramatically expedited growth in that demand--resulting in large part from the availability of cost efficient, readily usable microcomputers and the relative ease with which those microcomputers communicate with each other and server computers--has coincided with declining CIT budgets. The consequence has been a widening gap between unmet IT needs and CIT's capacity to respond.

Arriving at an accelerating pace, changes in IT of unprecedented scope have become the norm and will persist well into the future. The advance of IT is driven by several factors:

• the development of enabling technologies, ceaselessly introducing an abundance of potentially useful resources and capabilities;

• the progressively more favorable cost and value of IT, gained from the economies of scale and the rigors of market competition, regularly presenting new options and opportunities;

• widespread adaptation to IT, fueled by education and necessity, creating ever more demand for improved ways of working and communicating;

• governmental actions and national initiatives, such as the emerging realization of an ubiquitous international information network, irremediably altering the inventory of skills and instruments individuals and institutions must have to succeed.

Several developments, in particular, have far-reaching implications:

• networks linking individuals to other individuals, to a sprawling array of computers, and to a vast assortment of information resources, institutions, and services all over the world;

• the dissemination of access to data and to information derived from data to an extent never before possible;
the emerging value of IT as an instrument for instruction and its already unquestioned primacy in the performance of research;

growing recognition and demand for the considerable benefits of IT to student life and to the conduct of University business.

An IT planning mechanism and infrastructure capable of capitalizing on change and flexible enough to be, itself, changed when necessary must be devised. As in most matters of institutional gravity in the late twentieth century, the distinction between success and failure may reside in our preparedness for change.

VISION '99 addresses the IT needs of the University as a whole and offers an approach to ensure the University's ability to plan for and respond effectively to change in IT. It maps an important, central role for CIT, but compels involvement of the entire University community. That involvement will comprise distribution of responsibility for planning, funding, and operating many IT endeavors. Shared responsibility is critical to the University's ability to assimilate and profit from the rapidly expanding range and diversity of IT.

The University's total annual investment in IT must and will gradually increase in five years, by at least 50% over the current level, from approximately $20 million to $30 million or more (in 1994 dollars), in order to respond adequately to institutional demand. Conversely, with most growth occurring in distributed resources, base budget funding for CIT will not increase in real terms in the coming years. In the end, IT investment will be divided between CIT and the University community, striking an even balance—in funding and in staff.

CIT's funding has its basis in a complex of recognized need and purpose; the funding to support incremental IT investments beyond current levels does not. Addressing the disparity between CIT's budget and the University's IT needs, VISION '99 proposes a strategy comprised of:

•distribution of, at least, some operational and financial responsibility for selected activities of the University's IT enterprise to the entities benefitted by those activities;

•significant growth of IT support and capacity at the unit level;

•formation, as needed or desired, of partnership arrangements between CIT and concerned parties to advance narrowly focused or special interest IT activities;

•evolution, as appropriate, of the CIT service profile and organization to meet the changing IT needs of the University and to empower, to the greatest extent possible, the end users of IT;

•development of unit-based IT plans and funding strategies, stating objectives and outlining investment requirements;
• accelerated deployment of IT capabilities in support of teaching and learning.

Responsibility for management of key IT resources, such as data and information processing capability, will migrate to the users of those resources, who will also progressively assume responsibility for operational support of unit-based computing and data communications facilities. CIT will be responsible for the shared IT infrastructure, expert technical consultation and operational support services, specialized training, and facilitation of long-term IT planning efforts representative of the entire University community. All of this represents not so much a transformation as an evolution to a broadbased, highly responsive IT enterprise which fosters independence and entrepreneurial ingenuity.
The Future
The Future

A Vision for the University

Students and faculty, especially new faculty, are progressively more comfortable, literate, and committed to IT. The most powerful possible response to that commitment is to enable fulfillment of its promise. IT will, inevitably, become integral to the composition of University life, having, perhaps, its most dramatic impact in teaching and learning. VISION '99 addresses the IT needs of the University as a whole. It maps an important, central role for CIT, but compels involvement of the entire University community. That involvement will comprise distribution of responsibility for planning, funding, and operating many IT endeavors. Shared responsibility is critical to the University's ability to assimilate and profit from the rapidly expanding range and diversity of IT.

In our university, as well as in others, rising student and faculty expectations nurtured by awareness and speculation about IT products and services--both present and predicted--demand the attention of administrators and planners. Those expectations range from the concrete--access to raw computing power, for example--to the more abstract--access to knowledge. The common denominator is "access" in the least restrictive sense: access to computing and communications, access to data and information, access to the full spectrum of IT services and resources. With sustained effort, characterized by initiative and resourcefulness and based on strategic resource investments (outlined in the VISION '99 proposed resource plan), significant progress toward meeting those expectations will be made. CIT will actively encourage, offer its services to, and work closely with interested and concerned academic and administrative entities seeking to address these issues. In each of four domains requiring our most urgent consideration--student services and systems, instruction, research and scholarship, and administrative support--it is possible to offer reasonable projections of the benefits attainable from well placed, effectively managed investments in IT.

Student Services and Systems

Students want and increasingly need independent, direct, easily used access to information about themselves and about their progress in their studies as recorded and kept by the University. They should be able to view any and all of the information at will, and they should be able to update much of the information without the intervention of others. Faculty and students will be endowed with greater independence through a suite of "self-help" facilities encompassing aspects of registration, advisement, admission to majors, libraries, grading, transcripts, career planning and placement, probation oversight, student accounts, University events, and other services:
• students will have direct access--via secure, interactive interfaces, such as on-campus kiosks--to their demographic data, transcripts, and accounts, including tuition, library, telephone, and parking charges;

• voice response (touchtone) services will offer convenient, easily used interfaces to course registration, grade reporting, transcript requests, student account inquiries, student elections, and events bulletin boards;

• a SUNY-wide universal identification card will enable efficient and secured access to libraries, parking lots, dining facilities, University events and buildings, banking services, and other goods and services;

• direct lending will facilitate the awarding of financial aid by electronically linking the University with the Federal government, guarantee agencies, and other appropriate entities;

• a degree audit system will support and assist advisement and inform student course selection, while predicting course loads;

• faculty will be empowered to submit and audit grades, offer advisement, and obtain other appropriate student information online--without third party intervention;

• WINGS, the University's campus wide information service, will widely disseminate announcements and news about meetings, lectures, clubs, movies, and sports and entertainment events;

• prospective students will have access via the Internet to the University's catalog, to prerecorded segments of lectures and workshops, video samples of campus life, and electronic mail communications with faculty and staff;

• transcripts and other coursework information for students applying to or graduated from the University will be electronically transmitted.

