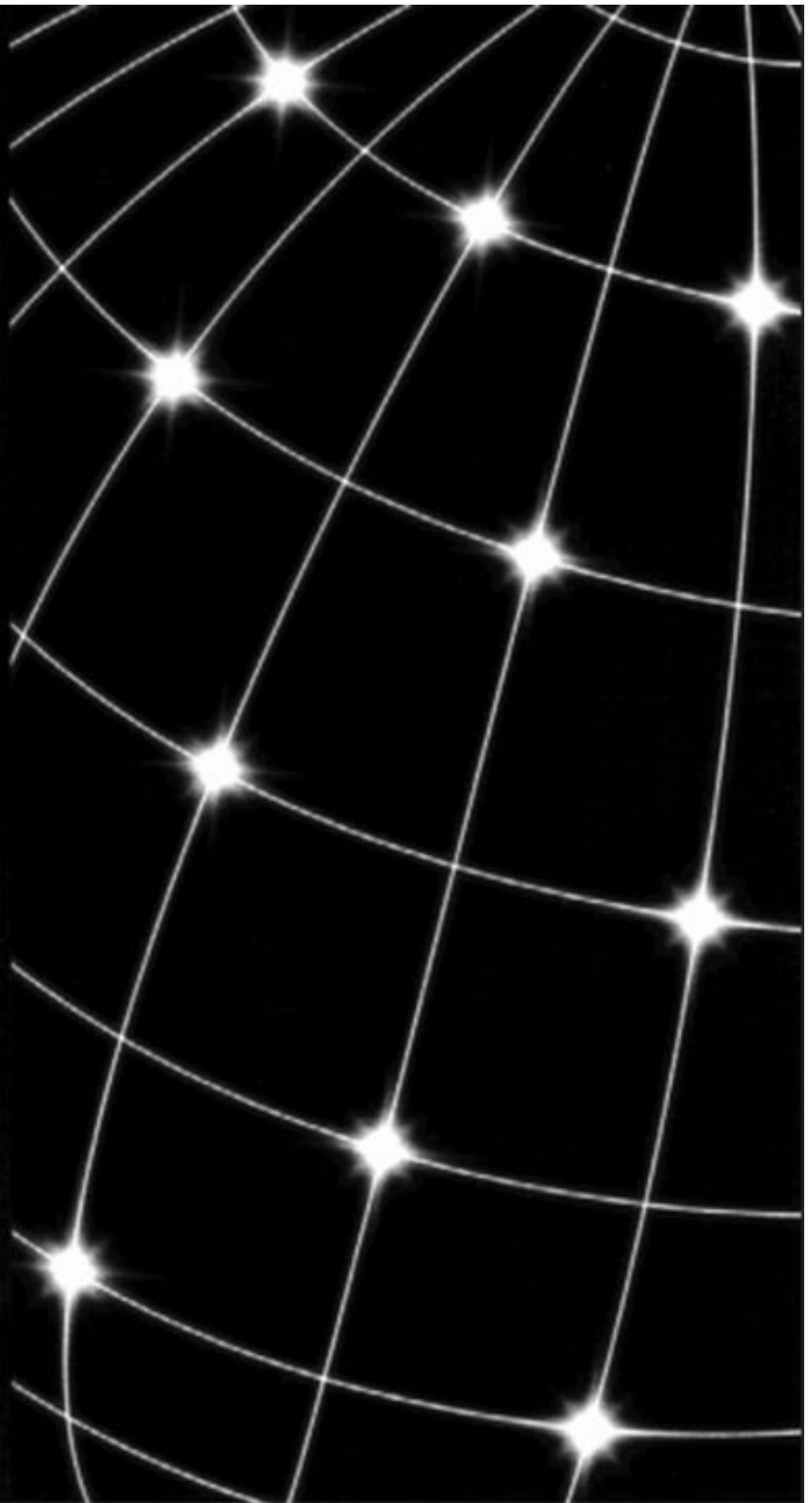


INDIANA UNIVERSITY

Office of the Vice President for
Information Technology and CIO

University Information
Technology Services

UITS
Accomplishments
Report
FY 1999-2000



**Office of the Vice President for Information Technology and CIO
University Information Technology Services**

UITS Accomplishments Report FY 99-00

Contents

Preface	1
Introduction	2
I. Solid Foundation of IT Infrastructure & Sound Fiscal Planning.....	4
II. Access to Network Resources.....	6
III. Institutional Commitment: Faculty and Staff Engagement	7
IV. Teaching and Learning: Content, Access, Distributed Education	10
V. Research: Computation, Communications, Collaboration	16
VI. Information Systems: Managing IU's Information Assets.....	22
VII. Telecommunications: Applications, Infrastructure, Convergence	28
VIII. Support for Student Computing	32
IX. Digital Libraries and the Scholarly Record	35
X. Security, Privacy, Intellectual Property	38
Contact Information	40

For more information, please contact the
UITS Communications and Planning Office
cpo@indiana.edu

For up-to-date information
technology news at IU, see
www.indiana.edu/~itiu/

Preface

The Indiana University Information Technology (IT) Strategic Plan was formally approved by President Brand and the Trustees in December 1998 and the Office of the Vice President for Information Technology and CIO (OVPIT) was given responsibility for its implementation. Thus 1999 was the first full calendar year, and FY99/00 the first full financial year, of the implementation of the Plan.

This document is a summary for this period principally of UITS accomplishments, but also of those of other parts of the University, in implementing the Plan and activities related to it. Though this document is, strictly speaking, prepared for FY99/00 as part of the University's annual budgetary process, realistically it reports accomplishments mainly for the calendar year 1999, given that it is prepared in early 2000. The Plan is a five-year plan and will guide IU's activities and initiatives in IT until the end of 2003. Hence, OVPIT will produce a document similar to this on an annual basis for the life of the Plan.

The Plan consists of 10 major Recommendations and 68 Actions. The accomplishments for 1999 are described under these.

Introduction

1999 was the first full year for the implementation of IU's extensive and far-reaching Information Technology Strategic Plan. During the year major progress was made in implementing nearly all of the Recommendations and Actions in the Plan. This work built on the University's already rich and robust IT environment for research, teaching, and learning, adding further to IU's profile as a leader in the use and application of IT. In fact, the rapid and successful progress that has been made in implementing the Plan makes it clear that nearly all of the major problems in IT that Indiana University has wrestled with for so many years are all on the verge of finally being solved.

The implementation of the Plan serves to provide the computing community on IU's eight campuses with the tools that are essential in today's environments for teaching, learning, research, outreach, and lifelong learning. All enable Indiana University to contribute in new and important ways to the development of the IT infrastructure in the State of Indiana, and to the development of the State information economy. The extensive accomplishments in IT over the past year put Indiana firmly on the global map as a creative force in shaping the IT environment of the 21st century.

Some key accomplishments in implementing the Plan during 1999 include:

- The near completion of the implementation of life-cycle replacement funding for basic desktop computing throughout the whole University. When this initiative is complete in mid-2000 it will mean that no desktop computer on the desk of any of the 15,000 IU faculty or staff members should be more than three years old and will be running the most recent releases of Microsoft or other popular desktop software. This situation would have been all but unimaginable five years ago. When this initiative is complete, IU may well be the first University in the United States to have put in place institution-wide, life-cycle funding for desktop technology.
- The establishment of reliable, uncongested off-campus remote access for the University community. This long-standing problem was effectively solved in 1999 and busy signals should rarely be encountered. The size of the IUB modem pool has almost tripled over the last two years to around 1500 modems and that at IUPUI has roughly doubled to around 900.
- The overwhelming success of the Microsoft Enterprise License Agreement (MSELA). More than 200,000 copies of Microsoft software were distributed by the end of 1999 with a retail value of over \$30M. Given that the total cost of the four-year MSELA was \$6M, this represents more than \$24M additional value to the University. Successful agreements of this type have also been established with other software companies, including Oracle (database software), Corel (desktop software), Symantec (security software), StarDivision (Unix software), SPSS (statistical software), and NETg (computer-based training software).
- The far-reaching agreement with IBM. Under this agreement, IU acquired a 150 Gflop computer, one of the most powerful in the region, and a massive data storage system with a total capacity of nearly 300Tbytes — one of the largest and most advanced at any University in the United States. These resources will provide completely new capabilities for research at IU.
- The opening of the Abilene NOC as part of the Internet2 project and the doubling to nearly \$10M per year of IU's grant to run the TransPAC international network between the US and the Asia Pacific. Both developments underscore IU's position as a global leader in advanced networking.
- The commencement of the re-engineering of all of IU's major, central, mission-critical information systems using "best of the breed" software and hardware systems from PeopleSoft, Compuware, Oracle and IBM. This is the largest software development project ever carried out by the University and promises vastly improved services to IU's students, faculty, and staff.
- Life cycle replacement funding and remote access were identified in the Plan as the two key "domestic" issues for the University. With their successful solution, UITS will be able to significantly expand its efforts in 2000 on the next major domestic issue — classroom technology upgrades.

Paralleling the growth of the IT infrastructure is the development of numerous programs that provide training and support to ensure the most effective and efficient use of IU's rich IT environment. Competitive programs like the Ameritech Fellows Program and the High Performance Network Applications Program (HPNAP) encourage the IU community to innovate in the sciences and in the arts, and in teaching and learning. The formalizing of IU's commitment to distributed education through the appointment of Erv Boschmann as Associate Vice President for this area, reporting jointly to the Vice President for Academic Affairs and the Vice President for Information Technology and CIO, along with the deployment of Oncourse, provide IU faculty with the resources and the support to creatively broaden their definition and methods of teaching.

Two other major developments in 1999, not strictly part of the Plan but closely aligned to it, were the approval by the Lilly Endowment of a \$30M proposal to establish a major new research program at IU — the Indiana Pervasive Computing Research Initiative (IPCRES) — and the approval of the School of Informatics. These developments are planned to have a significant impact on economic development in the State: IPCRES, through its role in the establishment of new IT businesses, and the School of Informatics through its role in significantly increasing the number of trained IT professional in the State to feed the voracious demands of the IT economy.

The effectiveness of a University focus on IT is demonstrated by many of the accomplishments achieved under the Plan. In other areas of IT this focus is also bringing great value to the University, in such forms as IU's new three-year contract with McLeodUSA for long-distance and international telephone services, which is expected to result in an average savings throughout the University of 30%.

This University focus has also been enhanced through the decision taken in 1998 to establish on each of the regional campuses the position of CIO; these report jointly to the VPIT and the regional chancellors. 1999 saw the appointment of the final two regional CIOs, giving additional momentum to the implementation of the Plan on the regional campuses.

The accomplishments described in this document have gained IU wide media recognition during the year. The educational media (*Chronicle of Higher Education*), the business media (*CIO Magazine*) the popular media (*USA Today*), the industry media (*PC World*, *MultiVersity*, *Yahoo! Internet Life*) have all given prominence to IU's vigorous IT activities. This in itself is an achievement. It logs IU's progression to the first tier of the nation's universities in the use and application of IT.

A critical development during the year was the approval by the State Legislature for the biennium 1999-01 of some of the funds required, in addition to the resources committed by the University, to begin implementation of the Plan. The State Legislature clearly recognizes the vital importance of IT to a leading research university. Continuing support from the Legislature is vital if the Plan is to be completely implemented. Other critical funding provided by the State includes funding for the new Communications Technology Complex building at IUPUI that will house UITS on that campus and will become the center of IU's telecommunications infrastructure, and funding to support the establishment of the Abilene NOC, the Indiana GigaPoP, and the Optical Fiber Infrastructure linking IUB, IUPUI, and Purdue University. The University is grateful to the Legislature for this essential support.



Michael A. McRobbie
Vice President for Information Technology and Chief Information Officer
January 2000

I. Solid Foundation of IT Infrastructure & Sound Fiscal Planning

Recommendation 1: The University should build a solid foundation of IT infrastructure that will help and enable IU to achieve a position of leadership, and to assure that sound fiscal planning permits the maintenance of this infrastructure at state-of-the-art levels.

Life-cycle Funding, Modernization, and Local Support

Action 1. The University should build life-cycle replacement funding into its planning at every level of investment in information technology (including personal, departmental, and central systems, and network hardware and software); and UITS should develop a life-cycle replacement model to use where needed in conjunction with its investments in information technology. Implementation should begin immediately, with full funding of life-cycle replacement phased in over a fixed number of years.

Action 2. The University should budget a standard amount per year, per FTE to support life-cycle replacement of faculty and staff desktop computers, and to cover the cost of providing local support to that desktop.

Action 3. The University's stock of computers should be systematically modernized so that they are all capable of supporting current releases of widely-used software, Web access, and other basic tasks of computation and communication.

In 1999 the University almost completed the implementation of life-cycle replacement funding for basic desktop technology (computers, printers and servers) for all schools and academic support units on all campuses. (Replacement needs for administrative support units will be addressed in Phase II which will be completed in 2000.) Ordering of equipment for Phase I at IUB was completed by the end of 1999 and installation should be completed by the end of the first quarter 2000. Phase I is nearly complete at IUPUI, with the exception of the School of Medicine, which is completing a life-cycle funding and modernization plan. This should be finished and implemented by the middle of 2000. Life-cycle funding replacement proposals and implementation plans for all regional campuses have been approved, with the exception of South Bend, whose plan should gain approval in early 2000.

