CONTENTS

Preface ..................................................................................................................................... 2

Introduction ............................................................................................................................ 3

I. Solid Foundation of IT Infrastructure & Sound Fiscal Planning ....................................... 6

II. Access to Network Resources .......................................................................................... 7

III. Institutional Commitment: Faculty & Staff Engagement ................................................... 9

IV. Teaching & Learning: Content, Access, Distributed Education ...................................... 14

V. Research: Computation, Communications, Collaboration .............................................. 21

VI. Information Systems: Managing IU’s Information Assets ............................................. 29

VII. Telecommunications: Applications, Infrastructure, Convergence ............................. 38

VIII. Support for Student Computing .................................................................................... 45

IX. Digital Libraries & the Scholarly Record ....................................................................... 49

X. Security, Privacy, Intellectual Property .......................................................................... 55

Contact Information ............................................................................................................. 58

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

For up-to-date information
technology news at IU, see:
it.iu.edu/
Preface

The Indiana University Information Technology (IT) Strategic Plan was approved by President Myles 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, 2001 was the third full calendar year, and FY 2001-2002 the third full financial year, of the implementation of the Plan.

This document is a summary for this period principally of University Information Technology Services (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 FY 2001-2002 as part of the University’s annual budgetary process, realistically it reports accomplishments mainly for the calendar year 2001, given that it is prepared in early 2002. 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 2001 are described under these.
Introduction

During 2001 IU passed the midpoint in the implementation of the Information Technology Strategic Plan. Since the inception of the Plan, extraordinary strides have been made towards achieving its vision for IT at Indiana University. In some areas, such as advanced networking, progress far exceeds expectations; in many other areas, including the lifecycle funding of basic IT tools and network access, and high performance and research computing, IU has achieved recognition as a national leader. These advances highlight the degree to which information technology is an inextricable part of the University fabric.

At my request last year, the University-wide IT advisory groups of faculty, staff, and students that were key in developing the IT Strategic Plan began an assessment of its implementation thus far. In their completed midterm assessment, the committees laud our progress. As well, they highlight some areas that need further attention. The report recognizes the progress made in previous years, and highlights specific accomplishments from 2001. It is available at www.indiana.edu/~uitc.

Advances made in 2000 established a foundation of basic IT tools and services, so that across the University faculty and staff can now expect a uniform, modern standard of desktop technology, ensured and protected by an annual lifecycle fund. In 2001 this foundation of uniform access was extended to several key areas and populations of the University.

- In IU’s 600 general-purpose classrooms, progress continues to be made in upgrading the complete IT infrastructure.
- In IUB residence halls, UITS completed its first full year of managing the IT services and infrastructure, providing students who use the labs in the halls with the same software and functionality as the campus Student Technology Centers (STCs). These improved services in the halls have been extremely well received.
- The systematic renewal of desktop computers and availability of current software has created a population of computers with common capabilities and constrained variation, ensuring that wherever in the University faculty, staff, and students use IT resources, they will find an IT environment of a standard high quality, supported by staff knowledgeable in this environment.

- The remarkable success of IU’s Microsoft Enterprise License Agreement (MSELA) continues during this five-year, approximately $7.5M agreement. More than $63M of products equating to 386,440 copies of software have been distributed to IU students, faculty, and staff during the first 3.5 years of the contract.

This year marked notable progress in the reengineering of University enterprise information systems. Among the highlights:

- Web registration was launched in March.
- Phase two of Admissions for the new Student Information System (SIS) was deployed in October.
- Common applications were developed for undergraduate, graduate, international, and departmental applications for admission, allowing students to apply to any IU campus over the Web.
- Planning for the development of the Human Resources Management System (HRMS) information environment is complete, as work progresses toward the December 2002 implementation of this major new system.
- An upgrade to the SIRSI Unicorn Library system paves the way for the delivery of self-service functions for Library patrons in Summer 2002.
- With the release of the OneStart Web portal application, IU launched what will eventually become the “front door” to many of the key University information and business services. Via this portal the IU community will enjoy streamlined and customizable access to such routine and periodic functions as checking e-mail and paying tuition bills, and to procedures for hiring staff.
2001 was a landmark year for demonstrating IU’s leadership and innovation in high performance computing.

- In August Pervasive Technology Laboratories at Indiana University launched three of an eventual six new labs. The Community Grids Lab works to integrate peer-to-peer computing with distributed processing and parallel computing. The Open Systems Lab researches the technologies that allow communities of experts to develop and share standard tools and protocols. The Advanced Network Management Lab is developing technology to manage the convergence of data, voice, and video over the Internet. Recently, a distinguished scientist was hired to lead the Visualization and Interactive Spaces Lab, the first to be based on the IUPUI campus. These Labs stand to make a significant contribution to economic development in Indiana through technology transfer, commercialization of innovations produced in the Labs, and joint research and development partnerships with government and industry.

- In October IU and IBM announced the upgrade of IU’s IBM SP to a peak computational capacity of 1.005 teraFLOPS, making it the largest university-owned supercomputer in the nation. Funded through the UITS IT Strategic Plan, the Lilly Endowment Indiana Genomics Initiative grant, and an IBM Shared University Research grant, this upgrade puts IU’s IBM SP 50th on the list of the world’s Top500 supercomputers. The IBM SP supports applications at IU in the life sciences, archaeology, astronomy, business, chemistry, economics, earth sciences, and physics.

- With a $1.8M National Science Foundation grant, IU is creating the innovative Analysis and Visualization Instrument Driven Data (AVIDD) facility. AVIDD will provide a means for IU faculty to manage, analyze, and visualize the vast amounts of data generated by new generations of large scientific instruments. A major tool for teaching and research, AVIDD will be distributed across three IU campuses and integrated with very high network bandwidth using the new I-Light optical fiber network.

- As part of the International Grid Operations Center, or iGOC, co-located with the Global NOC on the IUPUI campus, Indiana University will help build the International Virtual Data Grid Laboratory (iVDGL), a network of thousands of computers in the US, Europe, and Asia, able to handle petabytes of data.

- Indiana University led the effort responsible for the Research@Indiana exhibition at SC2001, the world’s most prestigious high performance computing conference and exhibition. This was a collaborative effort by IU, Purdue University, the University of Notre Dame, and the Rose Hulman Institute of Technology, and marked the first time that the major higher education institutions in a state have partnered to collectively showcase at this conference their latest advances in high performance computing.

The year has seen major achievements in networking by IU at the local, national, and international levels that have built on IU’s widely recognized expertise as a leader in network engineering and management.

- The highlight of networking achievements in 2001 was bringing into operation a very-high-speed optical fiber network, I-Light, which connects IUB, Purdue University, and IUPUI. I-Light can move the digitized contents of the library at IUB or Purdue from one campus to the other in seconds. Though primarily dedicated to research applications, I-Light will also support voice, e-mail, and videoconferencing among the three campuses. I-Light will also position IU and Purdue to more effectively compete for federal grants and other research opportunities.

- Upgrades on the IUB campus included a separate commodity Internet connection established for the Halls of Residence, doubling Internet bandwidth to the campus and allowing UITS to manage residential and campus Internet use in a manner consistent with their funding models.

- Enhancements to the IUB campus backbone and the upgrade of the IUPUI backbone to Gigabit Ethernet technology expand network robustness and efficiency and put Internet resources within easier reach of the IU community.
Introduction

Establishing a testbed system to be used in many areas of research in instruction, usability, human-computer interaction, and intellectual property rights.

IU significantly increased its emphasis on the importance of computer security this year through the broadening of the powers of the IT Policy and Security Offices and stronger programs in user awareness. Following a resolution on May 4, 2001, by the IU Board of Trustees, computer security activities were expanded and enhanced. In November Merri Beth Lavagnino was appointed Deputy Information Technology Policy Officer. Located at IUPUI, she will provide an effective presence for the ITPO at IUPUI and on the regional campuses.

One of the biggest challenges for the remaining years of the IT Strategic Plan will be to sustain progress in the face of challenges posed by the State’s fiscal crisis. Cuts in spending that affect information technology threaten to erode the gains made over the past several years in establishing a solid IT infrastructure across IU. Such cuts also put at grave risk the countless areas in which IU’s leadership and innovation have made high-level contributions to building the national and international fabric of high performance computing and communications. IU’s reputation as a leader is at stake. But more important, any loss of ground in IU’s efforts to help establish a sound, IT-based economy for the State of Indiana, threatens not only the University but all citizens of the State.

Michael A. McRobbie
Vice President for Information Technology and Chief Information Officer
January 2002
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.

**Lifecycle Funding, Modernization, and Local Support**

**Action 1.** The University should build lifecycle 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 lifecycle 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 lifecycle 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 August 2000, after little more than two years of progress on these Actions, IU completed the implementation of lifecycle funding for desktop computers, operating systems, and common applications for all the campuses of the University and for all 110 IU schools and service units. During the initial phase of this project, more than 10,000 obsolete computers in 110 schools and service units were replaced at a cost of $11M. The replacement value of the inventory was calculated at $20M.

A $6M annual lifecycle fund has been established to keep more than 15,000 faculty and administrative desktop computers up to date. The impact of systematic renewal of desktop computers throughout the University goes far beyond personal productivity and satisfaction. A population of computers with common powers and constrained variation makes the IT environment throughout Indiana University easier to support.

Agreements with major software vendors, including Microsoft, Symantec, Oracle, SPSS, and others, mean that all IU computer users have access to the most recent releases of popular desktop software. The most extensive of these agreements, the Microsoft Enterprise License Agreement, has distributed to date 386,592 copies of the Microsoft operating systems and personal productivity suites such as Microsoft Office. These agreements have resulted in savings for faculty, staff, and especially students of more than $62M thus far. In addition, a more easily supported common base of software and a common hardware platform allow for improved service to users.

UITs and IU Purchasing have negotiated to leverage the mass purchase power of the University to realize the lowest workstation prices in meeting lifecycle funding objectives. Such negotiations have now led to the purchase of more than 14,000 machines by IU schools and departments, saving some $8M over standard educational pricing.

The successful implementation of lifecycle funding and basic equipment modernization is an impressive achievement in a short time, and has brought IU national attention. This accomplishment should greatly enhance faculty members’ and students’ opportunities to make full instructional, administrative, and research use of IT. The success of this implementation is illustrated by the fact that access to basic hardware, software, and networks is taken for granted by students and faculty, and generally high levels of satisfaction are reflected in the UITS surveys.
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

With the long-standing problem of inadequate modem capacity on the two core campuses solved in 1999, service was monitored for quality during 2000 and 2001. Busy signals were encountered rarely and modem access remains, as a normal operating condition, rapid and straightforward.

Some changes are planned for the IUPUI modem pool in 2002. Because of low use, the 278-5619 modem line (IU network only) was removed from service on January 3, 2002. The 278-5620 (up to four-hour connections) and 278-5621 lines (up to hour-long connections) remain available. Together these lines have the capacity to support 989 simultaneous users. The new year also saw the removal of out-dated dial-up menus at IUPUI. Most modem pool users use the PPP dialup software available from UITS through IUware online and on the IUware CDs, so were not be affected by the change.

In the area of remote access, the University will migrate from a model of University-as-provider to one in which IU acts as facilitator between users and communication vendors. The leadership of UITS Telecommunications has made great progress in developing favorable subscription plans and direct network peering agreements with ISPs in the Bloomington area, such as Smithville Telephone for DSL. DSL provides download speeds up to 50 times faster than standard modems and up to 12 times faster than ISDN. It works with existing telephone service, allows subscribers to use their phones while connected to the Internet, and eliminates the need for dial-up connections. Through IU’s partnership with Smithville Telephone Company the IU Bloomington community can get DSL Internet service at a significantly reduced rate, at speeds up to 1.5Mbps.

By Summer 2002, broad offerings for high-speed access (DSL and cable modems) should be available in regions around many of the IU campuses, so that faculty, students, and staff can take advantage of these services. Continued progress in Bloomington will be key to the success of broader deployments in Indianapolis and the regional campus communities. UITS will continue to seek to leverage the power of IU’s 100,000-member community to secure the market’s best rates and most favorable service packages, and performance-enhancing local peering arrangements.

On-Campus Access

In early 2001, a new architecture was developed and implemented for the IUB campus that featured a separate commodity Internet connection for the campus and one for the Halls of Residence. The main benefit of this implementation, aside from the doubling of bandwidth, was that UITS could begin to analyze and manage the two separate forms of use – residential and campus – in a manner consistent with the needs and funding models of each. In the case of residential connections, UITS is leveraging its assumption of responsibility for IT in the residence halls by providing a role for resident government in helping to determine proper policy and practice for the residential commodity Internet connection. This new bandwidth, architecture, and approach have led to more productive and responsible use of IU’s network resources for students in their home and learning environments. A series of tests was conducted to determine the effect of filters upon certain types of data traffic to best manage the bandwidth in the residence halls.
During 2001, some 8,538 data jacks were installed or upgraded in locations across the IU Bloomington campus, bringing the total number of active Ethernet jacks to 30,170. Of these, 6,897 are capable of supporting up to 100Mbps.

An enhanced backbone, which will greatly improve the Bloomington campus network infrastructure, was begun in 2001, along with improvements to the publicly accessible Web site for current and historical display of traffic statistics (hydra.uits.iu.edu/vlan).

Through a gigabit distribution project, five additional buildings — Franklin, Lindley, Education, Showers, and the UITS complex — are now connected to the backbone, along with the Chemistry building and the Music Library building, at 1Gbps, with capacity available and plans for adding more buildings in 2002.

Efforts continued in 2001 to replace aging Ethernet equipment with 10/100Mbps-capable switches in five additional Residential Programs and Services (RPS) complexes (a total of 40 buildings). Additionally, 38 campus buildings have been upgraded as part of an equipment replacement program, and upgrades are proceeding until all buildings on the Bloomington campus are finished. The risers in these buildings’ infrastructures were upgraded to 100Mbps (using a combination of fiber and twisted pair copper risers), bringing those buildings up to the latest campus standards. The RPS project was completed months ahead of schedule and within budget.

Under the Wireless project, 53 new rooms and locations on the Bloomington campus now have secure Wireless Access Points, allowing authorized wireless users of the IU Bloomington network to connect securely and move freely among buildings that contain these access points without changing configurations.

Nine new Greek Houses have been added to GreekNet. A partnership between Ameritech, IU, and the Greek Houses, GreekNet facilitates access to the IU network from Greek housing.

At IUPUI, new connections were activated in 2001, bringing the total to 18,618. In the past year, more on-campus buildings have been upgraded to 100Mbps capability; however, in some of these buildings, cable upgrades still need to take place in order for the data ports to take advantage of this increase in capacity. In addition, 542 student walk-up (laptop) stations are now located on campus, including locations in the University Library, the Law School, the Medical School Library, and the University College.

The upgrade of the IUPUI campus network that began in August 2000 was completed by early March 2001. The old ATM-based environment, which was able to transmit 155 megabits per second, was upgraded to the more robust and efficient Gigabit Ethernet technology that is capable of transmitting one gigabit per second — more than six times as much information in the same amount of time.

UITS is also implementing secure wireless Ethernet access to the campus network at IUPUI. The VPN-secured wireless network went into production in July and now includes UITS offices in the Kelley School of Business/SPEA Building (BS), the Engineering and Technology Building (ET), and the Education and Social Work Building (ES).
III. Institutional Commitment: Faculty & 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.

The Actions associated with this Recommendation cover a broad and diverse range of issues: fellowships and development grants for faculty (Action 7), IT support for faculty and staff (Actions 8, 10), space for IT staff to be accessible to users (Action 9), and issues involving promotion and tenure (Action 6).

**Compensation for IT Professionals**

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

The Office of the Vice President for Information Technology continues to partner with campus human resources on the Mercer IT Salary Survey. Collaboration with the Indiana Information Technology Association is underway with the goal of producing a regionally based salary survey for more specific geographic data. These efforts will provide relevant compensation comparisons.