To accomplish this, it will be necessary in the near term to:

• identify and install secure interfaces for students to gain access to their own information;

• significantly improve the flow of information to and from students and faculty;

• evolve practices and procedures to empower direct student and faculty control of personal and purely academic information.

Instruction
The application of IT to teaching and learning has a long history of promise exceeding realization. Excessive costs coupled with inadequate software have impeded meaningful, lasting progress. However, recent and emerging factors--considerably lower costs, highly enhanced functionality, interactive graphics and multimedia capabilities, and, most important, much improved authoring software--have greatly enhanced the propensity to make beneficial use of educational technology.

Beyond its obvious applications to distance learning, self-paced study, and visual teaching aids, IT has the potential, when properly used, to fundamentally reinvigorate instruction, making it greatly more rewarding and productive for students and faculty, alike. In pursuit of that end, the University will:

• extend access to the data communications network to every office and dormitory room and even into classrooms, lecture halls, and laboratories;
• move forward quickly to plan and develop educational technology equipped classrooms and lecture halls (ETECs) until as many as forty-eight (48) are in service;
• deliver high definition video and image information to selected classrooms and lecture halls, employing state-of-the-art digital communications technology;
• increase the total number of public computing facilities' seats to 1,500;
• provide docking stations in public computing facilities to facilitate network communications via portable microcomputers carried by students and faculty;
• develop knowledgeable and skilled staff to support IT laboratories and to assist faculty in authoring educational technology courseware.

To accomplish this, it will be necessary in the near term to:

• enable access to the data communications network as needed, when needed, and where needed by all members of the University community, taking care to ensure equivalent capabilities for resident and non-resident students;
• project IT teaching and learning resources directly into classrooms, lecture halls, other public presentation spaces, and dormitories;
• enhance the capabilities and improve the quality of public computing facilities.

Research and Scholarship
It is no longer credible to contemplate most research and scholarly pursuits without reliance on, at least, some IT services and resources. Microcomputers and workstations, endowed with powerful capabilities, are the most visible and pervasive manifestation of IT. The capabilities they offer include complex modeling, scientific visualization, digital imaging technologies, and control of experiments and processes. Emerging technologies that can be applied to the design and execution of research include expert systems, heuristic systems, and fuzzy logic. Easily the most remarkable influence of IT on research and scholarship has resulted from the rapid emergence of an ubiquitous international information network, linking individuals to other individuals, to national centers of high performance/high capacity computing, and to a vast assortment of information resources, institutions, and services all over the world. This development has irremediably altered the inventory of skills and instruments individuals and institutions must have to succeed.

In the widely distributed, client/server environment of the near future, the University will be challenged by needs and demands for new and more resources and services. Some will be unit-based; some, particularly those considered elements of the University's IT infrastructure, will be developed and supported by CIT; many will derive from a complex of investments and allocated responsibilities; and the rest will issue from negotiated full partnership arrangements. Prominent examples of the various strategies for investment include:

• a fully connected campus-wide interbuilding network, installed and supported by CIT, with speeds, capacities, and privacy/security protections adequate to serve future data, video, image and document transfer requirements;

• a mix of CIT-funded and unit-based microcomputers, workstations, and server computers (for local networks, files and databases, and electronic mail), pervasively distributed throughout the campuses;

• local, intrabuilding networks, planned, installed, and technically supported by CIT, but administered by unit-based IT staff;

• knowledgeable, unit-based IT support staff helping to leverage the creativity and initiative of research faculty to an advanced level of productivity;

• core support, provided by CIT, in matters demanding intensive technical expertise;

• specialized or extraordinary IT resources, such as high performance, high capacity parallel processing systems, made possible by collaborative efforts between CIT and the entities expected to benefit from the joint ventures.

Administrative Support
Modern universities, like other large institutions and enterprises, have many and complex administrative support requirements. Without effective use of the capabilities of IT, those requirements cannot be adequately met. Given current funding constraints and competitive pressure, functionality, efficiency, and cost avoidance will be key determinants in the development of administrative support services. The University will make a commitment to a client/server-based model of operation, as an effective instrument to:

• continually improve business practices and processes, especially by reducing paperwork;

• enable unit-based online processing of most transactions, including payroll, purchasing, budget, and personnel appointments;

• replace current technologies, such as FAX transmissions, with more advanced electronic document transfer methods;

• foster the predominance of electronic mail for almost all written communications;

• create an environment with seamless, synchronous views of data from many heterogeneous vantage points;

• empower end users of information systems with enhanced decision making competence through improved access to data for ad hoc analysis and reporting.