Equipment replacement accounts are in place for all appropriate units on all campuses, with the units and UITS sharing responsibility for the accounts. Oversight from the UITS Finance Office and the campus budget offices ensures that these funds are used solely for equipment purchases. UITS contributes, on average, 25% of the modernization and life-cycle funding costs paid for from these accounts.

The UITS Finance Office has achieved very substantial savings for the University through aggregating large equipment orders and negotiating volume pricing agreements with vendors. Combining large purchase requests from the IU Libraries, UITS, and other departments netted a \$1.5 million savings under the first agreement with Dell; similar savings are expected under the second Dell agreement. Agreements with Apple have likewise provided substantial savings. In time UITS involvement in the life-cycle replacement process should be limited to oversight, aggregating orders, and setting standards.

When this initiative is complete by mid-2000, it will mean that no desktop computer on the desk of any IU faculty or staff member should be more than three years old and will also be running the most recent release of Microsoft or other popular desktop software. When this initiative is complete, IU may well be the first University in the United States to have implemented institution-wide life-cycle funding for desktop technology.

Information Technology Staff and Skills at IU

Action 4. The University should review the market compensation levels for qualified IT professionals at each campus and their surrounding communities, and seek to make compensation competitive with employment alternatives, within the context of overall University salary goals.

To meet President Brand's charge to become a leader in the use and application of information technology, UITS must be able to retain and attract skilled IT professionals in a national context in which demand significantly outstrips supply. Surveys of salaries paid in UITS mission-critical skills areas showed that UITS salaries fell 29-40% lower than those paid at Michigan and UC-Berkeley, 12-34% lower than the higher education survey averages, and 21-41% lower than industry survey averages. A list of job categories deemed especially vulnerable because of striking salary gaps was drawn up. Salary adjustments were then made to 100 staff in these categories and further adjustments have been made. These seem to have had a noticeable effect on staff retention and recruitment. An IT Compensation Task Force, co-chaired by Vice President for Information Technology and CIO (VPIT) McRobbie and Vice President and CFO Palmer, has been addressing compensation issues and strategies for attracting and retaining IT staff. Recommendations include addressing ever-changing staffing challenges with flexible solutions and pilot programs and applying supplemental and bonus pay in the short term to address the low compensation levels of exceptional staff and those with mission-critical skills.

UITS offers other kinds of compensation beyond salary increases. Surveys show staff regard training as a key benefit. Similarly, information technology competencies and skills constantly evolve because of dynamic business needs. Thus, UITS has increased training resources for staff and local support providers, including CBT Systems online tutorials in some 35 subjects, NETg training modules (600 titles), partnership agreements with other IU departments, and training opportunities from campus HR offices. Flexible kinds of appointments allow professional staff to take part-time leave to be with family or pursue degree or professional training. All FTE appointments include a fee courtesy. UITS and IU Human Resources plan to undertake a broadbanding pilot in which IT staff will be rewarded as they attain various levels of competencies and responsibilities.

II. Access to Network Resources

Recommendation 2: The University should provide students, faculty and staff with reliable access to computing and network services, on the campuses and off. (In the language of today's technology, "No busy signals!")

Action 5. The University should provide students, faculty, and staff with reliable access to computing, data storage, information and network services, on the campuses and off.

Off-Campus Access

Remote access to IU's networks and information resources has for many years been dogged by inadequate modem capacity on both campuses. The modem pools were heavily over-subscribed and congested, and users were extremely frustrated by constant busy signals. This long-standing problem was effectively solved in 1999. Busy signals should now be encountered rarely and modem access is normally rapid and straightforward.

In March, UITS increased the number of modems in IUB's 856-5200 modem pool by more than 10%. New lines were added to the 856-5200 (two-hour) modem pool, for a total of 667 lines and the total for the 6-5200 and 6-5202 pools to 736.

In June, a further major increase in the size of the modem pools at IUB and IUPUI was approved. Better pricing rates for primary rate interfaces (PRIs) were negotiated for the core campuses, which involved a subsequent migration of most PRI services at IUPUI from Ameritech to Time Warner. By the beginning of the new academic year, UITS had effected a 73% net increase (368) in the number of modems at IUPUI and 40% (391) at IUB. Adding 385 more modems during fall, the total at IUB was brought to 1,472 modems — double the March '99 number — with a total of 874 at IUPUI.

In September a Fair Usage Policy was issued for UITS modem pool access. Guidelines call for making one connection at a time and dialing in only when a connection is needed. The Policy posits four hours as an average fair limit for cumulative daily connect time. If an individual's modem use seems disproportionately high, the appropriate UITS Support Center will investigate and resolve the problem, involving the Information Technology Policy Office (ITPO), if necessary.

However, basic modem access will not serve the needs of IU faculty, staff, and students much longer as their needs for broadband access from off-campus grows. In anticipation of this, UITS issued a major RFI in 1999 to obtain options and pricing for higher-speed connectivity — including traditional Internet Service Provider offerings, and more advanced alternatives such as ISDN, ADSL, and cable modems. Pilots in this initiative may be ready to implement by Summer 2000.

On-Campus Access

At IUB some 2,500 data jacks were installed or upgraded in locations across campus; 10 buildings were upgraded from 10 Mbps to 100 Mbps backbone connections. The campus backbone was redesigned to accommodate moving 90 additional buildings from 10Mbps to 100Mbps connections. At IUB there are more than 28,703 unique connected hosts.

At IUPUI 2,139 new connections were activated in 1999, bringing the total to 13,120. Of these, 4,981 are capable of 100 Mbps. To date, 19 on-campus buildings have been upgraded to 100 Mbps. In addition, there are also 452 student walk-up (laptop) stations in locations across campus, including the University Library, Law School, Medical School Library, and University College.

III. Institutional Commitment: Faculty and Staff Engagement

Recommendation 3: Appropriate incentives and support should be established so that faculty and staff are encouraged in the creative use and application of information technology for teaching, research, and service.

Promotion & Tenure

Action 6. The Deans in each school should ask their faculty policy committees to review tenure and promotion guidelines to see whether they discourage creative activity involving the application of information technology, and refine these guidelines as necessary in a manner consistent with the mission and standards of excellence of the school.

To foster a better understanding of the role of IT in scholarship, the Associate Vice President for Distributed Education will host a symposium in late Spring 2000 for academic decision makers from all campuses, including department chairs, deans, faculty council leaders, chairs of academic affairs committees, chairs and members of promotion and tenure committees, and chancellors and vice chancellors of the regional campuses. Presenters will include faculty and administrators from institutions who have challenged traditional tenure and promotion guidelines, IU Faculty Council officers, and top IU administrators. The symposium is intended to broaden the understanding of scholarship and publishing in the digital age, with a view to updating the language in the promotion and tenure handbook.

Fellowships and Development Grants

Action 7. The University should review its current systems of faculty fellowships and staff development grants, with the aim of expanding these to offer financial support for the design, development, or innovative application of information technology to teaching, research and service, including the use of information technology in creative activity and the design of instructional materials to advance learning.

The provision of grants and fellowships to support faculty in the use and application of information technology has been a high priority in the implementation of the IT Strategic Plan. The current strategy is to provide this support in a focused way in specific areas rather than in a very general and unfocused manner. Efforts have also been made to identify external sources of funding and support. The following initiatives demonstrate a variety of approaches to expanding the University's program of grants and fellowships for exploring the use of IT in teaching and research.

Ameritech Fellows Program

With a \$1M grant from the Ameritech Foundation, IU has established the Ameritech Fellows Program that will award grants to some 60 faculty over five years whose projects demonstrate best practices in the use of information technology in teaching and learning. Faculty fellows chosen from all IU campuses will disseminate their expertise across the University by sharing their experiences in University-wide symposia and in a teaching and learning Knowledge Base. For a full discussion of the Ameritech Fellows Program, see Action 26.

The High Performance Network Applications Program (HPNAP)

This program was established to assist IU faculty, graduate students, and staff in developing innovative network-based applications for research and teaching that require high performance local, regional, or national advanced networks. The Program aims to significantly and qualitatively accelerate the evolution of the next generation of these applications and research tools at IU. The applications developed through this initiative will provide considerable competitive advantage to the University in the areas of teaching, learning, and distributed education, and in new collaborative technologies. To date, 19 grants, totaling more than \$400,000, have been awarded to IU researchers in the arts and sciences, business, and education. A further call for proposals under this Program will be made in early 2000. (See also Actions 27/28, 29/31, and 34.)

Other programs

UITS staff provide support for several University and campus programs that encourage innovative use of information technology in teaching, research, and service. Examples include the Network for Excellence in Teaching (NET) program at IUPUI and the Faculty Development Series on Learning Technologies at IUB.

Staff and Faculty Support

Action 8. Schools across the University should be encouraged to provide more resources for maintenance and training for departmental and school computing environments. They should work creatively and in collaboration with UITS to train, retain and distribute knowledgeable individuals to maintain distributed server and desktop systems (UNIX, NT, MacOS, etc.).

Action 10. The University should continue to support the efforts to educate and certify IT professionals in needed functional areas of the profession. These programs should be expanded to reach a wider University audience, especially on the IUPUI and regional campuses.

Action 16. To support existing and emerging faculty initiatives in basic skills education, the University should explore the use of IT to aid in the teaching of these basic skills.

Action 23. UITS should work with Human Resources and other IU departments to explore ways of using teaching and learning technologies for the training and development needs of IU staff and faculty. Also, Human Resources should develop actions, in cooperation with UITS and other units, to improve staff access to (and use of) technology training.

These four actions naturally group together under this heading. The major development in this area in 1999 was the establishment of a four-year, University-wide licensing agreement with NETg (National Education Training Group, Inc.), the nation's premier provider of computer-based IT training systems. This agreement will make more than 600 computer-based technology courses available to IU students, faculty, and staff over the next four years. NETg courses provide a range of information, from answers to computing questions to skills training. NETg's modular nature means that faculty will be able to incorporate discrete courses, tasks, and learning modules into their course curricula. Computer users at IU will be able to use NETg courseware to troubleshoot questions on such issues as creating a Microsoft PowerPoint presentation or editing an Excel spreadsheet. Users will also be able to use NETg courses to complement classroom training, to acquire new professional IT skills, or to pursue certification in Microsoft, Novell, Oracle, and other applications. In essence the NETg products mean that IU can now offer training on demand at any time or any place to members of the IU community. To broaden the accessibility of NETg modules, UITS staff are developing the architecture for delivering NETg via the Web, and for linking to its modules from the UITS Knowledge Base, with a target date of mid-March, 2000.

Information technology training is a very high priority and UITS has an extensive IT Education Program that offers a wide range of classes at IUB and IUPUI and which has won many awards. During 1998/99 a total of 1,563 classes were given under this Program on both campuses to a total of 26,768 participants.

Software Support

The first major University-wide license agreement that UITS negotiated was the four-year, \$6M Microsoft Enterprise License Agreement (MSELA) signed in 1998. This agreement makes nearly all Microsoft software — the most popular and widely used in the world — available on a non-exclusive basis to all IU faculty, students and staff at work or at home, on Apple or Windows platforms. The MSELA has been an overwhelming success. Though not even at the half-way point of the Agreement, over 200,000 copies of Microsoft software have been distributed throughout the University at a total estimated value of over \$30M. Virtually all parts of the University have been affected by this Agreement.

In addition to the MSELA and several other agreements negotiated in 1998 (Symantec, Corel), UITS added another University-wide agreement in 1999 following negotiations with StarDivision, Inc. This agreement makes available StarOffice 5.0 for Sun Solaris and Linux operating systems to all students, faculty, and staff.

Unix training

UITS has developed a certification course in “Unix System Administration” which certifies departmental staff to manage these sophisticated systems. This course draws people from local communities and outside Indiana. Also offered is an “Advanced Unix Environments” training course that prepares departmental IT professionals for the system administration class. UITS offers this class at IUB and will teach it on the IUPUI campus as demand increases.

Faculty Development Workshops

The IUB Teaching & Learning Technologies Lab (TLTL), in conjunction with the School of Continuing Studies, sponsored an extensive series of faculty development workshops to train faculty in the use of IT tools and encourage faculty to exchange information about the application of information technology to teaching and learning. Delivered via the Virtual Indiana Classroom (VIC) network, these workshops were available to faculty on all campuses. Similar programs are offered through the IUPUI Center for Teaching and Learning (CTL). The teaching staff in the TLTL and CTL are UITS employees.

TLTL, CTL expansion

The staffs at the TLTL and CTL are being augmented. Similar centers are being created or expanded on the regional campuses. (See Actions 11 and 20 for more details.)

Space for UITS Staff

Action 9. Specific action should be taken to locate improved workspaces for UITS staff at IUPUI, and to bring UITS staff at IUB onto campus, thus making them more accessible.

With the support of the State of Indiana, IU began planning for the Communications Technology Complex (CTC) at IUPUI which will house UITS and related academic programs including three of the IPCRES Laboratories. Building architect is Robert A. M. Stern of Robert A. M. Stern Architects of New York. A program plan for the building was finalized and preliminary planning work has begun. This building will be situated on a premier site at IUPUI on the corner of Michigan and West Streets. When complete it will become the center of IU’s telecommunications infrastructure and the home to IU’s Network Operations Center which also manages the Internet2 Abilene network, the TransPAC network, and a number of other advanced networks. This building will not be completed until around 2002. In the meantime, in early 2000, UITS will relocate the IUPUI Support Center from its current inconvenient location to renovated facilities in a more accessible location on the 2nd floor of the Education/Social Work (ES) Building. The Center’s improved location will mean it can better serve students, faculty, and staff.