**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.

When developing the IT Strategic Plan, the UITC recognized that there could be various incentives for faculty involvement in the use of technology for teaching and learning. Some, like promotion and tenure, are outside the scope of UITS or any IT organization, and should properly be addressed by faculty policy committees in each School. Ongoing dialogue on the issues of faculty rewards and incentives, related to the use of IT in teaching and learning, is needed among academic affairs offices, faculty leaders, and leaders in information technology.
Fellowships & 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.

Throughout the year efforts continue to support faculty in their use of IT in teaching, research, and service through the provision of grants and fellowships offered in specific areas.

**Ameritech Fellows Program**
In its third year, the Ameritech Fellows Program funds faculty applications of information technology to teaching and learning. The third round of awards, announced in December 2001, totaled $74,500 and included topics as diverse as the music of the Beatles, human anatomy, Chinese language, cardiovascular embryology, and human intelligence. The first Ameritech Fellows Summer Forum was held in June, providing an opportunity for Ameritech Fellows to share their projects with faculty colleagues.

**Technology Assessment Grant Program**
OVPIT partnered with the Office of Distributed Education (ODE) in 2001 to launch a grant program to support projects that focus on the use of instructional technology in teaching and learning. The Technology Assessment Grant Program (TAG) provides funding to faculty studying the impact of educational technology on their practices and on student, course, or program outcomes. Faculty are encouraged to collaborate with experts in instructional design, technology, and educational evaluation in developing and implementing the study. In its first year, the TAG program awarded more than $68,000 to 14 winners from IU core and regional campuses.

**TLTL Media Assistants**
This program, funded by the Dean of Faculties Office, is designed to provide assistance for projects that need discipline-specific or other specialized knowledge or talents (programming, graphics, etc.), and/or for projects that require concentrated or intensive efforts. This program will fund a Media Assistant to work with a faculty member along with TLTL staff to help develop or implement an instructional project. In 2001-2002, faculty helped identify and select three Media Assistants, each of whom received a $1,500 award. (See www.indiana.edu/~tltl/grants01/.)

**TLTL Grants-in-Aid**
Also funded by the Dean of Faculties Office, this program will fund small grants (up to $1,000 each) to enable faculty to purchase equipment, software, or other materials, or for other purposes (e.g., to defray workshop, travel, or other expenses) necessary to complete a project or to make project development or implementation proceed more efficiently. The total program amount for the 2001-2002 year is $3,000. (See www.indiana.edu/~tltl/grants01/.)

TLIT is combining Actions 7, 13, and 20 to create the Digital Media Service, which is discussed under “Digital Media and Web Development” in Recommendation 4.

**The High Performance Network Applications Program (HPNAP)**
Since its inception in 1999, the High Performance Network Applications Program (HPNAP), an initiative of the OVPIT, has provided funding to assist nearly 30 IU faculty, graduate students, and staff across the University in developing innovative applications in research and teaching that require high performance local, regional, or national research networks. The HPNAP has provided funding, access to advanced networks, and support resources for a wide variety of projects with the goal of significantly accelerating the evolution of next-generation, network-based applications and development tools at IU. (Descriptions of funded projects are available at www.indiana.edu/~uits/hpnap/projects/index.html.)

To recap HPNAP projects and accomplishments, “Collapsing Time and Space: A High Performance Network Applications Symposium,” was held in April 2001, bringing together researchers in disciplines across the sciences, the arts, and education to showcase the innovative applications in research and teaching under development at IU through the HPNAP.
The symposium featured presentations and poster sessions by IU researchers developing applications that use the capabilities of such high performance networks as the Internet2 Abilene network, the TransPAC international research network, and other emerging network connection technologies. Many of the funded projects are ongoing and have received funding and support from other internal and external agencies and organizations.

In part owing to budget constraints, the HPNAP is under evaluation. It is anticipated that future calls for proposals may be limited to areas where, based on past results, the University could expect to gain the most benefit and to those projects that could reasonably expect to receive additional funding from other resources.

**Faculty & Staff Support**

**Action 8.** Schools across the University should be encouraged to provide more resources for maintenance and training for department 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.

**Local Support Provider (LSP) Services**

LSP Services, with staff at IUB and IUPUI, provides technical support and consulting services to technical staff (LSPs) in IU departments. LSP Services at IUPUI provides second-tier support to technical support staff at regional campuses. Services include high-end workstation and server consulting, access to LSP Lab resources, technical training and IT certification opportunities, online technical tools and resources, and reserved access to specialized software distribution. For-fee services are available to departments that require personalized server assistance. LSP Services works closely with LSPs and other UITS service providers to ensure the successful implementation of new services. This last year, IUB and IUPUI LSP Services played a significant role in the University’s successful migration to Microsoft’s Active Directory Services and the retirement of the old IUPUI Novell NDS tree, and offered second-tier assistance with Exchange/Outlook. LSP Services further expanded the technical education and certification services offered to University IT professionals as identified in the IT Strategic Plan.

**Microsoft Windows Education/Certification**

LSP Services at IUB and IUPUI have Microsoft Certified Professional staff who teach Microsoft Official Curriculum to LSPs and technical support staff from regional campuses. In 2001, IUB LSP Services provided eight Windows 2000-related Ed/Certs to 180 LSPs and technical staff and IUPUI provided nine Windows 2000-related Ed/Certs to 98 LSPs and technical staff. For those in the LSP community who wish to obtain Microsoft Certification, LSP Services provides MS Test Vouchers for those that pass the appropriate Transcender pre-certification tests, also made available through LSP Services. IUB and IUPUI LSP Services will become Microsoft Certification Test Sites in 2002. This will reduce the cost and time away from work for LSPs and
is expected to increase the number of MS Certifications at each campus. In other short-term educational initiatives, LSP Services hosted 30 sessions at IUB for an estimated 900 participants and 29 sessions at IUPUI for an estimated 1,000 participants. (See www.indiana.edu/~edcert and https://lspservices.iupui.edu/edcert.asp.)

**UNIX Ed/Certs**

The Unix Workstation Support Group (UWSG) continues to refine and expand its Ed/Cert program in Unix system administration. Seventy-seven students have passed the certification tests since the initiation of the IU IT Strategic Plan; 15 of these were during the past year. (Because the course was being revamped, no Fall session was held in 2001.) Participants have come from IUB, IUPUI, and several regional campuses. In addition, UWSG offers online education through its “Unix Systems Administration Independent Learning” program (www.uwsg.indiana.edu/usail/). This facility is well known and used within both the IU and the Unix communities.

**Self-paced Learning**

To address the needs of IT support for faculty and training of IT support staff, UITS negotiated a four-year, University-wide licensing agreement in 1999 with National Education Training Group, Inc. (NETg), for access to courses that include basic IT skills for beginners, advanced training and specialized skills for IT staff, and Microsoft certification training for local support providers. All members of the IU community may use these classes in self-study mode, and IU faculty may incorporate selected courses into their curricula. More than 600 self-paced courses are available, either on the Web or on CD. More than 8,000 users have registered to take some 350 different self-paced courses online, and more than 51,000 courseware CDs have been distributed. Successful integration of course content with the Knowledge Base (KB) provides KB users with links to topics relevant to their queries. Total launches to NETg from the KB registered 28,799.

**UITS IT Training & Education**

UITS IT Training & Education (formerly the UITS Education Program) offers instructor-led technology classes and provides self-study training resources to the Indiana University community and beyond. It delivers training to more than 30,000 participants each year across all campuses through more than 1,000 instructor-led and self-study classes. UITS IT Training & Education partners with many departments and individual faculty and staff members across all IU campuses to provide broad support for the technology education needs of the University community.

**Software Support**

UITS continues to leverage the buying power of the University to forge major software licensing agreements with leading software vendors for the desktop productivity tools and infrastructure server and messaging products that are fundamental in IU’s teaching, learning, research, and administrative activities. A partnership between UITS and University Libraries has led to a licensing agreement with ISI Researchsoft for its reference management software (EndNote, ProCite, and Reference Manager) which greatly facilities bibliographic referencing for researchers. A free training program on this software is in place for students and faculty. In addition, UITS has added licenses to support IU’s bioinformatics and genomics initiatives, notably the software packages GCG and SeqWeb for the analysis of molecular sequence data. Recent negotiations have also yielded licensing agreements with Adobe Corporation and Symantec, Inc.

**Ameritech Summer Forum**

Indiana University Bloomington hosted the first annual Ameritech Fellows Summer Forum in 2001. Five Ameritech fellows from IUB, IUPUI, IUSB, and IUS presented their innovative instructional technology projects and discussed their progress before an audience of colleagues. Projects were funded by the Ameritech Fellows Program, which provides grant support to promote and showcase innovation in teaching and learning as facilitated through technology. (See Action 7.)

**Teaching and Learning Center Expansions**

Staffs at the Teaching and Learning Technologies Lab and Center for Teaching and Learning on the core campuses were expanded, as were staffs at similar centers on the regional campuses. (See Action 11.)
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.

Construction of new IT buildings in central locations on the core campuses will leverage even more effectively the University’s IT resources and investments while providing better and more accessible IT services to the entire IU community. As such, these buildings will provide a very real symbol of IU’s commitment to building the information economy in Indiana.

**IUPUI**

On October 16, ground was broken for the new Communications Technology Complex (CTC) and Informatics Complex (IC) on the southwest corner of Michigan and West Streets on the IUPUI campus. At the groundbreaking, IU Vice President for Information Technology and CIO Michael A. McRobbie introduced the advent of a large-scale development campaign for the CTC, as well as for the proposed Computation and Information Building at IUB that would bring UITS expertise and resources from the periphery into the heart of the Bloomington campus.

The CTC at IUPUI will be the center of telecommunications for IU; an anchor of the Indianapolis-Bloomington technology corridor; and a hub of I-Light, the new Indiana optical fiber infrastructure linking IUB, IUPUI, and Purdue University. IU’s statewide data, voice, and video networks will converge and be managed from this location, and IU’s network will connect to global and national networks. The CTC will also be the home of the Pervasive Technology Labs that are based at IUPUI and funded through a major grant from the Lilly Endowment.

Connected to the CTC, the IC will be the permanent home for undergraduate and graduate programs in Informatics and New Media, Journalism, and Music Technology. The IC will create in Indiana one of the most advanced sites for pioneering work in a broad range of information technology fields, while enabling students to learn about the latest theoretical developments.

In all, the consolidation and relocation of IUPUI’s considerable IT resources at a high-profile crossroads of campus and community will make these resources much more visible and readily accessible for partnerships that can benefit local economic development. For more information, see www.iupui.edu/news/ctcic.htm.

**IUB**

At IU Bloomington, plans have been drawn up for a new Computation and Information Building (CIB) to be located near the intersection of 7th Street and Jordan Avenue. The CIB will consolidate IT expertise and resources in a central campus location, enhancing faculty, staff, and student access to heavily used IT resources. The CIB will provide badly needed security and structural protection for the University’s expanding volume of costly and mission-critical IT equipment: IU’s main computational and storage resources that support research, including IU’s teraflop supercomputer and massive data storage system, as well as IU’s enterprise information systems. The facility will also house the three Pervasive Technology Labs based at IU Bloomington.
IV. Teaching & 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.

The Actions associated with this Recommendation cover a number of interrelated issues, among them: digital media and Web development (Actions 12, 13, 14), Web-based course services and infrastructure (Actions 18, 19), classroom technology (Actions 21, 22), and assessment (Action 25). Progress toward other goals outlined in this Recommendation (e.g., faculty support and development services, Action 11) will also help address issues of faculty engagement detailed above, in the discussion of Recommendation 3.

**Faculty Support for Teaching & 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 of teaching support services for all faculty at IUB, IUPUI, and the regional campuses.

Action 11 calls for a standard level of baseline support for teaching and learning technology for all IU faculty, increasing the opportunities to explore new applications of information technology. The promotion or introduction of technology in courses and disciplines, previously without access to relevant applications or support, is also an important component of the IT Strategic Plan. The objective of supporting faculty in their use of technology is further enhanced by second-tier, professional course development services provided through Actions 7, 13, and 20.

As a result of the IT Strategic Plan, additional staff and upgraded technologies have been made available to provide a higher level of support to faculty at the Teaching and Learning Technology Lab (TLTL) at IUB and the Center for Teaching and Learning (CTL) at IUPUI. Resources have also been designated to establish or expand similar teaching and learning centers at the IU campuses at East, Kokomo, Northwest, Southeast, and South Bend. These centers are heavily used and highly rated in all surveys, and illustrate the potential of strong partnerships between the offices of academic affairs and UIITS. These centers promote teaching excellence by responding to local faculty needs and encouraging faculty members to first think carefully about how they design their courses, then implement technology in their courses within that pedagogical framework.

**IUB – Teaching & Learning Technologies Lab**

Staff at the Teaching and Learning Technologies Lab (TLTL) in Bloomington was expanded to 10 UIITS PA employees, three ISS PA employees, and four hourly employees.

In 2001, TLTL staff fielded 4,776 instructional consulting contacts with faculty; provided project development assistance on 300 projects for a total of 11,470 development hours; and conducted 1,948 instructional hours in 44 faculty development presentations with a total enrollment of 1,106. TLTL received requests for service from 17 Schools and departments in 2001.

TLTL dispersed $7,500 among nine faculty members through its Media Assistant Grants (which fund the hiring of assistants for routine digitizing tasks) and Grants-in-Aid program (which funds the purchase of equipment or materials for instructional technologies projects). In addition to providing funding, TLTL assisted or appropriately referred 23 of the 24 applicants to these two programs. (Details of these programs can be found in Action 7.)

TLTL assisted six faculty in writing Ameritech Fellows proposals and worked with previous grant recipients. Other projects include pilot testing the Turnitin.com anti-plagiarism service and working on academic publishing projects with the Archive of Black Film, the IU Art Museum, and the Archives of Traditional Music.
IUPUI - Center for Teaching & Learning
The Center for Teaching and Learning (CTL) this year completed the strategic action of hiring staff to improve services for faculty and academic units on teaching and learning issues, multimedia, Web applications, and instructional design. Six additional employees now contribute to a comprehensive support environment for faculty at IUPUI.

Of the 15 CTL staff members, 11 are UITS employees. Increased staffing has allowed CTL to expand its activities beyond the Center and into the Schools and departments.

In 2001, the UITS staff within the CTL conducted 735 consultations, each lasting one half hour or more and 71 workshops with a total enrollment of 486 faculty. The CTL received requests for service from 24 Schools and 55 departments. Outside IUPUI, CTL staff conducted 119 presentations including such activities as national conferences, outreach visits, and hosting external visitors. Staff also served on a total 32 committees at IUPUI and across the University.

IU Northwest – Instructional Technology Support
A center is in the process of being developed at IU Northwest.

IU Southeast – Institute for Learning & Teaching Excellence
Now in its fifth year of operation, the Institute for Learning and Teaching Excellence (ILTE) has transitioned its reliance on the strategic initiative funds used in its three-year startup phase to campus-based funding, while maintaining growth in staff and services. ILTE programs and services have increased in quantity and quality over the period and are valued for the contribution they make to faculty growth and development.

IU South Bend – University Center for Excellence in Teaching
At IU South Bend, the University Center for Excellence in Teaching (UCET) provides instructional design consulting to faculty, emphasizing the use of technology in the curriculum as well as course management. The UCET co-sponsored a series of workshops on Oncourse for beginning and advanced users, and another on incorporating multimedia products into instruction, focusing on digital photography, digital video, and digital music. The UCET also supports individual faculty development activity related to technology through consultation and providing resources at the Center. IUSB continues to fund a director from among its faculty to lead UCET.
Web-based Course Services & 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.

Actions 12, 18, and 19 focus primarily on the Oncourse production environment and associated support services. As IU’s online teaching and learning environment, Oncourse has grown to become one of the University’s most-used information systems. Launched in 1999 at the core campuses, Oncourse has seen a dramatic increase in users each semester. Student usage has grown by more than 8,000 each semester, from 723 in Spring 1999 to more than 50,000 in Fall 2001. Faculty use increased from 92 in Spring 1999 to some 3,000 in Fall 2001.