To accomplish these ends, new applications will be introduced in the near term:

• voice response (touchtone) services to offer convenient, easily used interfaces for University faculty and staff to inquire about and update selected personnel and payroll data;

• an alumni/development system to link the information and processes of central and decanal units, capacitating efforts to increase external support, particularly financial backing, of the University;

• an event scheduling system to provide a common database and methodology for planning and reserving University space;

• a space allocation modelling system to assist facility planners to optimize space utilization when designing construction and remodelling projects;

• a client/server access facility to endow authorized users of electronically managed University information with greater flexibility, particularly in applying desktop software tools to centrally stored data;
• a comprehensive, shared online data dictionary and repository for business rules to facilitate data access and advance understanding of data structures and relationships;

• a network of interconnected databases of University affiliated organizations, such as the University at Buffalo Foundation and the Research Foundation of the State University of New York, will facilitate access to and management of information about financial (all funds) and personnel data.
Sharing the Responsibility

The Challenges

*IT* services and resources at the University have in the past been primarily acquired and provided by CIT and its predecessor organizations. Until the end of the 1987/88 fiscal year, funding for CIT was in balance with steadily mounting demand for *IT* services. Since then, CIT's funding has suffered annual reductions in its base allocations as a consequence of the economic recession's impact on state revenues. Emphasized by dramatically expedited growth in demand--resulting in large part from the ready availability of cost efficient, easily usable microcomputers and the relative ease with which those microcomputers communicate with each other and with server computers--a widening gap (illustrated in Chart 1) between unmet *IT* needs and CIT's capacity to respond has developed. If it continues, this mismatch between resources and needs will negatively affect the University's competitive posture.

Microcomputers empower their users by enabling unprecedented gains in personal productivity through software products and interfaces, such as word processing, spread sheets, database managers, and network communications. The pervasive presence of microcomputers and workstations has become the driving force behind the demand for *IT* services and resources. This, truly, is the actualization of a distributed *IT* enterprise. The University's ongoing investment in its data communications network underlines the impact and distributed character of *IT* activities.

The University community must recognize that its *IT* enterprise now has both a centralized and a distributed component. Responsibility for supporting *IT* services and resources must, correspondingly, be distributed to the University community. An appreciably greater share of that responsibility must be assumed by entities other than CIT. As this shift occurs over the next five years, CIT will be a strategic partner with all interested and affected parties.

As the University endeavors to develop from a primarily centralized to a distributed *IT* enterprise, these challenges must be confronted:

- planning for growth of *IT* technical support staff and base funding at the unit level;
- delimiting the division of responsibilities between CIT and other entities;
- instituting joint *IT* planning, involving CIT and the University community.
CHART 1

Note: This chart was external to the original Word Perfect document and is missing.
Planning for Growth

The University's current annual investment in IT is approximately $20 million, including $14 million in CIT expenditures. In five years, the aggregate amount is projected to be, at least, $30 million annually, with the increase funded by a variety of mechanisms, including reallocations of resources at the unit level, new funding through SUNY’s Educational Technology and Graduate Research Initiatives, and other funding from sources external to the University. It is expected that CIT funding will not be increased beyond the level of FY 94/95. (The bases and details of these forecasts are presented in the section of VISION ’99 entitled "A Proposed Resource Plan." ) In the next five years:

• the number of distributed support staff primarily dedicated to supporting IT will nearly triple--from 40 to 120, in round numbers;

• organizational unit budgets specifically designated to support IT activities will be formally recognized and will grow to more than $2.5 million, not including salaries and hardware acquisition costs;

• the University will purchase additional microcomputers and workstations, bringing the total to a steady state working level of 8,000 (a very conservative estimate which may have to be adjusted upward by as much as 25%), with each having to be replaced every four years;

• entities other than CIT will spend $2.5 million annually on servers, unit-based computers, and other specialized IT equipment.

Delimiting Responsibilities

Decentralization and concomitant expansion of the University's IT enterprise necessarily involves reallocation of responsibilities as well--within CIT and between CIT and the University community. The one-time and recurring costs and staff commitments assumed to acquire and support IT resources and services will be shared by many entities. It is unlikely any single entity will deem it cost efficient to maintain the span and depth of services available from CIT.

As IT becomes widely distributed, the University will be challenged by increasing investment and support obligations. With the exception of units that have already assumed some IT responsibilities, a majority of the University community has presumed that CIT will be the continuing source of IT services and resources. Limits on resources allocated to CIT make dependence on such expectations unrealistic. Investment in and support of the University's IT enterprise must be fully shared, eventually on an equal basis, with CIT.
The delimitation between the contribution made by CIT and that made by the University community must be explicitly articulated and well and widely understood. The distribution of IT responsibilities--like the distribution of IT itself--will assume critical importance in strategic and budget planning. CIT will work with the University community to negotiate and establish guidelines and points of demarcation which are clear, useful, and flexible enough to respond to the changing nature of IT--regarding both its economics and its enabling technologies.

CIT will, over time, define and make widely known base service levels for the full spectrum of IT activities in which the University is engaged. Services which fall within the established range will be provided by CIT as a fundamental resource to the entire University community. For services outside that range, discrete arrangements will be negotiated which may involve partnerships with CIT, independent ventures by specific organizational entities, contracts with third party vendors, or a mix of relationships. By this means, responses to demand which would otherwise be unmet or forestalled could be devised, if concerned parties were able to identify needed supporting resources.

The base service level would be supported by CIT funding. The difference between that service level and actual demand--the gap referred to earlier--would be supported by other sources of funding. This transition will be made gradually in order to enable the University community to adjust without serious dislocations of ongoing IT enterprises. In the end, CIT will be offering those services it is best positioned and most cost efficiently able to provide; and mechanisms will be in place to enable the deployment of extraordinary IT services as needed, if supporting resources can be identified.

Four service class distinctions and associated criteria will guide the delimitation of responsibilities in the future:

• CIT Centralized Services (CIT-based funding)

CIT will continue to provide resources and services which are essential and clearly central in nature, such as the fully shared data communications infrastructure; computing facilities serving the entire University community; technical administration of engineering and software support functions which are not appropriately distributed, including network management, security, central data stores management, support for development and maintenance of administrative applications software serving broad sectors of the University community, and ETEC design and maintenance.

• CIT Central Support for Distributed IT Activities (CIT-base funding)

CIT will provide those central support services (especially those demanding intensive technical expertise) to the distributed IT enterprise which would not, or could not, be reasonably, effectively, or cost efficiently assumed by local entities, such as core technical support; identification, testing, and recommendation of hardware and software which potentially could be deployed widely in the University; interoperability; technical support for long-term planning efforts; articulation of campus-wide technical standards; UNIX system planning and
installation; UNIX operating system support; UNIX server data backup; local area network (LAN) planning and installation; LAN operating system support.