IV. Teaching and Learning: Content, Access, Distributed Education

Recommendation 4: Indiana University should assume a position of worldwide leadership in the use of information technology to facilitate and enhance teaching and learning.

Faculty Support for Teaching and Learning with Technology

Action 11. The Teaching and Learning Technology Lab and the Center for Teaching & Learning should be expanded, and new services developed where needed, to offer a standard level teaching support services for all faculty at IUB, IUPUI, and the regional campuses.

Action 20. UITS and other units, including classroom and technology support providers, should develop plans to adapt the Leveraged Support Model to the support of instructional technology, student technology, and Web development in general.

Broadening the reach of instructional technology support for faculty across campuses is being carried out through the expansion of the Teaching and Learning Technology Lab (TLTL, IUB) and the Center for Teaching & Learning (CTL, IUPUI). Staffs in both organizations will be augmented with two new FTEs and additional hourly positions. The TLTL facility will be expanded to accommodate growth and demand. To provide services on the regional campuses, it is proposed that one position per campus be funded by this initiative and another position will be funded by the campuses. Implementation plans developed by IUB, IUPUI, and the regional campuses have been completed. Faculty support centers for teaching and learning with technology will therefore be created or expanded on each campus during the Spring 2000 semester.

This initiative is particularly important to the University because the standard level of baseline support to faculty will be broadened and they will have more opportunity to explore the applications of IT. Professional staff resources that are being added will assist faculty in the design and development of instructional materials and courseware, expand the support for faculty using Oncourse, provide consulting for the development of instructional Web sites and use of media on the Web, and permit the expansion of development opportunities for faculty such as workshops, roundtables and other forums. Overall, faculty access to technology tools, professional technical staff, and instructional design consultants will be augmented significantly, and the capacity of Indiana University to meet faculty needs will be substantially enhanced.

Web-based Course Services and Infrastructure

Action 12. To support course tools development and initiatives in distributed education, UITS (through its Advanced Information Technology Laboratory) should evaluate Web-based and other network-based learning environments and offer faculty a comprehensive set of options to easily create, edit, revise and maintain online course material.

Action 18. UITS should ensure an available and reliable infrastructure of networks, servers, storage, and applications for the support of online courses and other new learning experiences.

Action 19. UITS should initiate changes to university information systems that improve the quality of instruction, service to students, or manageability of the distributed education program itself.

The focus of Actions 12, 18, and 19 in 1999 was the implementation of the Oncourse production environment and associated support services as one of the University's mission-critical central information systems. Oncourse is an online application that automatically and dynamically creates Web sites for courses, faculty, and students, and permits the integration of various Web-based teaching and learning resources. The process for extracting faculty, student, and course information from University systems has been fully automated, eliminating a manual merge process.

Oncourse presents students with learning tools in a single, consistent Web interface. For faculty, Oncourse offers a framework for building teaching environments that can include multimedia content and a range of online tools, without requiring users to know programming or HTML. Oncourse is a component in the University's strategic plan to create a Web-based teaching and learning environment, particularly in support of distributed education, and is available to all members of the IU community. In full production by July, Oncourse was used in more than 600 courses at IUPUI and 190 courses at IUB in the Fall semester. By this time a manager had been appointed in UITS for online learning technologies, among whose responsibilities is coordinating the Oncourse production environment and services for all campuses. A Teaching and Learning Applications Steering Committee, to include broad faculty representation, is being formed to provide oversight for the development of Oncourse and to consider strategic issues and to prioritize enhancements.

Supporting the Oncourse system required new servers, new data exchange and change management procedures, extended hours of operation for support services, and secure authentication. User interface improvements include a new front page that affords easier access to each campus, the ability to view previous semesters, a chat archive, the ability for faculty to log course statistics, an online suggestion form, and an increase in file storage space. The new page also allows for system status notifications during troubleshooting procedures. In progress is the addition of an online testing feature. The planned elimination of colliding usernames across campuses early in Spring 2000 will allow better authentication for Oncourse on the regional campuses.

A new troubleshooting process was implemented with the Support Center and Network Operations Center to provide immediate response to customer calls at any time of the day or night. It is being tested at IUPUI and may serve as the model for initial 7x24 support for several applications. Extensive effort is being invested in developing University-wide support resources for Oncourse and other teaching and learning applications such as WebCT and Front Page.

Marketing Instructional Material

Action 13. The University should offer, on a selective basis, intensive help in developing instructional material - for delivery to IU students, for eventual offering as a marketable IU product, or both.

Action 14. The University should provide overall guidelines and direct support to help facilitate relationships with publishers for the commercial development and marketing of technology-based instructional materials.

Partnership agreements have been signed with Pearson Education (the second largest publisher in the world), Archipelago (a technology publisher), and Harcourt. Another agreement is in development with Western Governors University. These agreements cover the marketing of courses that IU faculty develop. They also provide Indiana University with seed money for the development of other courses, endeavors that will strengthen IU's distributed education program and enhance the University's profile.

Such agreements represent a philosophical change in the relationships among faculty authors, the University, and publishers, as well as a shift away from IU's focus on print publications. Issues of content and distribution rights will come under discussion, and could in the future have an impact on promotion and tenure decisions (see Action 6).

Implementation of these Actions, along with Action 7, provides an opportunity for UITS to launch University-wide support for instructional materials development, including front-end services to faculty, back-end requirements for Web technical services, database management, media development, and other applications development services. (See also Action 26.)

Simulation and Visualization

Action 15. UITS should evaluate the opportunities to partner with faculty in the sciences to experiment with simulation-based laboratory courses, and should be alert to other possible partnerships for the enhancement of instruction through simulation and visualization.

UITS, principally through the Advanced Visualization Laboratory (AVL), has worked to develop a wide range of simulation-based laboratory courses. The following illustrate a number of these:

- AVL provided technical consultation and support for the Astronomy A100 class given by Sasha Barab and Mike Barnett in the IUB School of Education. This course employs a novel, constructivist approach to teaching students about the solar system by having them build interactive, three-dimensional simulations of planet rotations and orbits.
- The AVL extended and enhanced the “Effect” lighting interface for Rob Shakespeare in the Department of Theatre and Drama. This program provides an intuitive interface to the Radiance lighting simulation from Lawrence Berkeley Labs, allowing students to quickly evaluate the results of their design choices. This interface was used by Professor Shakespeare in Helsinki, Finland, as part of his Fulbright Fellowship teaching activities and was featured in the September 1999 issue of *Research & Creative Activity*.
- The AVL sponsored a group of students in conjunction with Future Camp, the virtual reality day camp for high school students run by the School of Science at IUPUI. This year’s project involved the design and virtual construction of a next-generation space station in a micro-gravity environment. Future Camp projects were part of a collective publication in the IEEE Virtual Reality ’99 conference proceedings.

UITS has established a strong partnership with the IUB Department of Geology to support outreach to Indiana schools. Geology’s Virtual Seismology Laboratory includes software and network links between participating schools and national seismographic instruments, allowing students to monitor and analyze earthquake data in near real time. UITS is helping to support the software and the training of high school teachers in its use.

Support for Distributed Education

Action 17. UITS, with the new Associate Vice President for Distributed Education, should help coordinate initiatives in distributed education, by helping departments and schools implement new programs, without duplicating existing services. UITS should continue to assist programs of distributed education, helping to identify supported and supportable technologies that can satisfy their complex requirements.

The implementation of this Action is the joint responsibility of the Office of Distributed Education (ODE) and the Teaching and Learning Information Technology (TLIT) Division of UITS. In January, Erv Boschmann was appointed to lead the ODE to which the School of Continuing Studies (SCS) also reports. A Distributed Education Strategic Plan is close to completion and is being developed under the guidance of Erv Boschmann through a University-wide distributed education advisory committee.

The ODE is making arrangements to assist schools and departments in their efforts to develop new courses and programs. Such assistance is provided on a cost-recovery basis in the form of experts (programmers, instructional consultants, editors, marketing, and assessment) and financial advances for faculty release time. Negotiations are under way for a Masters program in Speech Language Pathology through the Department of Speech and Hearing Sciences and a course, R366/566, “Therapeutic Interventions with the Elderly” in HPER. The Associate of Arts degree, offered through the School of Continuing Studies, is currently available at a distance, and within a year will be available totally online as well.

UITS supports distributed education through its infrastructure and services, which are being expanded in several areas. The Support Center hours will be extended into the late evening and weekend hours and the Knowledge Base will be broadened to include pedagogical and technological

support related to teaching and learning. A coordinated suite of services for multimedia development, storage and distribution is being developed through units in several divisions of UITS. These services include needs analysis and instructional design (in cooperation with the centers for teaching and learning), application development and programming, data management and Web technical services, media production, streaming media distribution, usability testing, and assessment. Consideration for the broad distribution of instructional content, including streaming media, is also included in UITS Telecommunications strategies.

Classroom Technology

Action 21. Beginning immediately, all planning and renovation of classrooms and other teaching spaces should evaluate and incorporate information technology needs. The costs of information technology identified in prior planning efforts as well as future efforts, should be fully base funded to provide for acquiring and installing equipment, as well as for maintenance, repair, life-cycle replacement, and support.

Action 22. UITS, in partnership with the appropriate campus offices and committees, should continue to provide leadership in campus planning for classroom technology, leadership in classroom technology design, and coordination of classroom technology use.

Implementation of these Actions will become one of the highest priorities for UITS in 2000. UITS is working closely with Instructional Support Services, the University Architect's Office, and other units to coordinate implementation of these Actions on all IU campuses. Guiding the renovation of existing classrooms and the design of new ones is a set of classroom model descriptions developed by the Bloomington Classroom Committee for use at IUB and adopted by IUPUI and the regional campuses. The technology mixtures for four classroom types were determined through a faculty survey sponsored by the Committee. The classrooms initially identified for enhancement were determined through Registrar usage data and consulting with faculty and users. The following describes the status of these Actions as of early 2000.

Phase I: IUB (implemented)

Eight classrooms were renovated in Summer and lighting and control systems upgraded in another. Fixed equipment was received for 10 new Type IV classrooms. Work has begun on five rooms and cables installed in eight additional classrooms to accommodate future technology installations. Telephones and security systems were installed in six new technology classrooms.

Circulating equipment stores were augmented with new video/data projectors and several laptop computers. Life-cycle replacement activities included replacing Windows and Macintosh computers in five Type IV classrooms. Through Physical Plant accounts funds were received for technology in 23 classrooms and maintenance budgets were established.

Phase I: IUPUI (implemented)

Two new Type II classrooms were completed in the School of Nursing in 1999. Other classroom renovations in the School included new flooring, marker boards, and lighting. Work is underway in the main IUPUI Lecture Hall Building. Permanent wall-mounted technology monitors and VCRs were installed in 15 Type II classrooms. Old, proprietary classroom automation systems were replaced with new Crestron Controllers. Circulating equipment stores were augmented. LCD panels were replaced with LCD projectors.

Phase II: IUB (planned)

Planned improvements include renovating two classrooms, installing technology in eight to 10 additional classrooms, and upgrading seven hybrid rooms to Type IV classrooms. During the planning cycle. The number of advanced technology classrooms with fixed equipment (Type IV) is expected to grow from the current 25 rooms to 65 by 2004.

Portable projectors and laptops will be purchased based on life-cycle schedules and user demand. An inventory system will be developed to track the most needed equipment and parts. Maintenance and upgrade schedules for technology classrooms will be developed. The need for additional full-time support staff will be assessed as the number of technology classrooms grows.

Phase II: IUPUI (planned)

Planned improvements include environmental upgrades to the Lecture Hall Building and creation of an informal learning prototype there and in the Education/Social Work Building. The focus at IUPUI will be on the transition from heavy dependence on portable technology (Types II and III) to fixed installations in renovated classrooms. The number of Type IV classrooms is projected to grow from three to 30 by 2004.

Circulating and spare equipment stores will be improved by upgrading Macintosh computers to G3s, upgrading Windows computers, and purchasing LCD projectors and laptops for faculty checkout. A maintenance and repair workspace will be created along with an inventory system. Short-term life-cycle replacement plans call for upgrading IT equipment in three Lecture Hall classrooms and replacing CRT projectors with LCD projectors.

Phase II: Regional Campuses (planned)

Site visits were made to each campus to select classrooms for early renovation. A meeting was held with the CIOs of each campus to review the site-visit report and discuss the short-term and strategic planning requirements. The CIOs have submitted five-year plans following the model developed at IUB and IUPUI. Implementation will proceed on the regional campuses during the Spring 2000 semester. In close cooperation with the University Architect's Office, plans are being drawn up for University-wide consultation and support for the design and development of technology classrooms, the design of systems in those rooms, and for providing up-to-date information through a new, comprehensive classroom resource Web site.

Evaluation and Assessment

Action 24. The core campuses should collaborate to create an interdepartmental advisory group that will provide advice and guidance on assessment and planning for assessment.

Work on this action has been focused in the CTL at IUPUI and the TLTL at IUB. Assessment tools have been examined and the Flashlight Instrument offered by the AAHE is being considered for a University-wide license. An advisory committee convened to develop the Distributed Education Strategic Plan is also determining assessment strategies. Once this Plan is complete, ODE and TLIT will work together to establish an assessment review committee.