User feedback is welcomed and enables Oncourse developers to keep the application responsive to user needs. Suggestions come from focus groups coordinated by the Manager of Online Learning, faculty forums sponsored by the Center for Teaching and Learning at IUPUI and the Teaching and Learning Technology Lab at IUB, the online suggestion box built into the Oncourse interface, and informal discussions with faculty. Suggestions are reviewed by the University-wide Teaching and Learning Systems Steering Committee that advises UITS on priorities for enhancements and future development. The Oncourse development process has been streamlined for improved implementation of user suggestions, and enhancements are released three times a year, scheduled around the Fall, Spring, and Summer semesters. This responsiveness helps keep user satisfaction high. The 2001 UITS User Satisfaction Survey logged a 91.2% satisfaction rate for Oncourse at IUPUI and 92.3% at IUB.

Oncourse has been successful in providing a standard level of learning environment services to faculty and students, but continued and accelerated development of Oncourse is needed to meet new requirements and add functionality. Ongoing responsibility for Oncourse development and operation is a joint effort of the TLIT and UIS divisions of UITS.

**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 the complex requirements of those programs.

In Fall 2001, the Office of Distributed Education (ODE) partnered with the UITS Digital Media Network Services group to coordinate the orientation and training of faculty in using the new Polycom videoconferencing equipment for distributed education (DE) classes.

To provide faculty with support in designing courses taught at a distance, the Associate Vice President for Distance Education published “Distance Education Course Design Practical Tips for IU Faculty.” (See www.indiana.edu/~iude/frameset-publications.html.)

Early in 2001, ODE announced a comprehensive, online inventory of IU DE degrees and courses. (See wwwdb.indiana.edu/iudisted/scripts/srchform.cfm.)

Other details associated with Distributed Education can be found in the Distributed Education Strategic Plan at www.indiana.edu/~iude/.
Digital Media and Web Development

**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.

**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 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.

Actions 7, 13, and 20 focus on expanding support for the design, development, and management of interactive Web-based and digital multimedia in teaching and learning. These initiatives are blended to encourage faculty innovation, provide intensive professional support in developing instructional materials (Actions 7 and 13), and develop the Leveraged Support Model for instructional technology (Action 20).

UITS is launching the first phase of the Digital Media Services (DMS) plan, approved in Fall 2001, which focuses on meeting the instructional needs of campuses, schools, and departments. This initiative is expected to have a major impact on the University’s ability to develop multimedia and Web content in support of teaching and learning, and distributed education goals.

DMS will create a single interface to the University’s most highly skilled practitioners in instructional design, multimedia, and digital development, and will provide a Web hosting resource for academic applications.

While other programs target individual faculty initiatives, DMS will offer grants for services to departments and schools. The Associate Dean for Teaching and Learning Information Technologies, appointed January 1, 2002, will work with deans of faculties to define priorities and criteria in awarding DMS service grants. Initial projects include a number of “gateway” courses identified as having the most substantial impact on undergraduates. Next, DMS will work closely with Local Support Provider (LSP) programs to define and offer services that better enable LSPs to assist faculty and staff in performing their own digital media work and Web development. These developmental Web hosting services will complement the front-line services offered by UITS staff in the campus centers for teaching and learning. In the third phase, DMS will evaluate whether it will offer services with full cost recovery or with subsidies from other funding sources. Project support will include services in design, media creation and programming, software evaluation and testing, distribution and access, project management, and Web hosting and technical services. This unit will draw upon the services and expertise of other UITS units and areas of the University, particularly in the delivery of distributed support for multimedia developers in departments and schools.
Teaching & Learning: Content, Access, Distributed Education

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.

Actions 21 and 22 represent IU’s first comprehensive, multi-classroom technology plan for general-purpose classrooms. This five-year plan, finalized in May 2000, calls for installation and support of technology in classrooms, and coordination of the design and renovation of classrooms to enable the use of that technology. The plan calls for more installed technology and less reliance on centrally-delivered equipment. Implementation is coordinated among UITS, Instructional Support Services, the University Architect’s Office, and campus physical plant offices. Individual campus plans are reviewed and updated annually.

Good progress has been made on these initiatives though the process is ongoing. Faculty survey responses suggest that faculty who use the Advanced Technology Classrooms are satisfied with the facilities and services those classrooms offer, although demand has often outpaced availability, suggesting that faculty are eager to leverage new technology in their teaching.

**Withdrawn.**

**Units** is partnering with IU researchers and faculty to support simulation-based laboratory courses and enhance teaching and learning through simulation and visualization. Several examples follow.

- In conjunction with Ameritech Fellows in the IU School of Dentistry, the Advanced Visualization Laboratory (AVL) is developing a radiographic imaging simulation that allows dental students to quickly and accurately view the results of various X-ray arrangements and exposure parameters. In addition, the AVL has been working with staff in the Medical Education Program in the IU School of Medicine to evaluate virtual reality techniques for use in student education and clinical skills practice.

- The AVL is working with researchers in the New Media Program and Project CLIOH to refine and deploy models of ancient historical sites (Uxmal, Chichen Itza), thereby allowing users to explore these environments using immersive virtual reality systems as well as desktop displays.

- Ongoing educational uses of visualization and simulation systems based on the UITS CAVE and ImmersaDesk include: interior design students studying architectural spaces, education and psychology students studying brain anatomy, fine arts students developing and interacting with 3D art pieces, and computer science students building and viewing 3D campus models.

See also activities detailed in the discussions of Actions 27 and 28.

**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.
IU Bloomington
One focus for IUB this year was upgrading several of the 263 general-inventory classrooms on campus. IUB sought to increase the number of Type IV (Advanced Technology) classrooms to 30%, and at the same time lower the number of Type I (Basic) classrooms to 20%. As part of this effort 20 new Type IV classrooms were completed, and eight existing technology classrooms were upgraded to full Type IV classrooms. In addition, 12 new Type III classrooms were completed (10 of these by the Kelley School of Business), and major life cycle replacements in 12 Type III classrooms are in progress. Major upgrades to 12 Type IV classrooms and six Type III classrooms are scheduled to be completed by August 2002.

IUPUI
IUPUI has engaged the support and input of Schools, faculty and the IUPUI Learning Environments Committee in the planning and installation of instructional technology upgrades in classrooms. Project planning is coordinated with the Office of the Registrar and Campus Facility Services. In this phase of the project implementation, IUPUI has increased the number of fixed technology classrooms and acquired additional computers for circulation to meet faculty demand.

Four Type IV Classrooms (two new/two upgrades) were completed in August 2001. Seven Type III (all new) were created during the same period. Custom code was developed to provide security for projectors; this prototype will be expanded to all Type II/IV classrooms over the next year. Plans are underway to identify classroom candidates for ITSP Projects for the remainder of 2001-02. This process includes input from The Office of the Registrar, Campus Facility Services, and the IUPUI Learning Environments Committee.

Regional Campuses
Implementation is underway on the five-year plans submitted by each regional campus CIO.

IU Kokomo
At IU Kokomo, six new Type IV classrooms have been completed with installation of three more planned for Summer 2002. Renovation of a new computer classroom will be completed for the beginning of the Spring semester in January 2002. The new Science Building includes two new Type IV classrooms, one computer classroom, and several laboratories with Type IV capabilities.

IU Northwest
In several computer labs at IU Northwest projectors and speakers have been installed, and two classrooms have received new technology, raising them to Type III functionality. Projectors have been upgraded in several classrooms and increased demand for mobile LCD projectors has been met with new and lifecycle replacement equipment. Several classrooms identified as future Type IV classrooms need additional infrastructure before the technology can be installed.

IU South Bend
The five-year implementation plan at IU South Bend launches a transition from circulating equipment to more installed technology in its 71 general-inventory classrooms. Fifteen new LCD projectors, 23 new computers, and two new DVD players have been added to the mobile equipment pool. Upgrades to five classrooms (four Type III and one Type IV) are underway and will be completed by June 2002. Two are slated for completion by the beginning of the 2002 Spring semester.

IU Southeast
IU Southeast has adopted the desk-mounted Crestron touch-screen controller for its advanced technology classrooms, and the IUS Media Services department is specifying and installing classroom technology. Seven new Type IV classrooms have been completed. Five Type III classrooms have been installed. Three existing Type III classrooms have received Crestron control systems. Three existing technology classrooms have received lifecycle projector replacements. Media Services is working with the Natural Sciences department to equip laboratories with mobile technology equivalent to a basic Type IV installation, with funding from an outside grant. Finally, most of the outmoded monitors, VCRs, and overheads in the mobile equipment pool have been replaced.
Evaluation & 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.

**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.

**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.

Actions 24, 25, and 26, are jointly administered by the Teaching and Learning Information Technologies (TLIT) Division and the Office of Distributed Education (ODE). The Technology Assessment Group, commissioned by TLIT and the ODE to implement Actions 24 and 25, was expanded to include a greater number of faculty members and representation from the regional campuses. Activities in the past year focused on tools and pilot programs for assessing technology-enhanced instruction.

**Flashlight Project**
This is an effort of the American Association for Higher Education (AAHE) to help faculty assess the degree to which the use of various technologies promotes principles of good practice in teaching and learning. UITS acquired a site license for the Flashlight Current Student Inventory (CSI), an item bank of more than 500 questions faculty can use to assess the use of technology in teaching and learning. Plans were developed to provide access to the resource via Oncourse. To introduce members of the University community to this tool, a workshop titled “Evaluating Practices and Outcomes in Technology-enhanced Courses” was held in July. The workshop was designed for faculty, coordinators of campus centers for teaching and learning, IT support staff, and administrators interested in student evaluation of the outcomes of the use of technology. Facilitated by the Associate Director of the Flashlight Program for the American Association of Higher Education (AAHE) TLT group, the workshop provided an introduction to the assessment resource and practice in its use.

Each campus was subsequently invited to participate in a pilot project during the 2001-2002 academic year to evaluate the Flashlight Current Student Inventory (CSI). The purposes of the pilot project are to determine implementation needs for technical, pedagogical, and assessment/research support for faculty and staff users of the CSI; to determine needs for widespread use of CSI; and to make recommendations for further use.

**Ameritech Fellows Program**
The Ameritech Fellows Program, supporting innovation in the application of information technology to teaching and learning, announced a third request for proposals in May. Five additional Fellows were named in December. A Summer Forum is planned where Fellows will showcase their projects and share findings with University colleagues.

**Technology Assessment Grants**
OVPIT partnered with the Office of Distributed Education in 2001 to launch a small grant program to support projects that focus on the use of instructional technology in teaching and learning. The Technology Assessment Grant Program (TAG) provides funding to faculty studying the impact of educational technology on their practices and on student, course, or program outcomes. Faculty are encouraged to collaborate with experts in instructional design, technology, and educational evaluation in developing and implementing the study. In its first year, the TAG program awarded more than $68,000 to 14 winners from IU core and regional campuses.
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.

The Actions associated with this Recommendation address several services and initiatives for IT support of research, including high performance computing and grid computing (Actions 29, 31); computation- and information-intensive applications (Actions 30, 33); massive data storage (Action 32, also Action 43 under Recommendation 6); and collaboration and communications (Actions 27, 28).

Collaborative Technologies

**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.

**Videoconferencing Models & Support**

The UITS Digital Media Network Services (DMNS) group, a unit of the Telecommunications Division, groups IU video conferencing systems into classroom, administrative conference room, and desktop models. The models have some similarities and can interoperate, but have differing features of scale, complexity, capabilities, and support. Common to all is the H.323 video conferencing standard which uses standard IP data networking.

**Desktop Videoconferencing.** In 2001 DMNS evaluated desktop videoconferencing systems and chose the Polycom ViaVideo as a University standard for its excellent video and audio, ability to integrate with the University room-based video conferencing systems, and its interoperability with systems in use at other institutions. Some 50 desktop units have been deployed, primarily for administrative conferencing purposes. Use of desktop conferencing is currently limited to point-to-point (two-party) connections because of the inability to create ad hoc multi-point conferences and the difficulty of centrally managing a large number of user requests for multi-point conferences. Telecommunications is testing a beta release of the software that allows ad hoc multi-point creation, and is purchasing additional multi-point bridge capacity, anticipating that that feature will be in production in the first quarter of 2002.

DMNS recommends and supports the Polycom Viewstation 128 or the Polycom FX videoconferencing terminal for administrative videoconferencing. IU has a three-year purchasing agreement with SKC Communication Products, Inc., for Polycom videoconferencing equipment.

**Streaming Server.** A streaming server, capable of streaming the latest RealTime and QuickTime formats, has been installed to support the growing demand for audio/video distribution. Faculty and support units are eligible for accounts.
Web Collaboration Technologies. Various Web collaboration technologies (co-browsing, application sharing) were tested and Polycom WebOffice was chosen for its ability to integrate with the IU videoconferencing environment. A pilot implementation is planned for January 2002 for which Smartboard electronic whiteboards and collaboration computers have been purchased. If the pilot is a success, the collaboration equipment and software may be installed in all Virtual Indiana Classrooms by Summer 2002. The pilot may also lead to a recommendation for administrative collaboration technologies.

Web Chat Tools. Various Web-based chat tools are being evaluated in the search for one that supports caller queuing, session recording, pushed documents, Web co-browsing, transcripts, annotation, reporting, and call forwarding. The tool should also be able to serve in such contexts as the Library Reference Desk, support (for the UITS Support Center), moderated group chat (for Web-based Student Financial Aid or Admissions advising sessions), and distance learning (in combination with and as a back channel for live video streaming).

Desktop Audio/Video/3D Collaboration Tools. The Advanced Visualization Laboratory (AVL) completed a thorough evaluation of commercial and open-source tools to provide audio, video, and 3D collaboration on the desktop. One outcome of this study was the adoption and deployment of an Active Worlds server in cooperation with faculty in the School of Library and Information Science. This system will provide a 3D, Web-based collaborative environment for use by researchers, educators, and students on all eight IU campuses.

Collaborative Tele-immersive Events. The AVL coordinated or supported a variety of collaborative, tele-immersive events through the UITS CAVE and ImmersaDesk facilities, including: remote education and tele-medicine demonstrations for the Indiana Distance Learning Association; a week-long, international, collaborative art exhibit bringing together participants from six sites in the United States and Europe; cooperative exploration of star cluster simulations from supercomputer calculations by astronomers in the Starlab consortium; and simultaneous analysis of PET scan results by collaborators at IUB, IUPUI, and Purdue.

High Performance Computing & 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 grid.

**IU** continues in its strategy to provide high performance computing systems that are the best in class in the three types of system architectures commonly used in the US:

- Distributed shared memory (the IBM SP)
- Shared memory (the SUN E10000)
- Linux clusters (as of January 2002 a Request for Proposals is in process for a new Linux cluster).

Details on these systems follow.

**IBM SP**

IU’s IBM SP, ranked for the past two years as IU’s most powerful supercomputer, underwent a series of upgrades during 2000 and 2001. In October IU and IBM announced the upgrade to a peak computational capacity of 1.005 teraFLOPS, achieved through a total of 632 processors. Made possible by funds from the UITS IT Strategic Plan, the INGEN grant from the Lilly Endowment, and a Shared University Research grant from IBM, this upgrade moved IU’s supercomputer to the 50th place within the Top500 list of the world’s largest supercomputers (www.top500.org). IU’s IBM SP provides balanced high performance computing in support of many applications, thanks in part to the inclusion of 452 gigabytes of memory and 5.3 terabytes of hard disk capacity.
Based primarily on IBM’s Power3+ processor, the SP includes some of IBM’s newest chip technology — a set of Power4 chips in an SP node optimized to support research databases, including databases for biomedical research. IU’s SP supports researchers in a broad range of areas, including the life sciences, archaeology, astronomy, business, chemistry, economics, earth sciences, and physics. (See http://sp-www.iu.edu/.)

**Sun Microsystems E10000**

IU’s E10000 was mildly affected by reliability problems for a brief time in early 2001. Sun Microsystems, Inc. replaced all 64 processors in IU’s E10000 during July 2001, providing excellent system stability. The system was reconfigured to match current user patterns, and in particular to enhance its utility as a platform for research that requires high performance databases. New software packages include Matlab, SPSS, SAS, Genetic Cartography, GIS software, ArcInfo, and Oracle. (See www.indiana.edu/~rats/research/solar/solar.shtml.)