• **IT Support Distributed to the University Community (unit-based funding)**

The University community will assume responsibility for those IT activities commonly, repetitively, pervasively or routinely performed throughout the distributed enterprise, such as microcomputer hardware and software installation and support; client administrative applications development and maintenance; distributed UNIX computing platform applications installation and support; LAN management; LAN server data backup; and IT training.

Activities in this service class can be configured in two ways--

☑ units may elect to assume all support by maintaining an appropriately sized and trained staff, or

☑ units may enter into cooperative cost sharing arrangements in which CIT provides some or all of the support.

• **CIT Services Obtainable on a Cost Recovery Basis (unit-based funding)**

CIT will offer on a cost recovery basis a limited suite of cost efficient and convenient services which will be available only so long as demand from the University community warrants their continuance. Those services will include computer equipment repair, non-instructional art and photographic services, non-instructional media services, and microcomputer workshops.

Some possible specific demarcations attainable in the future are:

• development and maintenance of the backbone infrastructure supporting voice, data, and video communications would be the responsibility of CIT, while local needs would increasingly become a distributed responsibility;

• support of local IT needs--including purchasing and installing microcomputer equipment and software, configuring and managing LANs--would increasingly become a distributed responsibility;

• CIT would fully support public computing facilities, partnership arrangements would cover departmental facilities, and departments would solely support specialized facilities;

• repair of computer and ETEC equipment in public instructional facilities would be funded by CIT, while the cost of repairs of departmentally owned equipment would be fully recharged;
• while CIT would continue to provide technical backup services in support of local area networks (LANs) and UNIX workstations, departmental staff would be encouraged and assisted to assume a progressively greater share of such responsibilities;

• administrative systems development and support would be done in partnership ventures, to be demonstrated in pilot projects in the immediate future.

**Joint Planning**

As the University's IT enterprise diversifies and becomes more complex, joint planning and open communications' links will be critical to enabling proactive responses to emerging needs (in preference to reactive crisis intervention). Appropriate organizational entities should be defined to effect desirable resource balances and to guide University decision making regarding IT. Those entities could address issues such as:

• changing usage patterns of CIT provided services and the consequent effects;

• anticipating and planning for local demand for extraordinary data communications or computing capacity;

• balancing the ratio of CIT technical support staff to distributed technical support staff.

**Summary**

Responsibility for some IT services and resources will migrate to the users of those services and resources. CIT will be responsible for the shared IT infrastructure, expert technical consultation and operational support services, specialized training, and facilitation of long-term IT planning efforts representative of the entire University community. Support for the growing presence of distributed IT activities will be accommodated by the University community--circumstantially as warranted or as deemed germane to academic missions and business exigencies.
A Proposed Action Plan
A Proposed Action Plan

Goals

The University Community

*IT* at the University has evolved from a strongly central perspective. In a natural concordance with the emerging computer era, CIT and its predecessor organizations developed a central *IT* service organization featuring batch and timesharing computing and, more recently, a campus-wide network. Driven by University funding practices, centralized approaches to institutional services were favored. Attention to the development of decentralized support was of secondary importance; instead, the emphasis was, and to a large extent still is, on faculty development. Consequently, the University is not well positioned to rapidly and productively exploit the inherent powers of distributed *IT*. The University must take decisive and proactive steps to build *IT* support capabilities throughout its academic and administrative enterprise. Development of unit-based *IT* plans, stating objectives and outlining investment requirements is particularly critical. Such plans will comprise:

- precise statements of *IT* needs;
- time-delimited, intermediate milestones by which final objectives will be attained;
- resource estimates, including investment in assets, unit-based staffing, training, and maintenance costs;
- proposals for sharing resources and technical support responsibilities and expenses with CIT or other entities.

Planning to address these issues has been undertaken by the Office of the Provost in conjunction with the Deans' Offices. Similar planning initiatives need to begin in the other Vice Presidents' Offices.

*CIT*

In the next five years, CIT will dedicate substantial resources to actualizing—in partnership with the University community—an *IT* environment which enhances teaching and learning and removes obstacles to and extends the boundaries of intellectual explorations. *IT* literacy and connectivity to a vigorous, diverse *IT* infrastructure are increasingly integral to the creation and sharing of knowledge, the vitality of the classroom experience, the conduct of administrative activities, and the facility of communications in general. In support of University goals, CIT will in the next five years:
shift from monolithic central computing platforms to distributed alternative platforms accessible through an ubiquitous network environment;

enable and advance--in close collaboration with the University community--the propagation and use of distributed computing and communications facilities;

project--directly into classrooms, public facilities, and dormitories--IT teaching and learning resources.

facilitate broadly propagated and dramatically improved access to data and to information derived from data for all members of the University community;

support development of the business processes and practices of the University in order to reduce paperwork and best make use of the capabilities made available by IT.

The IBM and DEC academic computing facilities currently available through CIT are becoming cost inefficient, are falling behind the curve of technology, and will be replaced by open systems UNIX-based computing platforms. For most purposes, improved utility and productivity can be obtained from alternative platforms with better price performance. CIT will work closely with users of central computing to facilitate their shift to UNIX-based environments. Every effort will be made to meet the needs--locally or elsewhere--of those few users who require extraordinary capacities.

Enabling and advancing--in partnership with academic departments--more dynamic and competent teaching environments, CIT will continue to offer expert guidance and assistance to project IT into teaching and learning activities via ETECs, instructional software, public computing facilities, network connectivity in dormitories, and other appropriate facilities, tools and resources.