Action 25. Faculty who participate in university-funded programs which support innovative applications of technology in teaching and learning should have access to the expertise and support resources needed to carry out an assessment of their project.

The Ameritech Fellows Program, discussed under Action 26, is designed to advance and disseminate best practices in teaching and learning with technology. An assessment process is effectively built into this Program which is expected to serve as a model for other programs in this area. Fellows will serve as mentors to others in their disciplines through offering workshops or departmental consultations in coordination with the campus teaching and learning centers. Additionally, Fellows' findings and expertise will be collected and made available to colleagues throughout IU and beyond to encourage scholarly publication on teaching and learning with technology. The UITs online Knowledge Base of IT-related questions and answers will be expanded to include best practices in teaching and learning with technology, advice, guidance, reflections, and examples drawn from the Fellows' experiences. Further, a final report for each funded project will be filed with OVPIT.

As mentioned under Action 24, planning is also under way to expand the Flashlight initiative to provide assessment tools for faculty use. Support will be provided through the CTL, TLTL, and the regional campus centers.

Action 26. A program of applied research in teaching and learning with technology should be considered as a means of identifying faculty and student needs, and identifying opportunities for improving teaching and learning.

Applications of information technology in teaching and learning were the focus of the first all-IU Teaching and Learning with Technology conference at IUPUI in November. The event drew nearly 200 faculty from all campuses and showcased 26 faculty projects through a competitive poster session. The conference also featured addresses by Sir John S. Daniel of the Open University and leading educator William Graves as well as a panel and poster sessions. IU faculty applications of IT in teaching and learning were also promoted through a special insert in the *IU Home Pages* in November that featured projects and perspectives of faculty representing all campuses.

The Ameritech Fellows Program will support faculty demonstration projects in the effective integration of information technology for use on campus and in distance education. Where appropriate, applicants are encouraged to involve the teaching and learning centers on the IU campuses in their proposals or the preparation of them. These centers include CTL at Indianapolis, TLTL at Bloomington, and the Internet and Multimedia Research and Development (IMRD) team in the School of Continuing Studies. The involvement of faculty development programs in schools and units is also encouraged. This will ensure that faculty have access to resources to assist in the design, implementation, and evaluation of their projects.

The appointment of an Associate Vice President for Distributed Education in January was a major step in enhancing activities in this area at IU. The Distributed Education Strategic Plan will stimulate pedagogic and technological experimentation and evaluation across IU. (See Action 17.)

V. Research: Computation, Communications, Collaboration

Recommendation 5: In support of research, UITS should provide broad support for basic collaboration technologies and begin implementing more advanced technologies. UITS should provide advanced data storage and management services to researchers. The University should continue its commitment to high performance computing and computation, so as to contribute to and benefit from initiatives to develop a national computational grid.

Collaborative Technology

Action 27. UITS should launch an aggressive program to systematically evaluate and deploy across the University state-of-the-art tools and infrastructure that can support collaboration within the University, nationally and globally.

Action 28. UITS should explore and deploy advanced and experimental collaborative technologies within the University's production information technology environment, first as prototypes and then if successful, more broadly.

Many of the activities of UITS in this area have been concerned with establishing the networking infrastructure that will make implementation of these Actions possible. Details of these activities can be found under Recommendation VII. OVPIT established a major program — the HPNAP Program described under Recommendation III — to assist in the development of network-based applications in this area. The AVL is involved in projects in this area that are prototyping new collaborative technologies:

- The Virtual Concert project is establishing a framework for collaborative musical performance over a network using MIDI encoding, supplementing the music with a virtual reality environment.
- The Bio-Medical Tele-Visualization project seeks to leverage high-end graphics workstations, such as the AVL's Onyx2 computers, as visualization servers and to transfer 2D images of a 3D scene to a group of remote collaborators using inexpensive desktop systems.
- The Collaborative Constrained Navigation project is facilitating tele-immersive collaboration by providing effective and intuitive aids to individual and group navigation through 3D environments and data sets. This technology is featured in publications in the IEEE Visualization '99 conference and the IEEE Virtual Reality 2000 conference.

In another initiative, the AVL is supporting a collaborative effort between NASA-supported researchers in the IUB Department of Computer Science and the University of Chicago's Department of Astronomy. The goal of the Solar Journey project is to develop collaborative desktop and virtual reality tools to visualize the dynamic local galactic environment of the Sun.

A research programming position, specializing in collaborative visualization, was created in the AVL, based at IUPUI.

Web-based data dissemination and sharing

UITS has proposed a Web-based suite of applications for collaborative data dissemination, sharing, and input. This service will be a key part of IU's efforts in helping to make the Web a multifaceted environment for research collaboration.

High Performance Computing and the National Grid

Action 29. In order to maintain its position of leadership in the constantly changing field of high performance computing, the University should plan to continuously upgrade and replace its high-performance computing facilities to keep them at a level that satisfies the increasing demand for computational power.

Action 31. The University should plan to evolve its high performance computing and communications infrastructure so it has the features to be compatible with and can participate in the emerging national computational grid.

IBM agreement

In May, IU and IBM announced a far-reaching agreement to work together to upgrade IU's information technology infrastructure and collaborate on joint research projects. The agreement includes a \$1M IBM Shared University Research (SUR) grant for new computational nodes and data storage hardware for the mission-critical areas of massive data storage, supercomputing, and the platform for IU's new central information systems. IU's SUR grants have focused thus far on collaborative research activities involving component technologies of high performance computing, distributed supercomputing, bioinformatics, and high-energy physics. The SUR grants are the cornerstone of a productive research relationship between IU and IBM that includes annual presentations of research during visits to IBM's research laboratories and at IBM research conferences.

Research SP upgrades

UITS followed the 1998 upgrades to the Research SP with an even more dramatic upgrade in 1999 which added some of IBM's newest Power3-based technology to the SP (some so new that it is not yet publicly announced). These upgrades were made possible in part by further hardware grants from IBM through its SUR program, which provided \$2.25M (retail value) worth of new hardware for the Research SP, which now includes 139 processors and has a theoretical peak performance of 146 GFLOPS. This brings the Research SP to around 100th place on the current list of the world's 500 most powerful supercomputers.

The Research SP is the most powerful supercomputer in this region, and is the mainstay of IU's research computation activities. IU researchers are developing novel and important software technologies on this system, including Professor Randall Bramley's Component Architecture Toolkit. The Research SP supports pathbreaking research in astronomy, chemistry, business, economics, and physics. A unique feature of IU's use of this supercomputer is that it is accessible to all faculty, staff, and graduate students. The same supercomputer that IU's most distinguished supercomputer experts use also provides excellent responsiveness in statistical software programs that first-year graduate students run. A benefit of this approach is that IU receives good value from its investment in this supercomputer, with utilization running better than 2/3 theoretical maximum, near the practical limit of the utilization of such systems.

High Performance Parallel PC (PPCC) cluster

In May IU announced the development, with Compaq, of a high performance parallel computing system for computationally intensive scientific and research applications. Based on a cluster of commodity PCs, and offering a theoretical peak performance of 25.6 GFLOPS, the system provides supercomputer levels of performance at a fraction of the cost. The system comprises 32 Compaq Proliant servers, each equipped with a pair of 400 MHz Pentium II processors. Distinguishing this cluster is the fact that researchers can use the Linux and Microsoft NT operating systems interchangeably. IU's PPCC is one of just three clusters in the US with this capacity. IU system administrators were the first to develop the ability to switch between operating systems under software control.

Origin 2000

Origin 2000 system utilization averaged 50% of capacity with research in chemistry, physics, astronomy, and geology. Through application and peer review the machine was opened to researchers beyond the SCAAMP (Scientific Applications on Arrays of Multi-Processors) group, whose successful NSF MRI grant partially funded its initial purchase.

High Performance Computing Support Group

A High Performance Computing Support Group (HPC) was created in Bloomington, and a Research Support Group is being created in Indianapolis. A primary goal of both groups is to better support users of the high performance computing systems, while expanding the userbase of IU's supercomputers. By helping the University's intellectual community make greater use of IU's world-class supercomputers, these activities bring the IU community into greater familiarity with the tools that will enable them to contribute to the kinds of dramatic advances in the state of human knowledge that IT enables.

Grids

The PPCC, the Research SP, and the SGI Origin 2000 have been added to the Globus computational grid, and the SGI Origin 2000 was added to the Legion computational grid. Craig Stewart is the co-principal investigator and primary author of a grant application for a CIC grid computing prototype submitted to the NSF. The grant proposes to build grid and network connections that will support QoS and DiffServ among CIC institutions and establish a Grid Operations Center and toolkit for grid management by IU.

National Computational Science Alliance (NCSA) supercomputers

As a CIC member and NCSA partner, IU received a block of 20,000 hours of CPU time on NCSA supercomputers for use by University researchers. OVPIT solicited applications from researchers for portions of this allocation. As of December, some 15,000 hours of CPU time had been used and more than a dozen IU researchers had been introduced to NCSA facilities. Some of these researchers will apply for larger allocations of NCSA time.

HPNAP awards

The HPNAP Program is described under Recommendation III and aims to accelerate the evolution of next-generation network-based applications and research tools at IU. This program provides grants to assist IU faculty, graduate students, and staff in developing innovative applications for research and teaching that require high performance local, regional, or national advanced networks. The applications developed through this initiative will provide considerable competitive advantage to the University in the areas of teaching, learning, and distributed education, and in new collaborative technologies. For more on the HPNAP initiative and projects, see Actions 7, 27/28, and 34.

Computation and Information-Intensive Applications

Action 30. The University needs to provide facilities and support for computationally and data-intensive research, for non-traditional areas such as the arts and humanities, as well as for the more traditional areas of scientific computation.

Action 33. The University through UITS should provide support for a wider range of research software including database systems, text-based and text-markup tools, scientific text processing systems, and software for statistical analysis. UITS should investigate the possibilities for enterprise-wide agreements for software acquisitions similar to the Microsoft Enterprise License Agreement.

IU's supercomputer facilities formed the core of an international collaboration on evolutionary biology. IU researchers in Professor Jeffrey Palmer's lab used the Research SP to estimate evolutionary relationships of organisms using data sets they have previously been unable to analyze. UITS modified the programs used in this research to enable these analyses.

IU's supercomputer is also used by Professor Richard Durisen's lab to model the formation of protostellar disks. Partly because of the processing capabilities of the Research SP, Durisen's simulations are unique in their full resolution of 3-dimensional models.

UITS provides consulting and programming help that enables IU researchers to enhance the quality and speed of their computing work; this dramatically enhances researchers' ability to make strides in their disciplines. At the same time, UITS staff have been involved in research that advances the understanding of advanced computer systems, such as characterizing the performance of the PPCC under Linux and NT and evaluating software packages.

In 1999, the AVL worked with a number of researchers in non-traditional areas, providing extended consultations, facility usage support, and custom application development. A selection is noted below.

- For Ray Burke in the Kelley School of Business, the AVL developed a virtual shopping simulation which was featured at the 1999 International Mass Retail Association conference.
- For Margaret Dolinsky in the Henry Radford Hope School of Fine Arts, the AVL provided coding support for her digital art class in Fine Arts, and to prepare her interactive art pieces for demonstration at SIGGRAPH '99 and the 1999 Ars Electronica Festival.

- For Katy Borner in the School of Library and Information Science, the AVL provided support for projects in adaptive, intelligent interfaces; interface usability studies; and digital library visualization. Other AVL projects are described in Actions 15, 27, and 34.
- In Spring 1999 the AVL developed several proof-of-concept applications using the newly commissioned PPCC. One application used the cluster to contrast ray-casting volume rendering with real-time 3D texture mapping; another used the cluster to ray-trace high-resolution stereo pairs for molecular visualization; the third application provided real-time, 3D visualization of the cluster's performance.

Research Software Support

The Stat/Math Center negotiated an Enterprise License Agreement with SPSS, Inc., making SPSS software available University wide. This agreement provides SPSS software (valued at \$2000 list price) to IU students, faculty, and staff at no charge on the day publicized for distribution, and for \$5 thereafter. Additional software site licenses signed in 1999 include Portland compilers and performance analysis systems. Negotiations of site licenses in collaboration with various schools and departments at IUPUI are estimated to have saved some \$50,000. Local support of statistical and mathematical software at IUPUI was enhanced, and three new staff positions were created to support computationally intensive data applications at IUPUI and the regional campuses.

The Unix Workstation Support Group (UWSG) licenses and distributes the latest versions of Unix along with consulting support to faculty, staff, and students. Available software and documentation includes all major versions of the Linux operating system, documentation from Sun Microsystems, and a network-based system for software installation. UWSG also site licenses many programs and software packages, ranging from compilers to word processors. Among the key additions in 1999 were the Island Office and Applixware productivity suites which provide word processing, spreadsheet, and presentation software for Unix workstation users. The UWSG hosted the highly successful LinuxFest Conference at IUB to promote the Linux operating system which offers a Unix-like alternative for PCs. While Unix has traditionally been the operating system of choice for research computing, commercial versions are very expensive and run only on high-end hardware. Downloaded free from the Web, Linux brings the stability and power of Unix to the desktop.

Massive Data Storage

Action 32. The University should evaluate and acquire high-capacity storage systems, capable of managing very large data volumes from research instruments, remote sensors, and other data-gathering facilities.