**AVIDD**

IU received a $1.8M National Science Foundation (NSF) grant in October 2001 to create the Analysis and Visualization of Instrument Driven Data (AVIDD) facility, an innovative facility for processing data generated by large scientific instruments. A major new tool for teaching and research, AVIDD will initially be distributed across three IU campuses — Gary (IU Northwest), Bloomington (IUB), and Indianapolis (IUPUI) — and integrated with very high network bandwidth using the University’s new Optical Fiber Infrastructure (I-Light). AVIDD will provide an integrated and coherent way to manage, analyze, and visualize the vast amounts of data generated by the new generations of large scientific instruments used by IU faculty, scientists, researchers, and students, and in their collaborations with researchers worldwide. Funded by the NSF’s Major Research Instrumentation (MRI) Program, AVIDD will comprise a large, geographically distributed Linux cluster, massive amounts of disk storage, and multiple visualization devices. This new experimental supercomputer will strongly complement IU’s IBM SP and will replace IU’s existing Parallel PC Cluster in 2002. (See www.indiana.edu/~uits/cto/mri/.)

**International Virtual Data Grid Laboratory (iVDGL)**

The National Science Foundation in October awarded a consortium of 15 universities, including Indiana University, $13.65M to build the International Virtual Data Grid Laboratory, or iVDGL. The iVDGL will consist of a seamless network of thousands of computers at 40 locations in the US, Europe, and Asia. Together, these computers will work as a powerful grid capable of handling petabytes of data.

IU’s contributions to the iVDGL will include a prototype Tier-2 Data Center for the ATLAS high energy physics experiment and the International Grid Operations Center, or iGOC, to be co-located with IU’s Global Network Operations Center (NOC) on the IUPUI campus.

The project builds on IU’s investments in several key areas of information technology, including advanced networking (Internet2 Abilene, TransPAC, and Global Network Operations Center), high performance computing, and massive data storage. The prototype Tier-2 Center will be a data analysis facility for physicists who use the ATLAS detector at the CERN Large Hadron Collider, located near Geneva, Switzerland, to search for new forms of matter. The operation of this globally distributed grid laboratory requires coordinated support services and management, which will be provided through iGOC.

**SciDAC Awards**

Two research projects at Indiana University received US Department of Energy’s (DOE) awards in August under the new Scientific Discovery through Advanced Computing (SciDAC) program. The goal of the program is the development of “collaboratory” software that enables geographically separated scientists using terascale computers to work effectively as a team, control scientific instruments remotely, and share data more readily.

Over the lifetime of the projects, IU will receive some $2.5M in grant funding. One project will create grid science portals that enable scientists to access and control remote resources and computations from their desktop machines. Though designed for grids, the benefits of the portals are general and will apply to a variety of computing applications.
IU also is involved in a $3.1M project to develop the Center for Component Technology for Terascale Simulation Software. Also taking part are Argonne National Laboratory, Los Alamos National Laboratory, Lawrence Livermore National Laboratory, Oak Ridge National Laboratory, and the universities of Tennessee, Maryland, Illinois, and California-San Diego. The project will research software component technology for high performance parallel scientific computing and address problems of complexity, re-use, and interoperability for scientific simulation software. (See www.iuinfo.indiana.edu/ocm/releases/scidac01.htm.)

Use of High Performance Computing
One of the critical success factors for UITS and IU in high performance computing (HPC) is promoting the adoption of this technology across a broad spectrum of disciplines. These activities and accomplishments in 2001 served to expand knowledge about and use of IU’s HPC resources.

The High Performance Computing Support Team (HPCST) provides the programming support that enables IU researchers to use IU’s parallel supercomputers, the IBM SP and Sun E10000. HPCST also manages software site licenses for mathematical programming libraries and parallel program analysis tools. As part of the Spring 2001 IT Seminar Series the HPCST presented seminars on grid computing to audiences at IUB and IUPUI, discussing local efforts that range from individual laboratories to planetary scale demonstrations. Such presentations build interest in using HPC technology among IU students and researchers.

The delivery of consulting and programming support for parallel programming is a critical part of HPCST’s services. IU’s high performance computer systems are at the leading edge in terms of providing raw processing power, but the programming required to harness this power is specialized and demanding. During the past year HPCST has helped convert several important programs used by IU researchers from serial (single processor) to parallel (many processors at once). These projects include codes in astronomy, cell modeling, computational phylogenetics, and medical imaging. Because of the creation of the Indiana Genomics Initiative (INGEN), UITS is adding high performance computing consultants specifically to support parallelization of biomedical codes in support of genomics research. One new staff member has been hired thus far.

The intellectual impact of IU’s high performance computing environment is broad and far reaching. One indication of this is provided in an extensive list of publications, presentations, and artistic works stemming from the use of UITS high performance computing systems, massive data storage facilities, or advanced visualization environments. (See www.indiana.edu/~rac/hpc/papers.html)

Research@Indiana at SC2001
The annual Supercomputing conference sponsored by the IEEE and ACM is the premier international, annual conference related to high performance computing. Research@Indiana was a collaborative display at SC2001 that featured some of the newest and most important high technology advances achieved within the State of Indiana. A collaborative effort among Indiana University, Purdue University, the University of Notre Dame, and the Rose-Hulman Institute of Technology, Research@Indiana was unique among the displays at the annual Supercomputing conference. Never before have the leading institutions in any state come together to collaboratively promote the accomplishments of that state. IU provided exhibit leadership and booth infrastructure, and coordinated conference attendance and demonstrations by more than 50 collaborators from the four universities.

Research@Indiana featured an innovative virtual poster session, providing short overviews of dozens of research projects. More than 1,000 conference participants visited the Research@Indiana display, which also received prominent press attention. (See www.research-indiana.org/.)
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.

AVL Project Support

The Advanced Visualization Laboratory (AVL) assisted with the development of a number of data-intensive visualization tools or productions, including: a five-minute video on the local galactic neighborhood of our Sun (with researchers in Computer Science); software to visualize the results of CFD (computational fluid dynamics) computations of airflow around an aircraft body (with students in the School of Engineering); a 15-minute, high-resolution video simulating a walk-through of retail environments deploying new consumer technologies (with a researcher in the Marketing Department of the Kelley School of Business); software for visualizing the orbits and possible collisions of satellites and space junk (with researchers in the Computer Science Department); and visualization of MRI and confocal microscopy data (with researchers in the Cardiology and Nephrology Departments of the IU School of Medicine).

Research Software Support

Site licensing of research software continues to be a great success. The Enterprise License Agreement for the statistical software package SPSS has been very popular. Some 6,730 copies of SPSS have been distributed to students, faculty, and staff on all IU campuses. The agreement includes the Macintosh version. In Spring 2001, a similar University-wide license was negotiated with ISI for their programs ProCite, ReferenceManager, and EndNote. These applications will be of great value for students and scholars in all the arts and sciences as well as in the professional schools. UITS also licensed two bioinformatics software packages to run on IU’s Sun E10000 supercomputer: the Wisconsin GCG package and SeqWeb. Site licenses save the University well in excess of $100,000 annually and make the best research software widely available for use by IU students, staff, and researchers.

A new area for UITS is support for bioinformatics software. UITS now provides software and services for researchers who do biological computing, particularly in the areas of genomics, cell biology, and molecular biology. UITS has a full-time bioinformatics expert who manages the licensing of bioinformatics software and who provides technical support and consulting.

UITS continues to promote the use of free, open-source software. Linuxfest 2001: A Gnu Odyssey featured a number of presentations about Linux, demos, exhibits (including those of local vendors), and free Linux consulting services. (See www.uwsg.indiana.edu/linuxfest/.)
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.** 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.

**HPSS**

IU’s HPSS massive data storage system fosters greater collaboration between researchers, faculty and students at the Bloomington and Indianapolis campuses with instant access up to the 500-terabyte capacity. Use of the massive data storage services increased significantly in the past year, with more than 600 users and almost 50 terabytes of storage in use (including mirror storage for selected datasets). As of year’s end, there were almost 20,000 users of the recently implemented common file system (CFS) storage service, which is based on the Distributed Computing Environment Distributed File System (DCE DFS). Top users of the HPSS and the DFS data storage services are researchers from a variety of departments including Astronomy, Economics, Radiology, Geology, Library and Information Science, Physics, Theater and Drama, and the IU Digital Library Program. Massive data storage resources figure into a number of high-profile IU research projects and scientific experiments ranging from the Cultural Digital Library Indexing Our Heritage (CLIOH) project (www.cs.iupui.edu/~clio/) and the ATLAS high energy physics experiment (www.usatlas.bnl.gov/) to the National Science Foundation-funded Variations2 digital music library project (dml.indiana.edu/) and the Indiana Genomics Initiative (ingen.iu.edu/).

Network speed to the desktop must be addressed for optimal use of IU’s massive data storage system. The slowest link for most potential users is the final connection to the workstation. Most users have a 10 Mbps Ethernet connection. At that speed it would take a minimum of 13.3 minutes to transfer a single 1-gigabyte file via FTP. Heavy users of HPSS may require a minimum connection of 100 Mbps Ethernet while some will require up to a gigabit Ethernet connection.

To help raise awareness among IU researchers of the availability and accessibility of IU’s high performance computing and storage resources, a workshop on the mass store system was held as part of the Spring 2001 IT Seminar Series. It addressed the system’s technology architecture, implementation and technical details, and current usage.

In December 2001, UITS installed a StorageTek 9310 tape silo at IUPUI, greatly increasing the HPSS storage capacity available to researchers at IUPUI. A primary focus of this expanded service will be the storage needs of researchers involved in the Indiana Genomics (INGEN) initiative. The addition of a StorageTek 9310 tape library will bring the storage capacity at IUPUI from the current 28TB to 120TB (with the ability to expand to 360TB) and will allow INGEN researchers to keep and access massive amounts of information in a near-line fashion.

**CFS Replaces Lockers**

In September, the Lockers at IUB became read-only in preparation for their January 2002 retirement and replacement by the Common File System (CFS) storage service. This new service provides considerably more storage space and a more usable interface, and is accessible from anywhere. Classes on the use of CFS were held during July and August and the transition to the new system began in Fall 2001. Usage of CFS has climbed steadily from some 250 contiguous connections in September 2001 to some 1,000 contiguous connections in November 2001. In December 2001, there were almost 20,000 users of CFS, compared to 115 users in December 2000.
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.

**AVIDD**
The AVIDD facility, discussed in the narrative on Actions 29 and 31, is the result of a grant awarded to IU from the National Science Foundation. This grant included representatives of OVPIT, UITS, and faculty from several schools and both of IU’s main campuses. UITS staff will work with the faculty participating in the AVIDD grant to create new advances in computer science and in sciences that depend upon advanced information technology.

**AVL Research Support**
The Advanced Visualization Laboratory (AVL) completed the evaluation, acquisition, and installation of a number of new interface, display, and rendering technologies, including: Reachin haptics systems for co-located visual presentation and force feedback; a VolumePro graphics card for real-time, high-quality volume rendering; a passive stereo display to provide portable and affordable semi-immersive visualization experiences; a 9.2-megapixel LCD display for analysis of high-resolution imagery; and a six-way rendering cluster with an 18.8-megapixel display for interactive rendering of complex data sets and detailed environments.

In conjunction with these hardware adoptions, the AVL also evaluated the next generation of visualization and virtual reality software, including Linux-based graphics APIs; open-source, multi-platform VR toolkits; and distributed, heterogeneous visualization frameworks.

Together, these new hardware and software technologies will ensure that University researchers continue to have access to the latest visualization tools and methods. The fact that these new systems are an order of magnitude less expensive and easier to maintain than the previous generation of technology will allow broader deployment and/or adoption of visualization systems across various departments and campuses of the University.

**Pervasive Technology Labs**
In August 2001, Pervasive Technology Labs at Indiana University (previously known as IPCRES) formally launched three of an eventual six new laboratories: Advanced Network Management Lab, Open Systems Lab, and Community Grids Lab.

Researching diverse, yet related, aspects of pervasive computing that will help drive the 21st-century information economy and foster the growth of IT in Indiana, Pervasive Tech Labs is focusing on key technologies that underpin pervasive computing. Funded by a $30M grant from the Lilly Endowment, Pervasive Tech Labs is contributing to the development of Indiana’s information technology sector through technology transfer, commercialization of innovations produced in the labs, and joint research and development partnerships with government and industry.

In addition, Pervasive Tech Labs is working closely with IU’s newly established School of Informatics and its Advanced Research and Technology Institute (ARTI) to increase the number of graduates trained in information technology and to elevate the University’s involvement in supporting and expanding economic development in the State’s technology sector.

Though only just established, Pervasive Tech Labs has generated interest from a number of companies, including such technology leaders as IBM, Sun Microsystems, Intel, and Kiva. Pervasive Tech Labs also plans to build upon existing agreements IU has with the National Science Foundation, Department of Defense, Department of Energy, National Center for Supercomputing Applications, and the CRANE Naval Surface Warfare Center.

The Community Grids Lab, directed by internationally renowned scientist Dr. Geoffrey Fox, focuses on grid computing, integrating peer-to-peer computing with distributed processing, and
parallel computing, converging IT research in the areas of architecture and middleware for computing grids. The lab currently employs 32 individuals, including five post-doctoral researchers and 27 graduate students.

The Open Systems Lab, under the leadership of Dr. Andrew Lumsdaine (formerly of the University of Notre Dame), centers its research on open source software and software interoperability — technologies that allow communities of experts to develop and share standard protocols, processes, and tools and to evolve them in a collaborative decentralized environment, bringing to bear the combined intellectual resources of research communities on individual software projects. The Open Systems Lab also supports existing open source projects and is working to establish new ones that enable pervasive computing technologies. The lab currently employs eight individuals, including two researchers, one post-doctoral researcher, and five graduate students.

The Advanced Network Management Lab (ANML), the first lab established by Pervasive Tech Labs, is developing technology to help manage the convergence of data, video, and voice over the Internet. Directed by the highly-regarded network technologist Steven Wallace, who led the implementation and design of the Internet2 Abilene network, the lab currently employs seven individuals, including four researchers and three graduate students.

The ANML has established an agreement with Public Ether Networks, owned by parent company Hoosier Times Inc., to collaborate on delivering a software product for wireless network authentication. Consisting of a PC with a CD-ROM accompanied by a CD containing the lab’s proprietary technology and a wireless access point device, this new product will enable access to the Internet without a wired connection in key physical locations (for example, reporters working in a sports arena would be able to wirelessly file reports).

This product is based on 802.11b wireless technology, also called Wi-Fi, considered the emerging standard for wireless. Unlike existing Wi-Fi technology, the lab’s product improves performance in the presence of radio interference and allows more flexibility in the ways computers can be configured. This technology will allow users to communicate on bandwidth levels comparable to cable modems.

The product supports IPv6 (the next generation of Internet Protocol) and can allow users to authenticate through a credit card or identification number, giving businesses the option of charging customers for using the wireless Internet connection. The lab plans to deploy the product in University stadiums and food courts during the Spring of 2002.

Visualization and Interactive Spaces Lab. In January 2002, Dr. M. Pauline Baker, formerly of the National Center for Supercomputing Applications at the University of Illinois, Urbana-Champaign, was appointed Distinguished Scientist in the Pervasive Tech Labs and will establish and lead the Visualization and Interactive Spaces Lab, the first to be based on the IUPUI campus. Dr. Baker is a widely regarded computer graphics and visualization expert. Her research interests include the development of advanced visualization techniques for the desktop and virtual reality, software architectures to support visual problem solving environments, and user interaction strategies for complex desktop and virtual reality applications. She is co-author of several graphics books, including a textbook used worldwide in colleges and universities. (See pervasivetechnologylabs.iu.edu/.)
VI. Information Systems: Managing IU’s Information Assets

Recommenda
tion 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.