CIT expects that within five years administrative computing at the University will be effected not on a mainframe computer, but on more cost efficient platforms distributed both centrally and locally in a client/server environment. This new environment will enable the University community to participate more fully in the development and support of administrative systems. In the nearer term, substantial savings attained by de-emphasizing central computing solutions, by selectively implementing new applications in client/server configurations, and by shifting some of the centralized computing load to distributed systems will be freed for investment in other IT resources.

In general, gradual conversion to client/server computing will enable the University to capitalize on savings that may be realized from deploying less costly platforms as alternatives to the IBM mainframe.

CIT is committed to making data and information derived from data more readily and easily available to administrative systems users by placing the means by which data are stored and processed under the control of those who use the information derived from that data in the fulfillment of their responsibilities. The scope of access envisioned is integral to the coming empowerment of faculty,
students, and staff, who require it for making decisions and for acting effectively to advance the mission of and promote the best interests of the University. Due and appropriate attention and resources must be devoted to issues and concerns regarding security and control, but only in the context of granting access as needed and to an extent acceptable within the constraints of governing legislation, confidentiality, and practicality.

Alternative platforms, running UNIX operating systems on reduced instruction set computer (RISC) architectures, offer substantially improved price performance and the flexibility and portability associated with open systems (non-proprietary) implementations. In contrast to all-purpose mainframes in which concurrent tasks (such as interactive timesharing, batch processing, electronic mail, and data communications services) are locked in competition for resources, multiple, discrete computing platforms with dedicated purposes can be configured to avoid performance-degrading conflicts by optimally distributing disparate functions.

To meet the challenges presented by emerging changes and needs, CIT will position itself as a provider and enabler--through collaboration with departmental staff--of distributed technical support services for a decentralized IT enterprise. CIT has extensive experience working in close partnership with departmental staff, distributing responsibilities and costs in varying ways. Core services will change only in regard to the specific technical environments supported. CIT will:

• provide technical expertise to support the migration from proprietary, central computing platforms to more distributed, flexible open systems platforms;

• support "logical" interfaces to University wide network services;

• advance a gradual shift of responsibility for technical support of distributed IT resources and services;

• enable core technical support of University business process reengineering.

The technical issues attendant to selecting, installing, and supporting computer platforms are many and complex. CIT will allocate significant support resources to the shift of computing from the IBM and DEC computing facilities to alternative platforms and will present a comprehensive migration plan to the University community during the 94/95 academic year. CIT will continue to provide expert guidance on hardware and software technical matters, ongoing operating systems support and assistance, and network interface services support.

A manifestation of the growth of distributed computing is the proliferation of LANs. Distributed computing and LANs present many opportunities as well as risks. To assist distributed technical support staff in dealing with the staggering diversity of products and options available, CIT will endeavor to be the definitive information resource for the University in technical matters regarding alternative computing platforms, operating systems, LANs, and network interfaces. CIT support for LANs will continue to comprise contractually agreed upon installation and maintenance services,
expert technical problem diagnosis and resolution, standards setting activities, and support for public computing sites and instructional facilities. As departments become more independent in their IT ventures, it will nonetheless be necessary for technical services to be available as needed from CIT. Such services will be offered in a variety of configurations, negotiated in partnership arrangements with University departments.

CIT will identify and test the technology supportive of departmental efforts to develop the business processes and practices of the University in order to reduce paperwork and, generally, to exploit IT capabilities. The departments, themselves, will lead in defining the functional requirements for improving business processes. A key to the success of such efforts is improved access to data and to information derived from data. Overcoming technical impediments and addressing security concerns, CIT will facilitate broader, more direct access to data through distributed computing platforms and via software interfaces conducive to ease of use and productivity. As in the case of distributed computing and LANs, the array of IT products purporting to enhance business efficiency and productivity is bewildering. CIT will assist in the selection and installation of office systems hardware and software. Again, such services will be offered in various partnership arrangements with University departments, depending upon need, resource availability, and departmental staff expertise.

As computing and data communications become a constituent element of the life of students, faculty, and staff, network services, already a very significant component of CIT, will grow into predominance. Deployment of a robust, extensive network is and will be compelled by the dissemination of access to data and to information derived from data to an extent never before possible. The four-year data communications plan begun in July, 1992, is no longer adequate. Driven by the breadth and utility of network-dependent services and the indispensable integration of those services in virtually every productive activity of the University, the need for increased access to and enhanced robustness of the network is rapidly becoming urgent. Inevitable developments like the near-term upgrade of the NYSERNET link to the Internet from T1 (1.544 Mbps) to T3 (45 Mbps) bandwidth will--over time--add to network traffic and contribute to the potential for congestion and unacceptably degraded performance. Consequently, it is necessary in the near future (no later than FY 95/96) to:

• accelerate the buildout schedule in order to respond to rising demand in a more timely manner;

• extend the scope of the current plan to include facilities not in the current schedule;

• upgrade network capacity to levels prescribed by standards of acceptable performance;

• add predictive network monitoring and management capabilities to ensure optimal utilization of resources and rapid resolution of problems;

• explore ways to make more efficient use of limited staff resources;
•seek innovative ways and means, including partnership arrangements, to distribute resource responsibilities.

Computer operations support will gradually shift from centrally located computers to shared, common services for an interconnected array of client/server platforms. Such services will include backup and recovery, archival storage and retrieval, contingency planning, performance monitoring and analysis, and emergency intervention.

Computer equipment repair will be offered by CIT for as long as the University community values the service from a cost, quality, and accessibility perspective. Currently, computer equipment repair includes IBM compatible microcomputers on a pilot basis. CIT proposes to shift the costs associated with this expanded service as well as with non-instructional equipment to the entities benefitted by the service.
Actions

The University Community

The University community must:

• steadily, and without weakening commitment, establish a strong, well trained distributed IT support staff—with a balanced mix between technical and semi-technical skills;

• develop a corps of departmental IT coordinators to function as liaisons with CIT and other sources of knowledge and ideas;

• launch an IT skills enhancement program for all professional staff;

• make plans to assume an increasing share of IT responsibilities;

• establish shared responsibility partnerships with CIT—or even assume responsibility for services historically provided only by CIT;

• build a funding base to support a distributed IT culture.