Action 43. UIITS should implement massive storage technology for storage of the University's institutional data, migrate tapes over time to the new environment, and integrate this technology with database management systems to support image, sound, and video data types.

In June the High Performance Storage System (HPSS) went into production with the Distributed File System (DFS) following in August, making IU's installation the first production system in the country using DFS/HPSS. The HPSS system currently houses more than five terabytes of data belonging to a number of major research projects in a variety of disciplines, among them: astronomy, biology, chemistry (including Molecular Crystallography), geological sciences, physics (including the FOCUS project), theater and drama, and the IU Digital Library Program.

IU's older generation of tape technology was phased out as all IBM 3484 tapes were migrated to newer, faster and more efficient IBM 3590 tapes. The conversion and migration process was completed in September.

Massive data storage services are available to all campuses. Additional storage system infrastructure has been implemented at IUPUI, and planning is underway to locate an IBM 3494 tape robot silo at IUPUI in February.

In 1999 StorageTek made a donation to IU of a 120TByte massive data tape storage silo. This donation, valued at around \$.75M, is one of the largest donations of equipment ever made to the University. The donation was made to help support IU's participation in Internet2 and is currently being integrated into the IU massive storage infrastructure.

The 1999 IBM SUR grant (see Action 29) will assist in the development of an HPSS Data Migration Application for the IBM General Purpose File System (GPFS) for fast, parallel data transfer. IU formed partnerships with Argonne National Laboratory (ANL) and the NCSA to research the new frontier of geographically distributed storage.

Plans are being developed to migrate the central NFS services (HPNFS at IUB and Network Appliance at IUPUI) to DFS. Hardware to create this common file structure for IUB and IUPUI will be installed in Spring 2000, reducing the common file system from six or seven file systems to no more than three.

Research Initiatives in Information Technology

Action 34. UITS should participate with faculty on major research initiatives involving information technology, where it is appropriate and of institutional advantage. Further, UITS should provide proactive encouragement and supportive services that create opportunities where faculty from diverse disciplines might come together on collaborative projects involving information technology.

The major development in this area in 1999 was the award by the Lilly Endowment Inc. in September to IU of a \$30M grant for the development of a world-class research initiative in some of the fundamental information technologies in the next century in the area of pervasive computing. This five-year grant will enable IU to establish the Indiana Pervasive Computing Research (IPCRES) Initiative. Under this Initiative, six world-class research laboratories will be established at IU in key areas that underpin pervasive computing. The IPCRES Laboratories will be geographically located to leverage IU's IT and academic strengths. Three will be established in advanced telecommunications at IUPUI in such areas as high performance networking, wireless networks, telecommunications convergence, and distributed storage. The other three laboratories will be established in software technologies at IU Bloomington to focus on information grids and portals, human-computer interaction, smart devices, and network agents. IPCRES will be managed by a Steering Committee chaired by President Brand, and Vice President McRobbie will be the IPCRES CEO.

Three UITS groups, the Research and Academic Computing (RAC) Division, and within it, the HPC, and the AVL have also made valuable contributions to this Action.

Use of High Performance Computing

A key goal of the RAC Division is to make IU's high performance computing systems broadly available to researchers so that they have the tools to be at the forefront of IT use in all areas of scientific inquiry and artistic accomplishment. RAC's success here is evidenced in the diverse groups that now make use of UITS resources. They include the Purdue School of Engineering at IUPUI, the IU School of Medicine, the IU School of Nursing, the IU School of Optometry, the School of Public and Environmental Affairs, the Purdue School of Science at IUPUI, the School of Liberal Arts at IUPUI, and the College of Arts and Sciences at IUB. COAS departments represented among supercomputer users include anthropology, astronomy, biology, chemistry, computer science, fine arts, geography, geology, mathematics, physics, psychology, and theatre and drama.

A program managed through the IU-chaired CIC Research Computing Group provided start-up grants of time on NCSA supercomputers. Over a dozen IU researchers have used these grants, and some are going on to make major requests for time on NCSA systems.

The HPC has worked extensively with Dr. Jeff Palmer's group on an exciting bioinformatics project. Dr. Palmer's group studies evolutionary phylogenies, and utilizes a program called fastDNAmI to perform maximum likelihood estimation of evolutionary relationships from DNA sequence data. The group ported this code to run on IU's Research SP and PPCC. They restructured and tuned the parallel processing algorithms of the program so it could be run on geographically distributed grids of supercomputers, greatly enhancing its performance. This has enabled Palmer's group to analyze much larger data sets than were previously possible.

Professor Richard Durisen in astronomy studies the formation of binary stars and planetary systems from dust and gas clouds by simulating the clouds' motion with a full 3-dimensional hydrodynamics code. The HPC helped restructure and improve the primary codes which are now written in OpenMP, one of the new and sophisticated approaches to parallel computing. This means it can be run on any parallel computer that supports Fortran77/OpenMP programming. The group's enhancements based on the MPI parallel processing standard will enable the code to run on the world's largest supercomputers and on large grids of supercomputers.

The AVL has engaged in numerous research partnerships discussed in Actions 15/16, 27/28, and 30. Other long-term partnerships with research faculty resulted in 1999 in software packages that have been released inside and outside the University. Beyond their application and usefulness within the University, the contribution of these packages to the larger academic research community helps establish IU as an active contributor to the field of immersive visualization and paves the way for possible external collaborations.

- In conjunction with the IUPUI Department of Computer Science and the IU School of Medicine, the AVL developed and released 3DIVE, a general-purpose volume rendering and image processing tool. IU researchers are using 3DIVE to study data sets of scales ranging from cellular microscopy to CT scans to interstellar gas clouds.
- In conjunction with the Molecular Structure Center at IUB, the AVL developed and released XMView/CMView, a scalable visualization system for molecular chemistry that supports work with desktop workstations and immersive VR systems.
- The Digital Library Visualization (LVis) project led by Katy Borner and underwritten by the HPNAP program is the first significant example of collaboration involving faculty and experts in diverse disciplines facilitated by the AVL. Dr. Borner is bringing together digital artists, VR programming experts, interface designers, and information scientists in the CAVE to develop and test prototypes of her ideas for visualizing citation relationships among documents in digital libraries.

Under development via HPNAP is We Think!, a collaborative learning tool for distributed education. Proposed by researchers in the Kelley School of Business at IUB, We Think! will enable as many as 40 concurrent, collaborative learning exercises among pairs of students in distributed classrooms, each performing exercises via personal control of voice, video, and data sharing as effectively as students sitting beside each other. We Think! will offer students the benefits of interaction with peers in other countries, cultures, and academic disciplines, and universities will benefit from the economic and strategic appeal offered by inter-institutional courses.

VI. Information Systems: Managing IU's Information Assets

Recommendation 6: University-wide prioritization, coordination, oversight and planning are required in the implementation and development of institutional information systems. In order for these systems to work together in a seamless manner and accommodate an ever-increasing number of users, UIS should implement common interfaces and a common information delivery environment that facilitate their integrated use. A new Student Information System should be a top University priority.

Action 35. The Office of the Vice President for Information Technology should establish an effective mechanism for overall prioritization, coordination and oversight of planning for the development and life-cycle replacement of University information systems.

Under this Action, OVPIT, through the UITS University Information Systems (UIS) Division, was given responsibility for all central mission-critical information systems in 1998. The University Information Systems Implementation Plan was then prepared to describe how the Actions in this area in the IT Strategic Plan would be implemented over the five years of this Plan. Since its approval, this Implementation Plan has guided the prioritization, coordination, and planning for new University-wide information systems.

A comprehensive advisory committee structure was established for the Student Information System (SIS), the Human Resources Management System (HRMS) and the Financial/Procurement Systems to provide overall advice and guidance to the development and implementation of these initiatives and ensure that end users and functional units are involved in systems design and development of major information systems. A more extensive committee and project team structure involving faculty, students, functional unit staff, and executive administration was established for the SIS and the HRMS systems. Under development is a Steering and Design Committee for the emerging Administrative Transaction Processing (ATP) environment where all enterprise-class administrative applications will operate.

Action 36. IU should implement as soon as possible a new Student Information System in a way that integrates identified best practices in providing services to students and is adaptable to future changes.

NOTE: Action 36 is subdivided in the UIS Implementation Plan as follows:

- 36a. Student Information Systems (SIS)
- 36b. Human Resources Management System (HRMS)
- 36c. Library Information Systems
- 36d. Fiscal and Procurement Systems
- 36e. Departmental Information Systems

In May Indiana University announced a major initiative to overhaul the University's enterprise-wide information systems. This is the largest software engineering project that IU has ever carried out. Each facet of the re-engineering initiative delivers an important component of technology infrastructure to support IU's administrative needs. Plans include a customizable Web-based environment to enable students and employees to carry out their administrative activities in a self-service mode. Students will be able to register, pay fees, take part in advising, and check course and degree requirements. Faculty and staff will be able to access their personnel data. An information environment is also planned for executive management, deans, directors and other University staff to carry out reporting, information extraction and data analysis with timely, consistent, and meaningful information. The University expects to complete the implementation of these new information systems by 2005.

Indiana University is partnering with PeopleSoft, Oracle, IBM, and Compuware in this initiative. The model that the University is using to design, develop, and implement these systems with vendor partners will be state-of-the-art in higher education.

In June UIS hosted a University-wide UIS Reengineering Conference to communicate widely to the institution the status of these major initiatives, encourage their participation on committees and teams, and begin initial comments on transformation and change in the operational units.

36a. Student Information Systems (SIS)

Two faculty administrators were appointed as co-chairs of the SIS Steering Committee, and a project team was formed that includes technical staff from UIITS and functional staff that have been dedicated to the project by key campus offices and University Administration. A detailed plan was completed for the April 2000 delivery of Admissions Phase 1 (Recruitment, Contact, and Event Management), which is on schedule for production use in Spring 2000. The admissions application and evaluation modules are on schedule for rollout in Fall 2000.

The academic structure prototype was established to assist in managing the system security, access, reporting data, mass change operations, and the automation of processes. Populating tables for the academic structure began, including such key items such as institution, campus, location, term structures, grading schemes, academic calendars, and academic organizations.

A full walkthrough with all SIS constituencies was held in October. Findings were presented to the Steering Committee which unanimously approved the "multiple institution" approach for IU. Local Implementation Teams will be formed for each division across IU that will be a part of the Spring 2000 and Fall 2000 implementations.

36b. Human Resources Management System (HRMS)

A project plan was created for the first phase of the HRMS implementation. Fall 2000 implementation for the HRMS Phase 1 electronic documents is on schedule. The initial technical infrastructure required to link the common front end for administrative applications to the PeopleSoft back end was completed. Prototypes were created for the electronic documents (e-docs) that will replace the paper Personnel Action Form and the current payroll voucher.

The initial conversion specifications for person data and job data from the old Employee Database to the new PeopleSoft tables were completed. The initial analysis on the linking of the New e-docs and PeopleSoft to the old payroll engine in HRIS for Phase 1 was completed.

36a&b. Common to HRMS and SIS

A team/decision model was developed for campus community issues and where HRMS and SIS overlap. Assignments were made for some 15 outstanding issues, many of which were brought to the Data Stewards, HRMS Executive Committee, and SIS Functional Advisory Committee in December.

Space in Poplars was remodeled to allow most Bloomington-based SIS and HRMS project team members to be co-located. IUPUI team members will move into new space in early 2000.

IU initiated and hosted a PeopleSoft meeting with Big 10 colleagues and contributed to a memorandum by several CIC universities to PeopleSoft addressing some concerns. This initiative on the part of IU resulted in the personal involvement of the PeopleSoft CEO. A meeting of the PeopleSoft CEO and his executives with the PeopleSoft CIC institutions took place in mid-January 2000. An interactive Web site was created for the HRMS/SIS projects allowing readers to view project history and current events and to provide feedback. The common committee structure was created to advise all levels of the project.

All coding and testing activities for Year 2000 for the current legacy HRIS and student systems were completed. Fourteen new staff joined the HRMS/SIS team in 1999. A few consultants were used when needed.

36c. Library Information Systems

A contract to purchase the SIRSI Unicorn product for use on all campuses was signed in early September. A SIRSI environment was established as part of the IBM-based Enterprise Unix Environment (EUE) initiative and a SIRSI Test system installed. Library and UIITS support staff training data conversion algorithms for NOTIS data. Data conversion planning for Horizon data is in process.

36d. Fiscal and Procurement Systems

The Physical Plant Material Management System (MMS) was deployed on schedule in June. This was the first enterprise-level system to use the new Oracle database technology the EUE.

Migration of the FIS from the HP/Sybase platforms to the IBM/Oracle technologies began in July. Conversion to Oracle is on schedule, expected to be complete by June 2000.

The project to retrofit the Purchasing system is under way. The E-Commerce Task Force was established in June 1999 following a joint charge from VP and CFO Judy Palmer and VPIT and CIO Michael McRobbie to create a service to enable the secure use of credit cards to purchase goods and services from IU entities. Since the implementation of this facility in July, IU Press and Athletics have put services in place that utilize it. In Fall 1999, two new full-time staff were added to support underlying e-commerce technology. In January, 2000, the E-Commerce Task Force was given an expanded responsibility to establish a University E-Commerce Strategic Plan. This is expected to be complete in April, 2000.