Actions associated with this Recommendation focus on the implementation of major, University-wide enterprise information systems including a new Student Information System (SIS), Human Resources Management System (HRMS), and Library Automation System (Action 36). Other actions focus on IT architectures and infrastructure for these new information systems (Actions 38, 43, 44, 45); development of a common user interface and improved access to information (Actions 37, 39); data administration (Action 40); and disaster recovery (Action 42).

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.

The University Information Systems (UIS) Implementation Plan continued to guide the prioritization, coordination, and planning for new University-wide information systems over the past year.

Advisory Committees
Advisory committees were active during 2001. The Student Information System Steering Committee, the Human Resources Management System Steering Committee, and the Fiscal/Procurement Steering Committee met regularly to review progress in their respective areas. The OneStart (formerly MyIU) Steering Committee advised on the design and implementation of the new portal for students, faculty, and staff. As well, the E-Commerce Steering Committee advised on the progress of e-business and e-commerce at IU.

The University Information Systems Task Force reconvened early in 2001 to look at progress on the UIS Implementation Plan and to advise on additional priorities in this area.

Completed Information Management Systems
Since the inception of the IT Strategic Plan, information systems have been completed and put into production for:

- **Facilities Management (FIMS):** tracking and inventory of facilities.
- **Course Management (Oncourse):** a Web-based course management tool, currently in use by 3,000 faculty and more than 50,000 students at all campuses.
- **Library (SIRSI):** a joint team of UITS staff and IU Libraries staff completed implementation of the SIRSI Unicorn Library Management System and Web-based catalog (IUCAT) on December 31, 2000. This project was completed on time and slightly under budget. It was funded jointly through the IT Strategic Plan, funds remaining from the earlier Ameritech Library project, and the library automation fund.
- **IU Information Environment (IUIE):** a new Web-based information environment was implemented and is being populated with new data as each new information system moves into production.
Admissions: the Student Information System (SIS) project has already implemented the entire module — phase I in October 2000 and phase II in October 2001. Still remaining are Student Records, Student Financials, and Financial Aid modules, to be implemented over the next three years. PeopleSoft is the vendor used for the SIS and the new Human Resources Management System (HRMS).

Timekeeping (HRMS): a system to track time of hourly employees is now in use for several departments. It will eventually be used for all hourly and bi-weekly staff.

Oracle version of the FIS: the Financial Information System (FIS) was converted from the legacy Sybase database to Oracle.

Electronic Research Project Administration (ERA): researchers can track their project proposals with this new system.

OneStart
The OneStart portal was implemented in Summer 2001 to address the need for a common user interface. Faculty, students, and staff will be able to access all their most frequently used applications from a single entry point and take advantage of a single logon. Cooperative efforts are underway with the campuses to ensure the portal will meet their needs.

Student Enrollment Services
Major changes in business processes and operational units to take advantage of new technology were recommended by Arthur Anderson consultants as needing to precede the new information systems. This has not yet happened, although implementation is moving ahead. The proposed Student Enrollment Services (SES) area, under the leadership of the new AVP for Academic Affairs, is working through funding issues. This new area is critical to the support of the SIS as the various modules are moved into production.

Supporting Change
The University Information Technology Committee recommends ongoing review and monitoring of the SIS and other new systems being developed, so that their capabilities are regularly communicated to academic deans, department chairs, and faculty. This will help ensure that schools and departments receive in a timely manner the information they may need to adapt their departmental procedures and information systems to work with the new SIS. UITS is planning for a post-implementation period within which additional features may be added to the system, if needed.

School of Medicine
To foster collaboration and share expertise, a UIS Director has been working with the IU School of Medicine as it develops a Strategic Technology Plan for the School. The Plan is slated to be published in March 2002.

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.

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

36a. Student Information Systems
36b. Human Resources Management System
36c. Library Information Systems
36d. Fiscal and Procurement Systems
36e. Departmental Information Systems

36a. Student Information Systems
The new Student Information System (SIS) now under development will, when complete, enable all IU’s 100,000 students to move easily through the financial aid process, updating personal information, and requesting transcripts — all in a Web-based environment.
Admissions Phase I. The first SIS module was implemented in September 2000. The components of the Admissions Phase I implementation are prospect management, recruiting, communications, and event management for prospective students. This implementation covers all IU campuses, with the project team converting data from 10 shadow systems on eight campuses into PeopleSoft. Campuses, schools, degrees, majors, minors, and grading schemes were some of the data structures configured for Admissions Phase I.

Web Registration. Foreshadowing implementation of the modules for registration and student records, scheduled for 2003-2004, the ability to register on the Web was delivered to students in pilot mode in October 2000. Web registration became available to all students in March 2001.

Admissions Phase II. The second phase of Admissions functionality for the new Student Information System (SIS) at IU was put in place in October 2001. Core functionality for processing and evaluating applications for admission for undergraduate, international, graduate, and professional schools is now available to staff in the Undergraduate, Graduate, and International Admission Offices. The system includes an automated process that can be used by IU staff to make admit and denial admission decisions en mass.

Development of Common Applications. Thirty-three offices and approximately 325 staff work in three environments: PeopleSoft SIS, the ApplyYourself Web-based application submission environment, and the IU Information Environment (IUIE). Common IU applications were developed for undergraduate, graduate, international, and professional schools is now available to staff in the Undergraduate, Graduate, and International Admission Offices. The system includes an automated process that can be used by IU staff to make admit and denial admission decisions en mass.

Record Conversions. The SIS Project Team converted approximately 1.25M active and inactive campus community records and 1.1M active and inactive admissions application records from the legacy student system. Content was developed for the IU Information Environment to support operational reporting and data extraction for this phase of the new Student Information System.

Admissions staff will continue to work with new and legacy systems until the remaining modules are implemented in the PeopleSoft SIS environment.

36b. HRMS
IU is implementing two major PeopleSoft applications: Human Resources Management Systems and Student Administration. In addition to the PeopleSoft components, each implementation includes a Self Service component and a decision support component through the IU Information Environment (IUIE).

These modules will be implemented on all campuses for Human Resource and Benefits users. The implementation of PeopleSoft will be accompanied by electronic documents developed in-house which will automate the HR business process. The IUIE will provide a decision support environment.

The HRMS project continues to move forward with the development, configuration, and analysis work in preparation for the December 2002 implementation. The scope includes the core HRMS PeopleSoft functions:

- Human Resources (staff & academic)
- Benefits
- Payroll

The Electronic Document initiative will include the replacement of paper forms and provide base functionality to support data collection, routing, and updating the HRMS database for the following processes:

- PAF
- Payroll Voucher
- Position Management
- Additional/supplemental pay

The HRMS project team has completed the technical proof-of-concept for HRMS electronic documents and completed the Routing and Approval requirements.

HRMS information environment development planning is complete. The initial HRMS information environment deliverables will be focused around core operational reporting requirements, with secondary focus on departmental requirements. Human Resources, Payroll, Benefits, Affirmative Action, and Budget reporting inventory
and requirements are being developed. HRMS design and datagroup development work is underway.

Much of the emphasis this past year has been the configuration of the HRMS PeopleSoft modules. The business analysts continue to finalize Control Tables as designs of specific functions are completed. Control Tables represent configuration of the business rules for the IU environment (e.g., payroll types, payroll calendars, benefit plan types, rank codes, etc). Scenario and use case documents have been completed for the following human resource actions:

- Hire
- Leaves
- Terminate
- Retire
- Modify pay
- Transfer
- Promote/Demote

The Base Benefit and Benefit Administration configurations for the above actions and associated employee events have been completed and the automated benefit administration processing has been successfully tested.

The HRMS prototype was successfully deployed to campus HRMS Local Implementation Team members. The prototype objectives included:

- Creating a working model of specific HRMS components
- Expanding institutional exposure to HRMS
- Gaining important feedback on data values, terminology, business process flows, and associated design rules
- Establishing a group of specific individuals to provide ongoing support throughout the project

The HRMS Local Implementation Team members—including representatives from each campus office for Academic Affairs, Human Resources, Affirmative Action, Budget, and Payroll—were identified.

Work on the HRMS data conversion is underway. The initial conversion load was completed with approximately an 80% success rate. Active records for some 37,500 employees will be converted and will include data for personal, appointment, funding, tenure, titles, and leave history.

36c. Library Information Systems

The conversion of data from the NOTIS and Horizon systems to the SIRSI Unicorn environment was completed in 15 months, starting in September 1999 and ending in late December 2000. This migration involved approximately 5.5M records.

Using the new Library System, users of all IU libraries can navigate the Web-based catalog and databases, search library resources on all IU campuses, and link to e-journals and indexes without using a mainframe infrastructure.

UI� Support Centers and Library staff worked together to establish user support structures which have been implemented on all campuses.

An upgrade to the latest version of the software was completed in December 2001. This will enable the deployment of patron self-service functionality in Summer 2002. The new functionality will include e-mail delivery of traditional paper Library notices, as well as online renewals and holds.

36d. Fiscal & Procurement Systems

E-commerce. Indiana University is developing an e-commerce initiative that facilitates online transactions for goods and services. The Fiscal & Procurement Systems group has played an essential role in the development and implementation of these technologies. The E-commerce Business to Consumer (B2C) project is currently used by such merchants as IU Press and the IU Bookstore.

In the near future, the University will offer e-commerce student services such as online tuition payment. The Business to Business (B2B) side of e-commerce is being developed for a broad array of uses, including the online purchasing system, TOPS Web. This system will allow University employees to purchase goods and services from vendors online.

In the B2C e-commerce project, three applications that can work together are highlighted here:

- E-Store. This is the equivalent of a catalog and shopping cart for B2C retailing associated with the University. Merchants can download this software and use it to build their Web storefront. Customers can view
items in the store, add items to their shopping cart, and view an itemized total of their purchases, including adjustments for quantity and special discounts.

- **IPAS (Internet Payment Authentication System).** The IPAS system provides a method of secure, Web-based processing of credit card transactions. A partnership with CyberCash cash register service and the IU Treasury department now makes it possible for University merchants to accept payment online.

- **TransformEP.** This is a form processing tool that retailers can use to send forms to customers by e-mail and to add form data to a log file. It also interfaces with CyberCash for payment processing. Using TransformEP, merchants can track all transactions that go through their site, and send e-mail confirmations for orders received.

**TOPS.** Design and development are underway on a new Web-based version of TOPS (The Online Purchasing System) that will replace the existing mainframe system. The new system will be Unix-based, written in Java, with the data stored in Oracle. It will be accessible through the OneStart portal and will interface with the FIS and other applications. Completion is projected for late 2003.

**TIME.** The Time Information Management Environment (TIME) is an enterprise-wide computing application that tracks the hours worked by hourly employees. Supervisors use the same system to approve those hours. Some 6,000 employees on the Bloomington and Indianapolis campuses currently use the TIME system.

**ERA.** The Electronic Research Administration (ERA) system provides an electronic means of conducting research administration processes and transactions. ERA was the first in-house, Web-based system developed with Uniface and running under the Universal Request Broker Architecture on the Enterprise Unix Environment with Oracle as the database engine. The ERA system underwent its first major upgrade in March 2001. ERA Release 1b was made available in July. A limited release that included Proposal Lookup/Inquiry screens was implemented in September 2001. Plans call for making available part one of the budget components by mid-April 2002.

**36e. Departmental Information Systems**
Various departmental applications were enhanced in 2001 and others developed.

- **Enhancements to the BARS system** in 2001 provided increased efficiency in processing student charges and decreased turnaround time in billing students.

- **The IU Publications time tracking system** gained additional functionality in 2001.

- **The Marketing Services time tracking system,** a clone of the Publications system, was enhanced with a new phase of tracking and reporting.

- **UIITS Peer Review.** The application used by the UIITS Human Resources unit for peer review of UIITS staff gained additional functionality in 2001.

- **IUBPC Voting System.** A secure online voting system was developed for the IU Bloomington Professional Council, reducing costs associated with the annual election.

- **Sterilization Tracking.** A Web-based system for the School of Dentistry, called Oral Microbiology Tracking, was developed to track the sterilization process.

- **School of Medicine Systems.** Two new systems are being created for the School of Medicine. One tracks the results of studies involving stroke victims. The other tracks radioactive materials used in medical testing.
**OneStart**

**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.

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

**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.

Indiana University launched the OneStart Web portal in 2001. OneStart is a Web-based application portal designed to provide users with streamlined and integrated access to business and services at Indiana University.

OneStart will act as IU’s “front door” to such University services as checking e-mail, registering for classes, performing financial transactions, hiring faculty or staff, looking up grades, paying tuition bills, purchasing event tickets, and checking benefits information. It will be customized to fit the needs of students, faculty, staff, alumni, and potential students.

This premier iteration of the portal includes an online tutorial, a “What’s New” feature, mobile bookmarks, custom channel creation, and an internal search engine.

OneStart will continue to be developed and upgraded according to user needs. The next upgrade, scheduled for January 2002, will quicken response time and include additional usability improvements and broader browser support. Additional upgrades over the next two years will include single authentication and wireless access capabilities.

**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.

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**

The thin-client environment using Citrix Metaframe with Microsoft Windows Terminal Server was implemented to support the first phase of the SIS delivered in September 2000. This is a highly scalable and supportable environment that minimizes floor space and management overhead.

The thin-client environment continued to grow in 2001 with the addition of a new application in the financial area to process check payments. The SIS Admissions Phase II rollout dramatically increased the number of users of that system. More recently, the environment was upgraded to the latest technology from Microsoft and Citrix, which greatly improves the manageability of the system and enhances the overall user experience.
38b. Enterprise Unix Environment
The Enterprise Unix Environment continues to change and expand with the development, testing, and production deployment of UIS applications.

The IBM SP complex has evolved, and as of December 2001, includes two Control Workstations and 17 nodes for a total of 74 CPUs. Additional IBM servers were also deployed for a total of more than 100 Unix CPUs.

A new PeopleSoft Student Information Systems (SIS) production server (an IBM M80) was deployed to provide greater throughput and scalability for future system growth. The PeopleSoft test environment was relocated to an IBM S7/A server to provide greater CPU, computer memory, and disk I/O capability to meet the demands of a high level of testing.

The Decision Support and IU Information Environment (IUIE) server was upgraded to meet increasing data volumes and activity.

New IBM servers were deployed, replacing old HP servers, to act as security servers for UIS.

Three new IBM B80 servers were installed in late December 2000 to serve as the initial set of servers for the new J2EE application development environment.

To meet increased online data storage needs, as of the end of 2001, 6 TB of disk storage were attached to the SP system, using IBM SSA architecture.

The SP system uses Tivoli Storage Management software for backup and recovery, and currently uses six high-speed cartridge drives within the IBM Magstar 3494 automatic cartridge library. Cycling backup copies to a secure off-site storage location provides additional recovery capability.

In addition to the IBM Unix environment, 35 Intel-based servers are managed for supporting various activities, including terminal serving, TNG scheduling systems, file serving, and electronic data exchange with external businesses.

All of these environments are involved in the support and delivery of UIS applications.

38c. Strategic Database Management
The University has implemented a robust enterprise database environment based on Oracle Database, the most widely used database technology in the world. IU now supports 70 instances of the Oracle server supporting development, test, and production environments of the transaction processing and decision support systems. There are now 1.7 terabytes of data in Oracle databases.

Production applications being supported by Oracle include:

- FIS: Financial Information System
- TOPS Web Purchasing System
- Time Keeping
- SIRSI Library System
- Student Information Systems (PeopleSoft): Admissions, contacts, recruitment, and student demographic data
- The University Register
- ERA: Electronic Research Administration
The IU Information Environment (IUIE)

**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.

IUIE is a comprehensive strategy for providing Web-based data reporting and analysis tools to facilitate access to and use of the University’s enterprise data stores. The core environment was completed in August 2000 and the first phase was implemented on schedule to support the first release of the PeopleSoft SIS initiative in September 2000.

The IUIE is designed to be a one-stop shopping environment for reporting and analysis. It comprises two components: the software and the report objects. The IUIE is also a personal reporting environment, keeping users informed about the report objects that have been published across the University.

A preference setting allows users to tailor the way the IUIE functions. The Master Catalog contains a listing of all report objects (reports, data groups, other content) that have been published for use. Users can create a personal catalog of shortcuts to often-used report objects. IUIE allows for executing queries (extract data) that are specific to their needs and can also view reports that have been generated on a scheduled basis.