CIT

The broad goals articulated for the next five years must be translated into discrete actions charted to move the University's IT enterprise into the future—with minimal dislocation and with optimal benefit.

To initiate and concentrate the University's development of a carefully planned approach to implementing client/server technology, CIT proposes formation of a Client/Server Technologies Team, comprised of three (3) CIT staff members and two (2) staff members from University departments. Addressing the needs of both academic departments and administrative offices, the Team will investigate, evaluate, recommend, and facilitate implementation of client/server technology. Throughout its proposed two- or three-year tenure, the team will actively solicit involvement of appropriate University entities and will work closely with all interested parties. Its major goals and tasks will be to:

• select architecture, software, and open standards for client/server development;

• define the relationship between centralized and distributed IT responsibilities;
• identify and execute as demonstration projects several applications for client/server implementation;

• develop and actuate a plan and schedule for educating University technical support staff in client/server technology.

To enable and support the University's gradual move from central to distributed computing in a client/server environment, CIT will:

• plan the migration from the IBM and DEC central computing facilities to more cost efficient platforms, configured with highly portable, open systems (non-proprietary) UNIX-based software;

• work closely with academic users of central computing to facilitate their move from the IBM mainframe by Fall 1995 and from the DEC OpenVMS Cluster by Fall 1997;

• explore the viability of open systems RISC/UNIX technologies to replace the IBM mainframe as platforms for administrative systems;

• evolve and refine the SUN Cluster UNIX timesharing and batch environments into a high quality operational support model;

• reengineer the UNIX file system to construct a technological context which can be scaled to local requirements;

• add UNIX computing capacity to the IT infrastructure in partnership with the University community.

To enable and advance the propagation and use of distributed computing and communications facilities, CIT will work with the University community to:

• identify and implement electronic mail servers to better serve the entire University community and to offload the IBM and DEC central platforms;

• plan, implement, and maintain public and departmental computing and communications facilities for students and faculty;

• guide and assist distributed technical support staff in developing services and resources designed to meet special or extraordinary needs;

• actively pursue the aggressive resale program, UBMicro, making desktop IT resources available to students, faculty, and staff.
IBM Mainframe Replacement Target Dates

Objective
• Replace the IBM mainframe with alternative platforms.
• Distribute workload to separately managed environments.
• Move in direction of client/server implementation.

Plan
• Summer 1995: Selected administrative systems move to Oracle-based servers
  (DARS, Financial Aid, Schedule 25).
  Data access enabled from Oracle-based servers.
• Summer 1996: Move academic timesharing to UNIX server.
  Begin moving business applications to Oracle-based servers.
  Begin testing transaction processing on UNIX/CICS @ TCP/IP.
• Summer 1997: Move BISON to UNIX-based client/server implementation.
  Move academic batch processing to UNIX servers.
• Winter 1997/98: Replace IBM mainframe with downsized MVS platform.
  Move remaining Student Systems to new MVS platform.
• Summer 2000: Phase out MVS.

OpenVMS Cluster Replacement Target Dates

Objective
• Consolidate central academic computing on single platform.
• Locate applications/functions on right sized client/server platforms.
• Reduce support load of complex platforms for majority of users.
• Provide software rich environment for research and scientific users.

Plan
• Summer 1995: Establish campus email server for distributed clients on all platforms.
  Upgrade UNIX cluster to newer technology.
  Complete installation of full software environment on UNIX cluster.
• Summer 1996: Enhance UNIX timesharing and batch capacity to absorb new interactive users.
  Begin to restrict addition of new OpenVMS users.
  Remove VAX from OpenVMS cluster.
• Spring 1997: Install new UNIX cluster sized to absorb new users.
• Fall 1997: Phase out OpenVMS as academic computing platform.
To project--directly into classrooms, public facilities, and dormitories--**IT** teaching and learning resources, CIT will:

- plan, install, and maintain new educational technology classrooms for inclusion in centrally scheduled instruction;
- enter into partnership arrangements to develop departmental educational technology equipped teaching and learning spaces;
- organize and foster the Learning Technologies Program to encourage and empower faculty acceptance and transference of **IT** into the classroom;
- infuse contemporary computer design and visualization capabilities into CIT's creative services, and integrate electrophotography and desktop video services into presentation materials production.

To empower independence and self-sufficiency by administrative systems users, CIT will:

- initiate at least one (1) administrative systems project per year to be completed in full partnership with the intended users of the application--beginning with the Payroll Office;
- identify impending, new administrative systems--such as course/classroom scheduling (Schedule 25) and degree audit (DARS)--to be implemented on alternative platforms.

To overcome impediments to departmental computing imposed by the complexity, scale, and relative inaccessibility of the mainframe database, CIT will:

- install and regularly refresh an Oracle copy of the DATACOM administrative database to be made available this year on the IBM mainframe and within one (1) year on an alternative platform;
- identify appropriate software interfaces conducive to ease of use and productivity that enable and facilitate access to Oracle and other distributed data sources, beginning with all funds budget information (STARS);

To reduce paperwork and promote efficiency and productivity, CIT will:

- lay the foundation for a partnership approach to systematically improving the business processes of the University;
- coordinate the ingenuity and innovative ideas available in the University community to broadly enhance administrative systems support.

To support distributed computing and LANs, CIT will:
•intensify the focus on UNIX/Oracle/LAN configurations for administrative systems;

•test and plan for the introduction of Novell Netware (the University's LAN management software of choice) over TCP/IP (the University's communications protocol of choice).