The TimeKeeping project began in Summer 1999 with 50 major stakeholders defining scope, outlining requirements, and establishing business rules. A two-part implementation phase is timed to follow the Fall 2000 implementation of the HRMS e-documents.

The Electronic Research Administration (ERA) system, Phase 1-Release 1, went live in October, including Proposal Preparation, Proposal Route Sheet, and the Routing/Approval Engine. ERA is the first in-house system developed with Uniface and running under the Universal Request Broker Architecture (URBA) on the EUE with Oracle as the database engine. Release 2 is targeted for January, 2000, focusing on the budget preparation and approved budget integration with the FIS Contracts and Grants System. Release 3 is targeted for April, 2000, focusing on Biosafety (IBC) Protocols.

36e. Departmental Information Systems

Several major departmental information systems, including one for the School of Nursing, were completed or under way in 1999.

When Indiana University Hospital, Riley Hospital, and Methodist Hospital consolidated to create Clarian Health Partners three years ago, the Information Systems Integration Team (ISIT) was formed to work through the technology integration issues between IU and Clarian. A temporary solution allows access to the appropriate systems for people on both campuses. For the first time since the consolidation, Clarian applications can be accessed from IU locations and vice versa. The Clarian Help Desk and the IU Support Center developed, documented, and shared common procedures for identifying problems and assigning problem resolution to the appropriate body. Clarian completed a network review (performed by Lucent Technologies) that focused on the interconnection between Clarian and IU; implementation of recommendations will begin in the first quarter of 2000.

Action 37. UITS, working with the users of IU's administrative systems, should develop a common interface environment that will support the efficient and effective accomplishment of the day-to-day administrative tasks of the University.

The System Integration Team (SIT) and Usability teams are working together on this initiative with a user-centered design focus (see Actions 44 and 45). Workshops on user-centered design and usability were conducted in Summer and Fall 1999. The Administrative Transaction Processing (ATP) environment has evolved from the initial common interface environment initiative and is being developed to provide a uniform method for faculty and staff to access and conduct administrative activities. It will offer e-docs to replace paper forms used for administrative business or will replace current electronic transactions. The ATP environment has been prototyped and should be in place in June 2000 to accommodate future phases of the ERA, FIS under Oracle, and the HRMS e-docs.

Action 38. UITS should enhance its current information and IT architectures to include the use of "thin client" technologies, and employ multi-tiered architectures in future software development.

NOTE: Action 38 is subdivided in the UIS Implementation Plan as follows:

- 38a. Thin Client
- 38b. Enterprise Unix Environment
- 38c. Strategic Database Management

38a. Thin client

Two successful projects were deployed in 1999 using thin client technology. The Physical Plant Material Management System (MMS) was deployed in June. The IUN campus switched to this technology in Fall 1999 for its FIS users. Work began on capacity and a financial plan for expansion beyond the MMS. A plan is in place to use thin client technologies for the Spring and Fall 2000 implementations of the SIS.

38b. Enterprise Unix Environment (EUE)

Equipment was installed in March for the PeopleSoft Student Administration and HRMS production environment. Capacity requirements were gathered and a plan defined for hardware purchases for FY 1999-2000.

- The Physical Plant Material Management System (MMS), the first application of the new IBM SP/Oracle environment, was deployed in June.
- The new Compuware Uniface development environment was established on the Research SP.
- The first phase of the ERA system, the first application of the Uniface environment, was deployed in October.
- Development and test environments were implemented for FIS, ERA, Decision Support and others.
- Equipment was configured and ordered for the SIRSI Library System and installed in December.
- Equipment to support the IU Procurement Card application was implemented in July.
- IBM's ADSM (storage management) is in production on the Research SP to automate backups.
- With the TLIT/Web Technologies unit, Spider, an HP server that was supporting Web database access, was decommissioned. The databases were converted to an existing IBM RS/6000. This is the second HP server removed from service.
- Equipment was ordered to implement the non-production environments for PeopleSoft and will be installed in 2000. These will allow the current environment to support the first production implementation.
- Disk and memory upgrades were installed to match increased use of the environment.

38c. Strategic Database Management

IU acquired a University-wide license to the Oracle database system as part of its information systems re-engineering project. This license provides Oracle to all faculty for research purposes as well as for the University's administrative systems. The transition from Sybase database technology to Oracle is the most substantial the University has ever made in this area and an implementation plan was developed to guide this transition. An Oracle database environment was established in 1999 to support ERA and MMS. Fifty-five UITs staff received Oracle and data modeling training in 1999.

Action 39. UITs should develop a consolidated information delivery environment, leveraging technologies already in use and expanding on these with newer tools. And UITs should complete implementation of an enterprise-wide data warehouse environment, currently in progress, to support university data access and information about this data. The participation of information users and all units affected is essential.

Implementation of the first phase of the IU Information Environment (IUIE) initiative is scheduled for Spring 2000. Sybase to Oracle data conversion and data modeling for the IUIE were well under way at the close of 1999. Staff were trained in Uniface Development, Web Application Server, and Component Based Development, all integral to the system.

An IUIE development team, established in late Fall, is using the new Component Based Development methodology to set up reusable modules. The team has documented high-level user scenarios and detailed business processes related to the IUIE. The Object model and plan for this effort are complete and Uniface and Web development work about to start. Hardware has been installed, and configured to support a Development and a Test/Quality Assurance environment for this application, and for its support of the Decision Support Data Warehouse.

A new development environment for SQR report writers is in place. It will be available to the SIS and HRMS report writers in January 2000. Progress has been made in converting the Decision Support data warehouse from Sybase to Oracle. Scripts were developed to convert existing data structures and data content to the new structure (rdbms), and these will be ready for production use by March 2000. The underlying configuration of the new Oracle data warehouse is finalized and standards established. Conversion of existing batch processes will continue through March 2000.

Action 40. OVPIT should reconvene the Committee on Institutional Data and conduct regular meetings with the goal of defining data administration and access policies for institutional data.

The reconvened Committee on Institutional Data (CID) is working closely with the Committee of Data Stewards (CDs) on University-wide data administration and management issues. UIS is active on both Committees.

Creation of a Data Administration group within OVPIT/UITs has been approved. This new function will establish standards and procedures in support of institutional data policies outlined by the CDs and the University IT Policy Office. The group will also work on information policy development and education, data modeling and classification, collection and maintenance of documentation and descriptive information related to technology resources, definition and documentation of data access, and authorization procedures.

Action 41. The UIS Division must continue the Year 2000 readiness initiative. This work must be completed according to a demanding timeline or the business systems of the University will fail.

The Year 2000 initiative was completely successful. Thanks to five years of careful preparation and planning, all enterprise-wide information systems made the transition to the year 2000 without any significant problems. UIS staff had inventoried, assessed, remediated, and tested all systems. Campus task forces worked with departments to ensure that important local equipment and data were not overlooked. Contingency plans were also put in place. Recommendations were documented on the Year 2000 Web site and through print and online publications. Relationships with external service and supply partners were carefully evaluated. Data exchanges with financial institutions and the federal government were assessed and tested. E-mail went to all IUB account holders in December with preparation instructions.

OVPIT activated a Y2K Command Center to monitor rollover activities starting 12/31/99. The Command Center coordinated communication during this critical period with UITS staff, operational departments, and Operations Centers at all campuses. It was officially closed at 12:30 pm on January 4, 2000, reporting no significant problems at IU. UITS staff continue to monitor systems.

The fact that IU suffered no significant Y2K problems with its information systems is a comment on the years of hard work that UITS staff put into remediating Y2K problems on all of its systems. Had this work not taken place nearly all of IU's central, mission-critical information systems would have failed. IU's response to the Y2K problem was conducted jointly with the Office of the Vice President for Administration; both Offices worked extremely effectively together to meet this challenge. IU's investment in addressing potential Y2K problems will have long-lasting benefits: among them, an assurance that IU's strategies for preparing for other unexpected events are well defined and up-to-date.

Highlights of this effort included:

- All programming was completed by March 7 and the core programming team disbanded.
- Functional offices were heavily involved in testing; all systems went through a rigorous shake-down. Testing was completed in the Summer.
- Critical processing dates including the Fiscal Year and 9/9/99 passed with only a few small problems.
- Some 400 servers were assessed for potential Y2K problems along with key services including e-mail and Web.

- The Interactive Voice Response System was upgraded.
- All major functional areas developed contingency plans.
- A comprehensive OVPIT rollover plan was developed.
- Complete data backups were conducted on all systems on 12/31.

Action 42. UITS should complete a disaster recovery plan with increasing levels of recovery based on systems priorities.

A plan is near completion for coordinating the recovery of computer systems and associated services in the Wrubel Computing Center in the event that the facility is rendered unserviceable. The plan provides an emergency response team and procedures for notification and gathering, damage assessment and salvage procedures, and internal and external communications, among other functions. A limited systems recovery site is being planned at a separate location at IUB, where environmental and networking are being pre-installed to support relocated and replacement computer systems. This capability should be in place by April 1, 2000. Once these procedures are proven effective, planning for the recovery of critical services University-wide will commence.

Action 43. UITS should implement massive storage technology for storage of the University's institutional data, migrate tapes over time to the new environment, and integrate this technology with database management systems to support image, sound and video data types.

The complete automation of the storage of all the University's institutional data was finalized in 1999. All 24,000 3480 tape cartridges were converted to the new massive data storage system, the 3480 tape library was dismantled, and most of the 3480 drives were removed. A dual-copy facility was developed to improve the IBM Virtual Tape Server reliability and disaster recovery abilities, demonstrating IU's technology leadership in VTS implementations. A draft of the operations staffing plan was completed and two FTE lines were reassigned to other areas of Operations as Phase 1 of the plan. Equipment was installed in support of a first quarter 2000 project allowing the IBM SP systems that are part of the EUE to use the tape robot.

Action 44. UITS should incorporate user-centered design techniques and Usability Lab testing into all major systems development projects.

This activity has been combined with Action 37 and focuses on the delineation and implementation of a complete methodology for application design, development, testing, implementation, and operation. Several workshops and training courses on user-centered design and usability were conducted.

Action 45. The UIS Division and the Advanced Information Technology Laboratory should continue evaluation and experimentation that will keep IU on the leading edge of new information systems technologies to be employed in the University's business systems.

The UIS AITL has been incorporated into the Systems Integration Team, which is overseeing Actions 37, 38, and 44. This team is concentrating on leading-edge technologies that will ensure integration of the re-engineered University information systems. A suite of Compuware Corporation tools was acquired in June for the design, development, testing, implementation, and operation of applications. A shared development environment was established, ensuring a coherent strategy for all enterprise-level development. More than 26 UITS staff were trained on the basics of Uniface Development; core groups were trained on Uniface advanced concepts and Web Application Design and Deployment; and consultation to the development teams continues, focusing on the ERA, HRMS, SIS, and the IUIE systems. UIS will soon establish a position dedicated to looking at future IS technologies that can be used for the University's information systems.

VII. Telecommunications: Applications, Infrastructure, Convergence

Recommendation 7: The University should accelerate planning for a converged telecommunications infrastructure. The University and campuses must ensure that there is appropriate funding for telecommunications services and infrastructure in the base. Specific attention must be given to improving the state of the inter-campus networks, planning for and deployment of adequate commodity Internet connectivity, a University-wide base level of campus telecommunications connectivity, advanced networking infrastructure and applications, wireless networks and support for multimedia and streaming media.

In 1999 the final piece of the University's Information Technology organization structure was put in place with the appointment of Brian D. Voss as Associate Vice President for Telecommunications. In this role, Voss will lead the Division of UITS that is responsible for the University's voice, data, and video networks and services, as well as electronic mail and messaging services. He will oversee IU's growing role in Internet2, initiatives to provide a robust optical fiber infrastructure within Indiana, and the establishment of the State GigaPoP in Indianapolis. With his background in service, Voss will emphasize that the new technological initiatives at IU relate directly to improved services for the University community, as well as for its partners in the arena of national and international telecommunications. He will lead the Division through the planning and implementation of the Information Strategic Plan Action Items discussed in this section, as well as others throughout this report.

Action 46. UITS should accelerate planning for a converged telecommunications infrastructure that aims to maximize the benefits to IU of this emerging technology direction. It should be accompanied by an aggressive program of testing and trialling of new "converged" technologies.

Telecommunications services — telephone systems, computer networks, and video conferencing — are highly visible services that the IU community has come to expect to be wholly dependable and of very high quality. The existing distinct network infrastructures are well understood and are extremely reliable, and thus provide a solid foundation for the delivery of all IT services at IU. Hence, while convergence offers the potential of great benefits, in order to maximize those benefits — and to minimize negative impact on services and optimize the University's investments — the Division will need to proceed cautiously, though quickly, through planning, testing, and trialling of new technologies in this area.

A Task Force has been formed, with representatives from voice, video, and data telecommunications areas in UITS and is developing a University-wide telecommunications Convergence Plan. The Plan will be a blueprint for how the University might merge voice, video, and data onto one network. It will emphasize network reliability, resiliency, cost, and, above all, education through University-wide standards and expectations. The plan will consider several levels of convergence, and will lay out a cautious but focused series of steps for converging the networks. The plan is in the latter stages of development and completion is expected during the first quarter of 2000, with implementation to commence immediately thereafter.