Committee on Institutional Data

**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 Data Stewards with the University Information Technology Policy Officer began discussing methods for evaluating the relative security risk on University servers in order to identify and mitigate situations where institutional and personal data are in peril. While the goal of such an evaluation is reasonable, the mechanics of such a process may be difficult to implement, and the project is expected to take some time to complete.

A subgroup of the Committee was appointed to look at technical, ethical, and legal issues related to inconsistencies in strong authentication requirements for data access. The Committee has been discussing whether inquiry access to restricted data should require authentication stronger than that provided for by a password (i.e., password tokens). Various new services require that a decision be made on this issue, among them the new Indiana University Information Environment, which is expected to be popular among data users. The Committee issued a “Data Administration Notice” to data managers, with good information about appropriate personal data protection and storage.

Because of growing concerns about disclosure of Social Security Numbers (and recognizing that the number will be used widely until the student and employee identifiers are no longer based on the SSN), the Committee on Institutional Data is developing guidelines for handling the SSN. These include recommendations about masking the visible display of the number on computer applications and on paper reports.
Year 2000

**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.

No new problems related to Year 2000 emerged in 2001 as systems have completed a full business cycle in the new century. The project has ended and all relevant documentation has been forwarded to the University Archives for appropriate preservation.

Disaster Recovery

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

Disaster Recovery (DR) planning for coordinating the recovery of computer systems and associated services in the Wrubel Computing Center machine room, should the facility be rendered unserviceable, has progressed to the point where testing the process can begin. The engineering improvements for data and voice networking, electrical power, air conditioning, and other infrastructure required to support systems relocated in the limited systems recovery site (HPER 161) have been completed. The Command Center site, located in IMU 086, will be ready to serve in January 2002.

A database-driven, software tool for DR planning has been purchased to expedite and facilitate loading and maintaining the written plan. When the initial data are loaded, the process of refining and testing command and recovery team response procedures will begin.

Phase 2 of the DR planning effort, which involves building a comprehensive plan that includes the data centers at IUB and IUPUI, is now underway.
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.

The Actions associated with this Recommendation address the development and implementation of an array of telecommunication services and initiatives, including network convergence (Action 46), intercampus networks and commodity Internet (Actions 48, 49), advanced applications and networking (Action 50), wireless (Action 51), and multimedia and streaming media (Actions 52, 53).

Telecommunications Division Strategic Implementation Plan

The importance of a highly responsive, accessible, and reliable telecommunications infrastructure is a key element of the IT Strategic Plan. The leadership of the Telecommunications Division, responsible for providing this infrastructure, put together a Telecommunications Division Strategic Implementation Plan which was approved in June 2000. The plan attempts to provide a “vision horizon” in line with the objectives of the IT Strategic Plan through FY 2003-2004, but as technology in the area of telecommunications is changing so rapidly, the plan must be viewed as a work-in-process throughout the next four years. While it is unlikely that UITS will make technology selections that would need to be suddenly and completely abandoned, mid-course corrections in directions and implementations are quite likely. In some key areas, such as wireless networking, relatively short lifecycle replacement models have been employed to accommodate the state of flux in the technology. In other key areas, such as commodity Internet bandwidth and IUnet bandwidth, assumptions have been based upon the premise that bandwidth will become cheaper and more readily available from competing sources as the years advance. These assumptions are the foundation for the implementation plan, and changes in these and other areas may dictate revisions of various aspects of the plan in the coming years.

Converged Technologies

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 trialing of new “converged” technologies.

Advanced Network Management Lab

In 2001, the Advanced Network Management Lab was the first lab established by Pervasive Technology Labs at Indiana University. The Advanced Network Management Lab will develop technology to help manage the convergence of data, video, and voice over the Internet. Network technologist Steven Wallace, who was instrumental in the design and implementation of the Internet2 Abilene network, was appointed as Director and Chief Technologist.
The Lab, with an annual budget of $1M, will develop technologies in the form of hardware and software to manage advanced Internet services research and development that will be of interest to corporate partners. Ten networking specialists, including researchers, technologists, and postdoctoral and graduate students will initially staff the lab.

Internet2 Abilene Network Operations Center on the IUPUI campus will serve as the perfect environment in which to test the lab’s technologies. This could include software that can visualize the distribution of multi-cast content, which, like broadcast television, is an efficient way to send data or video to multiple recipients over the Internet. (See www.anml.iu.edu.)

Lifecycle Replacement

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

**IU** is a large, multi-campus institution with more than 15,000 faculty and desktop computers. In little more than two years, IU successfully completed the implementation of lifecycle funding for these desktop computers and the related infrastructure across all its campuses and for all 110 of its schools and service units. In 2001, IU’s implementation of lifecycle funding, as described by Finance Officer Laurie Antolovic and IU Vice President for Information Technology and Chief Information Officer Michael McRobbie, was featured in the September/October issue of the *EDUCAUSE Review.*

Intercampus & Internet Connectivity

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

Full DS3 (45Mbps) service to the five regional campuses was installed and operational in July 2000. Connectivity between the IUB and IUPUI campuses was also increased by a total of 90Mbps (two additional DS3 connections) to support increased use associated with the regional campus expansion and Internet2.

In December 2001, Governor Frank O’Bannon activated I-Light, a high-performance, optical-fiber network that links the campuses of IUB and IUPUI, as well as Purdue University. It will be used to connect the universities to the Abilene Internet2 network.

In early 2001, a new architecture was developed and implemented for the IUB campus that featured a separate commodity Internet connection for the campus and one for the IUB residence halls. The main benefit of this implementation, aside from doubling bandwidth, was that UITS could begin to analyze and manage the two separate forms of use — residential and campus — in a manner consistent with the needs and funding models of each. In the case of residential connections, UITS is leveraging its assumption of responsibility for IT in the residence halls by providing a role for resident government in helping to determine proper policy and practice for the residential commodity Internet connection. This new bandwidth, architecture, and approach have led to more productive and responsible use of IU’s network resources for students in their homes and learning environments. A series of tests was conducted to determine the effect of filters upon certain types of data traffic to best manage the bandwidth in the residence halls.
Telecommunications Standards

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. Leveraging the solid relationship built between the IT organization of the core campuses and regional campus CIOs, University-wide telecommunications principles and standards were defined. These standards were delivered by the end of first quarter 2000 and were quickly reviewed and implemented across the institution.

IUPUI Campus Backbone. These standards had their first (and largest) practical impact in 2000 as the IUPUI campus network backbone was redesigned from an ATM structure, able to transmit 155 megabits per second, to a topology featuring the now-standard Gigabit Ethernet technology, capable of transmitting over six times as much information in the same amount of time. In March 2001, the IUPUI campus network upgrade was complete.

I-Light. The I-Light optical fiber infrastructure, connecting IU and Purdue campuses at Bloomington, Indianapolis, and West Lafayette, will benefit IU internally, by making available huge quantities of bandwidth linking the campuses (and more closely linking IU with Purdue). I-Light is a resource that can be leveraged to provide a variety of related benefits.

A key component of I-Light is that it links researchers at the Universities with each other, and with colleagues at other research institutions. I-Light acts as a digital on-ramp, extending the access to Internet2 networks and other high-speed research networks out further into the heart of the State to IU at Bloomington and IUPUI at Indianapolis. More details follow in the discussion of Action 50.

Advanced Applications & Networking

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

IU has maintained its position as a leader in advanced networking through a variety of endeavors. 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. Several separate endeavors are underway; progress is described below.

I-Light

On December 11, Governor Frank O’Bannon activated I-Light, a very high-speed optical fiber network connecting the IUB, Purdue, and IUPUI campuses. A lighting ceremony at IUPUI marked the completion of the two-year, $5.3M project to build the University-owned fiber-optic infrastructure needed to make the connections.

Discussion for the optical fiber network began in 1998. Following funding by the Indiana General Assembly in 1999, and a period of planning, design, and contract negotiations, construction of the network began in Spring 2001. Verizon installed the conduit and optical fiber lines while Juniper Networks and Cisco Systems provided the systems and equipment necessary to transmit data on the network.

I-Light’s aim is to support research applications; however, it will also support voice communications, e-mail, and videoconferencing among IUB, IUPUI, and Purdue. I-Light increases the data access speed between IUB and Purdue from 30M to 1 billion bits per second, and is expandable to hundreds of billions of bits per second. The difference in the amount of information scientists
and researchers are now able to exchange is even more impressive. I-Light can move the entire written contents of the library at IUB or Purdue from one campus to the other in seconds or to other universities nationwide through its connection to the Internet2 Abilene Network. I-Light presents countless possibilities for collaborative research and an unparalleled platform for distance education.

A potential second phase of expansion for the network will connect Indiana’s I-Light to important regional fiber structures, such as the Illinois I-Wire initiative, or possibly Michigan’s Merit Network and Ohio’s OARNet. The result will be an optical fiber network fabric that allows these institutions to engage in computing grids and share resources, and that positions IU and Purdue faculty more competitively for federal research grants and other opportunities.

**Abilene**
The Abilene Network, with its Network Operations Center at IUPUI, achieved nationwide connectivity in February 1999. Abilene is a packet-over SONET (POS) network, providing coast-to-coast OC48 (2.4 gigabits per second) IP transit (10,000 miles of fiber), withconnectors attaching to one of 28 regional network aggregation points, called Internet2 GigaPoPs, with either POS or IP-over-ATM access circuits running at speeds of OC3 (155 Mbps), OC12 (622 Mbps), or OC48 (2.4 Gbps).

In June 2001, Internet2 announced that Abilene reached at least one university in each of the fifty United States. As of December 2001 more than 190 universities and research centers were using the Abilene Internet2 research network, which registered 54 Connectors with bit rates ranging from OC3 to OC48; 204 Participants; 46 Sponsored Participants; 20 Sponsored Education Group Participants in 17 states, including the Indiana Higher Education Telecommunication System; and 27 peer networks across North America, Europe, and Asia. Abilene continues to provide high-performance network services to enable advanced applications such as high-definition television, tele-medicine, and remote access to scientific instruments, and to serve as a testbed for advanced network capabilities, such as Quality of Service standards, multicasting, and more.

The Internet2 agenda for 2001 included upgrading the Abilene backbone to leading-edge optical transport capability (OC-192c), collaborating with the GigaPoPs to facilitate international peering, and upgrading OC3 attachments. The goal remained to position Abilene as a critical component in the Internet2 End-to-End Initiative, making central its role in the US research infrastructure.

In December 2001, Qwest Communications International Inc. and Internet2 reached a new five-year agreement to quadruple the capacity of the Abilene Internet2 network. Qwest’s investment in the improvement of the Abilene Internet2 network is valued at $300M. The new agreement increases capacity to 10 Gigabits per second (Gbps) through the use of optical networking technologies, making the network one of the world’s most advanced and far-reaching educational research networks. The enhanced network will have enough capacity to send 9.7M, five-paragraph e-mail messages in one second.

**TransPAC**
TransPAC is the high performance international Internet service connecting the Asia Pacific Advanced Network (APAN) to the Internet2/Abilene high performance network, vBNS, and other global networks for the purpose of international collaborations in research and education. It also provides a global testbed for developing the next-generation Internet’s new networking protocols and services and for international scientific, research, and educational collaborations. Major funding comes from the US National Science Foundation and the Japan Science and Technology Corporation. Operational support is provided in the US by Indiana University’s Global Research Network Operations Center (Global NOC) and in Japan by the KDDI APAN NOC.

In September 2001, Indiana University reached agreements that provided TransPAC with increased network capacity for its connections that link some of the principal research and education networks in the United States with those in the Asia Pacific. As a result of new agreements with two international circuit providers, TransPAC increased bandwidth available for researchers from 155Mbps (megabits per second) to 1.244Gbps (gigabits per second). International circuits for TransPAC are provided by Kokusai Denshin Denwa, Co. Ltd. (KDDI) and Teleglobe.
Global Research Network Operations Center

Scientific research is a collaborative activity that spans the globe. Interconnecting the research and education networks in the United States with those in the Asia Pacific, Europe, and Latin America, gives scientists access to data, instruments, and expertise that would not otherwise be available. Growing out of its expertise in managing the Abilene and TransPAC networks, IU established the Global Research Network Operations Center (Global NOC) to manage these networks in an efficient and coordinated way. The Global NOC plays a key role in ensuring the reliable provision of the persistent advanced networking infrastructure that makes these international collaborations possible.

The principal international connections managed by the Global NOC are:

- TransPAC, two high performance network connections, totaling 1.244Gbps (gigabits per second), linking scientists in the United States with their counterparts in the Asia Pacific area (www.transpac.org/)
- Euro-Link, providing multiple high performance connections between The Netherlands, France, the Nordic countries, Israel and CERN, and the STAR TAP (www.euro-link.org)
- AMPATH, connecting to various emerging education and research networks in Latin America (www.ampath.fiu.edu)
- STAR TAP, the NSF-funded Science Technology and Research Transit Access Point (STAR TAP) in Chicago, providing infrastructure at which a number of international connections link to various higher education and research networks in the US (www.startap.net)

These operations are fully integrated within the existing 24/7 support model that the IU NOC provides for IUnet and Abilene. Designated NOC staff positions funded by these external networks comprise the primary support group for the various networks; additional support is available from all NOC staff, regardless of designation, as needed. Separate external identities, support mechanisms, and NOC Web pages are maintained for each network.

Wireless Networks

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

In 2001, wireless technology became an increasingly important element in telecommunications at IU. Several wireless pilot projects were funded in 2001 and are now in place in several locations at IUB, IUPUI, and IUE. These sites represent a mixture of academic classrooms, meeting locations, and student areas. At the moment, some of these sites are network islands with different security regimes.

Under the Wireless project, 53 new rooms and locations on the Bloomington campus now have secure Wireless Access Points, allowing authorized wireless users of the IU Bloomington network to connect securely and move freely among buildings that contain these access points without changing configurations. Sites at IUB include UITS, the Main Library, the Kelley School of Business, the School of Public and Environmental Affairs, Jordan Hall, Woodburn Hall, Radio and TV, the Lilly Library, and the Law School.

UITS is also implementing secure wireless Ethernet access to the campus network at IUPUI. The VPN-secured wireless network went into production in July and now includes UITS offices in the Kelley School of Business/SPEA Building (BS), the Engineering and Technology Building (ET), and the Education and Social Work Building (ES).

The site of the wireless pilot project at IUE is the Office of the CIO.

The VPN-secured wireless network has been in production since July 2001. This provides solid encryption for the wireless link and also requires authentication with an IU Network ID before use of the network is allowed.

Additional installations are being executed at IUB in such locations as libraries, residence halls, and the Indiana Memorial Union. Wireless areas have been added to four buildings on the IUB campus for portable A/V equipment as well as a cyber-café.
Wireless and VPN technologies are also being used on some regional campuses, including IPFW. In January 2002, IUK will begin building a VPN-secured system. IUS is currently using the UITS VPN model for its own VPN server. IPFW has implemented wireless on some areas on campus and IUN uses Apple Airports for wireless technologies.

IT-Policy 20 has been reviewed by the Telecommunications Advisory Committee and is being widely circulated within UITS before final approval. It requires that most wireless deployments on the core campuses use the VPN-secured system. There are exceptions for mobile and temporary setups. It has become clear from these trials that there is a high degree of overhead in the installation of each wireless access point. An intensive site visit is required to determine the areas that need coverage and to determine possible installation locations to cover those areas. New data jacks and power receptacles are often required.

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 Teaching and Learning Information Technologies Divisions and the IT Security Office are collaborating from the outset to ensure that the technology deployed is functional, supportable, and secure.