To deploy a robust, extensive network at a rate responsive to the needs and demands of the University community, CIT will:

•accelerate the current buildout schedule--increasing from 80 to as much as 130 installations per month--by adding core engineering staff and by entering into cost sharing partnerships augmented by funding from the Office of the Provost;

•recommend extending the scope of the current plan by over 30%--increasing from approximately 6,000 to a revised goal of 8,000 new connections--to include additional facilities;

•if justified by analyses of network utilization by resident students, recommend extending the scope of the current plan to include the dormitories;

•make upgrades--particularly to some network traffic control components and to intrabuilding infrastructure segments--to ensure maintenance of prescribed standards of acceptable performance by selectively increasing the performance of the fiber optic backbone from 100 Mbps to the gigabit level and the capacity of riser systems from 10 Mbps to 100 Mbps;

•accommodate a spectrum of partnership arrangements, including direct purchase of services and resources, shared responsibility agreements, and wholly independent departmental enterprises.

To properly support the network and to better ensure the reliability of service it delivers, CIT will:

•select and plan to acquire, install, and make effective use of comprehensive network monitoring, analysis, and management software, enabling preemptive, rather than reactive responses to developing performance problems.
A Proposed Resource Plan
A Proposed Resource Plan

Overview

This proposed resource plan addresses in specific terms the IT requirements of CIT. The focus is on shaping CIT’s resource utilization to make it an effective partner in the evolving central/distributed IT culture of the entire University. It is delineated at a level of detail correspondent to the proposed action plan.

The Five-Year Plan Estimate for CIT’s resource requirements which follows is preliminary and is intended to serve the limited purpose of calibrating the validity of the assumptions against the vision and the proposed action plan. This preliminary resource plan distributes all CIT expenditures over ten program areas, selected to illustrate how funding obligations are likely to change in the next five years and to guide examination of reallocation options. It also serves the purpose of stimulating discussion about the very critical matter of resource planning.

The cost figures referred to in this section are relatively reliable for FY 94/95. However, for later years they should be considered increasingly approximate and subject to change.

General Assumptions and Long Range Trends

The assumptions underlying this resource plan are:

• The total annual University IT investment will grow within the next five years from the present $20 million to $30 million (in 1994 dollars);

• University community IT activities will become widely distributed, in five years consuming approximately 50% of total IT expenditures, while CIT resource requirements will constitute the other 50%;

• CIT will evolve its service profile to support essential infrastructure and core functions, while simultaneously determining effective ways to support the distributed IT activities of the University community;

• CIT base funding will not increase in real terms after FY 94/95;

• CIT staff will be held at present levels for the years immediately ahead.
Chart 2 shows how staffing growth is expected to evolve over the next five years to achieve a more even balance between central and distributed activities. Stimulating such staff growth is critical to realizing the vision articulated in VISION '99. That growth must be advanced by the uncompromising commitment of the entire University community.

Chart 3 suggests how combined PSR and OTPS resources must grow over the next five years. Visible evidence already exists of the highly distributed presence of the microcomputer and associated peripheral equipment. However, significant increases in equipment outlay and software ownership will be required to support the various goals set forth in VISION '99. More equipment is needed—equipment capable of performing current tasks—and the ongoing requirement to maintain and periodically replace or upgrade existing equipment must be effectively addressed. Chart 3 also envisions a rapid growth of IT equipment needed to support the University's growing research enterprise.

The objectives of this resource plan for shaping the future of CIT base funding and the internal allocations to support a multi-faceted service profile are to:

• contain or reduce expenditures in major cost areas—by migration to lower cost hardware alternatives;

• shift the orientation of CIT from that of principal IT service provider to that of predominantly central support for distributed IT activities;

• target a number of service areas for a shift of financial responsibility via options for cost recovery of services rendered by CIT central support, as in computer equipment repair;

• define the use of bridge funding provided for FY 94/95 to achieve financial goals in the following years of the five-year plan.

Chart 4 shows how University expenditures could evolve in the next five years to attain a $10 million increase in IT investment.

Chart 5 suggests a model for the development of resources accompanying increased IT investment.

Five-year Plan Estimate of OTPS Obligations and Re-Allocation Options

Chart 6 is an overview of envisioned OTPS expenditures in all CIT service areas. Expenditures for FY 93/94 are based on actual accounts, while expenditures for each of the next five years have been derived from a detailed analysis of projected hardware and software costs as driven by the action plan outlined in VISION '99.
Note: These charts were external to the Word Perfect document and are missing.
An examination of the five-year projection suggests some preliminary conclusions:

- OTPS funding requirements will peak in FY 94/95;
- one-time bridge funding in the amount of $550,000 (without which other elements of this plan cannot be effected or will be delayed at considerable long-term cost) has been allocated through the University's financial plan for FY 94/95;
- opportunities for reallocation or redirection of CIT funding will develop—including, for example, to support increased investment in network infrastructure, management, and support.

Chart 7 merges information from Charts 2-6, offering an University-wide overview of estimated IT expenditures in the present year contrasted with a five-year projection.

**Focus Areas**

A number of service areas are envisioned to undergo significant transformations in the nature and level at which service is provided. The changes planned will give CIT the flexibility to achieve internal reallocations consistent with a shift in emphasis toward central support for distributed IT activities.

**Focus on IBM Mainframe Downsizing**

One of the major goals of the five-year plan is reduction of the high cost of supporting the IBM mainframe. In FY 93/94 and 94/95, IBM mainframe-related OTPS expenditures are approximately $2.3 million. The biggest component is a $1.08 million payment to finance purchase of the hardware. Significant savings can be achieved through downsizing. The action plan outlines a shift of existing workload to alternative platforms and replacement of the mainframe during the 97/98 academic year. Approximately $200,000 of the bridge funding in FY 94/95 will be used to start developing alternative platforms for both academic and administrative computing. A decline of $750,000 in annual IBM mainframe-related expenditures can be realized in FY 95/96 and subsequent years.
Note: This chart was external to the Word Perfect document and is missing.
Focus on OpenVMS Migration to UNIX

A second major area targeted for reduction and alternative platform migration is the OpenVMS cluster (formerly known as the VAX cluster) to the growing UNIX environment. This is a key step to consolidation of the multiple platforms used for academic computing—IBM VM/CMS, DEC OpenVMS, and UNIX. It is not an elimination of workload, but a consolidation of two platforms into one. The goal is to have a robust UNIX-based central computing platform, appropriately sized and configured to support the rich variety of University academic computing needs. The shifting expenditure pattern for this plan effects an increase for FY 95/96 and following years.