A limited Voice over IP (VoIP) trial was completed in Summer 1999. While results were encouraging, technical and administrative hurdles remain, including the feasibility of VoIP as a large-scale application and the reliability of the data network for carrying voice traffic. UITS is working with leading vendors in the field to learn more about convergence technology, and to participate in a variety of equipment trials. IU's partnership in the Abilene Project will serve this purpose well, as trialling VoIP via the Abilene network will be explored in the second quarter of 2000.

Trialling and testing of video conferencing over IP, including desktop and small conference room technologies, are under way. A major trial of IP-based technology with the potential to replace the current Video Indiana Classroom (VIC) technology has begun and will be completed in the first half of 2000.

Action 47. The University as a whole and the campuses individually should establish base funding for the life-cycle replacement and ongoing development of telecommunications services and infrastructure.

Through extensive work by the OVPIT Finance Office and the Telecommunications Division during 1999, funding models are now in place to fully support life-cycle replacement and ongoing development of telecommunications services and infrastructure at IUB and IUPUI. Similar models are being developed for the regional campuses, leveraging the work done on the core campuses and in partnership with the regional campus CIOs and Campus Budget Officers. A first step on the regional campuses is the standardizing of the billing systems, enabling the recovery of life-cycle funds for voice and data networks. To this end, these campuses have been integrated into the IUB billing and service request system, and billing statements for the regional campuses have been standardized.

Action 48. A five-year plan for the University's intercampus networks and commodity Internet connectivity should be immediately developed, funded and implemented.

Design and budgetary planning is under way for the expansion of the statewide network linking all campuses. By July of 2000 connectivity levels up to 45 megabits/second (Mbps) or DS3 will be implemented, carrying backbone-converged voice, data, and video services. The latter will benefit the most from the dramatic increase in bandwidth, providing the network capacity required to implement new video technologies emerging in the market and being tested at IU.

To improve performance for the IU community's access to the commodity Internet, connections were expanded at IUB (from 15 Mbps to 30 Mbps at the start of the Fall semester, and to 45 Mbps by the end of 1999) and at IUPUI (from 6 Mbps to 15 Mbps), improving performance of user connections and data transfers. Usage of these connections continues to grow, and UITS continues to monitor use so that subsequent increases can be made in a timely fashion to ensure peak performance. However, expansion is only a part of the endeavor. Policy was put into place and actions have been taken to minimize and eliminate superfluous use, ensuring that IU's resources are utilized to support the mission of the University and its constituents.

Action 49. A uniform base level of telecommunications connectivity and standards should be defined, communicated, and where necessary, implemented for all campuses.

As the key infrastructure component in IU's IT environment, telecommunications standards are required to ensure interoperability and high quality network services. Again, leveraging the solid relationship built between the core campus IT organization and regional campus CIOs, UITS is working to define University-wide telecommunications principles and standards. A draft of these standards is expected by the end of first quarter 2000 and they will quickly be reviewed and then implemented across the institution.

Advanced Applications and Networking

Action 50. The University should consider implementing a network architecture that separately supports production and advanced network applications.

IU has now firmly established itself as a leader in advanced networking, through a variety of endeavors in which the University has taken a leadership role. These advanced networks effectively separate advanced research activities from those of the commodity production Internet, providing IU researchers with separate high-speed links to other researchers across the nation and around the world. Two networks in particular – Abilene and TransPAC – are now fully available to the IU community of scholars, and in fact, IU has the prestigious responsibility for managing these networks.

Abilene

In February, the Abilene Network, with its IUPUI-based Network Operation Center (NOC), achieved nationwide connectivity, with links operating from New York to Seattle. Abilene was formally launched at a gala event in Washington, DC, with the capacity to transmit 2.4 gigabits/second (OC48). In

October, the Abilene NOC and the Cisco Certified Internetworking Expert (CCIE) Practice Laboratory at IUPUI were officially recognized by Governor Frank O'Bannon. News conference participants included IU President Myles Brand, UCAID President and CEO Doug Van Houweling, and Cisco Systems Chairman John Morgridge. At the most recent Abilene Executive Meeting, IU was lauded by all partners (UCAID, Cisco, Nortel, and Qwest) for the speed in which NOC services were established, and for the quality of support provided by IU technicians and engineers, which has contributed greatly to the success of the project.

Several positions were provided to IU as part of the Abilene project to support the design and operation of the new Abilene network. By the end of 1999, all key positions provided to IU by this project were filled, with the final position supporting expanded Web-based information dissemination functions for the network to be filled during the first quarter of 2000. These positions not only provided growth opportunities for long-time IU staff, but also enabled IU to recruit new technical expertise from outside the University.

TransPAC

In May, the Japan Science and Technology (JST) Corporation awarded IU a further \$10M over five years to double the capacity of TransPAC, another network that is managed by UITS. JST awarded Japan's Kokusai Denshin Denwa (KDD) Co., Ltd., an additional \$2M per year over five years to double the Japanese circuit. Currently, the connection's bandwidth is 73Mbps; negotiations are ongoing to expand capacity to 100Mbps, and possibly to OC3 in 2000.

As IU's participation in these networks grows, and as IU seeks to leverage its success to broaden its role in other existing and developing Internet2-style advanced networks, IU will require an increasingly larger conduit of bandwidth to connect the core campuses, and to link IU to the new Internet. As well, as IU seeks to enhance its position as a center for high performance computational research, it will need a high-capacity bridge to fuel further development of computational resources. To accomplish these goals, an optical fiber infrastructure and a high-capacity connection facility will be needed to provide the bridge between IU's researchers and resources and those at other institutions connected to the advanced networks.

Optical Fiber Infrastructure (OFI) and the Indiana GigaPoP

In early 1999, OVPIT worked closely with the Higher Education Commission and the Governor's Office to secure an appropriation from the Indiana Legislature to fund a project to provide a high-volume fiber route that will connect Indiana University and Purdue University to Internet2. To provide the network infrastructure for advanced network-based research between the universities, connectivity to Abilene, and participation in I2, the universities propose minimally to establish:

- Multi-fiber connections and conduit between the IU campuses at Bloomington (IUB) and Indianapolis (IUPUI), Purdue at West Lafayette and IUPUI, and IUPUI and the Abilene Core Node in Indianapolis (or its equivalent)
- A distributed GigaPoP on the IUPUI campus and at the carrier premises where the Abilene Core Node is located.

During the last quarter of 1999, several parallel tasks were under way to advance the project.

The universities, under the leadership of the OVPIT, have worked through details of administration of the appropriation with Intelenet. A final agreement is expected early in the first quarter of 2000 that will pave the way for release of funding for the establishment of the OFI and the Indiana GigaPoP.

An RFP for the OFI was released and refined in the last half of 1999, and a finalist will be selected in early 2000. The OFI will be put in place, depending upon the vendor-partner selected, sometime in the period of mid-year 2000 to the first quarter of 2001. Equipment evaluations will commence in the first quarter of 2000, and will be completed in time to light the dark fiber when it is ready for use.

Wireless Networks

Action 51. Implementation should begin for a University-wide wireless network, initially through a trial with a School.

Wireless technology will become an increasingly important element in telecommunications at IU in 2000. Although IU has some of the best wired campuses in the nation, mobile, “de-wired” computing technology will play an increasing role in the lives of IU students and faculty in the next decade. Wireless networks will not replace the need for wiring plant infrastructure and the life-cycle modernization of that infrastructure as it ages and new technologies are available for use. However, wireless will play a role in augmenting the campus networks, removing the boundaries of buildings and wire-jacks from the IU technology-using community.

Given that wireless technology is rapidly developing, IU will need to take a cautious, though committed path to the deployment of wireless networks and services. Initially, the plan will be to implement limited rollout pilots on the two core campuses by the end of Spring semester 2000 in student/faculty gathering areas, or in buildings that present difficult hard-wiring challenges. Supported applications will initially be limited to Web browsing and e-mail – though these comprise the largest share of use of data networking applications. UITS will also work with a limited number of departments or faculty members interested in using wireless technology as part of specific technology programs under grants.

Successful deployment will require robust support services — advising on user-held technology (wireless access cards in PCs), standardization of laptop configurations, and user training — and a fully secure environment. The Telecommunications and TLIT Divisions and the IT Security Office are working closely together from the outset, to ensure that the technology deployed in the pilots is functional, supportable, and secure. Wider deployment plans will be developed through the 2000-2001 academic year.

Multimedia and Streaming Media

Action 52. The networking demands due to the increasing use of multimedia applications should be addressed as the University network continues to develop.

As detailed in Action 48, plans are in place to enhance intercampus data/voice/video transmission by July 2000. The expansion of the statewide IUNet to DS3-level service will provide the necessary bandwidth to facilitate the deployment of multimedia/video applications across the Institution.

Action 53. The University should begin the production deployment of streaming media services such as videoconferencing and video and audio stores. It should ensure that support is provided for quality of service on the University networks to ensure that emerging instructional and research applications relying on interactive or streaming media (including digital libraries and distributed education) can have consistent and acceptable performance.

A video streaming advisory group was established in 1999, and several tests and trials were successfully accomplished through the end of the year. Approximately a dozen University events including panel discussions, music, athletic events, and media events have been Internet-streamed in partnership with *broadcast.com*. Infrastructure was established on the Bloomington campus, including encoders and servers, and a pilot project was established for support of streaming services on the University Web pages.

IP-based H.323-standard videoconferencing was deployed successfully in test-bed desktop and room-system applications in the third quarter of 1999. Room systems at the IU Connersville and Newcastle extension centers utilizing the H.323 technology are being readied for Spring 2000 classes. Very high quality MPEG2/IP video conferencing systems were tested and are being deployed to interconnect the Bloomington and Indianapolis video services hubs.

VIII. Support for Student Computing

Recommendation 8: IU must provide the information technology tools, infrastructure, and support services so that students may effectively engage in learning and research, appropriate to their various academic disciplines and areas of study. IT support for students should include technology support centers and a computing environment that is seamless across boundaries of campus, home, residence hall, and community.

Action 54. UITS, with the departments, schools and campuses, should develop a model for student technology support that provides:

- *a basic level of support and technology infrastructure to all students;*
- *advanced support, typically for advanced degree students in graduate and professional programs, that is discipline-specific and may be integrated with the teaching or research activities of a school or department; and*
- *advanced support to undergraduate students, as needed, especially for students in disciplines which do not provide such specialized support.*

This Action calls for expanding support availability for students from the IUB and IUPUI Support Centers by leveraging technology and staffing on both campuses. Implementation is expected to begin in early 2000. It is planned that Support Center hours will be extended on both campuses in Spring 2000. These expansions — on the IUB campus coupled with a transition of IT Support Services to residents of the Halls, and at IUPUI — will make telephone and personal support contact services available during the hours of greatest student demand — evenings and weekends.

Access in Student Residence Halls

Action 55. UITS should work with the Halls of Residence and Residence Life, at IUB and IUPUI, to provide students with a seamlessly integrated computing environment, available on campus, in the residence halls, including academic support centers or from remote locations.

Throughout 1999, discussions between UITS and Residential Programs and Services (RPS) at IUB focused on how to best serve the IT needs of the residents of these facilities. By the third quarter, essential agreement for the transitioning of IT services from RPS to UITS had been achieved and the process of involving the residents in the transition commenced. UITS, RPS and the Residence Hall (RH) Association formed an RH Information Technology Committee to explore the needs of the residents for IT infrastructure and services, and to determine the budget and funding required to support that infrastructure and service suite.

The Committee determined the set of services to be offered and the budget required to deliver those services. The RH Association charged UITS and RPS with resolving minimal funding shortfalls for Academic Year 2000-2001, and with beginning the transition of service to UITS during Spring 2000. In this final step of the process, UITS and RPS will complete the process early in the first quarter of 2000, and the transition of responsibility and the modernization of IT infrastructure and integration of student computing services will commence immediately. The goals of this initiative are:

- Modernizing the Residence Halls labs and integrating them seamlessly with the Student Technology Centers
- Modernizing the network infrastructure within the Residence Halls and making it completely compatible with the campus at large
- Improving the support provided to residents using IT, and seamlessly integrating it with the support services available across the IUB campus (see Action 54).

In anticipation of the agreement and this advancement of this initiative, UITS hired an experienced IT Support manager, who actively participated in the aforementioned process, and who will assume leadership of Residence Hall IT Services during the transition. Responsibility for IT support will be housed in the TLIT Division of UITS, though leadership of the transition project has been assigned to the Associate Vice President of the UITS Telecommunications Division because of that Division's extensive involvement in the modernization of network infrastructure.

Action 56. Housing on the IUPUI campus should be planned carefully with involvement of UITS and others, to ensure that it is developed as a premier living and learning community, making effective use of technology for student learning.

No new housing has been approved at IUPUI, but some is anticipated. Should this proceed, UITS will be involved in planning for the IT aspects of such housing.

Action 57. UITS, in partnership with Halls of Residence and Residence Life, should develop a program to provide teaching and learning technology and support services in one or more selected residence halls, as one part of an on-campus pilot in distributed learning.

Much of the effect of what is called for in this Action will happen as a result of the responsibility of IT services in the Halls of Residence transitioning from RPS to UITS.

Student Ownership of Computers

Action 58. IU should consider a program of incentives to increase student ownership of computers, including some combination of direct financial assistance, negotiation of institutional discounts for student purchases, on-campus sales and support, and encouragement from the highest levels of the University. IU should further evaluate programs that would require computer ownership for all students.