**Multimedia & 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.

**VIC Upgrade and Migration to IU Data Network**
Beginning with Summer 2001 classes, the Virtual Indiana Classroom network was fully converted from the old circuit-based videoconferencing technology to H.323 IP-based technology. The new technology uses the standard IU data network rather than special T1 circuits, resulting in lower operation costs and eliminating the dependency on specially wired classrooms. Faculty and student response to the new technology has been positive: users encounter fewer network and equipment problems, find the controls easier to use, and enjoy very-high-quality video and audio. The spread of similar technology at other next-generation, network-connected universities is expanding the opportunities for inter-university collaborations. Pedagogical use of the technology to points outside of IU have included Humboldt University, Berlin; Texas A&M; UT Austin; UIC; Purdue; and U Wisconsin-Madison.

**Implementation of IP-Based Videoconferencing**
Early in 2001, the Telecommunications Division evaluated the suitability of desktop videoconferencing systems and undertook a pilot deployment.

Digital Media Network Services (DMNS) categorizes IU video conferencing systems into three models: classroom, administrative conference room, and desktop. The models have certain similarities and can interoperate, but have differing features of scale, complexity, capabilities, and support. Common to all is the H.323 video conferencing standard. H.323 is a collection of complex protocols, with the important specification that H.323 systems utilize standard IP data networking for communications.

Digital Media Network Services (DMNS) has specified standard technology for IU videoconferencing group and desktop systems — the Polycom Viewstation and ViaVideo respectively — and installed a Polycom-Accord multi-point conferencing bridge. IU has entered into a three-year purchasing agreement with SKC Communication Products, Inc., for Polycom videoconferencing equipment.

As of December 2001, more than 120 videoconferencing group systems have been deployed throughout IU’s eight campuses and extension centers. The systems are used in teaching, research, and administration. Cross campus units using the system heavily for meetings are able to pare travel expenses. The system also allows for extending technology training and user-group meetings.
Beyond a single campus to include a University-wide focus.

More than 50 desktop videoconferencing systems have been deployed, primarily for administrative use. Ten units were supplied to the Faculty Council Technology Subcommittee, eliminating the need to travel to meetings. Advanced management tools, including the Polycom Global Management System, have been implemented to provide comprehensive central management of videoconferencing terminals. In June 2001, DMNS held a University-wide showcase for videoconferencing to boost University awareness.

**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.

**Streaming Media**

A full-production Real Network media streaming server was put in production, to which Digital Media Network Services and the WebTech Services unit provided front-end access through user accounts on the institutional Web servers Veritas and Champion. As of December 2001, 59 user accounts for publishing streaming content had been created, using 180 gigabytes of the server’s 640 gigabytes of storage capacity. Content includes media for teaching, research, and administration.

A system of servers links videoconference sessions to video streaming. Videoconferences can be streamed live and recorded for later viewing. This service is becoming popular for distance learning classes, giving students access to class content on demand. Used for meetings, the system allows for maintaining meeting records. Plans are in progress to outfit the Medical Sciences lecture halls with this video recording technique, allowing medical lectures to be archived and delivered as streaming video and as downloadable MP3 audio. Based on the success of this pilot, additional lecture halls and classrooms will be so enabled.

The IUPUI IMDS Tilt Rac analog videotape server was replaced with digital streaming technology. Because of copyright restrictions, not all videotape assets could be digitized and placed on the streaming server; some will remain on videotape and made available for loan through the Library, where UITS has provided additional videotape viewing stations for that purpose. The Medical Education and Research Program (MERP) anatomy and histology series tapes were acquired from the publisher in digital form. Other IMDS-based tapes, for which IU owns the copyright, have been digitized and placed on the streaming servers. In addition, a significant body of Community Learning Network content has been digitized and made available for streaming. Windows Media and IBM Videocharger MPEG-1 streaming servers are utilized in the IMDS replacement. MPEG-1 is used for content that demands high-quality video (e.g., medical content) and for which distribution will be limited to the high-bandwidth IU intranet.

An automated digitizing/encoding system was developed to convert videotape-stored content to digital video files. As a videotape is played, the system automatically creates two digital masters that are stored on IU’s Massive Data Storage System. The system also transcodes the masters to multiple streaming media files, uploads the streaming files to the institutional streaming server, and produces files that can fit three hours of video on a standard CD. Specifications have been defined for streaming files that are optimized for broadband and dialup modem users.

Through IU’s standing as a leader in large-scale and advanced deployment of IP-based videoconferencing, IU has a close working relationship with Polycom. The benefits to IU include providing input in product development, gaining advance knowledge of product plans, and having advance participation in product rollouts. As part of this relationship, Polycom selected IU to serve as an exhibition site for the ClassStation classroom technology package, and donated the $60,000 package to IU.
VIII. Support for Student Computing

Recommendation 8. IU must provide the information technology tools, infrastructure and support services so that students 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.

The Actions associated with this Recommendation address IT support services for students, including Student Technology Center and Support Center services (Action 54), access in student residence halls (Actions 55, 56, 57), and student ownership of computers (Action 58).

Student Technology Support

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 that do not provide such specialized support.

IUB & IUPUI Support Center Enhancements

Front-line support services on the two core campuses have been extended to improve student access to IT help. Hours at the IUB Support Center have been extended to seven days per week, Monday-Thursday, 8am-9pm. Weekend hours vary. Four new professional staff members were hired at the core campuses to enable this extended support, each receiving rigorous training to prepare for longer nighttime and weekend hours. Coverage for late-night support is provided by Student Technology Center staff and Operations staff. Consultants can attempt to solve callers’ problems or log their requests for expert service during following shifts. This extended support makes telephone and personal contact support services available virtually around the clock. Actions 55 and 57 extend support hours and resources to those in the IUB residence centers.

Throughout the year Support Centers on both campuses fielded thousands of inquiries and help requests from the campus community. IUB’s Support Center averaged more than 2,700 customer contacts per week, while the IUPUI Support Center received more than 1,800 inquiries in a week via telephone, e-mail, and the walk-up windows. Additionally, the IU Knowledge Base averaged some 19,900 hits per day and more than 7M hits per year. The Knowledge Base, developed, maintained, and updated by the UITS Support Center, contains more than 7,500 searchable documents and is available 24 hours a day.

UITS Falcon Project. Support Centers at IUB and IUPUI are the primary development team for Falcon, the enterprise trouble-ticket system for IU. Falcon will provide enterprise management for all areas of technology support, including help desk inquiries, service requests, network management, change management, telecommunications services, account management, and requests for instructional technology resources. Falcon will go online in January 2002 for internal testing and be fully operational by July 2002.
Adaptive Technology Center Awards
TLIT’s Adaptive Technology Center received two awards in November from the City of Bloomington’s Council for Community Accessibility (CCA). The first was the CCA’s annual Public Service Award for providing enhanced materials and services to people with disabilities, including providing Braille menus to restaurants in Monroe County, and Braille agendas and other alternative-format materials for the Bloomington Common Council ordinances and resolutions. The second was the CCA Special Recognition Award, for the collaboration among the ATC, UITS, and the Office of Disabled Student Services to provide a replacement system for a stolen student workstation.

Access in the 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.

In March 2000, UITS assumed responsibility for information technology resources in the IUB residence centers. Calendar year 2001 marks the first full year that UITS has managed the IT services and infrastructure in the residence halls.

Staffing is now at full capacity, with four full-time and 40 part-time employees serving the needs of residents in campus housing.

Replacement and upgrading of Residential Technology Center (RTC) equipment is complete, with all 260 workstations equipped with the same configurations, software, and functionality as those in the Student Technology Centers.

Network improvements include the installation of a second high-capacity Internet connection that serves IUB residence halls. The connection, with peak inbound and outbound capacities of 45Mbps (45M bits per second), provides IUB residence halls with a link to the Internet that is separate from other campus Internet data traffic. The link is in addition to an existing 45Mbps circuit, doubling the campus data capacity to and from the external Internet. The link benefits the Bloomington campus by moving residence halls traffic off the campus-wide connection.

Effective network management procedures have enabled student access to high-bandwidth entertainment while providing adequate access to those using network connections for academic purposes.

To help campus housing residents monitor their personal network usage and learn how to take greater control over their connection to the Internet, UITS created an informational Web site. It provides links to network-related issues, news and announcements about the university network, and statistics for personal usage and network traffic. (See http://resnet.indiana.edu/.)

A new program established in Fall 2001 enabled thousands of incoming residents to quickly connect to the IU network without the connection backlogs of previous years. On arriving at the residence halls, students received IT packets containing Ethernet cables, UITS Netconfig CDs, information on how to connect, and door hangtags for assistance. This system enabled virtually all students, for the first time ever, to establish their own connections prior to the beginning of classes. It also streamlined the process of getting help.

Ongoing and improved training for the residence halls IT staff, more effective staff scheduling, and network troubleshooting utilities for Support Center staff have combined to greatly improve responsiveness to residents in campus housing. Survey results show that customer satisfaction has increased by 10% for residence center hardware, by 16.1% for the knowledge of the residence hall consultants, and 20.7% for courtesy and helpfulness of consultants, with an overall satisfaction of 94.1, a significant improvement in just one year.
**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.

IUPUI has one “traditional dormitory” co-ed facility (Ball Residence) which consists of 195 rooms. Residents can connect to the IU Network from their rooms if they have a personal computer with a network cable provided by campus housing and an Ethernet card. UITS provides information and recommendations for Ethernet cards in the Computer Guide distributed to new students before Orientation.

Student housing options at IUPUI have been considered by various students, faculty, and administrative groups since 1980. An October 1999 report by the Anderson-Strickler consulting firm found a demand for housing and stated that construction is financially feasible. Campus and University administration officials have determined that IUPUI will house no more than 10% of its student population (or 1,880 full-time equivalents), consistent with its peers. The first phase of new housing development at IUPUI, to be privately developed and managed, is not, however, expected to approach 1,880 units.

UITS will work with IUPUI residential planners to ensure that the new housing is developed as a premier living and learning community, demonstrating effective uses of technology.

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

The RTCs/STCs have centralized three small residential RTCs into one location. This move creates a “critical mass” of workstations in the much larger and no-longer-used Ashton Center Dining Hall and also co-locates the RTCs with two new Academic Support Center classrooms and tutorial space.

A pilot was done in July to deliver IT training close to home for IUB residential students. Residential IT Support and IT Training and Education partnered to deliver two STEPS workshops in Eigenmann Hall: “MS Word Paperless Editing” and “PowerPoint: A Short Introduction.”

UITS and the IU Libraries are partnering to develop an “Information Commons,” an environment that fosters individual and group study and delivers state-of-the-art information technology services and resources. Planning calls for the Information Commons to be located in the west tower of the IUB Main Library and to be open 24/7/362. The IUB Libraries and UITS will contribute expertise and responsibility toward the goal of offering high-quality, seamless information and technology services that are delivered dynamically to student users. Because of the state budget freeze for renovation funding, the timeframe for implementation is now unclear.
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.

Although IU does not require students to own computers (because of the potential impact on students’ personal expenses), computer ownership continues to rise on the core campuses. Responses to the 2001 User Survey show a 7.2% increase in personal computer ownership at IUB, with 92.4% of students stating they own or have access to a computer at home, as compared with 85.2% in 2000. At IUPUI, the 2001 User Survey shows an increase of 2.8% with 90.9% of the respondents stating they own a computer at home, as compared with 88.1% in 2000.

This increase in personal ownership is believed to reflect positively on the incentives in place that encourage ownership. Each year UITS provides extensive guidelines to all incoming students in the form of the IU Computer Buying Guide, which contains current hardware and software recommendations, instructions for connecting to the IU network, and information on special offers on computers. Prospective students receive this guide before matriculating, enabling them to research purchase options before arriving on campus. During new student orientation sessions, UITS staff members advise students and their parents about IT resources. IU continues to leverage the buying power of the University by working with such vendors as Dell, Apple, Compaq, and Gateway to secure special pricing on high-quality computers and software, and extending University pricing to students for their personal purchases. Volume purchasing arranged through various vendor agreements during the year brought per-machine costs down by an average of some $430 below standard educational pricing.
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.

The Actions associated with this Recommendation address the development and implementation of an array of digital library services and initiatives, including digital library infrastructure (Action 60), access to electronic resources and electronic reserves (Actions 61, 62), lifecycle funding for existing digital library services (Action 63), digital archives and electronic records (Actions 64, 65), and digital library research (Action 59).

The IU Digital Library Program (DLP) 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.

Digital Libraries

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.

Three areas of research are proposed:

- Digital libraries as complex systems (technological, social, organizational, and human)
- Streaming audio and video data as digital library services
- The relation of testbed digital libraries to networked learning environments and collaborative workspaces.

Such research will advance the state of knowledge and practice in digital libraries through the contributions of IU’s research faculty in areas of human-computer interaction and systems design, instructional systems technology, social and organizational informatics, and other areas.

New Digital Library Research Initiatives

- Cultural Digital Library Indexing Our Heritage (CLIOH). In Fall ’01 IU received an award from the Institute for Museum and Library Services that is helping to fund the CLIOH project. CLIOH is a multi-disciplinary initiative to digitally preserve endangered archaeological sites, compiling vast amounts of data — from still photos to virtual-reality tours — that can be accessed through the Internet. (See www.cs.iupui.edu/~clioh.)

- ReciprocalNet. A Fall ’01 award from the NSF National Science Digital Library program is partially funding the ReciprocalNet project, an inter-institutional collaboration, led by the IU Molecular Structure Center. This initiative will create a national digital library of molecular structure data, software tools for visualizing molecules and interacting with these data, software components for constructing lessons based on the collection, and examples of such lessons as the beginning of a public repository for educational materials based on the collection. (See www.recipnet.indiana.edu/.)

CLIOH and ReciprocalNet are initiatives of the School of Informatics, with participation from other schools and departments including Computer Science, Education, School of Library and Information Science, UITS, and the Libraries.
• International Conference on Music Information Retrieval (ISMIR). In Fall 2001 IU Bloomington hosted the 2nd Annual International Conference on Music Information Retrieval (ISMIR). ISMIR is the world’s only music information retrieval conference and concerns the study of systems for indexing, searching and recalling musical data in education, academe, and entertainment. The conference drew attendees from around the world to participate in academic discussion and examine progress IU has made in MIR initiatives.

• Text Encoding Initiative Consortium. Indiana University has joined the Text Encoding Initiative Consortium, becoming one of its Founding Members. Perry Willett was elected to the Advisory Council of the TEI Consortium for 2002-2004, which will hold its first meeting in London on January 12, 2002. (See www.tei-c.org.)

Ongoing Digital Library Research

• Variations2: The IU Digital Music Library. Work continues on the initiative to support research and education in the field of digital libraries for music. IU’s digital music library, Variations2, is funded by the National Science Foundation’s Digital Library Initiatives 2 program. Building upon VARIATIONS, the project seeks to establish a digital music library testbed system containing music in a variety of formats, involving research and development in the areas of system architecture, metadata standards, component-based application architecture, and network services. This system will be used as a foundation for digital library research in the areas of instruction, usability, human-computer interaction, and intellectual property rights. (See: dml.indiana.edu/.)

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.

In Fall 2001 LETRS implemented a new Linux server to serve electronic text collections. In addition, new text search software from the University of Michigan was installed, which will allow for searches across collections, eventually integrating the large collections of commercially licensed collections with the electronic texts created by IU. The University of Michigan package also includes software for search and display of image collections, bibliographic indexes, and finding aids that may provide a common solution for IU’s digital collections.

The DLP is participating in the development of FEDORA, open-source digital object repository management software developed by Cornell University and the University of Virginia. The DLP will test a beta version of the software in Spring 2002. (See fedora.com.mnslib.org/.)
Electronic Information Resources

**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.

**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.

**SIRSI and Web-based IUCAT**

A joint team of UITS staff and IU Libraries staff completed implementation of the SIRSI Unicorn Library Management System and Web-based catalog (IUCAT) on December 31, 2000. This project was completed on time and slightly under budget and brought into service a Web-based library catalog with links to electronic resources and full-text articles.

Full use of the catalog’s features depends on global authentication and authorization for all IU campuses. Many electronic resources are licensed separately by campus, or groups of campuses. Global Directory Services will allow patrons across all campuses to access the catalog, renew materials, place holds, receive e-mail notices for overdue notices, and the like. There is also an increasing demand for reserves for all campuses, which requires a means for authenticating and authorizing patrons based on their enrollment in particular classes.