It is important to note that UNIX will be the computing environment of choice for the University, both in central and in distributed settings. UNIX is a naturally evolving environment in which workstations, distributed servers, centralized batch and timesharing systems, and remotely located supercomputers function harmoniously together—supported by the developing University and global communications network. The CIT commitment to UNIX will be comprehensive, comprising a large UNIX computing platform developed centrally with network coupled and tightly coupled systems. Approximately $350,000 of the bridge funding in FY 94/95 will be used to start developing alternative platforms for academic computing. Planned growth of the central facility will be coordinated with expansion and proliferation of distributed facilities. It is expected that selected academic entities, especially those with major IT interests, will develop local discipline-focused UNIX resources.

Focus on Data Communications/Network Build-out Plan

Beginning with FY 92/93, the University endorsed and made commitments to a four-year plan to buildout data communications access facilities. Funded at $2.2 million per year, including a special $600,000 data fund generated by an all funds payroll-based assessment, the plan had a comprehensive, but limited, goal. Conceived two years ago in an atmosphere of reduced State funding, the limitations of the plan have had an adverse impact on the University by substantively impeding progress in essential IT development.

The extant four-year plan will remain operational through FY 94/95, despite its known shortcomings. The importance of bridge funding for development of alternative computing platforms, the need for more unit-based IT investment, and other exigencies currently preclude increased commitments to data communications buildout. However, the efficacy of the four-year plan will again be reviewed before FY 95/96. Given current trends in demand and technology, it can be assuredly anticipated that substantial amplification of the fourth year and addition of two (2) additional years will then be deemed necessary. In the interim, the Office of the Provost will subsidize accelerated installation of as many as fifty (50) additional connections per month for those units prepared to pay $100 per connection in batches of twenty (20) or more.
Before FY 95/96, CIT will propose urgently needed revisions of the plan to:

- further accelerate installation of Ethernet connections;
- increase total Ethernet connections from 6,000 to 8,000 (predicted level needed), with the additional 2,000 budgeted for years five (FY 96/97) and six (FY 97/98);
- elevate the network infrastructure from Ethernet capacity (10 Mbps) to 100 Mbps capacity or more, including
  - enhancing the capacity of the interbuilding infrastructure to support gigabit level bandwidth,
  - enhancing the capacity of the backbone-to-building infrastructure to support 100 Mbps bandwidth,
  - selectively upgrading intrabuilding subnetworks to support 100 Mbps bandwidth capacity;
- add predictive network monitoring and management capabilities, including staff, software, and some hardware upgrades;
- establish a robust network operations center.

The currently planned FY 94/95 budget will fund installation of approximately 1,200 data communications connections, of which 200-300 are expected to be relocations of existing ports as part of rehabilitation projects. Infrastructure improvements will include:

- completion of fiber optic cable installation to major academic and administrative buildings;
- installation and upgrades of network infrastructure components to improve performance and enable new subnetwork expansion;
- installation of 15 new subnetworks to allow attachment of additional buildings to the backbone and to alleviate congestion.

The plan does not make possible an increase in the connections installation rate or the provision of additional bandwidth for servers and workstations.
**Focus on Computer Equipment Repair**

The computer equipment repair program is envisioned to undergo an important transformation. Beginning with FY 94/95, CIT will limit its no-charge repair service to equipment and facilities operated by CIT and available to the University community at large. This includes all public computing facilities, ETECs and lecture halls, and public central and remote printing. All other University IT equipment and facilities will be eligible for CIT maintenance on a cost recovery basis. This program, when approved, will be phased in gradually by limiting its applicability to equipment purchased after July 1, 1994. The estimated recharge revenue of $200,000 per year to CIT will offload the repair program, and the savings will be available for redirection.

**Staff**

**The Current Picture**

CIT currently has a staff count of 190.75 FTE (including nine (9) vacancies), of which 148.75 are professional staff, while the remainder are classified staff. 177 are supported by the state operating budget, 12.75 are supported by IFRs, and 1 by RF funding. (These data are subject to minor changes.)

Internal reallocations of filled and vacant positions have been an important factor in shaping the current CIT staff profile. For example:

• reduced from a one-time high of twenty-eight (28) to the current level of fifteen (15), computer operator positions have been reallocated to support data communications installation and operations needs;

• data entry staff have been eliminated entirely, reduced from a one-time high of fourteen (14), many of the positions having been surrendered to address budget reductions over the years;

• many staff members have been retrained and are working in positions with substantially different descriptions from those they previously filled;

• opportunities for reallocation will continue to develop through turnover (at least six (6) retirements or resignations are expected in FY 94/95, alone).
Shaping the Profile

For the next five years, CIT expects to maintain its current staff level. However, should new and unanticipated University priorities mandate incremental CIT participation, upward adjustments may be necessary. Turnover will present important opportunities for reallocation from central to distributed support areas. Retraining of staff will be vigorously pursued, particularly in areas undergoing major transformations. Central support areas requiring additional staff will be UNIX user services and network operations and management. Distributed IT support areas requiring additional staff will be LANs and other network activities, UNIX workstations, end user computing, and public facilities. Additional staff will also be required for advancing and supporting educational technology, including:

- the Learning Technologies Pilot Program, supporting the development of technological tools for teaching and learning by funding selected faculty proposals;

- ongoing hardware and technical assistance support for the growing inventory of ETECs, which will eventually number forty-eight (48).

The challenge for CIT will be to address these staffing needs within the current envelope. Timing for internal reallocations is not predictable. Opportunities for redirection of the CIT staff base are not immediately evident. Future developments will alter the equation as distributed technical support staff resources in the University community are developed.