This non-funded Action is implemented through the allocation of existing resources. Indiana University has not required students to own computers because of concerns that this would drive up student expenses. Nevertheless, the UITS User Survey reflects student computer ownership has increased over the past two years by 9.4% at IUB and by 6% at IUPUI.

Computer ownership	IUB	IUPUI
1999 Survey	79.8%	81.1%
1997 Survey	70.4%	75.1%

IU's current strategy is to market the strength of IU's IT resources and provide guidance in the purchase and use of personally owned machines. UITS supplies the tools described below to help students select an appropriate computer.

An online Computer Guide for IUB and IUPUI students provides recommendations for buying computers or making currently owned ones compatible with the IU network, FAQs, instructions for connecting to the network, special offers, and Ethernet card information. The UITS Knowledge Base contains more than 50 searchable documents related to buying new and used equipment, using hardware and software, and using IU resources. Each summer all new students receive a letter outlining the benefits of computer ownership, and referencing the above resources. At New Student Orientation UITS staff are on hand to advise parents on student IT resources.

UITS also leverages the Institution's purchases of desktop computers by working with vendors to make the same high-quality, system-integrated workstations available for purchase by IU students (as well as faculty and staff). Success in this endeavor is evident in the extensive purchases made this past year as part of the life-cycle funding and modernization initiatives (Actions 1-3). Beyond these leveraged deals, UITS works with a complete set of vendors (including Apple, Dell, Compaq, Gateway,

and others) on special deals for computer purchase. Data from June-September show that 567 faculty, staff, and students made personal purchases solely from the Dell offering. Software licensing agreements with Microsoft, Corel, Hummingbird, Norton, and SPSS provide software at either no cost or low cost, which reduces the overall cost of computer ownership for IU constituents, and improves the value of their investments.

Students living in the Halls of Residence have Ethernet connections to the IU network, and this will be enhanced as part of the transition of IT services to UITS in the coming year. Remote access to University resources is provided on the core campuses, which further improves the value of ownership by providing Internet access to home-based computers. IUB has increased the number of PPP connections to the digital modem pool to 1,472. IUPUI has 874 modems of all types in the central modem pool, and UITS maintains 96 modems at the School of Medicine and an additional 48 at the School of Dentistry. While modem usage continues to climb, both campuses are meeting demand.

Plans are under way to pilot personal workstation connectivity at IUB and IUPUI through the use of wireless networks (see Action 51). By expanding the network beyond physical connectivity and enabling more mobile personal computing, IU will enrich and broaden the value of computer ownership for students.

IX. Digital Libraries and the Scholarly Record

Recommendation 9: The University should build upon and expand its digital library program and develop the digital library infrastructure needed to support research, teaching and learning.

Action 59. The University should develop a program of digital library research, and engage in national initiatives, to address the issues of user services, creation and management of digital collections, the federation of distributed digital libraries, and the design of digital library systems.

The IU Digital Library Program is a collaborative effort of the Indiana University Libraries, The Office of the Vice President for Information Technology, and the University research faculty with leadership from The School of Library and Information Science. In Spring 1999 the IU Digital Library Program submitted a proposal to the National Science Foundation Digital Library Initiative, Phase 2 (DLI2) for development of the Digital Music Library. Indiana University is lead institutional on the project, which has six collaborating institutions: Northwestern University, University of Massachusetts, University of Illinois, Oxford University, King's College in London, and Waseda University in Tokyo. Other IU participants in the project include faculty from the School of Library and Information Science, the School of Music, and the School of Law. IU is awaiting a funding decision on this proposal.

As part of a program of research and development, a number of exploratory digital library research projects are also being undertaken. These include a demonstration project for digital media delivery across wide-area, high performance networks, and a prototype digital publication and electronic pre-print service, which will serve an interdisciplinary and international scholarly community centered at IU.

Action 60. The University should develop a digital library infrastructure that will provide a common technical and organizational base for new and ongoing digital library programs.

UITS and the University Libraries have undertaken the ongoing upgrade and improvement of the University's digital library infrastructure, to assure that it remains current in technology and optimally useful to IU faculty and students. This has included establishment of the Digital Media Image Center in the Main Library at IUB. The Center includes a wide array of digitization hardware, software, and media source equipment, which has played a key role in a number of digital collection projects, among them:

- Digital Stardust-Hoagy Carmichael Online. This is a digital library collection containing significant portions of Indiana University's entire collection of materials pertaining to the life and career of songwriter Hoagland "Hoagy" Carmichael (1899-1981). Included in the online collection are sound recordings, photographs, sheet music, playscripts, correspondence, and other materials from the world's largest holding of Hoagy Carmichael materials. Digital Stardust is a collaboration of the Archives of Traditional Music and the IU Digital Library Program, with support from UITS.
- Hohenberger Photograph Collection. The IU Lilly Library houses a collection of some 9,400 photographic negatives made by Brown County photographer Frank Michael Hohenberger (1876-1963). There are many images of Brown County and southern Indiana, as well as many from Hohenberger's travels. Beginning in 1999 several hundred photographs from the collection were digitized and made available via the Web, accompanied by an electronic index and finding aid to the entire collection, and a digitized biography and commentary on Hohenberger's work. Work on digitizing the collection will continue in the coming year. The Hohenberger project is a collaboration of the Lilly Library and the Digital Library Program, with support from UITS.
- Digital Photography Collection of the Gary Works. IU has undertaken a project to digitize and present on the Web the US Steel Photograph Collection, a series of 1,900 photographs of the Gary Works steel mill and the corporate town of Gary, Indiana. The photographs document the construction and growth of a town conceived and built by United States Steel Corporation and documented by US Steel photographers between 1906 and 1941. The images record many aspects of

this planned industrial community: the steel mill, the city, and its citizens. The Gary Works project is a collaboration of the IU Digital Library Program and the Calumet Regional Archive at the IU Northwest campus, with the support of UITS.

Action 61. The University Libraries, with UITS, should provide students, faculty, and staff at all campuses with convenient and reliable access to a comprehensive and coordinated collection of electronic information resources, on the campuses and off.

Several projects in the past year have involved the integration and coordinated delivery of electronic information resources. In the process of developing these projects (e.g., the Hoagy Carmichael collection) the need was identified for staff expertise in the design of information resources and computer interfaces.

A key to addressing this need is the allocation of proper staff resources to the design and development of digital library services. Position requirements have been identified and a search is under way to fill the position of Content Analyst and Interface Design Specialist in the Digital Library Program.

Action 62. The University should develop within its digital library program an "electronic reserve" service so that faculty can assemble and make available content in all media and formats: text, image, audio, or video; published or unpublished; digitized representation or original digital artifact; etc.

It is essential that the Library's electronic reserve system be compatible with and ultimately integrated with the overall library management system (online public catalog, library circulation, etc.) Now that IU has selected SIRSI as its next library management system, work can proceed on planning and implementing electronic reserves. Pat Steele from the University Libraries is taking the lead in this effort, and participation from the Digital Library Program and UITS is expected.

Action 63. The University should establish sound funding for existing digital library initiatives (including Variations, LETRS, IMDS, others), and should provide support for other digital library projects of merit that are advanced in the years ahead.

System upgrades and improvements have been made to the ongoing digital library programs including the Variations digital music library application, DIDO (the fine arts digital image database), and the services provided by LETRS (Library Electronic Text Resource Service).

Variations delivered 191,305 sound file accesses between July 1, 1998 and June 30, 1999, averaging 590 accesses per open day; 1472 additional sound recording titles were digitized by Music Library staff; and 19 opera scores (6393 pages) scanned by Music Library staff. Fine Arts Slide Library staff added 3290 images to DIDO in 1998-99, bringing the total to 9597 images, and supplied images for 35 Art History and Fine Arts Studio course Web pages. Also in the past year the DIDO image bank was successfully moved from a Sun SPARCstation at the Slide Library to a Digital Library Program server with no interruption in service.

LETRS Web-based collections received increasing use during the year, peaking at 22,000 accesses per month, and averaging about 15,000 per month. Web-based collections continued to expand: notable additions were the complete works of Goethe, the Patrologia Latina, and collections of medieval Spanish texts.

For the first time, Variations and DIDO are operating on current computing platforms that also have in place a life-cycle replacement plan, while LETRS continues to operate with an effective life-cycle replacement plan.

Action 64. UITS, in partnership with the University Archives, Internal Audit, the Committee of Data Stewards, and others should develop a program to assure preservation of electronic institutional records.

Action 65. UITS, in partnership with the University Libraries, University Archives, and others should evaluate technologies and propose methods and standards to protect digital materials against media deterioration and technological obsolescence.

UITS and the University Archives have an ongoing collaboration to develop methods, standards and practices that will assure long-term access to and preservation of IU's electronic records. In 1999, University Archivist Philip Bantin received a grant from the National Historical Publications and Records Commission (NHPRC) to continue the work in electronic records analysis and preservation that he began as part of an earlier NHPRC-funded project undertaken in cooperation with UITS.

UITS is also working with the University Archives, the School of Library and Information Science, and the School of Informatics to develop courses and course modules for teaching undergraduates and graduate students about electronic records. Further progress on this action is being made as part of the University's Data Administration initiative.

X. Security, Privacy, Intellectual Property

Recommendation 10: The University, with leadership from the OVPIT, must continue to develop policies and implement procedures that protect the security of IU's information technology resources and institutional data, safeguard personal privacy, and respect intellectual property rights, while at the same time promoting two traditional university values associated with academic freedom: access to information and freedom of discourse.

IT Policy

Action 66. The University should develop clear and forceful policies to address the management and protection of information and the security of IT resources.

The Information Technology Policy Office (ITPO) and University Information Services (UIS) Division have developed a plan to establish a Data Administration/Information Management function within OVPIT/UIT. The proposal to establish this function was approved in December. The Data Administration/Information Management unit will work with data management committees (Committee of Data Stewards, Committee on Institutional Data), University business areas, University archivists, library staff, technicians, and others to develop policies, procedures, and education programs related to appropriate protection, use, and retention of institutional data.

IT Security

Action 67. UITS, with the Committee on Institutional Data and others in the University community, should develop security mechanisms that properly enact institutional policy. Implementation of these security mechanisms should include risk assessment, audit and controls, and education and awareness. UITS should focus special attention on providing reliable authentication and access management systems.

The Information Technology Security Office (ITSO) has undertaken an initiative to increase the scope and capacity of security services provided to all campuses by the ITSO. These security services include intrusion detection, risk assessment, scanning network-connected computers for vulnerabilities, initiation and coordination of incident response, and provision of security information resources to all campuses. Major upgrades to security services will be in place by February 2000.

Authentication and access control systems are a central component of IT security. Establishing a University-wide Global Directory service is a critical first step toward a University-wide common authentication service. The multi-campus Global Directory Services team has identified username conflicts among all members of the University community (i.e., situations where two or more users on different campuses have the same username). These conflicts must be resolved before a global authentication mechanism can be implemented. Work is under way to resolve these conflicts and each member of the IU community should have a unique University username by March 2000.

Intellectual Property

Action 68. UITS should collaborate with the Copyright Management Center on developing policies and programs that advance the use of information technology and information resources, especially in areas of teaching and research, while limiting the University's liability exposure regarding intellectual property rights.

The University ITPO has been working in collaboration with the Copyright Management Center and University Counsel on matters related to intellectual property and copyright. This collaboration has led to the registration of an agent with the US Copyright Office (August), as encouraged by the Digital

Millennium Copyright Act. This agent (the University IT Policy Officer) is the contact for all IU campuses, and will receive and coordinate the resolution of complaints of alleged copyright infringement by members of the IU community. Specific University procedures regarding intellectual property and copyright are being developed and will be published by February 2000.

Contact Information

Office of the Vice President for Information Technology and Chief Information Officer

Franklin Hall 116	ES 2129
Indiana University	Indiana University
Bloomington, IN 47405-1223	Indianapolis, IN 46202
(812) 855-5752	(317) 278-3956
(812) 855-3310 (fax)	(317) 274-4513 (fax)

Vice President for Information Technology and Chief Information Officer

Michael A. McRobbie (vpit@indiana.edu)

Associate Vice Presidents

Erwin Boschmann (erv@iu.edu)
Distributed Education

Garland C. Elmore (elmore@iupui.edu)
Teaching and Learning Information Technologies and Dean for Information Technology, IUPUI

Norma B. Holland (nholland@indiana.edu)
University Information Systems

Christopher Peebles (peebles@indiana.edu)
Research and Academic Computing and Dean for Information Technology, IUB

Brian D. Voss (bvoss@indiana.edu)
Telecommunications

Assistant Vice President

Bill Stephan (wstephan@indiana.edu)
IPCRES Economic Development Director

Officers

Karen H. Adams (kadams@indiana.edu)
Chief of Staff and Communications and Planning Officer

Debby Allmayer (dallmayer@indiana.edu)
Human Resources Officer

Laurie Antolovic (lantolov@indiana.edu)
Finance Officer

Mark Bruhn (mbruhn@indiana.edu)
IT Policy Officer

Mike Halbrook (halbrook@indiana.edu)
Development Director

Regional Chief Information Officers

IU South Bend	Kirk Aune	kirk_aune@iusb.edu
IU Southeast	Larry Mand	lmand@ius.edu
IU East	Stephan Reynolds	steve@indiana.edu
IU Northwest	Donald Steward	dsteward@iunhaw1.iun.indiana.edu
IU Kokomo	Gordon Welty	gwelty@iuk.edu