**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.

The implementation of SIRSI was essential to the development of an electronic reserve system. In Summer 2001, the IU Libraries licensed and installed electronic reserves software and hardware, the E-Res system from Docutek, and began a pilot test in two Bloomington libraries during Fall semester. Sixty-five graduate and undergraduate courses, including two that emphasize distance learning, have been in place since September; 791 documents are on reserve for the pilot. IUCAT links into the E-Res system via brief bibliographic entries. The e-reserves pilot was popular with students and faculty, with some documents receiving over 300 accesses per month. The implementation team plans to expand the service to all Bloomington libraries for Spring 2002 and is planning to offer access to all regional campus libraries for fall 2002.

The Digital Library Program added two new positions during 2001. Perry Willett was appointed Associate Director for Projects and Services and Kenrick Rawlings was appointed Programmer.

**New Digital Library Initiatives**

- **Digital Library of the Commons.** From 1999-2001, the Digital Library Program worked with the Workshop on Political Theory and Policy Analysis to develop a Web site to support the publication of working papers on common pool resources. The site runs on Eprints open archive software. The Digital Library of the Commons was launched in Fall 2001. (See dlc.dlib.indiana.edu/.)

- **Indiana Magazine of History Online Index.** In Summer 2000, the Library Electronic Text Resource Service (LETRS) began working with the Indiana Magazine of History to make the magazine’s indexes searchable over the Web. In Fall 2001 the Web interface was implemented and the index made publicly available in November 2001. On the Web are yearly
indexes from 1980 to 2000; the 25-year index covering 1955-1979 will be online in Spring 2002. Work continues on two additional 25-year indexes covering the years 1905-1954. The *Indiana Magazine of History* Online Index is available at: www.letrs.indiana.edu/inmh/

**Ongoing Initiatives**

- **VARIATIONS: School of Music Digital Audio Library.** The VARIATIONS project is expanding its collection of digitized audio to meet instructional and research needs. Changes include providing access to image-based content, including musical scores, and expanding access to such campus and University locations as student computing labs, other libraries, faculty offices, the student housing network, as intellectual property issues permit. Experiments in providing inter-institutional access to music collections will be pursued in cooperation with other universities. VARIATIONS delivered 448,809 sound file accesses between January 1, 2001 and December 31, 2002, averaging more than 1,000 accesses per open day. To date, Music Library staff have digitized approximately 7,000 sound recordings and 200 scores.

- **LETRS: Electronic Text Resources for the Humanities.** LETRS is expanding its SGML-encoded electronic collections available over the Web and participating in and supporting new projects, using as a model the ongoing Victorian Women Writers Project. LETRS is exploring collaborations with the Library’s Preservation Department, with IU faculty, and with Indiana University Press. Web-based collections continued to expand. Notable additions were the newest version of the CETEDOC Library of Christian Latin Texts and the Soncino Talmud. During 2001, the LETRS server received some 500,000 hits as did the Victorian Women Writers server. IU Libraries and UITS are reviewing the LETRS mission with respect to providing public services and its role in developing and managing a specialized digital (CD-ROM) collection of works in the humanities, including English, Classics, Religious Studies, Philosophy, History, Languages, and Linguistics. (See www.letrs.indiana.edu)

- **DIDO: Digital Images Delivered Online.** The Digital Library Program supports a collection of low-resolution (72 dpi) digital images selected from the 300,000-image Slide Library. Between January 1, 2001 and December 31, 2002, the Fine Arts Slide Library staff added nearly 3,000 images to DIDO, bringing the total to more than 20,000. In Fall 2001 access was granted across all IU campuses via keyword searching and browsing. An advisory group will advise on enhancements to DIDO and ways to provide improved service to users outside the Department of Art History, on all campuses. (See dlib.indiana.edu/collections/dido/.)

- **Russian Periodical Index Digital Project.** A three-year, United States Department of Education Title VI Technology Program grant to the IU Digital Library Program provides for the digitizing and Web publication of a portion of the Letopis’ Zhurnal’nykh Statei, a serial publication that indexes Soviet periodicals from 1926 to the present. This resource will provide access to the periodical literature for 1956-1975, a key time in modern Russian history. The project runs until September 2002. (See www.dlib.indiana.edu/collections/letopis/letopismain.html.)

- **Charles W. Cushman Collection.** A two-year grant to IU from the Institute for Museum and Library Services (IMLS) for digitizing and publishing on the Web some 18,000 slides from the Cushman Collection in the University Archives in Bloomington supports the project until September 2002. (See www.dlib.indiana.edu/collections/cushman/) 

- **U.S. Steel Photograph Collection.** The IU Digital Library Program received a grant from the Indiana State Library through federal Library Services and Technology Act funding to digitize and offer on the Web the 2,200 photographs in the U.S. Steel Photograph Collection in the Calumet Regional Archive at IU Northwest. The project was funded July 1, 2000-December 31, 2001. The project is nearly complete; the Web site, with photographs and accompanying text materials and teacher guides, will be launched January 15, 2002. (See www.dlib.indiana.edu/collections/steel/)
• **Wright American Fiction Project.** The IU Digital Library Program has taken the lead in a three-year CIC project to digitize a collection of American fiction based upon Lyle Wright’s bibliography, American Fiction, 1851-1875. IU owns the collection on microfilm. All 2,844 titles have been digitized and approximately two-thirds have been converted to text files. Nine institutions are contributing to the encoding of these text files. By the end of 2001, 144 texts had been encoded; additions will be made continually. The first release of the Web site with the completed volumes is planned for mid-January 2002. (See www.letrs.indiana.edu/web/w/wright2.)

• **Inscriptions from the Land of Israel.** LETRS and the Digital Library Team in Indianapolis are providing support for a project that will create a prototype of a Web site that presents the culture of Israel from the Second Temple period to the Arab conquest. External funding is also being sought.

• **Frank M. Hohenberger Photograph Collection.** The first 500 photographs in the Frank M. Hohenberger Photograph Collection have been digitized. Subject descriptors are being added to the finding aid to increase the consistency of subject searching. The Lilly Library is a partner in this project. In early 2002, the collection will be part of a new subscription digital service offered by the Research Libraries Group, RLG Cultural Materials. (See www.dlib.indiana.edu/collections/lilly/hohenberger/.)

**Indianapolis Projects**

• **Electronic Atlas of Central Indiana.** The Atlas is a Web-based repository of maps and GIS (Geographic Information Systems) data covering Central Indiana. These data include the social and economic data created by the SAVI Project as well as maps and datasets produced by other providers including the US Census Bureau, the US Geological Survey, the IUPUI Center for Earth and Environmental Science, The Polis Center, the United Way of Central Indiana, and the Natural Resource Conservation Service. Maps are available as images and downloadable files. The Atlas encompasses several digital library initiatives including Geographic Information Systems development, the Historical Aerial Archive, the Indiana Geographic Information Catalog, and Historical Maps. The project is funded by grants from the Indianapolis Foundation. An object-oriented spatial database is under development that will facilitate the development of an online mapping system. The retrieval and delivery system being developed for the Atlas will also provide a dynamic data download and decompression application. Digitized historical aerial photographs of six of the nine counties of Central Indiana have been incorporated into the Atlas. An image server allows users to pan or zoom on the image. Future enhancements will include address-matching capabilities. Funded in part by the Ayres Foundation, the Historical Maps section of the Atlas will include a selection of maps from Indianapolis and the Central Indiana region. The team has consulted with the Indiana State Library, the Indiana State Museum, and the IU Geography and Map Library on the project. (See atlas.ulib.iupui.edu/.)

• **IUPUI University Libraries Community Project.** Funded by a National Leadership Grant from the Institute of Museum and Library Services (IMLS), and with the partnership of The Indianapolis Museum of Art, IUPUI University Library offers public libraries and K-12 educational institutions access to digital image databases. Other museum supporters of the Community Project are The Eiteljorg Museum of American Indians and Western Art, The Indiana State Museum, The Children’s Museum, and The Indiana Historical Society. (See www.ulib.iupui.edu/imls/home.html.)

• **Philanthropic Studies Index (PSI).** The Philanthropic Studies Index is an online reference tool to literature on voluntarism, nonprofit organizations, fundraising, and charitable giving. PSI covers 1940 to 1999. PSI was migrated into an Oracle database structure in 2000. A Web interface for citation editing and data loading has been incorporated into the management system. Future enhancements will include advanced searching, new data entry screens, and gathering and delivery of detailed search statistics. (See cheever.ulib.iupui.edu/psipublicsearch/.)
Preservation of Digital Records & Materials

**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 the past year, the University Archivist began work with the Information Technology Policy Office and Data Administration area on projects involving the management and preservation of electronic records. In March Archives staff began working with data managers and others to create business process models for the business areas of student admissions and academic advising.

UITC 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 management. This curriculum development is activity supported in part by a grant from the National Historical Publications and Records Commission.
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.

The Actions associated with this Recommendation address issues of information technology policy and security, including the protection of information and security of IT resources (Action 66); authentication and access mechanisms (Action 67); and intellectual property (Action 68).

**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 primary role of the Information Technology Policy Office (ITPO) is to develop and maintain policies regarding the appropriate use of Information Technology by members of the Indiana University community and to administer education programs about common technology and security issues and concerns. The Office coordinates investigations and responses to reports of abuse or inappropriate use of electronic information or information technology, interacting daily with and on behalf of students, faculty, and staff. The Office also works closely with University administration, judicial officers, counsel, and other IU agencies, as well as internal and external law enforcement and prosecutors.

**Deputy Information Technology Policy Officer Appointed**

In November, the IU Office of the Vice President for Information Technology and Chief Information Officer announced the appointment of Merri Beth Lavagnino as Deputy Information Technology Policy Officer.

In this role Lavagnino will manage the daily operations of the ITPO, including budgeting and administration. In addition, she will develop and interpret policies, supervise the incident response process, and oversee activities related to computing accounts administration for the entire IU community. Her office is located at IUPUI to provide a more effective presence for the ITPO on that campus as well as on the regional campuses.

**New Services**

The Global Directory Services (GDS) project will replace and/or upgrade all facilities and services related to identification, authentication, authorization, and enterprise directory services, for users of IU technology resources on all campuses. As part of this project, a new University-wide password change facility (https://password.iu.edu) was implemented in early 2001. With the implementation of systemwide authentication services (Active Directory Services and Kerberos), it was important that all users have a common password synchronization capability. In addition, a new “super password” facility has been made available to select user support staff on all campuses, so that users can get password help local to their campus or department space. Other components of the GDS project are being given a high priority and are progressing. Some new account maintenance services have been developed and are undergoing usability testing, while others are well along in the design phase.

The Distributed Account Generation System (DAGS), the application with which users and administrators maintain user accounts and which will be subsumed by new GDS services, was migrated to new database and hardware platforms. In addition, a development and test environment for DAGS was installed to make it easier and quicker for technicians to troubleshoot and implement service changes. The DAGS
service was updated to support Active Directory Services and the Common File Store.

A Translation Service was implemented to facilitate application handling of unique identifiers. This facility permits, for example, conversion from an individual’s network username to the Social Security Number or Student Identifier. This is another element designed to help reduce files of sensitive personal data distributed around the University. See the GDS web site at http://gds.iu.edu.

**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.**

**ITPO and ITSO entrusted with security directives.** In May 2001, Indiana University trustees unanimously passed a resolution aimed at avoiding future security breaches. The resolution charges the Office of the Vice President for Information Technology “to develop and implement policies necessary to minimize the possibility of unauthorized access to Indiana University’s information technology infrastructure regardless of the Indiana University office involved.” It also directs the same office to assume “leadership, responsibility, and control of responses to unauthorized access.” The Vice President and CIO delegated the authority to implement these directives to the Information Technology Policy and Security Offices.

Changes made as a result of the Active Directory Services project and significant upgrades to the Kerberos service have helped to speed convergence to that method as the single University-wide authentication service. As more ADS-related and applications changes are made, more users use this standard method, making password management easier for both the user and technical support staff. In addition, new and easy password change facilities were introduced for users and support staff, allowing the coincidental change of passwords for most central computer systems.

UITS Telecommunications, in consultation with the ITSO, developed new network protection services. These include IP addresses so departments can isolate from the Internet computers that are used only internally, Router-based Access Control Lists that allow departments to allow only required protocols through to a specific computer on campus, a fire-walled subnet in the IUB and IUPUI machine rooms, and a VPN-secured (authentication and encryption) method for off-campus connectivity and wireless networking on campus.

**Information sharing.** Communication between staff on IU’s campuses increased in 2001 with the inception of two lists that inform system administrators on the eight campuses about virus threats so they can protect their systems in a timely fashion. ITSO also increased security awareness by offering and/or upgrading a vulnerability scanning service and an advisory subscription service, and by offering more security seminars.

Following security incidents in 2001, the IU Policy Officer discussed the state of computerized records and security at IU in IU’s cross-University publication, Home Pages. He explained how IU maintains one of the most secure enterprise computing environments while, at the same time, allowing scholarly activities and student services to flourish. (See www.indiana.edu/~ocmhp/092801/text/viewpoint.html.)

**New Technology Policies Posted**

Several technology policies have been updated and posted. Some are posted as interim and are being applied while comments are solicited and some are posted for comment, only. Among these are several that are significant to this Action (e.g., technical security policy, network policy, and wireless policy). The ITPO has posted documents related to appropriate information handling, and the IT Security Office has posted documents related to best technical security practices. See these and other documents at www.itpo.iu.edu and www.itso.iu.edu.
In an ongoing effort to aid IU computer users in deploying and maintaining secure systems, the IT Security Office purchased a University-wide annual subscription for security guides from the System Administration, Networking, and Security (SANS) Institute on Linux, Solaris, Windows NT, Windows 2000, and Intrusion Detection. (See www.itso.iu.edu/howto/.)

Three members of the University Information Technology Policy and Security Offices earned the formal designation of Certified Information Systems Security Professional (CISSP). Staff fulfilled strict requirements for this recognition, which includes a minimum of three years of experience focused on data and technology security, and successful completion of a comprehensive exam. One staff member was awarded a Microsoft Certified Professional designation, and others received functional certification.

**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.

In February 2001, the Copyright Management Center at IUPUI offered two presentations that explored issues of ownership and fair use of copyrighted works in support of innovative teaching and learning. These presentations focused on the use of Web sites, Oncourse, and electronic reserves to disseminate information and the ways in which these technologies can give rise to complex copyright issues.

In Fall 2001, the IT Policy Office collaborated with the Copyright Management Center to inventory existing resources related to copyright and IP, identify additional potential materials to create or programs to undertake that would reduce the University’s liability in this area, and gather feedback on which activities would produce the most benefit for the least cost. Interviews were held in Winter 2002 to obtain that feedback from administrators from OVPIT and UITS, faculty and staff from University Libraries and University Archives, staff from the Centers for Teaching and Learning, Oncourse administrators, University Counsel, and representative faculty who are interested in and/or active in the use of copyrighted materials for teaching and research. A graduate student was hired to analyze and update the Copyright Management Center Web site based on the feedback received.

A report is expected in Summer 2002, outlining recommended next steps for continued efforts to educate and inform in order to reduce the University’s liability in this area.
Contact Information

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

Franklin Hall 116
Indiana University
Bloomington, IN 47405-1223
(812) 855-5752
(812) 855-3310 (fax)

Education/Social Work 2129
Indiana University
Indianapolis, IN 46202
(317) 274-4507
(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@iu.edu)
Teaching and Learning Information Technologies and Dean
Norma B. Holland (nholland@indiana.edu)
University Information Systems
Christopher Peebles (peebles@indiana.edu)
Research and Academic Computing and Dean
Brian D. Voss (bvoss@indiana.edu)
Telecommunications

Officers
Karen H. Adams (kadams@indiana.edu)
Chief of Staff and Communications Officer
Debby Allmayer (dallmaye@indiana.edu)
Human Resources Officer
Laurie Antolović (lantolov@indiana.edu)
Finance Officer
Mark Bruhn (mbruhn@iu.edu)
IT Policy Officer
Mike Halbrook (halbrook@indiana.edu)
Development Director